OVIPOSITIONAL PREFERENCES OF THE SPITTLEBUGS *Zulia entreriana* (BERG, 1879) AND *Deois flavopicta* (STAL, 1854) (HOMOPTERA:CERCOPIDAE)

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RESUMO

Preferências para oviposição das cigarrinhas das pastagens *Zulia entreriana* (Berg, 1879) e *Deois flavopicta* (Stal, 1854) (Homoptera: Cercopidae)

As duas espécies das cigarrinhas *Deois flavopicta* (Stal, 1854) e *Zulia entreriana* (Berg, 1879), que são as maiores pragas das pastagens no Brasil Central, foram estudadas em laboratório para determinar suas preferências quanto à oviposição. Em geral, ambas as espécies mostraram a mesma tendência aos cinco fatores avaliados: 1. umidade 2. compactação 3. palha morta 4. espessura da camada de palha e 5. tamanho das partículas do solo (textura). A compactação, tanto do solo como da palha foi preferida em relação às superfícies não compactadas, mas a palha compactada foi preferida ao solo compactado. A camada de palha de 8mm foi preferida em relação a de 4mm. As partículas do solo de tamanho médio foram preferidas ao tamanho pequeno. Nenhuma espécie mostrou preferência pelas partículas de solo soltas, bem como, o solo seco. Estas descobertas podem ser úteis no manejo das pastagens no Brasil Central onde as compactações do solo e da palha fornecem para estas cigarrinhas o ambiente mais favorável à oviposição.

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INTRODUCTION

Pasture spittlebugs are a major insect pest in many areas of Brazil where they damage introduced grasses, mainly *Brachiaria decumbens* Stapf. Damage consists of leaf yellowing and a reduction in plant growth. The acreages of introduced grasses are extensive and the loss to the cattle industry is significant (PACHECO, 1981).

In general most research relating to spittlebugs has involved species in the United States and only recently has work been started on the problem of spittlebugs in Brazil. There are three general stages in the life cycle of spittlebugs: the egg stage, the nymphal stage, and the adult stage. Studies leading to the eventual control of these insects probably should be concentrated on either the egg or nymphal stage since the adult insect is short-lived and also mobile. In Central Brazil non-diapause eggs remain in the ground for 14-18 days and diapause eggs, laid by the last generation of adults, are in the ground 4 - 5 months before hatching. Since no effective economical control method is available any basic information on the life cycle, including ovipositional preferences, should be of value in planning a means of surpressing these insects. Very little is known about the environmental factors wich influence oviposition.

Some researchers have reported on the location of spittlebug eggs in the field. Eggs of *Prosapia bicincta* (Say) are usually deposited in the soil or moist litter at the base of grass plants and occassionally between the sheath and stem of the grass (BYERS 1965, PASS & REED 1965; FAGAN & KUITERT 1969). The meadow spittlebug, *Philaenus leucophtalmus* (L.) lays eggs between the leaf sheath and stem of the plant (BARBER & ELLIS 1922, MUNDINGER 1946, AHMED & DAVIDSON 1950, PUTMAN 1953). KING (1975) listed the sugarcane froghopper, *Aeneolamia varia saccharina* (Dist.) as preferring ovipositional sites that are damp and the soil of a certain texture.

In Brazil both *Zulia entreriana* (Berg, 1879) and *Deois flavopicta* (Stal, 1854) were reported to oviposit primarily around plants in soil and trash but a few eggs were found on plant parts (DOMINGUES & SANTOS 1975, PACHECO 1981). NILAKHE *et alii* (1984) also studied the location of eggs of these species in *B. decumbens* pastures. They sampled eggs within grass clumps and within the areas surrounding the clumps. They reported that more eggs were found in the areas surrounding the grass clumps when plant debris was present and more eggs were found in the grass clumps when little or no plant debris was present. Thus egg distribution was influenced by the quantity of plant debris present in the pasture.

Thus, this paper reports on the conditions which influence oviposition by *Z. entreriana* and *D. flavopicta* - the two species which cause the most damage to pastures in the state of Mato Grosso do Sul. Five factors relating to oviposition

were studied: 1. surface moisture 2. compaction of soil and litter 3. leaf litter vs soil 4. depth of litter, and 5. soil particle size.

