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Longhorn beetles (Coleoptera, Cerambycidae) Chapter 8.1

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Abstract

A total of 19 alien longhorn beetle species have established in Europe where they presently account for ca. 2.8 % of the total cerambycid fauna. Most species belong to the subfamilies Cerambycinae and Laminae which are prevalent in the native fauna as well. The alien species mainly established during the period 1975–1999, arriving predominantly from Asia. France, Spain and Italy are by far the most invaded countries. All species have been introduced accidentally. Wood-derived products such as wood- packaging material and palettes, plants for planting, and bonsais constitute invasive pathways of increasing importance. However, only few species have yet colonized natural habitats outside parks and gardens. Present ecological and economical impacts, and future trends are discussed.

Keywords

Cerambycidae, Europe, Introductions, Establishments, Biogeographical origins, Pathways, Impacts

8.1.1 Introduction

The coleopteran family Cerambycidae (longhorn beetles) is currently classified in the superfamily Chrysomeloidea, along with the families Vesperidae and Distenidae (Hunt et al. 2007, Szeoke and Hegyi 2002). Cerambycidae is a large family comprising about

40000 described species worldwide. Longhorn beetles are all phytophagous. Larvae may be found in conifer, deciduous and fruit trees, in bushes and herbaceous plants. They are mainly xylophagous borers of living, decaying or dead wood. Some species also bore small twigs, roots or fruit endocarps. They usually have a long period of larval development, some species being capable of developing in woody material a long time after the death of the tree. They are thus very susceptible to transport with wood products, facilitating their introduction and establishment.

The oldest known introduction of a longhorn beetle from one continent to another was probably that of the house borer, *Hylotrupes bajulus* (L., 1758), which was first described by Linnaeus from both Europe and 'America septentrionali' (von Linnaeus 1758). Since a study by Duffy in 1953 (Duffy 1953a) for Great Britain, there has been no further large synthesis of the alien cerambycid species introduced to Europe. Since 1999, the development of research interests in the Asian longhorn beetles, *Anoplophora* spp., in North America has raised awareness of the risks presented by cerambycid importation and provided a baseline for subsequent studies (Haack et al. 2000, Haack et al. 2010). There is an urgent need for a comprehensive literature review of the alien cerambycids that have successfully established in Europe.

The exponential growth in the volume of international trade in both horticulture and forestry has allowed an increasing number of wood products and ornamental plants potentially containing cerambycids to arrive in Europe. More than 250 species have been introduced to Europe or moved within Europe since the middle of the 18th century (Cocquempot 2007) but most of them never established. We have identified 19 species alien *to* Europe that have established in Europe but have not yet been eradicated.

8.1.2 Taxonomy of the Cerambycid species alien *to* Europe

Taxonomy in Cerambycidae *sensu lato* is not well established (e.g., Hunt et al. 2007, Lawrence and Newton 1995, Napp 1994, Özdikmen 2008, Sýkorová 2008) but a general consensus exists about the presence in Europe of 7 subfamilies, namely Cerambycinae, Lamiinae, Lepturinae, Necydalinae, Prioninae, Spondylidinae, and Vesperinae (the latter being sometimes considered as a valid family). A total of 677 native species are known to occur in Europe (Althoff and Danilevsky 1997, Fauna Europaea), being largely dominated by 3 subfamilies (Lamiinae- 343 spp.; Cerambycinae- 158 spp.; Lepturinae- 130 spp.) which account for 93.2% of the total.

The 19 alien species established in Europe belong to only 3 of these subfamilies, Cerambycinae, Laminae and Prioninae (Table 8.1.1). The alien species are mostly represented by the subfamily Cerambycinae, followed by Lamiinae but the relative proportion of aliens compared to the total cerambycid fauna is still limited (<6%) in these two subfamilies. By contrast, the proportion of aliens is much more important in Prioninae with 2 species adding to 10 native ones (Fig. 8.1.1.). In addition, Parandrinae, a subfamily which is not represented in the native European entomofauna, is represented by *Parandra brunnea,* a North American species introduced in Germany (Nüssler 1961).

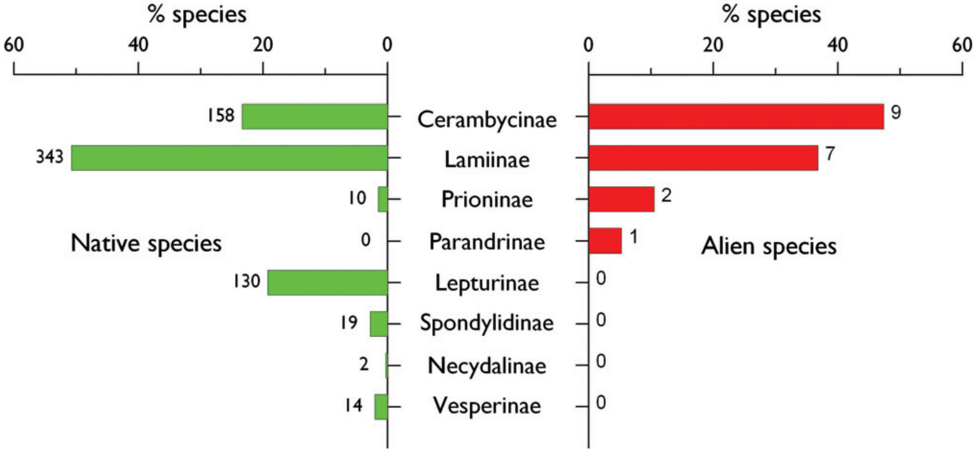

Figure 8.1.1. Relative importance of the subfamilies of Cerambycidae in the alien and native entomofauna in Europe. Subfamilies are presented in a decreasing order based on the number of alien species. Species alien *to* Europe include cryptogenic species. The number over each bar indicates the number of species observed per family.

Two more alien species have been introduced and established in Israel, *Batocera rufomaculata* (DeGeer, 1775) (Bytinski-Salz 1956, Chikatunov et al. 1999, Sama et al. 2010) and *Xystrocera globosa* (Olivier, 1795) (Chikatunov et al. 2006, Sama et al. 2010), but they have not yet spread to Europe and were not considered in Table 8.1.1.

Table 8.1.2 gives a list of species of European origin introduced through human activity in another part of Europe (aliens *in* Europe). These species are mostly of Mediterranean origin introduced in more northern areas and species from Continental Europe introduced to the Atlantic islands.

