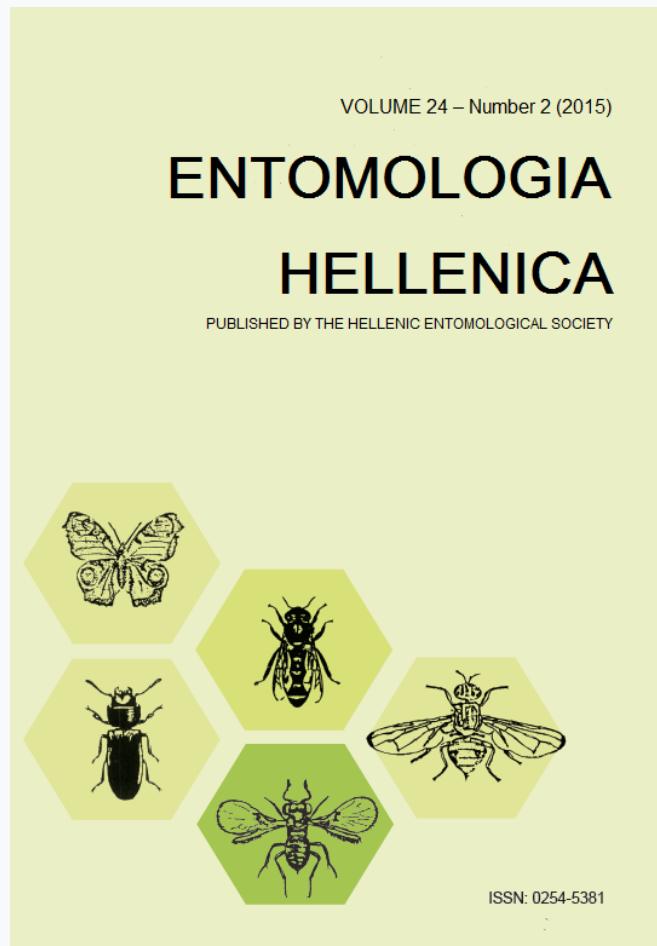


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SHORT COMMUNICATION

First report of the bordered straw, *Heliothis peltigera*, on sunflower in Greece

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ABSTRACT

In June 2015, infestations of sunflower crops by the bordered straw *Heliothis peltigera* (Lepidoptera: Noctuidae) were recorded in rural areas of the Regional Unit of Drama, N. Greece. Larval feeding-damage symptoms were observed on leaves and buds of sunflower plants, mostly at pre-flowering growth stages. Infestations were recorded in approximately 80% of the inspected sunflower fields, the infestation levels, however, were low (<5%) apparently resulting in no economic damage. The presence of *H. peltigera* has been reported in Southern and Central Europe, Canada, the Middle East and Africa, infesting several hosts. Infestations of sunflower crops have been reported in India, Pakistan and Sudan. To our knowledge, this is the first report of *H. peltigera* infestations on sunflower crops in Greece and possibly in Europe.

KEY WORDS: First report, Noctuidae, bordered straw, *Helianthus annuus*, Greece.

Sunflower (*Helianthus annuus* L., Asteraceae) is the main raw material source for the bio-fuel industry in Greece. A byproduct of sunflower kernel processing is sunflower meal, which is a protein-rich livestock feed. Since 2010, the crop has attracted the attention of many growers, resulting in the cultivation of approximately 48,200 ha of sunflower crops in Greece, in 2014 (FAOSTAT 2015).

In early June 2015, in the rural area of

Agios Athanasios (near to the city of Drama, Region of East Macedonia and Thrace, Greece) where approximately 700 ha of sunflower are cultivated, numerous infestations of sunflower crops by larvae of an unknown insect species were recorded for the first time. The majority of sunflower plants were at the developing bud growth stages (R1-R2) (Schneiter and Miller 1981). Collected larvae were then reared in the laboratory of the Department of Quality and

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Phytosanitary Inspections in Drama, Greece. The morphological characteristics of both the larvae and the emerged adults resembled *Heliothis peltigera* Denis and Schiffermüller (Lepidoptera: Noctuidae) (Figs 1 and 2) (Alford 1999, Passoa 2014). For species confirmation, the genitalia of adult samples were examined by the third author at the Institute of Biodiversity and Evolutionary Biology in Valencia, Spain. Based on both the external and genitalia morphology of males, the species was confirmed as *H. peltigera* (Bhattacherjee and Gupta 1972, Matthews 1991).



