European and Mediterranean Plant Protection Organization
Organisation Européenne et Méditerranéenne pour la Protection des Plantes

Data sheets on quarantine pests
Fiches informatives sur les organismes de quarantaine

Ips cembrae and *Ips subelongatus*

Identity

Taxonomic position: *Insecta*: *Coleoptera*: *Scolytidae*
Notes on taxonomy and nomenclature: the taxonomy of *Ips* species attacking larch in Europe and Asia is still under study. Several authors have considered *I. subelongatus*, *I. fallax*, *I. shinanonensis* and *I. cembrae* var. *engadinensis* as synonyms of *I. cembrae*, as they cannot be distinguished on the basis of their morphological characteristics. These species or subspecies were separated on the basis of their host plants and geographical distribution. Phylogenetic studies have been conducted, comparing the DNA sequences of a region of the mitochondrial gene and also the species of blue-stain fungi associated with European and Asian beetles. The results suggested that the *I. cembrae* complex included at least two taxa: *I. cembrae* infesting larch in Europe and *I. subelongatus* infesting larch in Asia (Stauffer *et al*., 2001). With respect to the whole Eurasian region covered by EPPO, *I. cembrae* and *I. subelongatus* are regarded as presenting distinct phytosanitary risks (whether considered as two distinct species, or as subspecies of a single species) and therefore *I. subelongatus* is here documented separately from *I. cembrae*.

Ips cembrae

Name: *Ips cembrae* (Heer)
Synonyms: *Bostrichus cembrae* Heer, *Ips cembrae* var. *engadinensis* Fuchs
Common names: large larch bark beetle (English), grosser Lärchenborkenkäfer (German), Lerkebarkbille (Norwegian)
EPPO code: IPSXCE
Phytosanitary categorization: EU Annex designation II/B

Ips subelongatus

Name: *Ips subelongatus* Motschulsky
Synonym: *Ips fallax* Eggers
Common Names: larch bark beetle, oblong bark beetle (English); большой лиственничный короед, продолговатый короед (Russian)
EPPO code: IPSXFA
Phytosanitary categorization: EPPO A2 action list No. 325. The species is not mentioned by name in the EU Directive, but it could be regarded either as assimilated to *I. cembrae* in Annex II/B or as forming part of the category *Scolytidae* (non-European) in Annex II/A1

Hosts

Larix decidua is the main host of *I. cembrae*. Exotic *Larix* species planted in Europe may also be affected (e.g. *Larix leptolepis*). *I. cembrae* may also occasionally breed in species of the genera *Pinus* and *Picea*. *I. subelongatus* mainly attacks *Larix sibirica*, *Larix gmelinii*, *Larix leptolepis* and *Larix olgensis*. Like *I. cembrae*, it may occasionally breed in other conifers (*Pinus sylvestris*, *Pinus sibirica*, *Pinus koraiensis*, *Picea* spp., *Abies* spp.).

Geographical distribution

Ips cembrae

EPPO region: Austria, Croatia, Czechia, France, Germany, Hungary, Italy, Netherlands, Poland, Romania, Russia (Central Russia), Serbia & Montenegro, Slovakia, Slovenia, Switzerland, Ukraine, United Kingdom (Scotland). *I. cembrae* is distributed throughout the *Larix* forests of the Alps and Carpathians in central Europe but has spread to *Larix* plantations in the Netherlands (Luitjes, 1974), Scotland and other countries
EU: present

Ips subelongatus

EPPO region: Russia (north-east of European Russia, all Siberia, Transbaikalia and Far East). Detected in 1985 in wood of *Pinus sylvestris* imported from Russia to Finland (Siitonen 1990)
Asia: China (Heilongjiang, Jilin, Liaoning), Japan (Hokkaido, Honshu), Korea Democratic People's Republic, Korea Republic, Mongolia (northern part), Russia (all Siberia, Transbaikalia and Far East) (Gao *et al*., 2000; Pavlovskii *et al*.,

