ENTOMOTROPICA
Vol. 31(5): 40-47
on line 19-Febrero-2016

ISSN 2443-437X (electrónico)
ISSN 1317-5262 (impreso)

Fluctuation and vertical distribution of a population of brown root stink bug *Scaptocoris castanea* (Hemiptera: Cydnidae) in the soil profile in Mato Grosso do Sul State, Brazil.

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Abstract

Ávila CJ, Xavier LMS, Santos V. 2015. Fluctuation and vertical distribution of a population of brown root stink bug (*Scaptocoris castanea*) in the soil profile in Mato Grosso do Sul State, Brazil. (Hemiptera: Cydnidae). Entomotropica 30(24): 40-47.

Population fluctuation and vertical distribution of the brown root stink bug, Scaptocoris castanea Perty, 1833 (Hemiptera: Cydnidae) were determined. There were two peaks of brown root stink bug (in January and September). Population peaks were in December for adults; in January and February for small and middle-sized nymphs, and in September for large nymphs. There was a significant and positive correlation ($r = 0.58$; $p < 0.05$) between rainfall and the number of insects sampled, which shows that the presence of insects in soil profile (from 0 to 0.75 cm depth) is influenced by local rainfall. Population of the stink bug is restricted to the first 45 cm soil depth during the year.

Additional key words: Insecta, population dynamics, soil pest.

Resumo

Ávila CJ, Xavier LMS, Santos V. 2015. Flutuação e distribuição vertical da população do percevejo castanho (*Scaptocoris castanea*) no perfil do solo in rio grande do sul, Brasil. (Hemiptera: Cydnidae). Entomotropica 30(24): 40-47.

Determinou-se a flutuação populacional e a distribuição vertical do percevejo castanho, *Scaptocoris castanea* Perty, 1833 (Hemiptera: Cydnidae). Foram observados dois picos de ocorrência do inseto ao longo do ano (janeiro e setembro). Os adultos apresentaram pico populacional durante o mês de dezembro, as ninfas pequenas e médias em janeiro e fevereiro e as ninfas grandes, em setembro. Foi encontrada correlação significativa positiva ($r = 0,58$; $p < 0,05$) entre os valores de precipitação pluviométrica e os valores de amostragem de percevejos, evidenciando que a disponibilidade do inseto no perfil do solo (0 a 0,75 m) foi influenciada pelo regime de chuva no local de amostragem. Ao longo do ano, a maioria da população do percevejo ficava restrita até 45 cm de profundidade.

Palavras-chave adicionais: Insecta, dinâmica populacional, praga de solo.

Introduction

The common names "brown stink bug" or "brown root stink bug" have been attributed to the bug species with underground habits which belong to the subfamily Scaptocorinae of the family Cydnidae (Becker 1967, Lis et al. 2000). Among the species of brown stink bug, three are important pests in different Brazilian states, viz. Scaptocoris castanea Perty, 1833; S. carvalhoi Becker, 1967 and S. buckupi Becker, 1967. These stink bugs are polyphagous and feed on roots of various crops.

The species S. castanea stands out primarily for its frequent damage on soybean crops, cotton, corn, pasture and rice (Becker 1996, Corrêa-Ferreira and Panizzi 1999, Oliveira et al. 2000, Nakano et al. 2001, Oliveira et al. 2003, Ávila et al. 2009, Medeiros et al. 2014), but it has been cited as attacking several plants in different families (Costa Lima 1940, Silva et al. 1968, Salvadori 1999, Lis et al. 2000, Oliveira et al. 2000, Matias et al. 2011, Silva et al. 2013).

Brown stink bugs have a brown coloration and are characterized by the peculiar structure of the tibiae and the convex and globe-shaped body (Costa Lima 1940, Becker 1967). As they have underground habits, nymphs and adults feed by sucking the sap from the roots. Symptoms of plants being attacked by this pest depend on the intensity of the attack and the time of appearance in the crop, varying from wilting and yellowish leaves to plant underdevelopment and desiccation. Damage may reach 100 % of a crop (Costa and Forti 1993, Oliveira et al. 2003).

