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Rapid Communication

Anisandrus maiche Kurentzov (Curculionidae: Scolytinae), an Asian species recently introduced and now widely established in Northern Italy

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Abstract

The present contribution reports the current distribution of the Asian scolytine beetle *Anisandrus maiche* Kurentzov (Curculionidae: Scolytinae, Xyleborini) in Italy. Previously, in the entire European Union, this species was known only from a single specimen collected in the Treviso province of Northeast Italy in 2021. The data presented here considerably increase the distributional range of *A. maiche* in Italy, and clearly show that this ambrosia beetle species is established and widespread in at least two northern Italian regions, namely Lombardy and Veneto.

Key words: ambrosia beetles, alien species, EPPO, detection, monitoring, biological invasion

Introduction

The introduction and establishment of non-native bark and ambrosia beetles (Coleoptera: Curculionidae, Scolytinae) is constantly increasing worldwide mostly due to globalization and climate change (Lantschner et al. 2020; Pureswaran et al. 2022). This trend is expected to further increase despite regulations (Allen et al. 2017), specific monitoring activities (Rassati et al. 2015; Rabaglia et al. 2019), and the implementation of new and innovative early detection tools and technologies (Poland and Rassati 2019; Marchioro et al. 2020a; Ruzzier et al. 2021a), which can help to prevent some invasions. In Europe, Italy has one of the highest numbers of intercepted, adventive and established exotic Coleoptera (Ratti 2007; Jucker and Lupi 2011), including bark and ambrosia beetles (Kirkendall and Faccoli 2010; Rassati et al. 2016). This peculiarity can be associated with the high diversity of Italian ecosystems and the pivotal role of Italy in international trade as a crossroads within Europe and beyond (Ruzzier et al. 2020a, b).

Anisandrus maiche Kurentzov, 1941 (Curculionidae: Scolytinae, Xyleborini) is an ambrosia beetle native to Asia (China, Korea, Japan, and the Russian

Far East) (Mandelshtam et al. 2018; Smith et al. 2020). In 2009, the species was recorded for the first time in North America (Rabaglia et al. 2009) where it is now widely distributed (Gomez et al. 2018; Young et al. 2021). This species was recorded also in the Western Palaearctic in 2007, where it was established in Ukraine and European Russia (Terekhova and Skrylnik 2012; Nikulina et al. 2015); more recently a single specimen was collected in Treviso (Veneto Region), Northern Italy (Colombari et al. 2022; Europhyt Outbreak No.1560), indicating the arrival of this species also in south-western Europe.

In 2021, *A. maiche* was largely detected in multiple, non-contiguous areas and in a consistent number of specimens during trapping activities carried out in different localities in both Lombardy and Veneto regions (Northern Italy). Finding, conditions and distribution of the local populations are here presented and discussed.

Materials and methods

In Lombardy, trapping was performed in multiple localities in the provinces of Bergamo, Milan and Lecco using bottle traps baited with red wine, apple cider vinegar, red wine vinegar and white wine vinegar (Ruzzier et al. 2021a). The trapped specimens were collected in April–May 2021.

In Veneto, trapping was performed in the Euganean hills area (province of Padua) using home-made cross-vane traps. All traps were baited with ethanol released by a perforated 50-ml Falcon tube, and were hung approximately 1 m from the ground, a height allowing a high capture rate of ambrosia beetles (Marchioro et al. 2020b; Miller et al. 2020). The trapping period lasted from the end of March to mid-July 2021.

Species were identified morphologically according to the keys provided in Gomez et al. (2018) and Smith et al. (2020).

All specimens collected in Lombardy are deposited in the Enrico Ruzzier private collection (Mirano, Italy) while the specimens collected in Veneto are stored in the entomological collection of the Department of Agronomy, Food, Natural Resources, Animals and the Environment (DAFNAE) (Padua, Italy).

SEM photographs were taken using a Hitachi TM1000 Tabletop Scanning Electron Microscope.