FIG. 1. *Heliothis peltigera* adult.

In the collected samples, last-instar larvae were mostly observed and feeding damage was recorded on the younger leaves, primarily on the upper third of the plants, as well as on the bracts of developing buds. The leaf-feeding of the larvae resulted in the formation of holes which caused the deformation of the leaf blades. Superficial tissue damage was also observed on the posterior sides of capitula, probably due to larval feeding activity. After the first *H. peltigera* infestations were detected, an extensive survey was conducted covering approximately 700 ha in the area of Agios Athanasios and around 150 fields cultivated

with sunflower were monitored once, from mid-June to mid-August 2015. Interestingly, in 80% of the inspected fields, infestations by *H. peltigera* were detected, suggesting that its presence was widespread in that area. The infestation levels per field were estimated following Manjunath et al. (1976) and the general EPPO guidelines (EPPO 2012). Briefly, 400-500 plants/ha were examined for the presence of larvae, by following a random path within the field and calculating the percentage of infested plants per sample.



FIG. 2. *Heliothis peltigera* larvae.

In all of the infested crops, the infestation levels never exceeded 5% per field, apparently resulting in no economic damage. Due to the fact that this is the first observation of sunflower infestations by this pest, we have no prior data on economic threshold levels and, to our knowledge, there is no information in the literature about the economic threshold for *H. peltigera* in sunflower. If severe infestations were to be observed in the future, we could potentially establish economic threshold levels. From the onset of flowering and onwards (R5), no larvae were detected in the sunflower fields. Similarly, Iqbal and Mohyuddin (1990) have also reported a reduction of infestations after sunflower inflorescence in Pakistan and additionally, that the insect's phenology from August to September is not well known. Accordingly, this indicates a narrow window of about 5-6 weeks in which *H.*

peltigera can infest sunflower crops. There is no available information in the literature regarding overwintering and the annual number of generations of this pest.

The presence of *H. peltigera* has been reported in most of Europe (Skule and Fibiger 2013), Canada, India, Turkey, Pakistan, Iran, Iraq, Israel, Syria, New Zealand, Sudan and South Africa, infesting several economic hosts such as cotton, soybean, corn, bean, herbs and especially safflower (*Carthamus tinctorius* L.) (Manjunath et al. 1976, Iqbal and Mohyuddin 1990, Weigan and Tahhan 1990). The host range of the insect also includes native plants such as *Chrysanthemum coronarium*, *Hyoscyamus niger*, *Lavandula* spp., *Matricaria chamomilla*, *Mentha* spp., *Salvia pratensis*, *Calendula officinalis*, *Atropa belladonna* (Meierrose et al. 1989). Infestations in sunflower crops have been reported in India (Singh et al. 1981), Pakistan (Iqbal and Mohyuddin 1990, Nassar and Mohyuddin 1990) and Sudan (Ahmed and Elamin 1996) damaging up to 50% of the seed crop (Jagadish et al. 2010).

Heliothis peltigera has several natural enemies (Manjunath et al. 1976, Pawal et al. 1986, Meierrose et al. 1989, Iqbal and Mohyuddin 1990), including the parasitoids *Microchelonus curvimaculatus*, *Chelonus heliopae*, *Orthostigma pumilla*, *Aspilota insidiatrix*, *Meteorus pulchicornus* and *Apanteles* spp. (Hymenoptera: Braconidae), *Campoletis chlorideae*, *Pristomerus* spp., *Eriborus argenteopilosus* and *Hemiteles* spp. (Hymenoptera: Ichneumonidae), *Carcelia illota*, *Goniophthalmus halli*, *Sturmiopsis inferens*, *Palexorista laxa*, *Winthemia quadripustulata* and *Tachina fera* (Diptera: Tachinidae), *Trichogramma chilonis* and *T. chilotraeae* (Hymenoptera: Trichogrammatidae). The predator *Chrysoperla* spp. (Neuroptera: Chrysopidae) was observed in particularly high numbers in the infested sunflower fields and may also be a natural enemy of this pest, as it has

originally been reported by Manjunath et al. (1976) that *Chrysoperla carnea* Steph. feeds on young larvae of *H. peltigera*. Iqbal and Mohyuddin (1990) reported that the most important parasitoids of *H. peltigera* in Pakistan were *C. chlorideae*, *Apanteles* spp. and *T. chilonis*. These natural enemies may significantly contribute to maintaining the populations of the species below the economic threshold levels.

