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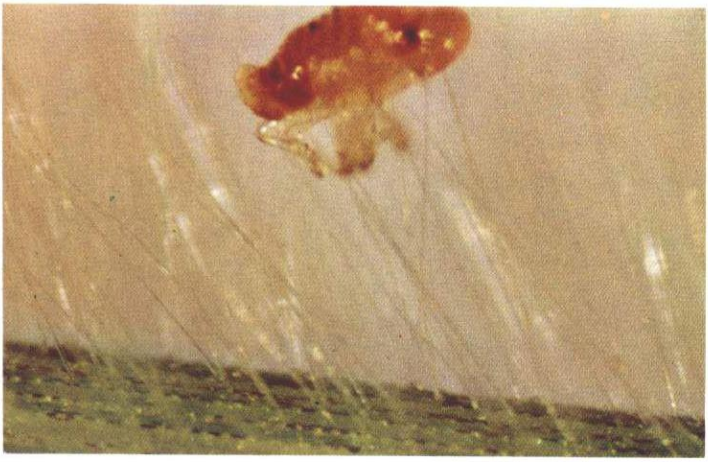

RESISTANCE IN GRASSES TO THE PASTURE SPITTLEBUG, (DEOIS FLAVOPICTA, Stal, 1854)

a dos Cerrados

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RESISTANCE IN GRASSES TO THE PASTURE SPITTLEBUG, (DEOIS FLAVOPICTA STAL, 1854)

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RESISTANCE IN GRASSES TO THE PASTURE SPITTLEBUG, (Deois flavopicta (Stal, 1854)

Gilson Westin Cosenza[1]

The spittlebugs, *Deois flavopicta* (Stal), *Zulia entrerriana* (Berg) and *Deois incompleta*(Walk), Cercopidae, Homoptera, are the most important pasture pests in Brazil (Guagliume 1971). In the Cerrados area, the most important species is *D. flavopicta* (Cosenza 1981).

To identify resistant grasses to this pest and to determine how this resistance works are the basic points in establishing a system of integrated control of this pest (Cosenza et al. 1981).

Studying the insect biology it was found that it takes an average of 14 days for the eggs to hatch under conditions of saturated relative humidity and 28ºC, and that the nymph stage lasts about 53 days (Cosenza & Naves 1980).

Byers (1965) found that eggs of the pasture spittlebug of Florida, *Prosapia bicincta* (Say), required an average of 17 days to hatch and that the nymph stage lasted 50-60 days.

The first stage of this research work was to determine levels of resistance to the spittlebug in 34 different grasses. Plots of 20 m^2 planted with 34 different grasses were set in a pasture of signal grass (*Brachiaria decumbens*) with high spittlebug infestation. Between the plots a 2 meters wide strip of the former pasture was maintained. Besides the natural infestation, adult spittlebugs were brought from other pasture areas and released in the area. A completely randomised design with 3 replications was used (Fig. 1 and 2).

Each 15 days, counts of the number of spumes and nymphs per plot was performed and a damage index was calculated. According to the damage indexes the most resistant grasses were: andropogon grass cultivar Planaltina (*Andropogon gayanus* var. bisquamulatus), molasses grass (*Melinis minutiflora*), jaraguá grass (*Hyparrhenia rufa*), setaria grass cv. Kazungula (*Setaria anceps*) and *Panicum maximum* cv. Makueni. The most susceptible were: Ruzi grass (*Brachiaria ruziziensis*), Buffel grass cv. Texas (*Cencrhus ciliaris*) and signal grass (*B. decumbens*) (Table 1).

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Fig. 1 – Plots used for resistance evaluation of grasses to the pasture spittlebug.

Fig. 2 – Plot of andropogon grass, cultivar Planaltina, resistant to the spittlebugs.

Table 1 — Resistance in grasses to the pasture spittlebug, *Deois flavopicta* (Stal. 1854).

