

**Plant Health Leaflet No 9**

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**Forestry Commission**

# **Dendroctonus Micans – a guide for Forest Managers on control techniques**

**Guidance for  
Forest Managers in the  
detection of the Great  
Spruce Bark Beetle and  
on controls to prevent  
its spread**





# Dendroctonus Micans – a guide for Forest Managers on control techniques

## Introduction

The Great spruce bark beetle, *Dendroctonus micans*, is regarded as a major pest of spruce from eastern Siberia to the west of Europe. It breeds under bark, causing destruction of the cambium, which debilitates and, in extreme cases, kills the tree. Its reputation as a pest is based on the ability of single female beetles to colonise living trees, without the necessity of the mass attack typical of most bark beetles. It was first discovered in Britain in 1982 and was, until 1997, restricted to the west of the country, mainly in Wales and adjoining English counties. During 1996, an outbreak was discovered near Ashford in Kent.

## Control Strategy

Since *Dendroctonus micans* was detected, vigorous control measures have been adopted to minimise the spread of the beetle. The national control strategy was decided on the basis of recommendations by the Dendroctonus Micans Working Group, a joint Forestry Commission and private sector advisory body. The Working Group met regularly to develop a control strategy and to review progress. Details of control measures were promulgated by the Commission in its series of Plant Health Information Sheets. There were four main elements to the strategy:

- a. Licensed timber movement control, associated with an ‘approved mills’ scheme, under a Forestry Commission Order (which delineated a Scheduled Area for control purposes - *The Restriction on Movement of Spruce Wood Order 1982*, as amended).
- b. Surveys - carried out to identify new attacks and to monitor spread.
- c. Sanitation felling.
- d. Biological control - by release of the specific predator *Rhizophagus grandis*.

In 1993, when the Single Market within the EU was completed, the controls set out in the Restriction on Movement of Spruce Wood Order were modified. The new arrangements for protected zones within the EU incorporated movement controls through a system of registering forestry traders and authorising them, where appropriate, to issue plant passports. The new rules are set out in the Plant Health (Forestry) (Great Britain) Order 1993, as amended, (“the Order”) and controls on the movement of spruce bark originating in the affected area are set out in the Treatment of Spruce Bark Order 1993, as amended. The main elements of the current strategy are broadly similar to the former arrangements. They are:

- a. the area affected by *D.micans* has been designated the Dendroctonus Micans Control Area (DMCA) while the rest of Great Britain has been designated a protected zone under EC legislation and is Scheduled in the Order as the ‘Dendroctonus Micans Protected Zone (DMPZ);
- b. registration of forestry traders dealing in conifer wood originating within the DMCA and sawmills receiving such material;
- c. prohibiting the movement of spruce wood, with bark (unless kiln-dried), from the DMCA to the DMPZ;
- d. controlling the movement of non-spruce conifer wood, with bark, by the use of plant passports and related plant health checks;
- e. surveys - carried out intensively on spruce in the peripheral zone, a 10 km-wide strip bounded by, and within, the DMCA, and at selected sites throughout the rest of the country;
- f. sanitation felling - confined to the peripheral zone and to any localised outbreaks found elsewhere.
- g. biological control - by release of the specific predator *Rhizophagus grandis*.

The arrangements are reviewed by a joint FC/industry Plant Health Working Group (which is not restricted to *D.micans* issues) and information is disseminated to the industry by way of Newsletters, which cover all plant health matters.

This leaflet provides a short background to *Dendroctonus micans* in Britain and the control techniques which have been developed to minimise its impact and spread. The guidelines are intended to give managers a framework for assessing the risks in their plantations and provide practical advice on what to look for and what to do if *Dendroctonus micans* is found.



## Tree Species Attacked

In Britain, *Dendroctonus micans* attacks and breeds in all species of spruce. British foresters are concerned mainly with Sitka spruce (*Picea sitchensis*) and Norway spruce (*Picea abies*). The probability of successful attack and consequent mortality varies between the spruces as the table below indicates; although the ultimate destructive capability of the beetle is greater on Sitka spruce, the adult beetles prefer to attack Norway spruce, even in mixture. This host preference should be remembered when looking for signs of beetle activity in *Picea* spp.

Susceptibility to initial attack		Ultimate likelihood of mortality
Higher	a. <i>abies</i> , <i>alba</i> , <i>omorika</i>	a. <i>pungens</i> , <i>omorika</i> , <i>orientalis</i>
Intermediate	b. <i>pungens</i> , <i>orientalis</i>	b. <i>sitchensis</i> , <i>alba</i>
Lower	c. <i>sitchensis</i>	c. <i>abies</i>

## Effect on the Host Tree

The progress of damage to individual trees and to the crop as a whole is extremely variable and it may take several years before a tree is completely girdled at one or more points along the stem and thus killed. Long before individual trees are killed a large breeding population may have built up, giving rise to serious risk of spread to other adjacent or nearby stands. Neither the beetle nor its larvae burrow into the wood itself and consequently, provided the wood is salvaged before the tree is completely dead, the timber is not spoiled in any way nor made unmarketable.