8.1.3 Major biological characteristics of the cerambycid species alien *to* Europe

Lepturinae but also Prioninae and Parandrinae share some biological characteristics that reduce their probability of introduction. Larvae in these subfamilies develop in decaying wood and are rarely imported with wood products or living plants. Interceptions have shown that they are mainly introduced through accidental importation in industrial packages or in stocks of perishable vegetables. Only a few species of Lepturinae (Tribe Rhagiini, and some Lepturinii) developing on recently felled trees are likely to be successfully introduced through the wood trade. The importation of living potted plants is also a potential new pathway for Prioninae.

Cerambycinae and Lamiinae seem more predisposed to introduction. Most species develope in living plants and several Cerambycinae undertake their entire life-cycle in dead wood, e.g. the cosmopolitan tribe Hesperophanini and the species *Hylotrupes bajulus* and *Gracilia minuta.* Thus, Cerambycinae and Lamiinae can easily survive throughout the importation process of living plants including bonsai (e.g. *Anoplophora chinensis* (Cocquempot 2007, EPPO 2006, van Rossem et al. 1981, Schmidt and Schmidt 1990)), recently felled logs and other non-aged wood products (e.g. *Anoplophora glabripennis* (Cocquempot et al. 2003, Haack et al. 2000), *Monochamus* spp. (Cocquempot 2007, Cocquempot (Unpubl.), Duffy 1953a), *Chlorophorus annularis* (Cocquempot 2007) and *Phoracantha* spp. (Cocquempot and Debreuil 2006)). Species in the genera *Hesperophanes*, *Trichoferus*, and *Stromatium* can emerge from wood products even several years after importation (Duffy 1953a).

Once a population is introduced, the capability for natural dispersal constitutes an important factor for establishment success. Although our knowledge about the dispersal behaviour of alien longhorn beetles is still rather limited and mostly concerns only a few species of recent invaders such as *Anoplophora glabripennis* (Smith et aol. 2001) and *A. chinensis* (Adachi 1990, Komazaki and Sakagami 1989), this variable is important when designing an eradication attempt (MacLeod et al. 2002).

8.1.4 Temporal trends of introduction in Europe of alien Cerambycids

Figure 8.1.2 presents the temporal changes in the records of Cerambycid species alien *to* Europe from 1492 to 2007. Cerambycids have tracked trade routes since the beginning of overseas communications. The first species to have moved are those which live in dry wood and undergo a long stage of larval development. These species have become cosmopolitan (e.g. *Hylotrupes bajulus*) or nearly so (e.g. *Stromatium* spp.). With the increased speed of international transport from 1850 to 1925, species with shorter life cycles were able to reach Europe alive and become established, e.g. *Neoclytus acuminatus* (Reineck 1919, Sama 2002, Tassi 1969). Later, only two species were introduced from North America to Europe via the US effort to supply extra furniture and increase military material after the 1st World War (i.e., *Parandra brunnea*, *Neoclytus acuminatus*). Subsequently, 50 years passed until a second wave of introduction arrived alongside with the rapid development of international exchange of goods and transportation after the 2nd World War. During the recent period, two further species have been detected in the wild - *Anoplophora chinensis* in 2000 in Italy (Colombo and Limonta 2001) and *A. glabripennis* in 2001 in Austria (Dauber and Mitter 2001).

The number of interceptions of Cerambycids is still increasing throughout Europe. However, more effective control at borders is like to have reduced establishments following interception or introductions. The importation of exotic plants also offers opportunities for introduction but also constraints the establishment of some alien species. For example, *Phoracantha* spp. could not have been introduced without the importation and mass cultivation of its host plants, *Eucalyptus* spp. in the Mediterranean basin. In south-eastern France, an Australian cerambycid, *Bardistus cibarius* (Newman, 1841) could survive only on its original host plant, an introduced grass tree (*Xanthorrhoea* sp., Xanthorrhoeaceae); the beetle population disappeared immediately after the infested host plants were removed (Cocquempot 2007). The case of *Batocera*

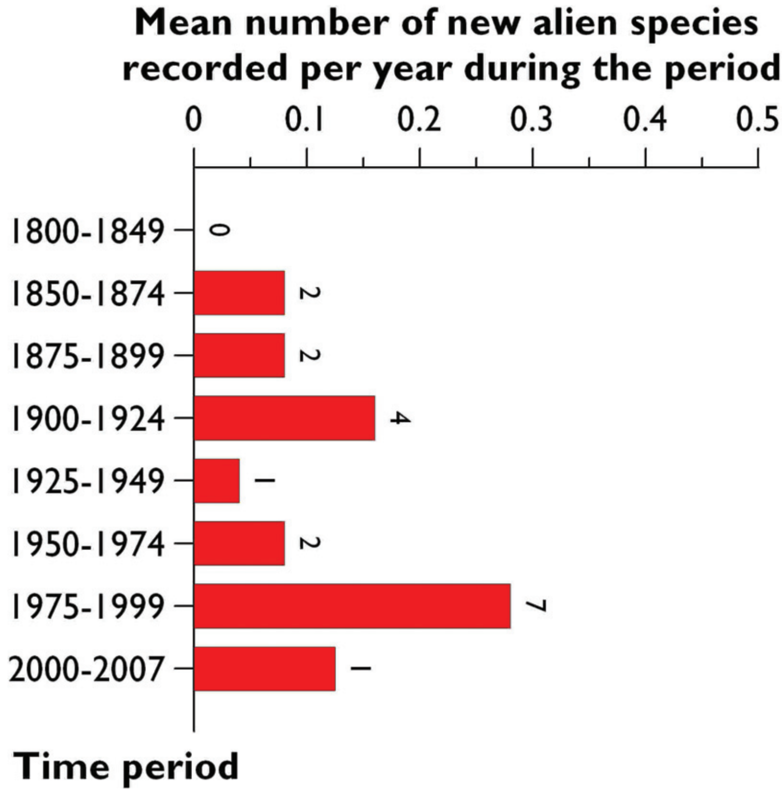

Figure 8.1.2. Temporal changes in the mean number of new records per year of Cerambycid species alien *to* Europe from 1492 to 2007. The number over each bar indicates the absolute number of species newly recorded per time period.

rufomaculata (DeGeer, 1775) found in Munster's Zoo (Germany) is similar (Cocquempot 2007) although this tropical species has established in Israel since at least 1948 (Bahillo de la Puebla and Iturrondobeitia-Bilbao 1995, Plavilstshtikov 1934, Sama et al. 2010). The combination of importation of longhorn beetle species with their specific host plant or groups of plants followed by establishment is rare. However the establishment of *A. chinensis* is an exception. Other species are frequent intercepted at border controls, e.g. *Mimectatina meridiana* (Matsushita, 1933) with *Cycas* fruits from Japan (Cocquempot 2007) or *Trichoferus campestris* (Faldermann 1835) with *Salix* timber from China (Cocquempot 2007).

