TWO INVASIVE ALIEN INSECT SPECIES, *LEPTOGLOSSUS OCCIDENTALIS* (HETEROPTERA: COREIDAE) AND *CYDALIMA PERSPECTALIS* (LEPIDOPTERA: CRAMBIDAE), AND THEIR DISTRIBUTION AND HOST PLANTS IN ISTANBUL PROVINCE, TURKEY

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Abstract

Leptoglossus occidentalis (Heidemann, 1910) and *Cydalima perspectalis* (Walker, 1859) are alien insect species which have invaded Turkey. *Leptoglossus occidentalis* was recorded for the first time in Istanbul (Turkey) in 2009 and *Cydalima perspectalis* was recorded there for the first time in 2011. We examined the distribution of these two invasive alien insect species, and their host plants, in Istanbul province of Turkey. *Leptoglossus occidentalis* was observed in Istanbul Province on *Pinus nigra*, *Pinus pinea*, *Pinus radiata* and *Abies concolor*. *Cydalima perspectalis* was recorded only on *Buxus sempervirens* and *B. sempervirens* cv 'aureavariegata' in Istanbul Province, and severe damage was inflicted on these cultivars.

Key Words: *Leptoglossus occidentalis*, *Cydalima perspectalis*, *Buxus sempervirens*, *Buxus sempervirens* cv 'aureavariegata', *Pinus nigra*, *Pinus pinea*, *Pinus radiata*, *Abies concolor*

Resumen

Leptoglossus occidentalis (Heidemann, 1910) y *Cydalima perspectalis* (Walker, 1859) son especies de insectos exóticos invasores en Turquía. Se registró *Leptoglossus* occidentalis por primera vez en Estambul, Turquía en el 2009 y se registró *Cydalima perspectalis* por primera vez en Estambul, Turquía en el 2011. Este estudio examinó la distribución de estas dos especies de insectos exóticos invasivores y sus plantas hospederas en la Provincia de Estambul en la Turquía. Se observó *Leptoglossus occidentalis* en la provincia de Estambul sobre *Pinus nigra, Pinus pinea, Pinus radiata* y *Abies concolor.* Se registró *Cydalima perspectalis* sobre *Buxus sempervirens y B. sempervirens* cv 'aureavariegata, en la Provincia de Estambul, y causando daño grave a estos cultivares.

Globalization of trade and travel on an unprecedented scale, has inadvertently led to the increased transport and introduction of alien species, and the breaking down of natural barriers between countries and continents (Lowe et al. 2000). Invasive alien species are increasingly recognized as one of the major threats to biodiversity (Wittenberg et al. 2006).

The western conifer seed bug, *Leptoglossus occidentalis* (Heidemann, 1910) (Heteroptera: Coreidae), is an invasive alien species of North American origin (McPherson et al. 1990). In Europe, it was first collected in Italy in 1999 (Tescari 2001). From there, it quickly expanded its range to western and eastern Europe (Bernardinelli & Zandigiacomo 2001; Hradil 2008; Kment & Banar 2008; Lis et al. 2008; Rabitsch 2008; Simov, 2008; Werner 2011). *Leptoglossus occidentalis* was recorded for the first time in Sariyer, Turkey in 2009 (Arslangündogdu &Hizal 2010).