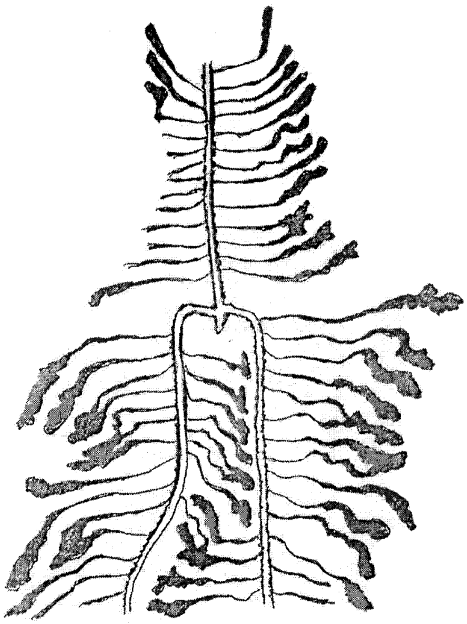

Fig. 1 Galleries of *Ips subelongatus* on almost healthy trees (Shamaev, 1994).

1955; Issaev, 1966; Maslov, 1988; Yu & Cheng, 1984, Zhang *et al*., 2000)
EU: absent

Biology

Ips cembrae

Adults emerge from hibernation sites in May. Main flight takes place on warm days in late May/early June. Males initiate boring and release a pheromone consisting of ipsdienol, ipsenol and 3-methyl-3-buten-1-ol (Stoakely *et al*., 1977; Rebenstorff & Francke, 1982). There may be one or two annual generations depending on the length of the summer season. The second generation may fly in August/September. There may also be a sister brood of the first generation, flying in June.

The new generation adults have a maturation feed in late summer, either in branches of younger trees or near to the brood gallery, if there is still fresh bark present. Adults aggregate in response to terpenoid pheromones (Kohnle *et al*., 1988). Adults hibernate partly in tunnels resulting from maturation feeding under thicker bark of trunks lying on the ground or, more commonly, in the forest litter (Schneider, 1977).

Ips subelongatus

The first (spring) mass flight of *I. subelongatus* usually occurs from mid May to the end of June in the southern part of the area of its distribution, when midday temperature reaches 16–20°C, and lasts for 15–17 days. Adults aggregate in response to pheromones (Qiu *et al*., 1988; Zhang *et al*., 2000). After making galleries and laying eggs, some adults begin a second ('sister') flight, forming a 'sister' generation (Issaev, 1966). This usually occurs from the end of June to the end of July in the same region and lasts 22–23 days. The other adults from the first generation meanwhile continue additional feeding and enter diapause to prepare for overwintering. Second main and sister generations follow in succession. Mature beetles overwinter in forest litter (Schneider, 1977), whereas pupae, larvae and some adults overwinter under larch bark.

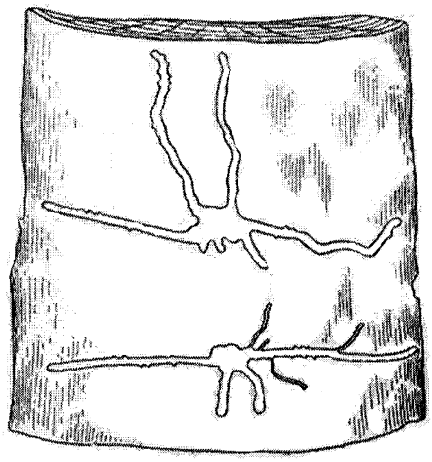

Fig. 2 Galleries of *Ips subelongatus* on heavily stressed trees (Issaev, 1966).

I. subelongatus may lay eggs in almost healthy trees, but more usually in dying trees and cut trunks. The form and the depth of galleries vary very much depending of the health of the tree (Figs 1 and 2). Female galleries, 3.0–3.5 mm wide, are usually 16–18 cm long but may sometimes reach 27 cm. Adults need additional feeding, which usually occurs on the trunk at the region of larval development, but, in the case of shortage of food, may also be on roots and at the zone of thin bark at the top of the trunk and on the branches (Fig. 3). These galleries are characterized by high quantities of frass.