The degree of polyphagy is also an important factor in the likelihood of establishment. Polyphagous species appear to have a higher potential to establish than oligophagous and monophagous species. The large number of hosts utilised by *Anoplophora* spp. (Cocquempot et al. 2003, Hérard and Roques 2009, Maspero et al. 2007a) is a main factor in the difficulty in eradicating this species for example. These difficulties appear much less important for oligophagous species such as *Callidiellum rufipenne* (Bahillo and Iturrondobeitia-Bilbao 1995, Campadelli and Sama 1988, Plavilstshtikov 1934) or Phoracanthine species. It is also the case for the North American wood borer *Saperda candida* (Fabricius, 1787), which was introduced in Germany in 2008 but apparently did not established yet (EPPO 2008, Nolte Krieger 2008). By contrast, *Monochamus* species have a regime close to polyphagy, including a large number of conifer species, and may spread throughout Europe. There is no example of establishment in Europe of a strictly monophagous exotic long-horned beetle. Species with a limited host range do not seem to be capable of going beyond the interception or introduction stage, e.g. *Bardistus cibarius* (Cocquempot 2007).

8.1.5 Biogeographic patterns of the cerambycid species alien *to* Europe

Alien species established in Europe mostly originated from Asia, followed by Africa (Figure 8.1.3). The region of origin appears to depend on the major trade routes developed by each country. Some North African species have colonized Mediterranean countries such as Spain, France, and Malta for example. Other African species have often been intercepted but only *Phryneta leprosa* has established in Malta where the climate is favourable for development (Mifsud and Dandria 2002). Long-established trade routes between Iberian countries and South American countries have resulted in some historic, isolated establishments in the Spanish and Portuguese Atlantic Islands but with a limited risk of further expansion (Lemos-Perreira 1978, Méquignon 1935). With the numerous interceptions in the U.K (Duffy 1953a) together with the colonial trade routes with African and Asiatic countries, it is surprising that only *Trinophylum cribratum* has established to date (Gilmour 1948); the incompatible climate may negate the development of tropical and subtropical species. Two species native to North America, *Parandra brunnea* and *Neoclytus acuminatus,* also colonized Europe at the beginning of the last century. The first species is well established but restricted to Dresden (Germany) (Nüssler 1961). The second is widely established in the Mediterranean area but its populations appear to be declining (Brustel et al. 2002). Beside these two species, there have been no further establishments originating from North America; the pathway of transported material is mainly in the reverse direction, from Europe to America.

Some Australian species have reached Europe but only those using *Eucalyptus* (*Phoracantha* spp.) have successfully established (Cocquempot and Sama 2004) and only in areas newly planted with these fast-growing tree species. The large differences in species composition between the floras of Australia and Europe probably accounts for the failure of Australasian longhorn beetles such as in *Bardistus cibarius* on *Xanthorrhoea* sp. (Cocquempot 2007) to establish.

Recent increases in commercial traffic from Asia (especially China) to Europe has accounted for the introduction of a number of new species of cerambycids. Striking examples are *Callidiellum rufipenne* which has recently established in Spain (Bahillo de la Puebla and Iturrondobeitia-Bilbao 1995) and Italy (Campadelli and Sama 1988), *Anoplophora glabripennis* and *A. chinensis* which can be considered as established or

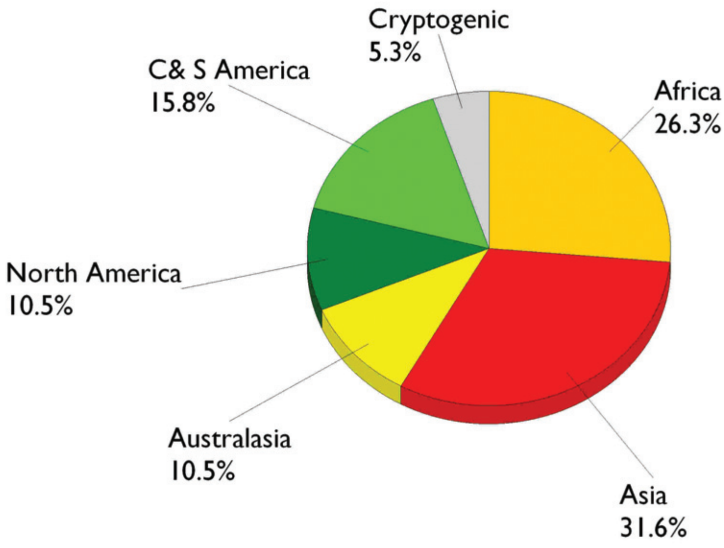

Figure 8.1.3. Origin of the Cerambycidae species alien *to* Europe

not eradicated in several countries (Hérard and Roques 2009, Maspero et al. 2007a), *Psacothea hilaris* (Pascoe, 1857) under eradication in Italy (Cocquempot 2007, Jucker et al. 2006), and *Monochamus alternatus* Hope, 1842 intercepted a number of times in Germany (Cocquempot 2007) and France (Cocquempot Unpubl.) but not yet established. A final case, *Xylotrechus stebbingi,* is less clear. It is believed that an initial introduction from its native area of central Asia to Asia Minor was followed by a step-wise expansion into southern Europe and North Africa (Cocquempot and Debreuil 2006, Sama 2002, Šefrová and Laštůvka 2005).

Alien cerambycid species are not evenly distributed throughout Europe. Large differences in the number of aliens are apparent between countries, France, Italy and Spain being by far the most invaded (Figure 8.1.4).

