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Occurrence of *Helicoverpa armigera* (Lepidoptera: Noctuidae) on tomato in the Espírito Santo state

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ABSTRACT

The species *Helicoverpa armigera* is one of the most important polyphagous and widely distributed pests in the world. Its occurrence was recently reported on soybean and cotton, in the states of Goiás, Mato Grosso and Bahia, Brazil. Tomato is also host species of *H. armigera*, among the 200 registered, being one of the most important crops in the Espírito Santo state. The production of tomatoes is fully dedicated for fresh consumption and the damage caused by *H. armigera* in fruits make unfeasible marketing. Therefore, this study aimed to record the occurrence of *H. armigera* in tomato crop in the Espírito Santo state. From February 2012 to October 2013, insects were collected from tomato plants in some producing areas. After insect identification, by dissection of the genitalia of adult moths, it was possible to confirm the occurrence of *H. armigera* on tomato crop in the Espírito Santo state.

Keywords: *Solanum lycopersicum*; Heliiothinae; moth; caterpillar.

RESUMO

Ocorrência de *Helicoverpa armigera* (Lepidoptera: Noctuidae) em tomateiro no estado do Espírito Santo

A espécie *Helicoverpa armigera* é uma das mais importantes pragas polífagas e de ampla distribuição geográfica. Recentemente, foi registrada sua ocorrência no Brasil, nos estados de Goiás, Bahia e Mato Grosso nas culturas de soja e algodão. O tomateiro também é espécie hospedeira de *H. armigera*, entre as 200 espécies registradas, sendo uma das culturas mais importantes no estado do Espírito Santo. A produção de tomates é totalmente voltada para consumo *in natura* e os danos causados por *H. armigera* nos frutos inviabilizam a sua comercialização. Esse trabalho teve como objetivo registrar a ocorrência de *H. armigera* na cultura do tomate no estado do Espírito Santo. No período de fevereiro de 2012 a outubro de 2013 foram realizadas coletas de insetos atacando plantas de tomateiro nas regiões produtoras no estado. Após a identificação por meio da dissecação da genitalia das mariposas adultas, ficou comprovada a ocorrência de *H. armigera* em cultivos de tomate no Espírito Santo.

Palavras-chave: *Solanum lycopersicum*, Heliiothinae, mariposas, lagartas.

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The species *Helicoverpa armigera* (Lepidoptera: Noctuidae) is one of the most important polyphagous pests in agriculture. This species attacks over 200 plant species worldwide, having been reported in Europe, Asia, Africa and Oceania (Zalucki *et al.*, 1986, 1994; Guo, 1997). In Brazil, this pest was considered quarantine by early 2013, when a confirmation of its occurrence in soybean (*Glycine max*) and cotton (*Gossypium hirsutum*) and in soybean plants infesting other crops (seeds remaining from previous crops) was observed in the states of Goiás, Mato Grosso and Bahia, respectively (Czepak *et al.*, 2013).

Helicoverpa armigera causes

severe losses in different plant species, especially cotton, sorghum, beans, soybeans, canola, corn and tomato (Fitt, 1989; Romeis & Shanower, 1996; Pogue, 2004; Moral Garcia, 2006). The female moths lay around 1000-1500 eggs, singly, on leaves, flowers, fruits and stalks, which makes clear their reproductive potential (Fye & McAda, 1972). *Helicoverpa armigera* caterpillar can damage both the vegetative phase as the reproductive phase of the plant, feeding on leaves, stems, buds, inflorescences, fruits and pods (Reed, 1965; Wang & Li, 1984). Direct damage to the structures of flowering and fruiting of host plants by *H. armigera* caterpillars and the extensive use of

insecticides result in low productivity and high costs of control, respectively (Lammers & MacLeod, 2007; Fathipour & Naseri, 2011).

This work aims to report the occurrence of *H. armigera* in tomato crop in Espírito Santo state, considering constant requests for inspections in tomato crops attacked by caterpillars.

MATERIAL AND METHODS

From February 2012 to October 2013, outbreak occurrences were reported and collections of caterpillar populations were carried out on tomato crop as well as evaluation of types

of injuries in plants and fruits and identification of the sampled species.