Pasture grasses		Damage Index	Number of nymphs per plot *
Scientific name	Common name		
Andropogon gayanus cv. Planaltina	Andropogon grass	1	0,7
Hyparrhenia rufa	Jaragua	1	1,5
Cynodon plectostachyus 171	Giant star grass	1	1,9
B. radicans x *B. mutica*	Tangola grass	1	2,1
Setaria anceps cv. Kazungula	Setaria grass	1	2,6
Setaria angustifolia	Setaria grass	1	3,1
Panicum maximum cv. Makueni	Makueni grass	1	5,8
Melinis minutiflora	Molasses grass	1	13,4
Cenchrus ciliaris CL 1.004	Buffel grass	1	15,3
Brachiaria brizantha	Signal grass	1	22,5
Cenchrus ciliaris 465	Buffel	1	27,2
Brachiaria humidicola	Creeping signal grass	1	163,6
Panicum maximum	Guinea grass	2	39,5
Panicum maximum	Guinea grass	2	42,9
Brachiaria decumbens CPAC	Signal grass	2	43,7
Cenchrus ciliaris 505	Buffel grass	3	41,0
Panicum maximum	Green panic	3	63,1
Cenchrus ciliaris 2953	Buffel grass	3	65,8
Cenchrus ciliaris cv. Biloela	Buffel grass	3	102,9
Brachiaria dyctioneura	Creeping signal grass	3	157,5
Digitaria umfolosi	Slender stem digitgrass	4	123,9
Brachiaria decumbens cv. Australiana	Signal grass	4	128,1
Brachiaria decumbens cv. IPEAN	Signal grass	4	137,2
Cenchrus ciliaris cv. Texas	Buffel grass	4	139,2
Brachiaria ruziziensis	Ruzigrass	4	149,7

Damage Index 0 — No spittlebugs. 1 — Presence of spittlebugs, no damage. 2 — Points or chlorotic streaks on leaves. 3 — Chlorotic areas on leaves. 4 — Leaves with dryed tips. 5 — Completely dryed leaves.

* Plots of 20 m^2.

The second step of this research was to study the mechanism of resistance of the grasses: andropogon, molasses, setaria and creeping signal grass (*Brachiaria humidicola*); signal grass was used as a check because it is the most frequently used grass in pastures of the Cerrados area and very susceptible to this pest.

Test 1 — Feeding and oviposition preference of adults.

A preference test for feeding and oviposition was performed under screened cage conditions. The 5 grasses listed above were tested. They were planted in wooden trays, 3 months before the test. These trays were placed in screened cages and 300 adult spittlebugs captured on pastures were released in each cage. Twenty--four hours later data about the number of adults feeding on each grass were collected. This counts were repeated for 5 days.

A significant preference ($P < 0.01$) was found for creeping signal grass and signal grass while there was no difference among andropogon grass, molasses grass and setaria grass (Table 2). To test oviposition preference a 2 cm sample of the soil surface of the trays was obtained. This soil was passed through a set of sieves. The soil part retained in the 35 mesh sieve was mixed in a saturated solution of sodium chloride. Spittlebug eggs rose to the surface of the solution and were counted (Fig. 3). A significant preference for oviposition in soil covered by signal grass and creeping signal grass was found. Oviposition preference probably is conditioned by feeding preference.

Table 2 — **Mechanism of resistance in grasses to spittlebugs (*Deois flavopicta*, 1854). Preference test.**

Pasture grasses	Feeding preference Mean number of adults in 6 plants	Oviposition preference Mean number of eggs per tray *
Melinis minutiflora	3,55a **	71,65a
Andropogon gayanus	6,75a	81,90a
Setaria anceps	7,50a	96,35a
Brachiaria decumbens	13,70b	163,85b
Brachiaria humidicola	15,00b	165,40b

* Size of the tray: 50 cm x 30 cm x 10 cm.
Means in a column followed by the same letter are not significantly different at the 1% level of probability as determined by the Duncan's test.

