Data Sheets on Quarantine Pests

Ips confusus and *Ips paraconfusus*

IDENTITY

Taxonomic position: Insecta: Coleoptera: Scolytidae
Notes on taxonomy and nomenclature: Although the quarantine pest which appears in the EPPO and EU lists is named as *I. confusus*, Furniss & Carolin (1977) explain that this species, the piñon ips, has in the past been confused with the very similar *I. paraconfusus*, the California five-spined ips. The former is confined to pinyon pines, while the latter occurs on all pine species within its range, especially *P. ponderosa*. For this reason, it seems evident that the intended quarantine pest, originally listed in the 1970s, must have been *I. paraconfusus* at least as much as *I. confusus.* Both species are therefore covered in this sheet. With their range in western USA, they belong to the same group as the very similar sibling species *I. grandicollis* (southeastern USA and Caribbean) and *I. lecontei* (Arizona and Mexico) (EPPO/CABI, 1996).

- ***Ips confusus***
  Name: *Ips confusus* (LeConte)
  Synonyms: *Tomicus confusus* (LeConte)
  Common names: Piñon ips (English)
  Bayer computer code: IPSXCO
  EPPO A1 list: No. 271
  EU Annex designation: II/A1 - under non-European Scolytidae
- ***Ips paraconfusus***
  Name: *Ips paraconfusus* Lanier
  Common names: California five-spined engraver, California five-spined ips (English)
  Bayer computer code: IPSXPA
  EU Annex designation: II/A1 - under non-European Scolytidae

HOSTS

I. confusus attacks the pinyon pines *Pinus edulis* and *P. monophylla*, and rarely other *Pinus* spp., while *I. paraconfusus* attacks the timber species *P. ponderosa, P. attenuata, P. contorta, P. coulteri, P. lambertiana, P. monticola, P. muricata, P. radiata and P. sabiniana.* According to Cane *et al.* (1990), female *I. confusus* are attracted specifically to pinyon pines on which males have aggregated, while male *I. confusus* and both sexes of *I. paraconfusus* are not specifically attracted to individual pine species.

GEOGRAPHICAL DISTRIBUTION

- ***Ips confusus***
  EPPO region: Absent.
  North America: Mexico, southwestern USA (Arizona, California, Colorado, Nevada, New Mexico, Oregon, Texas, Utah, Wyoming).
  EU: Absent.

- ***Ips paraconfusus***
  EPPO region: Absent.
  North America: USA (California, Oregon).
  EU: Absent.

BIOLOGY

There is little specific information available about *I. confusus* or *I. paraconfusus* and the following account relates to North American *Ips* spp. in general. Adults and larvae are phloeophagous or bark-feeding, mainly attacking declining or dead trees and freshly cut wood. They frequently carry the spores of bluestain fungi. They usually overwinter in the adult and larval stage with the proportion of adults to larvae varying from species to species (Wood, 1982).

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 *I. confusus*. There are three larval instars (Wilkinson, 1963). 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.

I. confusus has three or sometimes four annual generations. *I. paraconfusus* typically has two summer generations in fallen logs and an overwintering generation in standing trees. In the southern part of its range, there may be 3-5 summer generations.

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. In *I. paraconfusus*, the egg galleries comprise 3-5 nearly straight tunnels radiating from the entrance chamber. The typical pattern has three galleries in an inverted "Y" pattern.

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. Larval mines are always visible on peeled bark.

Morphology

Eggs

Smooth, oval, white, translucent.

Larva

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 *Ips* spp.). 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. For generic keys to the larvae of *Ips* and other bark beetles, see Thomas (1957).

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 (3.0-5.5 mm in *I. confusus*), 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. confusus* and *I. paraconfusus* belong to a group with 5 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). *I. confusus* and *I. paraconfusus* closely resemble each other morphologically.

I. confusus and *I. paraconfusus* can be distinguished from each other and from other members of the *Ips grandicollis* group (*I. grandicollis, I. lecontei* and others) by the random amplified polymorphic DNA (RAPD) technique, which yielded a diagnostic DNA banding pattern for each species (Cognato *et al*., 1995).

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.

They mostly breed in slash, or in broken, fallen or dying trees. In this way, *I. confusus* can kill pinyon pines in southwest USA, when outbreaks start on trees that are damaged or uprooted in land-clearance schemes (Furniss & Carolin, 1977). *I. paraconfusus* is of greater practical importance because it attacks the timber tree *P. ponderosa*, killing saplings and young trees up to about 65 cm in diameter. Outbreaks develop on recently cut wood and spread to nearby living trees. This is reflected by a much greater number of publications on *I. paraconfusus* than on *I. confusus*. Top-killing by *I. paraconfusus* can contribute to outbreaks of the more dangerous pest *Dendroctonus brevicomis* (EPPO/CABI, 1996).

I. paraconfusus is also one of the possible vectors of *Fusarium subglutinans* f.sp. *pini*, the pathogen of pine pitch canker, a disease which is increasing in importance in California (Storer *et al*., 1994).

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. confusus is an A1 quarantine pest for EPPO, within the category "non-European Scolytidae" (EPPO/CABI, 1992); it may be that this A1 entry was based in part, or mostly, on the risk presented by *I. paraconfusus*. For *I. confusus* in the strict sense, the risk for the EPPO region can be assessed as practically negligible, since this species is a secondary pest of pinyon pines only, in a specific montane environment in southwestern USA. *I. paraconfusus* can, however, make primary attacks on *Pinus* spp. and presents a moderately high risk for the EPPO region, since the geographical range of this species in North America (California and southern Oregon) covers climatic conditions which are similar to those of southern Europe and because the main *Pinus* species concerned in North America is *P. ponderosa*, which has been widely planted in the EPPO region.

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

If measures are needed against *I. paraconfusus*, those recommended for *I. pini* (EPPO/CABI, 1996) should also exclude it.

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