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SIREX WOODWASP

A PEST OF PINE IN N.S.W.

by

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INTRODUCTION

The sirex wasp, *Sirex noctilio* Fabricus (Hymenoptera:Siricidae) is an accidentally introduced tree killing borer of *Pinus* species. This borer is now established in Tasmania, Victoria, South Australia, Southern New South Wales and Australian Capital Territory. Sirex has also proved to be a serious pest in New Zealand where it has been established since early this century. The main plantation tree in Australia and New Zealand is radiata pine (*P. radiata*). This tree species is particularly susceptible to the sirex wasp and successful attack almost always results in the rapid death of infested trees.

The original discovery of sirex wasp establishment in Australia was near Hobart, Tasmania, in 1952. The first mainland infestation was found near Melbourne, Victoria in 1961. Both infestations were likely to have been from separate accidental introductions, some years previously, in logs or sawn timber imported from overseas. Native to Europe and North Africa, sirex is most common in the countries around the Mediterranean. *Pinus* species are the preferred host trees in its native range but, because of a greater resistance to sirex attack within the local trees, they are rarely killed.

DISTRIBUTION

Since the sirex wasp was found to be established in Victoria in 1961 it has gradually spread, and is now present in all pine growing areas of that state. In 1980 sirex was found to have extended its distribution into both South Australia and New South Wales.

In New South Wales sirex was first found near Albury and it has since spread in a northern and easterly direction. This natural spread has been at a maximum rate of about 40 km per year. By 1989 sirex was present in the Forestry Regions of Albury, Batemans Bay, Bathurst and Eden as well as the A.C.T.

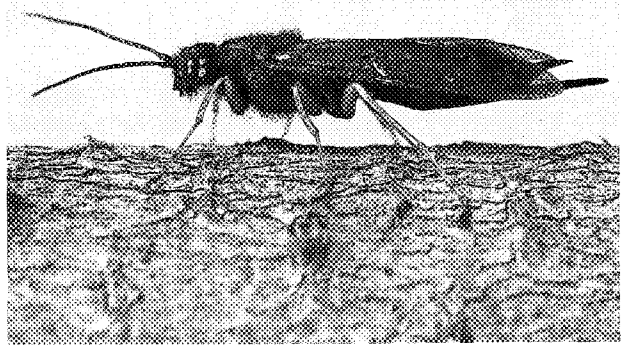

Fig. 1. Adult female *S. noctilio*. The female has a metallic blue body and prominent ovipositor. (CN 15424)

RECOGNITION OF ADULTS

Sirex are large wasps characterized by conspicuous colouring and an upturned spine or horn at the tip of the abdomen. The adult female measures from 2.5 to 4cm in length, is uniformly iridescent blue-black and has a prominent robust ovipositor, or egglaying apparatus (Fig. 1). The adult male is blue-black with orange-yellow areas on the legs and abdomen (Fig. 2). Neither can sting.

LIFE HISTORY

The life cycle of Sirex is usually completed in 12 months with a small proportion of the population having a 2 year life cycle. In some circumstances it may be much shorter than 12 months.

Egg laying, or oviposition, occurs during the adult flight season which may extend from November through to April. Peak flight times in N.S.W. appear to be December - January.

Oviposition is usually preceded by the female sirex drilling exploratory holes in living or freshly felled trees or heavy slash with her fine tube-like ovipositor. Where sap pressure is high she injects phytotoxic mucus and the spores of a wood decay, or sirex fungus, *Amylostereum areolatum*, into these "test" drills. Egg laying occurs when low sap pressure is detected. A single egg is deposited into each of a number of closely grouped drills with the final drill injected with mucus and spores.

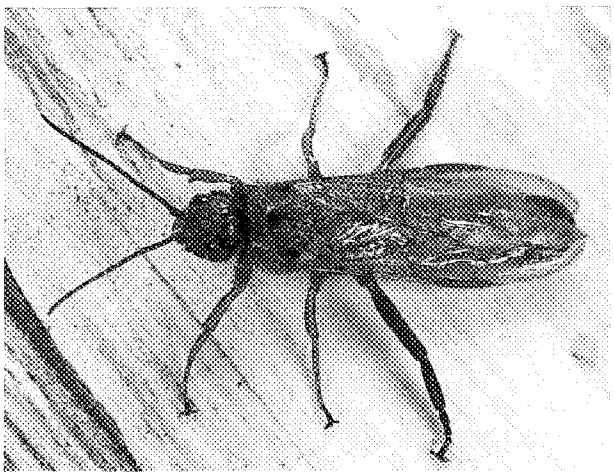

Fig. 2. Adult male *S. noctilio*, distinguished by an orange-coloured band on the body behind the wings. (CN 15363)

Trees drilled by the sirex wasp die due to the combined action of the phytotoxic mucus and the wood decay fungus. The mucus disrupts the functioning of the needles of a pine tree by a number of complex actions. This in turn creates conditions within the stem of the tree which are favourable to the growth of the decay fungus. The growing fungus causes the death of phloem, cambium and ray tissue and further dessication of the wood in the infested stem.

