First records of *Xylosandrus compactus* (Coleoptera: Curculionidae, Scolytinae) in the Iberian Peninsula: an expanding alien species?

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Abstract

Xylosandrus compactus (Eichhoff) (Col.: Curculionidae, Scolytinae) is an ambrosia beetle species native to subtropical Eastern Asia, with great concern due to its high invasive ability. This species has invaded 54 countries worldwide, including 4 European countries (Italy, France, Greece, and Spain); it was detected in Mallorca (Balearic Islands, Spain) in October 2019. In the present work, *X. compactus* is recorded for the first time in the Iberian Peninsula (Girona province, NE Spain); specimens were collected in Banyoles (August 2020, attacking twigs of *Laurus nobilis* and *Liquidambar styraciflua*) and Platja d'Aro (October 2020, attacking twigs of *L. nobilis*). Up-to-date information is presented about its geographical distribution, host plants, biology, symptoms, associate damages, and the possible origin of this species in Europe.

Key words: ambrosia beetles, Xyleborini, invasive species, alien species, *Laurus nobilis*, *Liquidambar styraciflua*, Girona, Iberian Peninsula

Introduction

Xylosandrus compactus (Eichhoff) (Col.: Curculionidae, Scolytinae) was detected for the first time in Europe in winter 2010, in Portici and Napoli provinces (Campania, Italy), attacking twigs of *Quercus ilex* in a garden. In winter 2012, its presence was reported from Lucca province (Toscana), on *Laurus nobilis*, also in a garden. Just a couple of years later, the insect was recorded attacking 26 host plant genera (Bosso et al. 2012, Francardi et al. 2012, Garonna et al. 2012, Pennacchio et al. 2012). In summer 2016, a heavy attack on 13 ha of Mediterranean maquis in Circeo National Park (Lazio, Italy) aroused considerable concern because the infestation affected characteristic vegetation, such as *Ceratonia siliqua*, *L. nobilis*, *Pistacia lentiscus*, *Q. ilex*, *Ruscus aculeatus* and *Viburnum tinus* (Vannini et al. 2017). In August 2016, damages due to attacks of *X. compactus* in big branches and trunks of *C. siliqua* were described as unusual in Sicily (Gugliuzzo et al. 2019a, 2019b, 2020). Currently, this invasive species is present in the Italian regions of Campania (since 2011), Toscana, Liguria (since 2012), Lazio (since 2013), Lombardia (since 2015), Sicilia (since 2016), and Emilia-Romagna (since 2018) (SAMFIX 2021, EPPO 2020).

In France, *X. compactus* was detected in summer 2015, in the departments of Alpes-Maritimes and Var, attacking various ornamental plants, as *Arbutus unedo*, *L. nobilis*, *Phillyrea* sp. and *Q. ilex* (Chapin et al. 2016, EPPO 2017, Barnouin et al. 2020). Greece reported occurrences of *X. compactus* in July 2019 in the region of Argolida (Peloponnese Peninsula), affecting mainly twigs of *C. siliqua*, but also in twigs of *L. nobilis*, *Olea europaea*, *Cercis siliquastrum*, and *Rhamnus* sp. (Spanou et al. 2019). Spain was the last European country to report attacks of this alien species when it was detected in October 2019 attacking twigs, branches, and trunk of one *C. siliqua* in a private garden located in Mallorca (Balearic Islands) (Leza et al. 2020).

So far, the affected hosts in Italy and France are included in 54 genera of forest, agricultural and ornamental plants: *Acacia*, *Acer*, *Alnus*, *Arbutus*, *Azalea*, *Caesalpina*, *Camellia*, *Cassia*, *Castanea*, *Casuarina*, *Celtis*, *Ceratonia*, *Cercis*, *Cinnamomum*, *Citrus*, *Cornus*, *Corylus*, *Croton*, *Diospyros, Eucalyptus, Eugenia*, *Euonymus*, *Fagus*, *Ficus*, *Fraxinus*, *Gardenia*, *Hibiscus*, *Hydrangea*, *Jasminum*, *Laurus*, *Liquidambar*, *Liriodendron*, *Magnolia*, *Malus*, *Melia*, *Olea*, *Ostrya*, *Phyllyrea*, *Pistacia*, *Pittosporum*, *Platanus*, *Prunus*, *Punica*, *Quercus*, *Rhamnus*, *Rhododendron*, *Ruscus, Salix, Sambucus*, *Tilia*, *Ulmus*, *Viburnum*, *Vitex* and *Vitis* (ANSES 2017, CABI 2020, EPPO 2020, SAMFIX 2021). However, the attacks in Italy, France, and Greece have shown a great preference for twigs of *L. nobilis* and *C. siliqua* (Spanou et al. 2019, Gugliuzzo et al. 2020).