Leptoglossus occidentalis is specialised to conifers. It has been recorded from about 40 species of conifers, mostly from pines (Pinales: Pinaceae), e.g., Coulter pine (*Pinus coulteri* D. Don), Aleppo pine (*P. halepensis* Mill.), Jeffrey pine (*P. jeffreyi* Balf.), sugar pine (*P. lambertiana* Douglas), western white pine (*P. monticola* Douglas ex D. Don), mugo pine (*P. mugo* Turra), Austrian pine (*P. nigra* J. F. Arnold), Italian stone pine (*P. pinea* L.), Ponderosa pine (*P. ponderosa* P. Lawson & C. Lawson), Monterey pine (*P. radiata* D. Don), red pine (*P. resinosa* Alton), California foothill pine (*P. sabiniana* Douglas), eastern white pine (*P. strobus* L.), and Scots pine (*P. sylvestris* L.), but also on Douglas fir (*Pseudotsuga menziesii* [Mirb.] Franco), big-cone Doulas fir (*P. macrocarpa* [Vasey] Mayr), eastern hemlock (*Tsuga canadensis* Carrière), mountain hemlock (*T. mertensiana* (Bong.) Carrière), incense cedar (*Calocedrus* [=*Libocedrus*] *decurrens* (Torr.) Florin [Pinales: Cupressaceae]), white fir (*Abies concolor* [Gord. & Glend.] [Pinales: Pinaceae]), California red fir (*A. magnifica* A. Murray), white spruce (*Picea glauca* [Moench] Voss; [Pinales: Pinaceae]) and Italian cypress (*Cupressus sempervirens* L. [Pinales: Cupressaceae]) (e.g.,

Koerber 1963; McPherson et al. 1990; Gall 1992; Vanin et al. 2005; Kment & Baňař 2008; Protić 2008; Maltese et al. 2009).

Leptoglossus occidentalis feeds on young developing cones and may cause abortion of young conelets, fusion of seeds to cone scales as well as direct damage by depletion of the lipid and protein content of the seed up to its complete emptying (Bates et al. 2000a, b). Tiberi (2007) listed *L. occidentalis* among pests of *Pinus pinea* cultivated in Italy. Uyemoto et al. (1986) reported damage caused by *L. occidentalis* on cultivated pistachio.

Box tree moth *Cydalima perspectalis* (Walker, 1859) (Lepidoptera: Crambidae) is an invasive alien species of East Asia origin. The natural range of the *C. perspectalis* is the humid subtropical regions of East Asia, India, China, Japan, Korea and Russian Far East (Mally & Nuss, 2010). In Europe, it was reported for the first time in 2007, in Germany (Billen 2007). In subsequent years, *C. perspectalis* (Walker 1859) continued to spread in Germany and nearby countries (Straten & Muus 2010). *Cydalima perspectalis* was recorded for the first time in Sariyer, Turkey in 2011 (Hizal et al. 2012).

Cydalima perspectalis causes damage on Japanese box (*Buxus microphylla* Siebold & Zucc.; Euphorbiales: Buxaceae), common box (*B. sempervirens* L.), Chinese boxwood (*B. sinica* [Rehder & E. H. Wilson] M. Cheng), Japanese spindletree (*Euonymus japonicus* Thunb.; Celastrales: Celastraceae), Burningbush (*E. alata* (Thunb.) Siebold), Purple holly (*Ilex purpurea* Hassk.; Aquifoliales: Aquifoliaceae) (Maruyama 1993; Kawazu et al. 2007, 2010; Straten & Muus 2010; Korycinska & Eyre 2011). The plants lose all of their leaves as a result of the attack of this moth.

Here I report on the distribution and host plants of *L. occidentalis* and *C. perspectalis* in the Istanbul Province Turkey.

Materials and Methods

Leptoglossus occidentalis especially prefers coniferous trees and damages young developing cones. For this reason, coniferous tree species distribution areas were marked on forest management plan maps. The marked points included possible areas of damage. The species is much easier to find in the late summer and fall when it is seeking out overwintering locations. Possible areas of damage were visited 4 times each month between the dates Sep-Dec 2009, Aug-Dec 2010, and Aug-Dec 2011. Adults were captured by using an insect net on the needles, cones and insects in flight. Bird nest boxes, the loose bark of trees, and buildings near the possible areas of damage were investigated.

Cydalima perspectalis larvae damage boxwood leaves. *Buxus* species are widely used for decorative purposes in parks and gardens. European and Asian (Anatolian) sides of the parks and gardens were visited 2 days a week starting on 20 Jun 2011. Leaves were searches for *C. perspectalis* larvae.