Although brown stink bug is characterized as an important pest along this last decade in Brazil, most related studies report only the occurrence and damages on crops (Oliveira and Malaguido 2004). The main difficulty for effective management of this species is the scarcity of basic studies about its biology, taxonomy and behavior in the agriculture ecosystem (Fernandes et al. 2004).

In Mato Grosso do Sul State severe infestation of this pest have been reported, mainly in no-tillage systems (Xavier and Ávila 2005, Ávila and Xavier 2007). For proper management of this pest, adequate monitoring is essential. Therefore, it is necessary to know the dynamics of this insect in the soil profile as well as aspects related to its bioecology. Studies related to the dynamics of the brown root stink bug population in the soil have been done in recent years (Fernandes et al. 2004, Oliveira and Malaguido 2004). These informations when related to biotic and abiotic factors of agroecosystem are important as they contribute to establishing strategies for the effective management of this pest.

The aim of this work was to study the population fluctuation and vertical distribution of the brown stink bug in soil profile along a year.

Materials and Methods

An area of approximately two hectares was used to study the seasonal fluctuation of the brown stink bug population in soil profile from December 1999 to December 2000, in Maracaju county, State of Mato Grosso do Sul – Brazil (lat 21° 43´ S, long 55° 32´ W, 551 m). Monthly, five rectangular surface trenches (0.30 m x 0.30 m) were opened until the depth of 0.75 m, in each sampling period. Each sample was taken in layers of 0.15 m - forming up 5 layers in soil profile (0 - 0.15 m, 0.15 – 0.30 m, 0.30 - 0.45 m, 0.45 - 0.60 m and 0.60 - 0.75 m). Each sample was placed in a plastic bag and taken to the entomology laboratory of the Embrapa Agropecuária Oeste for counting the insects and separing adults, large nymphs (> 5 mm) medium nymphs (between 3 mm to 5 mm) and small nymphs (< 3 mm). A sample of the collected insects was sent to Dra. Myriam Becker of the Universidade Federal do Rio Grande do Sul to confirm specific identification. Also, samples from the soil were taken for determining its present humidity for establishing a relation between this parameter and the population density of the stink bug. Soil samples were placed in steel rings and sealed with insulfilm for retaining the humidity, being the humidity determined by the gravimetric method. Moreover, rainfall data were recorded in the areas where the samples were collected using a rain gauge fixed in a stake. We performed Pearson correlation analysis between stink bug sample values in the soil profile and precipitation observed on the place. During the studies soybean was grown in the summer season 1999/ 2000, and soon after, corn was planted. After that, during August, September and October 2000 there was no cultivation. Native vegetation in the region is of cerrado type, with an average texture soil managed by a switch system of cattle and crops in intervals of three years each.

Results and Discussion

The bug species identified was Scaptocoris castanea Perty, 1833 (Hemiptera: Cydnidae). Two peaks of occurrence were noted along the year: one in January and another in September (Figure 1). There was a significantly positive correlation ($r = 0.58$; $p < 0.05$) between values of rainfall in the region and sampling values of the stink bug, which may suggest that the presence of the stink bug in the soil profile (0 a 0.75m) was influenced by the rainfall in the field studied (Figure 1). Oliveira and Malaguido (2004) studied the population dynamics of S. castanea and found peaks of adults of this pest in February and June in São Paulo state, during rainy periods. Nardi et al. (2007) also found that the number of adults of S. carvalhoi in a pasture area was dependent on rainfall, observing higher incidence during increase in rainfall. This positive correlation between precipitation and the number of adults was also observed for Atarsocoris brachiariae Becker, 1996 in pasture (Medeiros et al. 2009).

Proportion of adults and small, big and medium nymphs from the stink bug in the soil was variable along the year (Figure 2). However, different developmental stages of the stink bug were noticed in different periods of samplings. Similar results were found in the bug S. castanea, in the State of Goiás by Fernandes et al. (2004). Pessa et al. (2013) also found that both, nymphs and adults of S. castanea, occurred throughout the year.

