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Basic Data on the Biological Control of Tropical Weeds in the Genus *Sida* (Malvaceae): I. *Sida glaziovii*

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For more effective weed management programs, collection of data on the arthropod fauna associated with the native weeds is a prerequisite of the utmost importance, especially in areas where native weed species account for a high proportion of weed pest problems. Three species, *Sida glaziovii, S. rhombifolia* and *S. cordifolia*, were chosen for study because of their importance as invaders in pasture and recently cultivated areas in Southeast Brazil. These species are also considered as important weeds in many other parts of the world wherever they have been introduced. An inventory of arthropods associated with *S. glaziovii* in Southeast São Paulo State, Brazil, showed that most of the individuals and species encountered are sap feeders belonging to the orders Homoptera and Heteroptera. Leaf-eaters, mainly represented by Lepidoptera larvae, are the second richest group. Root- and stem-borers although more abundant than leaf-eaters, are ranked third in species richness. Leaf-miners and gall-makers are relatively rare. Seedlings proved to be more susceptible to herbivorous attack than mature plants. The large host spectrum and parasitism by Microhymenoptera seem to be strong constraints to the efficiency of the herbivores as natural controllers of this weed in Campinas Region. Surveys in areas where the weed is not as abundant as in the region of Campinas could reveal better insect species for *S. glaziovii* biological control, in native or exotic situations.

Introduction

Inventory of the fauna associated with weeds is a basic step for detection and study of species potentially useful in the biological control of these plants. Beyond academic importance, this type of study is of great practical relevance. The intense use of chemical pesticides has been severely criticized, and research such as those of Huffaker (1958, 1959), Huffaker & Messenger (1976), Zwölfer & Harris (1971), Pimentel (1973), Pimentel & Levitan (1986), Pimentel *et al.* (1987), Altieri (1983), and Altieri *et al* (1983) have pointed towards alternatives using biological agents for pest and weed control.

Nowadays, based on the holistic view of agroecosystems (Altieri 1884, Andow 1990, Garcia 1991), inventories of the arthropod fauna associated with weeds permit a better analysis of its role in the agroecosystem and better suggestions for its management. This knowledge can also be exchanged among researchers working on similar subjects. This sort of cooperation for weed management can reduce time and investment and establish a healthy interaction among scientists in many countries.

Most of the weed species in the genus *Sida* L. (Malvaceae), are native to the New World. However, many were introduced into Africa, Australia and Asia, where they represent problems in pastures and cultivated lands. The study of the herbivores associated with these weeds in different regions where they are a problem can facilitate exchanges for the biological control of these weeds.

In Brazil, some *Sida* species are considered important weeds in São Paulo State (Leitao Filho *et al.* 1972, 1975). *S. glaziovii, S.*

rhombifolia and S. cordifolia are very common (Lorenzi 1982) and are mentioned as pest problem for many Brazilian regions (Almeida & Rodrigues 1985). On the other hand, *S. acuta*, which is mentioned as an important weed in many countries, is restricted to forest path and borders in Brazil. Its study can reveal interesting aspects of ecology associated with the invasive potential in these Malvaceae weeds.

This paper describes the fauna associated with *S. glaziovii*, the first species studied in the genus.

Materials and Methods

Survey Areas

The arthropod fauna on *S. glaziovii* was surveyed between 1987 and 1988 in the Campinas region, São Paulo State, Brazil. Five sites used for collection were distributed 10-20 km from the University campus, at 670 m altitude. The Serra do Japi was the most distant, located 40 kilometers south of the campus and at 1,200 m altitude.

The localities were chosen considering the different habitats where this weed species occurs, such as pastures, agriculture lands, roadsides, and disturbed lots. The Serra do Japi Panoramic View point, a very disturbed area inside a forest reserve, was included mainly because of its greater altitude.

The surveys were taken at least 4 times at each site. Collecting dates were distributed so as to represent the fauna in each site during both dry and wet seasons.

Sampling Techniques

For each site, on each collection date, 3 areas or patches of the weed were chosen. Three seedlings, 3 immature, and 3 mature plants were taken randomly. A total of 27 plants were thus collected in each survey. Before being cut at the base of the stem, the plants were inspected and all the arthropods collected. Roots were also surveyed. Based on the evidence of complete absence of insects associated with deeper roots the collections were restricted to the first 10 cm below the soil surface. In addition to the random samples, individual plants showing signals of debility were also inspected and taken to the laboratory.

