BRIEF REPORT

First record of *Anoplophora glabripennis* (Coleoptera: Cerambycidae) in Montenegro

IGOR PAJOVIĆ*, DUŠAN PETRIĆ, ROMEO BELLINI***, LJILJANA PAJOVIĆ* AND STEVE QUARRIE******

*University of Montenegro, Biotechnical Faculty, Podgorica, Montenegro

***University of Novi Sad, Faculty of Agriculture, Novi Sad, Serbia*

****Centro Agricoltura Ambiente "G.Nicoli" (CAA), Crevalcore - Bologna, Italy*

*****University of Belgrade, Faculty of Biology, Belgrade, Serbia*

Corresponding author: *Igor Pajović, E-mail: pajovicb.igor@gmail.com*

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Abstract

The Asian longhorn beetle, *Anoplophora glabripennis*, native to China and Korea, was found for the first time in Montenegro in the beginning of August 2015. One adult female was captured on an infested willow tree, *Salix sp.* in a stream bed of village Lastva Grbaljska, in a semi-urban area of Budva municipality (N42°18'25.2"; E18°48'18.2"), Montenegro.

Identification of the pest was made on the basis of morphological characters as well as the position of symptoms observed on the tree. *Anoplophora glabripennis* is on the EPPO A1 List of Pests recommended for regulations of quarantine pests (version 2014-09) No 296. It is a quarantine pest for Europe according to Directive 2000/29/CE and should be treated under urgent measures in the EU by Commission Decision 1999/355. Montenegro has been identified as a high-risk part of Europe, with a pest risk index of 75 using McLeod's predictive model of pest risk assessment.

Keywords: Asian longhorn beetle, invasive insect, quarantine pest

Introduction

The Asian longhorn beetle *Anoplophora glabripennis* (Motschulsky 1853) is native to East Asia: China, DPR Korea and Republic of Korea (Lingafelter and Hoebeke 2002). In Asia it is also present in Turkey (Ayberk et al. 2014). The species is present in some states of the USA (according to USDA 2016) as well as in Canada (Ric et al. 2007). In Europe, it has been recorded in Italy (Maspero et al. 2007), Switzerland (Pluess 2013), France (with restricted distribution), England and Wales in the UK (according to EPPO 2006, 2011, 2014). The Asian longhorn beetle was also found in Croatia (Pernek 2012), the Czech Republic and Denmark (according to EPPO 2006, 2011, 2014). In the Netherlands (Loomans et al. 2013), Austria and Germany the species is under eradication and has been eradicated from Belgium (according to EPPO 2006, 2011, 2014).

Anoplophora glabripennis is xylophagous, and highly polyphagous, while in Europe it is recorded mainly on trees of *Populus* and *Salix* sp. Apart from weak and diseased trees, it can also attack healthy trees (Hu et al. 2009). Haack et al. (1996) give a list of the host's genera: *Acer, Alnus, Aesculus, Albizia, Betula, Fraxinus, Liriodendron, Malus, Melia, Morus, Platanus, Prunus, Pyrus, Robinia, Rosa, Sophora, Sorbus* and *Ulmus*. In previously infested sites of Europe, *A. glabripennis* was found on *Acer, Aesculus, Betula*, *Carpinus, Fagus*, *Platanus*, *Populus*, *Prunus* and *Salix* (Hérard et al. 2006).

In its native area, *A. glabripennis* develops within one or two years (Hua et al. 1992), and overwinters in the larval or pupal stage. Depending on the date of egg laying and climatic conditions, larval development lasts from 10 to 22 months. In China (the native range), adults emerge from mid-May through to early October (Li and Wu 1993), while in Southern England, predictions of the timing of adult emergence based on degree-day accumulation indicated that adults emerge late in the season, from August onwards (Straw et al. 2015). Emerged adults feed upon the tender bark of twigs and on leaves and petioles (Lingafelter and Hoebeke 2002, Ric et al. 2007).

