ECOLOGY, BEHAVIOR AND BIONOMICS

Distribution of the Spittlebug *Deois flavopicta* Stal (Homoptera: Cercopidae) on Wild and Cultivated Host Species

Carmen S. S. Pires[1], Peter W. Price[2] and Regina C. de Oliveira[3]

[1]Embrapa/Cenargen, Caixa postal 02372, 70849-970, Brasília, DF.
[2]Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ, 86001-5640.
[3]Universidade Estadual de Campinas (UNICAMP), Caixa postal 6109, 13083-970, Campinas, SP.

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Distribuição da Cigarrinha-das-pastagens *Deois flavopicta* Stal (Homoptera: Cercopidae) em Hospedeiras Nativas e Cultivadas na Região do Distrito Federal

RESUMO - Onze espécies de gramíneas nativas ou naturalizadas foram encontradas hospedando ninfas da cigarrinha-das-pastagens em áreas de cerrado na região de Brasília, Distrito Federal. Grande número de ninfas foi encontrado na espécie *Axonopus marginatus* (Trin.) Chase. Do total de 224 ninfas observadas, 85,7% foram encontradas alimentando-se nessa espécie de gramínea. Aparentemente a presença da cigarrinha-das-pastagens nas gramíneas do cerrado estava associada com qualquer forma de perturbação, tais como pastejo pelo gado ou desmatamento parcial. Ninfas foram encontradas somente em áreas perturbadas de cerrado do tipo campo sujo e *sensu strictu*. As densidades de ninfas no cerrado foram muito mais baixas do que as densidades encontradas em pastagens cultivadas. O número de ninfas/m^2 no cerrado *sensu strictu* foi aproximadamente 105 vezes mais baixo do que as densidades encontradas nas áreas de *Brachiaria ruziziensis* Germain & Evrard . Em dois sítios de cerrado do tipo campo sujo as densidades foram, aproximadamente, 2.273 e 1.212 vezes mais baixas do que as densidades nas áreas de *B. ruziziensis.* A distribuição e as densidades populacionais da cigarrinha-das-pastagens em áreas de vegetação natural foram influenciadas pela presença de pastagens cultivadas infestadas por este inseto nas adjacências, sugerindo que áreas de *Brachiaria* são focos de infestação para outras hospedeiras.

PALAVRAS-CHAVE: Insecta, densidade ninfal, savana brasileira, *Brachiaria* spp.

ABSTRACT - Eleven species of native or naturalized grasses were found hosting spittlebug nymphs in the natural grassland areas around Brasília in the Federal District of Brazil. A large number of nymphs were found on the species *Axonopus marginatus* (Trin.) Chase. Out of a total of 224 observed nymphs, 85.7% were found feeding on *A. marginatus*. Apparently the presence of the spittlebug nymphs in the cerrado vegetation, the Brazilian savanna, was associated with any form of disturbance, such as cattle grazing and partial deforestation. Nymphs were found only in disturbed areas of the "cerrado campo sujo" and in the cerrado *sensu strictu*. The densities of spittlebug nymphs in the cerrado were lower than the density found in the cultivated pasture. The nymphal density in the cerrado *sensu strictu* was approximately 105 times lower than the densities in *Brachiaria ruziziensis* Germain & Evrard area. In two sites of "campo sujo" form of cerrado the densities were, approximately, 2,273 and 1,212 times lower than the densities in *B. ruziziensis* areas. The distribution and density of the spittlebug in the natural vegetation were influenced by the presence of adjacent infested areas of cultivated pasture. This fact indicates that areas of *Brachiaria* are the source of infestation for other host plants.

KEY WORDS: Insecta, nymphal density, Brazilian savanna, *Brachiaria* spp.

