EPPO Datasheet: *Dendroctonus micans*

Last updated: 2021-01-08

IDENTITY

Preferred name: *Dendroctonus micans*
Authority: (Kugelann)
Taxonomic position: Animalia: Arthropoda: Hexapoda: Insecta: Coleoptera: Curculionidae: Scolytinae
Other scientific names: *Bostrichus micans* Kugelann, *Hylesinus ligniperda* Gyllenhal, *Hylesinus micans* Ratzeburg
Common names: European spruce bark beetle, great spruce bark beetle
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EU Categorization: PZ Quarantine pest (Annex III)
EPPO Code: DENCMI

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Notes on taxonomy and nomenclature

The majority of species in the genus *Dendroctonus* occur in the Nearctic region, and include several highly damaging forest pests. *Dendroctonus micans* and the North American boreal forest species, *D. punctatus*, are morphologically and ecologically very similar, and were considered doubtfully distinct (Wood, 1963). They are now understood to be closely related, and confirmed to be different species (Furniss, 1996; Reeve *et al.*, 2012).

HOSTS

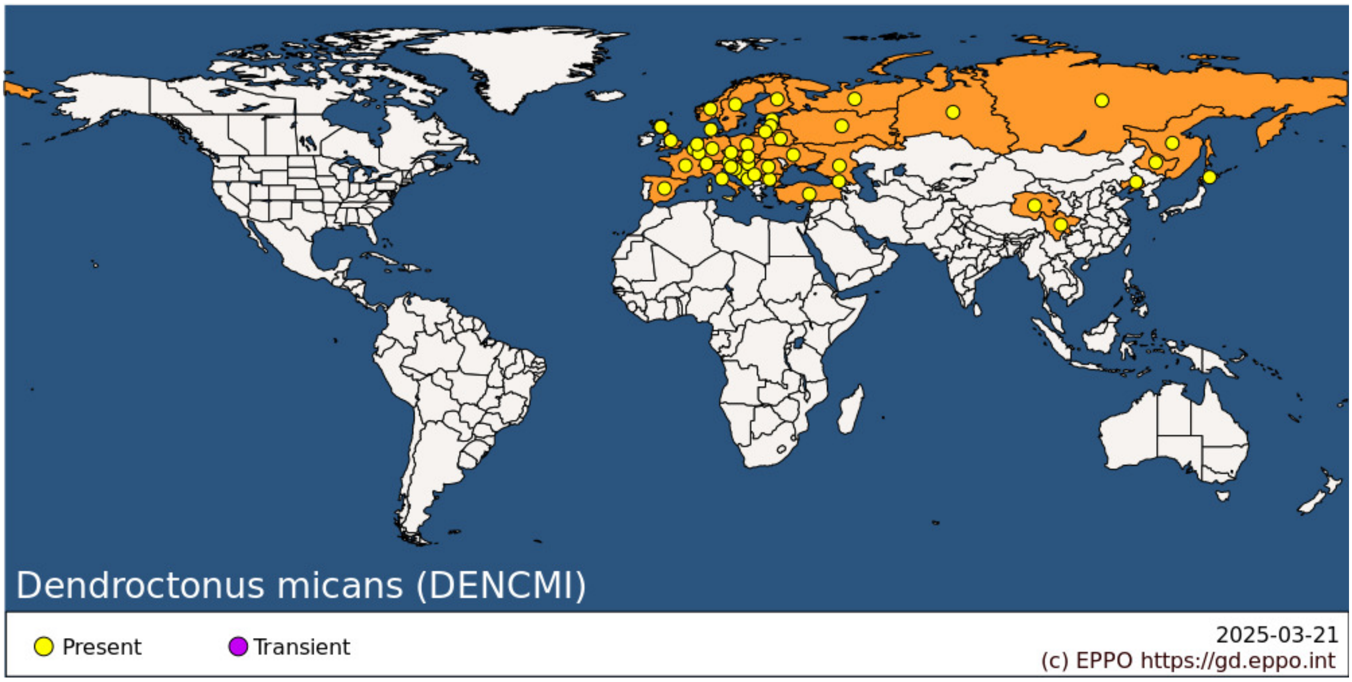
Throughout its range, *D. micans* breeds primarily in spruce (*Picea*) spp., mainly *P. abies*, *P. sitchensis*, *P. orientalis* and *P. obovata*, but also on occasion in *P. ajanensis*, *P. breweriana*, *P. engelmannii*, *P. glauca*, *P. jezoensis*, *P. mariana*, *P. omorika* and *P. pungens* (Grégoire, 1988; EFSA, 2017). Other native and introduced conifers are also occasionally attacked, including *Pinus sylvestris*, on which outbreaks have been recorded quite widely, typically on sites suffering adverse conditions (Voolma, 1993; CABI, 2020). Sporadic attacks have been observed on other *Pinus* spp. and on some *Abies* spp., *Larix decidua* and *Pseudotsuga menziesii*. *Picea abies* is preferred to *P. sitchensis* when the two species coexist, but is also generally more resistant to being killed than other spruce species (Bejer, 1984; Fielding, 2012).