All data concerning the presence of these pests were transferred to tables and maps, and specific mapped locations were sampled to ascertain the distribution of these 2 adventive species.

Results

Leptoglossus occidentalis was first recorded from the Istanbul Province on 14 Sep 2009 in the Fatih Forest at Sariyer-Istanbul. Sampling locations and host plants on which *L. occidentalis* was observed for all sampling dates are listed in Table 1; and these same locations are displayed on the map of sampling locations, Fig. 1. Consistent with earlier host plant records, *L. occidentalis* was observed in the Istanbul Province on *Pinus nigra*, *Pinus pinea*, *Pinus radiata* and *Abies concolor*.

Cydalima perspectalis was recorded for the first time in the European side of Sariyer-Istanbul in Turkey on 15-VI-2011, and the species was particularly abundant in the Sariyer district. *Cydalima perspectalis* was not detected in the Asian side of Istanbul until 30-VII-2011 (Hizal et al. 2012).

Host plants on which *C. perspectalis* specimens were recorded and their locations are listed in the Table 2, and shown in Fig. 2. Only *Buxus sempervirens*, common boxwood, and *B. sempervirens* cv 'aureavariegata', golden variegated boxwood, were noted as host plants in Istanbul Province. I observed severe damage to *Buxus* spp. in the parks and gardens of Istanbul Province, where these boxwoods are used extensively in topiary plantings.

Discussion

In 2009 *L. occidentalis* was observed only on the European side of Istanbul, but in 2010, it was recorded for the first time from the Asian (Anatolian) side. At a minimum, the water barrier to dispersal in Istanbul is 700 m wide between Kandilli point and Aşiyan. This may have slowed down, but clearly did not stop, the spread of this very strong flier. It may be that the presence of large plantation areas in Istanbul Province contributed to ease with which this species has spread in Turkey. Because *L. occidentalis* is known as a pest of cultivated pistachio (Uyemoto et al. 1986), it's presence in Turkey potentially threatens cultivated *Pistacia vera* L. (Sapindales: Anacardiaceae) in Turkey.

There are 2 natural *Buxus* species (Balearic box- *Buxus balearica* Lam., and Common Box- *B. sempervirens* L.) in Turkey (Yaltırık and Efe 2000). *Cydalima perspectalis* is a new harmful

TABLE 1. *LEPTOGLOSSUS OCCIDENTALIS* DISTRIBUTION AND HOST PLANTS. EACH NUMBER IN PARENTHESES IS A POINT ON THE MAP SHOWN IN FIG. 1.

	Periods When Systematic Sampling Was Conducted					
	Between 14 Sep 2009 and 30 Dec 2009		Between 10 Aug 2010 and 30 Dec 2010		Between 15 Aug 2011 and 30 Dec 2011	
Host Plant	European Side	Asian (Anatolian) Side	European Side	Asian (Anatolian) Side	European Side	Asian (Anatolian) Side
Pinus nigra	Fatih Forest (1)	Anadolu Feneri (8) (Not detected)	Fatih Forest (1)	Anadolu Feneri (8)	Fatih Forest (1)	Anadolu Feneri (8)
	Rumeli Feneri Road (2)	Polonezkoy (9) (Not detected)	Rumeli Feneri Road (2)	Polonezkoy (9)	Rumeli Feneri Road (2)	Polonezkoy (9)
	Koç University Campus (3)	Kanlica (10) (Not detected)	Koç University Campus (3)	Kanlica (10)	Koç University Campus (3)	Kanlica (10)
	Istanbul University Forestry Faculty Campus (4)	Beykoz (11) (Not detected)	Istanbul University Forestry Faculty Campus (4)	Beykoz (11)	Istanbul University Forestry Faculty Campus (4)	Beykoz (11)
		Alemdag (13) (Not detected)			Tayakadin (12)	Alemdag (13)
Pinus pinea	Fatih Forest (1)	Alemdag (13) (Not detected)	Fatih Forest (1)	Beykoz (11)	Fatih Forest (1)	Alemdag (13)
	Ataturk Arboretum (5)	Anadolu Feneri (8) (Not detected)	Ataturk Arboretum (5)		Ataturk Arboretum (5)	
			Demircikoy (7)			
Pinus radiata	Feneryolu (6)		Feneryolu(6)		Feneryolu(6)	
Abies concolor	Ataturk Arboretum (5)	(Not detected)	(Not detected)	(Not detected)	(Not detected)	(Not detected)