8.1.6 Main pathways of introduction to Europe of alien cerambycid species

All alien longhorn beetles established in Europe have been introduced accidentally; there are no examples of a successful, deliberate introduction. The principal pathways of arrival have been identified and presented by Frank 2002 and each relates to the import of immature stages that subsequently emerge as adults. There are relatively few records of living adults imported with vegetables or fruits although Eucalyptus beetles, *Phoracantha recurva,* were found in a cluster of bananas (Bosmans 2006).

The longest established pathway is timber importation for house construction (*Hylotrupes bajulus*) or building furniture (e.g. *Trichoferus* spp., *Stromatium* spp. and *Chlorophorus annularis* arriving with bamboo- made objects (Cocquempot 2007)). Species

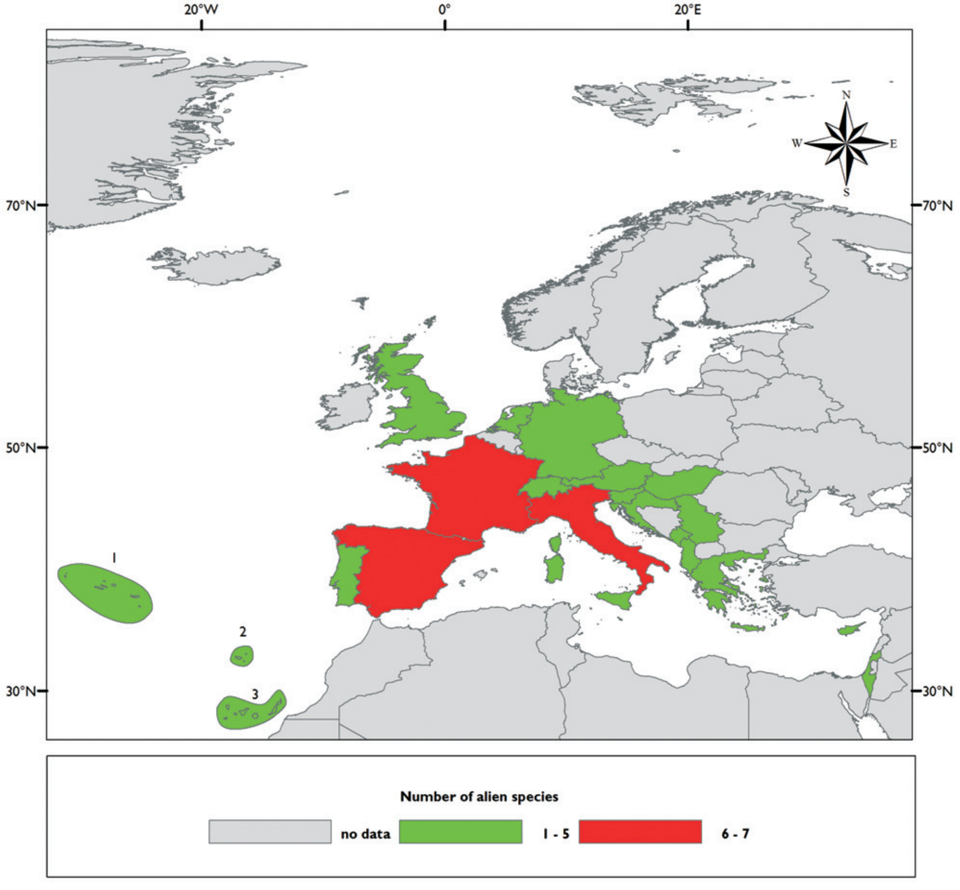

Figure 8.1.4. Comparative colonization of continental European countries and islands by Cerambycidae species alien *to* Europe. Archipelago: **1** Azores **2** Madeira **3** Canary islands.

introduced through this pathway have traditionally required a long life cycle but more rapid travel now enables the introduction of species with a one year life cycle. The second pathway is via the importation of timber for pulp (e.g., for *Phoracantha* spp.). A third, more recent, pathway concerns wood packages, palettes and other wood-derived products (e.g., for *Anoplophora glabripennis*) (Hérard and Roques 2009). The final pathway is the importation of plants for planting in nurseries, including the bonsai industry, which has resulted in the arrival of species such as *Anopolophra chinensis* (Cocquempot 2007, EPPO 2006, van Rossem et al. 1981, Schembri and Sama 1986), *Callidiellum rufipenne* and *Bardistus cibarius*.

All pathways are still prevalent but they vary in importance. Most recent interceptions (from the end of the 20th Century) have related to wood-manufactured products (e.g. *Chlorophorus annularis* and *Trichoferus campestris*). Importation of *Eucalyptus* wood for pulp has also resulted in the introduction of a second species of *Phoracantha, P. recurva* (Miquel 2008). If such importations continues a number of additional species of this genus, which are mainly related to *Eucalyptus* (Wang 1995), are expected to arrive.

Since their first usage, wood packaging and palettes have constituted an important introduction pathway. The source material spends sufficient time as logs without sanitary controls to be colonized by longhorn beetles. When the wood is turned into packages or palettes, infestation occurs mainly as unnoticed early stages (eggs or first-instar larva). Development continues in the woody material during importation and emergence of adults occurs often unnoticed in warehouses, weeks or months after arrival. This is the case for *A. glabripennis*, *P. hilaris* and *M. alternatus* which may already complete their entire lifecycle before the source wood is processed or destroyed. Wood package is often produced using low quality timber often colonized by longhorn beetle species, which is increasing its potential as a vector.

Other, less significant, introduction pathways have also been identified, yet they typically only transported one or a few individuals which fail to establish. The introduction route is unknown for other species such as *Acanthoderes jaspideus* (Méquignon 1935), *Oxymerus aculeatus* (Alluaud 1935), *Deroplia albida*, and *Phryneta leprosa* (Mifsud and Dandria 2002) but they may be related to the uncontrolled importation of wild plants. Natural range expansion cannot be ruled out for a few species which have a nearby native range, e.g. *Lucasianus levaillantii* (Mayet 1905, Pellegrin and Cocquempot 2001) and *Xylotrechus stebbingi* (Šefrová and Laštůvka 2005) originating from North Africa and the Middle East, respectively.

