

EPPO Datasheet: *Pissodes nemorensis*

Last updated: 2023-03-07

IDENTITY

Preferred name: *Pissodes nemorensis*

Authority: Germar

Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta:
Coleoptera: Curculionidae: Molytinae

Other scientific names: *Pissodes approximatus* Hopkins,
Pissodes canadensis Hopkins, *Pissodes deodarae* Hopkins

Common names: deodar weevil, northern pine weevil

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EPPO Categorization: A1 list

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EU Categorization: A1 Quarantine pest (Annex II A)

EPPO Code: PISONE

Notes on taxonomy and nomenclature

Subsequent to the original description of *P. nemorensis* in 1824, three closely related species (*P. approximatus*, *P. canadensis* and *P. deodarae*) were described by Hopkins (1911). Dietrich (1931) synonymized *P. deodarae* with *P. nemorensis* based on morphology and biology. Smith (1970) synonymized *P. canadensis* and *P. approximatus* based on cytogenetic evidence. Using ecological, behavioural and morphological data, Phillips *et al.* (1987) synonymized *P. approximatus* with *P. nemorensis*. Much information about *P. nemorensis* published under the junior synonyms, especially *P. approximatus*. A species that was inadvertently introduced to South Africa from North America before 1942 was originally thought to be *P. nemorensis* (Gebeyehu & Wingfield, 2003). However, recent morphological and mitochondrial DNA studies of the species in South Africa show that it is not *P. nemorensis* but rather a new closely related species or a hybrid between *P. nemorensis* and *P. strobi* (Wondafrash *et al.*, 2016). *Pissodes nemorensis* naturally hybridizes with *P. strobi* in the field and produces fertile offspring (Boyce *et al.*, 1994), but it is not known how commonly this happens. Based on mitochondrial DNA characters, there appears to be an undescribed species from Texas that is closely related to *P. nemorensis* (Boyce *et al.*, 1994).

HOSTS

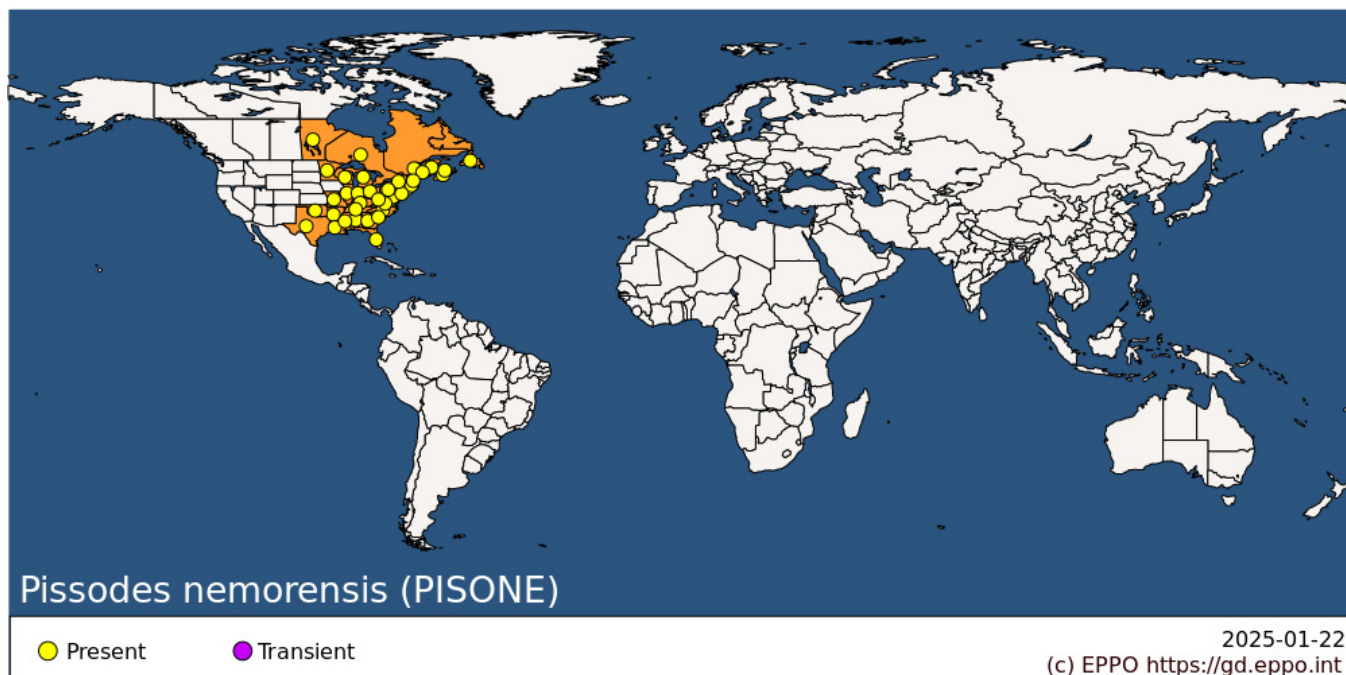
Pissodes nemorensis breeds in coniferous trees and has a very wide host range which includes most native and all of the economically important species of pines in the eastern half of the USA and Canada. Occasionally this weevil also breeds in native *Picea* species as well as in some introduced species of *Cedrus*. Blue spruce (*Picea pungens*) and lodgepole pine (*Pinus contorta*) are western Nearctic species which do not overlap with *P. nemorensis* in their natural range but have been attacked when planted in the eastern USA. Three species native to the EPPO region, Norway spruce (*Picea abies*), Austrian pine (*Pinus nigra*) and Scots pine (*P. sylvestris*), are attacked in eastern North American plantations. A comprehensive list of host plants of North American *Pissodes* spp. can be found in Smith & Sugden (1969).