Oliveira and Malaguido (2004), by studying the distribution of S. castanea in the soil profile in the County of Sapezal, State of Mato Grosso, also observed the presence of adults and different sizes of nymphs along the whole year, although higher incidence of adults was observed from November to January, during the rainy period in the region. The predominance of adults in the rainy period reveals that, in this occasion, the stink bugs are preparing for dispersion. In the State of Goiás, Fernandes et al. (2004) reported that dispersion of S. castanea occurred between November and March, coinciding with higher rainfall in that region.

Adults presented a population peak during the month of December; the small and medium nymphs along subsequent months (January and February) and large nymphs in September (Figure 2). This seasonal distribution of different stages of development is in accordance with its natural biological cycle (adult => small nymph => medium nymph => large nymph) in the soil.

Regarding the distribution of the brown stink bug along the year, a higher population density it was noticed in the layer of 45 cm depth (Figure 3). There was remarkable population reduction in the soil layers of 0 - 0.15 m and 0.15 - 0.30 m during February and in July and August. This might be due to the lower level of humidity in these layers (Figure 4), pushing the stink bug into deeper layers where higher soil moisture offered better survival conditions. Our results corroborate those obtained by Pessa et al. (2013) who observed strong relation between

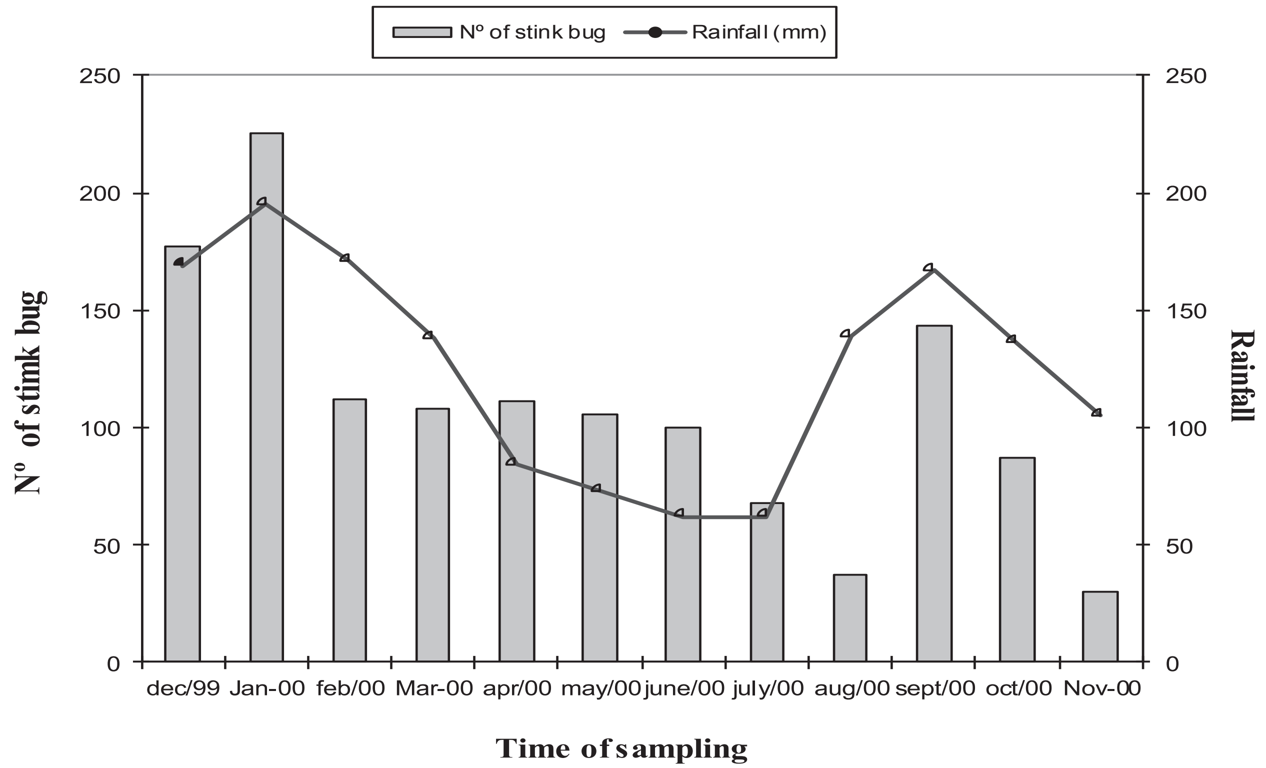

Figure 1. Population flotation of the brown stink bug (adults + nymphs) in the soil (sample of 0.3 m x 0.3 m x 0.75 m depth) and rainfall observed between December 1999 and November 2000 in Maracaju, MS.