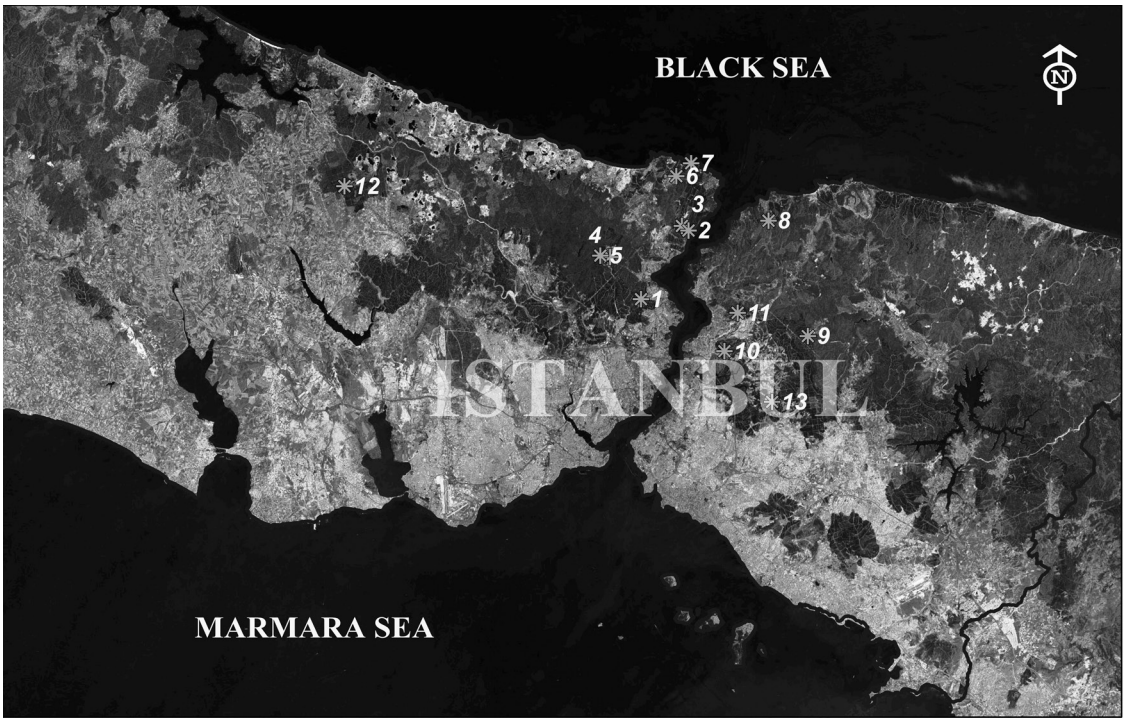

Fig. 1. *Leptoglossus occidentalis* (western conifer seed bug) distribution in Istanbul Province, Turkey. This invasive species was found on *Pinus nigra*, *Pinus pinea*, *Pinus radiata* and *Abies concolor*.