## Beetle Development

*Dendroctonus micans* has a long cycle, ranging from 12 to 18 months under British conditions, which results in extensive overlap of generations so that it is possible to find any stage at any time. There are, however, periods, particularly in the winter, where the majority of beetles may be at the same stage. The various stages are as follows:

### Adult (Plate 1)

Length 6-8 mm, width 2.5-3.0 mm. Light brown when immature, black when mature. Movement within and between trees is mainly by crawling (at temperatures of 12°C or greater), occasionally by flying (at temperatures of 22.5°C or

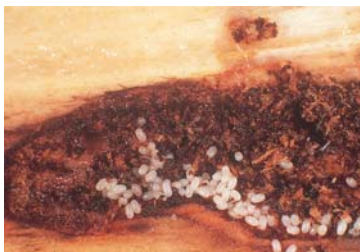


Adult  
*Dendroctonus micans*.  
(36064)

Resin tubes of  
*Dendroctonus*  
*micans*.  
(Plate 1a)  
(36058)



*Dendroctonus*  
*micans* egg  
chamber.  
(36066)



Mature  
larvae of  
*Dendroctonus*  
*micans*.



*Dendroctonus*  
*micans* pupae  
(white) and  
newly emerged  
adults (light  
brown).



greater). It is the entry of female beetles that gives rise to the characteristic resin tubes. This species is among the largest of the bark beetles. The large size and covering of orange hair enable the females to withstand the resin flow produced when they bore into the bark of host trees.

### Egg (Plate 2)

Eggs are laid within a small egg chamber in the cambium. Each female produces up to 300 eggs, laid in groups of 50-80 in interconnecting chambers. Note that the eggs are normally laid on one side of the chamber.

### Larva (Plate 3)

There are five progressively larger larval feeding stages (instars). All feed in a similar manner by aggregating under the bark, packing frass behind into islands where diseased and dead larvae are buried away from the main feeding site. These normally feed closely together packing a mixture of resin and frass behind them, forming the quilting illustrated in Plate 7.

### Pupa (Plate 4)

This is the immobile resting stage before moulting to the adult. Pupae are found in pupal cells among the larval frass. They are often in close proximity and may give rise to aggregations of adults under the bark. These stages may be prolonged over several weeks or months depending on temperature.

## What to look for

There are three main stages in assessing whether *Dendroctonus micans* is present in a spruce stand.

### Stage 1 - At a distance

Look for any indication that tree health is not normal. Check especially for isolated or small groups of dead or dying trees characterised by browning of foliage over some or all of the crown. *Plate 5*

### Stage 2 - On the tree

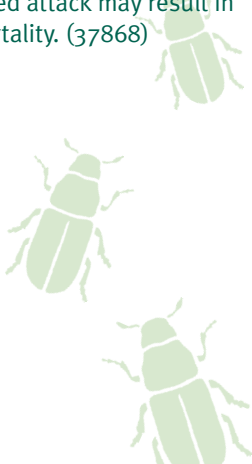
Resin tubes on the trunk (*Plate 6*) or granular resin at the base of the tree (*Plate 7*) are reliable signs of stem or root attack. Resin tubes vary in colour from pure white, cream, through to shades of purple and brown. They may be accompanied by copious resin bleeding. Loose bark, with exposed beetle galleries, usually indicates older infestations attacked by woodpeckers.

### Stage 3 - Under the bark

Inspect the bark around resin tubes, particularly those that are purple to brown. A hollow sound when the bark is tapped often indicates successful attack. Remove the bark carefully and inspect for signs of the beetle. The most characteristic indicator is the presence of a mixture of insect faeces (frass) and bark packed by the feeding larvae into a quilted or island appearance (*Plate 8*). Any stage from egg to adult may also be present.