In the laboratory, all collected plants were carefully dissected. The adult arthropods collected in the field and the endophagous species detected in the laboratory were fixed in 70% alcohol or pinned, depending on the group. All the immature insects were raised to obtain the adults or parasitoids. Flower buds, flowers, fruits, stems, and roots with borers, leaves with miners, and galls were kept in special vials 3 months or more to verify the emergence of endophagous species associated with these structures.

Reference Collection and Data Base

A reference collection and a data base were organized, associating the insect morphospecies to the plant organ attacked, plant phenophase, feeding habit, stage of development when collected, locality and date.

The morphospecies were classified to the family level whenever possible. Nymphs and larvae not associated with an adult form were classified at the order level. Depending on the taxonomic group, specimens were taken to museums and compared with identified specimens or directly identified by specialists. Some groups were mailed to institutions outside Brazil. Many are still unidentified or were identified only to genus or family by the specialists.

Results and Discussion

Associated Fauna

In all, 3,831 insect specimens were collected on *S. glaziovii*. Of these, 3,164 were herbivores belonging to seven orders, 33 families, and 114 species. At the third trophic level, predators were the most abundant group, with 410 individuals and 42 species. Ninety-six parasitoids belonging to 19 species were raised from larval and pupal hosts collected in the field. Only 1 species of scavenger was found. For 170 specimens belonging to 31 morphospecies, it was impossible to identify the feeding habit (Table 1).

The distribution of the different phytophagous species belonging to different insect orders shows that the leaves concentrate the highest number of species. However, most of the Homoptera, which make up the predominant group, are the same species listed for stems or reproductive organ. Roots are used by only 2 species, *Eutinobothrus cf. sidae* (Coleoptera: Curculionidae) and an unidentified coccid. Both of them were also found associated with the basal part of the stem of *S. glaziovii* (Table 1).

The use of more than 1 plant organ as a feeding resource is also seen in *Bagisara repanda* (F.) (Lepidoptera: Noctuidae) which eats leaves while a larva, and visits flowers to get nectar and pollen as an adult. In many cases, however, larvae and adults feed on the same organ although showing different habits. For example, larvae of *Anthonomus rubricosus* (Boheman) (Coleoptera: Curculionidae) are borers in fruit, and adults perforates fruit to feed on it from the outside. Another example is the leaf-miner, *Uroplata* sp. (Coleoptera: Chrysomelidae), the adult of which is a chewer and cuts off the hairs on the upper surface of the leaf before feeding on it.

Guild Structure

The guild structure of the insects on *S. glaziovii* shows a predominance of herbivores. The sap-suckers were the biggest group, representing 63% of herbivore species and 35% of the total fauna. Of the 72 sap-sucker species, 7 were sedentary and the remainder were free-living. This was also the dominant group in individuals, with 2,439 specimens, 1027 of these being aphids (Table 1).

The second largest group in number of species were the chewers, with 15% of the total species. Borers came in third place with 5.3% of the species, numerically more abundant then chewers. Miners and gall-makers were represented by only 3 species each (1.4%).

Predators, mostly ants, represented 20.3% of the insects on *S. glaziovii*. The parasitoid fauna is relatively smaller (9%).

Although it is difficult to make comparisons with data published by other authors when the plant species are different, the guild structure observed for *S. glaziovii* is quite similar to that reported by Wilson and Flanagan (1990) for *S. cordifolia* and by Fontes (1985) for *Solidago* spp., and differs in many aspects from that obtained by Moran (1980) for *Opuntia* spp. While in *S. cordifolia* and *Solidago* spp sap-suckers are the predominant phytophagous, in *Opuntia* borers represent >50% of the total fauna. Also for *Opuntia* the proportion of sedentary sap-suckers is 10.7% while 89% are free living; this relation is exactly the opposite of that in *S. glaziovii*. Among the natural enemies, parasitoids were richer than predators in *Opuntia* while again, the opposite is true for *S. glaziovii* and *Solidago*. The different architecture and texture of the plant parts in *Opuntia* are probably the main factors responsible for these discrepancies.

The guild structures for *S. glaziovii* seedlings, immatures, and mature plants are very similar, except that seedlings showed many fewer species.

