SEEFOR SOUTH-EAST EUROPEAN FORESTRY

OPEN ACCESS
ISSN 1847-6481
eISSN 1849-0891

PRELIMINARY COMMUNICATION

DOI: https://doi.org/10.15177/seefor.24-01

Damage to Sweet Chestnut Orchards in Croatia due to Invasive Alien Bark Beetle *Xylosandrus germanus*

Dario Ivić[1,*], Mladen Šimala[1]

(1) Croatian Agency for Agriculture and Food, Centre for Plant Protection, Gorice 68b, HR-10000 Zagreb, Croatia

*** Correspondence:** e-mail: dario.ivic@hapih.hr

Citation: Ivić D, Šimala M, 2024. Damage to Sweet Chestnut Orchards in Croatia due to Invasive Alien Bark Beetle *Xylosandrus germanus*. *South-east Eur for* 15(1): early view. https://doi.org/10.15177/seefor.24-01.

Received: 6 Nov 2023; **Revised:** 18 Dec 2023; **Accepted:** 30 Dec 2023; **Published online:** 28 Jan 2024

ABSTRACT

Black stem borer, *Xylosandrus germanus* (Coleoptera: Scolytinae), was first recorded in Croatia in 2009. Until now, the insect has been reported only as a part of ambrosia beetles entomofauna in oak stands (*Quercus robur* and *Quercus petraea*). In 2021, severe attack of ambrosia beetles causing tree decline and mortality have been observed in three orchards of hybrid sweet chestnut (*Castanea sativa* x *Castenea crenata*). Orchards near Topusko, Marija Bistrica and Vugrovec were inspected for the symptoms. Twenty-seven adult ambrosia beetle specimens were collected from eight samples of damaged sweet chestnut trees, and were identified according to their morphology. All 27 ambrosia beetles were morphologically identified as *X. germanus*. This is the first record of black stem borer causing damage on cultivated sweet chestnut in Croatia. Considering similar reports from Italy and Slovenia, *X. germanus* could be regarded as a new, potentially damaging pest in chestnut plantations.

Keywords: *Castanea sativa*; pest; ambrosia beetle; black stem borer

INTRODUCTION

Sweet chestnut (*Castanea sativa* Mill.) is a valuable tree species used in agriculture. In Europe, sweet chestnut is cultivated in various systems, from semi-natural forest stands to intensive orchards (Prgomet et al. 2013). Sweet chestnut trees cultivated in orchards are mostly hybrids between *C. sativa* and Asian species *Castanea crenata* Siebold & Zucc. or *Castanea mollissima* Blume (Prgomet et al. 2013). Today, several devastating diseases and pests threaten chestnut cultivation. Chestnut blight, caused by *Cryphonectria parasitica* (Murrill) M.E. Barr, continues to cause damage to native sweet chestnuts in forests, but it also attacks hybrids in orchards (Glavaš 1999, Jurc and Reščič 2013, Prgomet et al. 2013). Ink disease, caused by oomycetes *Phytophthora cambivora* (Petri) Buisman and *Phytophthora cinnamomi* Rands, has resurged in Europe at the end of 20th century (Vannini and Vettraino 2001). During the last decade, newly emerged fruit rot disease caused by *Gnomoniopsis smithogilvyi* L.A. Shuttlew., E.C.Y. Liew & D.I. Guest has caused substantial yield losses in some European countries (Visentin et al. 2012, Dennert et al. 2015, Ivić and Novak 2018). Oriental chestnut gall wasp (*Dryocosmus kuriphilus* Yasumatsu) has been considered as a damaging invasive alien chestnut pest in Europe, until the successful introduction of its natural enemy (Avtzis et al. 2019).