The spittlebug *Deois flavopicta* Stal is a neotropical species with a natural distribution throughout the Southeast and Central-West regions of Brazil. Originally, this species fed on a broad range of native grasses in the Brazilian savanna. Following the introduction of exotic grasses, principally *Brachiaria* spp. from Africa, *D. flavopicta* populations rose to high and outbreak levels on pastures areas cultivated with the introduced grass species (Fontes *et al*. 1995). Before the introduction of *Brachiaria* species, a mixture of the naturalized species *Melinis minutiflora* Beauv. and *Hyparrhenia rufa* (Nees) Stapf were used in pasture areas (G.W. Cosenza, personal communication). The native species *Paspalum erianthum* Nees was also used in small areas of cultivated pasture and there is no record of population outbreaks for these three host species (G.W. Cosenza, personal communication). Presently, *Deois flavopicta* is the predominant spittlebug species in cultivated pastures in the Central-West region of Brazil (Sá 1981). Apparently, *Brachiaria* areas have been the source of the adult infestation to other crops, such as corn (J.P. Santos, E. Cruz & W. Botelho - unpublished) and rice (Nilakhe 1985) since the insect does not complete its cycle on these plants.

In the last 19 years, different studies were conducted, mostly with introduced grasses, with the object of finding grasses resistant to spittlebug attack (Botelho *et al*. 1980, , Cosenza 1982, Nilakhe 1987, Botelho & Reis 1992) and/or finding a method of pasture management to control spittlebug populations (Botelho & Reis 1980, Cosenza *et al*. 1983, Hewitt 1988, Koller 1988, Koller & Valério 1988, Valério & Koller 1992, Koller & Honer 1994). However, few attempts have been made to find a native grass species with forage potential that would not favor spittlebug population outbreaks (Cosenza 1982, Lima & Gondim 1982, Nilakhe 1987, Botelho & Reis 1992).

The non-outbreak status of *D. flavopicta* on its native hosts has been mentioned repeatedly in the literature but the distribution and population densities of this insect on natural vegetation have never been measured before. In addition, the life history of this insect on native and naturalized host plants has been poorly studied, with the exception of some studies on *P. erianthum*, *P. guenoarum* Arechav., *P. plicatulum* Michx., and *M. minutiflora*, (Cosenza 1982, Nilakhe 1987).

In the present work, we studied the distribution and densities of spittlebugs on natural vegetation and addressed the following questions: 1. How many species and what species of native and naturalized grasses host *D. flavopicta* are there in the Brasilia region? 2. What is the distribution of *D. flavopicta* among the different native and naturalized host plants? 3. What is the abundance of *D. flavopicta* in areas of cerrados and in areas of cultivated pastures? and 4. How are the spittlebug population densities in the natural grassland affected by the presence of adjacent infested areas of *Brachiaria*? Using information about morphology, architecture, and chemical composition of the native and naturalized host species of the spittlebug, the possible mechanisms that keep the insect population at low levels on natural vegetation will be discussed.

Material and Methods

The Insect. In the Federal District of Brazil (Brasília), where this study was conducted, *D. flavopicta* has three population peaks during the rainy season (October through May) and diapauses in the egg stage during the dry season (Fontes *et al.* 1995). Eggs are laid in the soil, close to the host plants. After hatching the nymphs must find a feeding site to begin feeding and forming the spittle masses. The "spittle mass" is a foamy liquid formed by the introduction of air bubbles into the watery excretion. A spittle mass is an evidence of feeding by nymphs on the plant at that location. The nymphs feed gregariously on roots and stems close to the soil surface. Both nymphs and adults suck on the sap and debilitate the plant. Generally, adults feed on the leaves and frequently kill them, probably by the injection of salivary secretions that cause phytotoxemia (Valério 1988).

Study Sites. This study was conducted in areas around the Federal District of Brazil. The natural vegetation of the Federal District is dominated by the cerrado, a type of savanna vegetation that has been described in detail by Eiten (1984). All natural physiognomic forms of cerrado occur within the limits of the Federal District. The Brazil's Federal District is a rectangular area of 5,748 km^2 located in the southeastern part of the state of Goiás adjoining the state of Minas Gerais, at 15°31'-16°03' S, 47°21'- 48°15' W (Eiten 1984). Despite its small area, 0.07% of the total area of Brazil, the Federal District contains 22% of the entire known grass species in the country (Filgueiras 1991). In addition, 67.5% of the whole grass flora in the Federal District are composed of native species (Filgueiras 1991). For all these reasons a sampling in the Cerrado areas in Brasilia will be representative of native hosts of *D. flavopicta.*

