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Predaceous Ant Fauna in New Sugarcane Fields in the State of São Paulo, Brazil

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ABSTRACT

Predaceous ant fauna present in natural sugarcane field plantations in the state of São Paulo, Brazil, was evaluated by using sardine baits sampling technique. Three-month-old sugarcane plants were used for ant fauna estimation in two sugarcane mills, São João and Barra Mill. Twelve 30m X 30 m (900 m²) plots were previously delimited in each sugarcane mill for ant sampling. Ants were sampled in each plot by placing nine sardine baits in 12 mm X 75 mm plastic tubes. In the São João Mill, the predominant ant species observed was Solenopsis saevissima, *followed by* Dorymyrmex *sp. 1,* Pheidole *sp. 2, and* Crematogaster *sp. 1. Considering only ant genus,* Solenopsis, Pheidole, Dorymyrmex, *and* Crematogaster, *were predominant. In the Barra Mill, the predominant ant genus sampled was* Solenopsis, *followed by* Pheidole, Crematogaster, *and* Dorymyrmex. *As generalist predatory ants could be one of the reasons for the naturally low levels of* D. saccharalis *infestation on sugarcane in the state of São Paulo, this study could be helpful for the researchers to gain knowledge about the fauna of predaceous ants which acted as predators of eggs and early larval stages of* D. saccharalis *in Brazil.*

Key words: Ants, predation, *Diatraea saccharalis*, sugarcane, *Solenopsis*, *Pheidole*

INTRODUCTION

The sugarcane borer, *Diatraea saccharalis* Fabricius (Lepidoptera: Crambidae) is the main sugarcane pest in Brazil (Gallo et al., 1988). It causes direct injury through gallery construction, leading to weight loss and germination failure, and indirect losses by facilitating fungus infections that lead to sucrose inversion and a consequent loss of sugar during refinement (Gallo et al., 1988). In the state of São Paulo, Brazil, the only active population control of *D. saccharalis* is by inundative releases of the exotic parasitoid, *Cotesia flavipes* Cameron (Hymenoptera: Braconidae) and current infestation rates are approximately 2% (Botelho, 1992; Botelho et al., 1999). However, the production of *C. flavipes* in sugar mills entails costs and few studies have evaluated the effects of native predators on sugarcane borer populations.

Generalist predators can be effective regulatory agents of pest populations because they can adjust predation between a number of prey population, whether these are primary or secondary pests (Luff, 1983). One of the most common generalist predators in tropical forests are ants (Hymenoptera: Formicidae). For certain crops, a few species may dominate fields, despite high species richness (Adams et al., 1981; Risch and Carroll, 1982; Botelho et al., 1986).

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Ants have been mentioned as being important predators of the sugarcane borer *D. saccharalis*. Larval and egg cane borer stages are attacked by fire ants, *Solenopsis invicta* Buren (Hymenoptera: Formicidae). The constant use of heptachlor and dodecachlor (Reagan et al., 1972) for fire ant abatement programs resulted in drastic population reductions of fire ants *S. invicta* and three-fold increase of sugarcane borer populations in the United States (Charpentier et al., 1967; Negm and Hesley, 1969). Vogt et al. (2001), studying prey items collected by foraging *S. invicta* in an Oklahoma peanut field, observed that the largest percentage of foraged items were lepidopteran larvae, and these ants collected seven times more pest arthropods than beneficial arthropods. Fire ants have also been shown to be key predators for row crop pests in the Neotropics (Risch and Carroll, 1982) and a variety of pests in Florida and Louisiana (Cherry and Nuessly, 1992; Hu and Frank, 1996[a,b]; Fuller et al., 1997).

Through artificial infestations of sugarcane fields in the state of São Paulo (Brazil), Rossi and Fowler (2000) observed that fire ants were the most abundant ants. However, a wider description of the predatory ant fauna was absent in such study. Sousa-Silva et al. (1992), studying the fauna of predators of *D. saccharalis* in a sugarcane field in the state of São Paulo, Brazil, by using P-32 radio-isotop (marking sugarcane borer larvae and eggs), found that the main predators of the sugarcane borer were ants. The main ants sampled in this study were *Ectatoma quadridens* Fabricius, *Solenopsis* sp. and *Gnamptogenys* sp. Roger. However, these ant species have not frequently been observed by sugarcane mill field workers, exception to *Solenopsis* sp. (Harold Gordon Fowler, personal communication), raising doubts whether these ants are really part of the most abundant predaceous ant species in sugarcane fields. As ants are the most important predators of the sugarcane borer in Brazil, the correct information of the predaceous ant fauna present in sugarcane fields is indeed important. In order to elucidate this question, in this study we investigated the fauna of predaceous ants present in sugarcane fields of two sugarcane mills in the state of São Paulo, Brazil.