Collections were carried out in the three main production centers of tomato for fresh consumption in Espírito Santo state, those sampled regions being responsible for 82% of the production (Borel *et al.*, 2010). The first pole is located in the municipality of Venda Nova do Imigrante (São José do Alto Viçosa District, 20°23'56"S, 41°06'44"W), the second pole comprises the municipality of Afonso Claudio (Rio da Cobra, Fazenda Guandu, 20°13'05"S, 41°06'02"W), and the third pole is the municipality of Guaçuí (Rod. Guaçuí/Varre-Sai, 20°49'53"S, 41°42'54"W) (Figure 1). Besides the production centers, collections in tomato fields, at the Instituto Federal de Educação do Espírito Santo, were carried out, in the municipality of Alegre (Rive District, 20°45'54"S, 41°27'27"W) (Figure 1). Monthly samplings were carried out, at the stages of vegetative development and production of tomato, in three fields from each of the four selected regions for the work. The tomato cultivars grown in the fields were: Alambra, Fusion, Ivanhoé, Sophia and Batalha.

Collections were made at random, walking between the lines of planting to find fruits with holes up to 1 cm in diameter, which could be related to *H. armigera* or to the corn earworm on tomato *Helicoverpa zea* (Lepidoptera: Noctuidae), also called "brocão" (large caterpillar) by the producers. The damaged fruits were placed, individually, in plastic containers (12 cm diameter x 8 cm height) and sent to Setor de Entomologia do Núcleo de Desenvolvimento Científico e Tecnológico em Manejo de Pragas e Doenças of Universidade Federal do Espírito Santo. In the laboratory, the fruits were carefully cut, using a knife, to remove the caterpillars that might be inside.

All specimens were collected in the larval stage and placed in plastic boxes (11x11x3.5 cm) in order to avoid cannibalism among the larvae. The boxes with the specimens collected were stored at a climate-controlled room at a temperature of 25±2°C, relative

humidity of 70±10% and photophase of 12 hours. The caterpillars were fed until the pre-pupal phase with immature fruits of tomato (approximately 5 cm diameter). When reaching the pupal stage, the caterpillars were grouped in a cage consisted of an acrylic box (50x50x50 cm). When adults emerged, a part was captured and killed by freezing in a freezer at -10°C for 30 minutes. Later, the adults were mounted with entomological pins and sent to a specialist at Embrapa Cerrados, Brasília, Dr. Alexandre Specht, in order to perform the morphological characterization. The identification of specimens was performed through dissection and morphological analysis of the genitalia of male individuals (Specht *et al.*, 2013).

RESULTS AND DISCUSSION

In all crops of municipalities of Venda

Nova do Imigrante, Afonso Claudio, Guaçuí and Alegre, the occurrence of *H. armigera* was observed. These municipalities are the main tomato producers and they are located in the South Central region of Espírito Santo state.

Evaluating probable injuries caused by *H. armigera*, we observed that the injuries were on the fruits, except for one plant, which was attacked on the stem, where the formation of galleries (4x1 cm), downward, starting near the apical bud, was noticed. The attacked fruits were in medium to advanced developmental stage and were about 4 cm in diameter. The lesions showed varied shape, as a simple hole in the pericarp to the partial destruction of the fruits reaching the endocarp (Figure 2). The caterpillars which were causing lesions were more than 2 cm in length and showed varied pattern of colors from pale green to dark gray. With respect to the behavioral aspect, we observed that

