EPPO Datasheet: *Monochamus nitens*

Last updated: 2022-09-29

IDENTITY

Preferred name: *Monochamus nitens*
Authority: Bates
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Cerambycidae
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EPPO Categorization: A1 list
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EPPO Code: MONCNI

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Notes on taxonomy and nomenclature

Monochamus nitens was originally described from a specimen caught on a felled *Abies* sp. in Niojozan, Japan in the middle of August (Bates, 1884). *M. griseonotatus* is considered to be a synonym of *M. nitens* (IRD, 2021). Genetically *M. nitens* is described as a sister species to *M. urussovii* and *M. sartor* and is believed to have diverged from the Eurasian mainland species *M. urussovii* species approximately 1.4 million years ago (Gorring, 2019).

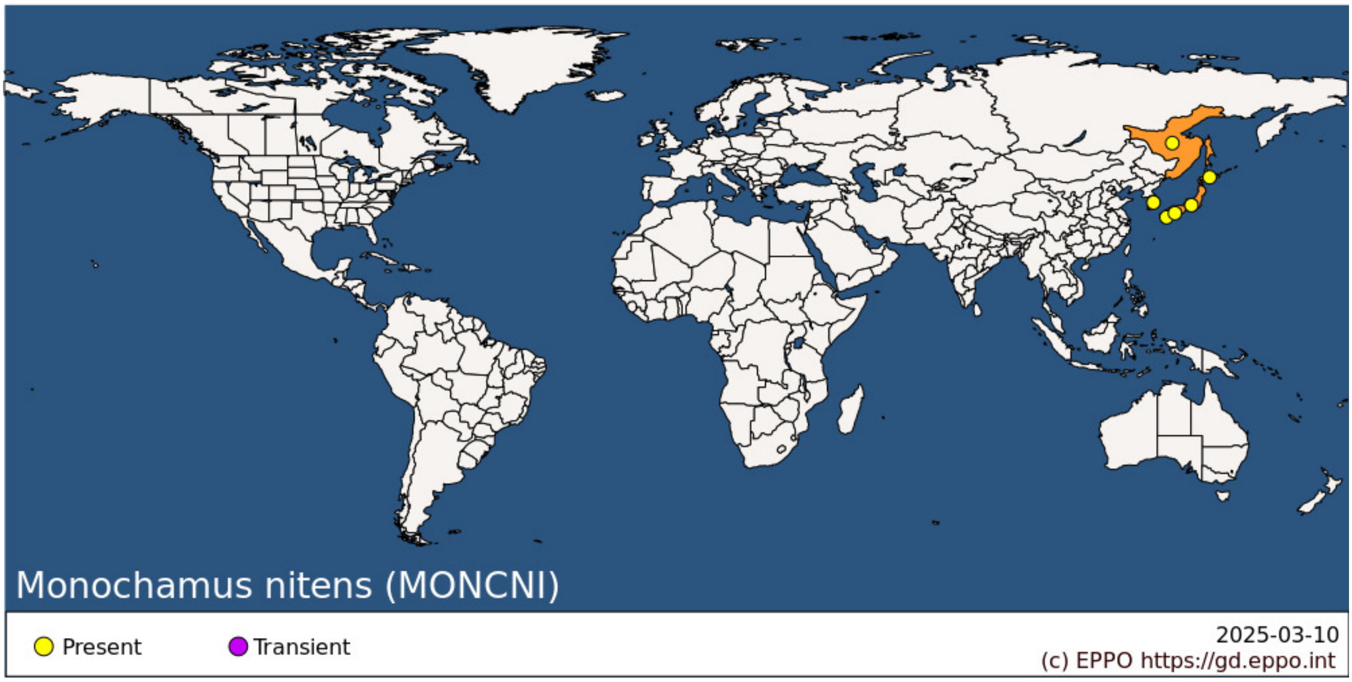
HOSTS

Larix kaempferi, which is a known host of *M. nitens,* is an important timber species in Northern and Central Europe. There are important forestry species for the EPPO region among the other known host genera, namely *Abies, Picea* and *Pinus.*

Host list: *Abies firma*, *Abies mariesii*, *Abies*, *Larix kaempferi*, *Larix*, *Picea*, *Pinus*

GEOGRAPHICAL DISTRIBUTION

M. nitens has been recorded in three countries in the Far East of Asia and is not known to be established as an invasive species elsewhere. *M. nitens* prefers ‘cool areas i.e. high latitudes and is not distributed around the Hachioji (Tokyo) area’ (Kanzaki & Akiba, 2014).