The Asian longhorn beetle and other wood-boring insects represent the smallest group of invasive species in the USA, but are the most pestiferous. These species

annually generate more than USD 3.5 billion losses, primarily to local governments (USD 1.7 billion) and homeowners (USD 1.59 billion). Other costs have been reported by forest landowners (USD 130 million) and the Federal Government (USD 92 million) (Aukema et al. 2011). Larvae are most destructive, making galleries under the bark and tunnels in the wood. There is not much information available about the costs of ALB eradication programmes in Europe, but economic analysis of eradication program in north-east Italy clearly showed that benefits are much greater than costs (see e.g. Faccoli and Gatto 2015).

Here we report the first finding of *Anoplophora glabripennis* in Montenegro at the beginning of August 2015.

Materials and Methods

Willow trees (*Salix* sp.) were inspected for symptoms and the presence of adults in the coastal part of Montenegro in August 2015 during field studies on invasive mosquito species.

Identification of the pest was made on the basis of morphological characters (Samuelson 1965) and characteristic symptoms observed on the host *Salix sp.* tree (Hérard et al. 2009).

Results

On August 2015, one adult female was captured manually, on an infested *Salix* sp. growing in a stream bed in village Lastva Grbaljska, a semi-urban area of the municipality of Budva (N42°18'25.2"; E18°48'18.2"), Montenegro (Figure 1).

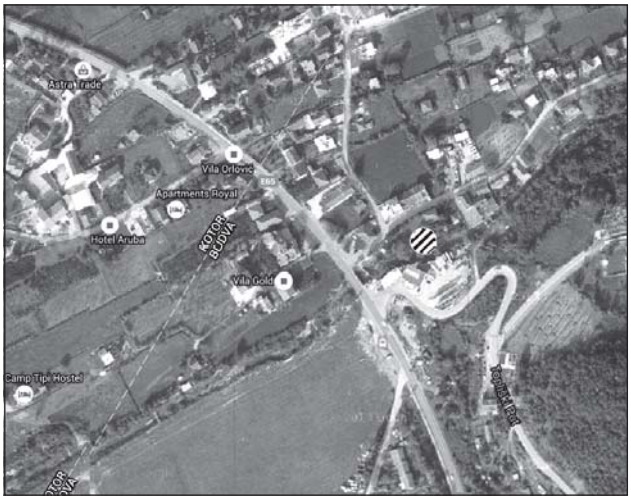

Figure 1. Location of pest finding, village Lastva Grbaljska, Budva, Montenegro

The female had the typical cerambycid shape, was 31 mm long with 11 segmented antennae, 1.3 times as long as the body. Antennal segments of the flagellum were whitish blue at the base. Black elytra scattered with white spots had a smooth basal surface (Figure 2). The scutellum was covered with dark setae (Figure 3).

Figure 2. Adult female of *A. glabripennis found in Montenegro*

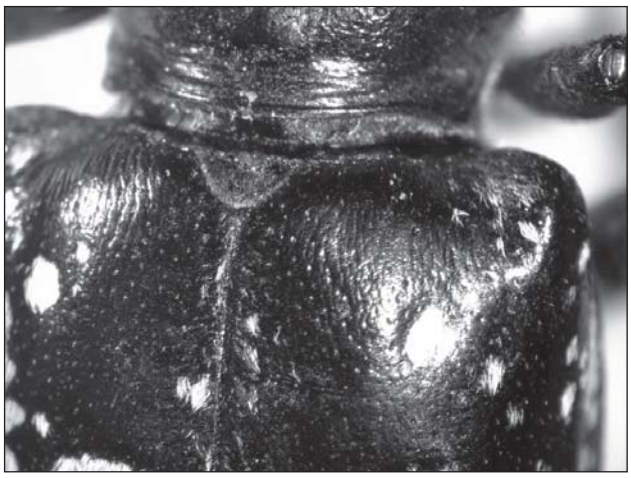

Figure 3. Taxonomic characters important for determination of *A. glabripennis* (voucher specimen is stored at the University of Montenegro – Biotechnical Faculty)

Identification was supported by the symptoms observed on the tree: sawdust around the tree and holes on the upper branches (Figure 4).

