

Pearl Millet: A Green Bridge for Lepidopteran Pests

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Abstract

This study evaluated the occurrence of lepidopteran pests on millet cultivated in off-season in the state of Mato Grosso, Brazil. Larvae were collected from May to July 2013 in an area of 145 hectares located in Tangará da Serra, MT. After being collected, caterpillars were kept in the laboratory and fed an artificial diet until the pupal stage. After emergence, adults were dry mounted, identified, and deposited in the entomological collection of Embrapa Cerrados, Planaltina, Distrito Federal, Brazil. Adults obtained from 117 caterpillars were identified as *Mocis latipes* (Guenée), *Spodoptera frugiperda* (J.E. Smith), *Helicoverpa armigera* (Hübner), *H. zea* (Boddie), *Mythimna (Pseudaletia) sequax* Franclemont, *Urbanus proteus* (Linnaeus), and *Leucania latiuscula* Herrich-Schäffer. This study describes the first record of lepidopteran pests on millet plants in the state of Mato Grosso, and the incidence of lepidopterans in the system that uses millet as cover crop represents a risk of the occurrence of insect pests on subsequent crops on the straw of this grass.

Keywords: intermediate host, caterpillars, direct seeding.

1. Introduction

The area cultivated with pearl millet (*Pennisetum glaucum* L.) has expanded in Brazil, especially in the Cerrado, as one of the main cover crop alternatives for direct seeding (Priesnitz et al., 2011). The production system that includes millet after the summer crop and in late winter/early spring predisposes it and other cash crops, such as corn, sorghum, soybeans, sugarcane, and rice, to the attack of insects that use this cover crop as intermediate host (Perreira-Filho et al., 2003).

The number of pest insects attacking millet worldwide is extensive, comprising 458 listed species (Sharma & Davies, 1988). Also, this crop may be attacked by groups of pests that are common to other grasses and some legumes. In an intensive cropping system, the various annual crops act as nearly permanent habitat for insects, allowing their populations to increase and facilitate their dispersion between crops (Perreira-Filho et al., 2003).

Therefore, the incidence of pests in this system that uses millet as cover crop represents a risk of attack by these insects on cash crops grown on millet straw.

Thus, given the importance of defoliating caterpillars in crops during the growing season, the present study was aimed at evaluating the occurrence of lepidopterans in millet in the Cerrado region in the state of Mato Grosso.

2. Method

The study was conducted in the Aparecida da Serra Farm (14°18'59"S, 57°45'16"W, 560 m in altitude), located between the municipalities of Tangará da Serra and Nova Marilândia, southwestern the of Mato Grosso state, Brazil. The millet variety used was ADR 7010, followed by soybean planting near areas sown with corn in March 2013. The plot consisted of 145 ha bordering a Cerrado area and an eucalyptus plantation. Sampling of caterpillars was carried out 48 days after planting until near harvest time (120 days).

Twelve points were set up in a transect along the plot, with a distance between each point of 67 meters. At each point, the sampling method used was the linear meter with the aid of a measuring tape. The collected larvae were placed in plastic containers (145 ml) and sent to the laboratory where they were individually placed in flat-bottomed tubes (8 cm × 2 cm in diameter) and fed an artificial diet (Greene, Leppla, & Dickerson, 1976) until the pupal stage. Pupae were then removed and kept in plastic containers until adult emergence. Adults were dry mounted, sent for identification, and deposited in the entomological collection of Embrapa Cerrados, Planaltina, Distrito Federal, Brazil.

3. Results and Discussion

A total of 175 specimens was collected, of which 117 were identified. The remaining 58 specimens died during their development not completing the larval cycle. In order of frequency, adults of the following species were obtained: *Mocis latipes* (Guenée) (Lepidoptera: Noctuidae) (Figures 1A and 1B), *Spodoptera frugiperda* (Smith) (Lepidoptera: Noctuidae) (Figures 1H, 1I, and 1J), *Helicoverpa* sp. (Lepidoptera: Noctuidae) (Figures 1C, 1D, 1E, 1F, and 1G), *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae), *Mythimna (Pseudaletia) sequax* Franclemont (Lepidoptera: Noctuidae), *Urbanus proteus* (Linnaeus) (Lepidoptera: Hesperidae), *Helicoverpa zea* (Boddie) (Lepidoptera: Noctuidae), and *Leucania latiuscula* Herrich-Schäffer (Lepidoptera: Noctuidae) (Table 1).

Mocis latipes and *S. frugiperda* were the most frequent species during sampling collections (Table 1). The attack of these caterpillars to soybean and cotton seedlings cultivated on pearl millet straw has been increasingly frequent, representing a risk to crops. *Spodoptera frugiperda* and *M. latipes* have a similar behavior to the black cutworm (*Agrotis ipsilon*), cutting the hypocotyl of seedlings, and consequently reducing the stand and yield (Soria & Degrande, 2011).

