

This text is an integral part of the *EPPO Study on bark and ambrosia beetles associated with imported non-coniferous wood* and should be read in conjunction with the study

Pest information sheet

Ambrosia beetle

PLATYPUS APICALIS AND *P. GRACILIS* (COLEOPTERA: PLATYPODINAE)

EPPO Lists: Not listed. The assessment of potential risks in this information sheet is not based on a full PRA for the EPPO region, but on an assessment of the limited information for that species used to prepare the information sheet. These two species are treated together due to similarities in their distribution and biology.

PEST OVERVIEW

Taxonomy

- *Platypus apicalis* White, 1846. Synonyms: *Crossotarsus apicalis* auct.; *Platypus douei* Chapuis, 1865; *Platypus castaneus* Broun, 1880.
- *Platypus gracilis* Broun, 1893. Synonyms: *Platypus inimicus* Broun, 1910b; *Platypus denticulatus* Browne, 1980.

Associated fungi

Sporothrix nothofagi is the symbiont of *P. apicalis* and *P. gracilis* and the related *Treptoplastypus caviceps* (Ploetz *et al.*, 2003). *S. nothofagi* is highly pathogenic on *Nothofagus* spp. The fungus alone is able to kill trees after artificial inoculation (Faulds, 1977, citing others). Faulds *et al.* (1977) mention that other fungi isolated on *Nothofagus* (yeasts, a *Ceratocystis* sp., others) were not pathogenic.

In experiments using artificial inoculation, *S. nothofagi* caused the death of healthy *Weinmannia racemosa*. Such mortality of healthy trees was also observed following attacks by *P. apicalis* and *P. gracilis* in the field (Payton, 1988). Scion (2009) mentions 'susceptibility to a sapwood pathogen' linked to attacks of *P. apicalis* on *Nothofagus obliqua*, *Castanea sativa*, and *Brachyglottis*, but it is not clear if the pathogen has been identified as *S. nothofagi*.

Morphology and biology

Adults of *P. apicalis* and *P. gracilis* measure less than 1 cm and 0.5 cm, respectively (Scion, 2009). *P. apicalis* and *P. gracilis* are wood-boring ambrosia beetles. They have a similar biology, and often occur together in the same material (Brockerhoff *et al.*, 2003, citing others).

P. apicalis and *P. gracilis* may attack healthy or weakened living trees, stumps, freshly felled trees, logs and larger branches, and occasionally green sawn timber (Scion, 2009). Apparently healthy trees can be attacked particularly if large head logs or stumps lay nearby, and the beetles invade indiscriminately the felled material and standing trees (Milligan, 1974b). *P. gracilis* can also establish in logs, stumps, and dead standing trees invaded in previous seasons. For example, broods have been established in *Nothofagus* logs felled 20 years previously, and galleries containing fully grown larvae have been found in the stump of a large *Nothofagus* felled 25 years previously (Scion, 2009). Broods of *P. apicalis* and *P. gracilis* may emerge from dead parts of a live tree (Scion, 2009).

Six centimetre diameter stems are rarely attacked, but abortive attacks are not uncommon on stems above 15 cm in diameter (Milligan, 1974b). Broods of *P. apicalis* can be reared in felled branches less than 10 cm in diameter (provided they lie in moist conditions) (Scion, 2009). Attacks of *P. apicalis* and *P. gracilis* are concentrated on the lower six metres of living trees (Milligan, 1974b).

P. gracilis (but not *P. apicalis*) commonly start tunnels from a concealed site (e.g. bark crevice) (Scion, 2009). *P. apicalis* is essentially limited to the sapwood, but fully grown larvae of *P. gracilis* extend their

galleries throughout moist heartwood. Wood from trees that recently died, and which is persistently moist, is the most favourable habitat for the broods.

The life cycle of both species takes ca. 2 years and broods are produced (small groups of eggs) over a long period (Milligan, 1974b; Scion, 2009). Some individuals of *P. apicalis* emerge 2 years after gallery initiation, but 40% emerge later (most in the third season, few in the fourth season).

For *P. gracilis*, emergence begins 2 years after gallery initiation, but most broods (ca. 80% of the total) are produced in the third and fourth seasons. Brood production may continue for longer periods: more than half the galleries in a large-diameter stump and log of red beech continued to produce 6 years after nest initiation. During this period the maximum number of offspring per pair of beetles was 528, and the mean for 40 broods was 115 (Scion, 2009).