Detection and identification

Symptoms

Breeding occurs under thick bark of *Larix*. Most commonly, three female galleries diverge longitudinally from the nuptial chamber, two in one direction and one in the opposite direction. Galleries with one, two or four female galleries are also found. Female galleries are rarely longer than 25 cm, usually 13–17 cm. Pheromone trapping can be used to detect *I. cembrae* in the field (Niemeyer, 1989).

For *I. subelongatus*, characteristic symptoms are: flow of resin coming from the places where attempts have been made to lay eggs, species-diagnostic gallery system with central chamber and radial larval galleries, sparse crowns of larch trees with partly dead tops and branches. The leaves of attacked trees often show yellowing and wilting.

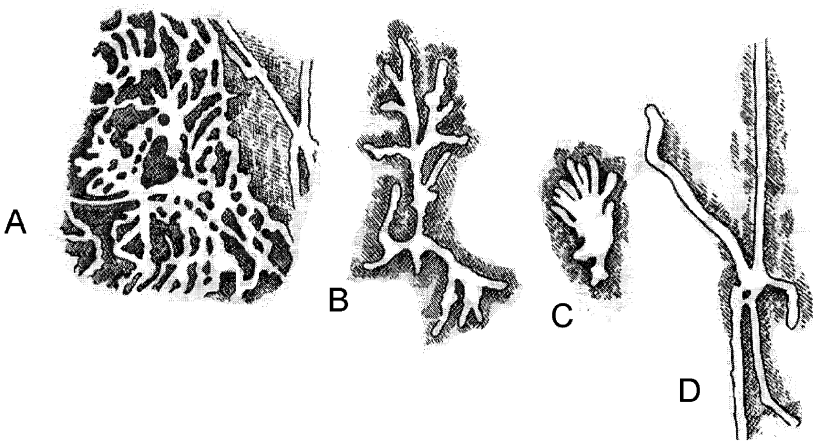

Fig. 3 Galleries of additional feeding of *Ips subelongatus*: A – in the region of larval development; B – on roots; C and D – in the zone of thin bark at the top of the trunk and on branches (Issaev, 1966).

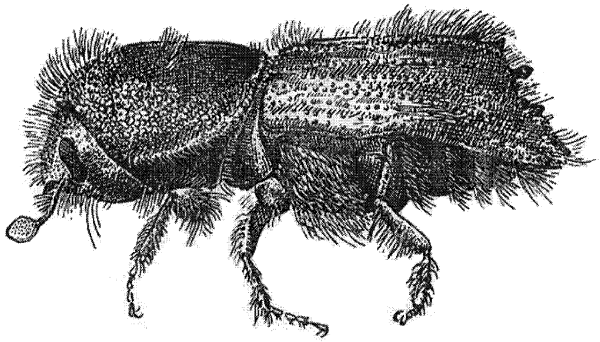

Fig. 4 Adult of *Ips subelongatus* (Mamaev, 1985).

Morphology

Adults of *I. cembrae* and *I. subelongatus* are not readily distinguishable. They are blackish brown, 4–6 mm long. There are four equally spaced spines on each side of the elytral declivity. The third is the largest and is strongly capitate (Balachowsky, 1949; Grüne, 1979). The surface of the elytral depression is covered with long hairs (Fig. 4). The larva has been described by Kalina (1969).

Pathways for movement

Laboratory experiments have shown that adult *Ips* spp. can fly continuously for several hours. In the field, however, flight has only been observed to take place over limited distances and then usually downwind. Beetles have been found in the stomach of trout in lakes 35 km from the nearest spruce forest, probably carried by the wind (Nilssen, 1978). Dispersal over longer distances depends on transportation under the bark of logs. *I. cembrae* has been found on wood from central Europe imported into Sweden. There is little risk of movement with plants for planting, but *Ips* spp. could be carried as contaminating pests on other commodities.

Pest significance

Economic impact

I. cembrae is a secondary pest in native European *Larix* plantations, breeding in logs, wind-blown stems and dying trees. In Germany, timber from the April felling of larch is rapidly attacked and severely invaded (Elsner, 1997). Drought conditions on drier sites may promote attack on green trees. The introduced population in the UK is able to attack live trees suffering from drought stress (Bevan, 1987). The introduced population in the Netherlands developed on storm-damaged trees (Luitjes, 1974).