EPPO Region: Russia (Far East)
Asia: Japan (Hokkaido, Honshu, Kyushu, Shikoku), Korea, Republic

BIOLOGY

There is little published data on the biology of *M. nitens* other than the fact that in Japan, adult *M. nitens* fly in July and August (Cherepanov *et al.*, 1990). The following information is generic to *Monochamus* spp. or relates to *Monochamus alternatus* and is from Akbulut *et al.* (2017). Complete development takes from several months to two years and can vary within a species depending on when the eggs were laid, the host and environmental conditions. In Japan, *M. alternatus* usually has one generation a year, but in cooler areas, 20-30% of beetles have a two-year lifecycle. Larval development can be stopped at the final larval instar by diapause. In Southern China, *M. alternatus* is bivoltine. After maturation feeding and mating, female beetles use their mandibles to create oviposition slits in the bark of host trees and lay their eggs in the slits. Egg incubation normally takes six to nine days. Early instar larvae develop in the subcortical zone of host trees. The later instars create galleries in the sapwood and pupate at the upper end of a gallery after sealing the entrance with wood shavings. Adults emerge by chewing a round exit hole in the wood and bark and after emergence feed on fresh bark of host tree twigs during the day. This feeding is necessary for the development of the female reproductive system. Generally maturation feeding occurs for 10-14 days in *M. alternatus.* The mean longevity of *M. alternatus* females as adults is 83 days. The recorded fecundity of *M. alternatus* ranges from 33 to 581 eggs per female. *M. alternatus* are more likely to disperse from the tree that they emerge from when the density of health pine trees declines due to pine wilt disease. Both sexes of sexually mature *Monochamus* beetles are attracted to stressed host trees and / or recently cut logs for mating and oviposition which takes place during the night. In *M. alternatus,* females approach males and after antennal contact the male will attempt to mate.

DETECTION AND IDENTIFICATION

Symptoms

The following signs and symptoms may be seen in wood infested with *Monochamus* spp. (Wilson, 1975):

1. Slits chewed by adult female for egg laying in the bark, although only a minority of these may have eggs in them
2. Scoring in the xylem and phloem caused by larval feeding
3. Frass – the waste expelled by feeding larvae from trees

4. Oval shaped holes made by larvae as they bore deeper into sap wood
5. Circular exit holes created by adults

Morphology

The description of juvenile stages below is generic to *Monochamus* species.

Eggs

Monochamus spp. eggs are white, elongate, cylindrical and slightly flattened, with rounded ends (Akbulut *et al.*, 2017). They are about 3 mm long and 1 mm in diameter.

Larvae

Monochamus spp. young larvae are soft-bodied, elongate, and dirty white in colour, with a light-yellow thorax and an amber brown head. The final instar larvae have 10 abdominal segments, and the length of mature larvae is between 25 and 50 mm (Akbulut *et al.*, 2017). *Monochamus* spp. larvae can be identified using DNA barcoding, but it has not been validated for all species (EFSA, 2018).

Pupae

Monochamus spp. pupae resemble the adults with reduced wings, legs, antennae and mouthparts clearly visible. They are about 1.5-3 cm long.

