EPPO Datasheet: *Apriona rugicollis*

Last updated: 2020-09-10

IDENTITY

Preferred name: *Apriona rugicollis*
Authority: Chevrolat
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Cerambycidae
Other scientific names: *Apriona gressitti* Gilmour, *Apriona japonica* Thompson, *Apriona plicicollis* Motschulsky
Common names: mulberry Longhorn beetle, mulberry borer
view more common names online...
EPPO Categorization: A1 list
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EU Categorization: Quarantine pest ((EU) 2019/2072 Annex II A)
EPPO Code: APRIJA



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Notes on taxonomy and nomenclature

Until 2011 *Apriona rugicollis* was considered a synonym of *Apriona germari*, but it has been resurrected as a distinct species by Jiroux (2011). *Apriona japonica*, *A. gressitti*, and *A. plicicollis* have all been synonymised with *A. rugicollis*. This alters the understanding of the distribution of *A. rugicollis* and *A. germari*, and there may be some uncertainty about the identity of earlier records, interceptions, and literature referring to these species, so where the original specimens are not available it is important to determine their geographic origin. Jiroux (2011) also proposed the creation of two subspecies: *A. rugicollis* subsp. *nobuoi* (= *A. japonica* subsp. *nobuoi* - present in Okinawa, Japan) and *A. rugicollis* subsp. *yayeyamai* (= *A. yayeyama* - present in Ishigakishima island, Ryukyu archipelago, Japan).

HOSTS

A. rugicollis is a polyphagous longhorn beetle, infesting a range of broadleaf tree species, principally from the Moraceae, Salicaceae, and Ulmaceae families, including economically important species grown for fruit, timber, bonsai cultivation, and silkworm cultivation (mulberry). Due to previous uncertainty over the taxonomy of the *Apriona germari* species group, many host lists include host species of both *A. rugicollis* and *A. germari*, so it is important to understand the distribution of the different species, and that of the host trees. In Japan, *A. rugicollis* (= *A. japonica*) is recorded as having 49 host species in 19 families (Esaki, 2007a). Some hosts appear to be preferred by adults for maturation feeding, for example those feeding on poplar have considerably shorter life-spans and lower fecundity than adults feeding on paper mulberry or white mulberry (Gao *et al.*, 1994; Shao, 2007).

Host list: *Broussonetia papyrifera*, *Carya illinoinensis*, *Celtis sinensis*, *Crataegus*, *Enkianthus perulatus*, *Eriobotrya japonica*, *Fagus crenata*, *Ficus carica*, *Malus*, *Morus alba*, *Morus indica*, *Populus tomentosa*, *Populus x canadensis*, *Populus*, *Robinia pseudoacacia*, *Salix babylonica*, *Zelkova serrata*

GEOGRAPHICAL DISTRIBUTION

Note: *Apriona rugicollis* is notably more widely distributed in China than *A. germari*, with a more northerly distribution.



Asia: China (Anhui, Beijing, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangxi, Qinghai, Shaanxi, Shandong, Sichuan, Xizhang, Zhejiang), Japan (Honshu, Kyushu, Shikoku), Korea, Democratic People's Republic of, Korea, Republic of, Taiwan

BIOLOGY

Due to the broad geographic distribution of *A. rugicollis*, development rates vary considerably according to average local temperatures, and generation time varies between 1 year in the southern part of its range to 3 years in the north. Adult insects typically emerge between late May and August, but emergence is not synchronized and may continue into late summer. Adults feed on the tender phloem tissue of stems and branches of their hosts, and are most active at night. Mating occurs around 10 days after emergence. Females lay 1-2 eggs each day into oviposition grooves which they gnaw on stems and branches of typically 1-10 cm in diameter. Oviposition tends to occur at a height between ground level and 2 m, and eggs develop for around 10-20 days. Newly hatched larvae initially bore into the sapwood, and then excavate deeper galleries into the xylem, making holes at intervals to the stem surface from which frass is expelled. Larval feeding typically progresses downwards; galleries may extend over 1m in length and extend as far as the roots. Larvae may complete as many as 11 instars, until a pupal cell packed with fibrous shreds of wood is prepared higher up in the gallery. Exposure to a period of cold temperature terminates larval diapause and triggers pupation; the pupae developing for approximately 20 days. The new adult then emerges from a circular emergence hole of 13 mm or more in diameter (Gressit 1942; Yoon & Mah 1999; Esaki 2001, 2006, 2007a).