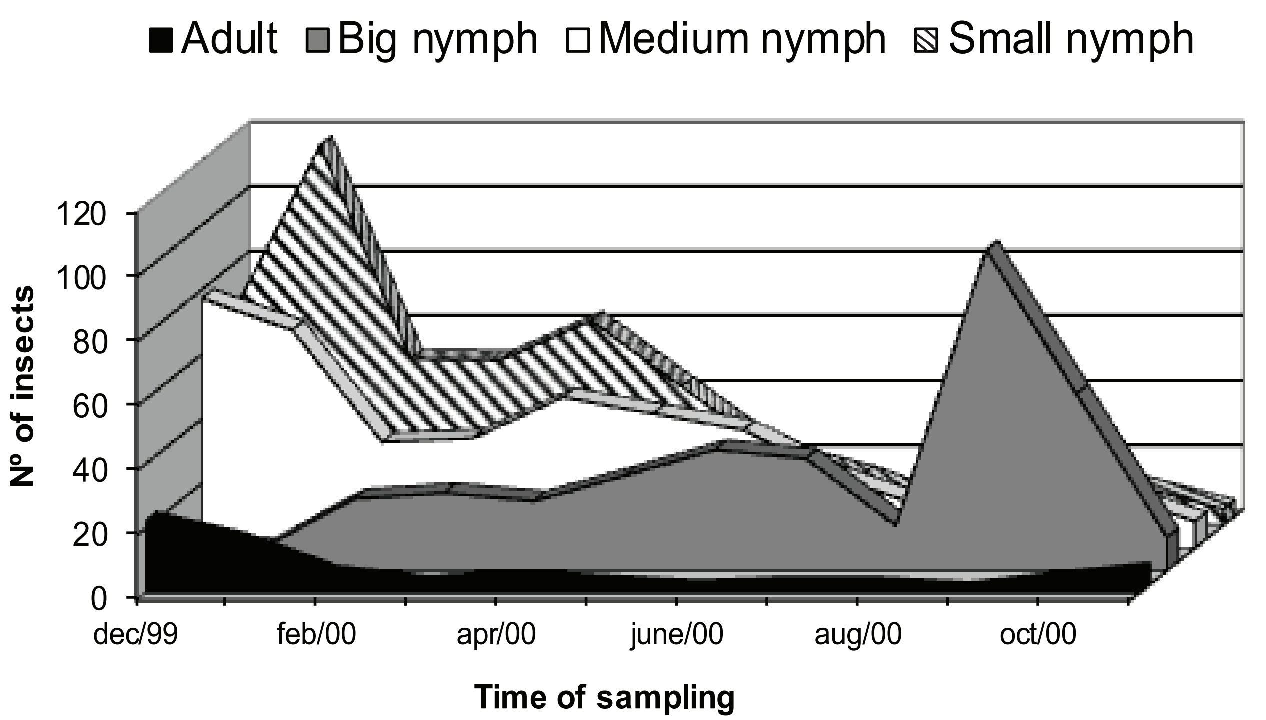

Figure 2. Population flotation of adults, big nymphs (> 5 mm), medium nymphs (3 mm a 5 mm) and small nymphs (< 3 mm) of brown stink bug in the soil (samples of 0.3m x 0.3m x 0.75m depth), in the period of December 1999 to November 2000, in Maracaju, MS.