Adults

The adults of *M. nitens* were described by Bates (1884) in Latin. There is also a full description of *M. nitens* adults translated into English in Cherepanov *et al.* (1990) which is summarized as follows: The adults are characterized by convex lustrous elytra, with a yellow spotlet on the sinciput. The head has compact uneven punctuation and adherent grey or yellowish hairs with a narrow medial longitudinal groove and antennal tubercles. Eyes sharply faceted, deeply incised. Antennae twice as long as body in males and 1.2 times longer than the body in females. Pronotum not longer (male) or shorter (female) than basal width. Pronotal shield posteriorly broadly rounded with dense adherent rusty coloured or grey hairs. Elytra parallel sided, in anterior third with distinct or faint semicircular depression leaning toward the inner side of humeri by its ends, beyond humeri slightly compressed, apically individually (female) or jointly (male) rounded. Forelegs in males slightly longer than midlegs. Elytra black lustrous. Body length 23-29 mm.

Morphologically, *M. nitens* is very similar to *M. urussovii* (Gorring, 2019).

Detection and inspection methods

There is no specific information for *M. nitens,* but *Monochamus* spp. are attracted to weakened, dying or dead host trees. Therefore, such trees, which often have partly or completely discoloured needles, should be the focus of surveillance for *Monochamus* spp. Close inspection may allow the detection of oviposition slits in the bark of dead or dying trees, oval-shaped larval entrance holes in the sapwood under the dead bark, or round adult exit holes in the sapwood. Larvae can also be extracted from the bark or sapwood, and adults can be found walking or resting on cut or dead wood during the summer (EFSA, 2018). The most efficient detection method is trapping (see below). Blatt *et al.* (2019) caught *M. marmorator*, *M. notatus* and *M. scutellatus* in traps in plantations of healthy Christmas trees (*Abies balsamea*) showing that there are exceptions to the general association between *Monochamus* spp. and weakened or dead trees.

Safranyik and Raske (1970) devised a sequential sampling plan to determine the damage caused by *Monochamus* spp. larvae to timber. The plan was based on a study in Alberta in which lodgepole pine (*Pinus contorta*) logs were sampled for *M. scutellatus*, *M. maculosus* and *M. notatus*. The method involved counting larval entrance holes into the logs any time after September following the summer of attack. At densities of greater than 2.5 holes / ft^2 (approx. 30cm x 30cm), there was a 30% loss in value of the timber.

Traps

There is no published data on trapping *M. nitens,* but there is data on trapping other *Monochamus* spp.

In a large study at 16 sites across North America, Miller *et al.* (2013) demonstrated that multiple-funnel traps baited with a blend of ipsenol, ipsdienol, ethanol and ?-pinene were attractive to the *M. titillator / M. carolinensis* complex, *M. scutellatus, M. clamator, M. obtusus* and *M. mutator.* This mixture of four compounds, was more effective than unbaited traps or traps with a mixture of ispenol and ipsdienol or traps with a mixture of ethanol and ?-pinene. Ethanol is produced by stressed conifer trees and ?-pinene is a constituent of the oleoresin of most pine species. Ispenol and ipsdienol occur naturally in pine forests (Miller *et al.* ,2013).

Ryall *et al.* (2015) provided evidence that monochamol is attractive to *M. scutellatus*, *M. notatus* and *M. carolinensis* which supported evidence from previous studies (e.g. Fierke *et al.* (2012); Allison *et al.* (2012)), they also provided the first evidence that monochamol is attractive to *M. mutator* and *M. marmorator*. The studies also demonstrated a synergism between monochamol and host volatiles. Allison *et al.* (2012) showed that monochamol is attractive to *M. titillator* as well as to traps baited with (2R*,3R*)-2,3-hexanediol plus -pinene (but not to traps baited with (2R*,3R*)-2,3-hexanediol alone). There is evidence showing that monochamol is attractive to 12 *Monochamus* species and so it has excellent potential for surveys of beetles of the Genus (Ryall *et al.*, 2015).

Miller *et al.* (2016) tested the efficacy of different combinations of ?-pinene, monochamol and ipsenol for catching *Monochamus* spp. in two Canadian provinces and eight states in the USA. The study provided evidence of the beneficial effect of including both monochamol and ipsenol in lures. Monochamol did not increase catches of other Cerambycidae, bark beetles, other weevils or bark beetle predators.