MATERIALS AND METHODS

Three-month-old sugarcane fields (variety SP 79-1011) in Aguaí, São Paulo, Brazil (22°01'30'S, 47°08'30'W), were used for estimation of the predaceous ant fauna. Twelve 30m X 30 m (900 m²) plots were previously delimited for ant sampling. Ants were sampled in each plot by placing nine sardine baits (canned sardines), contained in 12 mm X 75 mm plastic tubes, three every five rows of sugarcane, with an 8 m spacing between baits on the same row. Baits were left for 50 min and then collected for subsequent species identification. Three days of sampling were performed considering an interval of fifteen days among them. Areas used for samples were located at the São João sugarcane Mill.

Another set of field samples was again taken in newly planted sugarcane (three-month-old) (variety RB 83-5486), but approximately 150 Km south-west of the first area (22°35'30'S, 48°33'50'W). As in the first selected sampling area mentioned above, twelve 900 m² plots were baited in an identical manner to determine the predaceous ant fauna. As above, three days of sampling were performed considering an interval of fifteen days among them. Areas used for samples were located at the Barra sugarcane Mill. As this second set of samples was taken three months later than the first one, only the four most abundant predaceous ant genus were identified since the ant species sampled repeated when compared with those sampled in the São João Mill.

The abundance of ant species (or genus, in the second set of samples) sampled in each day was estimated by summing the number of plastic tubes containing a given ant species in all 12 plots. The abundance of ants was then bar plotted to its corresponding ant species, however, these plots were performed only for the total of ants sampled in the three days. A similar plot was also performed considering only the ant genus.

RESULTS

The abundance of predaceous ant species sampled per day of sampling in the São João Mill is given in Table 1. A total of sixteen predaceous ant species was sampled during the period of study (Fig. 1). For all days sampled, *Solenopsis saevissima* Forel was the predominant ant, comprising 28% of occupied

baits (21 in a total of 75 sardine baits occupied by ants), followed by *Dorymyrmex* sp. 1 (12%), *Pheidole* sp. 2 (8%) and *Crematogaster* sp. 1 (8%) (Fig. 1). Thus, these ant species comprised 56% of occupied baits and the remaining ant species comprised the other 44% (Fig. 1). However, for ant genus only, *Solenopsis* comprised 40% of occupied baits (30 in a total of 75 sardine baits), *Pheidole* (23%), *Dorymyrmex* (13%) and *Crematogaster* (12%) (Fig. 2), hence, these ant genus comprised 88% of occupied baits. Thus, *Ectatomma*, *Camponotus* and *Brachymyrmex* genus comprised only 12% of the occupied baits.

The abundance of predaceous ant genus sampled per day of sampling in the Barra Mill is given in Table 2. In all the days sampled, *Solenopsis* was the predominant ant genus, comprising 41% of occupied baits (44 in a total of 107 sardine baits occupied by ants), followed by *Pheidole* (33%), *Crematogaster* (14%) and *Dorymyrmex* (12%) (Fig. 3).

Table 1 - Abundance of predaceous ant species considering each day sampled in the São João Mill.

