



First Record of *Helicoverpa armigera* (Lepidoptera: Noctuidae) Feeding on *Plectranthus neochilus* (Lamiales: Lamiaceae) in Brazil

Authors: Krinski, Diones, and Godoy, Ana Flávia

Source: Florida Entomologist, 98(4) : 1238-1240

Published By: Florida Entomological Society

URL: <https://doi.org/10.1653/024.098.0434>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

First record of *Helicoverpa armigera* (Lepidoptera: Noctuidae) feeding on *Plectranthus neochilus* (Lamiales: Lamiaceae) in Brazil

Diones Krinski^{1*} and Ana Flávia Godoy²

Helicoverpa armigera Hübner (Lepidoptera: Noctuidae), the cotton bollworm, also known as the gram pod borer or the tomato fruit worm, is a polyphagous agricultural pest with a wide geographical distribution, recorded from Europe, Asia, Africa, Oceania, and recently South America (Czepak et al. 2013; Specht et al. 2013; Bueno & Sosa-Gómez 2014; Murúa et al. 2014). Larvae of *H. armigera* have been reported from over 67 host families, including Asteraceae, Fabaceae, Malvaceae, Poaceae, and Solanaceae (Pogue 2004), and this pest has caused losses to economically important crops such as cotton, legumes, sorghum, maize, tomato, soybean, ornamental plants, and fruit trees (Moral-Garcia 2006; Specht et al. 2013).

Helicoverpa armigera females lay eggs on host flowers and fruit, and larvae feed on various parts of the plants, although they prefer buds, inflorescences, fruits, and pods (Moral-Garcia 2006; Perkins et al. 2009; Specht et al. 2013) and thus cause damage to reproductive structures. This study reports the first occurrence of *H. armigera* feeding on *Plectranthus neochilus* Schltr. (Lamiales: Lamiaceae). Larvae were collected during Aug 2014, in Paraná State (Londrina, Embrapa Soybean; 23.190667°S, 51.184056°W; 630 m asl), Brazil, feeding on inflorescences of “boldo-rasteiro” (*P. neochilus*) (Fig. 1A).

The collected larvae were kept under laboratory conditions with natural diet (inflorescences) until pupation. Pupae were separated by sex and emerging adults identified by external (pattern and color of wings; Fig. 1B) and internal (morphology of male and female genital organs) characteristics (Pogue 2004). A pair of adults was allowed to mate in a cage, and the eggs used to confirm species identification (Kirkpatrick 1961). Male and female genitalia were cleared in a 10% potassium hydroxide solution and mounted on microscope slides (Specht et al. 2013). We performed the molecular characterization of *H. armigera* in the Laboratório de Entomologia da Embrapa Soja (Londrina/PR, Brazil). For DNA extraction, moth samples were obtained from 2 adults (heads and legs). The analyses followed the methods of Behere et al. (2008).

Specimens were diagnosed as *H. armigera* based on adult external and internal morphology, especially the genitalia. Other morphological characters used to identify specimens were the external structure

of the eggs, the shape of the base of abdominal sternite and of the valves, and the number of cornuti (= spines) inside the aedeagus (12 cornuti sets or less). Vouchers of genitalia slides and pinned specimens were deposited in the Laboratory of Biological Control of Caterpillars (Embrapa Soybean, Brazil).

For molecular characterization, we used polymerase chain reaction (PCR) amplification of partial *COI* (511 bp) and *Cyt b* (434 bp) genes for each specimen; DNA from all individuals was amplified successfully. The restriction endonuclease digest of the 511 bp *COI* PCR product resulted in 2 bands of 318 bp and 193 bp. Within the 434 bp of *Cyt b* sequences, the recognition site for *HphI* [GGTGA (N)8] was present, and the restriction digestion of the 434 bp *Cyt b* PCR product therefore resulted in 2 bands of 280 bp and 154 bp (Fig. 1C). These data are consistent with the molecular identification of *H. armigera* described in the literature (Behere et al. 2008).

Larvae of *H. armigera* prefer to feed on the reproductive structures of the host (Moral-Garcia 2006; Perkins et al. 2009), and this was observed in this study, with larvae on *P. neochilus* found only on the flowers (Fig. 1A). Growers should monitor other species of plants that may be temporary reservoirs during the period between harvests of economically important crops.