Most of the species found on *S. glaziovii* were uncommon, and even those that were frequent were not always present in damaging numbers.

Potential for Biological Control

A minimum of 32 species of herbivores were considered as being closely associated with *S. glaziovii* feeding and even reproducing on the plant (Table 1). Many immature specimens brought to the laboratory died before reaching the adult stage, or had been parasitized and were left unidentified (NI). Therefore, the list of the closely associated herbivorous species considered in Table 1 is an underestimation.

Tingids, especially *Corythaica monacha* Stål and *Gargaphia torresi* (Costa Lima) were very common infesting seedlings which are susceptible to intense damage imposed on the leaves. In field conditions it was observed that seedlings were dying because of intense tingid attack. The importance of damage for plant dynamics depends not only on the amount of tissue destroyed but also on the age of the plant because it is closely related to potential growth and reproduction. These species can not be considered as candidates for biological control, however because both were successfully grown

Table 1. Frequencies, stage when collected, part of the plant attacked, and feeding habit of arthropod species associated with *Sida glaziovii*.

Taxa	Stage Collected[1]	Organ Attacked[2]	Feeding Habit			Number
			Herbivore[3]	Carnivore[4]	Unidentified	
Araneida	n/a			pr		129
Blattodea	n/a				?	3
Coleoptera						
Alleculidae						
Lobopoda sp.	a	?	c			1
Protenus sp.	a	?	c			1
Anthicidae						
Species 1	l,a				?	2
Species 2	a				?	1
Bostrichidae						
[5]Species	a	s	b			29
Bruchidae						
Hypothenemus obscurus (Fabricius)	a	?	c			1
Buprestidae						
[5]*Paragrilus* sp.	l,a	s,l	g,c			10
Carabidae						
Species 1	a				pr	1
Species 2	a				pr	1
Species 3	a				pr	1
Cerambycidae						
[5]*Parmenonta punctigera* (Germ.)	l	s	b			1
Chrysomelidae						
[5]*Chrysodina punctatostriata* Lefèvre	a	ro	c			32
[5]*Diabrotica speciosa* Germar	a	l	c			8
Lema sp.	a	l	c			1
Maecolaspis joliveti (Bechyné)	a	l	c			1
[5]*Maecolaspis* sp.	a	l	c			8
Typophorus sp.	a	l	c			1
[5]*Uroplata* sp.	l,a	l	m,c			10
Species 1	a	?	c			1
Species 2	a	?	c			1
Species 3	a	?	c			1
Species 4	a	?	c			1
Species 5	a	?	c			1
Species 6	a	?	c			1
Species 7	a	?	c			1
Coccinellidae						
Eriopis connexa (Germar)	a			pr		4
Hyperaspis sp.	a			pr		2
Scymnus sp. 1	l			pr		1
Scymnus sp. 2	a			pr		3

Table 1. Continued.

Taxa	Stage Collected[1]	Organ Attacked[2]	Feeding Habit: Herbivore[3]	Feeding Habit: Carnivore[4]	Feeding Habit: Unidentified	Number
Unidentified	l			pr		2
Cryptophagidae						
Species 1	a				?	2
Species 2	a				?	1
Curculionidae						
[5]*Anthonomus rubricosus* Boheman	a	ro	c			45
Apion sp.	a	?	?			1
Chalcodermus sp.	a	s	b			1
Chelotonyx brasiliensis Monte	a	?	?			1
Chelotonyx sp.	a	?	?			3
[5]*Conotrachelus* sp.	l	s	b			178
[5]*Eutinobothrus* sp. 1	l,a	s,r	b			82
[5]*Eutinobothrus* sp. 2	1	s	b			8
Macropteris sp.	a	?	?			2
Naupactus sp.	a	l	c			1
[5]*Parapantomorus fluctuosus* Boheman	a	l	c			5
[5]*Pheloconus* sp.	l	ro	b			2
Species 1	a	?	?			1
Erotylidae						
Species 1	a	l	?			1
Lagriidae						
Lagria villosa Fabricius	a	?	dt			1
Scarabaeidae						
Bolax flavolineatus (Mannerheim)	a	?	?			1
Staphylinidae						
Paederus brasiliensis Erichson	a			pr		1
Species 1	a			pr		1
Family Unidentified						
Species 1	a				?	1
Species 2	a				?	1
Unidentified	l	s,ro	b,g,c?	pr		115
Diptera						
Agromyzidae						
[5]Species	l,a	l,s,?	b,g,m		?	24
Dolichopodidae						
Species 1	a			pr		15
Lauxaniidae						
Species 1	a				?	3
Otitidae						
Species 1	a				?	1

Table 1. Continued.

