

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

#### **GNATHOTRUPES SPP. OF NOTHOFAGUS SPP. (COLEOPTERA: SCOLYTINAE)**

*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.

#### **PEST OVERVIEW**

The genus *Gnathotrupes* currently contains 31 species, all from the Americas (Wood and Bright, 1992; Wood, 2007). 16 *Gnathotrupes* species associated with *Nothofagus*<sup>1</sup> (Southern beech) are listed in Table 1. In addition, at least 3 undescribed species are also associated with *Nothofagus* (Kirkendall, 2011). In recent decades, Southern beech decline has affected *Nothofagus* trees in Chile. Its causes are unknown to date, but the hypothesis has been made that it could be caused by a fungus transported by a *Gnathotrupes* species (Kirkendall, 2011). The correlation between the presence of *Gnathotrupes* galleries and diseased trees has been reported in studies on *N. pumilio* and *N. antarctica* (De Errasti, 2016; De Errasti *et al.*, 2016). Consequently, *Gnathotrupes* was included in this study as the case of an emerging decline associated with one or several fungus vectored by ambrosia beetles. It should be noted that limited information has been published on *Gnathotrupes* spp. of *Nothofagus*.

#### **Taxonomy**

*Gnathotrupes* spp. associated with *Nothofagus* in Chile and Argentina (Aguayo Silva *et al.*, 2008; Naumann-Etienne *et al.*) are listed in Table 1. There is a synonymy issue for the *Gnathotrichus* spp. (*G. nanulus* and *G. vafer*), the *Gnathoglochinus* sp. (*G. impressus*) the *Gnathocortus* sp. (*G. caliculus*) and the *Gnathomimus* sp. (*G. nothofagi*) in Naumann-Etienne (1978). All these genera names are considered synonyms of *Gnathotrupes* by Wood and Bright (1992). *G. similis* is a synonym of *G. barbifer*; *G. solidus* is a synonym of *G. velatus*, *G. ciliatus* is a synonym of *G. longiusculus* (Aguayo Silva *et al.*, 2008).

#### **Associated fungi**

A yeast had been found associated with declining *Nothofagus* trees (Kirkendall, 2011). A recent study on fungi associated with *Nothofagus* in the Patagonian Andes of Argentina (De Errasti, 2016; De Errasti *et al.*, 2016) identified 8 *Ophiostoma* species, 1 *Leptographium* species, and 1 species in the *Sporothrix lignivora* complex. *L. gestamen* and *S. cabralii* (both new species) were obtained from dead or declining *Nothofagus* trees, associated with galleries of *Gnathotrupes*. Their pathogenicity was not tested in the study (and is not known to date), but the authors raise the question as to whether they could contribute to *Nothofagus* decline.

#### **Morphology and biology**

*Gnathotrupes* are small beetles that measure about 2.5-4 mm long depending on the species. Aguayo Silva *et al.* (2008) provide pictures of adults of 13 *Gnathotrupes* on *Nothofagus*, and of galleries for *G. fimbriatus*, *G. longiusculus* and *G. vafer*, that extend into the wood. Naumann-Etienne (1978) provides drawings of the gallery patterns of *G. pustulatus*, *G. cirratus*, *G. vafer* and *G. nanulus*, as well as of morphological features (antennae, pronotum, head and mandibles, and elytral declivities) for several species. The genus is said to be monogynous (Wood 2007, Kirkendall *et al.* 2015), but the *Nothofagus*-breeding species studied by Naumann-Etienne (1978) are bigynous. The life cycle of some *Gnathotrupes* spp. of *Nothofagus* is not well known, although there is some information for the majority of species

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<sup>1</sup> *Nothofagus* is classified under Fagaceae or in its own family Nothofagaceae depending on the sources (e.g. respectively the [Index Nominum Genericorum \(ING\)](#) and the [International Plant Names Index \(IPNI\)](#)).

(Naumann-Etienne, 1978). For most species, a 'family' is composed of a male, which creates the entrance hole, and two, rarely more, females. All elements below are from Aguayo Silva *et al.* (2008) except if another source is indicated. The species described below all attack live *Nothofagus*. Entry holes are in twigs, branches and trunks of *Nothofagus* (depending on the species, see below).

Damage by *G. fimbriatus* can be located anywhere in the tree (twigs, branches or trunk), on all diameter wood. Kirkendall (2008) collected *G. fimbriatus* from (or saw distinctive galleries in) trunks, branches and saplings, suggesting that it has an unusually broad niche. *G. fimbriatus* is thought to have an annual life cycle similar to the *Gnathotrupes* spp. of the National Park Nahuel Huapi in Argentina (citing Naumann-Etienne, 1978). In Chile, adults are found from November to April. Eggs are laid in vertical larval galleries, while associated species in the same habitats make horizontal galleries.