The sampling covered four vegetation types or habitats: the "cerrado *sensu strictu"* (SS), "cerrado campo limpo" (CL), "cerrado campo sujo" (CS), "cerrado vereda" (V). This vegetation classification was adapted from Eiten (1984) and Filgueiras (1991). Cerrado *sensu strictu* is the most common form of cerrado in the Distrito Federal. It is a tree and scrub woodland with the trees more widely spaced than in the closed-canopy forest-like forms of cerrado, with 10% of the ground layer cover by shrubs and grasses. Cerrado campo limpo is an open savanna form. This type of cerrado occurs in the form of pure grassy fields without any woody plants or with only a few scattered thick-stemmed shrubs. Cerrado campo sujo are areas visually dominated by grasses, with less than 10% cover with woody plants. Cerrado vereda are wet campos. They are small areas of permanent grassy marshes with the presence of the buriti palms *Mauritia flexuosa* L. f.

These cerrado vegetation types were chosen because the greatest number of grass species was found in SS, CL, and CS, and because the grass species which grow in the wet campo (V) are not normally found elsewhere (Filgueiras 1991).

Distribution of Spittlebug on its Native and Introduced Host Grasses. Third and fourth instars nymphs were sampled in January and February of 1996 and 1997 during the second and third generations of this insect in the Federal District (Fontes *et al.* 1995). During 1996, one site of each of the cerrado types: campo limpo and campo sujo was sampled. For each site 30 plots of 4m x 10m each were sampled.

In 1997, a second site of campo limpo and campo sujo, two sites of cerrado *sensu strictu*, and two sites of the cerrado type vereda were sampled. In this year, due the sampling effort and number of surveyors necessary to cover the thirty 40 m^2 plots, the methodology of sampling was modified. For the cerrado campo limpo, campo sujo and site 1 of the cerrado *sensu strictu*, 30 plots of 1 m x 5 m each were sampled. For the second site of the the cerrado *sensu strictu* and the two sites of the cerrado type vereda, a timed sampling was used. This sampling method consisted of a 30 minute sampling time with three people walking in different directions within the site. In the 30-minute sample, one area equivalent to 5 m x 10 m was covered by each person. All individual plants of the different grass species present in the plots (replicates) or found during the timed sampling were checked and the number of nymphs found per plant of each species was recorded. Individual plants of each grass species were caged until nymphs had completed their development and adults had emerged to confirm the identity of the insect species. Voucher specimens have been placed in Cenargen's insect collection. Samples of the plants were collected for identification and vouchers have been placed in the herbarium of the Embrapa Cenargen.

To check the distribution of the spittlebug nymphs on the different native host species, another area of 48 m x 100 m of the campo sujo type of cerrado was surveyed. The vegetation type was chosen based on the nymphal density. Densities of the different host species were not measured, although the genus *Trachypogon* was the most abundant in the studied area. In addition, previous work reported that the species in the genus *Trachypogon* constituted 33.4% of the biomass of gramineae in this area, followed by the genus *Axonopus* (12.54%) and the genus *Echinolaena* (3.74%) (Almeida *et al.* 1987).

To compare the density of *D. flavopicta* nymphs in the natural grasslands versus the cultivated grasses, we sampled one adjacent area planted with the introduced grass species, *Brachiaria* spp., for each site sampled in the campo sujo cerrado type. Due to high level of infestation and high plant density, the areas of *Brachiaria* located adjacent to the cerrado of campo sujo type were surveyed using the method of sampling per quadrat. Thirty quadrats of 0.25 x 0.25m each were randomly sampled following the methodology modified by Sujii (1994). In sites where *Brachiaria* did not occur in large areas or the spittlebug densities were not high, timed sampling was used following the methodo-logy already described.

To verify how the population densities of spittlebug in the grassland areas have been affected by the presence of infested adjacent areas of *Brachiaria*, two sites of the campo sujo type of cerrado were surveyed. One was located adjacent to areas of cultivated pastures and the other was located far from cultivated pastures. In the Cerrado area located adjacent to cultivated pastures, four 100 m long by 1m wide line were demarcated from the border located 20 m from the pasture area. All individual plants of the different grass species present along the transects were checked and the number of nymphs found per 10 m^2 was recorded. In the Cerrado area located far from cultivated pasture the same methodology was used, but the total number of nymphs found in each transect was recorded.