Host list: *Abies alba*, *Abies holophylla*, *Abies nordmanniana*, *Abies sibirica*, *Larix decidua*, *Picea abies*, *Picea breweriana*, *Picea engelmannii*, *Picea glauca*, *Picea jezoensis subsp. jezoensis*, *Picea jezoensis*, *Picea mariana*, *Picea obovata*, *Picea omorika*, *Picea orientalis*, *Picea pungens*, *Picea sitchensis*, *Pinus contorta*, *Pinus mugo subsp. uncinata*, *Pinus nigra*, *Pinus strobus*, *Pinus sylvestris var. hamata*, *Pinus sylvestris*, *Pseudotsuga menziesii*

GEOGRAPHICAL DISTRIBUTION

Dendroctonus micans is distributed widely across the northern Palaearctic region, from Eastern Siberia and Japan (Hokkaido) across to France and Great Britain. Its presence reflects the natural and planted distribution of spruce, where its northerly limit is that of the coniferous forest, and it occurs as far south as Italy, Georgia and Northern Turkey. It is therefore present throughout Europe, and is only absent from Spain and Portugal, and a few areas which have protected zone status, namely Greece, Ireland and parts of the United Kingdom (Northern Ireland, Isle of Man and Jersey).

Genetic evidence suggests that *D. micans* has been present for a long period in Europe, rather than a more recent colonisation from Siberia as previously suggested (Gregoire, 1988; Mayer *et al.*, 2015). Certainly, the extensive planting of spruce has enabled *D. micans* to extend its natural range within Europe.



EPPO Region: Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France (mainland), Georgia, Germany, Hungary, Italy (mainland), Latvia, Lithuania, Luxembourg, Montenegro, Netherlands, Norway, Poland, Romania, Russia (Central Russia, Eastern Siberia, Far East, Northern Russia, Southern Russia, Western Siberia), Serbia, Slovakia, Slovenia, Spain (mainland), Sweden, Switzerland, Türkiye, Ukraine, United Kingdom (England, Scotland)
Asia: China (Heilongjiang, Liaoning, Qinghai, Sichuan), Japan (Hokkaido)

BIOLOGY

Dendroctonus micans primarily reproduces via sibling mating, where new adults mate under the bark within the natal chamber. The sex ratio of the insect is therefore adapted towards a much higher proportion of females (between 5 and 48 : 1) which are fertilized by their brothers (Grégoire, 1988). The female beetles therefore do not need to locate a mate in order to colonise a new host tree or begin a new infestation, and no aggregation of adults takes place, an unusual characteristic for a bark beetle attacking live standing trees. Some outbreeding does occur, but to a much lesser extent (Fraser *et al*., 2014). New galleries are created by lone females, which may simply bore at the edge of their own natal chamber, emerge to establish galleries on the same tree, or fly to colonize new trees. The flight threshold temperature is between 20 - 23°C (Evans *et al*., 1984), but dispersal often occurs at cooler temperatures by walking. Gallery formation and oviposition can occur from April/May to August-November depending on latitude and altitude. The female excavates an egg chamber in the inner bark of the host tree, into which she lays 50-100 eggs. She may then create additional connecting chambers, laying up 300 eggs in total. As the larvae hatch, they begin feeding gregariously (side by side), apparently regulated by a larval aggregation pheromone (Grégoire *et al*., 1982), so that the larval chamber is enlarged across a wide front, helping to overcome the induced defences of the host. Larvae only leave the feeding front to molt, defecate, and to take turns tightly packing frass to the rear. This characteristic behaviour serves to enclose dead and diseased individuals, and presumably to help to exclude predators, such as *Rhizophagus grandis*, an important biocontrol agent. Pupation occurs in individual cells within this packed frass. Newly eclosed adults continue to maturation feed communally under the bark, during which period they also mate, prior to emergence.

The length of *D. micans*' life cycle varies from 1 - 3 years depending on climate and location. The beetle is well adapted to the cooler temperate conditions where spruce is often grown, with optimal development reached at the relatively mild temperature of 20-22.5°C. Larval diapause prevents the beetle from overwintering as a delicate pupa, and so it overwinters either as a larvae or an adult (Gent *et al*., 2017).