Results

In the monitored provinces the trapping activity resulted in a total of 165 adults of *Anisandrus maiche* (Figure 1). The localities where *A. maiche* was found are the following:

Bergamo province (Lombardy)

1 ex., Seriate, 45.669671 9.729666, 31/05/2021, attractant: red wine; 4 ex., Grassobbio, 45.653881 9.734999, 31/05/2021, attractant: red wine; 1 ex., Seriate, 45.667755 9.728427, 31/05/2021, attractant: red wine; 3 ex., Grassobbio, 45.662270 9.727816, 31/05/2021, attractant: red wine; 1 ex.,

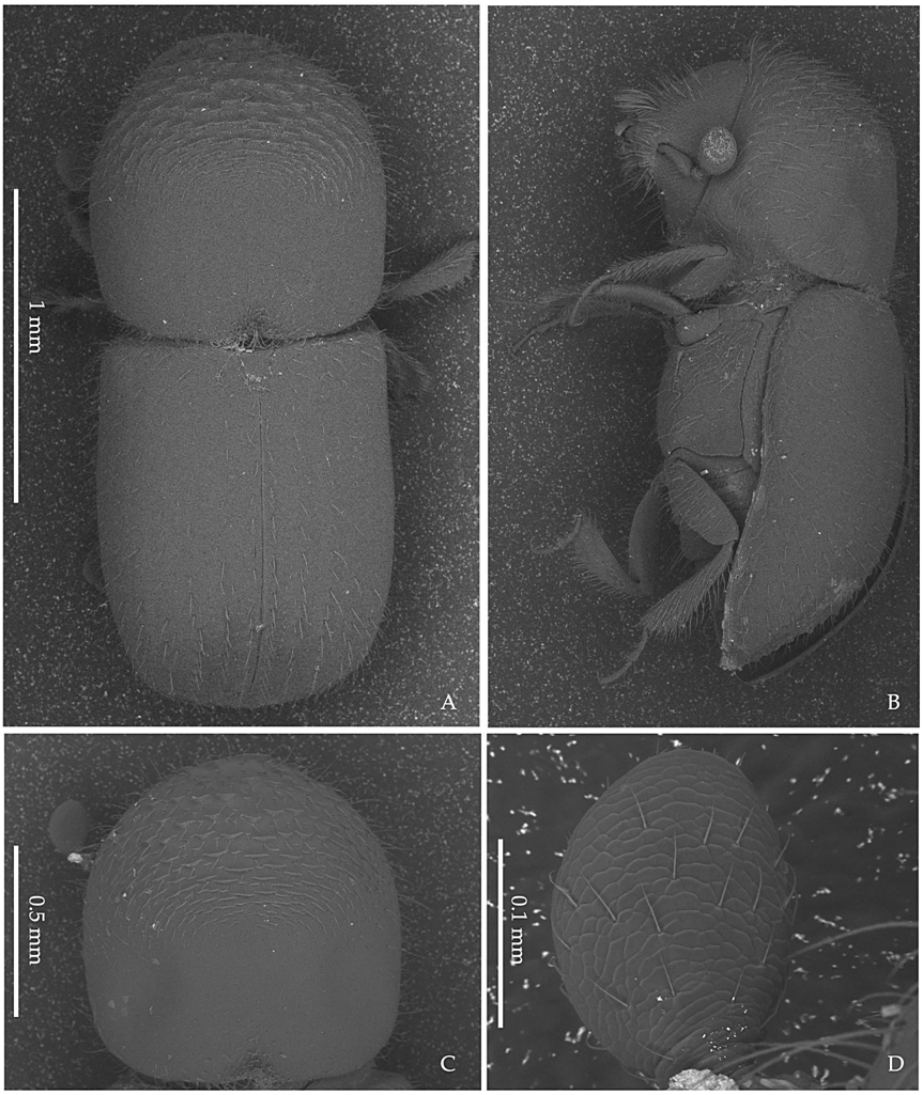

Figure 1. *Anisandrus maiche* Kurentzov, 1941: A. dorsal habitus; B. lateral view; C. detail of the pronotum, dorsal view; D. dorsal view of the antennal club. Microphotographs by Enrico Ruzzier.

