



SURVEY OF PARASITOIDS IN MAIZE (*Zea mays* L.) GROWN IN CONVENTIONAL SYSTEM

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RESUMO

O cultivo do milho (*Zea mays* L.) via sistema convencional, no Brasil, tem sido explorado praticamente durante todo ano. O objetivo deste trabalho foi estudar a flutuação populacional dos parasitoides de lagartas de *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) em milho cultivado no sistema convencional de produção. Sementes de milho convencional (BR 106) foram plantadas em área de plantio convencional. Durante todo o ciclo da cultura do milho, três vezes por semana, foram amostradas em cada parcela, 10 plantas ao acaso, totalizando 240 plantas por amostragem. As larvas de *S. frugiperda* foram coletadas e o ciclo biológico acompanhado até o aparecimento dos adultos e/ou parasitoides. Foram realizadas 20 coletas de plantas de milho, o número total de lagartas de *S. frugiperda* foi de 1108, do total de lagartas de *S. frugiperda* amostradas, 86,2% originaram adultos; 7,7% parasitadas por Hymenoptera ou Diptera e 6,1% mortas pela ação de microrganismos. Em todas as coletas de plantas de milho foram encontradas lagartas parasitadas, indicando a importância dos agentes de controle natural na redução da densidade populacional de *S. frugiperda*.

ABSTRACT

The cultivation of maize (*Zea mays* L.) via conventional system in Brazil has been explored almost all year round. The aim of this work was to study the fluctuation of parasitoids of larvae of *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) in maize grown in the conventional production. Conventional maize seeds (BR 106) were planted in the area of conventional tillage. Throughout the growing cycle of maize, three times a week, were sampled in each plot, 10 plants at random, a total of 240 plants per sampling. The larvae of *S. frugiperda* were collected and the biological cycle accompanied by the appearance of adults and/or parasitoids. Were carried out 20 collections of plants of maize, the total number of larvae of *S. frugiperda* was 1108, the total number of larvae of *S. frugiperda* sampled, 86.2% originated adults; 7.7% parasitized by Diptera or Hymenoptera and 6.1% killed by the action of microorganisms. In all collections of plants of maize were found caterpillars parasitized, indicating the importance of natural control agents in reducing the population density of *S. frugiperda*.

INTRODUCTION/OBJECTIVES

The cultivation of maize (*Zea mays* L.) via conventional system in Brazil has been exploited almost throughout the year is the harvest of summer and late season (fall), for the production of grains and seeds, or irrigation, for maize industry or selling fresh. (Figueiredo et al., 2005). In this form of cultivation, are used herbicides, fertilizers than chemical insecticides that are effective for elimination of blight, but some are highly toxic to natural enemies, leading to their elimination from the agro-ecosystem, favoring the occurrence of resistant populations of secondary pests and disastrous consequences of these pesticides on the environment.



In the context of modern farming, pest control is important to get increased productivity in maize. However, this control should be made rationally aimed at reducing pesticide use and should prioritize other more environmentally safe methods such as biological control, which enables the producer to reduce contamination of the product, the consumer and the environment. This method may offer lower costs and can be used the wealth of the Brazilian fauna organisms with the potential to act as agents for pest control.

The fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) is considered a pest of global significance, for attacking different plants of agricultural interest, such as cotton (*Gossypium hirsutum* L.), rice (*Oryza sativa* L.), sorghum [*Sorghum bicolor* (L.) Moench] and maize (Wyckhuys & O'Neil, 2006), being the main pest of this last crop in Brazil. Under favorable conditions, can reduce 17 to 54.49% of the production of this cereal grains (Cruz & Turpin, 1982; Cruz & Turpin, 1983, Cruz et al. 1999a, Figueiredo et al., 1999, 2006a), with losses estimated at more than \$ 400 million (Cruz et al., 1999a).

The control of the fall armyworm have been done by spraying of insecticides with granules applied in the cartridge (Cruz & Santos, 1984) or as seed treatment (Cruz et al., 1999b). The cultural control through tilling the soil, is also recommended as it may promote mortality of 35 to 50% of pupae of Lepidoptera (Cruz, 1995), which pupation occurs in soil.

The manipulation of weed flora has also been studied in the management of *S. frugiperda* (Altieri & Whitcomb, 1980), and the development of maize genotypes resistant to this pest (Viana & Potenza, 2000, Lima et al., 2006).

Alternative methods for the reduction population of *S. frugiperda* have been studied (Figueiredo et al., 1999, 2002, 2006ab, 2009; Cruz, 2009ab). Among the natural biological control agents of *S. frugiperda*, there is particular interest in the group called parasitoid, particularly the efficiency and specificity in relation to the hosts.

The aim was to study the population dynamics of parasitoids of larvae of *S. frugiperda* in maize grown in the conventional production.

MATERIALS AND METHODS

The experiment was conducted in experimental fields and in the Laboratory of Insect Rearing (LACRI) of the Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA Milho e Sorgo) in Sete Lagoas, Minas Gerais State, Brazil (19 ° 28 '00"S and 44 15 '00"W).