Until 2019, two species belonging to *Xylosandrus* were found in Spain: *X. germanus* (Blandford, 1894) and *X. crassiusculus* (Motschulsky, 1866). *Xylosandrus germanus* was collected in Muxica (Bizkaia, Basque Country, Northern Spain) using traps baited with conifer bark beetles attractants in July 2003 (López et al. 2007). In 2011 and 2012, some specimens of this species were collected in other localities of Eastern Basque Country (Goldarazena et al. 2014), also captured in baited traps. The host plant of *X. germanus* remain unknown in Spain, although Pfeffer (1994) cited attacks on *Fagus sylvatica, Picea abies, Pinus densiflora, and P. pentaphylla* from Western Europa, while Schott (1994) reported infestations on *Alnus* spp., *Betula* spp., *Carpinus betulus*, *Castanea sativa*, *Fraxinus* spp., *Picea* spp., *Pinus sylvestris*, *Populus* spp., *Pseudotsuga menziesii*, *Quercus* spp., *Salix* spp. and *Ulmus glabra* from Alsace region (France). At present, no new locations for *X. germanus* have been reported in Spain; so the actual widespread of this species remains not yet clear. In the future, this situation could be worse if *X. germanus*, currently recorded in the Basque Country, attacks vegetation from the Mediterranean maquis; in summer 2018, it was captured in the Circeo National Park (Lazio, Italy), sharing habitat with *X. crassiusculus* and *X. compactus*, when years ago its attacks were focused in deciduous (*Juglans* spp., *Fagus sylvatica*, *Castanea sativa*, and *Quercus petraea*) and conifer forests from Northern regions (Contarini et al. 2020).

On the other hand, the occurrence of *X. crassiusculus* in Spain is more recent. This invasive species was reported from Benifaió (Valencia, Eastern Spain) in October 2016, attacking *C. siliqua* in a residential area (Gallego et al. 2017). Currently, and thanks to the tasks developed in the LiFE SAMFIX project, the species was reported from other four municipalities near the city of Valencia: Alfarp, Monserrat, Picassent, and Náquera, attacking exclusively *C. siliqua*. This restriction in host tree diversity in Spain contrasts with the high number of host species reported for this ambrosia beetle: a total of 124 plant species, distributed in 46 families, whose at least 12 species occur in the invaded area, highlighting forest genera (*Alnus*, *Populus*, *Quercus*, *Salix*), crops (*Diospyros*, *Ficus*, *Malus*, *Olea*, *Prunus*) and ornamental genera (*Acacia*, *Hibiscus*, *Magnolia*). In France, attacks of *X. crassiusculus* have been reported in *C. siliqua*, *Cercis siliquastrum*, *Lagerstroemia indica*, and *Olea europaea*, although this insect shows high preferences for *C. siliqua* in the Mediterranean region (Barnouin et al. 2020).

X. compactus was reported for the first time in Spain in October 2019, after the detection of one carob tree showing wilt, foliar necrosis and twig death, and a multitude of small holes with exudates, located in a private garden of a residential area in Calvià (Mallorca, Balearic Islands) (Leza et al. 2020). In summer 2020, this species was collected from an attacked *C. siliqua* in another private garden in Andratx, at 10 km from the first occurrence. Finally, in summer–fall 2020, this species was recorded in Girona province (NE Spain), with data from several localities and damages as reported in this work. Also were reported to the competent authority of the Government, for notification through the European Union Notification System for Plant Health Interceptions, EUROPHYT.

Methods

In July 2020, the gardener of a private property located in Banyoles (Girona, NE Spain; 42°06' N, 2°45' E) reported sudden and generalized damages in a hedge composed by *L. nobilis* 5–7 m height, planted in 2008. Damages started with foliar discoloration and twig wilts, evolving to twig dried, died, and broken. A small hole was observed in the affected twigs, but no insects were found inside the gallery. As a caution measure, all declined twigs were pruned and burned, and then a foliar spray treatment with deltamethrin was applied.