For comparison of the nymphal densities between the cultivated pasture and the natural grassland areas, the nymphal densities were expressed as the number of nymphs per 1 m^2. Then the number of nymphs found in the cultivated pastures, using the quadrat sampling and timed sampling were divided by 0.0625 and 50, respectively. The number of nymphs found in the savanna areas were divided by the size of the sampled area.

The nymphal densities found in the grassland areas and in the cultivated pasture areas were compared using the Mann-Whitney rank sum test, a non-parametric method for two group comparisons. The nymphal densities found in the different types of savannas: the two sites of campo sujo form of cerrado and site 2 of cerrado *sensu strictu* were compared using the Student-Newman-Keuls test, a non-parametric method for pairwise multiple comparisons.

Results

Host Plants. Considering the four types of vegetation sampled, a total of 11 species of native or naturalized grasses were found hosting spittlebug nymphs in the Federal District of Brazil (Table 1). Additionally, three other native species of *Paspalum* (*P. guenoarum*, *P. erianthum*, and *P. plicatulum*) are mentioned in the literature as natural hosts of *D. flavopicta* (Nilakhe 1987, Cosenza *et al.* 1989). A large number of nymphs were found on the species *Axonopus marginatus* (Trin.) Chase in the cerrado campo sujo (Table 2), even though this grass was not the dominant species in the studied area. Out of a total of 224 observed nymphs, 85.70% were found feeding on *A. marginatus*.

Distribution and Density of Spittlebug. In the cerrado areas, the spittlebug was found in the two sites of the cerrado campo sujo and in one site of the cerrado *sensu strictu* (Table 3). However, in the cerrado *sensu strictu* (site 2), the spittlebug was only found in a small area containing clumps of the grass species *A. marginatus*. Spittlebug nymphs were not found on the cerrado areas of the types campo limpo and vereda. Apparently nymphs of *D. flavopicta* were concentrated on the campo sujo form of cerrado (Table 3). A significant

Table 1. Species of grasses hosting the spittlebug *D. flavopicta* found in two sites of four vegetation types in the Federal District of Brazil, Brasília.

Subfamily/tribes/ species	Vegetation type CS Site 1	CS Site 2	CL Site 1	CL Site 2	CC Site 1	CC Site 2	CV Site 1	CV Site 2
Panicoideae								
Andropogoneae								
Schizachyrium tenerum Nees (N)	X	X	-	-	-	-	-	-
Trachypogon polymorphus Hackel (N)	X	-	-	-	-	-	-	-
Paniceae								
Axonopus barbigerus (Kunth) Hitchc. (N)	-	X	-	-	-	-	-	-
A. marginatus (Trin.) Chase (N)	X	X	-	-	-	X	-	-
A. siccus (Nees) Kunth (N)	-	X	-	-	-	-	-	-
Echinolaena inflexa (Poiret) Chase (N)	X	X	-	-	-	-	-	-
Melinis minutiflora Beauv. (IN)	-	X	-	-	-	-	-	-
Mesosetum loliiforme (Hochst.) Chase (N)	-	X	-	-	-	-	-	-
Panicum campestre [Nees ex] Trin. (N)	X	-	-	-	-	-	-	-
Paspalum pilosum Lam. (I)	X	-	-	-	-	-	-	-
Setaria geniculata (Lam.) Beauv. (N)	X	-	-	-	-	-	-	-

CS = Campo sujo form of cerrado (Brazilian savanna), CL = Campo limpo form of cerrado, CC= cerrado *sensu stricto*, and CV= wet campo form of cerrado (disturbed area). (N) = Native, (I) = Introduced, species that were introduced in the last 40 years, IN = Naturalized, species that were introduced possibly about 300 years ago during the Brazilian colonial years. (X) = presence and (-) = absence of nymphs.

Table 2. Distribution of the spittlebug *D. flavopicta* on native grass species in campo sujo type of cerrado[1], the Brazilian savanna, in the Federal District of Brazil.