Host list: *Cedrus atlantica*, *Cedrus deodara*, *Cedrus libani*, *Picea abies*, *Picea glauca*, *Picea mariana*, *Picea pungens*, *Pinus banksiana*, *Pinus clausa*, *Pinus contorta*, *Pinus echinata*, *Pinus elliotii*, *Pinus glabra*, *Pinus nigra*, *Pinus palustris*, *Pinus pungens*, *Pinus radiata*, *Pinus resinosa*, *Pinus rigida*, *Pinus serotina*, *Pinus strobus*, *Pinus sylvestris*, *Pinus taeda*, *Pinus virginiana*

GEOGRAPHICAL DISTRIBUTION

Pissodes nemorensis occurs in the eastern half of the USA and Canada. Although previously reported from South Africa, it is now known that this introduced species is not *P. nemorensis*. The records from Far-East Russia

undoubtedly represent an error in identification (Lu *et al.*, 2007), as does the record from Hokkaido, Japan. Earlier records of *P. nemorensis* ranging across the boreal forest of Saskatchewan, Alberta and British Columbia (Figure 1 in Boyce *et al.*, 1994) to the Yukon Territory (Evans *et al.*, 1978) are in error and undoubtedly represent misidentifications of the similar bole inhabiting species, *Pissodes schwarzi*.



North America: Canada (Manitoba, New Brunswick, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, Québec), United States of America (Alabama, Arkansas, Connecticut, District of Columbia, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia, Wisconsin)

BIOLOGY

Due to its broad north-south distribution in Eastern North America, the life cycle of *P. nemorensis* varies with respect to climate zone. One life cycle, whereby adults disperse in the spring, is typical in the northern part of its range in Ontario (Finnegan, 1958; Martin, 1964), Pennsylvania (Bliss & Kearby, 1970b) and upstate New York (Phillips & Lanier, 1983; Phillips *et al.*, 1987). A different life cycle, with adult dispersal in the autumn, is typical of the southern part of its range in Georgia and Florida (Fontaine & Foltz, 1982, 1985; Fontaine *et al.*, 1983; Phillips *et al.*, 1987; Atkinson *et al.*, 1988a, 1988b). These two life cycles occur in populations in Virginia (Phillips *et al.*, 1987), and probably in some adjacent states.