### Plate 5

Norway spruce (*Picea abies*) showing typical 'top death' resulting from a well established attack by *Dendroctonus micans*. Continued attack may result in tree mortality. (37868)





### Plate 6

Norway spruce showing extensive resin bleeding following *Dendroctonus micans* attack. The partially exposed larval brood is the result of bark damage by woodpeckers. (36060)



### Plate 7

Resin tube at soil level accompanied by granular resin are characteristics of attack by *Dendroctonus micans* at ground level. (36061)



### Plate 8

*Dendroctonus micans* brood in Sitka spruce showing the quilted appearance of the larval feeding chamber that is typical of this bark beetle. (36072)



# Assessing the Risks of *Dendroctonus Micans* Attack

If a stand is currently free of *Dendroctonus micans* the risk of an attack developing is dependent on the proximity to existing infestations. Adult beetles occasionally fly to more distant stands (isolated stands up to 7 km from known infestations have been colonised) and the risks increase with proximity to extraction and haulage routes and also to main roads. Vigilance in these situations must be high at all times. The earlier any infestation is detected, and controls initiated, the better the chances of eradication.

The accumulated evidence from world-wide studies of bark beetles in general, and of *Dendroctonus micans* in particular, indicates that a number of factors are consistently associated with the probability of initial beetle attack and with rate of spread. The factors which must be taken into account when preparing a pest risk assessment are set out in the summary below and should enable the forest manager to identify, using local knowledge, those stands at high risk of infestation and where high rates of population growth may require active control measures to be carried out. These factors have a compounding effect so that they act in concert to substantially increase the susceptibility of a stand.

## Location

- Within 7 km of infested stands.
- Close to public roads and forest roads leading from infested stands.

## Crop age

- Mature and over-mature trees.

## Climate

- Conditions giving rise to host stress i.e. low rainfall; area prone to soil moisture deficit; exceptionally dry (or wet) summer.

## Windthrow

- High incidence of wind-related problems such as snapped top, windthrown trees and root disturbance.

## Site

- Poorly suited to spruce growth.
- Previous management
- Extraction damage, brashed trees. Soil compaction. Climber damage.

## Tree growth

- Poor growth. Malformed with multiple forks and other growth irregularities.

## Vigilance in both Infested and At-Risk Stands

As *Dendroctonus micans* does not use pheromones, insect traps cannot be used and detection is therefore entirely dependent on visual surveys.

### High hazard stands

Regular and thorough inspection must be carried out in stands identified to be of high hazard.

### Low hazard stands

General inspection is sufficient in low hazard sites but the risk assessment should be carried out at 1-2 year intervals since hazard ratings may change. In particular, new infestations may have become established in the area during the interval, thus increasing the risk from proximity to infested stands.

### Thinning, Brushing and Pruning

Any damage to stems and live branches will encourage beetle attack. Great care should be taken when carrying out felling or brushing; pruning should normally be avoided. Similarly, cutting of road lines should be undertaken with care to avoid unnecessary direct or indirect damage such as windthrow.

## Outbreaks – Options for Practical Control if Presence of *Dendroctonus Micans* is Suspected

Within the framework of the national control strategy, there are two main practical silvicultural options open to forest managers to control a *Dendroctonus micans* outbreak.

- a. **Sanitation felling** - by felling infested trees and spot peeling to ensure the removal of all beetle stages.

Sanitation felling is a mandatory requirement wherever infested trees are discovered on the periphery of, or outside the *Dendroctonus Micans* Control Area. It must always be carried out if there are no uninfested susceptible stands within 7 km, or *Dendroctonus micans* populations are low and static and there is a programme of control by *Rhizophagus grandis*.

Sanitation felling is optional in already infested stands within the *Dendroctonus Micans* Control Area where the manager may decide to defer felling until normal thinning/felling takes place.

(Subsequent movement of timber must be in compliance with the registration and plant passport regulations mentioned in Section 2.)

- b. **Biological control** - by release and maintenance of the specific predator *Rhizophagus grandis*. This beetle feeds exclusively on *Dendroctonus micans* larvae and is routinely introduced into infested sites. It now appears to be exerting significant long-term regulation of *Dendroctonus micans* populations at levels acceptable to the forest manager. (Introduction of the predator is normally undertaken only by the Forestry Commission under licence from the Department of the Environment.)

## Active Management in Infested Stands

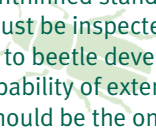
### Thinned stands

Thinning provides the opportunity to remove infested or highly susceptible trees in the course of normal management. Where practicable, infested trees should be selectively removed during normal thinning. This may involve a separate survey to identify infested trees and therefore represents an extra cost in time and labour. The extent of such special selection should be related to the risk assessment so that more effort should be put into high hazard stands. In low hazard stands it is only necessary for fellers to keep a close watch on felled trees and to spot-peel infestations if they are found.

It must be remembered that by thinning and opening the canopy the susceptibility of the stand may increase, partly because the conditions in the stand will be more suitable for *Dendroctonus micans* development, but mainly as a result of damage to remaining trees during extraction. However, the overall change in risk should be small if care is taken to minimise damage during the thinning operation.