Boone *et al.* (2019) tested the efficacy of teflon-coated cross-vane traps with four lures monochamol: 2 mg/day; ipsenol: 2.5 mg/day, 2-methyl-3-buten-1-ol: 10 mg/day; and ?-pinene: 500 mg/day. Large numbers of *M. carolinensis* , *M. maculosus, M. notatus, M. scutellatus, M. clamator,* and *M. titillator* were trapped in North America, while large numbers of *M. alternatus* were trapped in China. This result demonstrated that such traps could be used for the detection of non-native *Monochamus* spp. In Europe.

PATHWAYS FOR MOVEMENT

There is no specific data on *M. nitens,* however, *Monochamus* spp. are able to naturally disperse by flight. A number of dispersal studies have been carried out with *Monochamus* spp. *Monochamus alternatus* adults were able to disperse 3.3 km from infested logs to diseased trees (Kobayashi *et al.*, 1984). In a mark-recapture experiment in Spain, *Monochamus galloprovincialis* (Olivier) flew a maximum of 22.1 km with around 2% of beetles flying further than 3 km (Mas *et al.*, 2013).

Pinewood nematode, which is vectored by *Monochamus* spp. has been found to be able to spread at a mean rate of 5.3 km per year in Portugal (de la Fuente *et al.*, 2018), 6 km / year in Japan (Togashi & Shigesada, 2006) and an estimated 7.5 km / year in China (Robinet *et al.*, 2009). However, long distance man assisted spread of pine wood nematode can occur over much larger distances with a mean annual dispersal of 111-339 km estimated in China (Robinet *et al.,* 2009). *Monochamus* spp. can be spread in coniferous wood and coniferous wood packaging material, dunnage, particle wood and waste conifer wood, hitchhiking and in finished wood products (EFSA, 2018, Ostojá-Starzewski, 2014). Between 1998 and 19 June 2018 there were 124 interception records of *Monochamus* sp. on wood packaging material in the EU (EFSA, 2018). Between 1984 and 2008, there were 42 interceptions of *Monochamus* spp. on wood packaging material in the USA which were identified to species level: *M. alternatus* (17), *M. carolinensis* (Oliver) (2), *M. clamator* (Leconte) (1), *M. galloprovincialis* (Oliver) (5), *M. sartor* (Fabricius) (5), *M. scutellatus* (Say) (2), *M. sutor* (Linnaeus) (9) and *M. teserula* White (1) (Eyre & Haack, 2017). Plants for planting are considered to be an unlikely pathway for the spread of *Monochamus* spp. because they tend to attack weakened or dead trees (EFSA 2018).

PEST SIGNIFICANCE

Economic impact

Apart from M. nitens being recorded in conifer plantations, there is no information on economic impact (Cherepanov *et al.*, 1990). *Monochamus* spp. insects damage the wood of recently conifers which recently died and conifers that are no longer standing, causing the degradation and loss of structural integrity of the timber. In some areas, they often attack conifers that are killed by bark beetles, fire or weakened by defoliating insects. If logs are stored in the forest or at the sawmill for prolonged periods prior to processing, they can be prone to attack by *Monochamus* spp.

Linit (1988) noted there were no records of *B. xylophilus* being transmitted by *M. nitens,* but Kobayashi *et al.* (1984) stated that *Bursaphelenchus xylophilus* has been found to be associated with *M. nitens.* Subsequently, *Bursaphelenchus mucronatus* and a *Diplogasteroides* sp. were isolated from an adult male *M. nitens* that had been feeding on a dead *Abies mariesii* tree on Mount Fuji, Yamanashi, Japan at an altitude of 1750m (Kanzaki & Akiba, 2014). The authors suggest that *M. nitens* is a potential vector of *Bursaphelenchus xylophilus.* However, the scarcity of data on *M. nitens* indicates that its economic impact in Japan is marginal in comparison to *M. alternatus* which is considered to be the principal vector of pinewood nematode. In Japan, *M. alternatus* is the insect most frequently associated with dying pine trees and is always heavily infested with *B. xylophilus* (Kobayashi et al., 1984).

