EPPO Datasheet: *Monochamus scutellatus*

Last updated: 2022-09-19

IDENTITY


more photos...

Preferred name: *Monochamus scutellatus*
Authority: (Say)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Cerambycidae
Common names: white spotted sawyer
view more common names online...
EPPO Categorization: A1 list
view more categorizations online...
EPPO Code: MONCST

Notes on taxonomy and nomenclature

Linsley and Chemsak (1984) describe two sub-species of *M. scutellatus: M. scutellatus scutellatus* (Say) (range from Alaska to Newfoundland and North Carolina, British Columbia to New Mexico) and *M. scutellatus oregonensis* (LeConte) (with a range from Washington and Idaho to California). However, the Titan database of cerambycids lists *M. scutellatus* as the valid name for both sub-species (IRD, 2021).

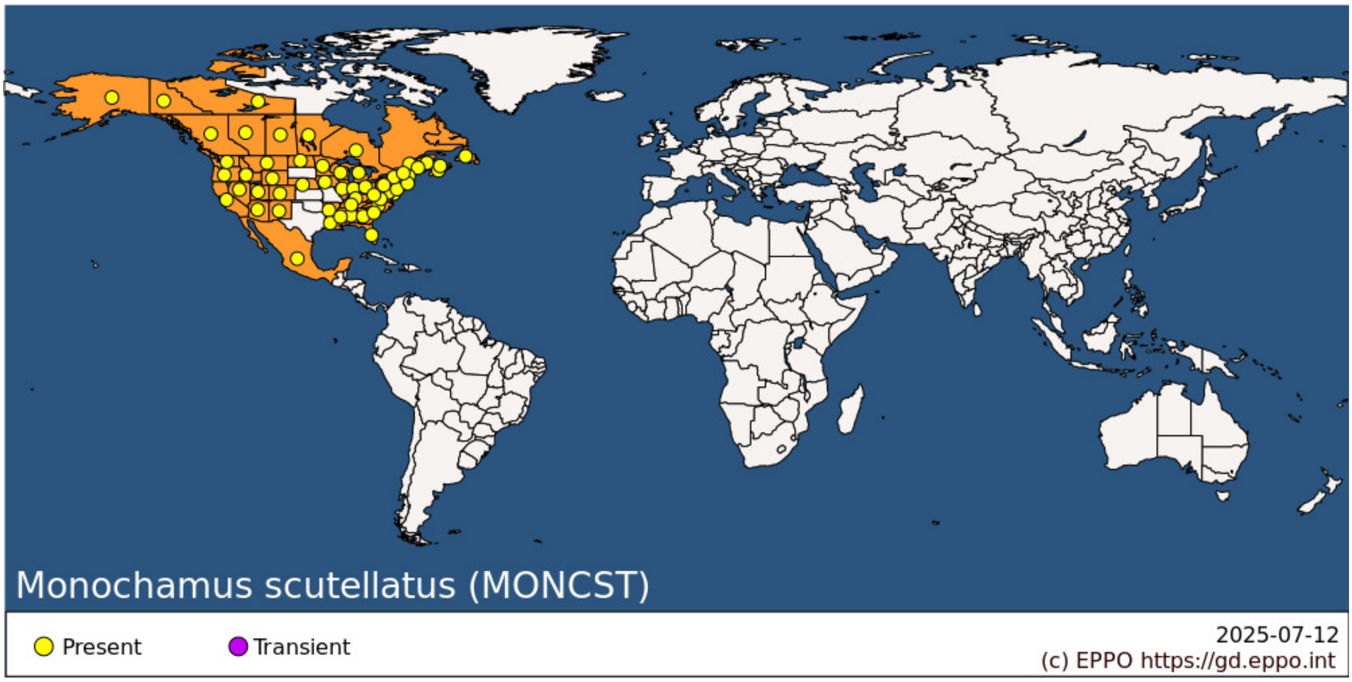
HOSTS

White pine (*Pinus strobus)* appears to be the favoured host of *M. scutellatus*, but it also attacks many other conifers such as red pine (*Pinus resinosa*) and jack pine (*Pinus banksiana*), balsam fir (*Abies balsamea)*, white spruce (common name for more than one species), black spruce (*Picea mariana*) and red spruce (*Picea rubens*), and larch (*Larix*) (Baker, 1972).