Table 1. Species of lepidopteran pests found in millet plants in Mato Grosso, Brazil

Species	Common name	N	%
<i>Mocis latipes</i> (Guenée) (Lepidoptera: Noctuidae)	Small Mocis Moth	61	52.0
<i>Spodoptera frugiperda</i> (Smith) (Lepidoptera: Noctuidae)	Fall armyworm	28	24.0
<i>Helicoverpa</i> sp. (Lepidoptera: Noctuidae)	<i>Helicoverpa</i>	12	10.0
<i>Helicoverpa armigera</i> (Hübner) (Lepidoptera: Noctuidae)	<i>Helicoverpa armigera</i>	09	8.0
<i>Mythimna sequax</i> Franclemont (Lepidoptera: Noctuidae)	Wheat armyworm	03	2.5
<i>Urbanus proteus</i> (Linnaeus) (Lepidoptera: Hesperidae)	Long-tailed skipper	02	1.5
<i>Helicoverpa zea</i> (Boddie) (Lepidoptera: Noctuidae)	Corn earworm	01	1.0
<i>Leucania latiuscula</i> Herrich-Schäffer (Lepidoptera: Noctuidae)	<i>Leucania latiuscula</i>	01	1.0

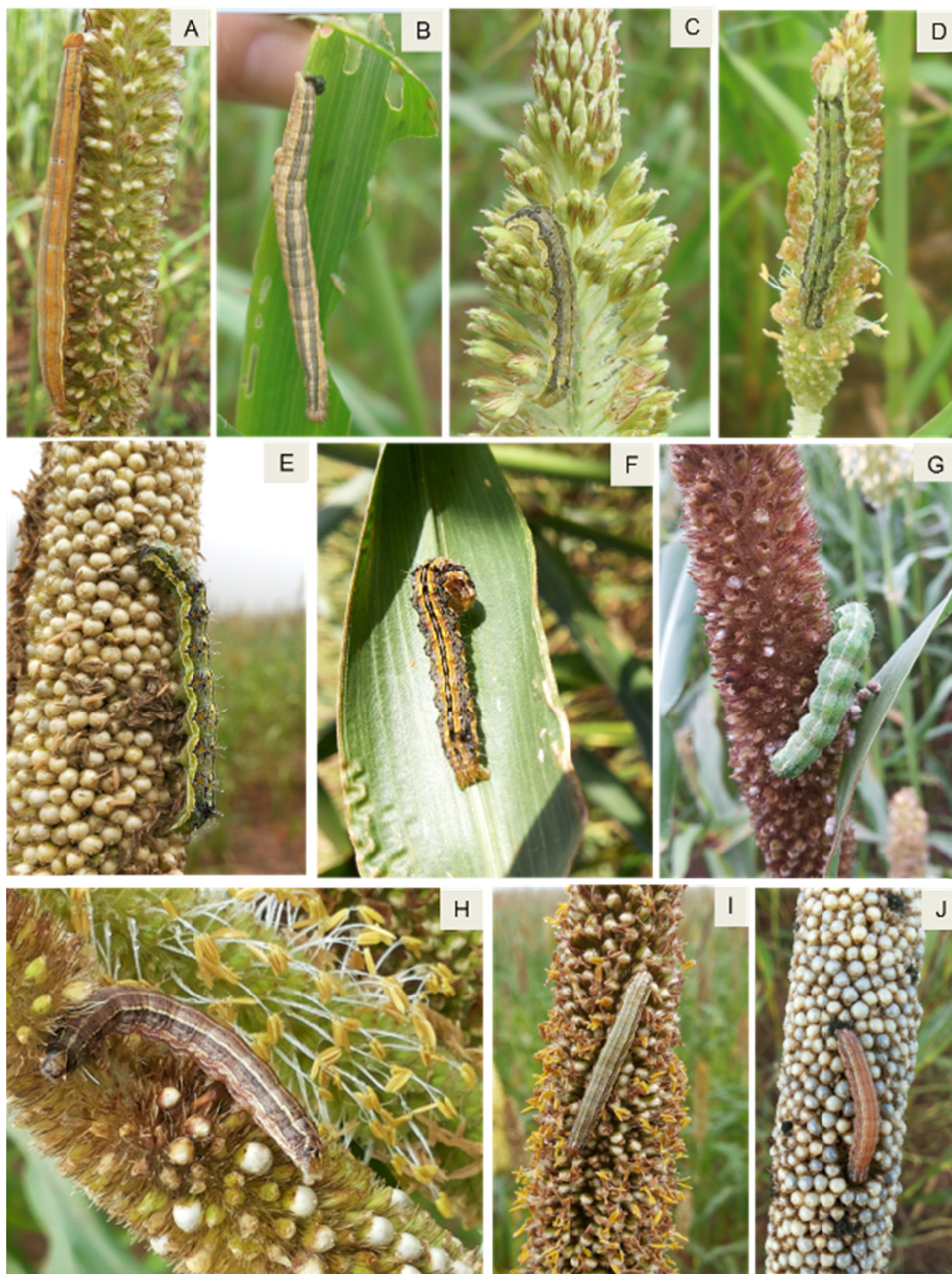


Figure 1. Some lepidopteran species found in pearl millet. *Mocis latipes* (A and B); *Helicoverpa* spp. (C, D, E, F, and G); *Spodoptera frugiperda* (H, I, and J). Source: Fabiano G. Schirmer

The occurrence of *H. zea*, *H. armigera*, and *S. frugiperda* in millet may be associated with the corn field nearby, as well as the succession with soybean crops, which can promote the migration and establishment of these species in the latter. Millet provides a green bridge to polyphagous species of the genus *Spodoptera* and *Helicoverpa*, which remain in the agro-ecosystem and may cause damage to subsequent corn and soybean crop.

In recent years, *H. armigera* has been reported in different crops and Americas regions, and this new record in millet should reinforce attention with this pest in off-season crops (Czepak, Albernaz, Vivan, Guimarães, & Carvalhais, 2013; Specht, Sosa-Gómez, Paula-Moraes, & Yano, 2013; Murúa et al., 2014; Pratisoli, Lima, Pirovani, & Lima, 2015; Kriticós et al., 2015; Krinski & Godoy, 2015).

Caterpillars of *M. sequax* have been found in millet plants in Dourados, Mato Grosso do Sul (Soria & Degrande, 2011). Although caterpillars of the genus *Mythimna* do not have a preference for soybeans grown on pearl millet straw, the damage to the stems of the plants, can lead to the death of plants, reducing the stand, similar to the observed for *S. frugiperda* and *M. latipes* (Tonet, Gassen, & Salvadori, 2000).

It is known that sustainable practices in agriculture, such as no-tillage, have been stimulated in Brazil (Faleiros, 2011) and in the world, since this practice improves the chemical, physical and biological properties of the soil (Aziz, Mahmood, & Islam, 2013). No-tillage, which was introduced in Brazil in the 1970s, and expanded in the 1990s, presents benefits to the environment (Marchão, 2007; Silva et al., 2007) and to the farmer (Cruz, 1999). However, in order to choose the most suitable cover crops, the producer must know the characteristics of the crop (Alvarenga et al., 2001) and the potential of these cover crops to be intermediate hosts for pests (Barros, Torres, Ruberson, & Oliveira, 2010).