Ant species in the first day of sampling	**Number of sardine baits containing ants**
Solenopsis saevissima	12
Ectatomma rudium	3
Solenopsis invicta	3
Dorymyrmex sp.1	2
Solenopsis (complex) *tridens*	1
Pheidole sp. 1	1
Ant species in the second day of sampling	
Pheidole sp. 2	5
Solenopsis saevissima	3
Pheidole oxyops	3
Dorymyrmex sp. 1	3
Pheidole sp. 3	3
Crematogaster sp. 1	3
Ectatomma quadridens	3
Crematogaster sp. 2	3
Dorymyrmex sp. 2	1
Solenopsis (complex) *tridens*	1
Ectatomma rudium	1
Camponotus abdomanalis	1
Ant species in the third day of sampling	
Solenopsis saevissima	6
Dorymyrmex sp. 1	4
Solenopsis (complex) *tridens*	3
Crematogaster sp. 1	3
Pheidole oxyops	2
Pheidole sp. 4	2
Solenopsis invicta	1
Brachymyrmex sp. 1	1
Pheidole sp. 2	1
Total of occupied baits	**75**

DISCUSSION

As predaceous ants have been reported as the main biological control agents of *D. saccharalis* eggs and early larval stages in sugarcane fields in Brazil (Campiolo, 1994), our study shows which ant species have probably contributed to such effect. The number of sardine baits containing ants was small when compared to the total of baits disposed in the field (see the total of occupied baits in the tables).

Table 2 - Abundance of predaceous ant genus considering each day of sampling in the Barra Mill.

Ant genus in the first day	Number of sardine baits containing ants
Solenopsis	18
Pheidole	15
Crematogaster	10
Dorymyrmex	1
Ant genus in the second day	
Solenopsis	13
Pheidole	12
Crematogaster	4
Dorymyrmex	4
Ant genus in the third day	
Solenopsis	13
Pheidole	8
Dorymyrmex	8
Crematogaster	1
Total of occupied baits	107

It probably occurred because we carried out the experiments over new sugarcane plants (three-month-old), thus, the arthropod fauna could be recovering their populations from the last sugarcane harvest.

The predaceous ant fauna collected by Souza-Silva et al. (1992) did not fully corroborate to our data. The ants *E. quadridens* and *Gnamptogenys* sp. were not the predominant ant fauna observed in our study because *E. quadridens* was rarely collected in our field plots, and *Gnamptogenys* sp. was not even sampled (Fig. 1, 2 and 3). However, *Solenopsis* sp., which was widely collected by these authors, was the predominant ant genus observed here (Fig. 2 and 3). This difference of results was probably related to the difference in the sampling techniques adopted in both the studies. Souza-Silva et al. (1992) used manual sampling and soil traps for predaceous arthropod estimation, (although they did not do any mention about the kind of soil trap that was adopted) and we used sardine baits. Apparently, sampling technique adopted by Souza-Silva et al. (1992) was probably misused, resulting in part, in an unclear estimation of the predominant ants habiting sugarcane fields in the state of São Paulo, Brazil. Another possible reason for the discrepancy in such results was that the experiments carried out by the authors mentioned above were spatially limited, sampling only ants that were occasionally present in those particular sugarcane plots. As generalist predatory ants could be one of the reasons for the naturally low levels of *D. saccharalis* infestation on sugarcane in the state of São Paulo (Rossi and Fowler, 2000), this study could be helpful for the researchers to gain knowledge about the fauna of predaceous ants which acted as predators of eggs and early larval stages of *D. saccharalis* in Brazil.

