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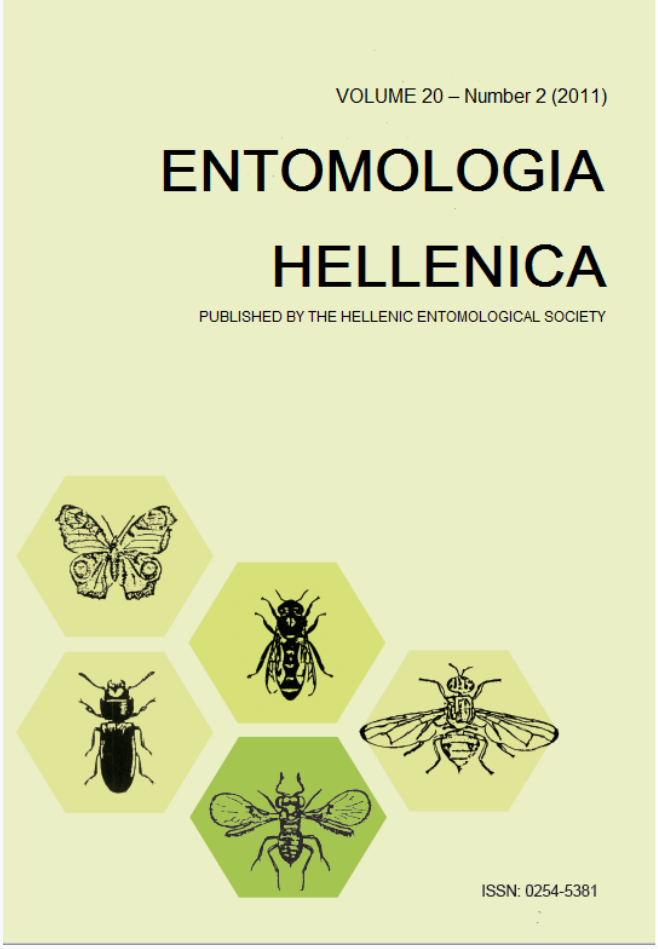

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First record of *Leptoglossus occidentalis* (Heteroptera: Coreidae) in Greece

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ABSTRACT

The Nearctic coreid *Leptoglossus occidentalis* Heidemann 1910 (Hemiptera: Coreidae) known as the Western Conifer Seed Bug, is recorded for the first time in Greece. This highly dispersible species is well established in Europe and was collected by the authors in various areas of continental Greece (Central Evia, Attica and North Peloponnisos), suggesting a wide distribution in this country.

KEYWORDS: *Leptoglossus occidentalis,* distribution, invasive species.

Introduction

The species *Leptoglossus occidentalis* (Heteroptera: Coreidae) was described for the first time by Heidemann (1910) in California. The genus is distributed in the Nearctic and Neotropical Region and consists of 54 species. The native range of this species extends from Mexico and California in the south to British Columbia, Alberta, and Saskatchewan (Heidemann 1910, Torre-Bueno 1941, Koerber 1963, Brailovsky and Sánchez 1983, Froeschner 1988, McPherson et al. 1990, Maw et al. 2000). After World War II, it started to spread eastwards, reaching the Midwest in the 1950s and 1960s and later it was found in all the eastern states (McPherson et al. 1990, Gall 1992, Kment and Banar 2008). The current distribution of the range is presented in Table 1 and the species is considered invasive, intercepted by passive movements of commercial consignments (McPherson et al. 1990). The major transport pathways are eggs in sawdust, wood material or seed sources for culturing trees in nurseries or even whole plant material such as Christmas trees (Mitchell 2000).

Adults of the insect are large (*circa* 17 mm [15 mm – 20 m]) and have characteristic leaflike expansions on metatibias. A diagnostic feature of the species is a light zigzag 'W' mark in the center of the forewings next to the basal part of membrane. The color of imagoes is light brown or reddish-brown, and in some individuals dirty grayish brown. The first antenomere is thicker than the rest, slightly curved, yellowish-brown with a black longitudical stripe. The scutellum is black with white apex. The corium is reddish-brown with a paler basal part and the membrane is black (Fent and Kment 2011). It differs from all European species but it is more similar to *L. corculus* although the metatibial expansion is more extended in the latter (Mjøs et al. 2010). *Leptoglossus occidentalis* feeds on the cones of conifers and can cause severe damage in pine orchards in North America. It is univoltine. Eggs are laid in spring and adults appear in late August though in Greece we have collected adults in the interval May-October.

The major host plants of the insect are conifers, mainly pines and to a lesser degree other coniferous species such as *Pseudotsuga menziesii,* even though other hosts in the genera *Juniperus*, *Tsuga*, *Picea*, *Cedrus, Calocedrus* have also been reported, raising the number of host plants to forty (Koerber 1963, Cambell and Shea 1990, Lait et al. 2001, Mjøs et al. 2010). The hosts in the countries where the insect has been introduced do not differ from the hosts in the original range and thus the insect was found on *Pinus pinea, P. nigra, P. sylvestris* whilst genera other than *Pinus* – i.e. *Picea, Pseudotsuga* and *Calocedrus* – are common (Barta 2009, Mjøs et al. 2010, Roversi et al. 2011).