New affections on twigs were observed some weeks later. Samples of affected laurel twigs were collected in 3 August 2020 (Figure 1A) for visual inspection under stereomicroscope; the remaining twigs were placed inside a special rearing cage. All collected insects were preserved in ethanol 70% until they were studied. A few days later, in the same garden, some affected twigs from a *Liquidambar styraciflua* were also collected and preserved in the same way. One black 7-funnel trap baited with alpha-pinene and ethanol lures (Econex, Spain) was set up in a corner of the garden, from August 27 to October 19; captures were collected on September 7 and October 19, and all Scolytinae were preserved in ethanol 70% for identification.

On 1 Oct. 2020, similar symptoms were detected in one specimen of *L. nobilis* (2 m height) in a forest property in Platja d'Aro (Girona, Spain; 41°48' N, 3°03' E). Samples of affected twigs were collected and insects found were preserved in ethanol 70%; the remaining affected twigs were pruned and burned. On 15 Dec. 2020, some specimens of ornamental *L. nobilis* (3 m height, in pots) from Vidreres (Girona, Spain; 41°48' N, 2°46' E) showed very similar symptoms and damages. Some affected twigs were collected, but no insects were found inside the galleries. During November/December 2020, several private and public gardens, with specimens or hedges of *L. nobilis*, were visited in Blanes (Girona, Spain; 41º40' N, 2º48' E) and Lloret de Mar (Girona, Spain; 41°41N, 2°50' E). No symptoms of *X. compactus* attacks were observed in these gardens.

Results

Taxonomic keys from Wood (1982), Dole & Cognato (2010) and Hulcr & Smith (2010) for genera, and from Faccoli (2008), Nageleisen et al. (2015) and Gallego et al. (2017) for species were used to identify the Scolytinae captures; comparison with specimens from our personal collections was also used. Number and source of collected specimens are summarized in Table 1. We confirm that the insects collected in Banyoles, from affected twigs (directly or by rearing cage emergence) and captured by the baited funnel trap, are *X. compactus*. A total of 80 adults were collected from the rearing cage, with 69 females (1.6–1.9 mm) and 11 males (< 1 mm). From the affected twigs of *L. styraciflua*, two adult females of *X. compactus* were collected. From Platja d'Aro, we collected 3 adult females by direct collection in affected twigs. The laurels from Vidreres showed signs of attack by *X. compactus* but the galleries were empty.

TABLE 1: Specimen number of *X. compactus* collected by locality and source.

Locality	Coordinates	Host plant	Date	Source	Specimens/gender
Banyoles	42°06' N, 2°45' E	*Laurus nobilis*	2020/Aug/03	Collection from twigs	5 ♀
			2020/Oct/01	Rearing cage	69 ♀ 11 ♂
		Liquidambar	2020/Aug/03	Collection	2 ♀

		styraciflua		from twigs	
			2020/Sep/17	Baited trap	6 ♀
			2020/Oct/19		7 ♀
Platja d'Aro	41°48' N, 3°03' E	*Laurus nobilis*	2020/Oct/01	Collection from twigs	3 ♀
Vidreres	41°48' N, 2°46' E	*Laurus nobilis*	2020/Dec/15	Collection from twigs	No specimens found in galleries

The mean size of attacked twigs of *L. nobilis* from Banyoles was 6.2 mm (Figure 1, Table 2), ranging from 3 mm up to 20 mm. The attacks in *L. styraciflua* occurred in twigs with a mean diameter of 4.4 mm, ranged from 3 mm up to 6 mm. In Platja d'Aro and Vidreres, both in *L. nobilis*, the size was similar, with 4.7 and 4.2 mm respectively. In the most frequent affected twigs (4 mm diameter, 15–30 cm length) a single attack hole was only observed, whereas in the biggest affected twigs (15–20 mm diameter, 50–90 cm length) a maximum of 9 holes was counted, spaced from 3 up to 20 cm between them. The length of galleries ranged from 13 to 30 mm, although not all attacks were completed; 35% of inspected holes showed no brood chamber or gallery inside. A dark coloration envelops the internal tissues around the brood gallery (Figure 1 B, C and E), showing the saprophytic activity of the ambrosial fungi inoculated by *X. compactus*.

Table 2: Size of attacked twigs. Std: standard deviation, Ø: diameter.