DETECTION AND IDENTIFICATION

Symptoms

Characteristic 'resin tubes' consisting of frass mixed with spruce resin, are formed as females burrow into the bark of live trees. The tubes vary from light to dark brown, becoming whitish as the resin hardens. The proportion of frass in the tube provides an indication of the extent of the gallery; attacks are often aborted, so resin tubes do not necessarily indicate successful host colonization. Attacks often focus upon the lower stem, and granular resin at the base of the tree can indicate an attack at ground level. Streams of white, dried resin flows may also be visible on the trunk, exuding from wounds created by the beetle. Trees usually survive single attacks, and may remain alive for years when the density of galleries is low. A tree suffering repeated attack may become encrusted with resin, and exhibit broken, peeling and often blackened bark (Bevan & King, 1983). The egg chamber is unique amongst European bark beetles, containing a large number of eggs on one side, and filled with frass. The gregarious larval feeding activity produces a very large chamber packed with frass, covered by unattached bark; this can be detected by a hollow sound when the bark is tapped. Older infestations may be indicated by woodpecker attack, which can detach the loose outer bark, and reveal larval galleries and the frass packed in an 'island-like' pattern (Fielding, 2012). Attacked trees are often found individually or in small groups, and repeat infestations or a heavy infestation eventually leads to signs of foliage browning, crown dieback and top death.

Morphology

Egg

Pale white and translucent, oval in shape, and just over 1 mm long.

Larva

Creamy-white, legless, cylindrical grub with a curved 'C-shaped' body which is sparsely covered in stout, dark setae. The head capsule is a dark amber colour. When fully grown, they are approximately 6.5-8 mm long.

Pupa

Uniformly white, gradually darkening in colour, 6-8 mm in length. Adult structures are apparent, including antennae, legs, and wings, folded against the body.

Adult

Cylindrical body form, distinctly narrowing towards the head (when viewed dorsally) and with a smoothly rounded elytral declivity (posterior). The head is visible from above, and the body appears hairy, being covered in moderately dense, pale setae, which are longest on the declivity. Light brown when newly emerged, becoming black when mature. This species is amongst the largest of the bark beetles, approximately 6-9 mm long and 2.5-3mm wide. Adults may be distinguished from Nearctic species of *Dendroctonus* by use of the key of Wood (1963), from *D. punctatus* using characters defined by Furniss (1996), and any life stages may be identified using DNA sequencing (Kelley and Farrell, 1998; Reeve *et al.* 2012).

Detection and inspection methods

Since *D. micans* adults do not produce pheromones for aggregation and mass attack of host trees, traps typically used for monitoring other pest bark beetle species (usually baited with pheromone lures) are of no real value for monitoring or detecting *D. micans*. Instead, visual observation of symptoms (described above) is critical for identifying infested trees and localized beetle outbreaks. Trees are typically attacked individually or in groups, and heavy infestation becomes apparent at a distance once trees exhibit needle discoloration and canopy dieback. Attacked trees may be identified by aerial surveillance combined with a follow-up ground survey to confirm the presence of *D. micans* attack.

PATHWAYS FOR MOVEMENT

Female *D. micans* have already mated with siblings before they emerge from the brood gallery, and so a single individual is capable of starting a new infestation. The initial spread of such inbreeding species is therefore not limited by the difficulties of mate location, and small populations are less vulnerable to extinction (Kirkendall *et al.*, 2015). However, *D. micans* typically fly only limited distances, and dispersal often occurs very locally by walking. As with other Scolytinae, movement over longer distances is therefore most likely via human-assisted spread, in infested wood, bark, and wood packaging material. Transportation of larvae under the bark of infested round wood is the pathway by which *D. micans* was most likely introduced to new areas such as Georgia and the United Kingdom (Kobakhidze, 1967; Bevan & King, 1983). The beetle has gradually expanded its range in many parts of Europe however, due to the extensive planting of *Picea* outside its natural range (Grégoire, 1988).

PEST SIGNIFICANCE

Economic impact

Within the established part of its distribution, *D. micans* is widespread but generally low in abundance. The beetle attacks live standing trees, but a variety of preformed and induced host defences such as resin flow and lignified stone cell masses frequently cause attacks to be aborted (Wainhouse *et al*., 1998). Successfully colonised trees typically survive single attacks, but the tendency of the beetle to re-colonise the same host often leads to multiple broods developing in the same tree, which can eventually cause girdling of the stem and tree death. Beetles often attack host trees where sap pressure is lowest, commonly at a fork in the main stem, or immediately below a branch node, and in particular they will often attempt to colonize the area around a wound on the stem, such as that caused by thinning operations (Alkan Akinci *et al*., 2009; Fielding 2012). Trees damaged by severe weather also become more susceptible to attack. Timber may be salvaged from attacked trees however, since it remains in good condition until the tree dies; the beetle does not penetrate the wood, and no blue-stain fungi are vectored to stain it (Grégoire, 1988).