DETECTION AND IDENTIFICATION

Symptoms

Infested plants may bear ‘horseshoe’-shaped oviposition scars made by the female as she inserts an egg into the phloem of the stem or branches, and adult feeding damage may be apparent as irregular scars in the tender bark, and as damaged small branches. Plants with burrowing larvae present may display a series of circular holes progressing down the stem, from which frass is expelled and sap may exude. The diameter of these holes typically increases towards the base of the plant (as the burrowing larva grows). The frass may become more apparent as it accumulates at the base of the stem.

Morphology

Egg

Elongate, slender, slightly curved, oval in shape; yellowish-white, darkening over time; 6-9 mm in length.

Larva

Elongate creamy-white grub without legs, up to 70mm in length; pale red-brown pronotal surface with darker chitinized sinuous band across anterior and dense rows of granules extending from posterior margin.

Pupa

Yellowish-white, shorter than larvae but slightly longer than adults, up to 50mm in length. Adult structures apparent; antennae extend posteriorly to curl above the developing wing pads and second pair of legs on the ventral surface; dorsal surface displays abdominal segmentation, unobscured by elytra.

Adult

'Typical' longhorn beetle in shape; body 26-50 mm in length, 8-16 mm in width; females typically larger and more robust than males. Body black but almost entirely covered with fine short olive-grey hair (varying from grey to greenish in colour), appearing less dense and more blue-grey along margins and suture of elytra, and upon legs. Antennae are black, with the 3rd segment onwards ringed with pale grey hair; antennal length is slightly longer than the body in females, but one-third longer than the body in males. The pronotum bears a pair of curved lateral spines. The apical third of the elytra exhibits a large number of shiny, smooth tubercles (>150 per elytron), spreading down to more than a third of the elytral surface. This is a key character separating *A. rugicollis* from *A. germari*, which has fewer, larger tubercles (approximately 50 per elytron) across a smaller area (Jiroux, 2011).

Detection and inspection methods

Larval infestation of host plants may not be readily apparent due to their cryptic nature within branches or stems, and careful inspection is required. Adult oviposition scars may be apparent, often near to the base of branches, and larval activity can be recognized by galleries in the branches or stems, frass-expulsion holes progressing downwards, exudation of sap from these holes, and the accumulation of frass at the base of branches or stems. Detection of the earliest stages of infestation is the most difficult before larvae have produced any frass-expulsion holes or damaged the health of the plant.

PATHWAYS FOR MOVEMENT

It is apparent that *A. rugicollis* is the principal species of the *Apriona* genus occurring across Eastern China, Japan, Korean Peninsula, and Taiwan, and infested material originating from these areas poses a risk of transporting immature beetle life stages. Following the taxonomic review of the *Apriona germari* group (Jiroux, 2011), most records of *A. germari* from Chinese provinces now probably correspond to *A. rugicollis*, although this remains to be verified. International movement of *Apriona rugicollis* is most likely to occur when eggs, larvae or pupae are transported within host plants for planting and untreated wood packaging material. Larvae of *A. rugicollis* have been intercepted on multiple occasions from wood packaging material originating from China and Taiwan, as well as from an *Enkianthus* tree imported from Japan (Netherlands NPPO, 2009, 2012; EPPO, 2013). Additional risks include imported bonsai trees, although these are typically too small to allow complete larval development, and unprocessed timber, especially poplar from China, although this pathway is relatively limited at present (EPPO, 2013). Natural dispersal by flying adults may be up to 2.5 km, although 250-500 m is probably more typical (EPPO, 2013). Spread of infested plants through the nursery trade is likely to be a key human-assisted pathway.

PEST SIGNIFICANCE

Economic impact

Apriona rugicollis attacks living trees, including economically important species, and is therefore a significant pest in its native range, including on mulberry in China and Korea, *Zelkova* in Japan, and poplar plantations in Northern China. Larval feeding activity may hollow out smaller branches, causing dieback and collapse, and attack by multiple larvae can weaken and kill entire trees, and increase their susceptibility to windbreak. Attacked mulberry trees become stunted, and fig trees die-back and fail to fruit. Attacks can be locally extensive, and feeding damage inflicted by adults can also be significant, causing dieback of the underlying sapwood and sometimes entire stems (Gressit 1942, Esaki 2006). The quality of infested poplar wood is reduced as its strength is compromised (Zhige *et al.*, 2006), and within the extensive poplar plantations in Northern China, *A. rugicollis* acts in concert with other longhorn beetles to kill and damage a very high proportion of trees (Ji *et al.*, 2011). Attacked trees are frequently predisposed by contributory factors such as poor site conditions or environmental stresses, although apparently healthy trees are also attacked.