In the 2009/2010 crop in the Cerrado region, an area of approximately one hectare known as area conventional farming has been isolated from other crop areas for about 1000 meters and distanced from each other by 300 meters. Conventional maize seeds (BR 106) were planted in this area.

To determine the initial appearance and frequency of moths during the experiment, immediately after emergence of maize plants was installed in the center of the experimental area, a delta trap, Ferocon 1C ®, containing the synthetic sex pheromone of *S. frugiperda*, BIO SPODOPTERA ® (Chem Tica Internacional, SA) type sachet.

The planting area was subdivided into 24 plots of equal size. When was detected in the traps, the presence of *S. frugiperda*, started collecting the plants. Throughout the growing cycle of maize, three times a week, were sampled in each plot, 10 plants at random, a total of 240 plants per sampling.

These plants were evaluated to seal recording the number of plants with larvae of *S. frugiperda*, the number of larvae per plant and length of each larva. Done such procedures larvae of *S. frugiperda* were distributed individually in containers to create an artificial diet (Cruz, 2009a). The presence of the subsequent stages of the larvae and/or the presence of natural enemies were also recorded.



The larvae of *S. frugiperda* were kept in air-conditioned rooms at 25 ± 2 °C, 12 h photophase and relative humidity $70 \pm 10\%$.

The life cycle of *S. frugiperda*, was observed by the appearance of adults. Similarly noted was the kind of emerged and the phase in which the pest has emerged.

RESULTS/DISCUSSION

Twenty samples were taken of maize plants, the total number of larvae of *S. frugiperda* collected was 1108 and the average number of larvae/sample collection was 55.4 (Figure 1). The density of larvae of *S. frugiperda* grew exponentially until the 15th significant reduction in recent collections. The total number of larvae of *S. frugiperda* sampled, 86.2% originated adults, 7.7% were parasitized by Hymenoptera or Diptera and 6.1% killed by the action of microorganisms.

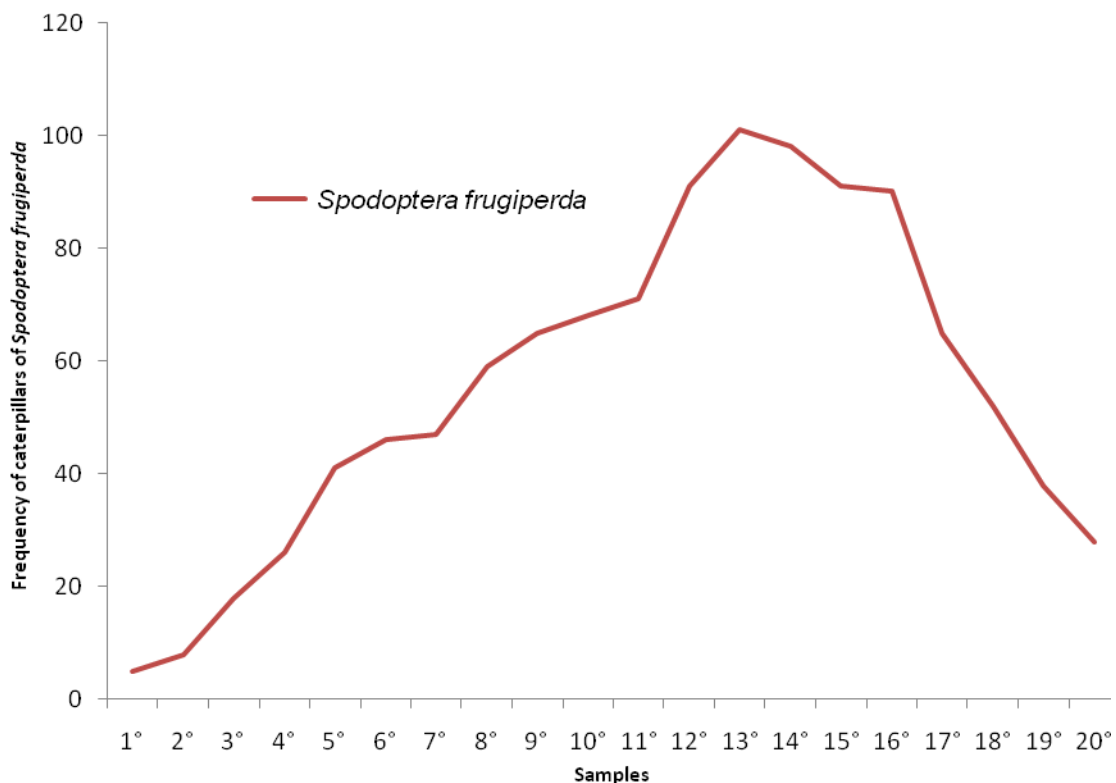


Figure 1. Population density of *S. frugiperda* in maize grown in the conventional production.