### Unthinned stands

Annual surveys are required, with intensity related to the risk assessment, in order to detect newly established or rapidly increasing *Dendroctonus micans* populations. (It may, however, be impracticable to detect the early stages of infestation in unthinned stands.) Stands particularly prone to windthrow and snap must be inspected more frequently since conditions more conducive to beetle development will be created. Unless there is a significant probability of extensive tree mortality the use of *Rhizophagus grandis* should be the only measure used in these stands.



## Thinning and felling

Infested trees, whether felled as part of sanitation work or in the course of routine thinning and felling operations in infested stands, must be spot-peeled to remove all evidence of the pest. Eggs, larvae and pupae will quickly die when exposed. Any adults must, however, be destroyed. There will often be a residual population in stumps which generally can be regarded as a potential reservoir within the area. However, it is impracticable to carry out any measures to control *Dendroctonus micans* populations in stumps. If the population is newly established or if *Rhizophagus grandis* had not been introduced previously, steps must be taken to establish the predator even if the site has been clear felled, provided it is close to (within 7 km of) established spruce stands. It should be borne in mind that mechanical harvesting methods make it more likely that brood chambers will be missed. Logs will need to be examined before being removed from the forest.

## Timber Movement

Control of timber movement is the major weapon in minimising further spread of *Dendroctonus micans*. It is the responsibility of forest managers, timber hauliers and mill owners to ensure that the rules governing timber movement, processing and residue disposal (bark and plant debris) are carried out. These are set out in:

- a. the latest amended versions of the Plant Health (Forestry) (Great Britain) Order and the Treatment of Spruce Bark Order;
- b. the Forestry Commission's Plant Health leaflets;
- c. the Forestry Commission's Plant Health Newsletters, which are issued free to registered traders, from time to time.

## Species Choice in Planting

Selection of tree species for planting should be based on normal management criteria of suitability. Thus, if spruce is the obvious choice in terms of the manager's objectives, it should still be planted. If the manager has the choice of spruce or another species, both likely to meet his objectives, then it would be sensible to consider alternatives to spruce.

## Other leaflets in the Plant Health series

- PHL1 Plant Health Import and Export Controls - Wood and Bark
- PHL2 Import Inspection Fees for Wood, Wood Products and Bark
- PHL5 Health and Safety at Work – A guide for Inspectors carrying out Plant Health Service work
- PHL7 Plant Health and the Single Market
- PHL8 Plant Health and the Single Market – Guidance on EC Plant Health controls for registered forestry traders
- PHL10 Plant Health Inspections – Minimum facilities at ports
- PHL11 Plant Health Controls – The use of dunnage in British ports





Forestry Commission

## ■ Further Information

Advice on any aspect regarding either *Dendroctonus micans* or *Rhizophagus grandis* may be obtained from:

Nick Fielding, Research Office, Forestry Commission, Uphampton, Shobdon, Leominster, Hereford HR6 9PB

Tel: 01568 708881 • Fax: 01568 709010 • Mob: 07836 381090  
Email: [nick.fielding@forestry.gsi.gov.uk](mailto:nick.fielding@forestry.gsi.gov.uk)

For advice on any aspect of plant health please contact your local Plant Health Regional Manager:

### Scotland

Ian Brownlee  
Tel: 0131 314 6480  
Fax: 0131 314 6148  
Mobile: 07831 159014  
Email: [ian.brownlee@forestry.gsi.gov.uk](mailto:ian.brownlee@forestry.gsi.gov.uk)

### East England

Stephen Mears  
Tel/Fax: 01507 328275  
Mobile 07831 204324  
Email: [steve.mears@forestry.gsi.gov.uk](mailto:steve.mears@forestry.gsi.gov.uk)

### North England & North Wales

Russell Collins  
Tel/Fax: 01751 475655  
Mobile: 07836 543234  
Email: [russell.collins@forestry.gsi.gov.uk](mailto:russell.collins@forestry.gsi.gov.uk)

### South England & South Wales

Mike Willingham  
Tel/Fax: 01622 850768  
Mobile: 07831 157692  
Email: [mike.willingham@forestry.gsi.gov.uk](mailto:mike.willingham@forestry.gsi.gov.uk)

Alternatively, advice can be sought from the Plant Health Service, Forestry Commission, 231 Corstorphine Road, Edinburgh EH12 7AT

Tel: 0131 314 6414 • Fax: 0131 314 6148  
E-mail: [plant.health@forestry.gsi.gov.uk](mailto:plant.health@forestry.gsi.gov.uk)

Information on Plant Health generally, as well as current items of interest, can be viewed on our website at: [www.forestry.gov.uk/planthealth](http://www.forestry.gov.uk/planthealth)

## Plant Health Service

*Guarding the health of Britain's forests and woodlands.*

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