Grassobbio, 45.649484 9.737621, 31/05/2021, attractant: red wine; 1 ex., Seriate, 45.652108 9.738260, 31/05/2021, attractant: red wine; 4 ex., Seriate, 45.671583 9.711527, 31/05/2021, attractant: red wine; 1 ex., Seriate, 45.6724646 9.729944, 31/05/2021, attractant: red wine; 1 ex., Campagnola, 45.674921 9.683777, 10/05/2021, attractant: red wine; 1 ex., Seriate, 45.652108 9.738260, 10/05/2021, attractant: red wine; 2 ex., Seriate, 45.667755 9.728427, 25/05/2021, attractant: red wine; 4 ex., Grassobbio, 45.649484 9.737621, 25/05/2021, attractant: red wine; 1 ex., Seriate, 45.671583 9.711527, 10/05/2021, attractant: red wine; 1 ex., Grassobbio, 45.653881 9.734999, 25/05/2021, attractant: red wine; 1 ex., Seriate, 45.671583 9.711527, 25/05/2021, attractant: red wine.

Milan province (Lombardy)

1 ex., Bosco in Città, 45.481381 9.099166, 07/05/2021, attractant: red wine; 2 ex., Bosco in Città, 45.484707 9.088344, 21/05/2021, attractant: red wine; 8 ex., Mediglia, 45.415755 9.301038, 10/05/2021, attractant: red wine; 1 ex., San Donato Milanese, 45.424568 9.273794, 24/05/2021, attractant: red wine; 3 ex., San Donato Milanese, 45.423512 9.279455, 10/05/2021, attractant: red wine; 3 ex., Peschiera Borromeo, 45.438616 9.2666881, 10/05/2021, attractant: red wine; 2 ex., Pioltello, 45.475596 9.318472, 10/5/2021, attractant: red wine; 1 ex., San Donato Milanese, 45.423512 9.279455, 10/05/2021, attractant: cider vinegar.