During outbreaks however, the beetle is able to destroy entire stands of spruce; sometimes on a large scale. The most serious damage has generally been associated with the spread of the beetle into new areas. For example, tens of thousands of hectares of *Picea orientalis* were infested by *D. micans* in Georgia after it established there (Kobakhidze, 1967), with another 120 000 hectares subsequently infested as it spread into North East Turkey (Alkan Akinci *et al*., 2009). The scale of outbreak seems to be related to such areas being at the extremes of the natural range of *Picea* and the trees likely being under stress, due to poor soil conditions or inadequate water for example. Escape from the control of natural predators also seems to play a role in outbreak development, since once the specific predator *Rhizophagus grandis* is established, whether naturally or through artificial release, damage tends to subside within a few years (EFSA, 2017).

Control

Perhaps the most important method of control against serious damage by *D. micans* is the specific predator *Rhizophagus grandis* (Coleoptera: Monotomidae), which is highly effective at locating *D. micans* infestations. Both adult and larval *R. grandis* feed upon the juvenile stages of *D. micans,* and the presence of *D. micans* larvae throughout much of the year probably contributes to the effectiveness of *R. grandis*, which can have 1-3 generations per year (Grégoire, 1988). Although the predator gradually spreads with *D. micans*, it has been reared in large numbers and released to provide effective control where *D. micans* has been introduced, in Georgia, Turkey, France and Great Britain (Tvaradze, 1984; King & Evans, 1984; Grégoire *et al*., 1985; EFSA, 2017). The predator provides the most effective control when released into new infestations of *D. micans*, and when the bark beetle population is at a relatively low level (Fielding & Evans, 1997). In Britain, small numbers of reared predators (approximately 100 individuals) were released in response to localised outbreaks of *D. micans*, to augment the endemic population and reduce the bark beetle population by an estimated 80-90% (Fielding, 2012).

Local sanitation felling is widely used to remove small outbreaks of *D. micans* on individual or groups of trees. Care should be taken during management operations such as felling or thinning, since any mechanical damage to spruce trees will make them more susceptible to attack. Where practical, infested trees are best removed during regular thinning operations to prevent additional wounding of surrounding trees. Careful site selection, and the avoidance of planting on poor sites, will promote vigorous growth and increase the trees' resilience against attack.

Phytosanitary risk

Dendroctonus micans is listed as a protected zone quarantine pest in Annex IIB of Council Directive 2000/29/EC for Greece, Ireland and the United Kingdom (Northern Ireland, Isle of Man and Jersey), where the pest is not present and quarantine measures are implemented to prevent entry. In the core part of its range *D. micans* is widespread and causes relatively low levels of damage. The beetle however poses a greater risk to newly colonised areas where outbreaks and significant tree death may occur, at least until the natural predator *Rhizophagus grandis* also establishes and helps to control the bark beetle at a more typical endemic level. Smaller outbreaks may continue to occur after that time however, particularly if spruce stands are subject to drought stress or damage from forest operations. *Dendroctonus micans* is a cryptic pest at low population levels, with initial attacks being inconspicuous, and the adults not readily caught by trapping. By the time killed trees become apparent, a newly established population is likely to be relatively large and widespread (EFSA, 2017).

PHYTOSANITARY MEASURES

To prevent entry of *D. micans* into the protected zones of Greece, Ireland and the United Kingdom (Northern Ireland, Isle of Man and Jersey) where it is considered a quarantine pest, phytosanitary measures are in place to prevent introduction of the pest with wood and bark. These include debarking of wood, and heat treatment of wood, bark and chips. The pest is regulated on five genera, *Abies*, *Larix*, *Picea*, *Pinus* and *Pseudotsuga*, reflecting the range of potential hosts which it can attack. The removal of bark from wood should ensure the absence of the pest, but caution must be exercised with regard to debarking of round wood, because small areas of bark can remain and harbour the pest, particularly around branch nodes which are a common area of attack for *D. micans.*

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Datasheet history

This datasheet was first published in 1997 in the second edition of 'Quarantine Pests for Europe', and revised in 2021. 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.

CABI/EPPO (1997) *Quarantine Pests for Europe (2nd edition).* CABI, Wallingford (GB).

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