Northern life cycle. This life cycle is characterized by a spring flight period and overwintering. Overwintering occurs primarily in the adult stage in leaf litter and top-soil overlying roots or in bark crevices of stumps and logs, although a few individuals may overwinter as mature larvae or pupae in trees. Adults emerge from overwintering sites in late April to early May and feed for about three weeks on inner bark of branches and, in the case of seedlings and small trees, also on stems. Adults remain on the bark surface and feed by inserting their snouts through the bark into the phloem layer, making small, inconspicuous feeding punctures 1-2 mm in diameter. In late May, adults disperse by flight to locate suitable host material whereupon the males release an aggregation pheromone consisting of grandisol and grandisal (Phillips *et al.*, 1984) to attract both sexes, and mating occurs. The oviposition is mainly from late May until July. Females chew punctures through the bark to the phloem and cambium, usually lay 1-2 eggs, but occasionally as many as five, in each puncture, and plug the punctures with defecated material. Typically adults oviposit in fresh logs and stumps, in boles (trunk from the roots up to the crown) and branches of weakened, standing trees of all sizes (e.g., weakened by transplantation shock, disease and drought), and even in 1- to 2-year-old seedlings. In an insectary females laid an average of 47 (maximum 62) eggs. Eggs hatch in about eight days and young larvae (approximately 1 mm in length) feed in the cambium layer, mining along the grain. When seedlings are

attacked, the bark is too thin to accommodate the mature larvae, and larvae bore to the centre of the stem to have room to pupate. Larvae pass through four instars in an average of 36 days. Each mature larva excavates a cavity in the outer wood using their mandibles, lining the walls with small strips of sapwood and phloem, and pupation occurs in this so-called "chip cocoon". The pupal period lasts about two weeks. New callow adults remain in the chip cocoon for about five days as their cuticle hardens, and then chew their way to the outside, making circular emergence holes of about 3-5 mm in diameter. Emergence occurs from mid-August to early October and adults feed before hibernating when temperatures get cold. No mating or oviposition occurs before winter.

A small proportion of individuals in northern populations have a two year life cycle. As some eggs are laid too late in the season for development to adulthood to be completed before winter, these individuals enter the winter as mature larvae and pupae, completing development the following year. Adults emerge in late June and July but do not reproduce before winter but rather feed until hibernation. They emerge from overwintering sites the following spring to disperse and reproduce at the same time as adults from the one-year life cycle broods.

Southern life cycle. This life cycle is characterized by an autumn dispersal period and no overwintering period of inactivity. In Florida and Georgia, the adult flight period is mainly between September and March and adults are reproductively mature during that period. Mating and oviposition take place from September to February. The oviposition period is long, which results in phenological asynchrony within populations. Females lay an average of 180 eggs (maximum of 284) under laboratory conditions, and they die after an average lifespan of 130 days. The optimal temperature for oviposition is 25°C. The development time from egg to adult depends on date of oviposition and temperature; it ranges from 7 to 25 weeks with a development time of 58 days at a temperature of 25°C. There are five larval instars in Florida. Pupation occurs in chip cocoons and pupae occur mainly from February to April. New adults emerge in late February to early May and spend the summer feeding on new shoots and branches during cool periods of the day.

For both life cycles, aggregation does not occur until the adults have dispersed to new host material and males release an aggregation pheromone.

DETECTION AND IDENTIFICATION

Symptoms

Pissodes nemorensis breeds mainly in recently cut logs and stumps and also in boles and branches of more than 1.25 cm in diameter of weakened, standing trees. Trees selected for weevil reproduction show signs of stress (e.g., foliage discoloration, resin flow on the bole). The presence of breeding weevils in stumps, logs and trees will be indicated by presence of ovipositing adults on the bark or other life stages under the bark. Nursery plants, outplanted seedlings as young as one year old and young saplings may also be utilized for weevil reproduction and killed by feeding larvae. Plants utilized for weevil reproduction exhibit resin flow from boles and branches, foliage wilting, and foliage discoloration (yellow to reddish brown) within a few days-to-weeks of attack.