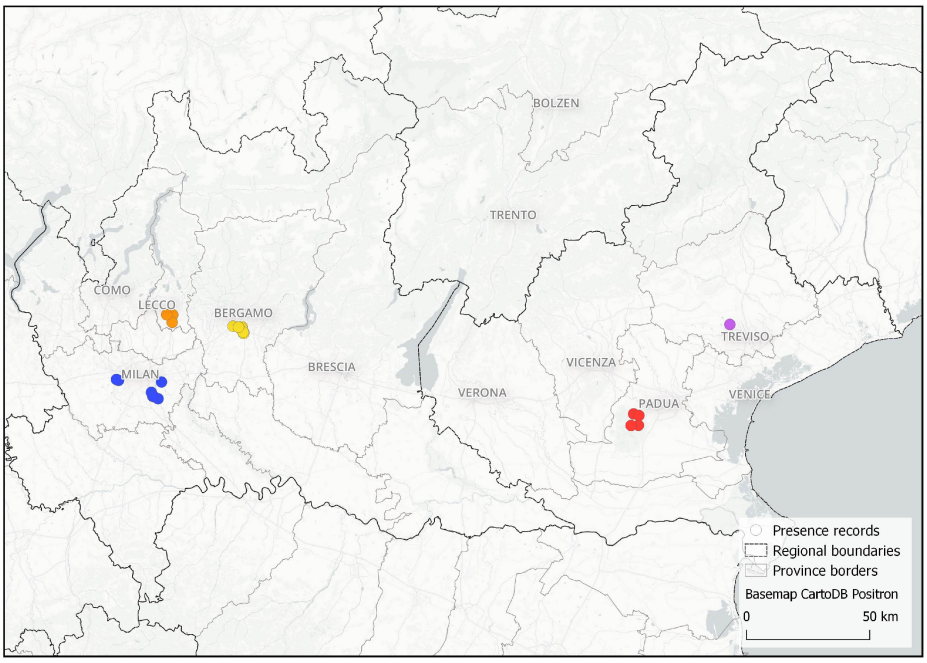

Figure 2. Records of *Anisandrus maiche* Kurentzov, 1941: purple dot, record provided in Colombari et al. 2022; red dots, records in the Padua province (Veneto); yellow dots, records in the Bergamo province (Lombardy); orange dots, records in the Lecco province (Lombardy); blue dots, records in the Milan province (Lombardy).

Lecco province (Lombardy)

1 ex., La Valletta Brianza, 45.714742 9.375604, 10/05/2021, attractant: red wine; 1 ex., La Valletta Brianza, 45.715381 9.375871, 31/05/2021, attractant: red wine; 1 ex., Montevecchia, 45.688512 9.373177, 25/05/20121, attractant: red wine; 2 ex., Missaglia, 45.715742 9.344833, 25/05/2021, attractant: red wine.

Padua province (Veneto)

51 ex., Torreglia, Mt. Alto, 45.320545 11.752657, 20/07/2021, attractant: ethanol; 29 ex., Torreglia, Mt. Rua, 45.319912 11.715074, 20/07/2021, attractant: ethanol; 1 ex., Torreglia, Mt. Lonzina, 45.361433 11.728045, 20/07/2021, attractant: ethanol; 33 ex., Abano Terme, Mt. Ortone, 45.355681 11.755307, 20/07/2021, attractant: ethanol.

Discussion

The records presented in this paper clearly indicate that *A. maiche* is a species established in Northern Italy, whose distribution covers an area of approximately 9,900 square kilometers, shared between the Lombardy and Veneto regions (Figure 2). Given the simultaneous multiple detection of this species in non-contiguous localities, it is difficult to reconstruct any pattern of introduction and spread. The species' sudden appearance, despite the constant and intense monitoring activities carried out by the regional phytosanitary services of both regions, would seem to indicate a recent introduction followed by a rapid spread or multiple independent introductions, as observed for other ambrosia beetle species (Storer et al. 2017; Urvois et al. 2022). This hypothesis might be also supported by the absence of *A. maiche* from the Euganean hills until 2019, when a large monitoring of bark- and wood-boring beetles was carried out (Cavaletto et

al. 2020). However, it has to be noted that traps used in the latter study were baited with longhorn beetle pheromones along with ethanol, which could have had a repellent effect on *A. maiche* (Sweeney et al. 2016), and were set up at 5–7 m from the ground, likely reducing the chances to trap ambrosia beetles (Marchioro et al. 2020b; Miller et al. 2020).

Anisandrus maiche is a polyphagous species breeding on a wide range of broadleaved trees and shrub species such as alders, birches, ashes, hazelnut, lindens, maples, poplars, willows, etc, and occasionally also spruce (Wood and Bright 1992; Mandelshtam et al. 2018). Mandelshtam et al. (2018) indicated that, despite the species' capability to produce outbreaks, no substantial economic or ecological impact has ever been recorded in its native area; similarly, no damage has been reported in Italy so far. In one case, the species has been recorded attacking frost-stressed deciduous trees in the USA (Ranger et al. 2019). Nonetheless, *A. maiche* remains an under-surveillance species (Rabaglia et al. 2009; Terekhova and Skrylnik 2012; Martynov and Nikulina 2016; Young et al. 2021).