P. apicalis and *P. gracilis* are gregarious. They use an aggregation pheromone to initiate mass attacks, attracting other males and females (Milligan, 1974b, Ploetz *et al.*, 2003; Scion, 2009). Males are attracted to volatiles produced by dying or freshly felled trees and stumps. Rapidly growing eucalyptus trees also produce an attractant which causes males to fly from up to 800 m away to concentrate attack on the most vigorous trees in the stand and on parts (usually the base in young trees) where thickening/growth is highest. Attacks on these healthy trees are aborted as the beetles die, and before they have penetrated more than a few centimetres (however, these attacks damage the wood, see *Known impact*). Attraction to fast growing individuals leading to abortive attacks has been observed for other tree species (Scion, 2009).

Spread biology

Both males and females fly. No precise information was found on the flight capacity, but males have been reported to fly from up to 800 m away to attack rapidly growing eucalyptus trees (see above).

Nature of the damage

P. apicalis and *P. gracilis* tunnel into the wood, and the associated fungus *S. nothofagi* causes wood staining and is highly pathogenic to at least *Nothofagus* spp. and *Weinmannia racemosa* (able to cause tree mortality on its own). On *Nothofagus* spp., attacks may lead to tree death. In studies, attack by *Platypus* was induced experimentally in 12 *Nothofagus* trees selected as healthy and, following massive attack (maximum density of 968 to 1291 holes per m² of bark), three trees larger than 35 cm DBH¹ died within 2-4 years of the first attack; four smaller trees (20-30 cm DBH) suffered abnormal leaf fall and some twig dieback, but survived despite thinning of the crown (Milligan, 1974a).

However, abortive attacks cause timber defects in living trees which may be of considerable economic importance (Scion, 2009). Mass-attacks can lead to large scale mortality particularly involving *Nothofagus* spp. (Brockerhoff *et al.*, 2003, citing others).

Trees only lightly and abortively attacked were also observed to die because of *S. nothofagi* if a drought occurred in the following summer even without a second attack in the drought year, indicating that the pathogen can survive for at least a year in trees which were only abortively attacked (Milligan *et al.*, 1974b). Moisture stress induced by waterlogging or drought has been associated with enhanced tree mortality (Ploetz *et al.*, 2003). When a temporary stress that triggered an infestation is over, the trees may react and kill the beetles with gum or resins in their galleries, but if the trees are susceptible to the pathogen, the sapwood is progressively killed, this intensifies stress, further attacks occur, and the tree eventually dies (Scion, 2009).

Detection and identification

- *Symptoms*. For both species, ejected frass may protrude from the entrance hole, and then fall (Scion, 2009). Death of branches, holes, general decline of trees, and death.
- *Trapping*. *P. apicalis* and *P. gracilis* are attracted to stressed trees, i.e. ethanol is probably an attractant. No information was found on whether the aggregation pheromone has been synthesised.
- *Identification*. A description of life stages is provided in Scion (2009).

¹ diameter at breast height

Distribution

Both species are native to New Zealand (Brockerhoff *et al.*, 2003).

- *P. apicalis*: New Zealand including Chatham Islands (Brockerhoff *et al.*, 2003).
Absent: Australia. In Wood and Bright (1992), but considered doubtful in Brockerhoff *et al.* (2003), and PaDIL (2018) considers this species as absent.
- *P. gracilis*: New Zealand. A record from New Guinea appears to be erroneous (Brockerhoff *et al.*, 2003 citing others).

Host plants

- *P. apicalis*. Known reproductive hosts:
 - live trees: the native *Nothofagus fusca*, *N. menziesii*, *N. solandri* and *N. truncata*, *Weinmannia racemosa*, *Cordyline australis*, *Nothofagus obliqua* (South American species), *Castanea sativa* (European species) and *Brachyglottis* (probably *B. huntii*).
 - felled trees, stumps, logs, and felled branches less than 10 cm in diameter (provided they lie in moist situations): native *Nothofagus* spp. (as above), *Weinmannia racemosa*, *Agathis australis*, *Corynocarpus laevigatus*, *Dacrycarpus dacrydioides*, *Dacrydium cupressinum*, *Acer pseudoplatanus*, *Pinus muricata*, *P. nigra*, *P. ponderosa*, *P. radiata*, *P. taeda*, *Prumnopitys ferruginea*, *P. taxifolia*, *Pseudotsuga menziesii*, *Acer pseudoplatanus*, *Beilschmiedia tawa*, *Elaeocarpus hookerianus*, *Salix babylonica*.