Numerous other invasive alien pests and pathogens emerge regularly in Europe, posing risks to European forestry, agriculture and natural environments (Bebber et al. 2014, Panzavolta et al. 2021). Black stem borer, *Xylosandrus germanus* (Blandford 1894, Coleoptera, Scolytinae), is one of such species. It is an ambrosia beetle originating from Japan (Dzurenko et al. 2021), recorded in Europe for the first time in Germany in 1952 (Groschke 1953). From the establishment period until now, *X. germanus* has become an economically relevant forest pest (Galko et al. 2019). Damage has been recorded on various broadleaf and conifer species (Graf and Manser 2000, Galko et al. 2019, Hauptman et al. 2019). In 2019, black stem borer was reported to occur in Croatia (Franjević et al. 2019). The insect has been caught in pheromone baited traps for ambrosia beetles, from 2009 to 2011. Its presence has been confirmed in lowland oak stands near Zagreb (Franjević et al. 2019).

While recognized mostly as a forest pest in Europe, *X. germanus* in the USA is also reported as a destructive pest

in apple orchards (Agnello et al. 2017) and in ornamental nurseries (Oliver and Mannion 2001). It shows a potential of polyphagous ambrosia beetles to adapt to different hosts, causing damage to forest, fruit or landscape trees.

In 2021, severe attacks of beetles were observed in three chestnut orchards, near Topusko, Marija Bistrica and Vugrovec (Zagreb). Since such heavy attacks on sweet chestnut have not been previously recorded, beetles were collected from infested trees and identified to the species level. The aim of the research was to identify beetles causing damage in sweet chestnut orchards.

MATERIALS AND METHODS

In the period from May to July 2021, three sweet chestnut producers observed extensive decline of trees in their orchards. Orchards were located near Topusko (Sisak-Moslavina County, 2.4 ha), Marija Bistrica (Krapina-Zagorje County, 0.7 ha) and Vugrovec (City of Zagreb, 0.2 ha) (Figure 1). Bouche de Betizac, a hybrid between *C. sativa* and *C. crenata*, was a dominant cultivar in all three orchards. In Topusko, cultivars Marsol and Maraval were also grown. The orchard in Topusko was four years old, while two smaller orchards in Marija Bistrica and Vugrovec were three years old. All three orchards were in the vicinity of forests.

Orchards were visually inspected during June and July 2021. Symptoms in all three orchards were similar. Numerous trees were obviously dead, not producing any new shoots. Some trees were declining, with dried branches and small, yellow leaves on other parts of the crown. On some trees, reddish patches of cankered tissue were visible on trunks, always with a small round hole in the middle. On others, rusty brown oozing flecks were evident, also with holes in the middle. Numerous holes were regularly noted at the base of the trunk, always accompanied with brownish exudates and oozing flecks. Certain holes on the trunk were filled with sawdust, indicating ambrosia beetles' attack. When outer layers of the bark were removed, numerous holes were evident in the xylem of infested trees (Figure 2).

Trunks of symptomatic trees were cut at nearly soil level to 1–1.5 m up to the trunk. Four trunk samples were collected at Topusko orchard, three samples at Marija Bistrica orchard, and one sample at Vugrovec orchard. Trunks were cut into smaller pieces, transported in plastic bags and analysed in the Centre for Plant Protection, Croatian Agency for Agriculture and Food in Zagreb. In the laboratory, trunks were carefully carved to catch and collect specimens of beetles inside. Some wood pieces were left in sealed plastic bags for two weeks, waiting for beetles to eventually come out of the wood. A total of 27 beetle specimens were collected.

Beetles were identified to the species level based on morphological characteristics of female adults, using classical identification method according to the key provided by Tuncer at al. (2017). Stereomicroscope Olympus SZX 7 was used for morphometry.