Test 2 – Nymphae feeding preference.

The grasses andropogon, molasses, setaria and signal were planted in 2 kg square pots. Each pot had the 4 grasses, one in each corner. Three months later the preference test was performed. One second instar nymph on the soil surface of each pot was placed among the grasses. These nymphae moved to the grasses and started feeding and producing spume on the base of the stem. Eight nymphae prefered brachiaria grass, 3 were on setaria, 2 on andropogon and 2 on molasses grass, while 5 of them were lost. The same test was repeated with first instar nymphae and nymphae behavior was observed. The nymph which goes to brachiaria grass moves up the stem and starts sucking above the line of invagination of the basal leaves, while during the night period it goes down to the base of the stem at the soil line and continues sucking and producing spume (Fig. 7).

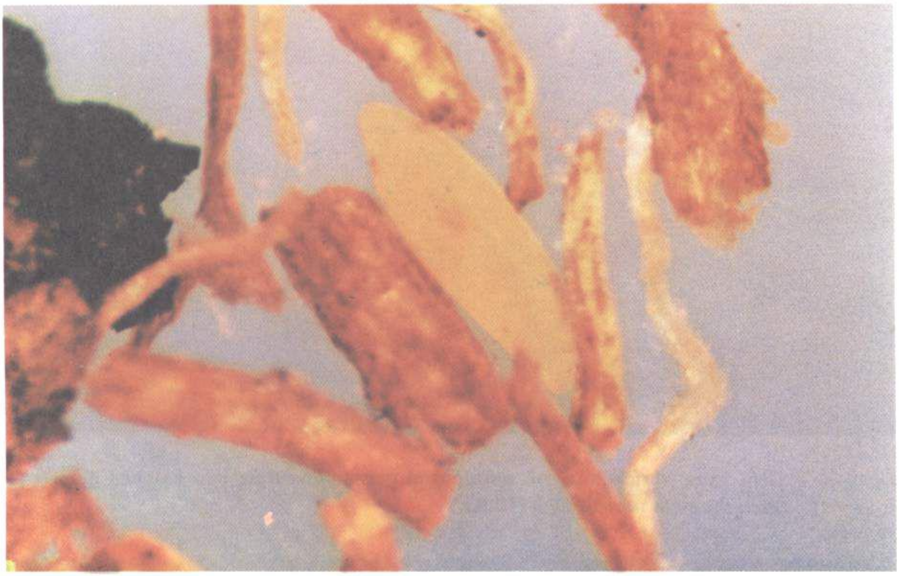

Fig. 3 – *Deois flavopicta* egg together with plant pieces, on saturated solution of Na Cl.

When the nymph goes to an andropogon plant and moves up the stem, it is prevented from sucking by rhe dense barrier of hair (trichomes) on the stem and returns to the ground or dries up on the hairs (Fig. 4). When the nymph goes to molasses grass it reachs the first tuft of glandular stem hairs and returns to the ground instead of trying to crawl up the hairs. Probably the exudation of the glandular hairs has a repellent effect on the nymph or spittlebug nymphae (Fig. 5). The basis for resistance on setaria grass is probably stem tissue toughness since the nymph moves up and down the stem and does not start sucking (Fig. 6). To test if the molasses grass exudation has a repellent effect on the nymph, cotton swabs were used to scrub the exudation from stems and leaves of molasses grass and coat the stem of 2 brachiaria plants in 4 plants of each pot. One first instar nymph was released among the plants. Twenty replications were used in the experiment. Eleven nymphae preferred the plants with no exudation, 2 nymphae remained on plants with exudation on the stem and 7 were lost.