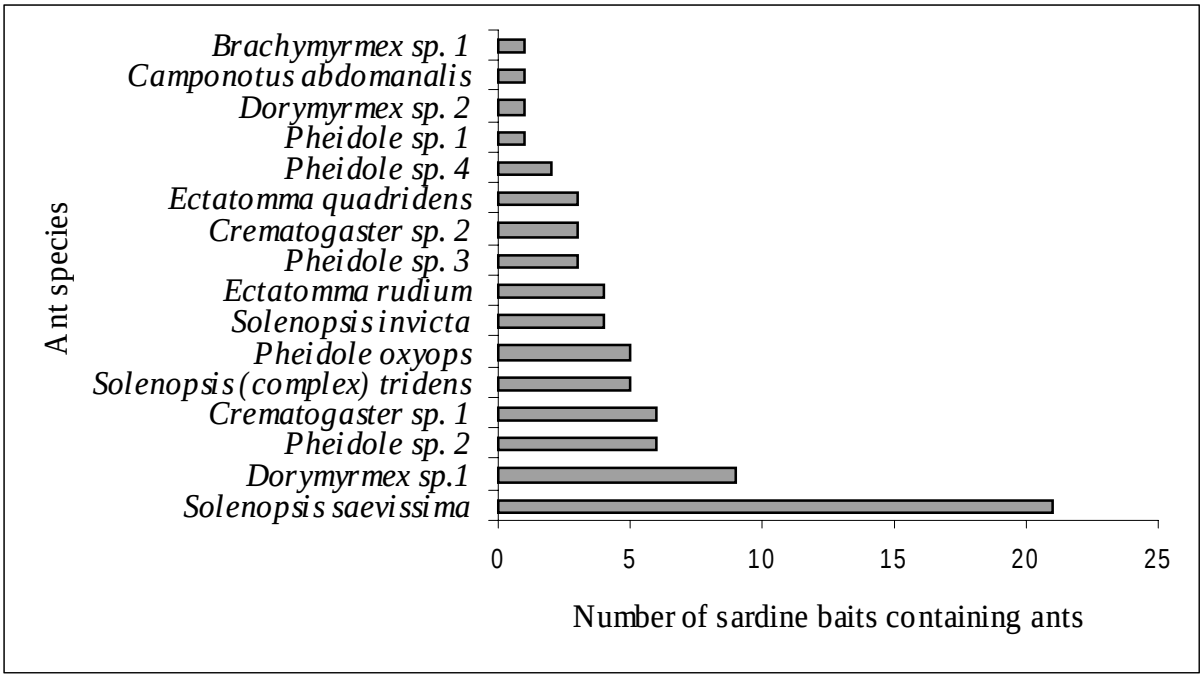

Figure 1 - Abundance of predaceous ant species, considering all days of sampling in the São João Mill.

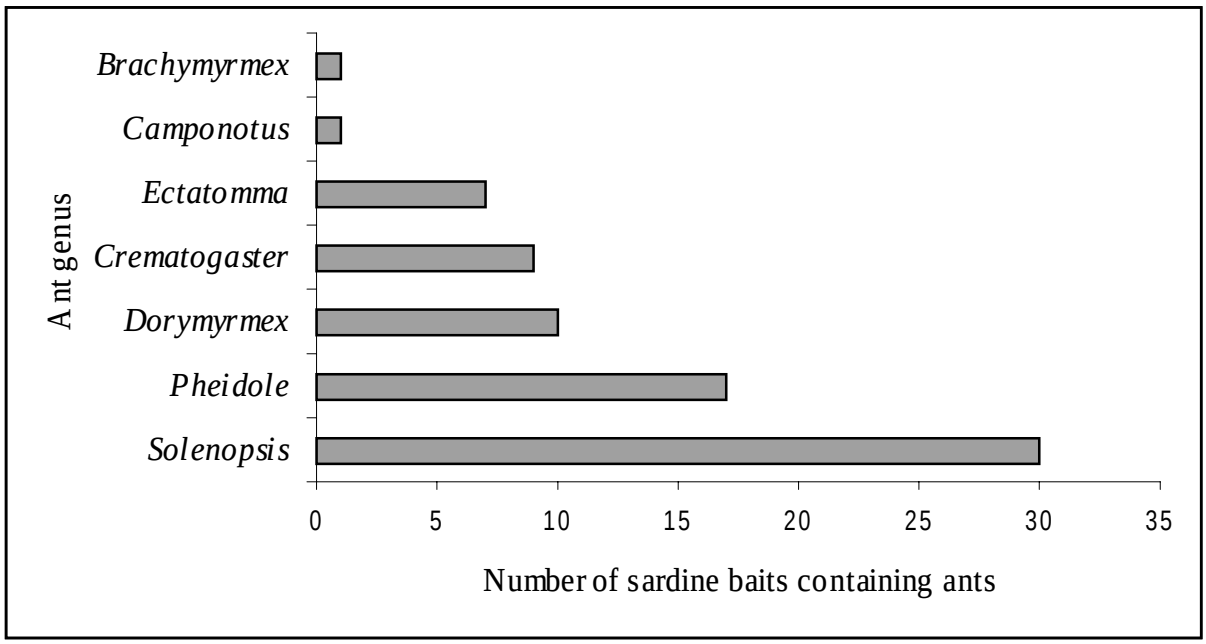

Figure 2 - Abundance of predaceous ant genus, considering all days of sampling in the São João Mill.