In the northern parts of its range distribution, *L. occidentalis* is univoltine while in warmer areas is bivoltine or even polyvoltine (e.g. in Mexico, EPPO Reporting Service 2010). In southern Greece the insect is expected to be bivoltine due to the warm climate. Also, voltinism seems to be affected by the host plant together with ambient temperature, both of which determine the duration of development (Cizek et al. 2006). A varied voltinism has been observed in North America and Mexico where a single and three generations have been reported, respectively (Koerber 1963, Mitchell 2000).

The number of generations completed annually usually determines the damage level on pines. In America north of Mexico the insect is considered a pest since it can cause reduction of the number of seeds, either by abortion of conelets or by restricting the germination of the seeds through the exploitation of the major storage reserves (Bates et al. 2001, Bates et al. 2002). In Europe, especially in Mediterranean countries where *P. pinea* grows in the wild, the production of seeds (pine nuts) is severely reduced by as much as 95% (Roversi et al. 2011).

This study is designed to provide answers concerning the number of host species. The number of generations is also speculated on the seasonal distribution of occurrences of this invasive insect.

Materials and Methods

The distribution of *L. occidentalis* in Greece was thoroughly studied by collecting samples from more than two hundred locations, during the years 2008 – 2010. The insects were collected with an entomological sweep net operated on various plants, particularly Pinaceae. Since the insect prefers newly formed cones it is expected to be found on the upper and outer parts of the crown. For the upper parts of the tree crown an entomological net was fitted to a collapsible 2 – 6m pole which was employed in sweeping the branches. A knock-down technique was also employed by spreading plastic sheets underneath the treated tree and beating the branches to make the insects fall onto the sheets from which they were collected.

The insect material was identified by B. Aukema (co-ordinator of Heteroptera in Fauna Europaea) and is deposited in the insect collection of I.M.F.E. and the Agricultural University of Athens as well as the authors' private collections. Attempts to establish a laboratory colony by offering insects small branches bearing new conelets for food and needles as oviposition substrate were unsuccessful.

Results and Discussion

The occurrence of *L. occidentalis* in Greece was expected, especially after the capture of this species in Bulgaria (Simov 2008) (Table 2).

The insect introduction and spread possibly were associated with ports and woodsheds (Attica) or construction of new buildings (Vouraikos gorge, Papadhes, Thracomacedones) and wooden materials (bee-hives in Platanos, Malthi) or material of unknown origin (Kehries, Malthi).

TABLE 1. Country and year of the first recording of *Leptoglossus occidentalis*. The reference where the recording was reported is also given.

Country of first record	**Year**	**Reference**
California (USA) [first description]	1910	Heidemann 1910
Pacific Coast (USA)	1963	Koerber 1963; Blatt & Borden 1996
Montana, Nebraska, Kansas (USA)	1950-1960	McPherson et al. 1990; Gall 1992; Kment & Banar 2008
Eastern states (USA)	1990	McPherson et al. 1990
Europe	1999	Mitchell 2000; EPPO Reporting Service 2010
Italy	1999	Taylor et al. 2001; Villa et al. 2001; Bernardinelli & Zandigiacomo 2001; Roversi et al. 2011
Switzerland	2002	Colombi & Brunetti 2002; Wyniger 2007
Slovenia	2003	Gogala 2003, 2008; Jurc and Jurc 2005
Spain	2003	Valcarcel & Portillo 2009
Croatia	2004	Tescari 2004; Kment & Banar 2008
Hungary	2004	Földessy 2006; Harmat et al. 2006
Austria	2005	Rabitsch & Heiss 2005; Novotny 2007
Slovakia	2006	Majzlan & Roháčová 2007; Hradil et al. 2008; Barta 2009
France	2006	Moullet 2006; Dusoulier et al. 2007; Rahola 2007;Alziar 2008; Guérin 2008; Seiller 2008; Tamisier 2008; Haran & Michel 2009; Hugel 2009
Germany	2006	Pérez & Hoffmann 2007; Hoffmann 2008; Landeck 2008; Schmolke & Schulz-Mirbach 2008; Arnold & Walter 2009; Rietschel 2009
Czechia	2006	Beránek 2007; Hradil et al. 2008; Kment et al. 2008
Serbia	2006	Protic 2008
The Netherlands	2007	Aukema 2008; Aukema & Libeer 2007; Aukema et al. 2009

United Kingdom	2007	Malumphy & Reid 2007; Malumphy et al. 2008; Bantock & Nau 2009; Witts & Russell 2009
Poland	2007	Lis et al. 2008
Bulgaria	2008	Simov 2008
Montenegro	2008	Hradil 2008
Romania	2008	Ruicănescu 2009
Portugal	2008	Grosso – Silva 2010
Asia (China, Japan)	2008	Ishikawa & Kikuhara 2009; Zhu 2010
Denmark	2009	Buhl & Stephensen 2009
Norway	2009	Mjøs et al. 2010
European Turkey	2011	Fent & Kment 2011

TABLE 2. Records of *Leptoglossus occidentalis* in Greece.