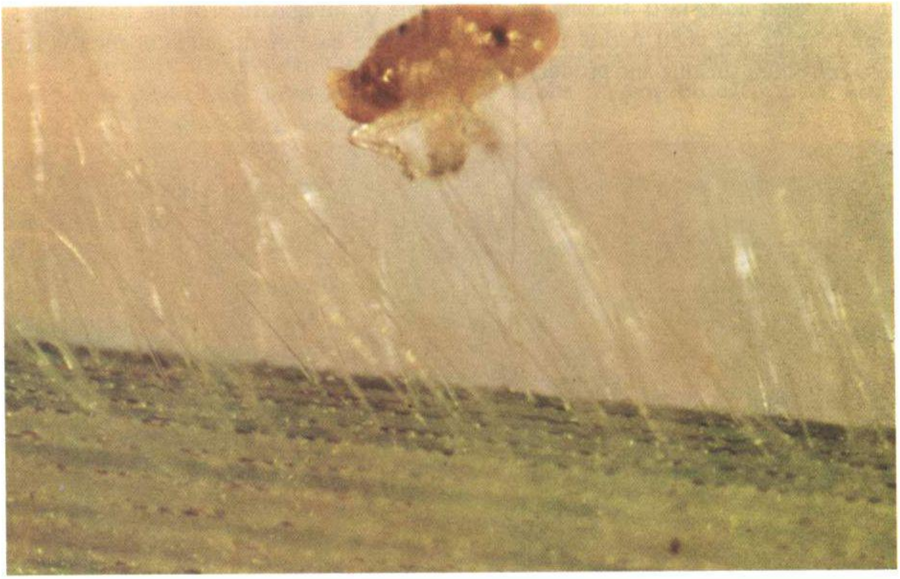

Fig. 4 – Stem hairs (thrichomas) of andropogon grass, preventing new hatched nymph to reach the stem time to suck (40 X).

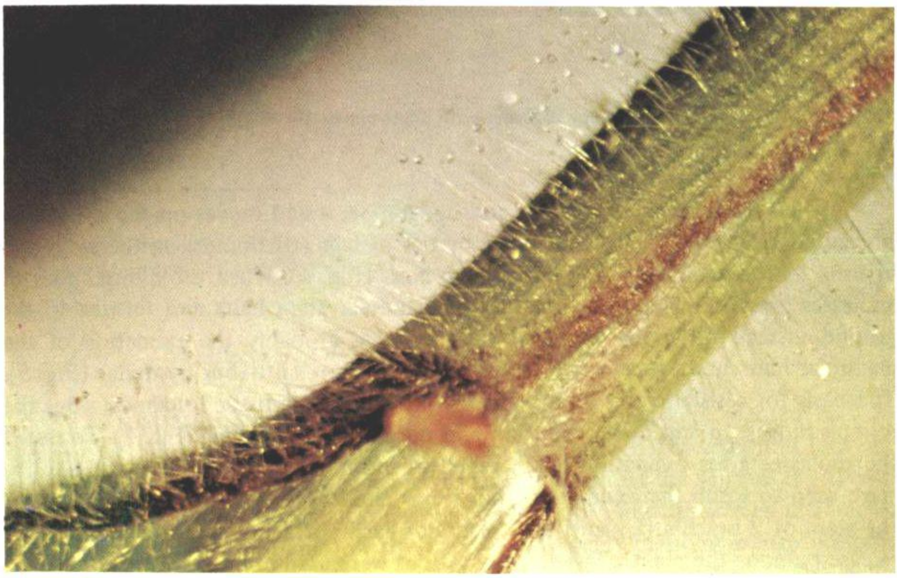

Fig. 5 – Glandular hairs on stem of molasses grass, with exudate (40 X).

Fig. 6 – New hatched nymph of *Deois flavopicta* on stem of setaria grass.

Fig. 7 – New hatched nymph of *Deois flavopicta* sucking stem signal grass (55 X).

These test showed that molasses grass exudation is probably a repellent factor for the nymphae and the mechanism of resistance of andropogon grass, setaria grass and molasses grass is probably antixenosis.

Test 3 – Performance of D. flavopicta nymphae reared on 5 grasses.