The situation for *I. subelongatus* is broadly similar, but has a much greater economic impact because *Larix* spp. constitute a much more important element of Siberian forests. *I. subelongatus* is regarded as one of the most serious pests of larch in the Asian part of the EPPO region. The most severe damage is usually observed in larch forests previously attacked by *Dendrolimus sibiricus*, *Xylotrechus altaicus* and other pests or damaged by forest fires (OEPP/EPPO, 2005a,b), and is very often followed by outbreaks of other wood borers (scolytids, cerambycids and others), particularly, *Scolytus morawitzi* (OEPP/EPPO, 2005c), *Monochamus galloprovincialis*, *Melanophila guttulata* (Issaev, 1966; Yu *et al*., 1984; Maslov, 1988; Shamaev, 1994; Vorontsov, 1995). *I. subelongatus* may continue to attack the same tree over several years. In particular, larvae sometimes encircle trunks feeding in the phloem, which may lead to the death of the infested tree.

As in the case of other conifer bark beetles, *I. cembrae* and *I. subelongatus* act as a vector for a blue-stain fungus (*Ceratocystis laricicola*) which also damages the tree (Redfern *et al*., 1987; Yamaoka *et al*., 1988).

Control

Control measures are not used against *I. cembrae*, except to protect logs (Stoakely, 1975). According to Watzek & Niemeyer (1996), larch harvested by modern harvesters is readily colonized

by *I. cembrae*, so control is needed. When thinnings are left unbarked in the stand, infestations may become severe, so spatial or temporal gaps should be left between harvesting and thinning.

In Siberia, on the other hand, official control efforts are undertaken in the area of the present distribution of *I. subelongatus.* Control measures include silvicultural and sanitary measures (improving the resistance of forests, cutting and elimination all infested trees), and treatments with chemical and biological preparations (lindane, phoxim, dichlorvos). Nematodes, micro-organisms, parasitoids and predators may play a role in regulation of *I. subelongatus* populations (Gusteleva, 1982; Korenchenko, 1987; Vorontsov, 1995). A forecasting system has been developed in China (Gao *et al*., 1998).

Phytosanitary risk

In most of Europe, *I. cembrae* is an indigenous species presenting no particular risk, and is a much less important pest than *I. typographus* (EPPO/CABI, 1997). In Ireland and Northern Ireland, however, no *Ips* spp. occur naturally, and many plantations of exotic conifers have been established, including *Larix decidua* and other *Larix* spp. It is desirable to maintain this zone free from other European and non-European bark beetles (including also *I. subelongatus*). *I. cembrae* may also present a risk to the eastern part of the EPPO region where *Larix* plantations are exploited, and to other continents such as North America.

With regard to the central European larch forests and other areas of Europe where larch is grown, *I. cembrae* already occurs, but the sister-species *I. subelongatus* presents an additional risk. This risk is accentuated by the considerable increase in export of conifer wood from Russia to western Europe in recent years. In general, *I. subelongatus* is reported to be more damaging to the local *Larix* species, and more in need of control, in Asia that *I. cembrae* is in Europe. *I. subelongatus* also presents a risk to other continents where *Larix* plantations are exploited, particularly North America.

It may be noted that a similar risk arises from *Scolytus morawitzi* (OEPP/EPPO, 2005c).

Phytosanitary measures

I. cembrae is regulated by the European Union (EU, 2000). A protected zone covering Greece, Ireland and parts of the UK (Northern Ireland, Isle of Man) is designated. The following measures are applied to material of *Larix* entering this zone: treatment (debarking or kiln-drying) or 'pest-free area' for wood, and treatment or 'pest-free area' for bark. For plants for planting and for cut Christmas trees, which present relatively little risk, 'pest-free place of production' is required for large plants (above 3 m). These requirements are also extended to the less important hosts (*Abies*, *Picea*, *Pinus*, *Pseudotsuga*).

