Zootaxa 4767 (2): 345–350
https://www.mapress.com/j/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.4767.2.9
http://zoobank.org/urn:lsid:zoobank.org:pub:F664171F-BBEF-4BDC-8244-C9B84857844F

First record of the black twig borer, *Xylosandrus compactus* (Coleoptera: Curculionidae, Scolytinae) in Spain

MAR LEZA[1,2], LUIS NUÑEZ[3], JOSEP MARIA RIBA[4], CLAUDIA COMPARINI[1,5], ÁLVARO ROCA[6] & DIEGO GALLEGO[7,8,9]

[1]*Department of Biology, University of the Balearic Islands, Spain.*
[2] *mar.leza@uib.es; https://orcid.org/0000-0002-0134-0221*
[3]*Forest Engineer, Palma, Spain. luisnunezvazquez@hotmail.com; https://orcid.org/0000-0002-7987-8187*
[4]*Plant Pathologist and Consulting Arborist, Tossa de Mar, Spain.*
jmriba2001@gmail.com; https://orcid.org/0000-0003-3147-0737
[5] *claudiacoga92@gmail.com; https://orcid.org/0000-0003-3245-7235*
[6]*Jardines Campaner S.L.U, Calvià, Spain. alvaro.roca.santandreu@gmail.com; https://orcid.org/0000-0003-1184-6119*
[7]*Department of Ecology, University of Alicante, Spain. diego.gallego@ua.es; https://orcid.org/0000-0002-9258-0238*
[8]*Sanidad Agrícola Econex S.L., Santomera, Spain*
[9]*Corresponding author*

Abstract

We present the first record for Spain of the black twig borer, *Xylosandrus compactus*, an ambrosia beetle of Asian origin, collected from an infested carob tree located in Calvià (Majorca, Balearic Islands, Spain). *X. compactus* is included in the EPPO Alert List, and it has been recently reported causing damages in a Mediterranean maquis ecosystem in Italy and Southern France. Here, we discuss about the first steps of management of this Invasive Alien species (IAS), the eradication plan and the hypothesis of the path of introduction in this Western Mediterranean island.

Key words: Xyleborini, Ambrosia beetles, Alien species, Balearic Island, *Ceratonia siliqua*

Introduction

In June 2019, unusual symptoms such as necrosis of the leaves and withered and dried twigs were observed in a carob tree (*Ceratonia siliqua* L.) in a private garden in "El Toro" Residential Area (Calvià, Majorca, Balearic Islands, Spain; 39°28'51.6"N; 2°28'59.1"E). Multiple small holes were located in both small and large branches (>10 cm diameter) and in twigs. During August, a sap exudation from holes was observed (Figure 1).

The attacked tree was located adjacent to a natural area with Aleppo pines (*Pinus halepensis* Miller) and mixed vegetation of Mediterranean garriga, with presence of *Pistacia lentiscus* L., *Rosmarinus officinalis* L., *Erica multiflora* L. and *Olea europaea* var. *sylvestris* L.

In October 2019, the Laboratory of Zoology of the University of the Balearic Islands received some insect samples. The collected specimens were then identified as the invasive alien species *Xylosandrus compactus* (Eichhoff), the black twig borer (Coleoptera: Curculionidae, Scolytinae) believed to be native to Asia. The observed damages in large branches (as opposed to small branches and twigs) of *C. siliqua* are a rare behavior and it has been reported by Gugliuzzo *et al.* (2019) for first time in Sicily (Italy).

The authors reported to the competent authority of the Government, who notified the presence of this IAS through the European Union Notification System for Plant Health Interceptions, EUROPHYT.

