

HISTORY AND MANAGEMENT OF SIREX WOOD WASP IN AUSTRALIA

Angus J. Carnegie

Forest Resources Research, NSW Department of Primary Industries,
PO Box 100 Beecroft NSW 2119, Australia

ABSTRACT

Introduction

This paper reviews the history and management of *Sirex noctilio* in Australia, including information from previous reviews as well as more recent data. The sirex wood wasp, *Sirex noctilio*, is one of the most important insect pests of *Pinus radiata* in Australia. Native to Europe, North Africa and Turkey, *S. noctilio* was introduced accidentally into Tasmania and detected there in 1951 (Neumann & Minko 1981). It then spread to the mainland and was detected in Victoria in 1961, and southern New South Wales (NSW) and South Australia by 1980 (Neumann & Minko 1981, Eldridge & Simpson 1987, Eldridge & Taylor 1989, Morgan 1989, Haugen et al. 1990, Haugen 1990). Sirex has not been detected in Queensland or Western Australia, although susceptible hosts grow in these states.

The biology and behaviour of *S. noctilio* has been detailed previously (Morgan & Stewart 1966, Taylor 1978, 1981; Neumann & Minko 1981, Madden 1988). Briefly, eggs are oviposited into trees which have low sap pressure, along with a phytotoxic mucus and a wood decay fungus (*Amylostereum areolatum*) carried by the wasps. Trees drilled by sirex soon die due to the combination of the mucus and fungus.

Sirex outbreaks in Australia

The significant pest status of sirex was soon realized once the wasp had established in the southern states of Australia. In Tasmania, up to 40 percent of intermediate-age slow-growing *P. radiata* in an area of 1,100 -ha near Hobart were destroyed within 6 years of the first record (Madden 1975, 1998). In Victoria, about 25 percent of a 1,900-ha plantation at Delatite in

central Victoria was damaged by sirex, with over 70 percent damaged in intermediate-age unthinned stands over a 7-year period (Neumann & Minko 1981). In the 'Green Triangle' (southeastern South Australia and southwestern Victoria) over 1.8 million trees were killed in a single year (1987), 7 years after detection of sirex in the region (Haugen 1990; Haugen & Underdown 1990; Madden 1998). In Hume Region, NSW, between 1987 and 1989, approximately 15 percent of 1,200 ha of unthinned stands were killed by sirex (Carnegie et al. 2005). In Macquarie Region, also in NSW, approximately 30 percent of 1,000 ha of unthinned stands were killed between 1991 and 1992 (Carnegie et al. 2005).

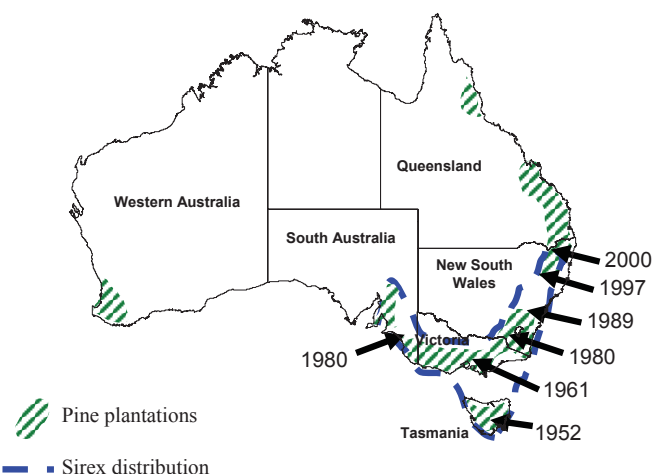


Figure 1. Map of Australia with location of exotic *Pinus* plantations (hatched) and distribution of sirex (dashed line), including the years sirex was detected in various regions in Australia.

Management of sirex in Australia

Control of sirex is achieved by the use of a combination of silvicultural and biological measures (Neumann et al. 1987, Eldridge & Taylor 1989, Morgan 1989, Haugen et al. 1990), as well as regular monitoring and forest health surveillance (Haugen et al. 1990, National Sirex Coordination Committee 2005).

Monitoring and surveillance

Determine sirex levels in areas of known infestation.—Where sirex is known to be in an area, surveys are used to determine the levels of infestation to identify further management options.

1. Aerial surveys, mostly by helicopter, are used as an initial step to identify the extent and incidence of dead trees (with typical symptoms of sirex attack). The majority of exotic *Pinus* plantations in Australia are surveyed annually.

2. Ground surveys are then used as a follow-up to confirm the causal agent of dead trees. These can also identify whether sirex has attacked suppressed trees that are often difficult to identify from the air.

3. Trap trees are mainly used in Australia as part of the biological control program (see below), but can also be used to identify very low levels of sirex.

4. Insect traps, using lures (alpha- and beta-pinene) have been used in recent years where sirex is at very low levels and cannot be detected either in trap trees or aerial and ground surveys.

Detection in areas not known to have sirex

Where sirex is not known to be in an area, the above monitoring and surveillance techniques are also used to increase the chance of detection.

Silvicultural methods.—Silvicultural treatment is concerned with maintaining the health and vigor of trees and minimizing water stress, with healthy pine trees resulting from such treatment very resistant to attack by sirex wasps (Haugen 1990, Eldridge & Taylor 1989). By managing plantations optimally (e.g., timing selective thinning to sustain tree vigor, restricting pruning and thinning to waste outside the wasp flight season and maintaining hygiene in the plantation through early felling of dying or diseased trees) the risk to pine plantations from sirex attack can be greatly reduced. However, market forces and/or budgetary constraints result in delayed thinning in many instances resulting in stressed stands.

Biological control.— Even with good plantation management, factors outside human control, such

as prolonged drought, can predispose whole plantations to sirex infestation. For this reason it is essential to implement biological control measures. Selected parasites have been imported into Australia from Europe and North America to assist in the control of sirex. The most effective of these is the nematode *Beddingia* (= *Deladenus*) *siricidicola* (Neotylenchidae), which feeds on the sirex fungus (*A. areolatum*) in one phase of its life history and infects sirex larvae in the other phase (Bedding 1967, 1972, 1993; Bedding & Akhurst 1974; Neumann & Minko 1981; Eldridge & Taylor 1989; Morgan 1989; Haugen et al. 1990). Infected sirex larvae complete their development into adult wasps but, because of nematode infection, the resulting female wasps are sterile. Several parasitic wasps were also introduced into Australia to help control sirex, including *Ibalia leucospoides* (Ibaliidae), *Megarhyssa nortoni* (Ichneumonidae) and two species of *Rhyssa* (Ichneumonidae) (Neumann & Minko 1981, Eldridge & Taylor 1989, Morgan 1989, Haugen et al. 1990).

Trap trees are used to assist in the introduction of nematodes into the sirex population. A network of trees are poisoned and made attractive to sirex during flight season. Once sirex larvae are detected in these trees, they are inoculated with the nematode. Billets (bolts) are cut from trap trees and monitored for parasitism rates to help in evaluating the biological control agents. Further detail on the nematode inoculation program can be found in National Sirex Coordination Committee (2005) and Haugen et al. (1990).

Conclusion

Although sirex can be a devastating pest of exotic pine plantations, effective management has now significantly reduced its impact in Australia.

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