Saperda candida **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Insecta	Coleoptera	Cerambycidae

Common name

Synonym

Similar species

Summary

The round-headed apple-tree borer (Saperda candida) is a longhorn beetle native to the Eastern United States and Canada. It was found introduced in Germany in 2008 but has been eradicated since. Because it spends most of its lifecycle inside of tree bark, it poses a high risk of invasion through the import of wood-derived products. This boring beetle uses healthy Rosaceae plants as hosts, often killing the tree during its two to three-year development by girdling it and making it susceptible to fungal infections.

view this species on IUCN Red List

Species Description

This beetle is 15-20cm long. It has an olive brown coloration with two longitudinal white stripes running along the length of its body on the dorsal side. The antennae, legs and head are white-gray. Its entire body is covered in fine hairs. The antennae are stout and have multiple segments, and are approximately of equal length to its body (Agnello, 1999). Males and females exhibit dimorphism, where females have shorter antennae ("ROUNDHEADED APPLETREE BORER", N.B). The eggs are light cream in color and darken to a rust-brown over time. They are 3-4mm long and about 1mm wide. The larvae are cream colored and measure 3-4mm when they hatch. A fully-grown grub can be 25mm long. Their head is brown, and they have black mandibles. The first thoracic segment is broader than the rest of the body and has a patch of brownish tubercles on the dorsal side. The 13 segments are divided by deep constrictions, and most of them have large, oval spiracles on either side (Agnello, 1999; Becker, 1918).

Notes

Wood-derived products, including packaging, palettes, and plants for planting, constitute the major invasive pathway for this species (Cocquempot & Lindelöw, 2010). Their hidden nature makes them difficult to detect in ornamental trees imported from areas where the pest occurs (Pests, 2014). The adult beetles can fly up to 200m from their original host tree, although often they are less mobile. This means that the risk of natural spread is low if infected areas are demarcated and quarantined (Eyre et al., 2013). They are predated upon by woodpeckers, which target the pupae. Grass spiders (Agelena naevia), carpenter ants (Camponotus) and carabid beetles have also been recorded to attack adults. (Hess, 1940) Currently in the EPPO alert list of potential invasive species in the EPPO region ("Saperda Candida Coleoptera", 2008).

Lifecycle Stages
Between May and September, females cut slits into healthy trees, near the base, and deposit a single egg near the xylem. The peak egg-laying time occurs in June (“Apple borers”, 2011). She cements the egg in place with a gummy secretion. These hatch between 10 and 25 days later, after which they feed under the bark for a year and then proceed to bore into the wood (“ROUNDHEADED APPLETREE BORER”, N.B; Hess, 1940). The grub moves through the tree, forming long galleries in which it overwinters (“ROUNDHEADED APPLETREE BORER”, N.B). The full development of the grub takes two to three years in North America, depending on the environment, during which it passes through six instars. After this, the grub moves close to the surface of the tree, where it pupates. This occurs between April and May. The pupal stage can last between 19 and 30 days. Adults remain in the pupal chamber for about 11 days before emerging. They then leave the host at night, through round, pencil-sized holes at the base of infested trees, while hiding during the day. They do this for about two to three weeks in mid-June (Agnello, 1999). During this time, males seek out females near feeding sites, which are around future larval hosts (Hanks, 1999). Because populations are not synchronized, adults are produced each year (“MINI DATA SHEET”, 2010).

Habitat Description
The natural habitat of the beetle is in eastern North America (Pests, 2014). It has been reported in elevations as high as 914m (Hess, 1940).

Reproduction
Mating occurs about one week after the adults emerge from the pupae. Females can live 40 to 50 days, and they lay 30 to 40 individual eggs during June and July (Agnello, 1999, Kehlenbeck & Schrader, 2009).

Nutrition
S. candida is a phytophagous woodboring beetle that uses Rosaceae plants as hosts (Cocquempot & Lindelöw, 2010). Its preferred host is the apple tree (Malus), but it also infects cherry, peach, plum (Prunus), quince (Cydonia), pear (Pyrus), mountain ash, beam-tree, rowan berry (Sorbus), serviceberry, shadbush (Amelanchier), Cotoneaster, hawthorn (Crataegus), chokeberry, black mountain ash (Aronia), Amydalus, Araria, and Pyracantha (Pest Risk Analsysis, 2010). The grubs feed on the cambium (inner bark) of the tree, while the adults feed on the leaves, twigs and fruit of the host plant (Agnello, 1999).

General Impacts
S. candida was considered a major threat to orchards in the US and Canada during the 1900s, and it has been ranked 39 in the 100 Worst Alien Species compiled by Nentwig et al., 2018. The burrowing activity of the grub can kill a host tree by destroying its vasculature (Colman’s Rural World 1866), often by girdling them (“Apple-Tree Borers”, New York Evangelist). They mostly target trees aged between 3-10 years old, where around four grubs can commonly be found (Becker, 1918). Their damage can be compounded through fungal infections, which gain access to the tree through the injuries inflicted by the grub (Agnello, 1999). Collar-blight (Erwinia amylovora), for example, has been associated to injuries from S. candida in the past (Hess, 1940). Lastly, weakened trees become more susceptible to wind breakage (“MINI DATA SHEET”, 2010).