Trees can also be damaged by newly emerged adults that are feeding but not engaged in reproduction; these adults feed on the phloem tissue of the twigs and branches of seemingly healthy trees, and this results in copious resin flow from feeding punctures. When the infestation of feeding adults is heavy and stresses the trees, the foliage can become discoloured and needles may drop prematurely (Finnegan, 1956).

In Eastern North America, *Pissodes affinis* can attack the same host species and cause the same symptoms as *P. nemorensis*. Adults of both species are about the same size but look distinctly different in terms of elytral colour pattern (Martin, 1964) and in other characteristics (Hopkins, 1911).

Morphology

Eggs

Eggs are translucent, pearly white, ovoid, 0.7-0.9 mm long and 0.4-0.6 mm wide (Finnegan, 1958), and look like the eggs of many other species of *Pissodes*.

Larva

Larvae are legless, have milk-white bodies and light brown heads, the abdomen is slightly curved downwards, and are about 12 mm long when fully grown (Finnegan, 1958). Superficially, larvae of this species look like larvae of other species of *Pissodes*. Detailed descriptions of the external anatomy of mature larvae of *P. nemorensis*, as well as those of the closely related *P. strobi*, *P. terminalis* and *P. schwarzi*, accompanied by illustrations, are provided by Williams & Langor (2002a). Keys do not exist to discriminate between larvae of *P. nemorensis* and those of the eight species of bole-inhabiting *Pissodes* in the EPPO region.

Pupa

Pupae are about 7-9 mm in length and are milk-white, but the mandibles, eyes, rostrum, prothorax and legs become medium brown before adult emergence (Finnegan, 1958). Pupae of different *Pissodes* species cannot currently be distinguished.

Adult

Adults have a long snout, are mottled brown with variable white and rusty brown patches on the elytra, and are 5-8 mm long (Finnegan, 1958). There is no sure way to morphologically discriminate between *P. nemorensis* and another closely related Nearctic species that breeds in boles of pines and spruces, *P. schwarzi*, without using a morphometric approach (Williams & Langor, 2002b). Adults of *P. nemorensis* are distinct from native species in the EPPO region but there is currently no identification key to discriminate among species.

Detection and inspection methods

This species attacks freshly cut spruce and pine logs and stumps as well as live hosts ranging in age from one year old seedlings to mature trees. The only way to ascertain if cut material has been infested is to look for aggregating adults on the bark surface, adult emergence holes of 3-5 mm diameter in the bark (not unlike bark beetle emergence holes) or by removing bark to look for larvae, pupae, chip cocoons, and callow adults.

In general, standing hosts, ranging from seedlings to mature trees, exhibiting signs of stress, e.g., copious resin on stems and branches, foliage wilting and discolouration, should be investigated for signs of weevil attack such as presence of adults on the bark and all life stages and chip cocoons under the bark. As *P. nemorensis* populations can build up quickly in stumps and logs from harvest operations (Finnegan, 1956), standing trees exhibiting signs of stress in the general vicinity of harvest activity should be suspected of weevil infestation. DNA barcodes are available for most species of *Pissodes* native to the EPPO region, as well as for all members of the *strobi* species group in North America (Langor & Sperling, 1997), and these are useful for species identification.

PATHWAYS FOR MOVEMENT

The natural spread of *Pissodes* spp. is determined by the flight performance of the species, which is probably not more than 10 km per year based on what is known about flight capabilities of other species of *Pissodes*. International spread could occur via shipment of host commodities: plants for planting, Christmas trees and cut foliage, untreated round wood and wood packaging material (including dunnage), especially if there is bark remaining on wood. *Pissodes nemorensis* has been intercepted on *Tsuga* (not a known host) and *Picea* logs at two ports in Japan (Yoshitake *et al.*, 2014).