Control

Control of *A. rugicollis* is based largely on chemical insecticides, to which the insects are increasingly developing resistance (Li *et al*., 2011). Surface spraying against adults, eggs or young larvae is common, using a range of chemicals including neem extracts, permethrin and imidacloprid. Spraying of branches with fenitrothion solution will kill bark-feeding adults, and a second application after three weeks will protect the trees for the period of adult activity (Esaki, 2007b). Control of larvae is more difficult however, since they are protected within galleries which may be long, and even enter the roots. Infested branches may be removed to prevent young larvae tunneling into the stem, and direct fumigation of the galleries can be effective against this life stage (Shui *et al.*, 2009). Removal of eggs, larvae and adults by hand from infested plants can be effective, but labour-intensive.

A range of natural control agents attack different life stages of *A. rugicollis*, including the egg parasitoid *Aprostocetus prolixus* (LaSalle and Huang 1994), and the beetle *Dastarcus helophoroides* which feeds on larvae and pupae (Wei *et al.*, 2009). Woodpecker predation can also have a local impact on larval abundance (Yang, 2005). Biological control agents demonstrated to be effective include entomopathogenic fungi, such as *Beauveria bassiana*, which is highly pathogenic to larvae, and fabric sheets impregnated with *Beauveria brongniartii* which can cause moderate mortality of adults feeding on adjacent trees (Esaki & Higuchi, 2006). Nematodes such *Steinernema* and *Heterorhabditis* spp. injected into larval galleries are effective parasites of the larvae (Xu *et al.*, 1997).

Removal of weeds from around the stems of host trees reduces available cover and can deter adults from ovipositing upon them (Esaki 2006), and the planting of susceptible trap trees such as mulberry or paper mulberry has proved effective in reducing attacks on poplar plantations (Zhang *et al.*, 1992; Gao *et al.*, 1994). Good silvicultural practice with integrated pest management is likely to be the most effective strategy, including the planting of resistant trees and mixed forest stands, matching tree species to site conditions, timely and appropriate forest management, and the strengthening of quarantine and inspection processes (Ji *et al*., 2011).

Phytosanitary risk

The risk of establishment of this species in the EPPO region will vary according to local climate and the presence of host plants. Some host trees of *A. rugicollis* are widely present and economically important throughout the EPPO region. Poplar and willow species are important components of indigenous and plantation forests, grown for commercial products as well as environmental purposes, whilst *Malus* spp. is the most widespread fruit host and is grown throughout the region. Other hosts such as mulberry, fig, and loquat are less widely grown, but are locally important, particularly in southern and Mediterranean regions (EPPO, 2013). Many of the other listed hosts are widely grown as ornamentals. The wide range of host plants is likely to aid establishment and spread.

Across much of the native range of *A. rugicollis*, summer temperatures tend to be hot, driving a 1-year life cycle, although the species also develops in cooler areas, extending the life cycle up to 3 years. The relatively cool summer temperatures of northern Europe are predicted to extend the generation time of the insect to 4 or even 5 years (Ibáñez Justicia *et al.*, 2010), which would limit its chances of successful establishment there. The climate of the Mediterranean region and warmer areas of Southern Europe are expected to be suitable for establishment of *A. rugicollis*, where it is predicted to have a 2-3 year life cycle (EPPO, 2013). the precise area of climatic suitability in the EPPO region remains uncertain. Overall, the expected damage and impact of an established population of the pest is likely to be greatest where high summer temperatures drive a more rapid life cycle.

PHYTOSANITARY MEASURES

At present, *A. rugicollis* is only listed as a quarantine pest in Morocco, and so there are no specific control measures in place against it across most of the EPPO region. The treatment of wood packaging material to ISPM 15 standards is an important measure preventing movement by this pathway, and so infested host plants for planting, and wood to a lesser extent, remain the most likely pathways for introduction. The wide variety of potential host species unfortunately makes specific phytosanitary measures more difficult to put into place. Some countries prohibit the import of certain fruit trees, including *Malus* spp. and *Ficus carica*, but other plants are only subject to general requirements and non-specific inspections. Careful inspection of plants may detect larval feeding activity and damage, but this is less likely at the earliest stages of infestation. Smaller-scale imports could be kept under post-entry quarantine conditions for a period of time sufficient to allow the development of characteristic symptoms such as frass-ejection holes. Theoretical phytosanitary measures include sourcing plants from pest-free areas or grown under protected conditions, but designated pest-free areas have not been identified, and adequately-protected growing conditions are uncommon and would require inspection (EPPO, 2013). No specific measures are currently in place which would prevent the movement of *A. rugicollis* life stages in wood.

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ACKNOWLEDGEMENTS

This datasheet was prepared in 2020 by Dr Daegan Inward, Forest Research UK. His valuable contribution is gratefully acknowledged.

How to cite this datasheet?

EPPO (2026) *Apriona rugicollis*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int



Co-funded by the
European Union