Locality	**Number and host plant**	**Twigs**	**Diameter (mean ± std, mm)**	**Max Ø (mm)**	**Min Ø (mm)**
Banyoles	15 *Laurus nobilis*	51	6.39 ± 3.68	20	3
	1 *Liquidambar*	5	4.40 ± 1.14	6	3
Platja d'Aro	1 *Laurus nobilis*	7	4.71 ± 1.38	7	3
Vidreres	2 *Laurus nobilis*	5	4.20 ± 0.84	5	3

Four species of Scolytinae were collected in the baited trap set up in Banyoles during the sampled period (Table 3). In the first revision (17 September. 2020), after 21 days, 6 *X. compactus*, 15 *Xyleborinus saxesenii* (Ratzeburg), and 5 Cryphalini (possibly *Hypothenemus eruditus* Westwood, pending confirmation) were collected. In the second revision (19 October 2020), 7 *X. compactus*, 7 *X. saxesenii*, 1 *Xyleborus monographus* (Fabricius), and 2 possible *H. eruditus* were collected.

Table 3**:** Scolytinae collected in the baited trap set up in Banyoles (from 27 August 27 to 19 October 2020).

Species	**17 Sep.**	**19 Oct.**	**Total**
Xylosandrus compactus	6	7	13
Xyleborinus saxesenii	15	7	23
Xyleborus monographus	0	1	1
Cryphalini (possibly *Hypothenemus eruditus*)	5	2	7

Review of Biology and Ecology

X. compactus is a typical ambrosia beetle, whose larvae eat the symbiotic ambrosia fungi that grow covering the gallery walls. These fungi spores have been transported into the thoracic micangium, located between pronote and mesonote, by the founder females. This species breeds by haplodiploidy, with arrhenotokous parthenogenesis: males are born from unfertilized (haploid) eggs and females from fertilized (diploid) eggs. The sex ratio is not balanced, with 1 male per 9–10 females approximately (Hara & Beardsley 1979, Greco & Wright 2015). Males have non-functional wings and usually live their whole life inside the gallery where born. Females are inseminated by a brother male inside their brood gallery. Only the adult females are able to leave the natal host plant and find new hosts, and emergence usual occurs in the afternoon hours (Hara & Beardsley 1979). Frequently, they attack twigs and small branches (up to 20 mm diameter), but attacks on bigger branches or main trunks of *C. siliqua* have been reported by Gugliuzzo et al. (2019a) from Sicily (Italy) and Leza et al. (2020) from Mallorca (Spain). Founder females bore for oviposition until reaching the twig medulla, where they construct a brood gallery, shaped linearly, more or less sinuous and centered in the twig, usually 10–30 mm length (up to 57 mm) and 0.5–6.5 mm width, and forked from the entrance tunnel. But galleries have a different morphology when females bore in big branches and trunks; in these situations, the galleries are bored in the xylem (Gugliuzzo et al. 2019b). Oviposition occurs 4–7 days after the female bores into a twig; eggs hatch 3–5 days after being laid (Greco & Wright 2015). Total egg production per female ranges from 2 to 16 eggs (Hara & Beardsley 1979) and each gallery could produce between 10 and 40–60 new adults (Dixon et al. 2003, Gugliuzzo et al. 2019b). Larvae do not bore galleries, but live in the brood gallery, eating the coating of ambrosia fungi.

Adult females overwinter inside the brood galleries and the new attacks start in spring. From Italy and Southern France, *X. compactus* could be bivoltine or trivoltine, from April–May to the end of November (Pennacchio et al. 2012, Roques et al. 2019). The life cycle is developed in 28–31 days at laboratory conditions (Ngoan et al. 1976, Hara & Beardsley 1979), but it could need up to 40 days depending on the physical and chemical conditions of the host tree and the climatic conditions (Brader 1964). Adult females live between 39 and 58 days, whereas males have a life span of 4–6 days (Hara & Beardsley 1979). The maximum flight and attacks would be in summer, from June to early September (Ngoan et al. 1976), and Gugliuzzo et al. (2019a) referred the, possibly exceptional, ability to migrate more than 8 km from an infested area to a healthy area within one year.