MATERIAL AND METHODS

Four ovipositional preference tests were conducted in the laboratory at a time when adults of both *D. flavopicta* and *Z. entreriana* were active in the field. Only *D. flavopicta* was used in test 1 but the other three tests included both species of spittlebugs. Twenty field collected females were used to infest the cages in all the tests except in test 1 where only 10 were used. All tests were concluded after 64 hours when most of the adult spittlebugs were dead. The soil and litter used in the tests was sterilized. The litter was collected from a *B. decumbens* pasture and was composed mainly of grass leaves in various stages of decomposition.

Test 1

Four pots (10 cm = diameter) each of which contained a growing *B. decumbens* plant about 14 cm tall were infested. Before infesting, fine soil (screen openings = 1 mm²) was placed on the entire surface one cm deep around each plant, moistened with distilled water and packed. Dry unpacted litter 1 cm deep was placed on one half of the surface area. The grass was on the line between the packed soil and unpacted litter. The number of eggs was recorded from the following locations: 1. eggs attached to the plant 2. eggs attached to the litter 3. eggs in the soil under the litter, and 4. eggs in the soil on the half without litter.

Test 2

Caged spittlebugs were offered four choices of an ovipositional medium: 1. compacted particles of medium soil - (screen openings = 2 mm²) 2. compacted particles of fine soil (screen openings = 1 mm²) 3. loose particles of fine soil 4. loose particles of medium soil. The four soil choices were placed in plastic caps (dia. = 4 cm, depth = 8 mm) and each group of caps placed in a petri dish. A plastic tube (30 cm high) was placed over each petri dish to form a cage. Gauze was held on the top by a rubbler band. Each cage contained freshly-cut grass stems held in water. The soil was weighed to insure the amount was the same in all caps. A total of eight cages were used for each spittlebug species. Three ml. of water was added to each of the four choices in four of the cages. The soil in the other four cages was dry.

Test 3

Procedures in this test were similar to those explained in Test 2 except all ovipositional choices contained water. A total of eight cages were used, four with each species. The four treatments included: 1. compacted litter (8 mm deep) over soil. 2. compacted litter (4 mm deep) over soil 3. no litter but soil compacted 4. loose litter (4 mm deep over soil). Both the soil and litter were weighted to insure equal amounts and were placed in the plastic caps. A mixture of 1.4 g of dried litter and 4 ml of water filled the plastic cap to a depth of 4 mm.

Test 4

Procedures in this test were similar to those in test 3 except only 3 choice were available: 1. soil densely compacted, vol. = 11.781 cm^3 2. soil medium compacted, vol. = = 16.493 cm^3 and 3. loose soil, vol. = 23.526 cm^3. An open-ended tube was placed on the table and filled with moist soil to a depth of 2.5 cm. This amount of loose soil was used as treatment number 3. A plunger in the tube compacted the soil into pellets to produce treatments numbers 1 and 2.

RESULTS

The mean number of spittlebug eggs recorded in all the tests is shown in Table 1. Observations from the literature indicate that most spittlebug species prefer to lay eggs in a moist microhabitat such as in soil and litter or directly on the plant. In the present study *D. flavopicta* laid a total of 520 eggs in moist soil and *Z. entreriana* laid 526. Each species laid only one egg in dry soil. This study has further shown that the compaction of either the soil or litter is preferred for oviposition over uninpacted surfaces by these two species. More eggs were laid in the compacted soil composed of medium size soil particles than in the compacted soil composed of small particles. When both compacted soil and compacted litter were available both species preferred to oviposit in the compacted litter. A litter layer of 8 mm was preferred over a layer of 4 mm. In one test, 65% of the eggs of *D. flavopicta* were laid in litter 8 mm deep and 31% were laid in litter 4 mm deep. Sixty percent of the eggs of *Z. entreriana* were laid in litter 8 mm deep and 29% in litter 4 mm deep. Loose soil particles were definitely not preferred for oviposition. Each spittlebug species reacted differently to the degree of soil compaction; *D. flavopicta* laid more eggs in densely compacted soil and *Z. entreriana* laid more in medium compacted soil. However, the number of eggs found in soil densely compacted and medium compacted was not significantly different when the species are considered separately.