8.1.7 Ecosystems and habitats invaded in Europe by alien cerambycid species

Although all natural or artificial terrestrial ecosystems and anthropogenic areas which contain trees, bushes or wood products are potentially occupied by alien longhorn beetles, establishment in Europe is concentrated in man-made habitats to date, especially in parks and gardens (Figure 8.1.5). To date, only the two clytine beetles, *Neoclytus acuminatus* and *Xylotrechus stebbingi*, have colonized natural habitats. *X. stebbingi* is very common on *Eucalyptus* cut wood in Crete (Sama 2002) for example and may be related to the polyphagous nature of these two species. Other polyphagous species such as *Anoplophora* spp. also have the potential to live in urban areas, in cultivated lanes (e.g. planted with poplars) as well as in natural forests where potential host plants occur. However, dispersal from man-made habitats to natural forests appears to be a slow process. For the first twenty-two years since its arrival in North America, *A. glabripennis* has been restricted to trees in urban areas until 2008 when it was found in natural forests dominated by *Acer* trees (Haack et al. 2010). Although such a process has not yet been observed in Europe, there is a strong risk that *Anoplophora* spp. will spread to naturally-forested landscapes, if the ongoing eradication attempts in Austria, Germany, France and Italy are unsuccessful.

The expansion of oligophagous species is inevitably more dependant on the presence of suitable host plants. Those using largely- planted trees can spread more easily.

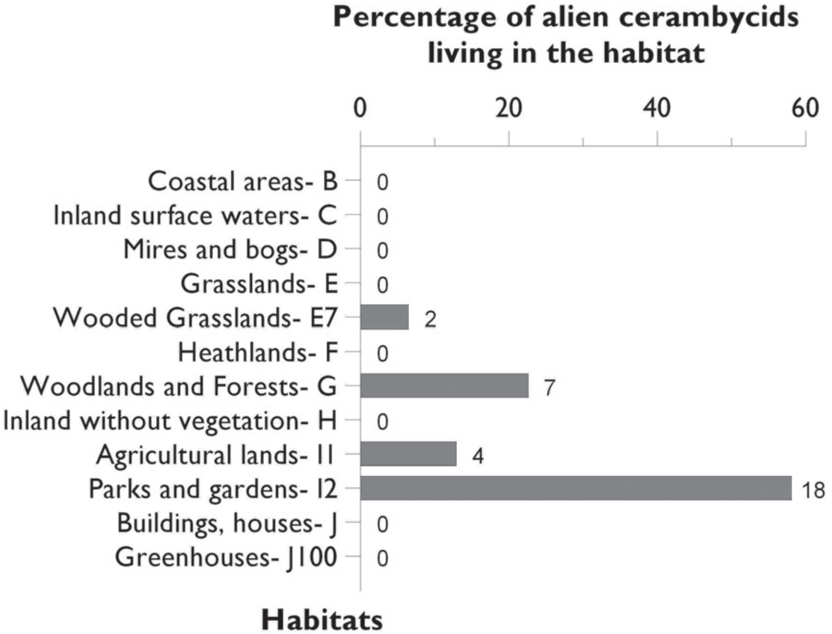

Figure 8.1.5. Main European habitats colonized by the established alien longhorn beetles. The number over each bar indicates the absolute number of alien longhorn beetles recorded per habitat. Note that a species may have colonized several habitats.

Thus, *Phoracantha* spp. that live only in eucalypt trees have colonized ornamental tree plantations in urban areas as well as old plantations such as those found on the Mediterranean islands and in neighbouring countries, and industrial plantations created for paper pulp. Other established species mostly have a distribution restricted to Mediterranean and Atlantic islands. In these areas, anthropogenic ecosystems are mainly colonized. A species of considerable concern with conifer forests is *Monochamus alternatus*, which could potentially become established in coniferous plantations and forests and subsequently transfer the pine wood nematode (Bursaphelenchus xylophilus Steiner & Buhrer, 1934).

8.1.8 Ecological and economic impact of alien cerambycid species

Although there is concern about the potential ecological impact of the invasive longhorn beetles *N. acuminatus* and *X. stebbingi*, there is no measure of their impact on trees or any estimation of possible competitive displacement of the native fauna. The ecological impact of *Anoplophora* species may also be important if they establish in European forests. *Anoplophora* could compete with other arthropods occupying the same niche, but they also create niches for other arthropods that live in tunnels in decaying wood or compete with other saproxylic beetles. The joint introduction and establishment of the Citrus longhorn beetle, *A. chinensis*, and its parasitoid, *Aprostocetus anoplophorae* Delvare, 2004, exemplifies the potential risk of adaptation of imported parasitoids which themselves might not specialise on the native fauna (Delvare et al. 2004).

Although the ecological niche occupied by an alien species may be vacant there remains a risk of secondary infection resulting from their damage. For example, secondary infestation by the pine wood nematode vectored by *Monochamus* spp. (Evans et al. 2008, Kawai Miho et al. 2006) may cause serious impacts to coniferous trees in all landscapes. *M. alternatus* has only been intercepted in Germany and France (Cocquempot 2007, Cocquempot (Unpubl.)); yet the pine wood nematode which it vectors was recorded from Portugal in 1999 (Mota et al. 1999). After having been contained for several years in a limited area, the nematode has spread throughout Portugal, as well as being eradicated following incursions into Spain in 2008 and Madeira in 2009. A novel association with the native species, *M. galloprovincialis* (Villiers 1967) has also been reported. The expansion as well as new introductions of the pine wood nematode could potentially have a substantial level of economic impact in all areas of coniferous cultivation in Europe.

Other economic impacts are mainly associated with ornamental trees in urban areas, cultivated trees such as poplars and eucalypts and nurseries, including these for bonsai production. Studies of *Anoplophora glabripennis* in North America and *A. chinensis* in China indicate the possible scale of economic damage following establishment of these species in a new country or in a plantation, especially of poplar or Citrus trees (Cocquempot et al. 2003, Haack et al. 2010, MacLeod et al. 2002). As a control measure, ornamental trees colonized by invasive longhorns must be eliminated without consideration of their aesthetic value. Eradication measures entail high costs to be borne by local communities or private owners. Special attention is paid to *A. chinensis* necessitating complete removal of trees, including the rootstock (Haack et al. 2010).

Poplars or eucalypt plantations can be highly affected as has already been the case in China (*A. glabripennis* on poplars) and in Spain (*Phoracantha* spp.), where infested trees become unsuitable for pulp and wood exploitation. The Citrus longhorn beetle is also considered as an important risk for all Citrus fruit production in the Mediterranean area and its islands.