The conditions created by the actions of phytotoxic mucus and the sirex fungus favour the hatching of sirex eggs, usually within 2 weeks but eggs can remain dormant for much longer. The fungus provides food for the larvae and the white rotted condition of the infected wood facilitates larval tunnelling.

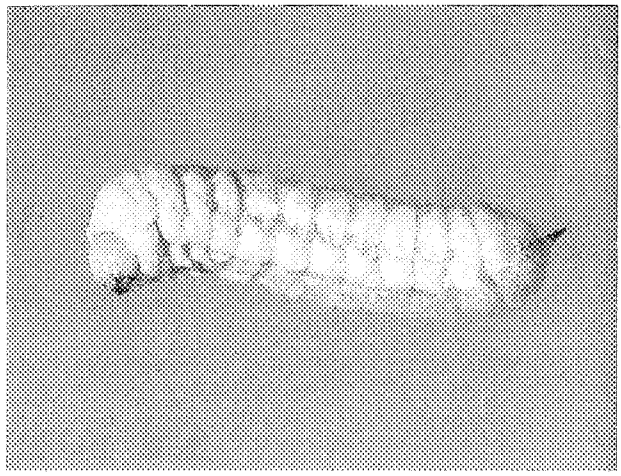

Fig. 3. Creamy-white *S. noctilio* larva with characteristic single spine at the tip of the abdomen. (CN 15712)

The larva (Fig. 3) is soft and white with a well-developed head carrying strong dark-coloured, biting and chewing mouthparts. Very small legs are present but these may at first appear to be absent. There is a dark-coloured prominent spine protruding from the tip of the abdomen. After hatching, the larva immediately begins to tunnel in a characteristic manner through the tree. Initially, the tunnel is narrow with the larva then turning inwards in either the up or down direction. The larva remains in the sapwood during the early stages, but later, as the tunnel is enlarged, it may enter the heartwood. The larval tunnel (Fig. 4), is always packed with a coarse frass of chewed up wood and droppings. When fully fed, the larva tunnels out towards the cambial area where it pupates in the sapwood.

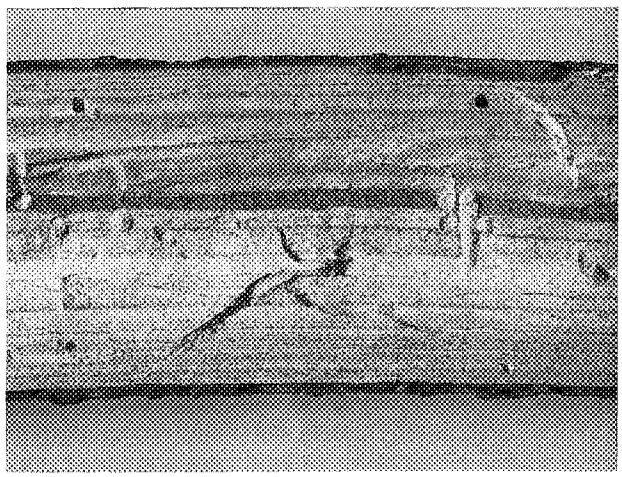

Fig. 4. Frass packed larval tunnels in an infested billet. (CN 15713)

When fully formed, the adult wasp bores out of the tree during summer and autumn through a circular hole (Fig. 5), the size of which reflects the diameter of the emerging adult. The holes range from 3-8 mm in diameter.

Fig. 5. Circular exit holes through the bark of *P. radiata*. (CN 15588)

DETECTION OF SIREX INFESTATION

Symptoms of sirex attack appear initially as needle wilt followed by yellowing of the foliage which will gradually turn a distinct brick red colour (Fig. 6). Dying and freshly dead trees become most obvious in the autumn to late winter. The larger infested trees are very obvious from the air (Fig.7) but it should be noted that Sirex infestations usually build up within the weaker suppressed trees of a stand. As these trees are often hidden from aerial observation by the dominant trees it is essential to supplement aerial survey results with ground surveys.