Host list: *Abies balsamea*, *Abies*, *Larix laricina*, *Larix*, *Picea glauca*, *Picea mariana*, *Picea*, *Pinus nigra*, *Pinus resinosa*, *Pinus strobus*, *Pinus*, *Pseudotsuga menziesii*, *Tsuga canadensis*, *Tsuga heterophylla*, *Tsuga*

GEOGRAPHICAL DISTRIBUTION

M. scutellatus occurs from Newfoundland south to North Carolina, westwards to Minnesota and north- westwards to Alaska (Baker, 1972), also from British Columbia south to California and Western Nevada (Linsley & Chemsak, 1984). *M. scutellatus* is the most widely distributed *Monochamus* species in Eastern Canada (Rose, 1957).



North America: Canada (Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Northwest Territories, Nova Scotia, Ontario, Prince Edward Island, Québec, Saskatchewan, Yukon Territory), Mexico, United States of America (Alabama, Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming)

BIOLOGY

M. scutellatus has a two-year life cycle in Canada and the US states surrounding the great lakes. Further south it has a one generation per year. Adults emerge through circular holes cut in the bark and feed for short periods on needles and tender bark of various conifers (Rose, 1957). Adults are thought to need to have completed a first phase of feeding before they become sexually mature (Fuentealba, 2007). Males arrive at mating sites and guard the territory until females arrive. *M. scutellatus* have been observed arriving at cut logs within a few hours of cutting starting (Wilson, 1962). Mating will take place repeatedly and can disrupt oviposition (Hughes & Hughes, 1985, Peddle *et al.*, 2002). Mating generally takes place on warm sunny days, on or near the host tree (Fuentealba, 2007). Eggs are then deposited in slits or notches chewed into the bark, preferably near old branch scars or in wrinkled areas on logs, pulpwood and recently killed trees (Baker, 1972). The choice of an oviposition site within *P. resinosa* logs was shown to be influenced positively by diameter and negatively by outer bark thickness (Fuentealba, 2007). Females primarily make ovipositional scars and lay eggs 3-4 cm apart in field conditions (Fuentealba, 2007). Females are less inclined to lay eggs on wood that has already been used by other females. Female *M. scutellatus* cut more scars than are used for oviposition suggesting that they need to excavate the bark before they can fully assess the suitability of a site for egg deposition and this may relate to phloem thickness (Peddle *et al.*, 2002). The final stage of egg laying involves the female depositing a jelly like substance over the egg with her abdomen. This substance may be to protect against desiccation, predators and parasitoids (Fuentealba, 2007).

In the Sioux Lookout district of Ontario, *M. scutellatus* adults emerge during June and July. About 23 months are required for development from egg to adult. There is thought to be a gap of seven to ten days between adult emergence and mating. In this district mating has been observed to take place in the afternoon on bright sunny days and was followed almost immediately by egg laying into slits cut into the bark. Oviposition tended to occur in partial shade with most eggs laid on the lower surface or side of logs. Approximately 70% of all slits cut into the bark were empty. Slits containing eggs were almost invariably cut into small cavities in the bark that appeared to be small empty resin blisters. Over the course of a six-year study, the oviposition period varied from seven to ten weeks, but in each year, 90% of eggs were laid during a period of four to six weeks. The date of the first oviposition varied between early June and early July (Rose, 1957).