Taxa	Stage Collected[1]	Organ Attacked[2]	Feeding Habit: Herbivore[3]	Feeding Habit: Carnivore[4]	Feeding Habit: Unidentified	Number
Richardiidae						
Species 1	a				?	1
Sarcophagidae						
Species 1	a				?	1
Syrphidae						
Species 1	l			pr		2
Tachinidae						
Species 1	a				?	1
Tephritidae						
Species 1	a				?	1
Species 2	a				?	1
Species 3	a				?	1
Unidentified	l,a	l,s,?	m,g		?	24
Hemiptera						
Anthocoridae						
Species 1	a			pr		39
Coreidae						
Hypselonotus interruptus Hahn	a	ro,s	s			2
Coriscidae						
Species 1	a	?	s			2
Lygaeidae						
Geocoris sp.	a			pr		6
Species 1	a	?	s			2
Species 2	a	?	s			2
Species 3	a	?	s			4
Species 4	a	?	s			1
Species 5	a	?	s			2
Species 6	a	?	s			1
Miridae						
Annona bimaculata Distant	a	l,s	s			1
[5]*Cafayatina* sp.	a	l,ro	s			2
[5]*Ceratocapsus* sp.	a	l,ro	s			2
[5]*Cyrtopeltis modestus* (Distant)	a	l	s			2
Garganus gracilentus Stål	a	l,s	s			1
[5]*Halticus pygmaeus* (Berg)	a	l,ro	s			1
Horcias signoreti Stål	a	l,s	s			2
Pycnoderes quadrimaculatus Serv.	a	l,s	s			1
[5]*Rhinacloa* sp.	a	l,ro	s			1
Taedia stigmosa Berg	a	l,s	s			4
Taylorilygus pallidulus (Blanchard)	a	l,s	s			1
[5]Species 1	a	l	s			1

Table 1. Continued.

Taxa	Stage Collected[1]	Organ Attacked[2]	Feeding Habit			Number
			Herbivore[3]	Carnivore[4]	Unidentified	
Neididae						
Leptocorisa tipuloide (De Geer)	a	?	s			1
Pentatomidae						
Dichelops furcatus (Fabricius)	a	?	s			2
Edessa meditabunda (Fabricius)	a	ro,s	s			4
Pyrrhocoridae						
[5]*Dysdercus* sp.	a	ro	s			24
Rhopalidae						
Harmostes prolixus Stål	a	?	s			1
H. serratus Fabricius	a	?	s			1
[5]*Niesthoea pictipes* Stål	a	ro	s			57
Xenogenus sp.	a	?	s			1
Scutelleridae						
[5]*Tettira* sp.	a	ro	s			2
Species 1	a	ro	s			4
Tingidae						
[5]*Corythaica monacha* Stål	n,a	l	s			297
Corythucha fuscomaculata Stål	a	l	s			3
[5]*Gargaphia torresi* (Costa Lima)	n,a	l	s			45
Unidentified spp.	n	l	s			358
Family Unidentified						
Species 1	a	?	s			2
Unidentified spp.	n	l,ro,?	s	pr	?	260
Homoptera						
Aphididae						
[5]Species	n,a	l,s,ro	s			1,027
Cicadellidae						
Agallia sp.	n,a	l,s	s			4
Agalliana sp.	n,a	l,s	s			4
[5]*Bucephalogonia xanthophis* (Berg)	a	l,s	s			1
Carneocephala sp.	a	l,s	s			6
Ciminius albolineatus (Taschenberg)	n,a	l,s	s			3
Ciminius sp.	a	l,s	s			1
Dechacona missionum (Berg)	a	l,s	s			1
Diedrocephala continua Sakakibara & Cavichioli	n,a	l,s	s			2
[5]*Empoasca* sp.	a	l	s			2
Exitianus obscurinervis Stål	a	l,s	s			1

Table 1. Continued.