Accepted by L. Kirkendall: 2 Apr. 2020; published: 24 Apr. 2020

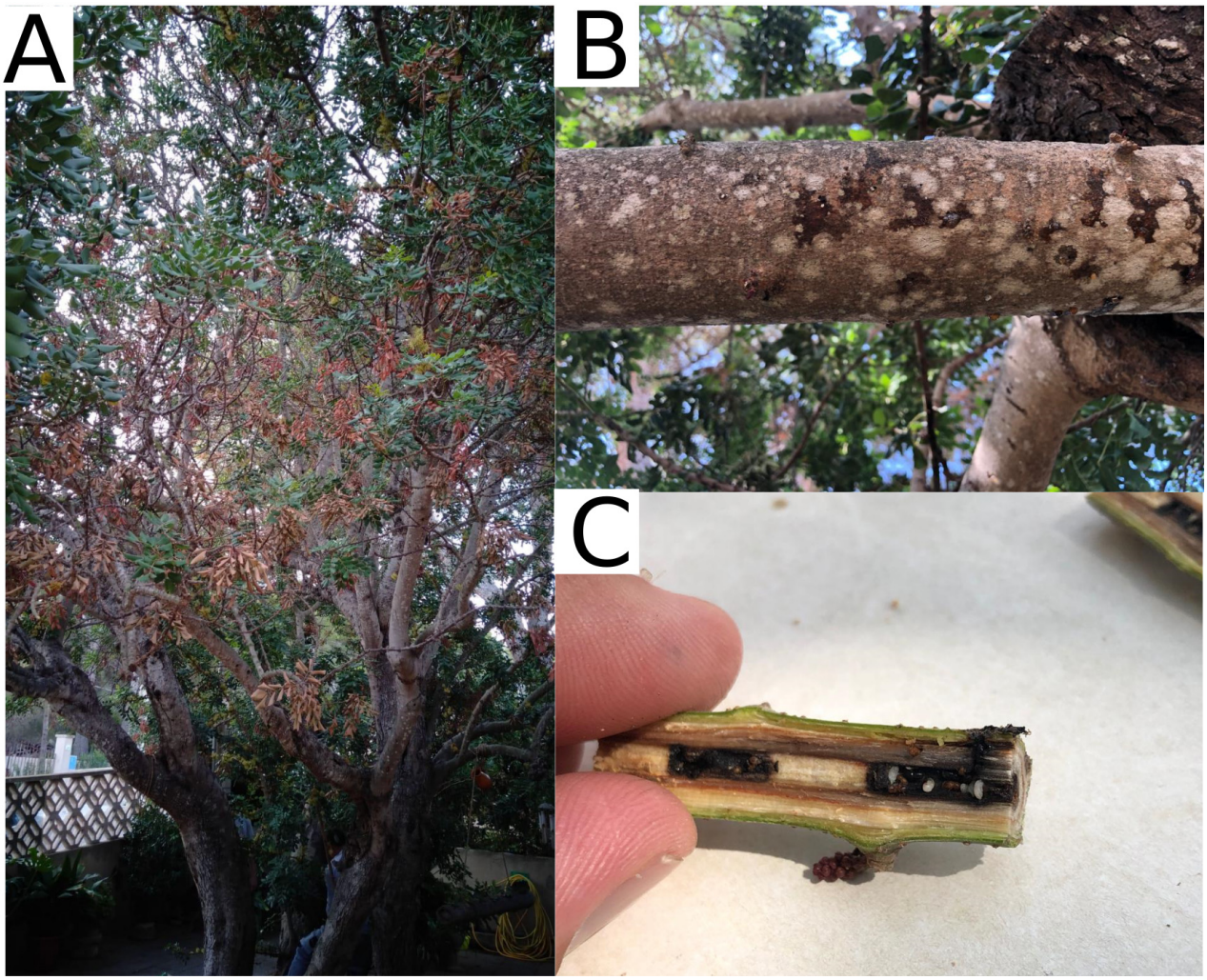

FIGURE 1. (A) The affected carob tree in August 2019. (B) Large branch (> 10 cm diameter) with holes and exudations; (C) Longitudinal section of branch, showing *Xylosandrus compactus* galleries containing adults and larvae.

Description and distribution

The black twig borer, *X. compactus* (Figure 2), is included in the Alert List of EPPO (EPPO 2019). This species is highly polyphagous, with 200 vegetal taxa recorded as effective agricultural and forest hosts, including very important species of Mediterranean maquis shrubland, species such as *Quercus ilex*, *Pistacia lentiscus, Ceratonia siliqua, Viburnum tinus* L., *Ruscus aculeatus* L., *Laurus nobilis* L., *Celtis australis* L., *Cercis siliquastrum* L. and *Fraxinus ornus* L. In native and other invaded areas, *X. compactus* is a pest of *Camellia sinensis* Kuntze (tea), *Coffea canephora* L. (coffee) and *Theobroma cacao* L. (cocoa), in addition to other tropical crops such as *Carica papaya* L. (papaya), *Litchi chinensis* Sonn. (lychee), *Macadamia integrifolia* Maiden & Betche (macadamia nut), *Persea americana* Mill. (avocado) or *Punica granatum* L. (pomegranate) (Bosso *et al.* 2012, Greco & Wright 2015, Vannini *et al.* 2017, CABI 2019, EPPO 2019, Gugliuzzo *et al.* 2019, Roques *et al.* 2019).