The nursery industry is already concerned. There are several examples of introductions or establishments of potentially invasive species such as *Callidiellum rufipenne* and *Anoplophora chinensis*, with the imports of nursery plants. Nurseries can themselves be vectors of aliens when they dispatch their products.

The eradication process established for quarantine species aims to limit introductions although only a few eradications have been officially reported in Europe, e.g. as for *Anoplophora chinensis* in France (Hérard et al. 2006, Hérard and Roques 2009). Phytosanitary interceptions at borders are likely to have prevented a number of introductions and further establishments (e.g., *Monochamus alternatus*, *Trichoferus campestris* in France, *Anoplophora glabripennis* and *A. chinenis* in several countries) (Cocquem-

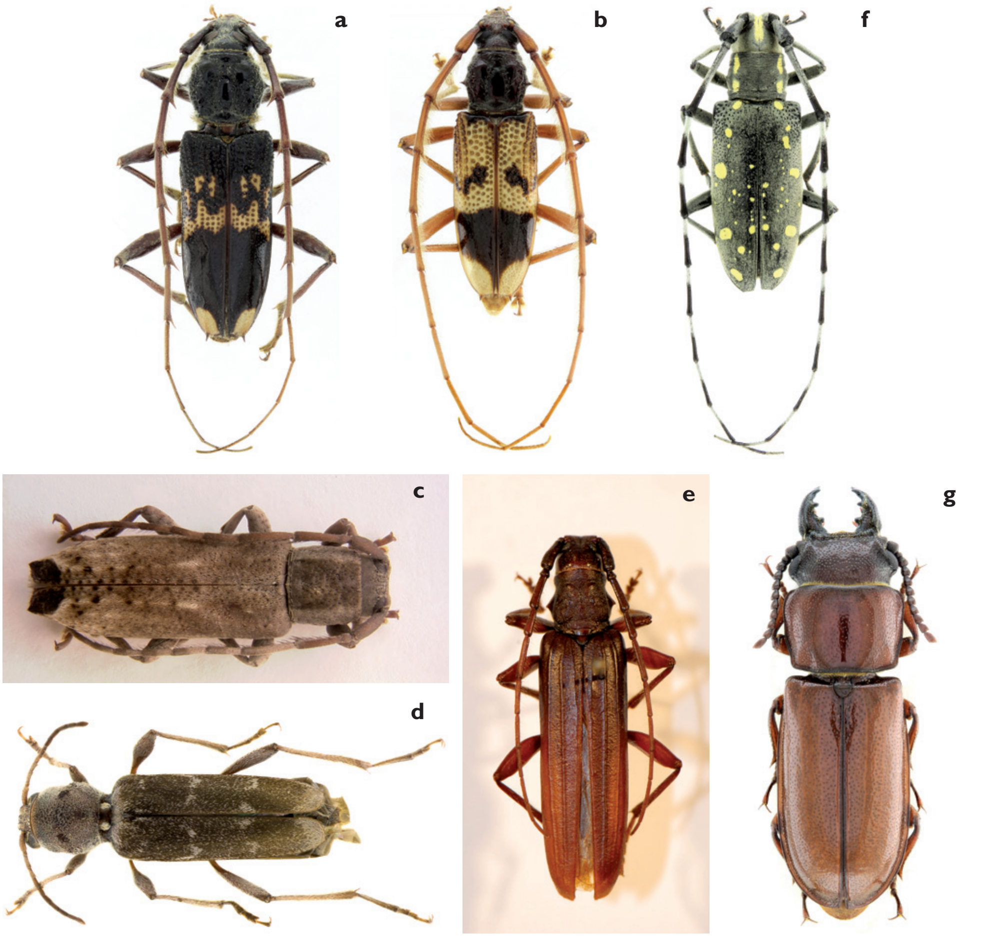

Figure 8.1.6. Adults of some alien longhorn beetle species. **a** *Phoracantha semipunctata* **b** *Phoracantha recurva* **c** *Mimectatina meridiana* (Credit: Christian Cocquempot) **d** *Xylotrechus stebbingi* (Credit: Vítěslav Maňák) **e** *Bardistes cibarius* (Credit: Christian Cocquempot) **f** *Psacothea hilaris* **g** *Parandra brunnea* (a, b, e, f, g: Credit: Henri-Pierre Aberlenc).

pot 2007) whilst at the same time, several non-quarantine species not submitted to importation controls have become established (e.g., *Xylotrechus stebbingi*, *Phoracantha semipunctata*, *Neoclytus acuminatus*). This illustrates the importance of quarantine species lists, which should be preventive and not only curative to be most effective.

Human-mediated dispersal should also be tightly controlled during the eradication process. Without due respect for control obligations, eradication can fail. For example, the long delay by Italian authorities in applying control measures and strong management measures against *Anoplophora chinensis* (EPPO 2009, Jucker et al. 2007) or inadvertent movement of untreated wood material for *A. glabripennis* in New-York (Haack et al. 1997) are examples of ineffective eradication efficacy.

8.1.9 Expected trends

The combination of increasing volumes of trade, the increased speed of import of potential vectors, the diversity of sources and sites for introduction is likely to result in increasing invasion risk (Cocquempot 2007). All recently established species alien *to* Europe have been intercepted too late after their introduction and have been outside official institutional controls. These factors make it increasingly difficult for rapid eradication after initial arrival. Effective monitoring of each point of possible entry is unfeasible when the key pathways identified here have different vectors and locations of arrival (e.g. airports, harbours, stations, lorry parks), and there are major difference in the quality of phytosanitary controls between European countries, particularly following the enlargement of the EU. The risk depends on volume and diversity of vector material imported, and subsequently there is greatest risk in countries such as the UK, France, Spain, Italy, Netherlands, Belgium and Germany. The case of *Anopolophora glabripennis* in North America and Europe clearly demonstrates the possibility of spread in our continent; such detailed assessment is required for all potentially invasive longhorn beetles (MacLeod et al. 2002).

