EPPO Datasheet: *Monochamus notatus*

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IDENTITY

[more photos...]

Preferred name: *Monochamus notatus*
Authority: (Drury)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Cerambycidae
Other scientific names: *Cerambyx notatus* Drury, *Monochamus confusor* Kirby
Common names: northeastern sawyer
view more common names online...
EPPO Categorization: A1 list
view more categorizations online...
EPPO Code: MONCNO

Notes on taxonomy and nomenclature

Monochamus notatus was first described by Dru Drury in 1773, originally as part of the genus *Cerambyx*. The species was renamed as *Monohammus notatus* by Fitch in 1859 and *Monochamus notatus* by Casey in 1913 (Linsley & Chemsak, 1984).

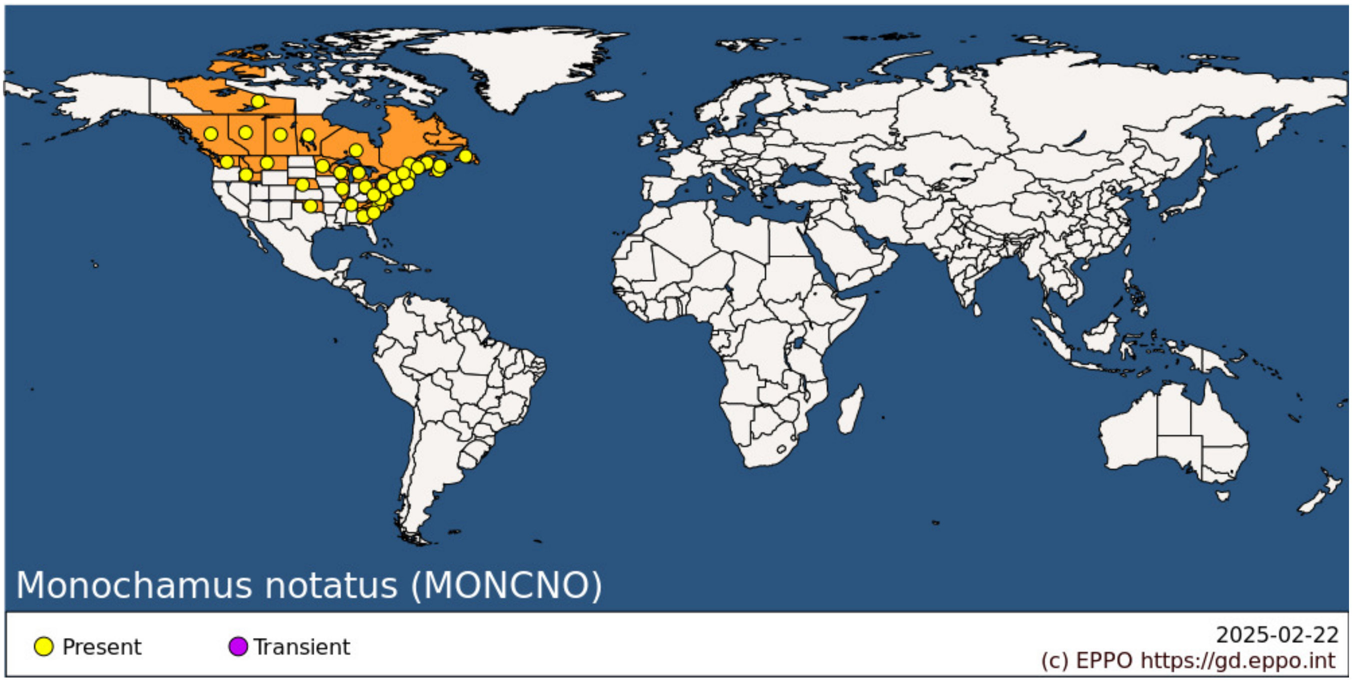
HOSTS

Monochamus notatus breeds in dead and dying *Pinus strobus* (white pine) and *Abies balsamea* (balsam fir) and in windthrown *Picea rubens* (red spruce) (Baker, 1972). It has been recorded from four genera of conifers. Of the named host species, *P. strobus* is planted as a timber tree in Europe, *Picea glauca* is planted in some northern European countries and *Picea menziesii* is planted worldwide as a timber tree, other hosts are non-native species that are not widely planted in Europe.