X. compactus can be differentiated from the other introduced species of this genus in the Iberian Peninsula, *X. germanus* (Blandford) and *X. crassiusculus* (Motschulsky) by its smaller size; the total length of females is 1.3–1.7 mm, whereas both other species are longer than 2 mm (Gallego *et al.* 2017). Besides this, its pronotum is clearly shorter than the elytra and the elytra is 1.2 times as long as wide; declivity commences at middle of the elytra; and lateral sides of elytra are clearly marked by strial rows. Because the mature adult has a dark brown color, it is named as the "black" twig borer.

X. compactus occurs in 15 Asian countries, 27 African countries, 8 countries from South and Central America, 11 USA states, 5 countries from Oceania and 2 European countries (EPPO Global Database 2019). Trade of woods

and wood packaging materials, and the most important, live plants, facilitate invasions of *Xylosandrus* species (Gallego *et al.* 2017, Roques *et al*. 2019). This is the first record of *X. compactus* from the Balearic Islands and Spain.

X. compactus belongs to the tribe Xyleborini, and in conjunction with Xyloterini and Corthylini tribes and Platypodinae subfamily form the majority of the "ambrosia beetles". These beetles excavate tunnels in the xylem of the affected plant, releasing spores of the "ambrosia" fungi which are then cultivated inside the galleries and provide nutrition for larvae and adults. These insects colonize xylem (unlike "bark beetles" that are phloeophagous species) of recently dead trees, stressed trees and/or healthy trees. The Xyleborini contain 1177 species distributed in 37 genera; some genera are large, as *Xyleborus* with 420 species (Hulcr & Stelinski 2017, Gómez *et al.* 2018). The Xyleborini species recorded in the Iberian Peninsula belong to *Anisandrus*, *Xyleborinus*, *Xyleborus* and *Xylosandrus* genera.

Vannini *et al.* (2017) reported 18 fungal taxa isolated from *X. compactus* and/or from their boring and necrosis areas, in Circeo (Central Italy); the most frequent were A*mbrosiella xylebori*, *Geosmithia pallida*, *Fusarium* spp., *Epicoccum nigrum* and *Bionectria* sp. These authors recommended the inclusion of *X. compactus* in the EPPO Alert List; finally, it was included in February 2017 and considered for developing a Pest Risk Analysis (EPPO, 2019). The associated fungus discovered in that initial study will be identified in future research, in coordination with the SAMFIX project Team (SAMFIX Project, 2019).

