

Tomicus minor

IDENTITY

Name: *Tomicus minor*

Pest Authorities: (Hartig)

Taxonomic Position: Insecta: Coleoptera: Scolytidae

Sub-specific Taxon:

Pest Type: Insect

Common Name(s):

Kleiner Waldgärtner (German)

Lesser pine shoot beetle (English)

Liten margborer (Norwegian)

Synonym(s):

Blastophagus minor (Hartig)

Dendroctonus minor Hartig

Myelophilus minor (Ritchie)

RISK RATING SUMMARY

Numerical Score: 6

Relative Risk Rating: High Risk

Uncertainty: Uncertain

RISK RATING DETAILS

Establishment Potential Is High Risk

The relevant criteria chosen for this organism are:

- Suitable climatic conditions and suitable host material coincide with ports of entry or major destinations.
- Organism has demonstrated ability to utilize new hosts
- Organism has active, directed host searching capability or is vectored by an organism with directed, host searching capability.
- Organism has high inoculum potential or high likelihood of reproducing after entry.

Justification: *Tomicus minor* occurs throughout Europe and Asia, and, therefore, has adapted to a wide range of climates and host species. This fact alone strongly suggests that it can adapt to the climates and habitats represented throughout North America. The closely related species, *Tomicus piniperda*, has already become established in portions of the United States and Canada, and is currently expanding its range. Available evidence suggests that *T. minor* and *T. piniperda* have similar tolerances and geographic ranges (Annala et al. 1999, Hui and Xue Song 1999).

Spread Potential Is Moderate Risk

The relevant criteria chosen for this organism are:

- Organism has demonstrated the ability for redistribution through human-assisted transport.
- Organism has a high reproductive potential
- Potential hosts have contiguous distribution.
- Newly established populations may go undetected for many years due to cryptic nature, concealed activity, slow development of damage symptoms, or misdiagnosis.

Justification: Adults are capable of flying several km in search of suitable hosts and is also subject to wind dispersal. Moreover, the immature stages (eggs, larvae and pupae) can be transported via unprocessed logs and crates, dunnage or pallets containing bark strips. Between 1985 and 2000, *Tomicus minor* was intercepted 8 times at U.S. ports of entry (Haack 2001). *T. minor* has a high reproductive potential and its potential North American hosts: pines and other conifers, are widely distributed. Because of its cryptic nature and small size, infestations could go undetected for several years. In addition, since adult maturation feeding damage is similar to that caused by tip moths, *Rhyaciona* spp. (Lepidoptera: Olethreutidae) or the larger European pine shoot borer, *Tomicus piniperda*, which is already established in parts of North America, damage could be misdiagnosed. Eradication of infestations would be difficult, especially if discovered several years after establishment. This insect has a broad host range (pine, spruce and larch) and is the vector of a blue stain fungus, *Ophiostoma minus*.

Economic Potential Is High Risk

The relevant criteria chosen for this organism are:

- Organism attacks hosts or products with significant commercial value (such as for timber, pulp, or wood products).
- Organism directly causes tree mortality or predisposes host to mortality by other organisms.
- Damage by organism causes a decrease in value of the host affected, for instance, by lowering its market price, increasing cost of production, maintenance, or mitigation, or reducing value of property where it is located.
- Organism may cause loss of markets (domestic or foreign) due to presence and quarantine significant status.
- Organism has potential to be a more efficient vector of a native or introduced pest.

Justification: *Tomicus minor* is regarded as a significant economic pest in Europe (Langstrom 1983). During outbreaks, healthy pine trees are killed by egg gallery construction, larval feeding and introduction of blue stain fungi. Adult shoot mining contributes to reduced growth and vigor. Adult shoot feeding is unsightly and can reduce the marketability of Christmas trees, especially Scotch pine, *Pinus sylvestris*, which is widely planted in some regions of North America. The blue stain fungus introduced by this insect could reduce the marketability of wood products.

Environmental Potential Is Low Risk

The relevant criteria chosen for this organism are:

Justification: Epidemic populations can kill healthy trees. North America pines, which have not co-evolved with this insect, may be more susceptible to attack by *Tomicus minor*. Introduction of this insect could result in implementation of eradication programs with potential adverse environmental effects.