The record of *A. glabripennis* was reported to the official phytosanitary authorities of Montenegro (Pajović

Figure 4. Symptoms on upper branches of the infested tree

et al. 2015). This is the first record of *A. glabripennis* in Montenegro and voucher specimen is stored at the University of Montenegro – Biotechnical Faculty. Identification is confirmed by the Institute for Plant Protection and Environment – Belgrade, Serbia, using DNA bar coding PCR, we do not have any additional information is this finding referred to GenBank, the sequence number of the match, are the DNA extractions archived?

Discussion

Several outbreaks of *A. glabripennis* and *A. chinensis* have been detected in North America and Europe starting in the late 1990s. The outbreaks have always been located in urban areas, with serious damage to gardens, avenues, parks and urban forests (Bozić 2015).

In neighbouring Italy, *A. chinensis* was first detected in 2000 in the area of Milan (Colombo and Limonta 2001). During 2007, a new infestation by *Anoplophora* sp. was found north of Milan, within the *A. chinensis*-infested area. After identification, it was confirmed that the sampled adults belonged to *A. glabripennis* (Hérard et al. 2009).

The damage from these pests to commercial production is mainly due to the impact on trade in the wood of the host plants. Serious infestations in urban green areas can result in a reduction in biodiversity. In some municipalities of Italy, authorities are cutting infested trees and replacing them with less susceptible species; this process depleting the native flora by up to 30%. Potentially, *A. glabripennis* and *A. chinensis* could invade large forests, causing significant environmental damage. The financial cost of controlling these insects is high. From 2001 to 2013, the Lombardy Region felled over 25.000 trees and spent almost EUR 18 million (Bozić 2015). From 1994 to 2008, in the USA over 8,500 infested trees were cut down, amounting USD 3.5 billion (Haack et al. 2010)

By International Standards for Phytosanitary Measures (ISPM) 8 – determination of pest status in an area (FAO 2006), the record in Montenegro belongs to the category of an intercepted/detected pest species – individual appearance found on a willow tree (*Salix* sp.). The means of introduction of the species into Montenegro is not known. In other countries, it most frequently occurs by international trade/transport of pallets originating from the native range or from already infested European countries. Humans are the most important vectors for long distance dispersal of the ALB by accidental transport of contaminated wooden packing material or infested plants (Nowak et al. 2001). *Anoplophora glabripennis* is on the EPPO A1 List of pests recommended for regulations of quarantine pests (version 2014-09) No 296, and is a quarantine pest for Europe, according to Directive 2000/29/CE. Control/eradication of *A. glabripennis* is under urgent measures in the EU according to Commission Decision 1999/355.

The establishment of the species could have high negative impact on the population of broadleaf trees in Montenegro. The South of Montenegro is within the area of high risk for establishment (MacLeod et al. 2002) with index of 75. Likewise, ISPM (FAO 2006) estimates the risk for both the introduction and establishment of *A. glabripennis* in Southern Montenegro as high, because of the import of wooden packing material from Asia and a suitable climate.

Asian longhorn beetle was detected in that part of Montenegro, which is not important from the point of view of forests usage (only 0.59% of industrial tree production of the country) (Radojević 2014). As most of the forests are in North Montenegro this finding urges for intensified surveillance of this region in order to timely detect possible introduction of the species. Possibility for spreading the species through Montenegro, from south to north, is moderate, but reusing and redistribu-

tion of pallets is a common practice in the country and might spreading more likely.

In conclusion, after finding the establishment of the species in Southern Montenegro is very possible, but is not likely to be as destructive as is usually. The necessary eradication measures will be implemented in this event by the phytosanitary authorities of Montenegro. Above that is essential that Phytosanitary Directorate starts to raise public awareness of *A. glabripennis*. Public participation in sharing information could greatly help in the early detection of the species. For this, the Android-based tool for passive surveillance of invasive vector mosquitoes (KOMARAC® 2015), developed by the authors could provide valuable support.

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References

Ayberk, H., Ozdikmen, H. and Cebect, H. 2014. A serious pest alert for Turkey: a newly introduced invasive longhorned beetle, *Anoplophora glabripennis* (Cerambycidae: Lamiinae). *Florida Entomologist* 97(4): 1852-1855.