Abortive attacks on live trees (i.e. unsuccessful reproduction) have been recorded on: native *Nothofagus* spp. (as above), *Acacia melanoxylon*, *Aristotelia serrata*, *Eucalyptus botryoides*, *E. delegatensis*, *E. fastigata*, *E. gunnii*, *E. macarthurii*, *E. nitens*, *E. obliqua*, *E. regnans*, *Populus trichocarpa*, *Quercus robur* and *Sequoia sempervirens* (Brockerhoff *et al.*, 2003, citing others; Scion, 2009).

Finally, tunnels were found in dead *Acacia dealbata*, *Dysoxylum spectabile*, *Diospyros kaki*, *Picea abies*, *Betula pendula*, *Ginkgo biloba*, *Rhus*, *Salix fragilis*, but it is not known whether brood can be reared.

On Chatham Islands, where main hosts do not occur, *P. apicalis* has been reported to "attack" (not known if reproductive hosts or not, and whether live trees or felled): *Coprosma chathamica*, *Corynocarpus laevigata*, *Melicytus chathamicus*, *Plagianthus regius* subsp. *chathamicus*, *Pseudopanax chathamicus*, *Brachyglottis huntii* and *Myrsine chathamica* (Scion, 2009).

- *P. gracilis*. Known reproductive hosts are:
 - live trees: *Nothofagus fusca*, *N. menziesii*, *N. solandri*, *N. truncata*, *Carpodetus serratus* and *Weinmannia racemosa*,
 - stumps and larger diameter dead material: species above, as well as *Pinus* spp. and *Pseudotsuga menziesii*.

Abortive attacks are common in native *Nothofagus*, *Eucalyptus delegatensis*, *E. fastigata*, and *E. gunnii*, and occasional in *Phyllocladus alpinus*, *Dacrydium cupressinum*, *Dacrycarpus dacrydioides*.

Finally, tunnels were found in *Metrosideros robusta* and *M. umbellata*, but it is not known whether living trees are attacked or whether broods can emerge from these hosts (Scion, 2009).

Note: *Nothofagus* is classified under Fagaceae or its own genus Nothofagaceae depending on sources, respectively the [Index Nominum Genericorum \(ING\)](#) and the [International Plant Names Index \(IPNI\)](#). *P. apicalis* has been recorded on *Castanea sativa*, and no other record on Fagaceae were found. However, Fagaceae are not frequent in New Zealand: only *Fagus sylvatica* and *Castanea sativa* are common in parks and gardens (https://floraseries.landcareresearch.co.nz/pages/Taxon.aspx?id=_e27ac9a9-18bc-4d46-8d06-8ad74f918b4f&fileName=Flora%204.xml).

Known impacts and control in current distribution

P. apicalis and *P. gracilis* associated with *S. nothofagi* have caused sapwood staining, reduction of the marketability of harvested timber and tree mortality (Ploetz *et al.*, 2003). Mortality of *Nothofagus* spp. in New Zealand was originally thought to be caused by *Nascioides enysi* (Coleoptera: Buprestidae), but

was shown in the 1970s to be caused by a pathogenic fungus vectored by *Platypus* spp. (Faulds *et al.*, 1977).

Both species are of the greatest economic importance in *Nothofagus* forests, where they occupy an ecological niche comparable with that of the aggressive bark beetles in coniferous forests of the Northern Hemisphere. The pathogen can kill trees. Even if trees are not killed, beetle attacks cause damage to the heartwood, gum streaks in sapwood, and death and staining of part of the sapwood, which enables entry of wood-rotting fungi (Scion, 2009). Faulds *et al.* (1977) mention that many *Nothofagus* trees survived successive annual *Platypus* attacks and that stem defect arose mostly from sublethal attacks, although the pathogen may kill the trees.

Attacks are not restricted to weakened trees. Trees of a sufficient diameter to contain an appreciable core of heartwood died following heavy attack; smaller trees which suffered comparable attacks recovered but were left with a core of dead and discoloured sapwood (Milligan, 1974a).