Current records and distribution of *A. maiche* in northern Italy further highlight the difficulties encountered in detecting and efficiently identifying exotic species before they establish in new habitats, underlining the need of improving pre-border and border surveillance strategies. *Anisandrus maiche* is in fact only the most recent in a series of exotic insects recently recorded in Italy after their establishment, as for example *Xyleborus bispinatus* Eichhoff, 1868 (Faccoli et al. 2016), *Micromalthus debilis* LeConte, 1878 (Ruzzier and Colla 2019), *Ozognathus cornutus* (LeConte, 1859) (Bazzato et al. 2021), *Stator limbatus* (Horn, 1873) (Cocco et al. 2021) or *Conoderus posticus* (Eschscholtz, 1829) (Ruzzier et al. 2021b).

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Authors' contribution

Research conceptualization: ER, LB, DR; sample design and methodology: ER, LB, GC, DR; investigation and data collection: ER, LB, GC; data analysis and interpretation: ER, LB, GC, MF, DR; writing – original draft: ER, MF, DR; writing – review and editing: ER, LB, GC, MF, DR.

References

Allen E, Noseworthy M, Ormsby M (2017) Phytosanitary measures to reduce the movement of forest pests with the international trade of wood products. *Biological Invasions* 19: 3365–3376, https://doi.org/10.1007/s10530-017-1515-0

Bazzato E, Marignani M, Ancona C, Caria M, Cillo D, Serra E (2021) First record of *Ozognathus cornutus* (LeConte, 1859) (Coleoptera Ptinidae) from Sardinia, Italy. *Redia* 104: 89–96, https://doi.org/10.19263/REDIA-104.21.10

Cavaletto G, Faccoli M, Marini L, Spaethe J, Magnani G, Rassati D (2020) Effect of trap color on captures of bark-and wood-boring beetles (Coleoptera; Buprestidae and Scolytinae) and associated predators. *Insects* 11: 749, https://doi.org/10.3390/insects11110749

Colombari F, Martinez Sañudo I, Battisti A (2022) First report of the alien ambrosia beetle *Cnestus mutilatus* and further finding of *Anisandrus maiche* in the EPPO region (Coleoptera: Curculionidae: Scolytinae: Xyleborini). *EPPO Bulletin* 00: 1–5, https://doi.org/10.1111/epp.12840

Cocco A, Brundu G, Berquier C, Andreï-Ruiz MC, Pusceddu M, Porceddu M, Porceddu M, Podda L, Satta A, Petit Y, Floris I (2021) Establishment and new hosts of the non-native seed beetle *Stator limbatus* (Coleoptera, Chrysomelidae, Bruchinae) on acacias in Europe. *NeoBiota* 70: 167, https://doi.org/10.3897/neobiota.70.70441

Faccoli M, Campo G, Perrotta G, Rassati D (2016) Two newly introduced tropical bark and ambrosia beetles (Coleoptera: Curculionidae, Scolytinae) damaging figs (*Ficus carica*) in southern Italy. *Zootaxa* 4138: 189–194, https://doi.org/10.11646/zootaxa.4138.1.10

Gomez DF, Rabaglia RJ, Fairbanks KE, 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

Jucker C, Lupi D (2011) Exotic insects in Italy: an overview on their environmental impact. In: López-Pujol J (ed), The Importance of biological interactions in the study of biodiversity. InTech, pp 51–74, https://doi.org/10.5772/24263

Kirkendall LR, Faccoli M (2010) Bark beetles and pinhole borers (Curculionidae, Scolytinae, Platypodinae) alien to Europe. *ZooKeys* 56: 227–251, https://doi.org/10.3897/zookeys.56.529

Lantschner MV, Corley JC, Liebhold AM (2020) Drivers of global Scolytinae invasion patterns. *Ecological Applications* 30: e02103, https://doi.org/10.1002/eap.2103

Mandelshtam MY, Yakushkin EA, Petrov AV (2018) Oriental ambrosia beetles (Coleoptera: Curculionidae: Scolytinae): new inhabitants of Primorsky krai in Russia. *Russian Journal of Biological Invasions* 9: 355–365, https://doi.org/10.1134/S2075111718040082

