Data Sheets on Quarantine Pests

Ips pini

IDENTITY

Name: *Ips pini* (Say)
Synonyms: *Bostrichus pini* Say
Ips laticollis Swaine
Ips oregonis (Eichhoff)
Taxonomic position: Insecta: Coleoptera: Scolytidae
Common names: Eastern pine engraver, pine engraver beetle (English)
Bayer computer code: IPSXPI
EPPO A1 list: No. 274
EU Annex designation: II/A1

HOSTS

I. pini is relatively non-specific, being found on many pine species: *Pinus banksiana*, *P. contorta*, *P. flexilis*, *P. jeffreyi*, *P. ponderosa*, *P. resinosa*, *P. strobus* and *P. sylvestris*. It has also been reported on *Picea*. In Western USA, the commonest hosts are *P. ponderosa*, *P. jeffreyi* and *P. contorta*.

GEOGRAPHICAL DISTRIBUTION

EPPO region: Absent.
North America: Canada (Alberta, British Columbia, Ontario), Mexico (northern; unconfirmed), USA (Alaska, Arizona, California, Idaho, Massachusetts, Michigan, Minnesota, Montana, New Mexico, New York, Oregon, Tennessee, Washington, Wisconsin).
EU: Absent.

BIOLOGY

The adults and larvae of *Ips* spp. are phloeophagous or bark-feeding, mainly attacking declining or dead trees and freshly cut wood. They frequently carry the spores of bluestain fungi, in the case of *I. pini* the fungi *Ophiostoma ips* and *O. nigrocarpa* (Raffa & Smalley, 1988). In California, *I. pini* usually overwinters as larvae or pupae with a few immature adults (Bright & Stark, 1973).

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.

Ips spp. are polygamous: the male excavates the entrance tunnel and nuptial chamber, and then admits two to five females. The females push their frass into the nuptial chamber. The male has the responsibility for ejecting their frass and for protecting the entrance hole. The eggs are usually deposited in individual niches, contiguous in the case of *I. pini*. The length of the larval period under optimum conditions is, as in other scolytids, 30-90 days. The end of the larval mine is usually slightly enlarged and cleared of frass to form a pupal chamber. The pupal stage, as in other scolytids, requires 3-30 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.

The adult beetles may emerge from the host tree immediately, even before becoming fully coloured, or may require a period of maturation feeding before emerging. 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. There may be up to four annual generations in *I. pini*, but only two in northern USA (one on pine slash in the spring and one on trees in summer) (Gast & Stock, 1994). For further information on the biology of this species, see Thomas (1961), Sartwell et *al.* (1971).

DETECTION AND IDENTIFICATION

Symptoms

In *Ips* spp., the gallery system is situated in the phloem-cambial region and consists of a central nuptial chamber from which elongate egg galleries fork or radiate, forming a species-diagnostic pattern. *I. pini* has three to four egg galleries, forming a comparatively long, longitudinal X or Y pattern (Bright, 1976).

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 *Ips* spp., larval mines are short to very long, straight to irregular, and always visible on peeled bark. The larval mines of *I. pini* are perpendicular to the egg gallery.

Morphology

Eggs

Smooth, oval, white, translucent.

Larva

In general, *Ips* larvae are white, legless, with lightly sclerotized head; head usually as broad as long with evenly curved sides, protracted or slightly retracted; frons sometimes with pair of tubercles (some species). 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 *Ips* and other bark beetles, see Thomas (1957). Bentz *et al*. (1996) describe characters for differentiating *I. pini* larvae from those of *Dendroctonus ponderosae* cohabiting in the same tree.

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.