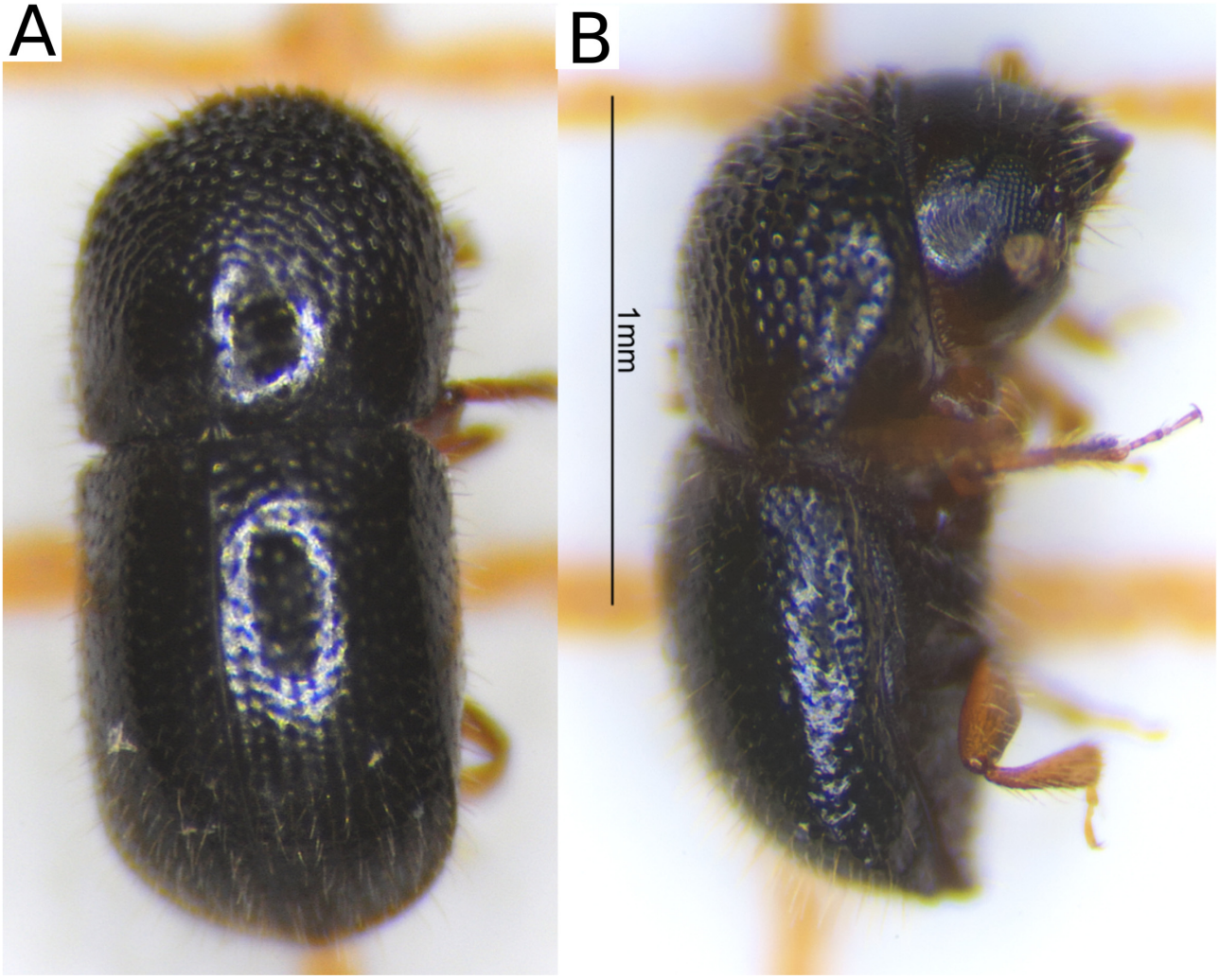

FIGURE 2. *Xylosandrus compactus* (females) collected in the affected carob tree, on its dorsal (A) and lateral (B) views.

Distribution and spreading in Europe

X. compactus is believed to be native to Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Philippines, Singapore, Sri Lanka, Taiwan, Thailand and Vietnam. It is also recorded from East Timor, but its status of

native is not clear. This borer has been introduced in Africa (Benin, Cameroon, Central African Republic, Comoros, Congo, Congo Democratic Republic, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Mauritania, Mauritius, Nigeria, Réunion, Senegal, Seychelles, Sierra Leone, South Africa, Tanzania, Togo, Uganda, Zimbabwe), USA (Alabama, Florida, Georgia, Hawaii, Louisiana, Mississippi, South Carolina, Texas), Central America and Caribe (Virgin Islands, Cuba, Curaçao, Netherlands Antilles, Puerto Rico), South America (Brazil, Peru) and Oceania (Fiji, New Zealand, Papua New Guinea, Samoa, Solomon Islands) (EPPO, 2019).

X. compactus was detected for the first time in Europe in 2010 in the Italian regions of Campania and Toscana (Francardi *et al.* 2012, Garonna *et al.* 2012, Pennacchio *et al.* 2012). Afterwards, this borer has been detected in 2016 in the Latium Region (Italy), in the Circeo Promontory in the Circeo National Park, affecting an extended area of more than 13 ha of maquis shrubland (Vannini *et al.* 2017). These authors found insects in galleries attacking twigs and branches of *Q. ilex, V. tinus, R. aculeatus, L. nobilis, P. lentiscus* and *C. siliqua*. Longo & Tropea Garzia (2016) found this beetle in Sicily, attacking *C. siliqua*, and in 2019, Gugliuzzo *et al.* (2019) report unusual attacks on trunks and branches with big diameters.

The first detection in France was reported in 2015, at the Alpes Maritimes region. Nowadays, *X. compactus* occurs in a wide area of the Alpes Maritimes coast, with high population levels in the Botanical Garden of Villa Thuret and the Garoupe Forest, near Nice (Roques *et al.* 2019).

Control actions

A total of two insecticide applications, were applied by trunk injection technique (9 August and 23 September 2019). In each treatment, a total of 14 ml of abamectin 1.8% (Vertimec, Syngenta, Switzerland) was applied through the 7 injection points around the trunk. On 2 September and 12 November, the affected twigs or branches, 10–15 mm below the shot hole, were pruned and grounded.