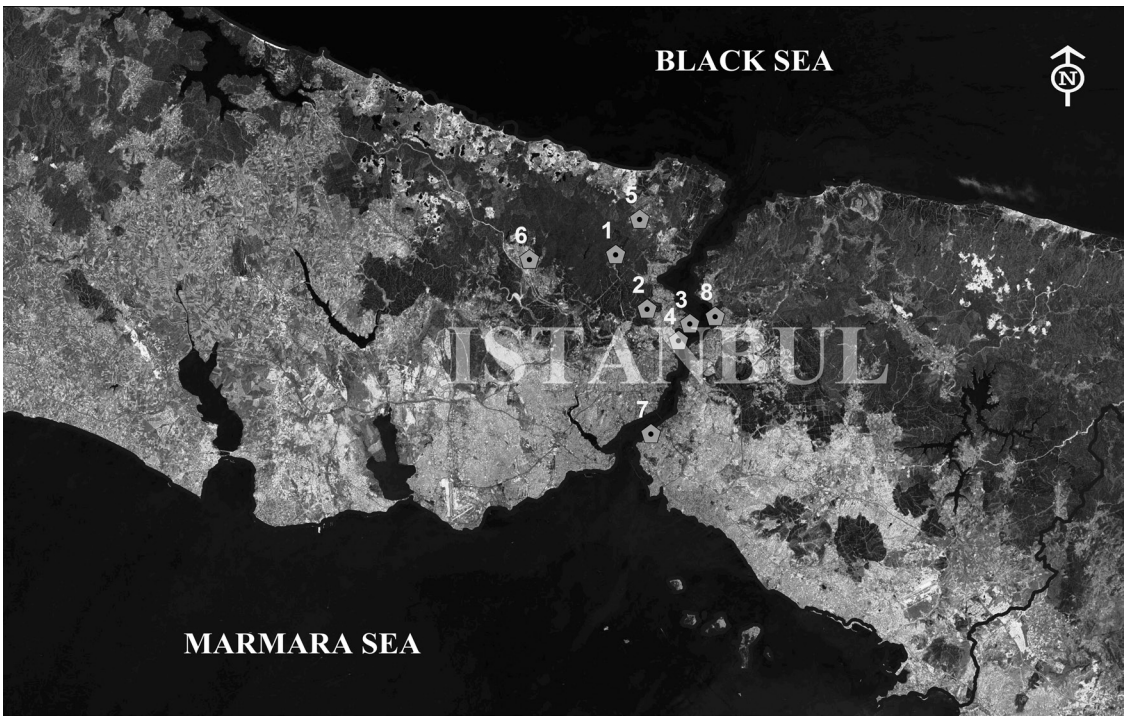

Fig. 2. *Cydalima perspectalis* (box tree moth) distribution in Istanbul Province, Turkey. This invasive species was found only on *Buxus sempervirens*, common boxwood, and *B. sempervirens* cv 'aureavariegata', golden variegated boxwood on which it inflicted severe damage.

TABLE 2. *CYDALIMA PERSPECTALIS* DISTRIBUTION AND HOST PLANTS. EACH NUMBER IN PARENTHESES IS A POINT ON THE MAP SHOWN IN FIG. 2.

	Periods When Systematic Sampling Was Conducted			
	Between 20 Jun 2011 and 30 Jul 2011		Later than 30 Jul 2011	
Host Plant	European Side	Asian (Anatolian) Side	European Side	Asian (Anatolian) Side
Buxus sempervirens	Istanbul Univ. Forestry Faculty Campus (1)	Uskudar (7) Not detected	Istanbul Univ. Forestry Faculty Campus (1)	Near woods, Fethipasa -Uskudar (7)
	Fatih Forest (2)	Beykoz (8) Not detected	Fatih Forest (2)	Beykoz (8)
	Yenikoy (3)		Yenikoy (3)	
	Emirgan (4)		Emirgan (4)	
	Zekeriyakoy (5)		Zekeriyakoy (5)	
			Kemerburgaz (6)	
Buxus sempervirens cv. 'aureavariegata'	Istanbul Univ. Forestry Faculty Campus (1)			

species that poses a great threat to both natural *Buxus* species and also the ones used in parks and gardens.

Our understanding of the biology, distribution, host plants, chemical and biological control methods of *Leptoglossus occidentalis* and *Cydalima perspectalis* in Turkey is far from adequate. Additional studies are needed to assess the extent of the threat posed by these 2 invaders, and to develop appropriate preventive or response strategies.

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