At Sioux Lookout, the egg stage lasts nine to fourteen days with a mean of twelve days. After hatching, larvae consume egg remnants and tunnel directly through the phloem to the cambium which takes two to three days. Flat mines are created in the cambium over the course of two to three weeks. Second stage larvae also feed on the cambium, widening, and extending the mines, noticeably scoring the wood surface, a phase lasting a further two to three weeks. Cannibalism can occur if larval density is high. The third instar is reached in early September, and this is the stage that starts to tunnel into the wood, although the larvae return to surface of the wood to feed. Extrusions of excess frass can become noticeable at this time. The majority of the first-year larvae overwinter in the third instar with a minority overwintering as second and fourth instars. In the autumn, activity continues until continuous cold weather starts. Second year larvae become active as soon as the first warm weather starts. The rate of larval growth has been found to relate to the thickness of the inner bark of hosts (Fuentealba, 2007). By mid-August, most of the population are fourth instars. By mid-summer, most larvae have reached their deepest point within the wood and are starting to tunnel towards the surface, although throughout the summer the larvae also continue to feed on the surface extruding large amounts of frass. By late September, pupal chambers are constructed within 5mm of the surface of the wood and the second winter is spent in the pre-pupal stage. Pupation takes place in the third summer about two weeks before the adults emerge. The start of adult emergence can be as early as late May and as late as mid-June (Rose, 1957).

Rose (1957) calculated that less than 2% of eggs laid on logs reached maturity. The main cause of mortality was the desiccation of eggs exposed to the sun and the second was cannibalism.

Miller (1986) studied the impact of excluding *Monochamus* spp. from freshly cut bolts (sections of a logs) of *Pinus taeda* on other insects. The presence of *Monochamus* spp. significantly reduced the number of emerging *Ips calligraphus* (Coleoptera: Curculionidae), *Platysoma cylindricum* (Coleoptera: Histeridae) and *Medetera bistriata* (Diptera: Dolichopodidae). This demonstrates that reducing *Monochamus* sp. populations could lead to increased populations of other damaging species.

Dauer larvae of pine wood nematode, *Bursaphelenchus xylophilus* have been found in association with of *M. scutellatus* on *Pinus nigra* and *Abies balsamea* in Minnesota (Wingfield & Blanchette, 1983). *M. scutellatus* is considered to be the second most important vector of pine wood nematode in the USA after *M. carolinensis* (Akbulut & Stamps, 2012). Bergdahl *et al.* (1991) collected *Monochamus* sp. from two locations in Vermont and sampled them for nematodes. The proportion of beetles infested with *B. xylophilus* was similar for *M. notatus* (51%) and *M. scutellatus* (56%), but *M. scutellatus* carried many more nematodes per beetle (mean 5450) than the *M. notatus* (595). Blatt *et al.* (2019) collected *Monochamus* spp. from Christmas tree (*Abies balsamea)* plantations in Nova Scotia. *B. xylophilus* was recovered from the three *Monochamus* spp. that were caught: *M. marmorator, M. notatus* and *M. scutellatus.*

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

Eggs

Eggs are white and oblong with an average size of 3.0 mm long by 0.9 mm wide.

Larvae

Young larvae are creamy white, without legs, and have an amber-brown head with a pair of short mandibles. Larvae measure up to 50 mm long and 5 mm wide at the thorax and can be found year-round inside the host plant. Pupae are white and soft like the larvae; they resemble adults (20-25 mm long). As the pupa ages, the mouthparts, legs, antennae and wings become more distinct; when fully developed, it turns brown and its exoskeleton hardens (Fuentealba, 2007). *Monochamus* spp. larvae can be identified using DNA barcoding, but it has not been validated for all species (EFSA, 2018).

Adults

Adults males are completely shiny black except for a small rounded white spot at the base of the elytra, females are either the same colour or have an elytra mottled with white spots (Baker, 1972).