Aukema, J.E., Leung, B., Kovacs, K., Chivers, C., Britton, K.O., Englin, J., Frankel, S.J., Haight, R.G., Holmes, T.P., Liebhold, A.M., McCullough, D.G. and VonHolle, B. 2011. Economic Impacts of Non-Native Forest Insects in the Continental United States. *Plos One* 6(9): 1-7, DOI: 10.1371/journal.pone.0024587.

Božić, N. 2015. Twinning Project – Further strengthening of capacities of phytosanitary sector in the fields of plant protection products, plant health and seed and seedlings, including phytosanitary laboratories and phytosanitary inspections. EU-FITO-BiH. Available online at: http://www.eufitobih.eu/project/.

Colombo, M. and Limonta, L. 2001. *Anoplophora malasiaca* Thomson (Coleoptera Cerambycidae Lamiinae Lamiini) in Europe. *Bollettino di Zoologia agraria e di Bachicoltura*, Serie II 33(1): 65-68.

EPPO 2006. Distribution Maps of Quarantine Pests in Europe, *Anoplophora glabripennis*. Available online at: http://www.eppo.int/QUARANTINE/insects/*Anoplophora_glabripennis*/ANOLGL_ds.pdf.

EPPO 2011. PQR–EPPO database on quarantine pests. Available online at: http://www.eppo.int/DATABASES/databases.htm.

EPPO 2014. PQR-EPPO Plant Quarantine Data Retrieval system. Version of June 2017 (5.3.5, 2017-06-08). Paris, France: European and Mediterranean Plant Protection Organization. Available online at: http://www.eppo.int/DATABASES/pqr/pqr.htm.

FAO 2006. International standards for phytosanitary measures: ISPM No. 1, 24 pp. Available online at: http://www.fao.org/3/a-a0450e.pdf.

Faccoli, M. and Gatto, P. 2016. Analysis of costs and benefits of Asian longhorned beetle eradication in Italy. *Forestry* 89: 301–309.

Haack, R.A., Cavey, J., Hoebeke, E.R. and Law, K. 1996. *Anoplophora glabripennis*: A new tree-infesting exotic cerambycid invades New York. *Newsletter of Michigan Entomological Society* 41: 1–3.

Haack, R.A., Hérard, F., Sun, J. and Turgeon, J.J. 2010. Managing Invasive Populations of Asian Longhorned Beetle and Citrus Longhorned Beetle: A Worldwide Perspective. *Annual Review of Entomology* 55:521-546

Hérard, F., Ciampitti, M., Maspero, M., Krehan, H., Benker, U., Boegel, C., Schrage, R., Bouhot-Delduc, L. and Bialooki, P. 2006. *Anoplophora* species in Europe: infestations and management processes. *EPPO Bulletin* 36: 470-474.

Hérard, F., Maspero, M., Ramualde, N., Jucker, C., Colombo, M., Ciampitti, M. and Cavagna, B. 2009. *Anoplophora glabripennis* – Eradication programme in Italy. Available online at: http://www.eppo.int/QUARANTINE/special_topics/anoplophora_glabripennis/ANOLGL_IT.htm

Hu, J., Angeli, S., Schuetz, S., Luo, Y. and Hajek, A.E. 2009. Ecology and management of exotic and endemic Asian longhorned beetle *Anoplophora glabripennis*. *Agricultural and Forest Entomology* 11: 359–375. DOI: 10.1111/j.1461-9563.2009.00443.x.

Hua, L., Li, S. and Zhang, X. 1992. Coleoptera: Cerambycidae. In: Peng, J, Liu, Y (eds.): Iconography of forest insects, Hunan, China. Hunan Scientific and Technical Publishing House, Hunan, China, P. 467–524.

KOMARAC® 2015. Mobile phone application for surveillance of invasive and indigenous species. Available online at: http://project-lovcen.me/page.php?id=30. (in Montenegrin and in English)

Li, W. and Wu, C. 1993. Integrated management of longhorned beetles damaging poplar trees. *China Forest Press*, Beijing, China.

Lingafelter, S.W. and Hoebeke, E.R. 2002. Revision of the genus *Anoplophora* (Coleoptera: Cerambycidae). Entomological Society of Washington, Washington, D.C., USA. 236 pp.