HOSTS

Tomicus minor attacks pines, *Pinus* spp. and, to a lesser degree, species of spruce, *Picea* spp. and larch, *Larix* spp. in Europe (Grüne 1979). Different species of *Pinus* vary in their susceptibility to this pest. In Europe, Scotch pine, *Pinus sylvestris*, is particularly susceptible to *T. minor* (Annala et al. 1999, Fernandez et al. 1999). *Pinus nigra* (Markalas 1997, Fernandez et al. 1999) and *Pinus pinaster* have also been reported as hosts for *T. minor* (Fernandez et al. 1999). In Cyprus, *Pinus brutia* and *Pinus nigra* var. *caramanica* are known hosts (Browne 1968). *Pinus contorta*, a North American species, and Norway spruce, *Picea abies* have also been identified as hosts (Langstrom & Hellqvist 1985). In China, *T. minor* is reported from *Pinus yunnanensis* (Hui and Xue Song 1999).

GEOGRAPHICAL DISTRIBUTION

Asia:

Widely distributed in Asia including China (Manchuria, Henan, Jiamngxi, Shaanxi, Sichuan, and Yunnan Provinces), Cyprus, Japan, Korea, Taiwan, Turkey and Asian Russia (Sakhalin Island) (Brown 1968, Lanne et al. 1987, Wood and Bright 1992).

Europe:

Tomicus minor is widely distributed in Europe. This insect has been reported from Austria, Belgium, Bulgaria, Czech Republic, Denmark, England (Browne 1968), Finland (Annala et al. 1999), France (including Corsica) (Fernandez et al. 1999), Germany, Greece (Markalas 1997), Hungary, Italy, Luxembourg, Netherlands, Norway, Poland, Romania, Scotland (Ritchie 1917), Spain (Fernandez et al. 1999), Sweden (Lanne et al. 1987), Switzerland, European Russia and the former Yugoslav Republics (Wood and Bright 1992).

BIOLOGY

The genus *Tomicus* consists of 6 Asian and European bark beetles. They are considered to be among the most serious pests of European and Asian forests (Stauffer 2003). Other than the European pine shoot beetle, *T. piniperda*, which was recently introduced (Haack and Poland 2002), this genus is not represented in North America.

Tomicus minor has one generation per year (Fernandez et al. 1999). Adult flight begins in early spring (Annala et al. 1999). This species prefers to invade dying or stressed pines, usually after other bark beetles have colonized the tree. *T. piniperda*, for example, can far outnumber *T. minor* in trees in insect defoliated trees (Annala et al. 1999). This may be because *T. minor* characteristically attacks trees after *T. piniperda*, and may even be attracted to trees under attack by *T. piniperda* (Langstrom 1983). In Greece, *T. minor* has colonized fire-burned trees that were not previously attacked by *T. piniperda* (Markalas 1997). Trees are most susceptible to attack by beetles when they are completely defoliated, and as little as 10% foliage remaining on trees is enough to repel beetle attacks (Annala et al. 1999). Large *Pinus sylvestris* with diameters of approximately 25 cm resisted attacks better than small trees with diameters of approximately 13 cm (Annala et al. 1999).

In Europe, *Tomicus minor* attacks high on the boles and branches (Annala et al. 1999, Lanne et al. 1987). This behavior is, in part, because *T. minor* prefers the thinner barked sections of the tree whereas *T. piniperda* attacks

larger trees and near the base of smaller trees (Annala et al. 1999). Also, *T. minor* flies to host trees 1-2 weeks after *T. piniperda* (Hui and Xue Song 1999). However, irrespective of the population, the occurrence of *T. piniperda*, or other bark beetles appears to determine which portion of the tree will be attacked by *T. minor* (Annala et al. 1999). *T. minor* females also prefer to oviposit on the underside of trunks of windblown pines. No beetles emerged from eggs oviposited on the upper side of the windfall (Langstrom 1983). Mortality of pre-adult *T. minor* is typically high, ranging from 45 - 100%.

Before tunneling into the tree, beetles aggregate in the crown of the host tree (Fernandez et al. 1999, Ye and Ding 1999, Langstrom and Hellqvist 1985, Lanne et al. 1999). The female constructs a nuptial chamber under the bark of a pine where she mates with one or more males (Lanne et al. 1999). Some females are already mated when they enter the host tree. These may be second year females or may have mated outside of the tree (Lanne et al. 1987, Fernandez et al. 1999). The female then burrows out two horizontal egg galleries in opposite directions from one another. Eggs are laid along these galleries. Larvae hatch between March and May and feed in galleries that are perpendicular to the oviposition galleries.

Tomicus minor larvae are dependent on the blue stain fungus, *Ophiostoma minus*, which the female transmits when she tunnels into the wood for food (Langstrom 1983, Lanne et al. 1987). Because the larvae feed on the blue stain fungus they require little space in which to develop (Langstrom 1983).