Furthermore, *P. neochilus* and other *Plectranthus* species are common throughout Brazil and associated with fruit orchards, home gardens, and vegetable gardens, because they have medicinal uses, especially in the treatment of digestive disorders (Lorenzi & Matos 2008). Because *P. neochilus* is widespread and is now a recorded host, this may be vital information in developing pest management strategies. The importance of plant-reservoirs is recognized for other species of insect pests and crops in Brazil (Krinski & Pelissari 2012; Krinski et al. 2012, 2015; Krinski 2013a,b, 2015). Furthermore, producers of commercial boldo crops should be aware of this pest and the damage potential it poses.

In Brazil, management of this pest is in the initial stages. Therefore, information about new host plants and correct identification and sampling techniques for adults, eggs, larvae, and pupae are essential for determining appropriate control tactics. Researchers in other coun-

¹Federal University of Paraná (UFPR), Department of Plant Science and Phytosanitarism, Division of Agricultural Sciences, Caixa Postal 19061, 81531-990, Curitiba, Paraná, Brazil

²Programa de Pós-Graduação em Agronomia (Proteção de Plantas), Faculdade de Ciências Agrônomicas, Fazenda Experimental Lageado, Universidade Estadual Paulista “Julio de Mesquita Filho” (UNESP), Câmpus de Botucatu, Caixa Postal 237, 18610-307, Botucatu, São Paulo, Brazil

*Corresponding author; Email: dioneskrinski@gmail.com

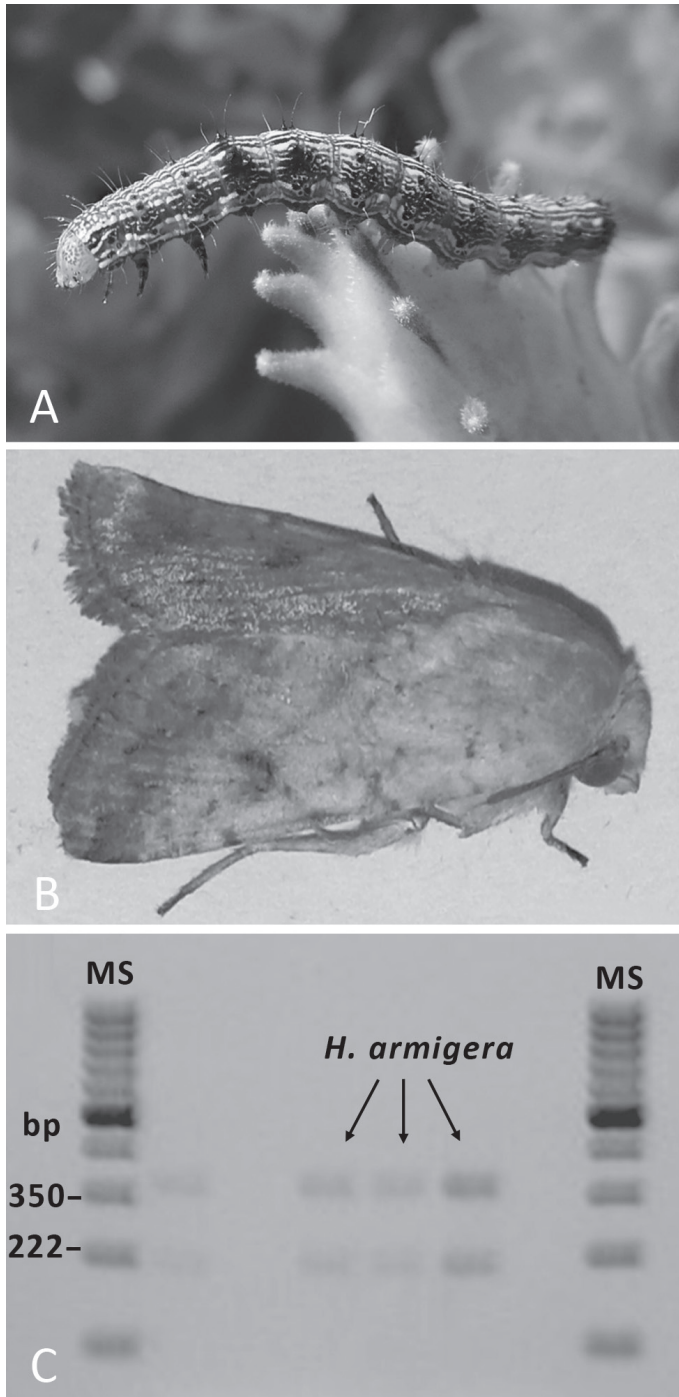


Fig. 1. *Helicoverpa armigera*. A) Larva; B) adult; and C) partial *COI* (511 bp) restriction fragment length polymorphism pattern (digested with *BstZ171*), with bands separated on a 6% polyacrylamide gel. Lanes labeled as MS are pGEM molecular weight standard DNA ladders. Photo credits: larva, D. K.; adult, Jhبران Ferral Piña.