PEST SIGNIFICANCE

Economic impact

Pissodes nemorensis is of little importance in natural, healthy pine and spruce stands due to the low amount of suitable breeding material. However, in Christmas tree plantations, the numerous stumps of trees cut the previous winter are ideal for population build-up. Newly emerged adults feeding on the phloem tissue of the twigs and

branches of nearby healthy trees can damage and kill remaining Christmas trees (Overgaard & Nachod, 1971). In a 10-year-old Scots pine plantation in Ontario, feeding adults killed 5% of trees and caused heavy damage to the remainder (Finnegan, 1956). As reforestation and afforestation increases, creating extensive open plantations and weakened trees, the damage caused by *P. nemorensis* increases. Nursery plants are often badly damaged as adults feed on the bark of seedlings and larvae girdle the stems. Besides the direct damage it causes, *P. nemorensis* acts as a vector of *Leptographium procerum*, the causative agent of procerum root disease, the most damaging pest problem for *Pinus strobus* Christmas tree plantations in Virginia (Nevill & Alexander, 1992a, b). Older trees that are under stress due to drought, disease or transplantation are readily attacked causing mortality (Martin, 1964). In Missouri, *P. nemorensis* adults were found to carry pinewood nematode, although transmission to trees has not been shown (Linit *et al.*, 1983).

Control

Ethanol and turpentine baited flight intercept traps can be used to monitor *P. nemorensis* populations in plantations but are not suitable for control (Rieske & Raffa, 1993). Removal of breeding material (e.g., fresh stumps and logs) in plantations will greatly reduce the weevil source. Herbicides applied to stumps can control weevil breeding (Ahrens & Dunbar, 1975). For control with pesticides, carbofuran has been reported to be effective in Christmas tree plantations (Appleby *et al.*, 1988). Other chemical insecticides have also proven effective in *P. nemorensis* control (Bliss & Kearby, 1970a; Dunbar, 1976), but some of these may no longer be registered for such purposes.

Phytosanitary risk

In its natural range *P. nemorensis* is a serious pest, especially in conifer nurseries and in Christmas tree plantations. It includes among its hosts the very important European species *Pinus sylvestris* and *Picea abies* and also several North American species which are more or less widely planted in Europe (*Picea glauca*, *Picea pungens*, *Pinus contorta*, and *Pinus radiata*). The climatic conditions of eastern North America are broadly similar to those of Europe and should not be an impediment to establishment of *P. nemorensis* in the EPPO region if introduced. In North America, *P. nemorensis* has a broad host range which suggests that other pine, spruce and cedar species in Europe would be susceptible. Introduction of *P. nemorensis* into the EPPO region could have severe economic and ecological consequences.

PHYTOSANITARY MEASURES

Adherence to International Standards for Phytosanitary Measures No. 15 for wood packaging material (IPPC, 2019) will greatly decrease the risk of introduction of bark- and wood-boring insects, including *P. nemorensis*. Fumigation of wood commodities suspected of being infested with *P. nemorensis* is expected to be highly effective as has been demonstrated for the related Asian species, *Pissodes nitidus*. Fumigation using methyl isothiocyanate (applied at 20 g/m³ for 24 h at 15 °C), sulfuryl fluoride (30 g/m³, 24h, 15°C), methyl bromide (10 g/m³, 24h, 15°C), and methyl iodide (30 g/m³, 24h, 15°C) cause complete mortality of *P. nitidus* eggs, larvae, and pupae under the bark (Naito *et al.*, 1999, 2003; Soma *et al.*, 1999). In the European Union, methyl bromide can only be used in emergency quarantine situations upon receiving special permission from the European Commission.

EPPO recommends phytosanitary measures against *P. nemorensis* for round wood of hosts (pest free area, or treatment by fumigation, irradiation or debarking associated with heat treatment) and for wood chips, isolated bark and similar commodities (pest free area or heat treatment) (EPPO, 2018). It is also recommended that host plants for planting (except seeds) and cut branches (including Christmas trees) should originate in a pest free area (EPPO, 2018). Pest free place of production is the specific requirement mentioned in the EU regulation for plants for planting and cut branches of hosts (EU, 2022).

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Datasheet history

This datasheet was first published in the EPPO Bulletin in 1980 and revised in the two editions of 'Quarantine Pests for Europe' in 1992 and 1997, as well as in 2023. It is now 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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