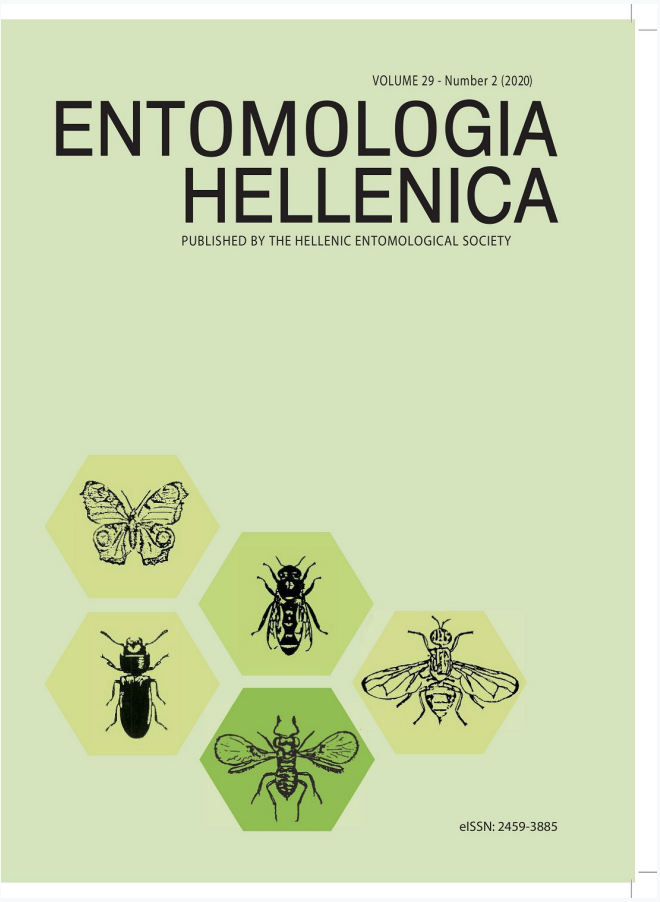
ENTOMOLOGIA HELLENICA

Vol 29, No 2 (2020)



On track to becoming a cosmopolitan invasive species: First record of the box tree moth Cydalima perspectalis (Lepidoptera: Crambidae) in the African continent

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doi: 10.12681/eh.23483

To cite this article:

Haddad, K., Kalaentzis, K., & Demetriou, J. (2020). On track to becoming a cosmopolitan invasive species: First record of the box tree moth Cydalima perspectalis (Lepidoptera: Crambidae) in the African continent. *ENTOMOLOGIA HELLENICA*, *29*(2), 27–32. https://doi.org/10.12681/eh.23483

ENTOMOLOGIA HELLENICA **29** (2020): 27–32

Received 20 June 2020 Accepted 23 September 2020 Available online 24 November 2020

On track to becoming a cosmopolitan invasive species: First record of the box tree moth *Cydalima perspectalis* (Lepidoptera: Crambidae) in the African continent

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ABSTRACT

Native to Eastern Asia, the box tree moth *Cydalima perspectalis* (Walker, 1859) has managed to establish itself, and gradually expand its distribution, across Europe, Asia and recently America. This publication documents the first known record of the invasive species in Africa. The moth was observed in Constantine, Algeria in 2018 and was later identified as *C. perspectalis*. Possible scenarios of its introduction on the continent, as well as potential ecological implications, are discussed.

KEY WORDS: Lepidoptera, Crambidae, *Cydalima*, invasive species, first record, Africa.

Introduction

Over the last decades, a progressive increase in human-mediated introductions of alien species has been observed worldwide, mostly due to globalization (Hulme 2009). This unprecedented rise in species translocations has altered the composition of biotas worldwide and can have extensive effects on native biodiversity, ecosystem stability, human health, and economy (Hulme 2009, Winter et al. 2009, Pyšek and Richardson 2010, Simberloff et al. 2013). Alien insect species represent one of the most numerous groups of introduced organisms (Roques et al. 2009), many of which with ecological impacts, on local flora (e.g. the lantana plume moth, *Lantanophaga pusillidactylus*; Demetriou et al. 2020) or fauna (e.g. feather-legged fly, *Trichopoda pennipes;* Kazilas et al. 2020).

The genus *Cydalima* (Lederer, 1863) comprises of 9 species inhabiting the Eastern Palearctic and Oceania, of which *Cydalima perspectalis* (Walker, 1859) is the only species reaching as far as the Western Palearctic. Native to Eastern Asia, the box tree moth has been introduced, established and gradually expanded its distribution across Europe, Asia and recently as far as America (CABI 2020). Its recent dispersal has been closely associated with the import of ornamental box trees (*Buxus* spp.), the leaves and shoots of which serve as larval feed and hibernarium (Bury et al. 2017). It has become a serious pest for ornamental box

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shrubs in the urban landscape (parks, gardens). However, the real concern lies on its spread in nature reserves and protected areas, where it can cause severe defoliation on native box trees [*Buxus sempervirens* (Linnaeus, 1753) and *B. colchica* (Pojark, 1947); Kenis et al. 2013, Mitchell et al. 2018].