Adult

In general, *Ips* adults are small, 0.5-8 mm in length (3.5-4.2 mm in *I. pini*), cylindrical to hemispherical in form, usually yellow, brown or black, sometimes shining and glabrous, dull and coarsely granulate, densely pubescent or covered with scales. Antennae geniculate, funicle five-segmented, with abrupt three-segmented club; subcircular to oval, strongly flattened, with sutures strongly to moderately bisinuate. Head partly concealed in dorsal view, not prolonged into distinct rostrum, narrower than pronotum, with mouthparts directed downwards. Eyes flat, usually elongate, sometimes notched, very rarely rounded or divided. Pronotum weakly to strongly declivous anteriorly and usually with many asperate crenulations in anterior half. Scutellum large and flat. Elytra entire, concealing pygidium, with basal margin straight and without crenulations. Elytra terminate in a rounded or blunt slope (the declivity) which is concavely excavated with lateral margins dentate, all teeth on summit (*I. pini* belongs to a group with 4 spines on the elytral declivity). Tibiae unguiculate. Tarsal segment 1 not longer than 2 or 3, distinctly five-segmented. For generic and specific keys to *Ips* and other genera, see Wood (1982).

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, *Ips* spp. periodically cause loss of wood (cut wood and sometimes 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. However, they tend to be less aggressive and less host-specific than *Dendroctonus* spp.

I. pini usually infests dead or weakened trees, but at high population densities can kill standing trees (Poland & Borden, 1994). It is a threat to sapling and small-pole stands of *Pinus* in or near thinning, logging and blowdown areas, particularly in western North America. Outbreaks do not always develop under conditions that appear favourable to the beetle but, when present, it can increase to destructive levels. It frequently infests the tops and larger limbs of trees being attacked by *Dendroctonus* and thereby may accelerate and intensify an epidemic. On the other hand, Rankin & Borden (1991) have suggested that induced *I. pini* infestation might be a means of reducing populations of *D. ponderosae*. *I. pini* is rarely able to sustain a primary attack without the association of *Dendroctonus*. In general, *I. pini* seems to be mainly of concern in western North America; there are few publications concerning this pest in the extensive other areas where it is present. In Wisconsin (Klepzig *et al*., 1991), *I. pini* and its associated fungus *O. ips* are secondary pests of declining *P. resinosa* after these have been attacked by other Coleoptera and their associated fungi.

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

I. pini is an A1 quarantine pest for EPPO, within the category "non-European Scolytidae" (EPPO/CABI, 1992). Since it can make primary attacks on *Pinus* spp., it presents a certain risk to the EPPO region, where pines are important forest trees. This risk can be assessed as fairly high because the geographical range of this species in North America (northern and western) covers a climatic zone essentially similar to that of the EPPO region, because some of the *Pinus* species concerned in North America (*P. ponderosa*, *P. contorta*) have been widely planted in the EPPO region, and because *I. pini* is considered to have a relatively wide and non-specific host range in North America, extending even to *Picea* (though it is not clear that this genus is subject to primary attack). Logs of the European *Pinus sylvestris* were infested by *I. pini* in experimental studies in Michigan (USA) (Haack & Lawrence, 1995). On the basis of all these arguments, *I. pini* seems to present the highest risk of the North American *Ips* spp.

Indigenous *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 *Ips* spp. and protect themselves from species already present elsewhere in Europe (e.g. *I. typographus*) have evident reason to protect themselves also from North American pest species of *Ips*.

PHYTOSANITARY MEASURES

EPPO recommends that all countries should prohibit import of plants of conifers from countries where *I. pini* occurs, and optionally also bark of conifers (OEPP/EPPO, 1990). If bark is imported, it should be heat-treated or fermented. Wood of conifers from such countries should be debarked, or kiln-dried, or treated (see below). An EPPO phytosanitary procedure for fermentation has been published (OEPP/EPPO, 1994a) and procedures for the other treatments are in preparation.

Infested conifer logs can be treated with chemicals on an individual basis, and fumigation of stacks with methyl bromide can provide excellent control where specialist facilities exist and temperature conditions are correct for effective treatment (White, 1971). EPPO recommends a phytosanitary procedure specifically for this fumigation (OEPP/EPPO, 1994b).

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