*G. vafer* attacks mostly trunks (Naumann-Etienne, 1978) of more than 20 cm in diameter. Branch and tree mortality may occur. Adults fly in winter. In Argentina, *G. vafer* mostly attacks the lower part of fallen trunks, while in outbreaks in Aysén (Chile) *G. vafer* was found in live trunks. Eggs are laid in vertical larval pockets (longitudinal), very close to each other. Imagos overwinter under bark 'scales' (citing Naumann-Etienne, 1978).

*G. barbifer*, *G. nanus*, *G. velatus* (as well as a yet undescribed species) seem to have the same ecology as *G. vafer* Aguayo Silva *et al.* (2008). However, *G. nanus* attacks dying thick branches on standing trees as well as trunks, *G. velatus* prefers thicker branches and is often found on felled logs (Naumann-Etienne, 1978).

*G. longipennis* attacks thick branches and trunks, while *G. consobrinus* is associated with thick branches. *G. consobrinus* and *G. longipennis* were collected in freshly felled logs or near wounds in standing trees (Naumann-Etienne, 1978).

*G. cirratus*, *G. impressus* and *G. pustulatus* attack branches, mostly of moderate diameter (10-20 cm) (Naumann-Etienne, 1978).

*G. longiusculus* mostly attacks twigs and small branches, and some death of these is observed. The mortality of branches in the Region of Magallanes and Antarctica Chilean appears to be due to *G. longiusculus* and *G. fimbriatus*. Eggs are laid in galleries that are horizontal and transversal to the main gallery.

*G. caliculus*, *G. naumannii* and *G. nothofagi* use the galleries of other *Gnathotrupes* species (Naumann-Etienne, 1978). The same author qualifies them as "cleptoinquilines".

### **Spread biology**

No details are available in the literature. For *G. vafer*, *G. fimbriatus* and *G. longiusculus*, Aguayo Silva *et al.* (2008) state that they have a high dispersal capacity 'as all Scolytinae' and that both sexes are good flyers.

### **Nature of the damage**

*Gnathotrupes* tunnel galleries that extend into the wood, though not very deeply. They cause death of branches or vertical segments of the bark (on large branches and trunks), fall of branches or twig, death of whole trees. It is not known if mortality of twigs, branches or trunk is due to direct damage, or to an ambrosia fungus or pathogen carried by the beetles (Aguayo Silva *et al.*, 2008). Depending on species, different plant parts are attacked.

### **Detection and identification**

- *Symptoms*. Dying branches or twigs may be observed (with yellowing leaves), as well as dead or fallen branches. For some species, dead trees (e.g. *G. fimbriatus*, *G. vafer*). Small entry holes are present on the infested trees and there is an accumulation of fine white sawdust. The galleries of *Gnathotrupes* species differ. Illustrations are given in Naumann-Etienne (1978).

- *Trapping*. No information was found.
- *Identification*. Wood (2007) provides a key to *Gnathotrupes* spp. and morphological characters of species on *Nothofagus* are also available in Naumann-Etienne (1978).

### **Distribution (see Table 1)**

The *Gnathotrupes* spp. associated with *Nothofagus* are reported from Chile and Argentina (see Table 1).

### **Host plants (see Table 1)**

The *Gnathotrupes* spp. considered here all attack *Nothofagus* spp. Some details of host species are given in Table 1. *G. fimbriatus* has been shown to attack hosts in other genera: a breeding population was found on *Pinus contorta* logs (Kirkendall, 2008) and *G. fimbriatus* was also found on *P. sylvestris* (no details on the type of material - Informativo Fitosanitario Forestal, 2012). The records on *Pinus* each came from one specific location.

### **Known impacts and control in current distribution**

Damage by *Gnathotrupes* spp. may cause growth reduction and complete tree mortality, but has not been quantified (Aguayo Silva *et al.*, 2008). Infestation by *Gnathotrupes* may be associated with dying and dead and dying trees, and a high level of tree mortality is so far known only in the Aysen region. In other regions, dying and dead branches are observed, leading to branch fall. *Gnathotrupes* are thought to be involved in Southern beech decline in Chile, and the hypothesis has been made that the decline could be caused by a fungus vectored by a *Gnathotrupes* spp. (Kirkendall, 2011). In Aysen, Alvarado (2016) mentions massive mortality of *Nothofagus dombeyi* caused by populations increase of *Gnathotrupes* spp. the latter a consequence of temperature increase.