Attacks by *P. apicalis* and *P. gracilis* on rapidly growing *Eucalyptus* (which are not reproductive hosts) may reduce the value of the wood produced (Scion, 2009). The overall impact could not be quantified because few plantations had reached commercial size, but during a minor mill study, all pieces sawn from the most rapidly grown of four 30-year-old *E. delegatensis* bore defects (gum) resulting from *Platypus* attack (only 2.8% pieces from the slowest grown trees were affected). In *E. gunnii*, *Platypus* tunnels extended further into the wood (Scion, 2009).

Steward (1989) studying the factors involved in forest decline in New Zealand noted that disturbances that cause physical injury to trees (e.g. snow breakage or windthrow) in *N. solandri* forests attract *Platypus* spp. The beetles then attack nearby living trees, especially large old trees and those under stress. Once some mortality has occurred, tree death is likely to spread rapidly, resulting in a dieback phenomenon. In *N. solandri* forests, an initial 2.3% loss of basal area due to snowbreak led to 11 % loss after ca. 10 years, and basal area was continuing to decline (Steward, 1989 citing others).

Damage to native *Nothofagus* forests has presumably caused environmental impacts (although this is not mentioned directly in publications).

Control. Control of *Platypus* species using the entomopathogenic fungi *Beauveria bassiana* has been investigated, but the methods are not yet resolved (Scion, 2009). No control has been attempted in native forests. In *Nothofagus* plantations, control relies on good forest management practices to reduce damage (e.g. avoiding logging operations nearby, removing possible sources of beetles such as rejected logs or damaged standing trees, clear-felling and regeneration of stands, breaking down of wood residues on site (Scion, 2009).

POTENTIAL RISKS FOR THE EPPO REGION

Pathways

Entry

P. apicalis and *P. gracilis* are associated with wood of many species and can attack large diameter trees. Both species are able to reproduce on cut material of various species, including *Eucalyptus* spp., *Pinus* spp. and *Pseudotsuga menziesii* (for both) or *Acer pseudoplatanus*. Life stages are in the xylem, and all wood commodities may be a pathway. Processes applied to produce wood commodities would destroy some individuals. The likelihood of entry on wood chips, hogwood and processing wood residues would be lower than on round wood, as individuals would have to survive processing and transport, and transfer to a suitable host is less likely. In addition, both species seem to require a certain humidity for their broods, which may not be available in some commodities. *P. apicalis* and *P. gracilis* may be able to transfer from wood commodities to a living host or felled material. Bark on its own is an unlikely pathway.

Plants for planting may be a pathway, but there may be a size threshold for attacks; it is mentioned that 6-cm diameter stems are rarely attacked. Plants for planting are normally subject to controls during production, and attacked plants may be detected and discarded. It is not known if there is a trade. Cut

branches are a less likely pathway, as they are used indoors, and the pest is unlikely to be able to transfer to a suitable host. It is not known if branches of hosts of a suitable size are traded.

Summary of pathways (uncertain pathways are marked with '?'):

- wood (round or sawn, with or without bark, incl. firewood) of hosts
- wood chips, hogwood, processing wood residues (except sawdust and shavings)
- wood packaging material if not treated according to ISPM 15
- plants for planting (except seeds) of hosts?
- cut branches of hosts?

Because of the large host ranges and recorded attacks on felled material of many species, pathways may cover all coniferous and non-coniferous species.

Spread (following introduction, i.e. within EPPO region)

P. apicalis or *P. gracilis* could spread naturally and through human-assisted pathways. If they were introduced into the EPPO region, spread would depend on their hosts. The major hosts *Nothofagus* spp. in the EPPO region are mostly cultivated as ornamentals or planted on limited scale. Small-scale plantations are reported as widespread in the UK (*N. obliqua* and *N. alpina* - Scanu *et al.*, 2012). However, Fagaceae is a family of great economic and environmental importance in the EPPO region, with the genera *Quercus*, *Fagus* and *Castanea*. Native New Zealand trees may be used as ornamentals or in botanical gardens. *Castanea sativa* (for *P. apicalis*) is widely grown in the EPPO region in the wild, and cultivated for fruit and wood, and as ornamental tree. Both beetle species are able to reproduce on cut material or stumps of various species, including widespread ones such as *Pinus* spp. and *Pseudotsuga menziesii* (for both) or *Acer pseudoplatanus*, *Salix babylonica* (for *P. apicalis*), which would contribute to their spread. Human-assisted pathways may help in creating multiple foci in the EPPO region, if introduced.