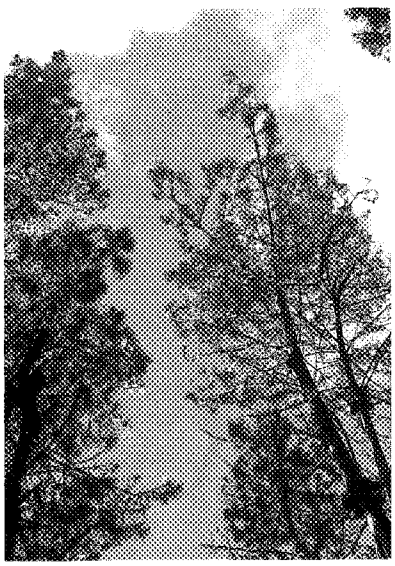

Fig. 6. Freshly dead *P. radiata* which was infested by sirex in January. Photograph taken in May, 1988.

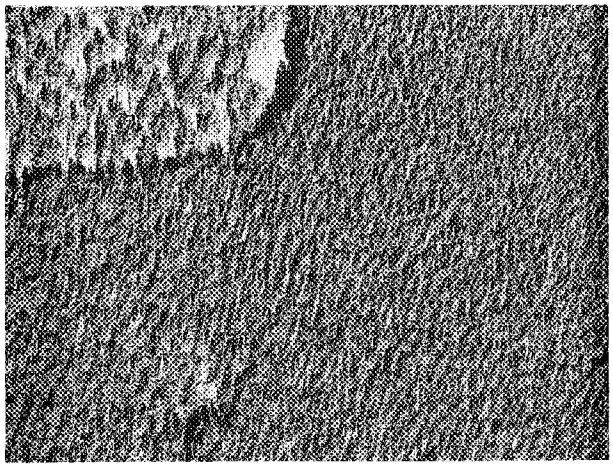

Fig. 7. Sirex killed trees from the air in May, 1988.

Sirex can be confirmed as the causal agent by examining the bark surface for resin beads (Fig.8), which exude from the drill holes made by the female wasp.

Fig. 8. Resin beads exuded from drills made by a female sirex. (CN 15595)

The round exit holes begin to appear in the trunk of infested trees after approximately 12 months (Fig. 5). The holes can appear along the whole length of the trunk, but in large trees the infestation may be more than 4 to 6 metres up and difficult to see.

Examination of the surface of the wood immediately beneath the bark under the resin beads should initially reveal a brown vertical lens shaped stain around a minute hole (Fig. 9). As the infestation proceeds this stain will extend to form vertical streaks of brown stain which will eventually cover the bole of the tree.

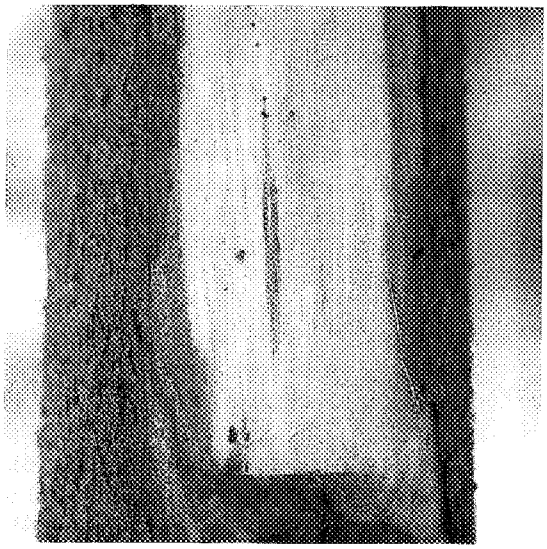

Fig. 9. Early stages of staining of the sapwood surface associated with sirex drill holes. (CN 15586)

If suspect trees (i.e. not showing exit holes) are cross-cut the vertical, frass packed, larval galleries should be visible in the cross section (Fig. 10).

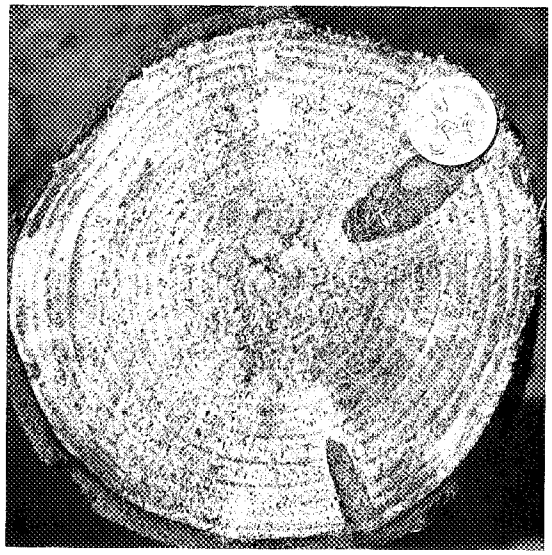

Fig. 10. Cross cut stem of infested *P. radiata* showing the vertical, frass packed, sirex larval tunnels. (CN 15703)

CONTROL

The sirex wasp can be controlled by the use of a combination of silvicultural and biological measures. It is not possible to control borers of this type by either chemical treatments or removal and destruction of infested trees.