*Control*: No control method is mentioned in the literature available.

## **POTENTIAL RISKS FOR THE EPPO REGION**

### **Pathways**

#### *Entry*

Wood of the hosts would be a suitable pathway, but there is insufficient knowledge to fully analyse the possible association of different *Gnathotrupes* species with different wood commodities. Species attacking only branches are unlikely to be associated with round wood (unless wood commodities include whole trees or harvesting residues that may carry these species). *Nothofagus* is used as wood, although the little detailed data available on wood trade (see Annex 5 of the study) only refers to *N. cunninghamii* and *N. obliqua* (not listed as hosts above). Among known hosts, at least *N. dombeyi* and *N. pumilio* are known commercial timber tree species (Mark *et al.*, 2014). No data was found on whether *Nothofagus* wood is used in commodities such as wood chips, hogwood, processing wood residues or wood packaging material. Processes applied to produce wood commodities would destroy some individuals. The wood would also degrade and may not be able to sustain development of the pest. 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. There was one finding of *G. fimbriata* on *Pinus contorta* and on *P. sylvestris*. Finally, bark on its own is an unlikely pathway.

Some species are associated with twigs and small branches, and plants for planting may be a pathway; no information was found on attacks by some *Gnathotrupes* spp. on nursery plants. Plants for planting are normally subject to controls during production, and attached plants may be detected and discarded. Data from the EU Project Isefor (Increasing sustainability of European forests: Modelling for security against invasive pests and pathogens under climate change) also reports occasional import of plants for planting of *Nothofagus* from Chile, between 1 and 1500 pieces per year in the period 2003-2010, in total over 3100 pieces. 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 also not known if there is a trade.

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

- *Nothofagus* wood (round or sawn, with or without bark, incl. firewood)
- non-coniferous wood chips, hogwood, processing wood residues (except sawdust and shavings)

- wood packaging material if not treated according to ISPM 15
- *Nothofagus* plants for planting (except seeds)?
- *Nothofagus* cut branches?

Pathways may also cover the known coniferous hosts (for *G. fimbriatus*).

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

There is no information on natural dispersal of *Gnathotrupes* spp, but almost all bark beetles can fly long distances (several hundred meters to several kilometres). *Nothofagus* are probably mostly used as ornamentals in the EPPO region. However, small-scale plantations are reported as widespread in the UK (*N. obliqua* and *N. alpina* - Scanu *et al.*, 2012). If *Gnathotrupes* are not able to infest Fagaceae hosts and are restricted to *Nothofagus*, spread would be limited. However, most ambrosia beetles are polyphagous, and they may be able to attack other hosts. For *G. fimbriatus*, it is not known if it could create outbreaks and spread using *Pinus sylvestris* or *P. contorta* as hosts. Given that it has been able to breed on *Pinus*, a host taxonomically very far from its original host, it is not unlikely that it would attack others, more closely related, such as other Fagaceae. Human-assisted pathway may help in creating multiple foci in the EPPO region, if introduced.

### **Establishment**

Based on the climate types in the Köppen-Geiger classification (see Annex 6 of the study), *Gnathotrupes* are present in temperate to cold climates in Chile and Argentina, which are also present in the EPPO region (oceanic Europe incl. UK and Ireland to Central Europe, to Scandinavia in the North and Russia to the East).

*Gnathotrupes* spp. are mostly associated with *Nothofagus*, which have a limited presence in the EPPO region (see *Spread*). The likelihood of establishment would be higher if they were able to attack Fagaceae or other hosts in the EPPO region. This is not excluded especially for *G. fimbriatus* (see *Spread*). *G. fimbriatus* may be able to establish populations on *Pinus*, at least on logs. Its known host *Pinus sylvestris* is widespread and *P. contorta* (on which logs a breeding population was found) is planted for wood production. Finally, *Gnathotrupes* spp. are ambrosia beetles, and although they show a strong host association to *Nothofagus* in Argentina and Chile, it is not excluded that they may be able to attack other hosts.

### **Potential impact (including consideration of host plants)**

If only *Nothofagus* are attacked, the potential impact of *Gnathotrupes* in the EPPO region would be limited (grown only as ornamentals or small plantations). However, the overall potential impact would depend on whether *Gnathotrupes* spp. would be able to extend their host range, especially within the Fagaceae. 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. For *G. fimbriatus*, *Pinus sylvestris* (native in the EPPO region) is environmentally and economically important, and *P. contorta* is planted for wood production. However, it is not known if *G. fimbriatus* could cause damage on these hosts. In all cases, the impact would also depend on whether some fungi pathogenic to *Nothofagus* are associated with *Gnathotrupes* and could be pathogenic on other hosts.