tries have studied *H. armigera* on different host plants (e.g., Razmjou et al. 2014). Because this species is new to Brazil and its ecology, behavior, and host preferences may differ, studies with different host plants should be conducted to better understand the biology and development of this pest in Brazil.

According to Lammers & MacLeod (2007), the worldwide cost per year to control this pest, along with yield losses, reaches US\$ 5 billion. In India and China, 50% of pesticides in agriculture are used to control

this pest. In Spain, *H. armigera* is one of the most serious pests of tomato. In Brazil, losses in the 2012–2013 crop season were estimated at US\$ 0.8 billion (Bueno & Sosa-Gómez 2014). Considering this level of damage, it is essential that monitoring for this pest and natural enemies is established. Surveillance and monitoring of new host records and changes in distribution, and research on control methods, such as natural enemies and plant deterrents (extracts and essential oils) as previously reported in the literature (Favetti et al. 2013; Bueno & Sosa-Gómez 2014; Krinski et al. 2014), will help determine what control options will be chosen. The Brazilian Agricultural Research Corporation (Embrapa) has already emphasized that effective monitoring of eggs, larvae, pupae, and adults of *H. armigera* is critical to successfully implementing management strategies for this pest, because these factors determine what control tactics will be used (Bueno & Sosa-Gómez 2014).

The authors acknowledge the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and the Fundação Araucária for a post-doctoral scholarship to the first author (Accord 069/2014 - Project 41138). Daniel Ricardo Sosa-Gómez and Adenel de Freitas Bueno provided logistical support and technical staff José Jairo da Silva, Jhبران Ferral Piña, Sérgio Henrique da Silva, and Ivanilda Luzia Soldorío, who all helped collect and rear the larvae in the Brazilian Agricultural Research Corporation (Embrapa Soybean) laboratory.

Summary

Helicoverpa armigera Hübner (Lepidoptera: Noctuidae) is a polyphagous agricultural pest recorded in Europe, Asia, Africa, Oceania, and recently South America. Larvae of *H. armigera* are recorded from over 67 host families, including Asteraceae, Fabaceae, Malvaceae, Poaceae, and Solanaceae. This study documents for the first time *H. armigera* larvae feeding on inflorescences of “boldo-rasteiro” *Plectranthus neochilus* Schltr. (Lamiales: Lamiaceae). The species was identified according to external and internal characteristics of adults, morphology of eggs, and by molecular characterization.

Key Words: identification; morphology; molecular characterization; new host record; boldo-rasteiro

Sumário

Helicoverpa armigera Hübner (Lepidoptera: Noctuidae) é uma praga agrícola polífaga com distribuição geográfica registrada na Europa, Ásia, África, Oceania e, recentemente, na América do Sul. Devido à sua distribuição mundial, suas larvas foram relatados em cerca de 67 famílias, incluindo Asteraceae, Fabaceae, Malvaceae, Poaceae e Solanaceae. Com o recente registro de sua ocorrência no Brasil, novas espécies de plantas hospedeiras tem sido registradas. Portanto, este estudo relata a primeira ocorrência de lagartas de *H. armigera* atacando inflorescências de “boldo-rasteiro” *Plectranthus neochilus* Schltr. (Lamiales: Lamiaceae). A espécie foi identificada de acordo com as características externas e internas, morfologia dos ovos e também por caracterização molecular.

Palavras Chave: identificação; morfologia; caracterização molecular; registro de novo hospedeiro; boldo-rasteiro

References Cited

Behere GT, Tay WT, Russell DA, Batterham P. 2008. Molecular markers to discriminate among four pest species of *Helicoverpa* (Lepidoptera: Noctuidae). *Bulletin of Entomological Research* 98: 599-603.

