Preparedness in biological control of priority biosecurity threats

Two-lined Chestnut Borer, *Agrilus bilineatus* (Weber)

Introduction

The two-lined chestnut borer *Agrilus bilineatus* Weber (Coleoptera: Buprestidae) is native to eastern areas of North America (Canada and the USA) where native oak (*Quercus*) and chestnut (*Castanea*) exist (EPPO, 2019). It is absent elsewhere in the world, except in Turkey, where it is now considered established following four reports of this species close to, and to the east of, Istanbul (EPPO, 2019). It is predicted to reach neighbouring Bulgaria by 2029 (EPPO, 2019).

Two-lined chestnut borer is a pest of the American chestnut (*Castanea dentata*) and species of oak (*Quercus* spp.). The larvae tunnel and feed in the cambium layer under the bark, resulting in girdling of the tree and death in one to four years depending on the level of outbreak (EPPO, 2019).

In North America it is usually a secondary pest; native *Castanea* and *Quercus* are generally only susceptible if they have already been weakened by various stresses (e.g. drought, disease), but healthy trees are attacked in outbreak years (EPPO, 2019). The European *Q. robur* is known to be highly susceptible to attack, with even healthy trees succumbing, and other European species of *Quercus* as well as the European sweet chestnut *Castanea sativa* are likely to be susceptible although the extent to which *C. sativa* is susceptible needs confirming (EPPO, 2019).

Species of *Quercus* and *C. sativa* are present throughout Europe and the EPPO region. This widespread distribution of host trees, and the fact that climatic conditions are not considered limiting for the two-lined chestnut borer, means that the impact of this pest is likely to be very high if it should invade and establish in these regions (EPPO, 2019).

History of classical biological control against *Agrilus bilineatus*

There is no history of classical biological control against two-lined chestnut borer.

Classical biological control is not applicable in North America where the pest exists as a native species.

It is an invasive species in Turkey, but the populations are at low levels, and no damage is recorded so far, so no control measures have been taken (EPPO, 2019).

Most promising natural enemies for classical biological control

The parasitoid *Phasgonophora sulcata* (Hymenoptera: Chalcididae) is described as the main, or most common, larval parasitoid of *A. bilineatus* in Wisconsin, New York and Pennsylvania (Cote & Allen, 1980; Haack *et al.*, 1981). Haack *et al.* (1981) reports a rate of parasitism of 10.5%. *Phasgonophora sulcata* is a solitary endoparasitoid (Roscoe *et al.*, 2016) found in North America (Canada and the USA) and is not reported as present elsewhere (CABI, 2019). It could therefore be considered as a potential classical biological control agent for *A. bilineatus* if the pest were to invade and establish elsewhere. However, *P. sulcata* is not specific to the two-lined chestnut borer and is known to attack other North American species of *Agrilus* (*A. liragus*, *A. anxius*), and the invasive emerald ash borer (EAB; *Agrilus planipennis*), as well as other buprestid species

(*Chrysobothris femorata*, *Chyrsobothris sexsignata*) and lepidopteran species (*Papilio* sp., *Antheraea polyphemus*) (Noyes, 2019).

Other natural enemies for classical biological control

Although several other natural enemies are reported for *A. bilineatus* in its native North America, little information exists on the nature of their associations with the pest. These include braconid parasitoid species belonging to *Atanycolus* (e.g. *A. simplex*, *A. cappaerti*), *Spathius*, *Leluthia* and *Wroughtonia* (e.g. *W. ligator*), *Eurytoma rosae* (Eurytomidae) as well as the egg parasitoid *Trichogramma* (Trichogrammatidae) (EPPO, 2019; Taylor *et al.*, 2012; references within). However, rates of parasitism are either not reported or very low. Hence none of these species are likely to be suitable agents for consideration in classical biological control programmes should the need arise.

Predators include various species of Coleoptera such as *Adelocera* (Elateridae), *Phyllobaenus* (e.g. *P. verticalis*) (Cleridae), *Cymatodera* (e.g. *C. bicolor*) and Tenebroides (e.g. *T. corticalis*) (Trogossitidae) as well as the predatory ground-nesting wasp *Cerceris fumipennis* (Hymenoptera: Crabronidae) (CABI, 2019; EPPO, 2019; references within). Little information exists on the nature of their association with *A. bilineatus* and further information would be required to ascertain whether any of these would be suitable for release in classical biological control programmes should *A. bilineatus* invade other regions.

References

1. CABI (2019) Invasive Species Compendium Datasheets. https://www.cabi.org.
2. Cote WA, Allen DC (1980) Biology of two-lined chestnut borer, *Agrilus bilineatus*, in Pennsylvania and New York. Annals of the Entomological Society of America 73:409-413.
3. EPPO (2019) Pest risk analysis for *Agrilus bilineatus*. EPPO, Paris. Available at https://gd.eppo.int/taxon/AGRLBL/documents.
4. Haack RA, Benjamin DM, Schuh BA (1981) Observations of the biology of *Phasgonophora sulcata* (Hymenoptera: Chalcididae), a larval parasitoid of the twolined chestnut borer, *Agrilus bilineatus* (Coleoptera: Buprestidae), in Wisconsin. The Great Lakes Entomologist 14(2): 113-116.
5. Noyes JS (2019) Universal Chalicidoidea Database. World Wide Web electronic publication. http://www.nhm.ac.uk/chalcidoids.
6. Roscoe LE, Lyons DB, Smith SM (2016) Observations on the life-history traits of the North American parasitoid *Phasgonophora sulcata* Westwood (Hymenoptera: Chalcididae) attacking *Agrilus planipennis* (Coleoptera: Buprestidae) in Ontario, Canada. The Canadian Entomologist 148(3): 294-306.
7. Taylor PB, Duan JJ, Fuester RW, Hoddle M, Van Driesche R (2012) Parasitoid guilds of *Agrilus* woodborers (Coleoptera: Buprestidae): Their diversity and potential for use in biological control. Psyche Article no. 813929.