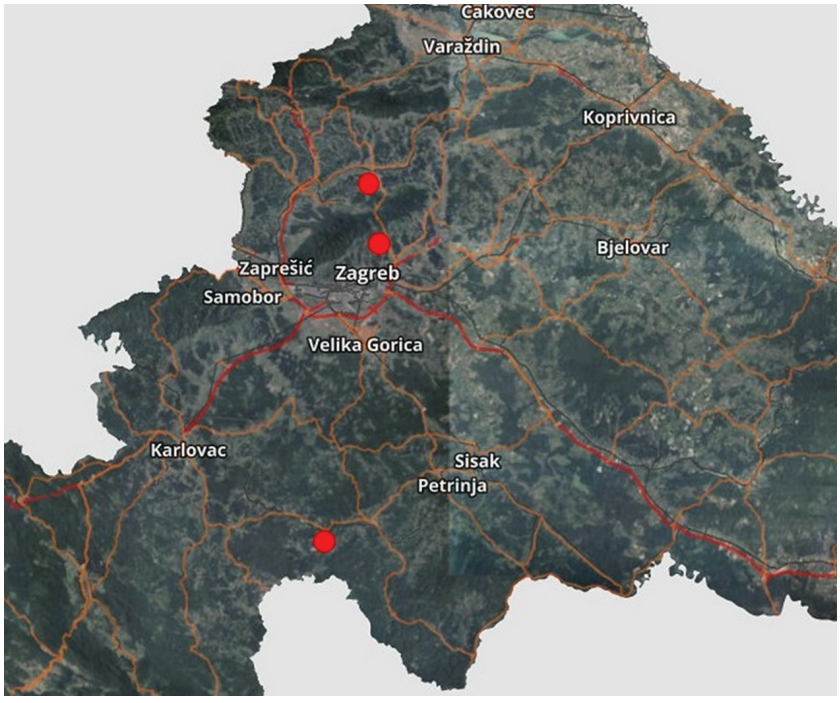

Figure 1. Location of sweet chestnut orchards inspected.

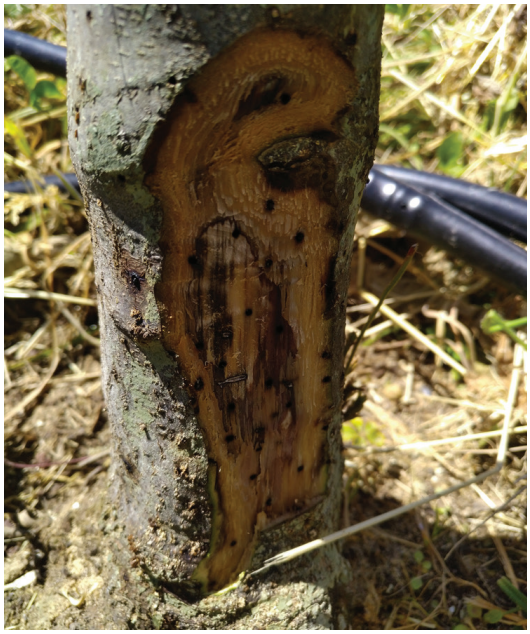

Figure 2. Holes inside the wood at the base of the trunk of sweet chestnut tree.

RESULTS AND DISCUSSION

All specimens of beetles collected from symptomatic chestnut samples were identified as black stem borer, *X. germanus*. So far, *X. germanus* has been reported in Croatia only on oaks (Franjević et al. 2019), and chestnut hybrids are recorded as new hosts of this polyphagous pest. Attacks of *X. germanus* on cultivated chestnut hybrids have been reported in Slovenia and Italy (Jurc and Reščič 2013, Dutto et al. 2018). In Slovenia, an attack was reported in experimental orchard of Bouche de Betizac, Maraval and Marsol varieties near Gorica in 2010 (Jurc and Reščič 2013). It was noted that black stem borer attacked trees from the inoculation site to the 1.3 m height of the trunk. Varieties affected and the patterns of the attacks were very similar to the ones observed in Topusko, Marija Bistrica and Vugrovec orchards. Bouche de Betizac variety has been proven as the most susceptible to *X. germanus* attacks (Jurc and Reščič 2013). In Italy, severe damage to chestnut plantations in Piedmont has been reported in 2018 (Dutto et al. 2018). Up to 25% tree mortality has been reported (Dutto et al. 2018). Bouche de Betizac variety was predominantly attacked, with up to 40 exit holes per dm^2 of the observed trunk (Dutto et al. 2018). European sweet chestnut has been reported as a natural host of *X. germanus* in Europe (Galko et al. 2019). However, the possible impact of *X. germanus* on European sweet chestnuts in forests remains unknown. Infestation of *X. germanus* on cultivated Chinese chestnut (*C. mollissima*) has been recorded in the USA (Oliver and Mannion 2001).