Linsley and Chemsak (1984) provide a more detailed description of the adults:

'Male: Form moderate-size to large; integument black, shining, often with a brassy caste, appendages often partially reddish, pubescence sparse to moderately dense, short, brownish, appressed. Head with a front convex, finely to coarsely confluently punctate, usually sparsely clothed with fine recumbent pubescence genae longer than lower eye lobe, parallel to slightly convergent; antennae extending five or six segments beyond elytra, usually twice the length of the body, segments finely, very densely aspirate, nonpubescent, segments from third or fourth with apical sensory areas. Pronotum about as broad as long, lateral tubercles strongly produced, apices blunt; apical and basal transverse impressions shallow, plicate; disk irregularly, transversely punctate at middle, center often longitudinally impressed; pubescence sparse, short, fine; prosternum glabrous to moderately pubescent; meso- and metasternum sparsely to densely clothed with long suberect hairs and often small patches of white appressed pubescence. Elytra a little more than twice as long as broad; punctures coarse, transverse, rugose appearing, becoming finer toward apex; pubescence very fine, brownish, sparse to moderately dense, often with small patches of white appressed pubescence at basal one-third; apices rounded. Scutellum apically rounded, densely white pubescent, usually with a glabrous median line. Legs finely gray pubescent. Abdomen sparsely to moderately densely pubescent; last sternite rounded to subtruncate at apex. Length 13-35 mm.

Female: Form more robust. Antennae extending two or three segments beyond elytra, segments apically broadly white annulate, not asperate. Elytra usually with scattered small patches of white appressed pubescence. Abdomen with last sternite truncate to shallowly emarginate at apex, densely tufted. Length 14-30 mm.'

Detection and inspection methods

There is no specific information on inspections for *M. scutellatus,* 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.

Traps

Traps baited with lures consisting of 95% (-)-?-pinene, (±)-ipsenol and (±)-ipsdienol were attractive to *M. scutellatus,* but the compounds were not tested individually (de Groot & Nott, 2001). Allison *et al.* (2001) found that *M. scutellatus* was attracted to a blend of ipsenol, ipsdienol, frontalin and 3-methyl-2-cyclohexen-1-one. In a study in British Columbia, Allison *et al.* (2003) showed that ipsenol was superior to ipsdienol as an attractant for *M. scutellatus* and recommended that it should be used for mass trapping programmes.

de Groot and Nott (2004) studied the response of *Monochamus* spp. to pheromones in stands of jack pine (*Pinus banksiana*

), black spruce (*Picea mariana*) and balsam fir (*Abies balsamea*) in Ontario. They found no evidence that frontalin is a kairomone for *M. scutellatus* or *M. maculosus* (synonym = *M. mutator*) or that ipsdienol was attractive to either species when either compound was used at release rates commonly used for bark beetles. Traps baited with ipsenol were more effective than unbaited traps at catching *M. scutellatus,* but not more effective than ?-pinene.

In a field and laboratory study, Fierke *et al.* (2012) provided evidence that monochamol is a component of the pheromone produced by male *M. scutellatus*.

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. maculosus.* This mixture of four compounds, was more effective than unbaited traps or traps with a mixture of ipsenol 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. Ipsenol 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)) 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 information on the pathways for *M. scutellatus* and so the following information is generic to the genus. *Monochamus* spp. can naturally disperse by flight. A number of dispersal studies have been carried out with *Monochamus spp.* For example, *Monochamus alternatus* adult were shown to be 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).

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.

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 2018 there were 124 interception records of *Monochamus* sp. on wood packaging material in the EU (EFSA, 2018). Between 1984 and 2018, 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). *Monochamus* spp. females lay their eggs in various parts of their trees, including smaller branches down to 2 cm in diameter. 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 and weakened trees are unlikely to be traded (EFSA 2018). However, the trapping of *Monochamus* spp. in plantations of healthy Christmas trees (*Abies balsamea*) suggests there would be some risk in importing host trees from North America into the EPPO region (Blatt *et al.*, 2019).

PEST SIGNIFICANCE

Economic impact

M. scutellatus emerged from timber in a newly built home at Mount Pearl, Newfoundland, Canada (CAIPR, 1967-1983). *M. scutellatus* can cause economic losses to the forest industry by damaging freshly cut trees during harvesting and at woodyards (Wilson, 1962). *M. notatus, M. marmorator* and *M. scutellatus* have been trapped in Christmas tree plantations in Nova Scotia (Blatt *et al.*, 2017).

