Prepared by CABI and EPPO for the EU under Contract 90/399003

Data Sheets on Quarantine Pests

Dendroctonus brevicomis

IDENTITY

Name: *Dendroctonus brevicomis* LeConte
Synonyms: *Dendroctonus barberi* Hopkins
Taxonomic position: Insecta: Coleoptera: Scolytidae
Common names: Western pine beetle (English)
Dendroctone du pin de l'ouest (French)
Bayer computer code: DENCBR
EPPO A1 list: No. 263
EU Annex designation: II/A1 (included in non-European Scolytidae)

HOSTS

The recorded hosts of *D. brevicomis* are *Pinus coulteri* and *P. ponderosa*.

GEOGRAPHICAL DISTRIBUTION

EPPO region: Absent.
North America: Canada (Alberta, British Columbia), Mexico, USA (Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington).
EU: Absent.

BIOLOGY

The adults and larvae of *Dendroctonus*are phloeophagous or bark-feeding. *D. brevicomis* usually overwinters as fully grown larvae or as adults. Adults emerge from overwintering sites between February and June. Activity is resumed when subcortical temperatures become sufficiently high, about 7-10°C. The insects fly individually or in small groups, during the warmth of the day in spring or near nightfall in summer (at temperatures between 20 and 45°C), and infest further trees. Terpenes in the oleoresin are the primary source of attraction, guiding pioneer beetles in the selection of a new host. Pheromones are responsible for the secondary attraction of other members of the same species and are the means by which individuals communicate after colonization. Like other bark beetles, *D. brevicomis* is associated with bluestain fungi, of which *Ceratocystis minor* is the most important.

Dendroctonus spp. are monogamous. The female initiates the boring of a new gallery by constructing a radial entrance tunnel through the bark into the wood. After pairing has occurred, the female is generally responsible for boring egg galleries, the formation of egg niches, and care of eggs and larvae. The male keeps the nuptial chamber and entrance tunnel clean and expels the frass from the entrance hole. In Dendroctonus, oviposition commences about 7 days after attack and the eggs are deposited individually or in small clusters in niches, or in rows in long grooves. In *D. brevicomis*, the egg niches are arranged alternately in the phloem on the sides of the egg gallery in contact with the cambium, about

3.5 mm apart with about 40 niches per gallery. One egg is deposited in each niche, which is then filled with specially prepared frass packed to the original level or contour of the gallery. The incubation period is 2-3 weeks in *D. brevicomis* (Bright, 1976).

The number of larval instars is four. The length of the larval period under optimum conditions is, as in other scolytids, 30 to 90 days. The end of the larval mine is usually slightly enlarged and cleared of frass to form a pupal chamber, or else the larva may bore into the wood or outer bark before forming the pupal cell. The pupal stage, as in other scolytids, requires between 3 and 30 days, but averages 6-9 days under ideal conditions. It may be extended if pupation begins in late autumn, but is rarely an overwintering stage except in areas where the winters are very mild.

Adult *Dendroctonus* may emerge from the host tree immediately or may require a period of maturation feeding before emerging. They usually emerge through separate exit holes. After completing one gallery system it is not uncommon for the parent beetles to re-emerge and construct a second, third or fourth system of tunnels to produce an equal number of broods. A few old adults may survive the winter and participate in the production of the spring brood. However, a majority of the adults die in their tunnels after producing one brood. *D. brevicomis*, in the northern part of its range, may have two or more generations per year, correlated with seasonal change, though the second generation may sometimes be only partial. This species can have three complete generations and a partial fourth generation in the southern parts (Wood, 1982). For further information on the biology of *D. brevicomis*, see also Miller & Keen (1960), Stark & Dahlsten (1970), Waters *et al.* (1985).

DETECTION AND IDENTIFICATION

Symptoms

The colour of the foliage in trees mass-attacked by *D. brevicomis* changes in a characteristic manner. The normal dark-green fades to pale-green, gradually changes to lemon-yellow, then to straw colour, sorrel, and finally dark-red. After the tree has been abandoned by the beetle progeny, the foliage slowly turns brownish-black and drops off (Wood, 1982). Pitch tubes on newly infested trees range in colour from dark reddish-orange to cream; they consist of resin and particles of bark expelled from the egg gallery by the beetles. Orange to cream-coloured particles of bark and wood in crevices and at the base indicate that the tree has been infested and killed by beetles.

The galleries formed by the adults and larvae are diagnostic. Within the gallery system, the entrance tunnel, mother or egg galleries and larval galleries can usually be distinguished. The entrance tunnel is usually short, more or less perpendicular to the tree axis and found at the base of simple galleries (in *Dendroctonus* spp., which are monogamous). This tunnel serves for the evacuation of frass and other debris which accumulates. The entrance hole is closed by tightly packed frass in *Dendroctonus*. The mother or egg galleries are the same diameter along their length and sometimes possess perforations (aeration or ventilation holes) to the exterior. These galleries are constantly cleared of boring frass in most species. In *D. brevicomis*, the egg galleries, in the soft inner tissues of the phloem, are generally 30-35 cm long (up to 89 cm), sinuous and always extending upwards from the entrance hole. They cross or anastomose frequently, forming a maze-like pattern. The diameter of the individual egg galleries is slightly greater than the width of a beetle.

The larval galleries commence more or less parallel to or divergent from the egg gallery, penetrating the bark or wood to varying depths and progressively widening away from it. These galleries are usually full of debris. The gallery terminates in a small chamber, where pupation occurs and the adult emerges through a hole from this chamber.