Marchioro M, Battisti A, Faccoli M (2020a) Light traps in shipping containers: A new tool for the early detection of insect alien species. *Journal of Economic Entomology* 113: 1718–1724, https://doi.org/10.1093/jee/toaa098

Marchioro M, Rassati D, Faccoli M, Van Rooyen K, Kostanowicz C, Webster V, Mayo P, Sweeney J (2020b) Maximizing bark and ambrosia beetle catches in trapping surveys for longhorn and jewel beetles. *Journal of Economic Entomology* 113: 2745–2757, https://doi.org/10.1093/jee/toaa181

Martynov VV, Nikulina TV (2016) New invasive phytophagous insects in woods and forest plantings of Donbass. *Caucasian Entomological Bulletin* 12: 41–51, https://doi.org/10.23885/1814-3326-2016-12-1-41-51

Miller DR, Crowe CM, Sweeney JD (2020) Trap height affects catches of bark and woodboring beetles (Coleoptera: Curculionidae, Cerambycidae) in baited multiple-funnel traps in Southeastern United States. *Journal of Economic Entomology* 113: 273–280, https://doi.org/10.1093/jee/toz271

Nikulina T, Mandelshtam M, Petrov A, Nazarenko V, Yunakov N (2015) A survey of the weevils of Ukraine. Bark and ambrosia beetles (Coleoptera: Curculionidae: Platypodinae and Scolytinae). *Zootaxa* 3912: 1–61, https://doi.org/10.11646/zootaxa.3912.1.1

Pureswaran D, Meurisse N, Rassati D, Liebhold AM, Faccoli M (2022) Climate change and invasion by non-native bark and ambrosia beetles. In: Hofstetter RW, Gandhi K (eds), Bark beetle management, ecology and climate change. Academic Press, pp 3–30, https://doi.org/10.1016/B978-0-12-822145-7.00002-7

Poland TM, Rassati D (2019) Improved biosecurity surveillance of non-native forest insects: a review of current methods. *Journal of Pest Science* 92: 37–49, https://doi.org/10.1007/s10340-018-1004-y

Rabaglia R, Vandenberg N, Acciavatti R (2009) First records of *Anisandrus maiche* Stark (Coleoptera: Curculionidae: Scolytinae) from North America. *Zootaxa* 2137: 23–28, https://doi.org/10.11646/zootaxa.2137.1.2

Rabaglia RJ, Cognato AI, Hoebeke ER, Johnson CW, LaBonte JR, Carter ME, Vlach JJ (2019) Early detection and rapid response: a 10-year summary of the USDA Forest Service program of surveillance for non-native bark and ambrosia beetles. *American Entomologist* 65: 29–42, https://doi.org/10.1093/ae/tmz015

Ranger CM, Schultz PB, Frank SD, Reding ME (2019) Freeze stress of deciduous trees induces attacks by opportunistic ambrosia beetles. *Agricultural and Forest Entomology* 21: 168–179, https://doi.org/10.1111/afe.12317

Rassati D, Faccoli M, Petrucco Toffolo E, Battisti A, Marini L (2015) Improving the early detection of alien wood-boring beetles in ports and surrounding forests. *Journal of Applied Ecology* 52: 50–58, https://doi.org/10.1111/1365-2664.12347

Rassati D, Lieutier F, Faccoli M (2016) Alien wood-boring beetles in Mediterranean regions. In: Paine TD, Lieutier F (eds), Insects and diseases of Mediterranean forest systems, Springer, Dordrecht, pp 293–327, https://doi.org/10.1007/978-3-319-24744-1_11

Ratti E (2007) Coleotteri alieni in Italia / Alien Coleoptera in Italy. Vers. 2007-05-25 https://msn.visitmuve.it/it/ricerca/settori/entomologia/progetti/coleotteri-alieni-in-italia-1957-2006/lista/ (accessed 15 December 2021)