Meteorology determines the phenology of *X. compactus*. The flight after overwintering comes when daily maximum temperatures remain stable for several days above 20ºC (Gugliuzzo et al. 2019a); similar behavior has been reported, using baited traps, for *X. germanus* (Reding et al. 2013). In Sicily, *X. compactus* could not stablish permanent populations above 400 m altitude, where minimum winter temperatures are usually negative (Gugliuzzo et al. 2019a). In Banyoles, during the 2016–2019 period (Table 4), the average temperature for the coldest months (January and February) ranged between 1.2 to 1.3 ºC, with minimum values of -3.9 ºC in February 2018 and -5 ºC in January 2017 (SMC 2020).

Table 4: Meteorological data from the station located in Banyoles (42º6'N, 2º47' E, www.meteo.cat) during the period 2016–2019; it shows (in ºC) annual mean temperature (AMeTem), minimum mean temperature (MMinT), and minimum temperature (MinT) for January and February

Year	AMeTem	MMinT (Jan)	MinT (Jan)	MMinT (Feb)	MinT (Feb)
2019	15,8	1,3	-3,5	3,9	-0,8
2018	15,6	4,5	-0,6	1,2	-3,9
2017	15,6	1,7	-5,0	5,8	-0,4
2016	15,4	4,9	-2,6	4,1	-1,2

Damages

X. compactus produces two kinds of damage on the host plant: mechanical by boring (Figure 1 D and E) and fungal by the inoculation of the saprophytic fungi into the xylem (Figure 1 B, C and E). Mechanical injuries are related to the boring of the entrance hole (0.7–0.9 mm diameter; Figure 1 D) and the excavation of the brood gallery (up to 30–57 mm long; Figure 1 E) along the twig medulla injure the vascular tissue, and the structural resistance is also reduced. On the other hand, the ambrosia fungi cultivated inside the gallery act as pathogens to the host plant, degrading the induced plant defenses and blocking the sap fluxes; moreover, the fungi can produce antagonistic substances to avoid the development of other microorganisms inside the galleries (Greco & Wright 2015). Gugliuzzo et al. (2020) reported in Italy 8 species of symbiotic fungi associated with *X. compactus* or its brood galleries, usually *Ambrosiella xylebori*, *A. macrospora*, and *Fusarium solani*. Moreover, Bateman et al. (2016) and Vannini et al. (2017) reported other fungi, as *Acremonium*, *Clonostachys*, *Cytospora*, *Penicillium*, and *Xenoacremonium*. Furthermore, the fungal diseases associated with some Scolytinae and Platypodinae species are some of the most important problems that have arisen in woody plants in recent decades (Ploetz et al. 2013).

We observed attacks of *X. compactus* in apparently healthy host plants, behavior also seen in other invasive Xyleborini on non-native plant species (Atkinson et al., 1988; Henin & Verstein, 2004). Their attacks are more frequent in the annual twigs (3–7 mm diameter), eliciting their death or breaking, though Gugliuzzo et al. (2019b) found attacks in trunks and branches with maximum values of 85 cm and 36 cm, respectively. The first attack evidence is white frass surrounding the entrance hole, followed by a turgor loss, wilt, and twig collapse, with a progressive discoloration that ends in dryness and death of the twig from the entrance hole to the apex. This wilting is already visible a few days after the attack, accordingly with Greco & Wright (2015) on *Coffea*. Other evidence of the attack and associated damage is the cortical canker (Figure 1D) that has formed around the entrance hole and along the brood gallery, between 1 and 21 cm length. The affected bark shows brown-purplish colorations, that stand out from the typical brown drying (above the attacked area in the twig) and from the normal photosynthetic green (below the attacked area). Debarking or cutting the twig on the affected area show xylem fibers with dark colorations, due to the ambrosia fungi activity (Figure 1B, 1C and 1E). These fungi do not cause degradation of the woody structure, but they are responsible for vascular collapse by plugging. This typology of symptoms and damages observed are in agreement with those reported by Hara & Beardsley (1979), Chong et al. (2009), Greco & Wright (2015), ANSES (2017), Gugliuzzo et al. (2019a, 2019b, 2020), Roques et al. (2019), Barnouin et al. (2020) and CABI (2020).