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.

Monochamus are not considered to be plant pests in their own right because they do not tend to attack healthy trees however, they can and damage and can facilitate the introduction and spread of pine wood nematode in Europe (EFSA, 2018). *Monochamus* spp. rarely, if ever, attack vigorously growing trees (Gibson, 2010). However, the impact from *Monochamus* spp. in the USA is high, largely due to the export restrictions of forestry products associated with pine wood nematode, *Bursaphelenchus xylophilus* (Miller *et al.*, 2013). In the USA, *Monochamus* spp. larvae, are also responsible for extensive damage to fire damaged, dying, recently killed, and felled conifers of various species—but especially pines, spruce, true firs, and Douglas-fir. *M. scutellatus* causes heavy losses to sawlogs and pulpwood in northern states of the USA and Southern Canada (Baker, 1972). The larvae damage infested trees and logs through series of extensive mines that introduce decay-causing fungi (Baker, 1972, Gibson, 2010). Wood chips harvested from wood infested by *Monochamus* species can be too small for use at pulp mills (Wilson, 1962).

Control

Wilson (1962) studied attacks by wood boring insects on stacks of felled balsam fir, *Abies balsamea* in Minnesota. *M. scutellatus* was the most frequently observed cerambycid beetle, accounting for c. 90-95% of all beetles observed. *M. notatus* and *M. marmorator* were also occasionally observed. Piles of wood placed in full shade suffered less damage than wood exposed to the sun. Also, standard piles with less wood exposed to beetle damage suffered less damage than piles stacked in ‘pens’ with wood stacked in open perpendicular layers. The average volume of wood lost from standard piles of wood over two years in the sun ranged from 0.47% of interior logs to 2.64% for exterior logs and for piles in the shade from 0.37% for interior logs to 0.59 % for exterior logs. Damage to felled wood can be reduced by: 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).

The following ichneumonids are natural enemies of *M. scutellatus*: *Rhyssa persuasoria* (L.) and *Rhyssa lineolata* (Kby.) as well as the following tachinids: *Eutheresia monohammi* Townsend and *Eutheresia tirvittata* Curran; the following entomopathogenic fungi: *Beauveria tenella* and *Beauveria bassiana* and the entomopathogenic nematode genus: *Hecamermis* sp. (Linsley & Chemsak, 1984).

Phytosanitary risk

The introduction of non-native *Monochamus* spp. into Europe could introduce pine wood 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). *M. scutellatus* is known to be an important vector of *B. xylophilus* in North America (Akbulut & Stamps, 2012).

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 pinewood 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).

REFERENCES

Akbulut S & Stamps WT (2012) Insect vectors of the pinewood nematode: a review of the biology and ecology of *Monochamus* species. *Forest Pathology* **42**, 89-99.

Allison JD, Borden JH, McIntosh RL, de Groot P & Gries R (2001) Kairomonal response by four *Monochamus* species (Coleoptera : Cerambycidae) to bark beetle pheromones. *Journal of Chemical Ecology* **27**, 633-646.

Allison JD, McKenney JL, Millar JG, McElfresh JS, Mitchell RF & Hanks LM (2012) Response of the woodborers *Monochamus carolinensis* and *Monochamus titillato*r (Coleoptera: Cerambycidae) to known cerambycid pheromones in the presence and absence of the host plant volatile alpha-pinene. *Environmental Entomology* **41**, 1587-1596.

Allison JD, Morewood WD, Borden JH, Hein KE & Wilson IM (2003) Differential bio-activity of *Ips* and *Dendroctonus* (Coleoptera: Scolytidae) pheromone components for *Monochamus clamator* and *M. scutellatus* (Coleoptera: Cerambycidae). *Environmental Entomology* **32**, 23-30.