Roques A (2010) Taxonomy, time and geographic patterns. Chapter 2. Alien terrestrial arthropods of Europe. *BioRisk* 4: 11–26, https://doi.org/10.3897/biorisk.4.70

Ruzzier E, Colla A (2019) *Micromalthus debilis* LeConte, 1878 (Coleoptera: Micromalthidae), an American wood-boring beetle new to Italy. *Zootaxa* 4623: 589–594, https://doi.org/10.11646/zootaxa.4623.3.12

Ruzzier E, Tomasi F, Poso M, Martinez-Sañudo I (2020a) *Archophileurus spinosus* Dechambre, 2006 (Coleoptera: Scarabaeidae: Dynastinae), a new exotic scarab possibly acclimatized in Italy, with a compilation of exotic Scarabaeidae found in Europe. *Zootaxa* 4750: 577–584, https://doi.org/10.11646/zootaxa.4750.4.8

Ruzzier E, Morin L, Glerean P, Forbicioni L (2020b) New and interesting records of Coleoptera from Northeastern Italy and Slovenia (Alexiidae, Buprestidae, Carabidae, Cerambycidae, Ciidae, Curculionidae, Mordellidae, Silvanidae). *The Coleopterists Bulletin* 74: 523–531, https://doi.org/10.1649/0010-065X-74.3.523

Ruzzier E, Galli A, Bani L (2021a) Monitoring exotic beetles with inexpensive attractants: a case study. *Insects* 12: 462, https://doi.org/10.3390/insects12050462

Ruzzier E, Tomasi F, Platia G, Pulvirenti E (2021b) Exotic Elateridae (Coleoptera: Elateroidea) in Italy: An Overview. *The Coleopterists Bulletin* 75: 673–679, https://doi.org/10.1649/0010-065X-75.3.673

Smith SM, Beaver RA, Cognato AI (2020) A monograph of the Xyleborini (Coleoptera, Curculionidae, Scolytinae) of the Indochinese Peninsula (except Malaysia) and China. *ZooKeys* 983: 1–442, https://doi.org/10.3897/zookeys.983.52630

Storer C, Payton A, McDaniel S, Jordal B, Hulcr J (2017) Cryptic genetic variation in an inbreeding and cosmopolitan pest, *Xylosandrus crassiusculus*, revealed using dd RAD seq. *Ecology and Evolution* 7: 10974–10986, https://doi.org/10.1002/ece3.3625

Sweeney JD, Silk P, Grebennikov V, Mandelshtam M (2016) Efficacy of semiochemical-baited traps for detection of Scolytinae species (Coleoptera: Curculionidae) in the Russian Far East. *European Journal of Entomology* 113: 84–97, https://doi.org/10.14411/eje.2016.010

Terekhova VV, Skrylnik YY (2012) Biological peculiarities of the alien for Europe *Anisandrus maiche* Stark (Coleoptera: Curculionidae: Scolytinae) bark beetle in Ukraine. *Russian Journal of Biological Invasions* 3: 139–144, https://doi.org/10.1134/S2075111712020105

Urvois T, Perrier C, Roques A, Sauné L, Courtin C, Li Y, Johnson AJ, Hulcr J, Auger-Rozemberg A-M, Kerdelhué C (2022) A first inference of the phylogeography of the worldwide invader *Xylosandrus compactus*. *Journal of Pest Science* 95: 1217–1231, https://doi.org/10.1007/s10340-021-01443-7

Wood S, Bright D (1992) A catalog of Scolytidae and Platypodidae (Coleoptera), part 2: taxonomic index. *Great Basin Naturalist Memoirs* 13: 1–1553

Young RG, Milián-García Y, Yu J, Bullas-Appleton E, Hanner RH (2021) Biosurveillance for invasive insect pest species using an environmental DNA metabarcoding approach and a high salt trap collection fluid. *Ecology and Evolution* 11: 1558–1569, https://doi.org/10.1002/ece3.7113