Vegetation	**Date of sampling**	**Geographic division**	**Site**	**Locality**
P. halepensis wood	1/9/2008	Sterea Hellas, Attica	Institute of Mediterranean Forest Ecosystem	Alsos Syggrou
P. halepensis wood	16/10/2009	Sterea Hellas, Attica	Institute of Mediterranean Forest Ecosystem	Alsos Syggrou
P. halepensis wood	28/8/2009	Sterea Hellas, Attica	Institute of Mediterranean Forest Ecosystem	Alsos Syggrou
P. halepensis forest	4/9/2009	Sterea Hellas, Evia	Papadhes	Dasiko Chorio
P. halepensis forest	4/9/2009	Sterea Hellas, Evia	Papadhes	Kerasia
P. halepensis forest	4/9/2009	Sterea Hellas, Evia	Papadhes	Amelantes
P. halepensis forest	26/8/2009	Sterea Hellas, Attica	Thracomacedones	Thraco-macedones
P. halepensis forest	29/7/2009	Sterea Hellas, Evia	Limni	Kehries
P. halepensis forest	4/5/2009	Peloponnisos, Achaia	Vouraikos gorge	On the road to Mega Spilaio
P. halepensis forest	12/6/2009	Peloponnisos, Arcadia	Platanos	Platanos

In addition, the tendency of the insect to enter residences while searching for shelter to overwinter in late autumn (EPPO Reporting Service 2010) gives additional opportunities of transportation to new countries.

Most specimens in Greece were collected from *P. halepensis,* which is a common host of this species in other European countries (Beranek 2007, Maluphy et al. 2008, Barta 2009, EPPO Reporting Service 2010). *Pinus halepensis* is widespread in Greece and this factor certainly has contributed to the rapid dispersal of *L. occidentalis* in the country. The insect was found in Vouraikos gorge on the road to Kalavryta, Achaia in a residential area outside the town with many tourist establishments and constructions. The planted roadside *P. pinea* trees (examined until now) did not harbor any population of the insect, in contrast to Italian populations where it is abundant and may cause a reduction of the cone harvests (Roversi et al. 2011). Probably the reduced abundance of *L. occidentalis* on the umbrella pine in Greece is due to the small natural populations of this species in the country whereas other pine host species are available on a much larger scale. The scarcity of the insect on *P. nigra* can be explained on the premises that the respective forests have high altitude which is unsuitable for the true bud species unlike other European countries in which black pines grow in lowlands.

The predators of *L. occidentalis* are usually frequent on pine foliage and associated substrates such as the ground layer of pine forests. Birds, frogs and bats are predators with a varying degree of efficiency. The mantids *Ameles decolor* Charpentier 1825 and *Mantis religiosa* Linnaeus 1758 devour several individuals daily in captivity and *Sphodromantis viridis* Forskal 1775 , collected from Cyprus fed on a diet consisting almost exclusively of *L. occidentalis*. However, they cannot be considered efficient predators since they live in completely different habitats from those inhabited by *L. occidentalis* and select other insect taxa as their prey (personal observation).

Studies conducted by Bates and Borden (2005) have shown that *L. occidentalis* can be controlled only if the population is suppressed at the egg stage (30% mortality) by introducing the egg parasitoid *Gryon pennsylvanicum* (Ashmead) (Hymenoptera: Platygastridae).

The fact that *L. occidentalis* was collected in various locations in both Central Greece and the Peloponnese suggests that it might have reached the Balkan Peninsula earlier than previously thought but had not been collected there since Greece and the adjacent countries are relatively under-sampled for this species (cf. Fent and Kment 2011). This is the southernmost record of this species in Europe and its presence in neighboring countries (Albania, F.Y.R. of Macedonia) is highly probable. Also, the records of *L. occidentalis* span the interval from May 4th to October 10th implying that there is enough room for two generations in a year. This speculation can be verified with detailed observations possibly coupled with laboratory experiments for in Attica (Alsos Syggrou) and Peloponissos (Vouraikos) populations (Table 2).

The possible distribution of this alien species in other parts of Greece and Europe, as well as its impact on the native ecosystems should be extensively studied in the future.

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Πρώτη αναφορά του είδους *Leptoglossus occidentalis* (Heteroptera: Coreidae) στην Ελλάδα

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ΠΕΡΙΛΗΨΗ

Το νεαρκτικό κορεοειδές έντομο *Leptoglossus occidentalis* Heidemann 1910 (Heteroptera: Coreidae) γνωστό ως «έντομο των σπερμάτων των δυτικών κωνοφόρων», αναφέρεται για πρώτη φορά στην Ελλάδα. Αυτό το πολύ διαδιδόμενο έντομο έχει σαφώς εγκατασταθεί στην Ευρώπη και έχει συλλεγεί σε πολλές περιοχές της ηπειρωτικής Ελλάδας (Κεντρική Εύβοια, Αττική, Βόρεια Πελοπόννησος) πράγμα που φανερώνει την ευρεία εξάπλωση του εντόμου στην χώρα αυτή.