During December 2019 some dead adults and alive larvae were collected inside the galleries of some branches from the affected carob tree. Because of this, the effectiveness of the endotherapy chemical treatment cannot be confirmed. The samples were processed *in situ*, to avoiding moving the infested material to other places. An intensive survey of the neighbouring areas was done and no infestation symptoms have been detected in other plants.

Regarding the introduction paths, trade of living plants, ornamental woods, and packing wood material could transport *X. compactus*. Currently, the path of introduction of *X. compactus* in the Balearic Islands is unknown and little information is available, since there are few biosecurity or quarantine measures in place for commodities arriving from overseas. Monitoring ports should be particularly taken into consideration for a successful eradication policy in the Balearic Islands, since *a priori* these points seem to be the main path of introduction of other invasive insects, such as the yellow legged hornet (*Vespa velutina*), the Asian tiger mosquito (*Aedes albopictus*), the red palm weevil (*Rhynchophorus ferrugineus*); even vertebrates such as snakes in Ibiza have probably also been introduced by maritime transportation to the Balearic Islands (Miquel *et al.* 2013; Silva-Rocha *et al.* 2015; Leza *et al.* 2018). Once established, such species are difficult to eradicate and they are likely to spread with the movement of infested plants, as well as by normal dispersal of the adults (CABI 2019). So, it is necessary to react quickly. In 2020 three actions are planned to be implemented at the infested site and surroundings, in collaboration with the Plant Health authorities of the Balearic Islands Government: (1) an intensive survey campaign; (2) a trapping network using crossvane traps (Crosstrap, Econex, Spain) baited with alpha-pinene and ethanol (Gallego *et al.* 2017, SAMFIX project 2019); and (3) an information campaigns to stakeholders and citizens. Future studies are necessary to find appropriated tools to manage this insect successfully, taken into account the unusual behaviour of attacking large branches.

An Early Warning Network using baited traps should be permanently active in forest areas and especially in urban and landscaped areas, aimed to detect either existing species or introduced species (with special attention to invasive alien species) in the Balearic Islands. Nowadays, the knowledge of the bark and ambrosia beetle fauna in Balearic Islands is not complete. Although in a systematic study carried using baited traps during four years in Majorca, in areas with pine forest (*P. halepensis*) and areas with evergreen oak forest (*Q. ilex*), reported four native species of Scolytinae not previously listed for the Balearic Islands: *Chaetoptelius vestitus* (Mulsant & Rey), *Coccotrypes dactyliperda* (Fabricius), *Xylocleptes bispinus* (Duftschmid) and *Xyleborus eurygraphus* (Ratzeburg)

(Comparini *et al.* 2018). But an Early Warning Network is not enough to assure effective detection, as the case of *X. compactus* has been. The promotion of citizen science by informative campaigns with new technologies support is an excellent complementary tool for prevention of non-native species introduction.

Acknowledgements

The authors would like to thank the tree owner, for allowing us to access to the study site and his assistance. Special thanks to the Servei de Sanitat Vegetal (Andreu Juan, Omar Beidas) and the Servei de Sanitat Forestal (Sandra Closa), from the Balearic Islands Government, and the students of the Laboratory of Zoology (University of the Balearic Islands).

References

Bosso, L., Senatore, M., Varlese, R., Ruocco, M., Garonna, A.P., Bonanomi, G., Mazzoleni, S. & Critinzio, G. (2012) Severe outbreak of *Fusarium solani* on *Quercus ilex* vectored by *Xylosandrus compactus*. *Journal of Plant Pathology*, 94 (4 supplement), 99.
https://doi.org/10.4454/JPP.V95I4SUP.036

CABI (2019) *Xylosandrus compactus* (shot-hole borer). Available from: https://www.cabi.org/isc/datasheet/57234 (accessed 18 December 2019)

Comparini, C., Gallego, D., Núñez, L., Closa, A. & Leza, M. (2018) First Record of Four Scolytid Species (Coleoptera: Curculionidae) in the Balearic Islands (Western Mediterranean; Spain). *Journal of the Entomological Research Society*, 20 (2), 61–70.

EPPO (2019) PQR database. Paris, France: European and Mediterranean Plant Protection Organization. Available from: http://www.eppo.int/DATABASES/pqr/pqr.htm (accessed 1 December 2019)

EPPO Global Database. (2019) *Xylosandrus compactus* (XYLSCO). Available from: https://gd.eppo.int/taxon/XYLSCO (accessed 19 December 2019)

Francardi, V., Pennacchio, F., Santini, L., Rumine, P., Paoli, A., Navarra, A. & Musetti, N. (2012) Prima segnalazione di *Xylosandrus compactus* su *Laurus nobilis* in Toscana. *Giornate Fitopatologiche*, 13, 443–446.