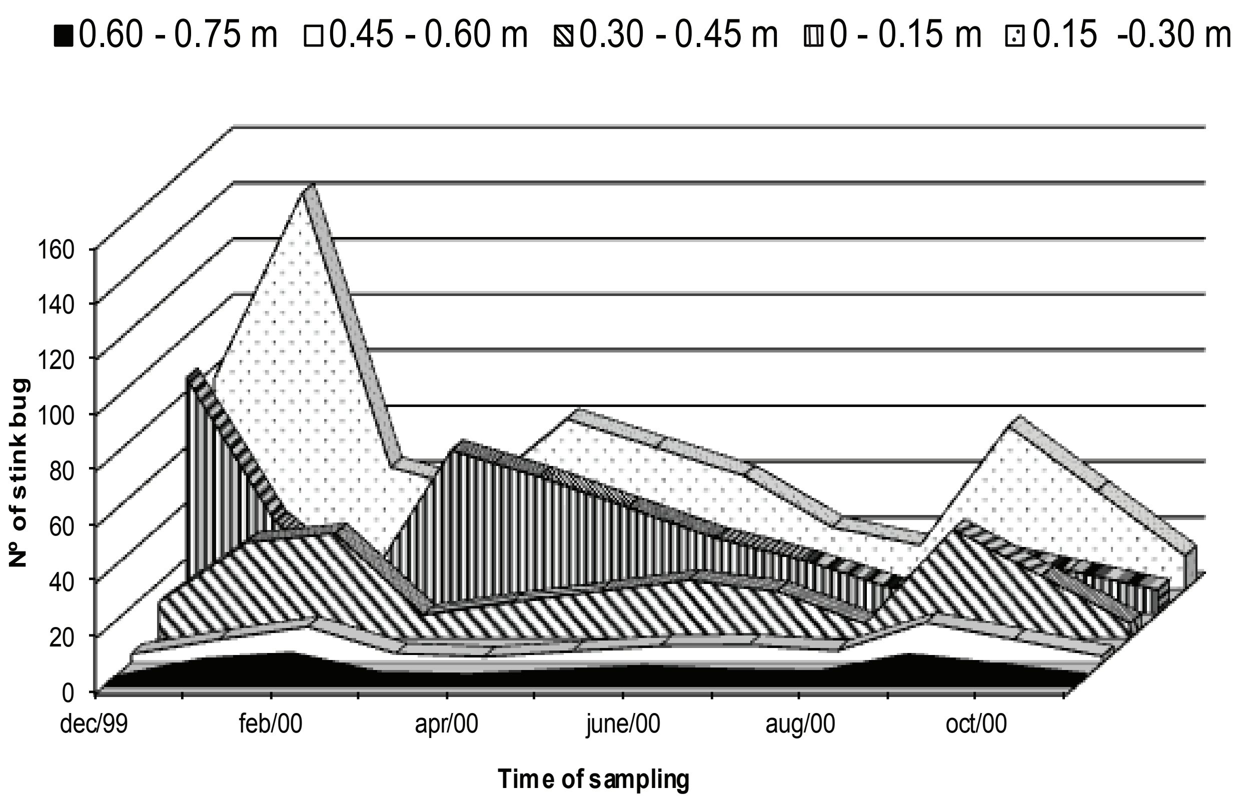

Figure 3. Population flotation of brown stink bugs (adults + nymphs) in different strata of the soil profile (between 0.0 a 0.75 m depth) from December 1999 to November 2000, in Maracaju, MS.

the highest rainfall values and the increase in the frequency of S. castanea individuals. The same authors pointed out that rainfall seems to be a more important factor than temperature in the population fluctuations of this stink bug. Nardi et al. (2007) also found that S. carvalhoi occurred in the upper layers of the soil in the rainiest months, and tended to move to deeper layers in the driest months of the year. In addition, this can also explain the increase of those stink bugs in deeper layers (45 to 75 cm) during the months of February and September (Figure 3). Fernandes et al. (2004) also reported that the brown stink bug, A. brachiariae, remains close to the soil surface in the rainy period and goes deeper in periods of drought. Data from S. castanea, gathered in Sapezal, MT by Oliveira and Malaguido (2004) revealed that from May to October (scarce water period) more than 60 % of the stink bug population were found at 0.30 m lower in the soil. These same authors stated that control measures, either cultural, chemical or biological, are more efficient when done in December, because nymphs and adults are more concentrated on the soil surface. In drought period, from August to September, Fernandes et al. (2004) observed that 90 % of S. castanea population was located from 0 up to 0.60 m of depth in the soil. Moreover, in the State of Goiás, Sousa (2002) noticed that, although during December, January, February and April, most of the population of A. brachiariae was 20 to 40 cm below soil surface, in August (drought period) 57 % of the population was positioned at 80 to 100 cm below. Pessa et al. (2013) found that S. castanea was observed at a depth of 60 cm during the months of June, July and August in Primavera do Leste, MT, and at 30 cm in