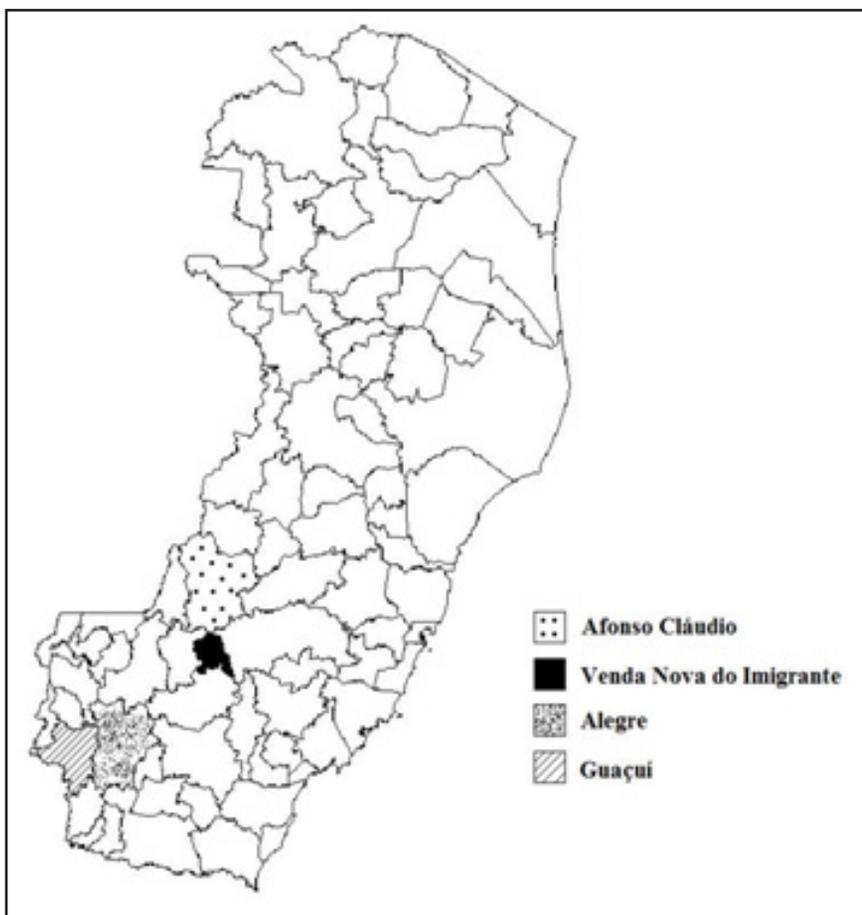


Figure 1. Municipalities in the state of Espírito Santo where samplings of *Helicoverpa armigera* were conducted (municípios do estado do Espírito Santo onde foram realizadas coletas de *Helicoverpa armigera*). Alegre, UFES, 2014.



Figure 2. Injuries caused by *Helicoverpa armigera* caterpillar in tomato fruit in the Espírito Santo state (injúrias causadas por lagartas de *Helicoverpa armigera* em frutos de tomate no estado do Espírito Santo). Alegre, UFES, 2014.



Figure 3. Female (left) and male (right) adult moth of *Helicoverpa armigera* {mariposas adultas fêmea (esquerda) e macho (direita) de *Helicoverpa armigera*}. Alegre, UFES, 2014.

caterpillars remained on or in the lesions during daytime, this behavior is different from the corn earworm in tomato, which seeks the fruits only at night.

The species *H. armigera* is similar to other caterpillar species like *H. zea*, *Heliothis virescens* and *Helicoverpa gelotopoeon*. All of them belong to the family Noctuidae and subfamily Heliiothinae and, therefore, they share some morphological characteristics. The caterpillar staining pattern is variable, according to the food (host plant) they eat, environmental conditions and age of larvae (Ali & Choudhury, 2009). The adult moths also have great similarity, mainly related to the size (35 - 45 mm wingspan) and the color of the wings, which varies from light yellow to dark brown (EPPO, 1981, 1996). However, other characteristics can help identify *H. armigera*, as the format of "saddle" on the first abdominal segment from the fourth instar and the behavior of bending the head capsule toward the first pair of false legs when touched (Matthews, 1999). Adults of *H. armigera* present sexual dimorphism. The females have the first pair of wings of brown orange color whereas the males have their first pair of wings of greenish gray color (Czepak et al., 2013) (Figure 3). Although some characteristics assist in identification of *H. armigera*, the morphological characterization, through dissection of the genitalia or molecular tools, is indispensable in order to state the species (Pogue, 2004; Tay et al., 2013).

The introduction of *H. armigera* in Brazil creates another problem, besides its difficult identification, that is the pest management. The difficulties in this pest management are faced in countries from different continents such as Europe, Asia, Africa and Oceania (Tayet et al., 2013). In Australia, for instance, despite the experience in combating *H. armigera*, management programs of pest resistance to insecticides have identified high levels of resistance, which reduces the effectiveness of most chemical groups employed in its management (Fitt & Wilson, 2000).

In tomato crops in Espírito Santo state, the pest management relies on the use of insecticides of diamides groups

and products based on Baculovirus and *Bacillus thuringiensis* (Bt). However, other methods can be employed in *H. armigera* management, in tomato and in other host crops of this species (Fathipour & Sedaratian, 2013). The use of egg parasitoids of the genus *Trichogramma* (Oztemiz et al., 2009), entomopathogenic nematodes (Hussain et al., 2014) and sex pheromones (Malik et al., 2003) are strategies of biological control with potential to be used in the management of *H. armigera*, considering the easiness that this species can develop resistance to certain insecticides (Fitt & Wilson, 2000).

The presence of *H. armigera* on tomato production in Espírito Santo state is already causing productivity losses and conducting surveys in other host crops for monitoring this species in the state is necessary. Due to the observation of the occurrence of *H. armigera*, work for providing awareness and orientation on the pest capacity of developing resistance have been carried out with producers, including the training of professionals for the proper identification and management of this exotic pest in Espírito Santo state.

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