Host species	Number of nymphs/ host species total number	%
Axonopus barbigerus	3	1.34
A. marginatus	192	85.70
A. siccus	12	5.36
Echinolaena inflexa	4	1.79
Melinis minutiflora	0	0
Mesosetum loliiforme	1	0.45
Panicum campestre	0	0
Paspalum pilosum	0	0
Schizachyrium tenerum	10	4.46
Setaria geniculata	1	0.45
Trachypogon polymorphus	1	0.45

[1]Surveyed area = 4,800 m^2

difference was found in the nymphal densities between the site 1 of campo sujo form of cerrado (0.027 ± 0.043, mean ± SD) and the cerrado *sensu strictu* (site 2) (0.007 ± 0.037, mean ± SD) (Student-Newman-Keuls, n = 30, P < 0.05). We found no significant difference between the site 2 of campo sujo form of cerrado (0.033 ± 0.092, mean ± SD) and the cerrado *sensu strictu* (site 2) (Student-Newman-Keuls, n = 30, P > 0.05).

D. flavopicta exhibited a very low density in the Cerrado. The densities of spittlebug nymphs in the natural grassland were much lower than the densities found in the *Brachiaria* sites (Table 3). Comparing the natural and pasture sites, the nymphal densities in the campo sujo form of cerrado sites 1 and 2; and in the cerrado *sensu strictu* were, approximately, 2,272; 1,212; and 105 times lower than the densities in *B. ruziziensis* areas, respectively (Table 3).

The presence of nymphs on the cerrado sites appeared to be related to the presence of infested areas of *Brachiaria* close to these areas (Table 3 and Fig. 1). In the natural grassland area, the nymphal density was higher in the 10 m closest to the border with the infested area of *Brachiaria* (Fig. 1). Additionally, nymphs were not found in the natural grassland areas located far from the planted pasture sites or located close to non-infested pasture (Table 3).

Discussion

Little information has been published about the chemical composition, phenology and ecology of the native grasses of cerrado. Most publications are related to floristic composition of the savanna areas and taxonomic descriptions of the grass species. Even for the species with forage potential, such as *Axonopus* spp., little information is available. Plants of the following host species of the spittlebug: *A. barbigerus* (Kunth) Hitchc., *A. marginatus, Echinolaena inflexa* (Poiret) Chase, *Mesosetum loliiforme* (Hochst.) Chase, *Schizachyrium tenerum* Nees, and *Trachypogon spicatus* (L. f.) Kuntze were visually more grazed by cattle than the other grass species in the cerrado campo sujo (Almeida *et al.* 1987). Among the plant nutritional features that favor cattle grazing, the contents of protein and fiber can also influ-

Table 3. Density of *D. flavopicta* nymphs in natural grassland and in adjacent areas planted with the introduced grass species, *Brachiaria* spp.

Savanna vegetation types		Number of nymphs /m² (mean ± SD)	(n)	T[1]	P
Campo sujo	Site 1	0.03 ± 0.043	(30)	1,233	< 0.001
	B. ruziziensis	61.33 ± 70.446	(30)		
	Site 2	0.03 ± 0.092	(30)	1,314	< 0.001
	B. ruziziensis	40.00 ± 32.479	(30)		
Campo limpo	Site 1	0			
	B. ruziziensis	0			
	Site 2	0			
	B. ruziziensis	0.14			
Cerrado *sensu strictu*	Site 1	0			
	B. ruziziensis	0.98 ± 0.174	(3)		
	Site 2	0.01 ± 0.037	(30)	96	< 0.001
	B. ruziziensis	0.73 ± 0.145	(3)		
Vereda	Site 1	0			
	Brachiaria	NA			
	Site 2	0			
	Brachiaria	0.56			

[1]Mann-Whitney test statistic;
NA = no adjacent area of *Brachiaria* in the site 1.

ence the foraging pattern and survivorship of spittlebug nymphs (Pires 1998). Plants of *A. marginatus*, collected in the Brasilia regions, showed no difference in total protein as compared to plants of *B. decumbens* (Pires 1998). Similar result was found for *Paspalum* spp. collected in the Amazon region (Lima & Gondim 1982). It was found that *P. coryphaeum* Trin., *P. guenoarum*, *P. secans* Hitchc. Chase, and *P. plicatulum*, had only 1.4% to 3.0% less protein than the introduced species *B. humidicola* (Rendle) Schweick.