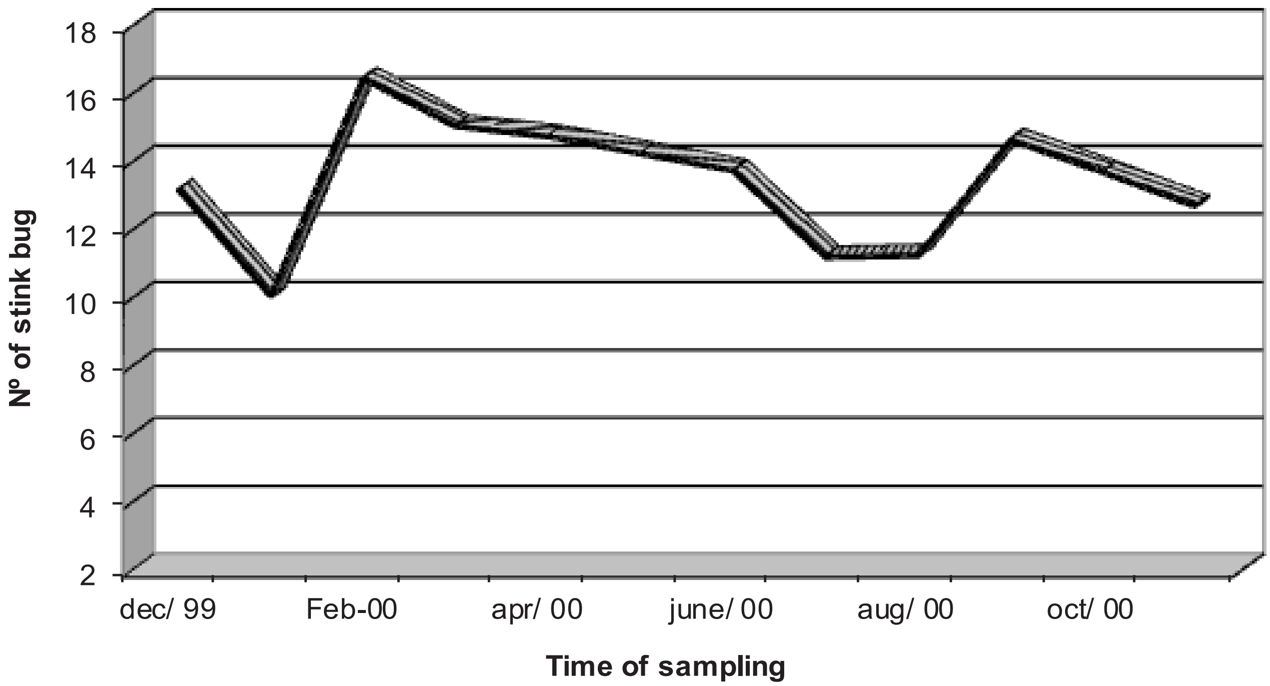

Figure 4. Flotation of the humidity in the soil profile (up to 30 cm depth), from December 1999 to November 2000, in Maracaju, MS.