Summarizing the species' distribution in the Mediterranean basin (Fig. 1), it has been reported from most Southern European countries: France (Feldtrauer et al. 2008), Croatia (Koren and Črne 2012), Slovenia (Seljak 2012), Italy (Bella 2013, Uhl and Wölfling 2013), Spain (Pérez-Otero et al. 2014), Bosnia and Herzegovina (Ostojić et al. 2015), Greece (Strachinis et al. 2015), Albania (Raineri et al. 2017), Montenegro (Hrnčić and Radonjić 2017), Malta (Agius 2018), and Gibraltar (Pérez and Guillem 2019). Regarding the Levantine coast the species has been detected only in Turkey (Hizal et al. 2012) and until now it has never been reported from Africa. Herein, we provide the first record of the box tree moth from the African continent.

Materials and Methods

On 29.ix.2018 a single adult was photographed in a garden, in the city centre of Constantine, Algeria (36.3643º, 6.6046º) by Dr. Karim Haddad (Fig. 2) and was subsequently added to iNaturalist online citizen science platform (iNaturalist 2020). The species was later identified as *Cydalima perspectalis*, due to its very distinguishable diagnostic characters; its rather large size, its white and slightly iridescent wings bordered by a dark brown costa, apex and tegmen as well as a white spot in the forewing's discoidal cell (Mally and Nuss 2010, Strachinis et al. 2015). Additional surveys were performed in order to confirm an established population of the species in Algeria, but no further individuals or infestation signs on box plants were observed.

FIG. 1. Physical map of the Mediterranean basin, where *Cydalima perspectalis* has been recorded. The shaded area represents the approximate distribution range of the species (by country; CABI, 2020). Our record in Constantine is indicated with X. Basemap: modified from Wikimedia Commons (creator: Nikita A. Zeemin). Inset: *C. perspectalis* (Thessaly, Greece); photo by C. Kazilas.

Results and Discussion

The dispersal of the box tree moth on the northern coasts of Africa has been already predicted, in accordance to the necessary climatological factors needed for the species development (Nacambo et al. 2014). As in most introduction incidents of non-native insects (Rabitsch 2010), the horticultural introduction pathway is proposed, in this case with the import of ornamental *Buxus* trees. An accidental human mediated dispersal is considered as the most possible scenario, as the species was first discovered in the busy city centre of Constantine and has been referred to as a weak flier, being able to travel distances between 5-10 km (van der Straten and Muss 2010, Agius 2018). Thus, given the distance between Algeria and Southern European coasts the species should not be able to cross the Mediterranean Sea barrier. In addition, the accidental introduction of the species has been originally associated with the import of its host plant, which is commonly traded from China to Europe as an ornamental plant (Leuthardt et al. 2010, Nacambo et al. 2014).

FIG 2. Individual of *Cydalima perspectalis* photographed *in situ* from Constantine, Algeria. Photo by Dr. K. Haddad.

Further contamination and potential spread of the species to native box tree vegetation, present in the country, should be prevented through the use of insecticides and removal of larvae from ornamental *Buxus* clusters in the city centre of Constantine. This method was proposed by Kenis et al. (2014) and while regarded as a temporary solution could be the first line of defence until agents of classical biological control can be deployed (e.g. *Chelonus tabonus* (Sonan, 1932) (Wang et al. 2014). The small populations of *B. sempervirens* in Algeria represent its southernmost distribution (Yahi et al. 2012), while *B. balearica* (Lam, 1785) is range-restricted to the Iberian Peninsula and north-western Africa (Balearic Islands, Algeria, Morocco, Spain; Carvalho et al. 2016). The loss of native box tree vegetation has been shown to have adverse biological (e.g. decline or disruption of habitat, native biodiversity and ecosystem properties), societal (e.g. religion) and economic (e.g. wood usage) impacts (Mitchell et al. 2018). An effective eradication could also prevent the introduction to neighbouring countries where the box tree moth has not been observed yet (e.g. Morocco and Tunisia).

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Καθοδόν να καταστεί κοσμοπολίτικο εισβλητικό είδος: Πρώτη καταγραφή του λεπιδόπτερου *Cydalima perspectalis* (Lepidoptera: Crambidae) στην Αφρικανική ήπειρο

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ΠΕΡΙΛΗΨΗ

Ιθαγενές στην Ανατολική Ασία, το λεπιδόπτερο *Cydalima perspectalis* (Walker, 1859) έχει καταφέρει να εδραιωθεί και σταδιακά να επεκτείνει την κατανομή του στην Ευρώπη, την Ασία και πρόσφατα την Αμερική. Η δημοσίευση αυτή τεκμηριώνει την πρώτη γνωστή καταγραφή του εισβλητικού είδους στην Αφρική. Το λεπιδόπτερο παρατηρήθηκε στην πόλη Constantine της Αλγερίας το 2018 και αργότερα αναγνωρίστηκε ως *C. perspectalis*. Αναλύονται τα πιθανά σενάρια εισαγωγής του στην ήπειρο, καθώς και πιθανές οικολογικές επιπτώσεις.