In most *Dendroctonus* spp., the galleries are individual and radiate from the parental mine, or the larvae may feed in congress for part or all of their development. The mines usually extend for 1-4 cm along a straight or winding route without increasing in diameter, and then abruptly expand into an oval to irregular feeding chamber approximately 0.5-1.0 cm wide by 1 or 2 cm long.

Morphology

Eggs

Smooth, oval, white, translucent. Eggs are laid separately but packed in niches and covered with frass.

Larva

In general, *Dendroctonus* larvae are white, legless, with lightly sclerotized head; head usually as broad as long with evenly curved sides, protracted or slightly retracted. Body at most only slightly curved; abdominal segments each with two or three tergal folds; pleuron not longitudinally divided. Larvae do not change appreciably in form as they grow. Identification requires the assistance of a specialist. For generic keys to the larvae of *Dendroctonus* and other bark beetles, see Thomas (1957, 1965), Peterson (1951).

Pupa

The pupae of scolytids are less well known than the larva: exarate; usually whitish; sometimes with paired abdominal urogomphi; elytra rugose or smooth; head and thoracic tubercles sometimes prominent. See in particular Thomas (1965).

Adult

In general, *Dendroctonus* adults are relatively large bark beetles, 3-8 mm in length; *D. brevicomis* is 3-5 mm long, cylindrical, dark-brown. Antennae geniculate, funicle five-segmented, with abrupt three-segmented club; subcircular. Head visible from above, not prolonged into distinct rostrum, narrower than pronotum, with mouthparts directed downwards. Eyes flat, usually elongate, entire. Pronotum scarcely declivous in anterior half, usually without crenulations except sometimes anterolaterally. Scutellum small and rounded or depressed. Elytra entire, concealing pygidium, with basal margin usually procurved and with crenulations. Elytra terminate in a rounded or blunt slope (the declivity) which may be fringed by a row of spines or tubercles. Tibiae unguiculate. Tarsal segment 1 not longer than 2 or 3, pseudotetramerous with third tarsal segment bilobed. *D. brevicomis* much resembles *D. frontalis*, except that it has uniformly short hairs on the elytral declivity. For generic and specific keys to *Dendroctonus* and other genera, see Wood (1982), Duncan (1987) and Lanier *et al*. (1988).

MEANS OF MOVEMENT AND DISPERSAL

Some bark beetles are strong fliers with the ability to migrate long distances. The most common mode of introduction into new areas is unseasoned sawn wood and wooden crates with bark on them. If wood is barked, there is no possibility of introducing bark beetles. Dunnage is also a high-hazard category of material, on which most of the scolytids intercepted in the USA are found. It is particularly difficult to monitor properly.

PEST SIGNIFICANCE

Economic impact

Like other scolytids, *Dendroctonus* spp. periodically cause loss of wood (cut wood or standing trees) over extensive areas. Their galleries do not affect the structural properties of the wood significantly, but may render it useless for veneer or furniture making. In general, compared with other genera such as *Ips*, they tend to be more aggressive and more host-specific. They mostly breed in coniferous hosts larger than 15 cm in diameter. *D.*

brevicomis has been a very destructive pest of *Pinus ponderosa* in California, USA (Teillon *et al.*, 1973). It has probably killed more merchantable wood in North America than any other organism (Wood, 1982). Miller & Keen (1960) estimated that approximately 1000 million board feet of standing timber had been destroyed annually in Pacific Coast states for at least 50 years. However, this estimate may almost double if losses in British Columbia, Canada and the mountain states of USA are included (Wood, 1982). Attacks were, however, linked to external stress factors, and the greatest volume of losses occurred in the 1920s and 30s during an extended drought in the Pacific Coast states. Since the 1950s, tree vigour has improved and outbreaks are less frequent and less damaging (Furniss & Carolin, 1977).

Control

Broadly, the same control methods are available for all bark beetles. A tree that has been attacked usually cannot be saved, so preventive rather than curative control is best. Since scolytid populations are probably always present in a forest, breeding on unthrifty, injured, broken, wind-thrown or felled material, damage can be reduced or avoided by maintaining the health and vigour of the stand; especially by thinning stagnated young stands or removal of overmature trees in older stands.

Losses caused by bark beetles usually involve individual trees or irregularly distributed groups of trees. Insect surveys are made to locate and appraise infestations in their early stages. If endemic conditions prevail, natural control factors (climate, weather, predators, parasites, disease) will hold the population at a steady level at which damage is within normal limits (losses less than annual tree growth). If epidemic conditions exist, damage exceeds normal limits (losses exceed annual growth). Such surveys determine the need for direct control. The available methods have been reviewed in EPPO/CABI (1992). Treatment with insecticides is used, if at all, for logs rather than for trees.

Phytosanitary risk

D. brevicomis is an A1 quarantine pest for EPPO, within the category "non-European Scolytidae" (EPPO/CABI, 1992). Since it can make primary attacks on *P. ponderosa*, it presents a certain risk to the EPPO region, where this species has been quite widely introduced. This risk can be assessed as relatively moderate because only this species is concerned, and because damage in North America has mainly been associated with drought conditions.

Dendroctonus micans and other indigenous bark beetles (*Ips* spp.) already occur on conifers throughout most of the EPPO region, so the risk arising from introduced species is uncertain. However, those areas of the EPPO region which lack indigenous bark beetles and and protect themselves from species already present elsewhere in Europe have evident reason to protect themselves also from North American bark beetles.

PHYTOSANITARY MEASURES

If measures are needed against *D. brevicomis*, those recommended for *D. ponderosae* (EPPO/CABI, 1996), adapted specifically for *P. ponderosa*, should exclude it.

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