Baker WL (1972) *Eastern forest insects*. U.S. Dept. of Agriculture, Forest Service, Washington.

Bergdahl D, Halik S, Tomminen J & Akar H (1991) Frequency of infestation of *Monochamus notatus* and *M. scutellatus* by *Bursaphelenchus xylophilus* in Vermont. *Phytopathology* **81**, 120.

Blatt S, Bishop C & Burgher-MacLellan K (2019) Incidence of *Bursaphelenchus xylophilus* (Nematoda: Parasitaphelenchidae) in Nova Scotia, Canada Christmas tree (Pinaceae) plantations. *Canadian Entomologist* **151**, 350-364.

Blatt SE, Bishop C & Sweeney J (2017) Incidence of *Monochamus* (Coleoptera: Cerambycidae) species in Nova Scotia, Canada Christmas tree plantations and comparison of panel traps and lures from North America and Europe. *Canadian Entomologist* **149**, 191-203.

Boone CK, Sweeney J, Silk P, Hughes C, Webster RP, Stephen F, Maclauchlan L, Bentz B, Drumont A, Zhao B, Berkvens N, Casteels H & Gregoire J-C (2019) *Monochamus* species from different continents can be effectively detected with the same trapping protocol. *Journal of Pest Science* **92**, 3-11.

CAIPR (1967-1983) *(Canadian Agricultural Insect Pest Review).*

de Groot P & Nott R (2001) Evaluation of traps of six different designs to capture pine sawyer beetles (Coleoptera: Cerambycidae). *Agricultural and Forest Entomology* **3**, 107-111.

de Groot P & Nott RW (2004) Response of the whitespotted sawyer beetle, *Monochamus s. scutellatus,* and associated woodborers to pheromones of some *Ips* and *Dendroctonus* bark beetles. *Journal of Applied Entomology* **128**, 483-487.

de la Fuente B, Saura S, Beck PSA & Fortin M-J (2018) Predicting the spread of an invasive tree pest: The pine wood nematode in Southern Europe. *Journal of Applied Ecology* **5**, 2374-2385.

EFSA (2018) Pest categorisation of non-EU *Monochamus* spp. *EFSA Journal* **16**, 5435.

EPPO (2018) PM 8/2 Coniferae. *EPPO Bulletin* **48**, 463-494.

EU (2012) Commission implementing decision on emergency measures to prevent the spread within the Union of *Bursaphelenchus xylophilus* (Steiner et Buhrer) Nickle et al. (the pine wood nematode). In *2012/535,* Brussels.

Eyre D & Haack RA (2017) Invasive cerambycid pests and biosecurity measures. In *Cerambycidae of the world: Biology and management*, pp. 563-618. CRC Press, Boca Raton.

Fuentealba I (2007) Reproductive behaviour and larval development of *Monochamus scutellatus* (Say) (Coleoptera: Cerambycidae) in three pine species from the Great Lakes Forest Region. In *Faculty of Forestry* University of Toronto.

Gibson K (2010) Management guide for sawyer beetles.

Haack RA, Britton KO, Brockerhoff EG, Cavey JF, Garrett LJ, Kimberley M, Lowenstein F, Nuding A, Olson LJ, Turner J & Vasilaky KN (2014) Effectiveness of the International Phytosanitary Standard ISPM No. 15 on reducing wood borer infestation rates in wood packaging material entering the United States. *PLoS ONE* **9**, e96611.

Hughes AL & Hughes MK (1985) Female choice of mates in a polygynous insect, the whitespotted sawyer *Monochamus scutellatus. Behavioral Ecology and Sociobiology* **17**, 385-387.

IRD (2021) Base de données Titan sur les Cerambycidés ou Longicornes.

Kobayashi F, Yamane A & Ikeda T (1984) The Japanese pine sawyer beetle as the vector of pine wilt disease. *Annual Review of Entomology* **29**, 115-135.