I. subelongatus is not explicitly regulated by the European Union (EU, 2000) but, since it is virtually absent from Europe (except for a small area in northeastern European Russia), it can be considered as a member of the category 'non-European *Scolytidae*', which is regulated by the EU. In 2004, *I. subelongatus* was added to the EPPO A2 action list of pests recommended for regulation as quarantine pests. The major risk of spreading *I. subelongatus* is with wood of *Larix*, in which eggs, larvae, pupae and adults may be present under the bark. The requirements mentioned for *I. cembrae* (above) are equally suitable for *I. subelongatus*, and apply also to *S. morawitzi* (OEPP/EPPO, 2005c).

References

Balachowsky A (1949). Coleoptera, Scolytides. In: *Faune de France*, Vol. 50. P. Lechevalier, Paris (FR).

Bevan D (1987) Forest insects. *A Guide to Insects Feeding on Trees in Britain. Forestry Commission Handbook no. 1*. Forestry Commission, London (GB).

Elsner G (1997) Relationships between cutting time in winter and breeding success of *Ips cembrae* in larch timber. *Mitteilungen der Deutschen Gesellschaft für Allgemeine und Angewandte Entomologie* **11**, 653–657.

EPPO/CABI (1997). *Ips typographus*. In: *Quarantine Pests for Europe,* 2nd edn. CAB International, Wallingford (GB).

EU (2000) Council Directive 2000/29/EC of 8 July 2000 on protective measures against the introduction into the Member States of organisms harmful to plant or plant products. *Official Journal of the European Communities* L169, 1–112.

Gao CQ, Ren XG, Wang DS, Zhang HY, Sun SH, Sun JB & Niu YZ (1998) [Occurrence, regulation and forecasting technique of *Ips subelongatus*.] *Journal of Northeast Forestry University* **16**, 24–28 (in Chinese).

Gao CQ, Sun SH, Ren XG, Niu YZ, Song LW & Zhang YS (2000) [Study of biological and ecological characteristics of *Ips subelongatus*.] *Journal of Forestry Research* **11**, 114–118 (in Chinese).

Grüne S (1979) *Brief Illustrated Key to European Bark Beetles*. M. & H. Schaper, Hannover (DE).

Gusteleva LA (1982) [Prospects of using microbial preparations against *Ips subelongatus*.] *Lesnoe Khozyaistvo* no. 9, 67 (in Russian).

Issaev AS (1966) [*Borer pests of* Larix dahurica.] Nauka, Moscow (RU) (in Russian).

Kalina V (1969) Larvae of European bark beetles (Coleoptera, Scolytidae). *Studia Entomologica Forestalia* **1**, 13–22; **2**, 41–61.

Kohnle U, Vite JP, Erbacher C, Baartels J & Francke W (1988) Aggregation responses of European engraver beetles of the genus *Ips* mediated by terpenoid pheromones. *Entomologia Experimentalis et Applicata* **49**, 43–53.

Korenchenko EA (1987) [*Cryptaphelenchus diversispicularis* n. sp. (Tylenchida, Aphelenchoididae) – a new nematode of the bark beetle, *Ips subelongatus*.] *Parazitologiya* **21**, 73–78 (in Russian).

Liu ZF, Zhang QH, Chu D, Sun YG, Sheng MN, Xu SB, Zhang XD, Shao CH & Han SC (1990) [Analysis of the incidence of stem borers in burned forests in Danxinganling Mountains.] *Forest Pest and Disease* **1**, 38–40 (in Chinese).

Luitjes J (1974) [*Ips cembrae*, a new noxious forest insect in the Netherlands.] *Nederlands Bosbouw Tijdschrift* **46**, 244–246 (in Dutch).

Mamaev BM (1985) [*Borer Pests of Forests of Siberia and the Far East*.] Agropromizdat, Moscow (RU) (in Russian).

Mamaev YuB (1990) [Outbreaks of trunk pests in larch forests of the Tuva ASSR damaged by *Dendrolimus sibiricus*.] *Izvestiya Vysshikh Uchebnykh Zavedenii Lesnoi Zhurnal* no. 2, 16–19 (in Russian).

Maslov AD (1988) [*Guide on Forest Protection against Pests and Diseases*.] Agropromizdat, Moscow (RU) (in Russian).