Although the protein contents of the host plants, *A. marginatus* and *Paspalum* spp., was somewhat similar to those of *Brachiaria* spp. and the spittlebug performance was lower on these native hosts as compared to the introduced host. The nymphal survival and female fecundity were lower on plants of *A. marginatus* (Pires 1998) and *P. guenoarum* (Nilakhe 1987, Cosenza 1989) than on plants of *B. decumbens*. In addition, adult longevity was lower on plants of *P. plicatulum* and *P. guenoarum* as compared to plants of *B. decumbens* (Nilakhe 1987). The plant nutrition features that contribute to reduced female fecundity on these grass species are unknown.

Some general features of the cerrado grass flora possibly can explain the low performance and and low densities of the spittlebug on the native grasses. In general, grasses from xeric environments such as the Cerrado, show the sclerenchyma, a tissue that mechanically support the young tissues, more developed than species from aquatic and humid environments, such as woodlands (Filgueiras 1989).

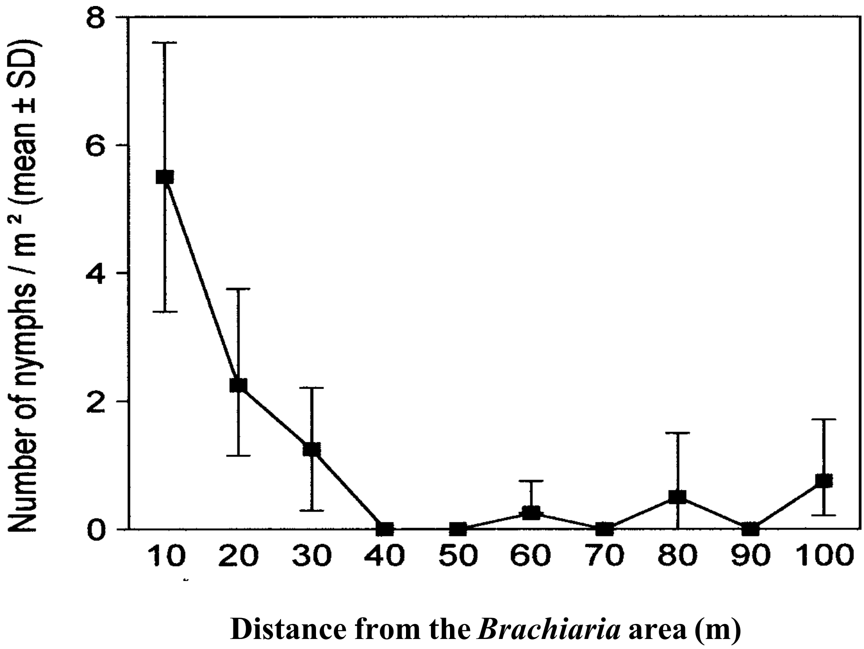

Figure 1. Density of *D. flavopicta* nymphs in the natural grassland located adjacent to a pasture area.

This feature confers more toughness to plant tissues and directly influences the suitability of the plant. Plants of *A. marginatus* have higher percentage of fiber compared to plants of *Brachiaria decumbens* (Pires 1998). Increase in tissue hardness can prevent spittlebug nymphs from reaching the feeding sites, since xylem sucking insects insert their stylets into xylem elements by mechanical means rather than by enzymatic dissolution (Raven 1983). The internal morphology of the shoots also influence the nymphal feeding behavior. For example, the peripheral vascular tissues in *Andropogon gayanus* (Hochst.) Hackel, an introduced host species, are surrounded by sclerenchyma tissue; while in species in the genus *Brachiaria*, the xylem is not protected by sclerenchyma tissue (Calderón *et al* 1982). This aspect of plant morphology has not been described for the native hosts of *D. flavopicta.*

The grass flora from cerrado generally contains high amounts of silica bodies in the epidermis of leaves and shoots, (Sendulsky & Labouriou 1966, Cavalcante 1968). This feature also contributes to increase the hardness of the plant tissue. Silica bodies were found in the species: *A. barbigerus*, *E. inflexa*, *M. loliiforme*, *M. minutiflora*, and *Setaria geniculata* (Lam.) Beuv., (Sendulsky & Labouriou 1966), which were reported in the present work as hosts of *D. flavopicta* (Table 1). Other plant features, such as the presence of trichome and glandular hairs on stems, have been mentioned as a mechanism of resistance in grasses to spittlebug attack. In the species *M. minutiflora*, the presence of oleoresin exudates produced by glandular trichome on shoots has a repellent effect on *D. flavopicta* nymphs (Cosenza 1982) and on nymphs of *Zulia colombiana* Lall., another grass feeding spittlebug (Calderón *et al* 1982).