Silvicultural treatment is concerned with maintaining the health and vigour of trees and minimising water stress. Healthy pine trees are very resistant to attack by sirex wasps. It has been found that properly managed plantations have a much lower incidence of sirex infestation than in unthinned plantations. Where sirex is established the risk to pine plantations can be minimised by following these recommendations:

(a) avoid planting on steep slopes where thinning cannot be carried out;

(b) restrict high pruning and thinning to waste to periods between May and November, i.e. outside the sirex flight season;

(c) time selective thinning for sustained vigour throughout the rotation and for removal of all multi-stemmed trees;

(d) minimise injury to trees from fire and silvicultural treatments;

(e) quickly salvage trees damaged through natural causes (wind, hail, lightning); and

(f) maintain a high standard of hygiene in plantations through early felling of dying or diseased trees.

Even with good plantation management adverse weather conditions, particularly sustained drought, can predispose whole plantations to sirex infestation. For this reason it is essential to also implement biological control measures.

BIOLOGICAL CONTROL

Biological control involves the importation and establishment of parasites from the pest insects' countries of origin. Selected parasites of sirex have been imported into Australia from Europe and North America. These biological control agents include one species of nematode and several parasitic wasp species.

The most effective of these natural controls is the nematode *Deladenus siricidicola.* This nematode feeds on the sirex fungus in one phase of its life history and infects sirex larvae in the other phase. These larvae complete their development into the adult wasp but because of the nematode infection the female sirex are sterile.

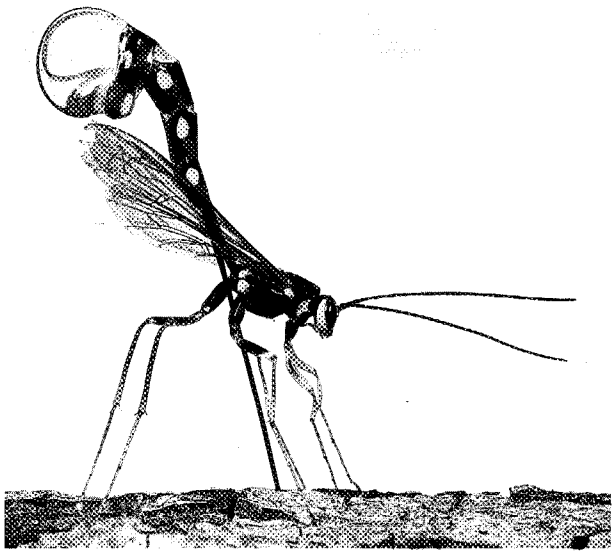

Fig. 11. One of the biological control agents, *Megarhyssa nortoni.* (CN 15385)

Of the introduced parasitic wasps the most widely established is *Ibalia leucospoides.* These small wasps infest the early stage sirex larvae. Other introduced parasites include two subspecies of *Megarhyssa nortoni* (Fig. 11) which are large ichneumonid wasps infesting the later stage sirex larvae. *Schlettererius cinctipes,* a stephanid wasp, also infests the larger sirex larvae. The ichneumonids *Rhyssa hoferi* and *R. persuasoria* have also been introduced into Australia and were thought to have failed to establish. *R. hoferi* is now confirmed to be established in N.S.W., near Tumbarumba.

Some native Australian parasitic wasps have also been found to occasionally infest sirex larvae but not to a significant degree.

In sirex infested pine plantations where both the nematode and wasp parasites have been intensively introduced over several years, it is possible to achieve a more than 90% control rate. This level of control significantly reduces sirex populations and limits the rate of population increase during drought years when many trees are in a stressed condition.

Sirex infestation can be transported long distances in logs and sawn timber. Suprisingly, it has also been shown that later stage larvae can survive the vacuum/pressure impregnation of their host timber with copper-chromium-arsenate salts to emerge later from the treated material as viable adults. For this reason it is very important that such infested material should not be transported to clean areas without treatment to eradicate the infestation. There are two types of treatment which will kill all sirex larvae in timber. These are kiln drying and methyl bromide fumigation.

CONCLUSION

At the present rate of natural spread the sirex infestation should reach the Queensland border by the year 2008. It is not known how far sirex will extend but is thought likely to take in the whole of New South Wales where *Pinus* spp., particularly *P. radiata,* are grown. It appears unlikely that native conifers such as *Callitris* spp. or *Araucaria* spp. will be susceptible to this pest wood wasp.

WHO TO CONTACT

Suspected occurrences of sirex should be reported to the nearest Forestry Commission Office. If possible samples of the insects or infested tree should also be submitted.

The Forestry Commission will provide advice on control measures which can be implemented by the grower or by a consultant forest service.

Addresses of Forestry Offices are listed in the State Government section of telephone directories.