Campoletis flavicincta (Ashmead) (Hymenoptera: Ichneumonidae) and *Winthemia trinitatis* Thompson (Diptera: Tachinidae) (Figure 2) were the parasitoids predominates and were present in almost all collections. The parasitoid *C. flavicincta* acts specifically in the control of small larvae, this natural enemy reduces dramatically leaf consumption of caterpillars, reducing your damage and causing his death (Cruz, 2009ab). While the parasitoid *W. trinitatis* operates in more control of caterpillars, plays an important role in the suppression of *S. frugiperda* and can be found in different countries of South America (Coelho et al., 1989).

The second parasitoid predominant was *Chelonus insularis* Cresson (Hymenoptera: Braconidae) (Figure 2). The female of *C. insularis* puts its eggs inside the eggs of *S. frugiperda*, allowing the emergence of caterpillars, which however do not show normal development. Larvae parasitized by *C. insularis* decrease significantly the leaf



consumption (Rezende et al., 1995). The occurrence and direct impact of *C. insularis* on *S. frugiperda* point this natural enemy as an additional factor in the management of *S. frugiperda* indicating the importance of proper management of the agro-ecosystem of maize, aiming at the preservation of natural enemies (Figueiredo et al., 2009). *Eiphosoma* spp. (Hymenoptera: Ichneumonidae) was the third parasitoid dominant in the samples (Figure 2), this genus has about 30 described species occurring in different agroecosystems are some important natural enemies of Lepidoptera pests (Cruz, 2009b).

Fewer were collected in reverse order the parasitoids *Cotesia* spp. (Hymenoptera: Braconidae) and *Exasticolus fuscicornis* (Cameron) (Hymenoptera: Braconidae) (Figure 2).

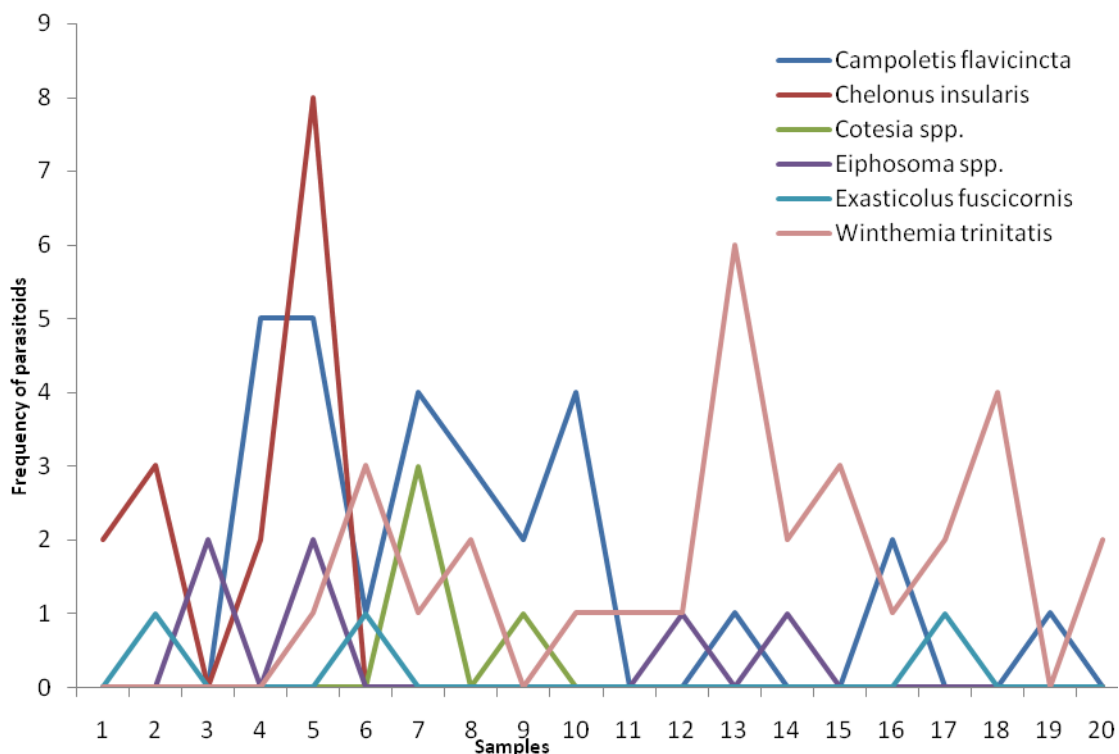


Figure 2. Population fluctuation of *S. frugiperda* in maize grown in the conventional production.

It is noteworthy that the work reported here was focused only on the larvae of *S. frugiperda*, so it is possible that the rate of natural control may be much higher especially considering the results in terms of exclusive egg parasitoids *Trichogramma* spp. (Hymenoptera: Trichogrammatidae) and *Telenomus remus* (Nixon) (Hymenoptera: Scelionidae).

CONCLUSIONS

In all samples of maize plants were found parasitized caterpillars, indicating the importance of natural control agents in reducing the population density of *S. frugiperda*, and especially the importance of proper management of the maize crop. The results showed the presence of parasitoids in some relatively high level in the area of conventional production. Thus, the probability of successful adoption of Integrated Pest Management (IPM) is relatively large and should be encouraged.

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