Geographical distribution and possible origin of the invasion

These records about the presence for *X. compactus* during summer/fall 2020 in Banyoles, Platja d'Aro, and quite possibly also in Vidreres, all of them in Girona province (NE Spain), are the first records for this species in Catalonia (NE Spain) and also in the Iberian Peninsula; it must be remembered that the first record in Spain was reported by Leza et al. (2020) from Mallorca (Balearic Islands) in October 2019. According to information received by the gardener from Banyoles, the presence of a few affected twigs in the laurel hedge was already observed during summer 2019, but it did not generate too much concern. However, in summer 2020, the damages were more conspicuous and generated alarm. This would indicate that *X. compactus* was present in this garden since spring 2019, at least.

The linear distance between Banyoles and Platja d'Aro is 42 km, while Platja d'Aro and Vidreres are separated by 24 linear km. On the other hand, according to Barnouin et al. (2020), the French records closest to Girona are located at Saint Tropez (captured in 2015 and 2017), at Bormes Les Mimosas (from 2018 and 2019), and at Saint Raphaël (from 2019), all of them in Var Department (Figure 2); the distance between these French locations and Banyoles is about 550 km. Probably, the introduction of *X. compactus* in the Iberian Peninsula is related to the commerce of live ornamental plants. The chronology of European records for this species starts at Campania (Italy) in winter 2010 (Garona et al. 2012), followed by Alpes-Maritimes and Var (France) in summer 2015 (Chapin et al. 2016), Argolida (Greece) in July 2019 (Spanou et al. 2019), Mallorca (Spain) in October 2019 (Leza et al. 2020) and we report Girona (NE Spain) in August 2020, although it is possible that the species was present in the area as early as 2019. The first detection of *X. compactus* in France happened at Alpes-Maritimes Department, near the Italian border of Piemonte and Liguria regions. Similarly, the congeneric *X. crassiusculus*, was first detected for Europe in the Italian region of Toscana (Pennachio et al. 2003) and the first record from France was in Alpes-Maritimes, near the Italian border (Roques et al. 2019). Possibly, both species arrived in France from Italy by ornamental plant commerce, facilitated by the garden industry from Southern France (ANSES 2017, Gallego et al. 2017, Roques et al. 2019). A very similar situation happened in Slovenia when *X. crassiusculus* was recorded in August 2017 at Podsabotin and Pračina, very close to the Italian border of the region of Friuli-Venecia Julia (Kavčič 2018). Accordingly, we suspect that live ornamental plant commerce for public and private gardens of residential areas are also related with the presence of X. compactus in Mallorca and Girona.

Simultaneous occurrence of several populations of *Xylosandrus* species in different European localities, after the first detection in Italia in 2010, could be evidence of independent introduction events, either by infested host plants directly from native Asian areas or by internal EU plant commerce from Italian plant producers. The European Life SAMFIX project has, between their tasks, put in light the origin of these populations by molecular techniques, currently in progress. New samples of insects from Girona will be taken in spring 2021 and will be sent to the SAMFIX team for analysis. The risk of invasion for these species to new areas is very high because a simple adult female could stablish a permanent colony by inbreeding, and generate up to three annual generations that could widespread quickly and silently across extended territories.

Potential distribution models of *X. compactus* proposed by Urvois et al. (2021) describe as suitable territories the Mediterranean coasts and islands, except for Tunisia, Libya, Egypt, and Southeastern Iberian Peninsula. Authors also indicate that the Atlantic coast of the Iberian Peninsula, France, up to the UK are suitable areas, although suitability decreases northwards and generally with distance from the coast. Accordingly, it is very likely that in the next few years *X. compactus* will colonize new areas, expanding its distribution across suitable habitats in the Iberian Peninsula. Kirkendall & Faccoli (2010) reported 19 alien Scolytinae species were apparently established in Europe, 14 as potentially expanding (as *X. crassiusculus*), and 5 as probably currently spreading (as *X. germanus*). Some years later, Rassati et al. (2016) reported 18 species in the Mediterranean Basin. Recently, Barnouin et al (2020) listed 21 invasive species to France since XIX century, but more than half, 11 species, have been recently introduced. Exotic and invasive Scolytinae pose a major threat to the forest, agricultural, and ornamental plant resources around the world, and they can have serious economic and ecological consequences. A globalized trade, aided by climate change, makes the transport of plant material colonized by these insects worldwide recognized as a very important means of current biological invasions. So, implement new management and policy measures on live plant commerce and early alert systems in the potential areas are indispensable to avoid future invasions.