Spittlebug nymphae were reared on signal grass, creeping signal grass, andropogón grass, molasses grass and setaria grass to test the mechanism of antibiosis in the grasses to the nymphae. The grasses were planted 5 months before the test in 2 kg pots, one plant per pot. Two first instar nymphae were installed on each grass. The nymphae were deposited on the grass stem at the soil line and were covered with spume of older nymphae. Twelve hours later 20 pots of each grass with nymphae feeding and producing spume were separed for the test. Data about nymphae development and mortality level were collected.

Percentage of nymphae mortality on signal grass and creeping signal grass was about 20% and on the other 3 grasses was about 90%. The nymph phase lasted from 44 to 50 days on signal grasses and from 55 to 60 days on the other 3 grasses. The size of nymphae of similar age was smaller on those 3 grasses than on signal grasses (Fig. 8 and 9).

Fig. 8 – Size of nymph spume on andropogon grass (right) compared with spume of same age nymph on signal grass (left).

Fig. 9 – Size of nymph spume on molasses grass (right) compared with spume of same age nymph on signal grass.

The grasses andropogon molasses and in a lower scale, setaria, display antibiosis as a mechanism of resistance.

Test 4 – Tolerance in grasses to adults of D. flavopicta.

The same 5 grasses used in the last test were planted in 2 kg pots 5 month prior to the test. Each plant was enclosed in a plastic screen-covered tube. Different numbers (4, 8, 16) of adults, captured in pastures were released into the tubes for each treatment. Six replications were used. The population of 16 spittlebugs per plant, during 7 days, showed the following results: signal grass leaves dryed completely; creeping signal grass and molasses grass were tolerant to this level of infestation, showing only chlorotic areas in the leaves. Setaria grass and andropogon grass showed an intermediate position between the tolerant grasses and signal grass (Table 3, Fig. 10, 11).

Table 3 – Damage index in grasses under different numbers of adult *Deois flavopicta* (Stal, 1854).

Grasses *	Damage index					
	During 3 days			During 7 days		
	4	8	16	4	8	16
Melinis minutiflora	2,0	2,7	2,2	2,8	2,8	3,0
Brachiaria humidicola	2,3	2,3	2,5	1,0	1,5	3,0
Andropogon gayanus	3,0	3,3	3,5	3,0	3,5	4,0
Setaria anceps	4,0	4,2	4,3	4,0	3,8	4,1
Brachiaria decumbens	3,3	3,9	4,4	3,7	4,2	4,5

* Grasses planted in 2 kg pots.

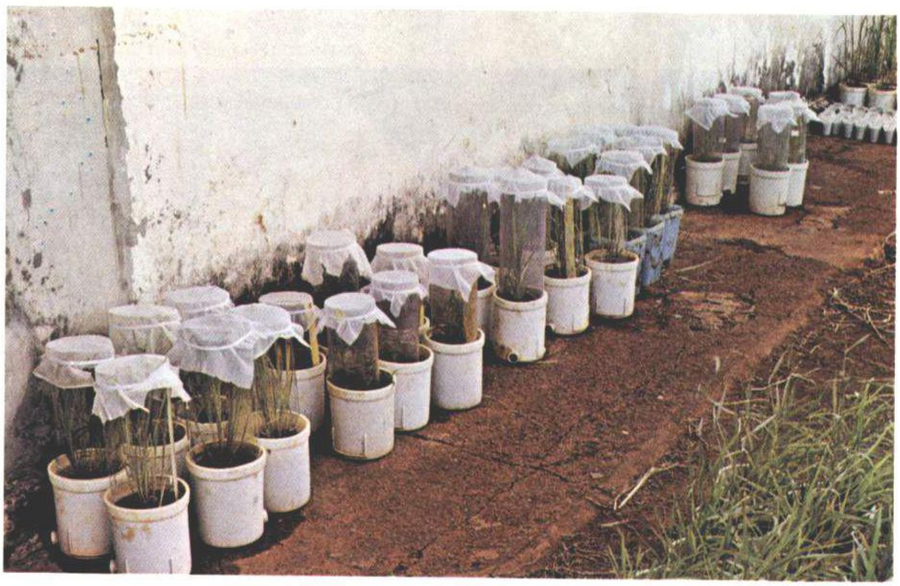

Fig. 10 – Tolerance test of grasses to adults of *Deois flavopicta*.