Brood adults emerge through holes constructed in the bark during early to mid summer (Fernandez et al. 1999). When adults emerge, they disperse to feed in the shoots of healthy pines. They construct a tunnel inside the shoot that is characteristically 4-7 cm long (Langstrom and Hellqvist 1985, Fernandez et al. 1999).

Tomicus minor overwinters as an adult from November to January, either in shoots on trees or on the forest floor or in the litter (Lanne et al. 1987). Adults spend up to 9 months either feeding or overwintering inside of the shoots of pine trees (Fernandez et al. 1999). Most beetles overwinter in the shoots of pines that drop to the forest floor. However, there are reports of *T. minor* overwintering in the litter at the base of trees where winter temperatures are excessively cold (Fernandez et al. 1999). In areas where winter temperatures do not drop below 8 degrees C, this insect is able to feed throughout the winter. Some beetles begin to oviposit as early as November and December (Hui and Xue-Song 1999).

PEST SIGNIFICANCE

Economic Impact: In Europe, this species attacks defoliated and stressed pines, and may contribute to tree death (Annala et al. 1999). *Tomicus minor* is regarded as a major pest of pine plantations throughout Europe. Because adults feed on young pine shoots, tree growth can be significantly reduced (Langstrom 1983). Characteristically, *T. minor* is considered to be a secondary pest, but when populations reach epidemic levels, it may attack healthy trees (Fernandez et al. 1999). To successfully attack live trees, 200-300 egg galleries per square meter are required (Annala et al. 1999). Besides direct damage as a result of feeding, *T. minor* transmits the blue stain fungus, *Ophiostoma minus*, which discolors and lowers the value of some wood products.

Environmental Impact: *Tomicus minor* is generally a secondary insect in Europe, where it colonizes trees that have been defoliated by insects (Annala et al. 1999). *T. minor* kills weakened trees and begins the process of decomposing dead trees (Fernandez et al. 1999). Bark beetles like *T. minor* are an integral part of forest ecosystems where they occur naturally. However, if introduced into new regions where the insect and its new hosts have not co-evolved, it may cause substantial environmental damage.

Control: Fallen shoots are the primary overwintering site of this insect (Fernandez et al. 1999). Therefore removal and destruction of infested shoots from forested areas during winter or early spring can dramatically reduce insect abundance. *T. minor* is attracted to the pheromone mixture (S)- and (R) - transverbenol and 3-carene-10-ol, to aggregate large numbers of adults (Lanne et al. 1987). Therefore, trap logs baited with attractant chemicals or blue stain fungus could also reduce populations. Logs inoculated with blue stain fungus are also attractive to adult *T. minor* (Annala et al. 1999).

DETECTION AND IDENTIFICATION

Symptoms: A good indication of adult maturation feeding damage is when new shoots containing adults drop to the ground during the winter (Fernandez et al. 1999). Adult emergence holes in the bark of the trunk and large branches in mid summer and characteristic galleries are indicative of breeding attacks. Egg galleries are opposite of each other and perpendicular to the grain of the wood.

Morphology: Adults are dark brown in color with reddish brown antennae and legs and 3.5-4 mm long (Grüne 1979). Adults of *Tomicus minor* can be distinguished from *T. piniperda* or *T. destruens* by the declivity on the elytra. In *T. minor*, the declivity has spines uninterrupted to the tip of the elytra while, in *T. piniperda* and *T. destruens*, there is a smooth area along the declivity (Passoa 1995).

Eggs are a pearly white color. Larvae are white, c-shaped, legless grubs with an amber colored head capsule. Mature larvae are about 4.5 mm long. The pupae are white, mummy-like and have some adult features including wings that are folded behind the abdomen

Testing Methods for Identification: As is the case with all bark beetles, immature stages (eggs, larvae and pupae) lack distinguishing features for species identification. Examination of adults by a taxonomist with expertise in the family Scolytidae is required for positive identification.

MEANS OF MOVEMENT AND DISPERSAL

Tomicus minor is capable of flight, and dispersal typically occurs in spring when beetles emerge from shoots in which they have been overwintering (Fernandez et al. 1999). Adults are also subject to wind dispersal. Long distance spread is facilitated by wood products containing bark strips via international trade. This insect was intercepted at U.S. ports of entry 8 times between 1985 and 2000, all in wood crating (Haack 2001).

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Galleries

Old gallery in wood. Strong branches in
the crown. Sachsen, Germany

Photo by Hannes Lemme,
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Galleries

Photo by Stanislaw Kinelski,

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Damage

Note horizontal feeding galleries and exit
holes

Photo by Stanislaw Kinelski,

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Damage

Photo by Gyorgy Csoka,
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Damage

Boring dust

Photo by Stanislaw Kinelski,