Management Info
While S. candida can be a major pest if not managed, as it was in the 1900s in the US and Canada, multiple management techniques working together have maintained the pest under control in these countries (Kehlenbeck & Schrader, 2009). Methods can be used both to prevent the infestation of trees and to treat infested trees so as to prevent further infestations. Monitoring - This can be difficult because most of the insect's life is spent inside host trees ("MINI DATA SHEET", 2010) - Adults are inspected for from June onward, near host trees. - Bark cracks and frass (sawdust like material) accumulating in piles at the bases of trees from June to September can reveal the presence of grubs ("ROUNDHEADED APPLETREE BORER", N.B, Agnello, 1999). The borer also causes discoloration of the bark above it, which can reveal its presence (Wilson, 1909). - Infested trees can appear sickly, with sparse, pale-colored foliage (Agnello, 1999). However, young trees can show excessive blooming when infested, after which they die in the course of fruit ripening (Pests, 2014). Cultural Practices - One aspect of mitigating the effects of the pest is to maintain the orchard trees as healthy as possible to reduce their vulnerability ("ROUNDHEADED APPLETREE BORER", N.B). - Removing wild host plants from the vicinity of orchards also reduces infections by ensuring no nearby populations are present, since the beetle can normally only disperse as far as 200m (Eyre et al., 2013). - Keeping the base of trees free from weeds and other growth makes detection of borers easier and exposes them further to predators (Agnello, 1999). - Heavily infested trees should be fully removed and burned to prevent the grubs from completing their development (Agnello, 1999). - Infested areas can be quarantined for rapid eradication of the pest in invasive ranges ("Final Report of", 2014). Foliar Sprays - Pesticides have been used to control the adult population during their active periods, particularly in June (Agnello, 1999). Regular use of Chlorpyrifos in the USA keeps the pest under control (Eyre et al., 2013). - Substances used in the US registered in the EU include: Acetamiprid, Chlorpyrifos, Cyfluthrin, Dimethoate, Esfenvalerate, Imidacloprid, Indoxacarb, Kaolin (which can be used in organic orchards), Lambda-cyhalothrin, Methomyl, Phosmet, Thiacloprid, Thiamethoxam ("Pest Risk Analysis", 2010). Surface Deterrents - These are mixtures applied onto the tree bark to deter the females from oviposition (Agnello, 1999). Soaps and alkaline washes have been used in the early season of Adult activity (late May), which also kill eggs ("Apple-Tree Borers", New York Evangelist). Oviposition Barriers - Different protective coverings can be wrapped around the base of the trunk, up to around 60cm, with the bottom underneath soil to prevent access through burrowing. These include tarred paper ("Apple-Tree Borers", New York Evangelist), mosquito netting, fine mesh hardware cloth, tree wrap, cotton batting and newspaper (Agnello, 1999). These prevent females from gaining access to the bark to lay their eggs. Worming - Infested trees can also be treated through manual removal of the grubs. This is labor-intensive but can be effective. The grubs can be detected during bloom and in September by pinholes in the bark surface containing a sawdust-like excrement known as frass. The frass can often be seen at the foot of the tree, as it falls from the hole. A knife can be used to cut through the bark at these points to expose the gallery, and a wire can be used to hook and remove the grub from the tree. - Alternatively, if the grub cannot be reached, a mixture of pyrethrum in ethanol, or para-dichlorobenzene, in cottonseed oil has been used in the past to kill the grub through injections with a grease gun (Agnello, 1999). - Becker, 1918, recommends worming during late July and August to kill newly hatched grubs, with a second round in spring to remove missed grubs.

Pathway
The introduction is speculated to have come with Sorbus intermedia trees planted in 1990 that may have originated in North America ("Final Report of", 2014).Thought to have arrived through shippments of apple stock (Hess, 1940).

Principal source: Agnello, A. M. (1999). Apple-Boring Beetles. Eyre, D., Anderson, H., Baker, R., & Cannon, R. (2013). Insect pests of trees arriving and spreading in Europe. Outlooks on Pest Management, 24(4), 176-180. FINAL REPORT OF AN AUDIT CARRIED OUT IN GERMANY FROM 10 TO 20 JUNE 2014 IN ORDER TO EVALUATE THE SITUATION AND CONTROLS FOR LONGHORN BEETLES (CERAMBYCIDAE). (2014) European Commission Health and Consumers Directorate-General. Hess, A. D. (1940). The Biology and Control of the round-headed Apple-tree Borer, Saperda candida Fabricius. The Biology and Control of the round-headed Apple-tree Borer, Saperda candida Fabricius., (688). Pest Risk Analysis for Saperda candida. (2010). European and Mediterranean Plant Protection Organisation

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