TABLE 1. Mean number of spittlebug eggs deposited in various egg laying mediums.

Treatment	Spittlebug species	
	D. flavopicta	*Z. entreriana*
	$\bar{x}$ S.E.[1/]	
	Test 1	
1. eggs in soil - no litter	59.50±17.27a	
2. eggs in litter	9.25± 3.64 b	
3. eggs in soil under litter	5.75± 1.93 b	
4. eggs attached to plant	0.50± 0.50 b	
	Test 2[2/]	
1. compacted soil - particles medium	103.50±15.08a	55.75± 6.86a
2. compacted soil - particles small	22.25± 6.84 b	45.75± 4.59a
3. loose soil - particles small	3.25± 0.85 b	27.25± 4.25 b
4. loose soil - particles medium	1.00± 0.41 b	2.75± 1.31 c
	Test 3	
1. compacted litter (8 mm), over soil	38.75± 6.47a	61.75±18.56a
2. compacted litter (4 mm), over soil	18.50± 4.32 b	30.25± 8.26a
3. no litter - compacted soil	1.75± 1.03 c	6.25± 3.20 b
4. loose litter (4 mm), over soil	1.00± 0.58 c	4.75± 1.11 b
	Test 4	
1. dense compaction soil volume = 11.781 cm^3	15.75± 7.18a	6.75± 1.55a
2. medium compaction soil volume = 16.493 cm^3	11.75± 5.66a	9.75± 2.50a
3. loose soil soil volume = 23.526 cm^3	0.00± 0.00a	0.25± 0.25 b

1/ Means based on 4 replications, S.E. = standard error. Means within a column followed by the same letter are not significantly different ($P<0.05$; Duncan's multiple range test)..

2/ *D. flavopicta* and *Z. entreriana* each laid only one egg in the part of the test without moisture.

DISCUSSION

It is concluded on the basis of this study that five factors greatly influence oviposition in the two spittlebug species studied. In descending order of importance these are: 1. moisture 2. compaction 3. presence of litter 4. depth of litter and 5. soil particle size. In general both of the species of spittlebugs reacted in a similar manner to these five factors.

In Central Brasil oviposition by spittlebugs occurs during the rainy season, usually from November through May. During this time rain showers occur frequently and the soil is usually moist. Under these condition compaction has been reported to be most severe (GIFFORD *et alii* 1977). Thus, a very favorable microhabitat for oviposition is provided during the rainy season especially in pastures that contain a well defined layer of litter.

The results reported here point to the possibility of renovating pastures in order to produce unfavorable ovipositional sites. Any technique used in pasture management that reduces soil compaction and litter should prove beneficial. For example, BECK (1963) reported that eggs of the spittlebug *Prosapia bicincta* (Say) were destroyed when pastures of coastal bermudagras were burned and fewer nymphs were found in pastures that were mowed and raked. Populations of spittlebugs have also been reduced by selective grazing (OOMEN 1975). The greatest impact of pasture renovation techniques and grazing animals appears to be indirect through effects on microclimate and environmental conditions imposed on the insect habitat (MARTIN 1983). Techniques which expose eggs and nymphs to desication by the sun and wind and disturb their well-being should prove beneficial. However, little is known of the effects of pasture renovation practices on soil compaction and litter accumulation. Additional research on these factors needs to be completed before definite conclusions can be made regarding pasture management for spittlebug control in the "cerrado" region of Brazil.

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ABSTRACT

Two spittlebug species, *Deois flavopicta* (Stal,1854) and *Zulia entreriana* (Berg, 1879) which are major pests of pastures in Central Brazil, were tested in the laboratory to determine ovipositional preferences. In general both species reacted similary to the five factors tested: 1. moisture 2. compaction 3. leaf litter 4. litter depth and 5. soil particle size. Compaction of either the soil or litter was preferred over unimpacted surfaces but litter compaction was preferred over soil compaction. A litter layer of 8 mm was preferred over a layer of 4 mm. Medium soil particles were preferred over small soil particles. Loose soil particles and dry soil was definitely not preferred by either species. These findings should be beneficial in managing pastures in Central Brazil where soil compaction and litter provide a most favorable microhabitat for oviposttion by these spittlebugs.