Considering the damage observed, as well as experience from Italy (Dutto et al. 2018) and Slovenia (Jurc and Reščič 2013), *X. germanus* may pose a new threat to sweet chestnut cultivation in Croatia. Along with *Cryphonectria parasitica*, *Phytophthora* species and *Dryocosmus kuriphilus*, this new invasive ambrosia beetle may severely limit the establishment and expansion of sweet chestnut plantations and negatively influence the health of the existing ones. It is also important to monitor the spread of this alien species into natural sweet chestnut forests in Croatia.

Damage to sweet chestnut orchards in Croatia due to black stem borer is a typical example of negative impacts associated with the invasive alien pests entering, establishing and spreading into new areas. Additionally, it is an example of a pest posing risk both to forestry and agriculture. As black stem borer is not regulated as a quarantine pest, it is assumed that its spread and population increase will continue. In such circumstances, efficient methods of *X. germanus* monitoring and management should be investigated and developed.

CONCLUSIONS

Black stem borer (*X. germanus*) has been identified as a causal agent of tree mortality in three sweet chestnut orchards in continental Croatia. Hybrid sweet chestnut (*C. sativa* x *C. crenata*), cultivated as fruit species, is a new host record for *X. germanus* in Croatia. Besides being a well-known forest pest, *X. germanus* may become an important pest of fruit crops.

Author Contributions

DI carried out the field work, collected samples and wrote the manuscript, MŠ carried out laboratory analysis and supported in drafting of the manuscript.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

REFERENCES

Agnello AM, Breth DI, Tee EM, Cox KD, Villani SM, Ayer KM, Wallis AE, Donahue DJ, Combs DB, Davis AE, Neal JA, English-Loeb FM, 2017. *Xylosandrus germanus* (Coleoptera: Curculionidae: Scolytinae) occurence, fungal associations, and management trials in New York apple orchards. *J Econ Entomol* 110(5): 2149-2164. https://doi.org/10.1093/jee/tox189.

Avtzis DN, Melika G, Matošević D, Coyle DR, 2019. The Asian chestnut gall wasp *Dryocosmus kuriphilus*: a global invader and a successful case of classical biological control. *J Pest Sci* 92: 107-115. https://doi.org/10.1007/s10340-018-1046-1.

Bebber DP, Holmes T, Gurr SJ, 2014. The global spread of crop pests and pathogens. *Global Ecol Biogeogr* 23(12): 1-10. http://dx.doi.org/10.1111/geb.12214.

Dennert FG, Broggini GAL, Gessler C, Storari M, 2015. *Gnomoniopsis castanea* is the main agent of chestnut rot in Switzerland. *Phytopathol Mediterr* 54(1): 199-211. http://dx.doi.org/10.14601/Phytopathol_Mediterr-14712.

Dutto M, Ferracini C, Faccoli M, 2018. Gravi infestazioni di *Xylosandrus germanus* (Blandford, 1894) (Coleoptera: Curculionidae, Scolytinae) in castagneti del Piemonte. *Forest@* 15: 112-116. http://dx.doi.org/10.3832/efor2860-015. [in Italian].

Dzurenko M, Ranger CM, Hulcr J, Galko J, Kaňuch P, 2021. Origin of non-native *Xylosandrus germanus*, an invasive pest ambrosia beetle in Europe and North America. *J Pest Sci* 94(2): 553-562. https://doi.org/10.1007/s10340-020-01283-x.