- Bueno AF, Sosa-Gómez DR. 2014. The Old World bollworm in the Neotropical region: the experience of Brazilian growers with *Helicoverpa armigera*. *Outlooks on Pest Management* 25: 261-264.
- Czepak C, Albernaz KC, Vivan LM, Guimarães HO, Carvalhais T. 2013. First reported occurrence of *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) in Brazil. *Pesquisa Agropecuária Tropical* 43: 110-113.
- Favetti BM, Krinski D, Butnariu AR, Loiacono MS. 2013. Egg parasitoids of *Edessa meditabunda* (Fabricius) (Pentatomidae) in lettuce crop. *Revista Brasileira de Entomologia* 57: 236-237.
- Kirkpatrick TH. 1961. Comparative morphological studies of *Heliothis* species (Lepidoptera: Noctuidae) in Queensland. *Queensland Journal of Agricultural Science* 18: 179-194.
- Krinski D. 2013a. *Physalis angulata* L. (Solanaceae): a potential host-plant of stink bugs *Edessa meditabunda* F. (Hemiptera, Pentatomidae). *Biota Neotropica* 13: 336-339.
- Krinski D. 2013b. First report of phytophagous stink bug in chicory crop. *Ciência Rural* 43: 42-44.
- Krinski D. 2015. First report of squash vine borer, *Melittia cucurbitae* (Harris, 1828) (Lepidoptera, Sesiidae) in Brazil and South America: distribution extension and geographic distribution map. *Check List* 11-1625: 1-3.
- Krinski D, Pelissari TD. 2012. Occurrence of the stinkbug *Edessa meditabunda* F. (Pentatomidae) in different cultivars of lettuce *Lactuca sativa* L. (Asteraceae). *Bioscience Journal* 28: 654-659.
- Krinski D, Favetti BM, Butnariu AR. 2012. First record of *Edessa meditabunda* (F.) on lettuce in Mato Grosso State, Brazil. *Neotropical Entomology* 41: 79-80.
- Krinski D, Massaroli A, Machado M. 2014. Insecticidal potential of the Annonaceae family plants. *Revista Brasileira de Fruticultura* 36: 225-242.
- Krinski D, Foerster LA, Grazia J. 2015. *Hypatropis inermis* (Hemiptera, Pentatomidae): first report on rice crop. *Revista Brasileira de Entomologia* 59: 12-13.
- Lammers JW, MacLeod A. 2007. Report of a Pest Risk Analysis: *Helicoverpa armigera* (Hübner, 1808). Plant Protection Service (NL) and Central Science Laboratory (UK) Joint Pest Risk Analysis for *Helicoverpa armigera* (European Union), 2007. <https://secure.fera.defra.gov.uk/phiw/riskRegister/plant-health/documents/helicoverpa.pdf> (last accessed 22 Apr 2015).
- Lorenzi H, Matos FJA. 2008. Plantas medicinais no Brasil: nativas e exóticas. Instituto Plantarum de Estudos da Flora, Nova Odessa, São Paulo, Brazil.
- Moral-Garcia FJ. 2006. Analysis of the spatiotemporal distribution of *Helicoverpa armigera* (Hübner) in a tomato field using a stochastic approach. *Bio-systems Engineering* 93: 253-259.
- Murúa MB, Scalora FS, Navarro FR, Cazado LE, Casmuz A, Villagrán ME, Lobos E, Gastaminza G. 2014. First record of *Helicoverpa armigera* (Lepidoptera: Noctuidae) in Argentina. *Florida Entomologist* 97: 854-856.
- Perkins LE, Cribb BW, Hanan J, Zalucki MP. 2009. The role of two plant-derived volatiles in the foraging movement of 1st instar *Helicoverpa armigera* (Hübner): time to stop and smell the flowers. *Arthropod-Plant Interactions* 3: 173-179.
- Pogue MG. 2004. A new synonym of *Helicoverpa zea* (Boddie) and differentiation of adult males of *H. zea* and *H. armigera* (Hübner) (Lepidoptera: Noctuidae: Heliethinae). *Annals of the Entomological Society of America* 97: 1222-1226.
- Razmjou J, Naseri B, Hemati SA. 2014. Comparative performance of the cotton bollworm, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) on various host plants. *Journal of Pest Science* 87: 29-37.
- Specht A, Sosa-Gómez DR, Paula-Moraes SV, Yano SAC. 2013. Morphological and molecular identification of *Helicoverpa armigera* (Lepidoptera: Noctuidae) and expansion of its occurrence record in Brazil. *Pesquisa Agropecuária Brasileira* 48: 689-692.