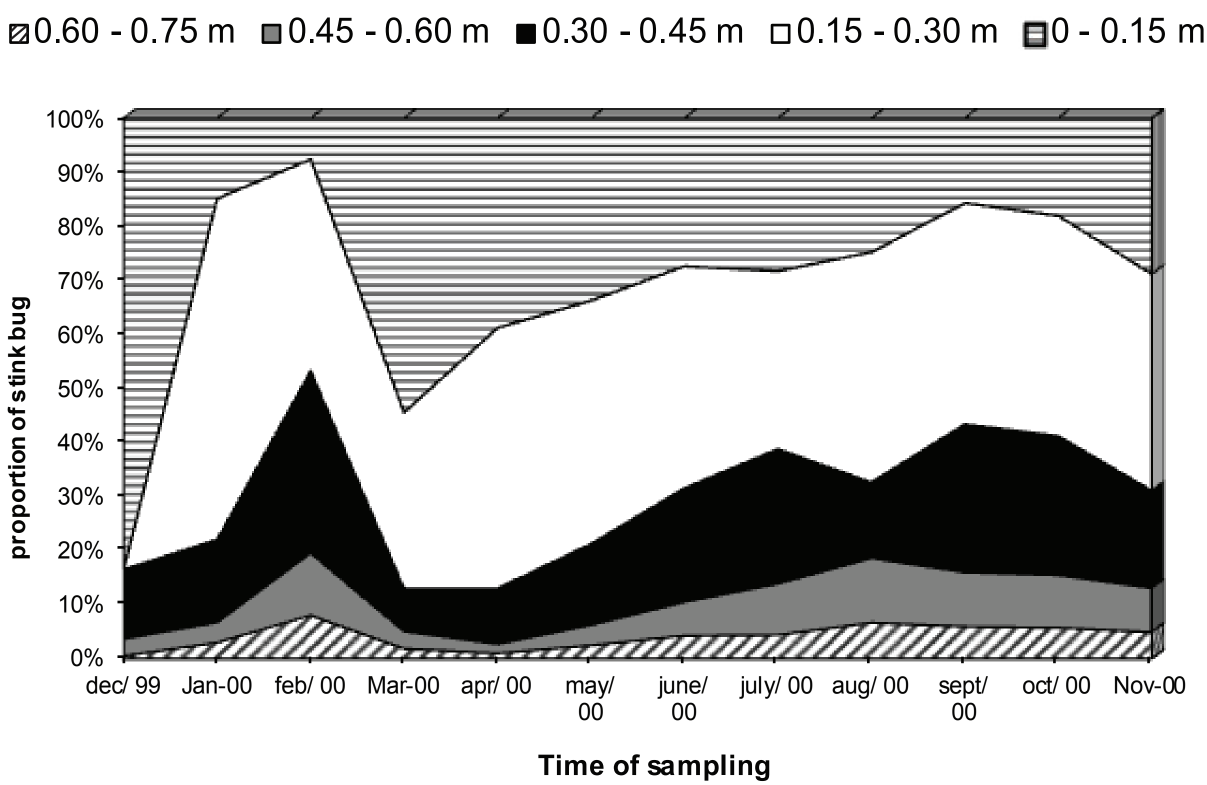

Figure 5. Proportion of the brown stink bug population (adults + nymphs) in different strata of the soil profile (from 0.0 to 0.75m deep) in the period from December 1999 to November de 2000, in Maracaju, MS.

September and October. However, higher population concentrations of this pest were observed between 30 and 120 cm depth.

In the present study, most of the population of nymphs and adults of S. castanea was found in the layers ranging from 0 to 45 cm of soil depth in soybean crop throughout the year. However, it is possible that this behavior can change depending on the frequency of rain at the place. Studies carried out with S. carvalhoi demonstrated that after a long period without rain in September, the frequency of adults present below 80 cm on soil profile was higher than 50 % to 80 % (Nardi et al. 2007).

Conclusions

Adults and nymphs of brown stink bug shows population fluctuation in the soil along the year, being its distribution affected by soil humidity

Adults presented an occurrence peak in December, small and medium nymphs in January and February, and large nymphs in September.

Acknowledgments

We thank the "Fundação de Apoio ao Desenvolvimento do Ensino, Ciência e Tecnologia dos Estados de Mato Grosso do Sul (FUNDECT)" for financial support of this research.

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Recibido: 20-11-2014
Aceptado: 20-07-2015