According to Worner (2002), progress in the knowledge of invasion processes and associated preventive measures have not been followed by actions since the late 1980's. Preventive methods are still routinely applied, e.g. the application of ISPM 15 (International Standard for Phytosanitary Measures No.15), which set standards for heat treatment and fumigation of wood product materials used in international trade is likely to limit the arrival of longhorn beetles related to these materials although a few have been found to survive (Haack et al. 2010). However, this method is not uniformly applied to all imported living trees, shrubs plants for planting or bonsais. Thus, a high number of imported bonsais or other nursery trees infested with *Anoplophora chinensis* are still discovered (Hérard and Roques 2009). Although importation controls could be improved, they will never offer full protection. Further, controls which reduce the risk of introduction are mainly restricted to quarantine species. Post-interception or controls at importation points should be extended to all the potential pests posing risk and not be restricted to quarantine species already intercepted, introduced or established.

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Table 8.1.1. List and characteristics of the Cerambycidae species alien to Europe. Status: A: Alien to Europe; C: cryptogenic species. Country codes abbreviations refer to ISO 3166 (see appendix I). Habitat abbreviations refer to EUNIS (see appendix II).

Family *Species*	**Status**	**Regime**	**Native range**	**1st record in Europe**	**Invaded countries**	**Habitat**	**Hosts**	**References**
Acanthoderes jaspidea Germar, 1824	A	phyto-phagous	Brazil	1880, PT-AZO	PT-AZO	I2	*Acacia, Albizzia*	Borges et al. 2005, Méquignon 1935, Serrano 1982
Acrocinus longimanus (Linnaeus, 1758)	A	phyto-phagous	Brazil	1977, PT	PT, PT-MAD	I2	Moraceae, Apocynaceae	Lemos-Perreira 1978 , Vives 1995
Anoplophora chinensis (Förster, 1848) (=*A. malasiaca* Thompson, 1865)	A	phyto-phagous	China South-Central	2000, IT	IT, NL	FB, FA, I2, G	*Acer, Betula, Carpinus Citrus, Corylus, Rosa* and deciduous shrubs (polyphagous)	Cocquempot 2007, Colombo and Limonta 2001, 2009a, EPPO 2009b, Evans et al. 2008, Hérard et al. 2006
Anoplophora glabripennis (Motschulsky, 1853)	A	phyto-phagous	China South-Central	2001, AT	AT, DE, FR, IT	FB, FA, I	*Acer, Aesculus, Betula, Carpinus, Fagus, Populus, Salix*	Carter et al. 2009, Cocquempot 2007, Cocquempot et al. 2003, Dauber and Mitter 2001, EPPO 2004, Hérard et al. 2006, 2009
Callidiellum rufipenne (Motschulsky, 1860)	A	phyto-phagous	Eastern Asia, Japan	1906, FR	ES, FR, IT	FA, FB, G1, G5, J4	Cupressaceae (*Cupressus macrocarpa*)	Bahillo and Iturrondobeitia 1995, Campadelli and Sama 1988, Cocquempot 2007
Chlorophorus annularis (Fabricius, 1787)	A	phyto-phagous	Asia-Temperate	1991, ES	ES	G	Bamboo	Vives 1995
Cyrthognathus forficatus (Fabricius, 1792)	A	phyto-phagous	Africa	1872, MT	MT	U	Unknown	Bertolini 1872
Derolus mauritanicus Buquet, 1840	A	phyto-phagous	Northern Africa	1884, FR	ES ?, FR ?	E7, F5, F8, FB, I2, X11	*Nerium oleander*	Brustel et al. 2002, Fauvel 1884, Mendizábal 1944, Verdugo 2004

Family *Species*	**Status**	**Regime**	**Native range**	**1st record in Europe**	**Invaded countries**	**Habitat**	**Hosts**	**References**
Deroplia albida (Brullé, 1838)	A	phyto-phagous	Canary Islands	1988, ES	ES	E7, F6, FB, G5	*Pelargonium*	Vives 1995
Lucasianus levaillantii (Lucas, 1846)	A	phyto-phagous	Northern Africa	1905, FR	ES, FR, PT	FA, G, FB	*Cupressus*	Brustel et al. 2002, Cocquempot et al. 2007, Mayet 1905, Pellegrin and Cocquempot 2001, Plaza Lama 1990, Vives 1995
Neoclytus acuminatus (Fabricius, 1775)	A	phyto-phagous	South-Central U.S.A.	1908, IT	CH, CZ, DE, FR, HR, HU, IT, ME, PT-MAD, RS, SI	FB, G, G1, G5, I2, X11	*Ulmus, Fraxinus, Juglans*	Bijaoui 1980, Brustel et al. 2002, Cocquempot 2007, Heyrovský 1951, Ilić 2005, Picard 1937, Pil and Stojanović 2005, Reineck 1919, Sama 1984, Tassi 1969, Villiers 1979, Winkler 1932, Wittenberg 2005
Oxymerus aculeatus lebasi Dupont, 1838	C	phyto-phagous	Unknown	Unknown	ES-CAN	U	*Calophyllum*	Alluaud 1935
Parandra brunnea (Fabricius, 1789)	A	phyto-phagous	North America	1916, DE	DE	G, J1	*Tilia, Populus,* deciduous trees	Grämer 1961, Nüssler 1961
Phoracantha recurva Newman, 1840	A	phyto-phagous	Australia	1992, IT	ES, GR, IL, IT, IT-SAR, IT-SIC, MT, PT	G1	*Eucalyptus*	Bercedo and Bahillo 1998, Bercedo and Bahillo 1999, Černý 2002, Cocquempot 2007, Cocquempot and Sama 2004, Friedman et al. 2008, Mazzeo and Siscaro 2007, Mifsud 2002, Miquel 2008, Orousset 2000, Palmeri and Campolo 2006, Pérez Moreno 2001, Ruiz and Barranco 1998, Sama and Bocchini 2003, Sama et al. 2010, Wang 1995