Taxa	Stage Collected[1]	Organ Attacked[2]	Feeding Habit			Number
			Herbivore[3]	Carnivore[4]	Unidentified	
Frequenamia sp.	a	l,s	s			1
Oragua sp.	a	l,s	s			1
Parallaxis sp. 1	a	l,s	s			1
[5]*Parallaxis* sp. 2	a	l,s	s			6
Plesiommata corniculata Young	a	l,s	s			2
Protalebrella brasiliensis (Baker)	a	l,s	s			2
[5]*Scaphytopius* sp.	n,a	l,s	s			19
Sonesimia grossa (Signoret)	n,a	l,s	s			5
Stirellus picinus (Berg)	a	l,s	s			1
Xerophloea sp.	a	l,s	s			6
Xestocephalus sp.	a	l,s	s			1
Species 1	n	l,s	s			2
Species 2	n,a	l,s	s			4
Species 3	a	l,s	s			2
Coccidae						
[5]*Ceroplastes sinensis* Del Guercio	n,a	l,s	s			24
[5]*Coccus hesperidum* L.	a	l,s	s			4
[5]*Saissetia coffeae* (Walker)	n,a	l,s	s			122
Unidentified spp.	n	l,s,r,ro	s			36
Delphacidae						
Species 1	n,a	l,s	s			6
Species 2	n	l,s	s			1
Species 3	a	l,s	s			3
Species 4	a	l,s	s			1
Diapriidae						
Species 1	a	l,s	s			1
Membracidae						
Ceresa malina (Germar)	a	l,s	s			1
Melusinella nervosa (Fairmaire)	n	l,s	s			1
Paraceresa bifasciata (Fairmaire)	n,a	l,s	s			2
Psyllidae						
Species 1	a	l,s	s			1
Species 2	a	l,s	s			1
Family Unidentified						
Species 1	a	l,s	s			1
Unidentified sp.	n,a	l,s	s			73
Hymenoptera						
Braconidae						
Agathis sp.	l			pa		4
Apanteles sp.	l,a			pa	?	6
Bracon sp.	a				?	1
Choreas sp.	l			pa		2

Table 1. Continued.

Taxa	Stage Collected[1]	Organ Attacked[2]	Feeding Habit: Herbivore[3]	Feeding Habit: Carnivore[4]	Feeding Habit: Unidentified	Number
Heterospilus sp.	l,a			pa	?	4
Nealious sp.	l			pa		2
Urosigalphus sp.	l			pa		1
Encyrtidae						
Homalotylus sp.	l			pa		5
Species 1	l			pa		1
Species 2	l			pa		1
Eucoilidae						
Ganaspidium sp.	l			pa		1
Zaeucoila sp.	l			pa		2
Eulophidae						
Diglyphus sp.	l			pa		1
Elasmus sp.	l			pa		3
Euderus sp.	l			pa		1
Species 1	l,a			pa	?	3
Species 2	l			pa		3
Species 3	a				?	1
Eurytomidae						
Species 1	a				?	1
Formicidae						
Atta sp.	a	l				1
Brachymyrmex sp. 1	a			pr		11
Brachymyrmex sp. 2	a			pr		3
Brachymyrmex sp. 3	a			pr		1
Brachymyrmex sp. 4	a			pr		12
Camponotus rufipes (Fabricius)	a			pr		5
Camponotus sp. 1	a			pr		2
Camponotus sp. 2	a			pr		2
Camponotus sp. 3	a			pr		1
Conomyrma sp.	a			pr		4
Crematogaster sp. 1	a			pr		2
Crematogaster sp. 2	a			pr		1
Ectatomma sp.	a			pr		3
Pheidole sp. 1	a			pr		45
Pheidole sp. 2	a			pr		4
Pheidole sp. 3	a			pr		2
Pseudomyrmex sp. 1	a			pr		1
Pseudomyrmex sp. 2	a			pr		2
Solenopsis sp. 1	a			pr		6
Solenopsis sp. 2	a			pr		3
Solenopsis sp. 3	a			pr		19
Solenopsis sp. 4	a			pr		8
Solenopsis sp. 5	a			pr		1
Zacryptocerus sp.	a			pr		1
Unidentified sp.	a			pr		1
Ichneumonidae						
Dichrogater sp.	l			pa		1

Table 1. Continued.