Franjević M, Šikić Z, Hrašovec B, 2019. First occurrence of *Xylosandrus germanus* (Blandford, 1894) – black stem borer in pheromone baited panel traps and population build up in Croatian oak stands. *Sumar List* 5-6: 215-219. https://doi.org/10.31298/sl.143.5-6.2.

Galko J, Dzurenko M, Ranger CM, Kulfan J, Kula E, Nikolov C, Zubrik M, Zach P, 2019. Distribution, habitat preference, and management of the invasive ambrosia beetle *Xylosandrus germanus* (Coleoptera: Curculionidae, Scolytinae) in European forests with an emphasis on the West Carpathians. *Forests* 10(1): 10. https://doi.org/10.3390/f10010010.

Glavaš M, 1999. Gljivične bolesti šumskog drveća. Sveučilište u Zagrebu, Šumarski fakultet, Zagreb, Croatia, 281 p. [in Croatian].

Graf E, Manser P, 2000. The imported Japanese scolytid beetle *Xylosandrus germanus*: biology and damage potential for stored round timber compared to *Xyloterus lineatus* and *Hylecoetus dermestoides*. *Schweiz Z fur Forstwes* 151(8): 271-281. https://doi.org/10.3188/szf.2000.0271.

Groschke F, 1953. Der "schwarze Nutzholzborkenkäfer", *Xylosandrus germanus* Blandf., ein neuer Schädling in Deutschland. *Zeitschrift für Angewandte Entomologie* 34: 297-302. [in German].

Hauptman T, Pavlin R, Grošelj P, Jurc M, 2019. Distribution and abundance of the alien *Xylosandrus germanus* and other ambrosia beetles (Coleoptera: Curculionidae, Scolytinae) in different forest stands in central Slovenia. *iForest* 12(5): 451-458. https://doi.org/10.3832/ifor3114-012.

Ivić D, Novak A, 2018. Gljive povezane s truleži plodova pitomog kestena, s prvim nalazom *Gnomoniopsis smithogilvyi* u Hrvatskoj. *Pomologia Croatica* 22(1-2): 13-22. [in Croatian].

Jurc M, Reščič M, 2013. Občutljivost sort evrojaponskega kostanja (*Castanea sativa* x *C. dentata*) na kostanjev rak (*Cryphonectria parasitica*), ambrozijskega podlubnika (*Xylosandrus germanus*) in konstanjevo šiškarico (*Dryocosmus kuriphilus*). *Novice iz varstva gozdov* 6: 12-13. [in Slovenian].

Oliver JB, Mannion CM, 2001. Ambrosia beetles (Coleoptera: Scolytidae) species attacking chestnut and captured in ethanol-baited traps in middle Tennessee. *Environ Entomol* 30(5): 909-918. https://doi.org/10.1603/0046-225X-30.5.909.

Panzavolta T, Bracalini M, Benigno A, Moricca S, 2021. Alien Invasive Pathogens and Pests Harming Trees, Forests, and Plantations: Pathways, Global Consequences and Management. *Forests* 12: 1364. https://doi.org/10.3390/f12101364.

Prgomet Ž, Prgomet I, Brana S, 2013. Pitomi kesten (*Castanea sativa* Mill.). Tiskara Sušak, Rijeka, Croatia, 135 pp. [in Croatian].

Tuncer C, Knizek M, Hulcr J, 2017. Scolytinae in hazelnut orchards of Turkey: clarification of species and identification key (Coleoptera, Curculionidae). *ZooKeys* 710: 65-76. https://doi.org/10.3897%2Fzookeys.710.15047.

Vannini A, VettrainoV AM, 2001. Ink disease in chestnuts: impact on the European chestnut. *For Snow Landsc Res* 76(3): 345-350.

Visentin I, Gentile S, Valentino D, Gonthier P, Tamietti G, Cardinale F, 2012. *Gnomoniopsis castanea* (sic) sp. nov. (Gnomoniaceae, Diaporthales) as a causal agent of nut rot of sweet chestnut. *J Plant Pathol* 94: 411-419.