Niemeyer H (1989) [First results with a pheromone trap system for monitoring bark beetles in Lower Saxony and Schleswig-Holstein.] *Forst und Holz* **44**, 114–115 (in German).

Nilssen AC (1978) Development of a bark fauna in plantations of *Picea abies* in northern Norway. *Astarte* **11**, 151–169.

OEPP/EPPO (2005a) Data sheets on quarantine pests *Dendrolinus sibiricus* and *Dendrolinus superans*. *Bulletin OEPP/EPPO Bulletin* **35**, 390–395.

OEPP/EPPO (2005b) Data sheets on quarantine pests *Xylotrechus altaicus*. *Bulletin OEPP/EPPO Bulletin* **35**, 406–408.

OEPP/EPPO (2005c) Data sheets on quarantine pests *Scolytus morawitzi*. *Bulletin OEPP/EPPO Bulletin* **35**, 396–398.

Pavlovskii EN & Shtakelberg AA (1955) [*Guide to Forest Pests*.] Izdatel'stvo Akademii Nauk SSSR, Moscow–Leningrad (RU) (in Russian).

Qiu HG, Fu WJ, Qi YT, He LF & Ling XD (1988) [Studies on the aggregation pheromone of *Ips subelongatus*. II. The relationship between aggregation behaviour and the host plant tree.] *Contributions from Shanghai Institute of Entomology* **8**, 67–72 (in Chinese).

Rebenstorff H & Francke W (1982) [The large larch bark beetle: monitoring with attractants?] *Allgemeine Forst Zeitschrift* **37**, 450 (in German).

Redfern DB, Stoakley JT, Steele H & Minter DW (1987) Dieback and death of larch caused by *Ceratocystis laricicola* sp. nov. following attack by *Ips cembrae*. *Plant Pathology* **36**, 467–480.

Schneider HJ (1977) [Experience in the control of the large larch bark beetle in stands of low vitality.] *Allgemeine Forst Zeitschrift* **32**, 1115–1116 (in German).

Shamaev AV (1994) [*Guide to the Identification of Trunk Pests of Forest Trees, Subject to Phytosanitary Import Requirements*.] Viktoriya, Syktyvkar (RU) (in Russian).

Siitonen J (1990) Potential forest pest beetles conveyed to Finland on timber from the Soviet Union. *Silva Fennica* **24**, 315–321.

Stauffer C, Kirisits T, Nussbaumer C, Pavlin R & Wingfield MJ (2001) Phylogenetic relationships between the European and Asian eight-spined larch bark beetle populations (Coleoptera, Scolytidae) inferred from DNA sequences and fungal associates. *European Journal of Entomology* **98**, 99–105.

Stoakely JT (1975) Control of larch bark beetle, *Ips cembrae*. *Research Information Note,* no. 5. Forestry Commission, London (GB).

Stoakely JT, Bakke A, Renwick JAA & Vité JP (1977) The aggregation pheromone system of the larch bark beetle *Ips cembrae*. *Zeitschrift für Angewandte Entomologie* **86**, 174–177.

Vorontsov AI (1995) [*Forest Entomology*], 5th edn. Ekologiya, Moscow (RU) (in Russian).

Watzek G & Niemeyer H (1996) [Reduction of bark beetle damage by using harvesters and by work organization.] *Forst und Holz* **51**, 247–250 (in German).

Yamaoka Y, Wingfield MJ, Ohsawa M & Kuroda Y (1998) Ophiostomatoid fungi associated with *Ips cembrae* in Japan and their pathogenicity to Japanese larch. *Mycoscience* **39**, 367–378.

Yu CM, Guo SP & Cheng DJ (1984) [Study of the larch bark beetle *Ips subelongatus*.] *Journal of North Eastern Forestry Institute, China* **12**, 27–39 (in Chinese).

Zhang QH, Birgersson G, Schlyter F & Chen GF (2000) Pheromone components in the larch bark beetle *Ips cembrae* from China: quantitative variation among attack phases and individuals. *Journal of Chemical Ecology* **26**, 841–858.