Fig. 11 – Damage caused by 16 adults of *Deois flavopicta* per plant.

Those 4 tests indicated that molasses grass probably displays antixenosis to nymphs, antibiosis to nymphs and tolerance to adults as mechanisms of resistance. Andropogon grass probably displays antixenosis and antibiosis to nymphs. Setaria grass, antixenosis to nymphs. Creeping signal grass, tolerance to adults. Signal grass did not display any mechanism of resistance.

Pasture management using resistant grasses to control spittlebugs. Initial research data and observations on farms in the states of Goiás, Mato Grosso and Minas Gerais, indicated that an adequate pasture management can control spittlebug damage (Cosenza et al. 1981).

When susceptible grass pastures are managed with light grazing during the spittlebug season (november – march), unfavorable conditions to this pest are created. The action of the spittlebug patogen *Metarhizium anisopliae* and other natural enemies (the syrphid fly *Salpingogaster nigra*, spiders, ants, etc) are activated, because of the taller condition of the grass.

In order to manage a light grazing on susceptible grass pastures it is necessary to have resistant grass pastures to feed the cattle during the spittlebug season. To test this procedure an experiment was performed with 0.5 ha plots of the grasses andropogon, molasses and setaria, combined with plots of signal grass. One ha plots of signal grass were used as checks.

During the spittlebug season heavy grazing was imposed on the resistant grass plots and light grazing on signal grass plots. During the first days of april the opposite was done by light grazing the resistant grasses and heavy grazing the signal grass plots until the grass was at the ideal length for the dry season. Signal grass check plots were heavily grazed all the time (The usual management on the ranches) (Fig. 12).

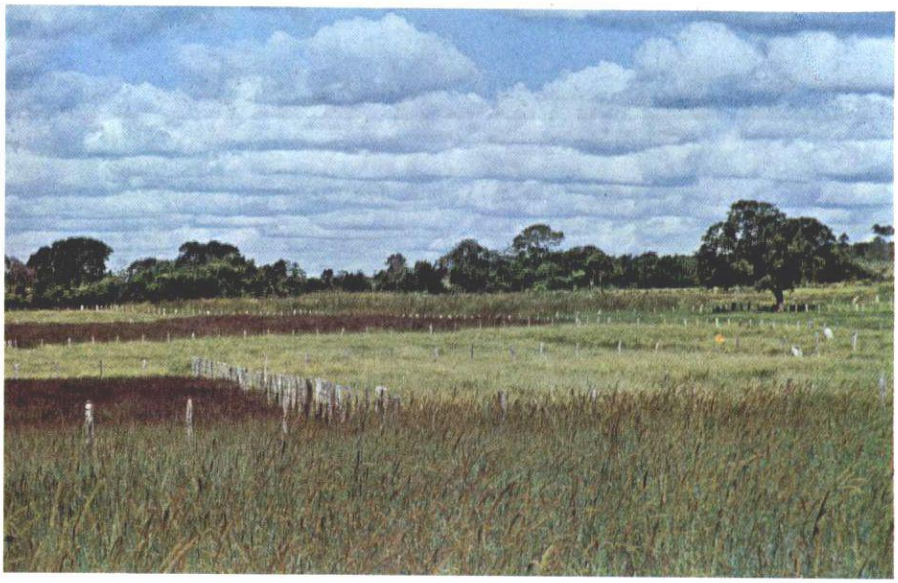

Fig. 12 – Pasture management to control spittlebugs, using resistant grasses and signal grass.

The present data indicate that proper management can keep spittlebug populations below the damage level.

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