Control

There are no published control measures specifically for *M. nitens*, however the control mechanisms used for other *Monochamus* spp. are likely to be effective. Controlling *Monochamus* spp. can help to prevent the spread of pinewood nematode. Immature *Monochamus* can be controlled by cutting, followed by cutting, burning or burying the infested wood or treating the wood with insecticides. In field studies, 100% mortality of *Monochamus* sp. larvae has been recorded when infested trees have been chipped to pieces with a maximum size of 80 x 60 x 16 mm (Kamata, 2008). The impact of removing infested trees on the further transmission of pinewood nematode is limited by the difficulty of being able to detect all the infested trees. Surveillance from helicopters can lead to the identification of three times as many symptomatic trees as surveys from the ground. Preventative sprays of insecticides that target *M. alternatus* adults can reduce transmission of pinewood nematode (Akbulut *et al.*, 2017).

In North America, the following methods have been used to reduce damage to felled wood from *Monochamus* spp.: i) transporting wood as soon as possible after felling; ii) placing wood in the shade of other trees; ii) covering wood in a layer of 45 cm of slash iv) stacking wood in standard piles to reduce the area exposed to beetle attacks; v) removing bark from felled wood; vi) immersing logs in water; vii) applying insecticides to exposed wood (Wilson, 1962, Wilson, 1975). *Monochamus* damage can be prevented by not exposing wood during the July-September egg laying period and minimized by processing any infested wood as soon as possible (Gibson, 2010).

Phytosanitary risk

Eschen *et al.* (2014) listed *M. nitens* and *M. alternatus* as species that are likely to become established in EU countries based on similarities in pest assemblages in the area of origin and the EU. This analytical method serves to identify areas which have a similar climate to EU countries and have had trade links. Although there are no known records of *M. nitens* becoming established outside its natural range in Asia, the species should be considered as a phytosanitary risk wherever its host genera are found, because interceptions of *Monochamus* spp. in wood packaging material in Europe have shown there is a viable pathway.

The introduction of non-native *Monochamus* spp. into Europe could introduce pinewood nematode to new locations and hosts and enhance the rate of spread of the pest. Pinewood nematode has causes severe damage to forests in East Asia and in Europe and the impacts are likely to increase (EFSA, 2018).

Monochamus alternatus is the main vector of pine wood nematode in Japan, but *M. nitens* is one of a further seven species of Cerambycidae which have been associated with this pest (Kobayashi *et al.*, 1984).

PHYTOSANITARY MEASURES

The EU has emergency measures to prevent the spread of pinewood nematode within the union (EU, 2012). These measures include demarcating areas, destruction of contaminated material, heat treatment of wood and wood products, hygiene protocols for forestry vehicles and transport conditions for plants, wood and bark (EFSA, 2018). Measures to reduce the risk of wood becoming infested during transit include: not transporting wood through infested areas; not transporting wood during the flight season or covering the wood during transit. Debarking of harvested wood can also reduce risks from *Monochamus* spp. (EFSA, 2018).

Recommended phytosanitary measures to reduce the risk of the introduction and spread of non-European *Monochamus spp.* and pinewood nematode are set out in the EPPO commodity standard for Coniferae, PM 8/2 (3). For example, there are recommendations by host species to reduce the risk of introducing pine wood nematode or its *Monochamus* sp. vectors on wood, such as pest free areas, treatment of wood and conditions for the transport of the wood (EPPO, 2018).

The treatment of wood according to ISPM 15 will reduce the risk of the introduction of xylophagous pests such as *Monochamus* spp. and pine wood nematode being introduced to previously uninfested areas in wood packaging material, although treatments are not always applied effectively (Haack *et al.*, 2014).

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ACKNOWLEDGEMENTS

This datasheet was prepared in 2022 by Dominic Eyre (Defra, GB). His valuable contribution is gratefully acknowledged.

How to cite this datasheet?

EPPO (2025) *Monochamus nitens*. EPPO datasheets on pests recommended for regulation. Available online.

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Datasheet history

This datasheet was first published online in 2022. It is maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', ‘Hosts’, and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

Co-funded by the
European Union