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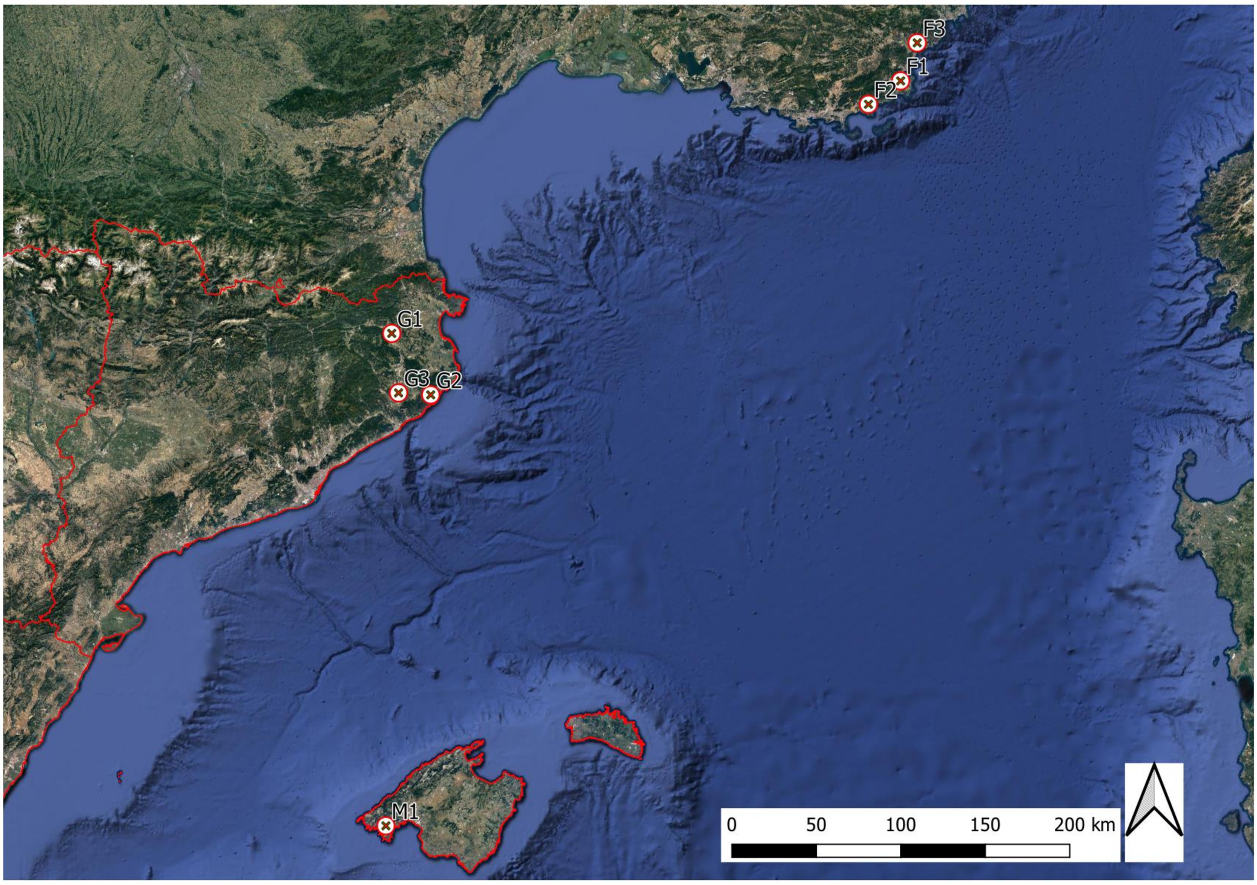
Figure captions:

Figure 1: (A) Affected laurel (*Laurus nobilis*) twig in Banyoles (Girona); (B) cross section of an affected laurel twig; (C) Females of *X. compactus* were found inside the brood gallery of a small laurel twig; (D) Detail of the cortical canker on an affected laurel twig, near the entrance hole to the brood gallery; (E) brood gallery (3 cm long) established along the twig medulla.

Figure 2: Reports of *X. compactus* in Spain and nearest in France: G1: Banyoles, G2: Platja d'Aro, G3: Vidreres (Girona) and M1: Majorca (Leza et al. 2020) from Spain; F1: Saint Tropez, F2: Bormes Les Mimosas and F3: Saint Raphaël (Var Department)



F3
F1
F2
G1
G3
G2
M1
0
50
100
150
200 km