Family *Species*	Status	Regime	Native range	1st record in Europe	Invaded countries	Habitat	Hosts	References
Phoracantha semipunctata (Fabricius, 1775)	A	phyto-phagous	Australia	1948, IL	CY, FR, FR-COR, ES, ES-CAN, GR, IL, IT, IT-SAR, IT-SIC, MT, PT, PT-MAD	FB, G, G1, G5, I2, X11	*Eucalyptus*	Berger 1992, Brustel et al. 2002, Cadahia 1980, Cavalcaselle 1983, Černý 2002, Cocquempot 1993, Cocquempot 2007, Cocquempot and Sama 2004, Mifsud and Booth 1997, Orousset 1984, Orousset 1991, Sama et al. 2010, Teunissen 2002, Vives 1995, Wang 1995
Phryneta leprosa (Fabricius, 1775)	A	phyto-phagous	South Tropical Africa	1997, FR	FR, MT	G	*Morus nigra*	Mifsud and Dandria 2002, Vincent 2007
Taeniotes cayennensis Thomson, 1859	A	phyto-phagous	Central America	1858, PT	PT-AZO	U	Tropical trees	Sama 2006a
Trinophylum cribratum (Bates, 1878)	A	phyto-phagous	India	Unknown	GB	I2	Deciduous trees, *Larix*, *Pinus* (polyphagous)	Duffy 1953b, Gilmour 1948
Xylotrechus stebbingi Gahan, 1906	A	phyto-phagous	Central Asia	1990, IT	CH, CY, DE, FR, GR, GR-CRE, GR-NEG, GR-SEG, IL, IT, IT-SAR	FB, G, G1, G5, I2, X11	*Alnus*, *Ficus*, *Morus*, *Populus*	Cocquempot 2007, Cocquempot and Debreuil 2006, Dioli and Vigano 1990, Köhler 2000, Sama 2006b, Sama et al. 2010, Šefrová and Laštůvka 2005, Tomiczek and Hoyer-Tomiczek 2008, Wittenberg 2005

Table 8.1.2. List and characteristics of the Cerambycidae species alien *in* Europe. Country codes abbreviations refer to ISO 3166 (see appendix I). Habitat abbreviations refer to EUNIS (see appendix II).

Family species	**Regime**	**Native range**	**Invaded countries**	**Habitat**	**Hosts**	**References**
Arhopalus rusticus (Linnaeus, 1758)	phytophagous	Continental Europe	PT-AZO, PT-MAD	G3	*Pinus, Picea, Abies, Larix*	Fauvel 1897, Picard 1937, Serrano 1982
Aromia moschata (Linné, 1758)	phytophagous	Continental Europe	PT-AZO	I2	*Salix, Populus, Alnus*	Borges et al. 2005
Cerambyx carinatus Küster, 1846	phytophagous	Balkans	MT	G	*Prunus*	Sama and Cocquempot 1986
Cerambyx nodulosus Germar, 1817	phytophagous	Balkans	MT	G	*Pyrus, Malus*	Fauvel 1897, Schembri and Sama 1986
Clytus arietis (Linné, 1758)	phytophagous	Continental Europe	PT-MAD	E5, G, G1, G5	Deciduous trees (polyphagous)	Picard 1937, Wollaston 1854
Gracilia minuta (Fabricius, 1781)	phytophagous	Southern Europe	AT, CH, , ES-CAN, IE, LV, LT, PT-AZO, PT-MAD	F3, G, G5	Deciduous trees (polyphagous	Borges et al. 2005, Bytinski-Salz 1956, Lucht 1987, Speight 1988, Wollaston 1863
Icosium tomentosum atticum Ganglbauer, 1881	phytophagous	Southeastern Europe	FR	G3	Cupressaceae	Cocquempot et al. 2007, Pellegrin 1990
Monochamus galloprovincialis (Olivier, 1795)	phytophagous	Southwestern Europe	NL	G3	*Pinus*	De Fluiter 1950
Monochamus sartor (Fabricius, 1787)	phytophagous	Northern Europe, Alps	BE, , NL	G3	*Picea*	Fauvel 1884, Wiel 1956, Lucht 1987
Monochamus sutor (Linnaeus, 1758)	phytophagous	Central and Northern Europe	BE, PT	G3	*Picea, Pinus*	Speight 1988, Weyers 1876
Morimus asper funereus Mulsant, 1863	phytophagous	Southeastern Europe	CZ, MT	G	Deciduous trees (polyphagous	Schembri and Sama 1986, Šefrová and Laštůvka 2005

Family species	**Regime**	**Native range**	**Invaded countries**	**Habitat**	**Hosts**	**References**
Nathrius brevipennis (Mulsant, 1839)	phytophagous	Southwestern Europe	AT, BE, CH, CZ, DE, GB, IE, LU, LV, PL, PT-AZO	F3	Deciduous and conifer trees (polyphagous)	Adlbauer 2006, Borges et al. 2005, Duffy 1953a, Heyrovský 1930, Korcynski 1985, Lucht 1987, Sliwinski 1958, Speight 1988, Weidner 1973, Weyers 1875
Phymatodes testaceus (Linné, 1758)	phytophagous	Continental Europe	PT-AZO	G	Deciduous and fruit trees, preferably on *Quercus*	Fauvel 1897, Picard 1937, Wollaston 1854
Poecilium lividum (Rossi, 1794)	phytophagous	Southeastern Europe	BE, CH, CZ, DE, LU, NL	G,J1	*Quercus, Castanea*	Lucht 1987, Heyrovský and Sláma 1992, Horion 1974, Šefrová and Laštůvka 2005, Wittenberg 2005
Rhagium inquisitor (Linné, 1758)	phytophagous	Continental Europe	IE	G3	Conifers *(Pinus, Picea, Abies, Larix);* deciduous trees (*Betula, Fagus, Quercus*)	Speight 1988
Rosalia alpina (Linné, 1758)	phytophagous	Central Europe, Alps	MT	G, I2, J1	*Fagus*, and other deciduous trees	Horion 1974, Schembri and Sama 1986
Stictoleptura rubra (Linné, 1758)	phytophagous	Central Europe	PT-AZO	G3	Conifers (*Pinus, Picea, Abies, Larix*)	Borges et al. 2005
Stromatium unicolor (Olivier, 1795)	phytophagous	Southeastern Europe	PT-MAD	G	Deciduous trees (mostly) and conifers (polyphagous)	Fauvel 1897, Picard 1937
Trichoferus fasciculatus (Faldermann, 1837)	phytophagous	Southeastern Europe	CH, PT-MAD	G	Deciduous trees (polyphagous)	Allenspach 1973, Picard 1937
Trichoferus griseus (Fabricius, 1792)	phytophagous	Southeastern Europe	CZ	G	*Ficus, Pistacia, Rosa*	Šefrová and Laštůvka 2005
Xylotrechus arvicola (Olivier, 1795)	phytophagous	Southeastern Europe	SP-CAN	G	Deciduous trees (polyphagous)	Demelt 1974