Loomans, A., Wessels-Berk, B., Mentink, N., Copini, P., deHoop, M.B., Steeghs, M.H.C.G. and den Hartog, W.G.S.A. 2013. Import-inspections, surveys, detection and eradication of the longhorn beetles *Anoplophora chinensis* and *A. glabripennis* in The Netherlands. In: Proceedings of an International Symposium "Anoplophora chinensis and Anoplophora glabripennis: new tools for predicting, detecting and fighting", ERSAF, 9-11 May 2012, Milan, Italy. *Journal of Entomological and Acarological Research*; 45(s1): 8. Available online at: https://www.researchgate.net/publication/283418515_Import-inspections_surveys_detection_and_eradication_of_the_longhorn_beetles_Anoplophora_chinensis_and_A_glabripennis_in_The_Netherlands

MacLeod, A., Evans, H. and Baker, R.H. 2002. An analysis of pest risk from an Asian longhorn beetle (*Anoplophora glabripennis*) to hardwood trees in the European community. *Crop Protection* 21: 635–645.

Maspero, M., Jucker, C. and Colombo, M. 2007. First record of *Anoplophora glabripennis* (Motschulsky) (Coleoptera Cerambycidae Lamiinae Lamiini) in Italy. *Bollettino di Zoologia agraria e di Bachicoltura*, Serie II 39(2): 161-164.

Nowak, D.J., Pasek, J.E., Sequeira, R.A., Crane, D.E. and Mastro, V.C. 2001. Potential effect of *Anoplophora glabripennis* (Coleoptera: Cerambycidae) on urban trees in the United States. *Journal of Economic Entomology* 94(1): 116-122.

Pajović, I., Petrić, D., Bellini, R. and Pajović, Lj. 2015. Izvještaj o prvom nalazu štetočine sa EPPO A1 liste. [A report on the first interception of pest from the EPPO A1 list.]. Unpublished scientific or technical document; Personal communication, unpublished. Fitosanitarna uprava. Podgorica, Crna Gora/Montenegro. 5 pp. (in Serbo-Croatian)

Pernek, M. 2012. Survey of two Asian Longhorn Beetles (*Anoplophora chinensis* and *A. glabripennis*) in Croatian Forests. *Radovi Hrvatskog šumarskog instituta* 44(2): 135-142.

Pluess, T. 2013. First findings of *Anoplophora glabripennis* in Switzerland. In: Proceedings of an International Symposium "Anoplophora chinensis and Anoplophora glabripennis: new tools for predicting, detecting and fighting", ERSAF, 9-11 May 2012, Milan, Italy. *Journal of Entomological and Acarological Research*, 45(s1): 21.

Radojević, G. 2014. Statistical Yearbook. Statistical Office of Montenegro – MONSTAT, Podgorica, Montenegro. 274 pp. ISSN: 2336-9698. Available online at: https://www.monstat.org/userfiles/file/publikacije/godisnjak%202014/GODISNJAK%202014.pdf (in Montenegrin and in English)

Ric, J., deGroot, P., Gasman, B., Orr, M., Doyle, J., Smith, M.T., Dumochel, L., Scarr, T. and Turgeon, J.J. 2007. Detecting signs and symptoms of Asian longhorned beetle injury. Training Guide. Natural Resources Canada, Great Lakes Forestry Centre, Sault Ste. Marie, Ontario, Canadian Food Inspection Agency. 118 p. (Canadian Forest Service Publications). Available online at: https://cfs.nrcan.gc.ca/publications?id=26860

Samuelson, A. 1965. The Cerambycidae (Coleopt.) of the Ryukyu Archipelago II, Lamiinae. *Pacific Insects* 7(1): 82-130.

Straw, N.A., Tilbury, C., Fielding, N.J., Williams, D.T. and Cull, T. 2015. Timing and duration of the life cycle of Asian longhorn beetle *Anoplophora glabripennis* (Coleoptera: Cerambycidae) in southern England. *Agricultural and Forest Entomology,* 17(4): 337–450. DOI: 10.1111/afe.12120

USDA 2016. The Asian longhorned beetle: an invasive tree pest. 16 pp. (Animal and Plant Health Inspection Service, Program Aid No. 2182) Available online at: https://www.aphis.usda.gov/publications/plant_health/2016/book-alb.pdf.

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