**Table 1.** *Gnathotrupes* spp. of *Nothofagus* (mostly from Aguayo Silva *et al.*, 2008. Marked with \*, also Kirkendall *et al.*, 2008, Informativo Fitosanitario Forestal, 2012, Naumann-Etienne, 1978; Wood, 2007). Distribution: AR = Argentina, CL = Chile. Data are from Aguayo Silva *et al.* (2008, citing other sources) and, for species only in Argentina, Naumann-Etienne (1978)).

<b><i>Gnathotrupes</i> species</b>	<b>Host species</b>	<b>Distribution</b>
<i>G. barbifer</i> Schedl, 1967	<i>N. dombeyi</i> , <i>N. pumilio</i>	Regions of Los Lagos (Chiloe), Aysén (El Manso)(CL); Parque Nacional Nahuel Huapi (AR)
<i>G. caliculus</i> (Schedl, 1975)	<i>N. dombeyi</i>	Region of Aysén (El Manso) (CL); Parque Nacional Nahuel Huapi (AR)
<i>G. cirratus</i> Schedl, 1975*	<i>N. antarctica</i> , <i>N. dombeyi</i>	AR
<i>G. consobrinus</i> (Eichhoff, 1878)*	<i>N. dombeyi</i>	Regions of Valparaíso, La Araucanía (Cherquenco), Los Lagos (Los Muermos), Aysén (El Manso), Coquimbo (Parque Nacional Fray Jorge) (CL)
<i>G. fimbriatus</i> (Schedl, 1975)	<i>N. pumilio</i> , <i>N. dombeyi</i> , <i>N. betuloides</i> , <i>N. nervosa</i> *, possibly others; also <i>Pinus contorta</i> *, <i>P. sylvestris</i> *	Southern Chile, from region del Maule to region Magallanes y La Antártica Chilena (CL).
<i>G. herbertfranzi</i> (Schedl, 1973)	<i>N. dombeyi</i> , <i>N. pumilio</i>	Regions La Araucanía (Malalcahuello), Los Lagos (Antillanca), Aysén (El Manso), Magallanes y La Antártica Chilena (Montealto) (CL)
<i>G. impressus</i> (Schedl, 1975)	<i>N. antarctica</i> , <i>N. dombeyi</i>	Region Aysén (El Manso) (CL); Parque Nacional Nahuel Huapi (AR)
<i>G. longipennis</i> (Blanchard, 1851)*	<i>N. dombeyi</i> , polyphagous	Regions Valparaíso (Valparaíso, Zapallar), Los Ríos (Valdivia), La Araucanía (Curacautín); Aysén (El Manso) (CL), Parque Nacional Nahuel Huapi (AR)
<i>G. longiusculus</i> (Schedl, 1951)	<i>N. dombeyi</i> , <i>N. pumilio</i> , possibly others	Southern Chile, from region del Maule to region Magallanes y La Antártica Chilena (CL); Parque Nacional Nahuel Huapi and Tierra del Fuego (AR)
<i>G. nanulus</i> (Schedl, 1972)*	<i>N. dombeyi</i>	Parque Nacional Nahuel Huapi (AR)
<i>G. nanus</i> (Eichhoff, 1878)	<i>N. dombeyi</i> , <i>N. pumilio</i>	Regions Bío-Bío (Concepción); Aysén (El Manso) (CL), Parque Nacional Nahuel Huapi (AR)
<i>G. naumanni</i> (Schedl, 1975)*	<i>N. dombeyi</i>	Parque Nacional Nahuel Huapi (AR)

<b><i>Gnathotrupes</i> species</b>	<b>Host species</b>	<b>Distribution</b>
<i>G. nothofagi</i> Schedl, 1975	<i>N. dombeyi</i>	Region Aysén (El Manso) (CL); Parque Nacional Nahuel Huapi (AR)
<i>G. pustulatus</i> Schedl, 1975	<i>N. dombeyi</i> , <i>N. pumilio</i>	Regions Los Lagos (Puerto Varas), Aysén (El Manso) (CL); Parque Nacional Nahuel Huapi (AR)
<i>G. vafer</i> (Schedl, 1975)	<i>N. pumilio</i> , <i>N. dombeyi</i> , <i>N. betuloides</i> , possibly others	Regions Aysén (El Manso)(CL); Parque Nacional Nahuel Huapi (AR). Probably more widely distributed
<i>G. velatus</i> Schedl, 1975	<i>N. dombeyi</i>	Region Aysén (Reserva Nacional Cerro Castillo) (CL); Parque Nacional Nahuel Huapi (AR)

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