Gallego, D., Lencina, J.L., Mas, H., Cever, J. & Faccoli, M. (2017) First record of the Granulate Ambrosia Beetle, *Xylosandrus crassiusculus* (Coleoptera: Curculionidae, Scolytinae), in the Iberian Peninsula. *Zootaxa*, 4273 (3), 431–434.
https://doi.org/10.11646/zootaxa.4273.3.7

Garonna, A.P., Dole, S.A., Saracino, A., Mazzoleni, S. & Cristinzio, G. (2012) First record of the black twig borer *Xylosandrus compactus* (Eichhoff) (Coleoptera: Curculionidae, Scolytinae) from Europe. *Zootaxa*, 3251 (1), 64–68.
https://doi.org/10.11646/zootaxa.3251.1.5

Gómez, D.F., Rabaglia, R.J., Fairbanks, K.E.O & Hulcr, J. (2018) North American Xyleborini north of Mexico: a review and key to genera and species (Coleoptera, Curculionidae, Scolytinae). *Zookeys*, 768, 19–68.
https://doi.org/10.3897/zookeys.768.24697

Greco, E.B. & Wright, M.G. (2015) Ecology, Biology and Management of *Xylosandrus compactus* (Coleoptera: Curculionidae: Scolytinae) with Emphasis on Coffee in Hawaii. *Journal of Integrated Pest Management*, 6 (1), 1–8.
https://doi.org/10.1093/jipm/pmv007

Gugliuzzo, A., Criscione, G. & Tropea Garzia, G. (2019) Unusual behavior of *Xylosandrus compactus* (Coleoptera: Scolytinae) on Carob Trees in a Mediterranean Environment. *Insects*, 10, 82.
https://doi.org/10.3390/insects10030082

Hulcr, J. & Stelinski, L.L. (2017) The ambrosia symbiosis: From evolutionary ecology to practical management. *Annual Review of Entomology*, 62, 285–303.
https://doi.org/10.1146/annurev-ento-031616-035105

Leza, M., Miranda, M.. & Colomar, V. (2018) First detection of *Vespa velutina nigrithorax* (Hymenoptera: Vespidae) in the Balearic Islands (Western Mediterranean): a challenging study case. *Biological Invasions*, 20, 1643–1649.
https://doi.org/10.1007/s10530-017-1658-z

Longo, S. & Tropea Garzia, G. (2016) Uno Scolitide asiatico nocivo al Carrubo in Sicilia. Available from: http://www.georgofili.info/detail.aspx?id=2909 (accessed 1 December 2019)

Miquel, M., Del Río, R., Borrás, D., Barcel, C., Paredes-Esquivel, C., Lucientes, J. & Miranda, M.A. (2013) First detection of *Aedes albopictus* (Diptera: Culicidae) in the Balearic Islands (Spain). *Journal of the European Mosquito Control Association*, 31, 8–11.

Pennacchio, F., Santini, L. & Francardi, V. (2012) Bioecological notes on *Xylosandrus compactus* (Eichhoff) (Coleoptera Curculionidae Scolytinae), a species recently recorded into Italy. *Redia*, 95, 67–77.

Roques, A., Bellanger, R., Daubrée, J.B., Ducatillion, C., Urvois, T. & Auger–Rozenberg, M.A. (2019) Les scolytes exotiques:

une menace pour le maquis. *Phytoma*, 727, 16–21.
SAMFIX Project. (2019) SAving Mediterranean Forests from Invasions of *Xylosandrus* beetles and associated pathogenic fungi. Available from: https://www.lifesamfix.eu (accessed 23 December 2019)
Silva-Rocha, I., Salvi, D., Sillero, N., Mateo, J.A. & Carretero, M.A. (2015) Snakes on the Balearic Islands: an invasion tale with implications for native biodiversity conservation. *PLoS ONE*, 10 (4), e0121026. https://doi.org/10.1371/journal.pone.0121026
Vannini, A., Contarini, M., Faccoli, M., Della Valle, M., Rodriguez, C.M., Mazzetto, T., Guarneri, D., Vettraino, A.M. & Speranza, S. (2017) First report of the ambrosia beetle *Xylosandrus compactus* and associated fungi in the Mediterranean maquis in Italy, and new host–pest associations. *EPPO Bulletin*, 47, 1–4. https://doi.org/10.1111/epp.12358