The choice of a cover crop without considering these criteria, favors the formation of a green bridge since the pests have food and micro habitats throughout the year, favoring mainly the species that are polyphagous (Oliveira, Auad, Mendes, & Frizzas, 2014), as is the case of *S. frugiperda*, which has been registered in more than 80 plant species (Pogue, 2002), and *H. armigera*, registered in more than 60 species of cultivated and wild plants and in about 67 host families (Fitt, 1989; Pogue, 2004) and both have been recorded in the present survey in millet culture and are pests that occur in subsequent cultures in the study region.

Studies that aim to evaluate the adaptability of the pests cover crops are essential to assist in the correct choice. In a study conducted by Dias et al. (2016), evaluated sunflower (*Helianthus annuus*), sun hemp (*Crotalaria juncea*), brachiaria (*Urochloa decumbens* e *Urochloa ruziziensis*), millet (*Pennisetum americanum*), black oat (*Avena stringosa*), white lupin (*Lupinus albus*), forage turnip (*Rafanus sativus*) and maize (*Zea mays*), which are the main cover crops used in Brazil, and found that *C. juncea* presented a lower susceptibility to *S. frugiperda* attack, being therefore a promising species for cover of the soil preceding crops that are susceptible to the attack of this pest.

It is worth mentioning that in regions where there is a severe winter in the period between harvests, the lepidopteran pest cycle can be interrupted, thus reducing its populational abundance. However, in places that there is no this climatic factor for reduce the pests in ambient (such as the Cerrado, where this study was carried out), the period between harvests are cultivated with the cover plants as is the case of millet, which favors the maintenance and increased populations of lepidopteran pest.

Thus, this study describes the first record of lepidopteran pests on millet plants in the state of Mato Grosso. In the cultivation system practiced in the Brazilian midwest, cover crops, such as millet, act as a green bridge for insects, facilitating their migration between crops and maximizing the damage caused by these pests. Thus, the incidence of lepidopterans in the system that uses millet as cover crop represents a risk of the occurrence of insect pests on subsequent crops on the straw of this grass.

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