Other plant features, such as growth form, might explain the low nymphal survival on native host plants. The growth habit among the attacked grass species was variable. In general, the caespitose grasses, or bunch-grasses, were more common among the observed spittlebug host plants. The following species are caespitose perennial grasses (Hitchcock & Chase 1917; Hitchcock 1927, 1930): *A. barbigerus*, culms 100-200 cm high; *A. marginatus,* culms 30-60 cm high; *A. siccus* (Nees) Kunth*,* culms 50-150 cm high; *Panicum campestre* Nees ex Trin.; *Paspalum pilosum* Lam., culms 40-75 cm high; *S. geniculata* culms 50-100 cm high; *Schizachyrium tenerum* Nees, culms 30-110 cm high ; and *T. spicatus*, culms 50-100 cm high. Consequently, these grasses rarely form a dense sward in the sampled cerrado areas. The other species, are stoloniferous perennial grasses: *E. inflexa*, culms 20-50 cm high and *M. minutiflora* culms up to about 100 cm high. The tall-growing habit does not favor the spittlebug attack since the central stems in a bunch grass probably are inaccessible to the nymphs. For example, for species in the genus *Axonopus* and for the species *P. campestre, P. pilosum* and *S. tenerum*, nymphs fed generally on the stems located at the perimeter of the clumps. Also, due to the plant architecture, the nymphs in the native grass species were more exposed to risks of environmental stress and natural enemies than on plants in the genus *Brachiaria*.

Besides the nearness to infested pasture areas, there are other factors which could have influenced the distribution of spittlebugs in the cerrado vegetation types. We observed that spittlebugs in all cerrado types occurred in disturbed areas: areas altered by cattle grazing (campo sujo - site 1) or areas abandoned after man-made disturbance (campo sujo - sites 1 and 2; and cerrado *sensu strictu*). Cattle grazing could have affected the host plants and consequently the spittlebug densities in different ways. Grazing has often been shown to increase the tiller production, to promote changes in plant growth habit (Harris 1978, McNaughton 1984) and to increase the nitrogen, phosphorus and sulphur content (Winter *et al.* 1977) of grass species. For *D. flavopicta* nymphs that feed on shoots of their host plants, tillering can result in an increase of feeding sites. Also, because the nymphs feed on the base of the shoots close to the soil surface, changes from bunch growth to more prostate habit possibly results in more protection to the nymphs against desiccation and predation. In addition, increases in nitrogen contents in the host plant has a positive effect on performance of sucking insects (Waring & Cobb 1992). For example, the nymphal survivorship of *D. flavopicta* was 20% higher on fertilized (NPK) plants as compared to non-fertilized plants of the native grass *A. marginatus* (Pires 1998). Finally, the growth of some grasses, such as the species *M. minutiflora*, *Axonopus* spp., and *Paspalum* spp., is favored by human disturbance (Gibbs *et al.*1983, Pott 1989). This fact can explain the presence of the spittlebug in the cerrado *sensu strictu* site 2, where the insect was only found in one small area where the species *A. marginatus* was growing. In non-disturbed areas (campo limpo and vereda types of cerrado) several grasses formed dense tufts that reached around 1m in height. As mentioned before, the tall-growing habit, possibly, does not favor the spittlebug attack. In addition, in dense clumps, the old and dry tillers (straw) attached to the plants also prevent the nymphs from reaching their feeding sites.

The first study concerning the distribution and density of *D. flavopicta* in its native grasses in the cerrado areas of Brasília is reported here. Nymphal sampling in natural vegetation should be considered the first step in studies about the interactions of spittlebugs and their native host plants. However, much more work needs to be done in order to determine the mechanisms that keep insect populations at such low densities on the natural vegetation. The spittlebug life history needs to be studied on its native hosts, especially with respect to the nymphal foraging pattern, in order to understand how the different host species affect the population dynamics of this herbivore. Knowledge of the mechanisms that keep spittlebug populations at low levels on the native host grasses is basic to studies on host plant resistance and pasture integrated management.

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