Establishment

Based on the classification of Köppen-Geiger (see Annex 6 of the study), the climate types in New Zealand are mostly Cfa and Cfb², which are also present in the temperate part of the EPPO region, from UK to Spain in the West to Poland and the Black Sea in the East.

The known hosts of *P. apicalis* and *P. gracilis*, in particular *Nothofagus* on which mortality is reported, have a limited presence in the EPPO region, but the beetles may also establish populations on cut material of a wide variety of species (see *Spread* above). In New Zealand, they have also attacked exotic species, and this may happen in the EPPO region. If they were able to reproduce on new hosts such as Fagaceae, establishment will be more likely. Finally, the fecundity of *P. gracilis* is high, which may also favour establishment.

Potential impact (including consideration of host plants)

The potential impact of *P. apicalis* and *P. gracilis* on *Nothofagus* spp. only in the EPPO region would be minor (as they are grown only as ornamentals or in small plantations). The potential impact of *P. apicalis* on *Castanea sativa* is difficult to assess because limited information is available (this tree is only grown as an ornamental in New Zealand), but the literature indicates that it is susceptible to *S. nothofagi* (Scion, 2009). In addition, economic damage has been observed in New Zealand on a number of non-reproductive species, such as *Eucalyptus*, and such damage may also occur once populations are well established. Finally, both species may reduce the timber value of a number of species (including *Pinus*). The overall potential impact would also depend on whether *P. apicalis* and *P. gracilis* would extend their host range, especially in the Fagaceae, and of the pathogenicity of *S. nothofagi* on new hosts. Genera such as *Fagus*, *Quercus* or *Castanea* are of major importance for the EPPO region, and occur in a wide diversity of habitats, including in the wild, or in cultivation for wood, ornamentals or fruit.

References (all URLs were accessed in March 2018)

² **Cfa**: warm temperate climate, fully humid, hot summer; **Cfb**: warm temperate climate, fully humid, warm summer.

- Brockerhoff EG, Knízek M, Bain J. 2003. Checklist of indigenous and adventive bark and ambrosia beetles (Curculionidae: Scolytinae and Platypodinae) of New Zealand and interceptions of exotic species (1952-2000). *New Zealand Entomologist* 26: 29-44.
- Faulds W. 1977. A Pathogenic Fungus Associated with *Platypus* Attack on New Zealand *Nothofagus* Species. *N.Z. J. For. Sci.* 7(3): 384-396.
- Milligan RH. 1974a. A Review of Beech Forest Pathology. *NZ Journal of Forestry*.
- Milligan RH. 1974b. Insects Damaging Beech (*Nothofagus*) Forests. *Proceedings of the New Zealand Ecological Society*, 21.
- PaDIL. 2018. High quality images and Information tools designed for Biosecurity and Biodiversity. <http://www.padil.gov.au>
- Payton IJ. 1989. Fungal (Sporothrix) induced mortality of kamahi (*Weinmannia racemosa*) after attack by pinhole borer (*Platypus* spp.). *New Zealand Journal of Botany*, 27(3).
- Ploetz RC, Hulcr J, Wingfield MJ, de Beer ZW. 2013. Destructive Tree Diseases Associated with Ambrosia and Bark Beetles: Black Swan Events in Tree Pathology? *Plant Disease*, 97(7):856-872.
- Scanu B, Jones B, Webber JF. 2012. A new disease of *Nothofagus* in Britain caused by *Phytophthora pseudosyringae*. *New Disease Reports* 25, 27.
- Scion. 2009. Pinhole borers, native. *Forest and Timber Insects in New Zealand* No. 37: The native pinhole borers. Limited revision 2001. Based on R.H. Milligan (1979) *Pest and diseases of forestry in New Zealand*.
- Wood SL, Bright DE. 1992. A catalog of Scolytidae and Platypodidae (Coleoptera), Part 2. *Taxonomic Index*. *Great Basin Nat. Mem.* 13:1-1553 (vol. A, B).

How to cite this document

EPPO (2020) Pest information sheet on *Platypus apicalis* and *P. gracilis*. In: EPPO Study on the risk of bark and ambrosia beetles associated with imported non-coniferous wood. EPPO Technical Document no. 1081, pp 120-124.

https://www.eppo.int/media/uploaded_images/RESOURCES/eppo_publications/TD-1081_EPPO_Study_bark_ambrosia.pdf