Host list: *Abies balsamea*, *Picea glauca*, *Picea rubens*, *Pinus monticola*, *Pinus resinosa*, *Pinus strobus*, *Pseudotsuga menziesii*

GEOGRAPHICAL DISTRIBUTION

Monochamus notatus occurs in Eastern Canada and in the North-Eastern United States, westward to the Great Lakes region (Baker, 1972). Compared to other N. American *Monochamus* spp. it has a relatively broad distribution being recorded from 22 US states and 11 Canadian provinces. It is not known to have spread outside its native range.



North America: Canada (Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Northwest Territories, Nova Scotia, Ontario, Prince Edward Island, Québec, Saskatchewan), United States of America (Connecticut, District of Columbia, Georgia, Idaho, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, Washington, West Virginia, Wisconsin)

BIOLOGY

In the North-Eastern United States, *M. notatus* adults begin to emerge in late June and continue to emerge until mid-August (Fierke *et al.*, 2012, Hodgson, 1957).

This paragraph is generic to *Monochamus* spp. from the Eastern United States. The larvae are commonly known as 'sawyers' because of the loud noise they make while feeding. Freshly cut, felled, dying trees or trees that recently died are preferred. Young larvae feed on the inner bark, cambium and outer sapwood, forming shallow excavations called surface galleries and filling them with coarse fibrous borings and frass. As the larvae grow older, they bore deep into the heartwood, and then turn around and bore back towards the surface, thereby forming a characteristic U-shaped tunnel. A pupal cell is formed at the outer end of the tunnel, from which the adult emerges by chewing a hole through the remaining wood and bark. Full-grown larvae are often more than 50 mm long (Baker, 1972). After emergence, *Monochamus* spp. adults need to feed on the living bark of young twigs to reach sexual maturity. This phase is obligatory before mating and subsequent oviposition. There is a wide between- and within-species variation in adult longevity, from approximately 1 to 5 months (EFSA, 2018). Generally, the life cycle of *Monochamus* spp. in North America is two years although in some years it can be just one year. Because of the overlapping generations, adults are found each year and may be more abundant in some years depending on the availability of host material and habitat conditions.

Miller (1986) studied the impact of excluding *Monochamus* spp. from freshly cut bolts (sections of 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.

M. notatus is considered to be a vector of pine wood nematode, *Bursaphelenchus xylophilus* (EFSA, 2018). 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

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 also 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

Adult *M. notatus* are noted to be dark brown and the head and pronotum are irregularly clothed with fine white hairs. The elytra are covered with fine grey and white hairs arranged in the form of interrupted stripes. The female head is greatly flattened and elongated (Baker, 1972).

Linsley and Chemsak (1984) provide a key to North American Cerambycidae in the subfamily Lamiinae, tribes Parmeninie through to Acanthoderini and *Monochamus* spp. are included in this. The key includes description of *M. notatus* adults:

Male: Form large, tapering posteriorly, integument reddish-piceous, elytra and outer antennal segments usually dark reddish-brown; pubescence recumbent, mostly greyish with small brown patches sparsely interspersed on elytra. Head with front convex, shallowly, irregularly punctate, irregularly clothed with white recumbent pubescence; genae longer than lower eye lobe, parallel; antennae extending about six segments beyond elytra, segments minutely aspirate, segments three to nine with apical sensory areas, scape rather densely pubescent, remaining segments rather sparsely clothed with very short recumbent pubescence, eleventh segment arcuate. Pronotum as long as broad, lateral tubercles prominent, rounded at apices; apex and base broadly impressed; disk with a median callus and a broad swelling on each side; punctures fine, irregular, sparse around median callus, remainder almost impunctate; pubescence whitish, irregular, recumbent, denser around lateral tubercles; prosternum rugulose, rather densely pubescent; meso- and metasternum irregularly punctate at sides, densely nonuniformly pubescent, long, suberect hairs numerous. Elytra less than 2.5 times as long as broad; base with scattered, small, rounded asperites, denser on humeri; punctures behind small, rather sparse, becoming obsolete toward apex; pubescence recumbent, mostly grey, mottled, with a few small patches of brown interspersed. Abdomen densely, irregularly pubescent, finely punctate; last sternite subtruncate at apex, often shallowly emarginate at middle, sides with a few long, erect hairs. Length 23-35mm.

Female: Form more robust, parallel. Head with front flat, broad, genae divergent; antennal tubercles much less prominent, more divergent; antennae extending about two segments beyond elytra. Abdomen with last sternite emarginate at apex, each side with large tufts of black hairs. Length 24-35 mm.

Detection and inspection methods

There is no specific information for *M. notatus,* 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

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. A combination of ipsenol and ?-pinene was significantly more attractive to *M. notatus* than unbaited traps.

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.* Field data also suggested that it is likely to be a pheromone for *M. notatus* and support for the hypothesis that it is a pheromone for the genus *Monochamus*. 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* (synonym = *M. mutator*). 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)), they also provided the first evidence that monochamol is attractive to *M. maculosus* 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 an 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. notatus* 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).

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

There is little specific information about the impacts of *M. notatus*, although *M. notatus* occurred in a new dwelling in Ottawa (Campbell *et al.*, 1989, MacNay, 1948) and *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 cause damage to timber 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. The larvae damage infested trees and logs through a 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

Prompt salvage and utilization of windthrow and dead and dying trees, debarking recently dead trees, and water storage of logs will prevent attacks by this species' (Baker, 1972, Duffy, 1960, Webb, 1909).

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).

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. *M. notatus* has been shown to be a vector of pine wood nematode (EFSA, 2018).

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, Togashi K & Linit MJ (2017) Cerambycids as plant disease vectors with special reference to pine wilt. In *Cerambycidae of the world,* pp. 209-252. CRC Press, Boca Raton, Florida.

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.

Campbell JM, Sarazin MJ & Lyons DB (1989) *Canadian beetles (Coleoptera) injurous to crops, ornamentals, stored products, and buildings*. Canadian government publishing centre, Ottawa.

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.

Duffy EAJ (1960) *A monograph of the immature stages of neotropical timber beetles*. British Museum (Natural History), London.

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.

Fierke MK, Skabeikis DD, Millar JG, Teale SA, McElfresh JS & Hanks LM (2012) Identification of a male-produced aggregation pheromone for *Monochamus scutellatus scutellatus* and an attractant for the congener *Monochamus notatus* (Coleoptera: Cerambycidae). *Journal of Economic Entomology* **105**, 2029-34.

Gibson K (2010) Management guide for sawyer beetles. Forest Health Protection and State Forewsy Organisations, Available online: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5187547.pdf

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.

Hodgson RL (1957) A life history study of the Northeastern sawyer beetle *Monochamus notatus* (Drury). University of Maine, Orono.

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.

MacNay CG (1948) Summary of the more important insect infestations and occurences in Canada in 1948. *Annual Report of the Entomological Society of Ontario* **78**, 71-89.

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.

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.

Safranyik L & Raske AG (1970) Sequential Sampling Plan for Larvae of Monochamus in Lodgepole Pine Logs1. *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.

Webb J (1909) *The southern pine sawyer*. US Department of Agriculture, Bureau of Entomology, Washington DC.

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*. U.S. Dept. of Agriculture, Forest Service, Northern Area State & Private Forestry.

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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.

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