Linsley E & Chemsak J (1984) *The Cerambycidae of North America Part VII, No. 1: taxonomy and classification of the subfamily Lamiinae, tribes Parmeninie through Acanthoderini*. University of California.

Mas H, Hernández R, Villaroya MG, Sánchez G, Pérez-Laorga E, González EG, Ortiz AL, Lencina J, Rovira J, Marco M, Pérez, Gil MAI, Sánchez-García FJ, Bordón P & Pastor C (2013) Comportamiento de dispersión y capacidad de vuelo a larga distancia de *Monochamus galloprovincialis* (Olivier 1795). 6th Congress of Foretry, Spain.

Miller DR, Allison JD, Crowe CM, Dickinson DM, Eglitis A, Hofstetter RW, Munson AS, Poland TM, Reid LS, Steed BE & Sweeney JD (2016) Pine sawyers (Coleoptera: Cerambycidae) attracted to ?-pinene, monochamol, and ipsenol in North America. *Journal of Economic Entomology* **109**, 1205-1214.

Miller DR, Dodds KJ, Eglitis A, Fettig CJ, Hofstetter RW, Langor DW, Mayfield AE, 3rd, Munson AS, Poland TM & Raffa KF (2013) Trap lure blend of pine volatiles and bark beetle pheromones for *Monochamus* spp. (Coleoptera: Cerambycidae) in pine forests of Canada and the United States. *Journal of Economic Entomology* **106**, 1684-92.

Miller MC (1986) Within-tree effects of bark beetle insect associates on the emergence of *Ips calligraphus* (Coleoptera, Scolytidae). *Environmental Entomology* **15**, 1104-1108.

Ostojá-Starzewski JC (2014) Imported furniture – A pathway for the introduction of plant pests into Europe. *EPPO Bulletin* **44**, 34-36.

Peddle S, de Groot P & Smith S (2002) Oviposition behaviour and response of Monochamus scutellatus (Coleoptera: Cerambycidae) to conspecific eggs and larvae. *Agricultural and Forest Entomology* **4**, 217-222.

Robinet C, Roques A, Pan H, Fang G, Ye J, Zhang Y & Sun J (2009) Role of human-mediated dispersal in the spread of the pinewood nematode in China. *PLoS ONE* **4**, e4646.

Rose AH (1957) Some notes on the biology of *Monochamus scutellatus* (Say) (Coleoptera: Cerambycidae). *Canadian Entomologist* **89**, 547-553.

Ryall K, Silk P, Webster RP, Gutowski JM, Meng Q, Li Y, Gao W, Fidgen J, Kimoto T, Scarr T, Mastro V & Sweeney JD (2015) Further evidence that monochamol is attractive to *Monochamus* (Coleoptera: Cerambycidae) species, with attraction synergised by host plant volatiles and bark beetle (Coleoptera: Curculionidae) pheromones. *Canadian Entomologist* **147**, 564-579.

Safranyik L & Raske AG (1970) Sequential sampling plan for larvae of *Monochamus* in lodgepole pine logs. *Journal of Economic Entomology* **63**, 1903-1906.

Togashi K & Shigesada N (2006) Spread of the pinewood nematode vectored by the Japanese pine sawyer: Modeling and analytical approaches. *Population Ecology* **48**, 271-283. Wilson LF (1962) Insect damage to field-piled pulpwood in northern Minnesota. *Journal of Economic Entomology* **55**, 510-516 pp.

Wilson LF (1975) White spotted sawyer. In *Forest Pest Leaflet 74*. In *Forest Pest Leaflet 74*. U.S. Dept. of Agriculture, Forest Service, Northern Area State & Private Forestry.

Wingfield MJ & Blanchette RA (1983) The pine-wood nematode, *Bursaphelenchus xylophilus*, in Minnesota and Wisconsin - insect associates and transmission studies. *Canadian Journal of Forest Research-Revue Canadienne de Recherche Forestière* **13**, 1068-1076.

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 scutellatus*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int

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