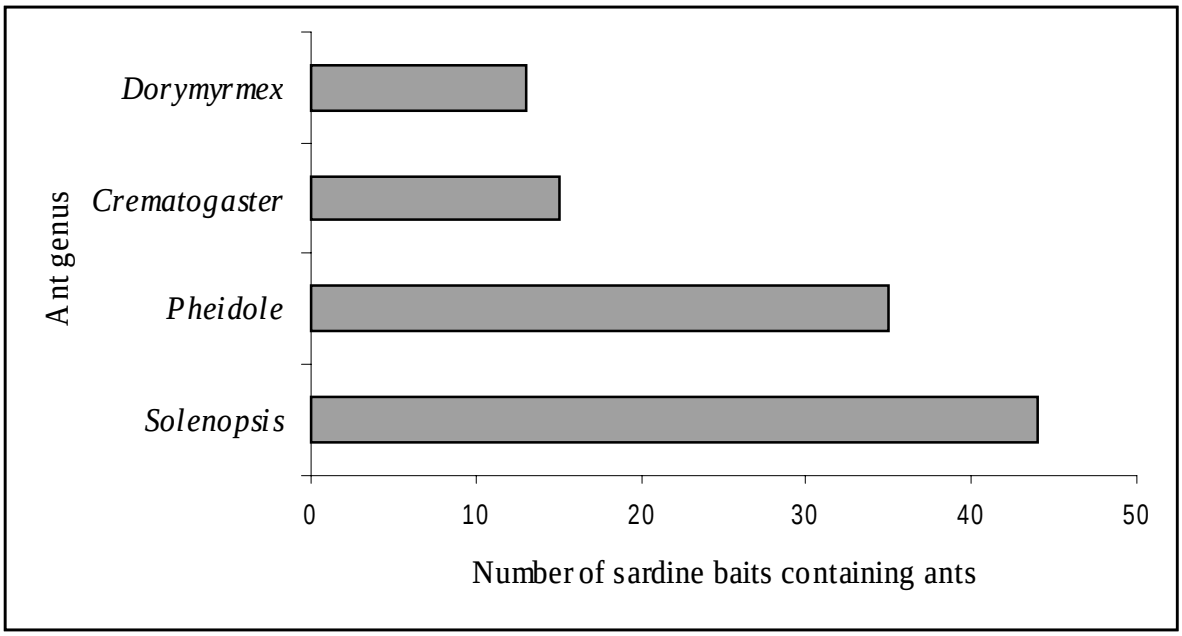

Figure 3 - Abundance of the four main predaceous ant genus, considering all days of sampling in the Barra Mill.

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RESUMO

A fauna de formigas predadoras presentes em lavouras de cana-de-açúcar localizadas no Estado de São Paulo, Brasil, foi avaliada utilizando-se iscas de sardinha. Plantas de três meses de idade foram utilizadas para a estimativa da fauna de formigas predadoras em duas usinas de cana-de-açúcar, usina São João e usina da Barra. Doze áreas [30m X 30 m (900 m²) cada] foram previamente delimitadas em cada usina para a coleta das formigas. As formigas foram amostradas colocando-se nove iscas no solo por área, sendo cada isca composta por um tubo de ensaio plástico (12 mm X 75 mm), contendo sardinha em seu interior. Na usina São João, a espécie de formiga predominante observada foi *Solenopsis saevissima*, seguida por *Dorymyrmex* sp. 1, *Pheidole* sp. 2, and *Crematogaster* sp. 1. Considerando apenas o gênero, os mais abundantes foram *Solenopsis*, *Pheidole*, *Dorymyrmex* e *Crematogaster*. Na usina da Barra, o gênero predominante amostrado foi *Solenopsis*, seguido por *Pheidole*, *Crematogaster* e *Dorymyrmex*. Como a predação por formigas predadoras generalistas deve ser uma das razões para os baixos níveis populacionais das infestações de *Diatraea saccharalis* em lavouras de cana-de-açúcar no Estado de São Paulo, este estudo ajudará futuras pesquisas destinadas a se conhecer as formigas predadoras que de fato agem como predadoras de ovos e estágios larvais iniciais de *D. saccharalis* no Brasil.

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