The control of *H. peltigera* can be based on cultural practices, conservation of its many natural enemies and if necessary, chemical agents. Apparently, local insecticide registrations should be taken into account. For example, deltamethrin can be used if serious infestations are detected (Hellenic Ministry of Agriculture 2015), however to date, there is no other chemical or microbial pesticide approved for the control of phylophagus Noctuidae in sunflower in Greece. Such limitation could be resolved by Ministerial Decrees granting temporary pesticide approvals, in case of a significant increase in the severity of future infestations. Serious damage to sunflower crops has been reported by another closely related species, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) (cotton bollworm) in tropical (Basappa 2004) and temperate areas (Maširević et al. 2004). It causes direct damage to the receptacle, ovaries and developing seeds and the resulting loss in seed crop can exceed 50% (Basappa 2004). Also, secondary capitulum rot caused by *Rhizopus* spp. can occur as a consequence of larval infestation (Maširević et al. 2004). Unfortunately, *H. armigera* has developed resistance to most of the commonly used insecticides in the cotton agroecosystem in Greece (Mironidis et al. 2012, 2015) and therefore it is important to protect sunflower from this pest with IPM tactics. Significant efficacy has been obtained by the coverage of the capitulum and upper plant parts thoroughly with biological insecticides such as nuclear polyhedrosis virus and *Bacillus*

thuringiensis either alone, or, more effectively, in combination with UV protectants (Grieco and Spence 1978, Basappa 2004, Shapiro et al. 2009). According to Singh et al. (2003), early sunflower sowing favors important predators such as *Chrysoperla* spp. and Coccinellidae. Also, cultural practices such as the mechanical destruction of crop residues and inversion tillage, proper plant nutrition management and conservation of natural enemies, are recommended for the control of the cotton bollworm (Kranthi 2007). Similarly, the cultural, biological and chemical measures that should be undertaken against *H. armigera* could help in the control of *H. peltigera* in sunflower.

To our knowledge, this is the first report of *H. peltigera* infestations in sunflower in Greece and possibly in Europe (Anastasiades et al. 2015). Although the infestations by *H. peltigera* did not cause any economic damage, the extent of the infestations detected in the area was notable. Therefore, the expansion of its distribution and its potential to cause damage to sunflower crops should be monitored in regions where sunflower is grown.

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Πρώτη αναφορά προσβολών του *Heliothis peltigera* στον ηλίανθο στην Ελλάδα

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ΠΕΡΙΛΗΨΗ

Τον Ιούνιο 2015, καταγράφηκαν προσβολές καλλιεργειών ηλιανθου από το έντομο *Heliothis peltigera* (Lepidoptera: Noctuidae) σε αγροτικές περιοχές της Περιφερειακής Ενότητας Δράμας. Παρατηρήθηκαν διαβρώσεις στα φύλλα και στους οφθαλμούς από τις προνύμφες του εντόμου, κυρίως στα προανθικά στάδια ανάπτυξης. Οι προσβολές παρατηρήθηκαν στο 80% των αγρών που επισκοπήθηκαν, ωστόσο το επίπεδο προσβολής των φυτών ήταν χαμηλό (<5%) και δεν διαπιστώθηκε πρόκληση οικονομικής ζημιάς στις καλλιέργειες. Το *H. peltigera* έχει αναφερθεί από τη Νότια και Κεντρική Ευρώπη, τον Καναδά, τη Μέση Ανατολή και την Αφρική να προσβάλλει διάφορους ξενιστές. Προσβολές σε καλλιέργειες ηλιανθου έχουν αναφερθεί από την Ινδία, το Πακιστάν και το Σουδάν. Στην εργασία αυτή παρέχονται τα διαθέσιμα στοιχεία βιοοικολογίας του εντόμου και οι δυνατότητες αντιμετώπισής του. Από όσο γνωρίζουμε, αυτή είναι η πρώτη αναφορά προσβολών του *H. peltigera* σε καλλιέργειες ηλιανθου στην Ελλάδα και πιθανώς στην Ευρώπη.