Taxa	Stage Collected[1]	Organ Attacked[2]	Feeding Habit: Herbivore[3]	Feeding Habit: Carnivore[4]	Feeding Habit: Unidentified	Number
Eiphosoma sp.	?				?	1
Microcharops sp.	a				?	1
Temelucha sp.	a				?	1
Pteromalidae						
Species 1	a				?	1
Species 2	l,a			pa	?	16
Species 3	l			pa		1
Unidentified sp.	l			pa		1
Scelionidae						
Species 1	a				?	2
Species 2	l			pa		1
Vespidae						
Species 1	a			pr		1
Species 2	a			pr		1
Unidentified	l,a			pa	?	35
Lepidoptera						
Gelechiidae						
[5]*Battaristis* sp.	l	l	c			2
[5]*Chionodes* sp.	l	l	c			1
[5]*Stegasta* sp.	l	ro	b			11
Hesperiidae						
[5]*Heliopetes domicella willi* (Ploetz)	l	l	c			5
[5]*H. omrina* (Butler)	l	l	c			2
[5]*Pyrgus oileus orcus* (Stoll)	l	l	c			4
Unidentified sp.	l	l	c			3
Noctuidae						
[5]*Bagisara repandra* (Fabricius)	l,a	l,ro	c,np			6
Unidentified sp.	l	l	c			2
Sesiidae						
[5]Species 1	l	s	g			3
Totricidae						
[5]*Crocidosema plebejana* Zeller	l,a	ro	b,np			9
Family Unidentified						
Species 1	l	l	m			4
Unidentified	l,p	l,s,ro	b,c,m			69
Mantodea						
Unidentified	n			pr		3
Neuroptera						
Unidentified	l,p			pr		8
Orthoptera						
Unidentified	n	l	c			16

Table 1. Continued.

Taxa	Stage Collected[1]	Organ Attacked[2]	Feeding Habit: Herbivore[3]	Feeding Habit: Carnivore[4]	Feeding Habit: Unidentified	Number
Thysanoptera						
Unidentified	n,a				?	91

[1] *Stage collected:* 1 = larva, n = nymph, p = pupa, a = adult.
[2] *Organ attacked:* l = leaf, s = stem, r = root, ro = reproductive organ.
[3] *Herbivore:* c = chewer, b = borer, g = gallmaker, m = miner, dt = saprophage and scavenger, s = sap sucker, np = nectar and pollen feeder.
[4] *Carnivore:* pa = parasitoid, pr = predator.
[5] Indicates the most closely associated species.

on cotton leaves in the laboratory and both are cited as cotton pest (Silva *et al.* 1967, 1968).

Heliopetes domicella (Ploetz) and *H. omrina* (Butler) (both Lepidoptera: Hesperiidae) are associated with other *Sida* species but not with cultivated Malvaceae (Garcia, unpublished data). Their larvae are heavily attacked by *Apanteles* sp. (Hymenoptera: Braconidae), however.

In *S. glaziovii*, parasitism by different Microhymenoptera seems to be a strong constraint to the supposedly more specialized groups of leaf-miners, stem gall-makers, and fruit borers in the Campinas region. On the other hand, the ectophagous sap-suckers, most of which show a large spectrum of host plants, seem to occupy a relatively parasitoid-free space.

Some more-specialized species such as the stem borers *Conotrachelus* sp. and *Eutinobothrus* sp. 1 (both Coleoptera: Curculionidae), were relatively abundant at the sampling sites. However, they do not seem to affect the plant vigor when compared with the effects of the tingids on the seedlings.

Therefore, none of the species found associated with *S. glaziovii* so far seems to have great potential as a candidate for biological control of this weed. The complete identification of the species is necessary to permit more firm conclusions. Perhaps the Hesperiidae and the endophagous species, especially *Conotrachelus* sp., *Paragrilus* sp. and *Pheloconus* sp., deserve more attention considering the possibility of biological control of this *Sida* where it is exotic. Surveys on areas where the weed is not as abundant as in the region of Campinas may, however, reveal better insect species for its control, in native or exotic situations.

Preliminary data collected on *S. rhombifolia* and *S. cordifolia* in the same region show that the most predominant insect species are the same as those found on *S. glaziovii.* Except for *Crocidosema plebejana*, none of these was mentioned in the 23 species listed by Wilson and Flanagan (1990) for *S. cordifolia* in Australia. Therefore, the establishment of cooperation among researchers in Brazil and Australia or any other country where species of this genus are weed problems should be extremely productive in the search for effective biological control agents for this weed group.

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