Proceedings of the Eighth International Symposium on Biological Control of Weeds
2-7 February 1992, Lincoln University, Canterbury, New Zealand.
Delfosse, E.S. and R.R. Scott (eds.). DSIR/CSIRO, Melbourne, pp. 447-9 (1995).

Biological Control of *Cassinia* spp. (Asteraceae)

Royce H. Holtkamp[1] and Malcolm H. Campbell[2]

[1] NSW Agriculture, Agricultural Research Centre, RMB 944, Tamworth, New South Wales, 2340, Australia
[2] NSW Agriculture, Agricultural Research & Veterinary Centre, Orange, New South Wales, 2800, Australia

Cassinia spp. are invasive native woody shrubs responsible for degradation of grazing land. Native scale insects, *Tachardina* sp. and *Austrotachardia* sp., are responsible for killing large stands of these weeds in some regions of New South Wales, Australia. The feasibility of using these scale insects for control of *Cassinia* spp. is being investigated.

Introduction

Cassinia spp. (Asteraceae) are invasive native woody shrubs in eastern Australia. In New South Wales (NSW), 1 species, *Cassinia arcuata* R.Br. (sifton bush), has spread from 93,000 ha in 1975 to 616,000 ha in 1988 (Campbell 1990). These infestations occur mainly in the tableland and slope areas of NSW (Campbell 1977) where they have reduced the production of wool, sheep meats and beef through competition with native and introduced pasture. Severe infestations of *C. arcuata* can reduce the carrying capacity of land by 90% (Campbell *et al.* 1990). *C. arcuata* also infests large areas of Victoria. Two other species, *C. laevis* R.Br. and *C. quinquefaria* R.Br., are present in large areas of southern Queensland and northern NSW. These latter 2 species are regarded as ecotypes by some workers. Their taxonomic status is currently under revision and they will be referred to as *C. laevis* in this paper. Other species of *Cassinia* are present in Australia but they are not considered pests. Control of *Cassinia* spp. on arable land can be achieved by pasture improvement. On non-arable land no economic method is available because high rates of herbicide are required to kill plants and access to many infestations is extremely difficult. D.T. Vere (Economist, NSW Agriculture, Orange) estimated that successful biological control of *C. arcuata* would yield a saving of $A 2 million p.a. to NSW.

In 1988, a native scale insect, *Austrotachardia* sp. (Hemiptera: Kerriidae), was found infesting small areas of *C. arcuata* near Orange, NSW. By 1990, *ca.* 800 ha of *C. arcuata* had been killed by this scale (Campbell and Wykes 1991) and pasture was regenerating in these areas. In northern NSW, another scale insect, *Tachardina* sp. (Hemiptera: Kerriidae), destroyed areas of *C. laevis*. These scales were killing mature plants and seedlings, the latter being difficult to control by conventional techniques (Campbell *et al.* 1990). A study is being undertaken on the biology and ecology of *Cassinia* scales and their hosts in an attempt to determine methods for rearing and distributing the scales. If successful, this would be a rare example of control of a native weed using native insects.

Methods and Materials

This project seeks to develop a biological control program for *Cassinia* spp. Aspects to be studied will include:

1.) Taxonomy of scale species on *Cassinia* spp.

2.) The biology and ecology of these scales. This will include studies on host range, life history, number of generations produced/yr, number of offspring produced/generation and the effects of parasites and predators of these scales.

3.) Population levels of pest *Cassinia* spp. to quantify the effect of scales and to determine whether other biological agents are responsible for *Cassinia* spp. deaths.

4.) Methods of distributing and establishing scales in new infestations of *Cassinia* spp.

Results and Discussion

The following section details some preliminary results and observations.

Taxonomy of Scale Insects

Two species of scale insect, *Austrotachardia* sp. and *Tachardina* sp., have been identified on *C. arcuata* and *C. laevis* respectively. A third species, *Paratachardina* sp., which also feeds on *C. laevis,* has been tentatively identified (J.F. Donaldson, Queensland Department of Primary Industries). Because the identification is tentative, this paper will only refer to *Austrotachardia* sp. and *Tachardina* sp.

Biology and Ecology of Scale Insects

Both scale species appear to be univoltine with first instar larvae (crawlers) being produced during late spring/early summer. Two years of observations indicate that *Tachardina* sp. produces crawlers in November while *Austrotachardia* sp. produces crawlers in December. Successful biological control depends on the ability of these insects to colonise a host as well as their ability to damage plants. Because scale insects are sessile, their dispersal is restricted to this mobile crawler stage. Therefore determination of emergence time is critical in establishing these insects on new plants.

Females produce approximately 300 crawlers each and can reach densities of 30 adult females/cm on heavily infested branches. This gives a potential reproductive rate of 9,000 crawlers/cm of branch. Crawlers exhibit negative geotaxis, crawling to the highest point of a branch where they either settle or are dispersed by wind to new plants.

Females of both species produce honeydew, which is highly attractive to ants of several species including *Iridomyrmex* spp. and *Camponotus* sp. These ants tend the scales and may deter potential predators and parasitoids. Scales and neighbouring areas of the branch are often covered with a sooty mould, *Capnodium walteri,* which grows on the honeydew exudate but appears to have no detrimental effect on either scales or plants.

No predators of these scales have yet been found but three as yet unidentified hymenopteran parasitoids have been reared from *Tachardina* sp. Two of these parasitoids have also been reared from *Austrotachardia* sp.

Host-Specificity

Both of these scales appear to be host-specific despite considerable overlaps in the ranges of their host plants. However, deliberately introduced crawlers of *Austrotachardia* sp. have colonised a *C. laevis* plant. It will not be known until December 1992 whether these insects will establish and reproduce. Field observations have not revealed any instance of these scale insects attacking plants outside the genus *Cassinia.*

Collections of other arthropod species on *Cassinia* spp. are continuing in an effort to determine their effects on plants and their interactions with scale insects.

Distribution and Establishment

Because these scale insects produce 1 generation/yr and only the crawlers are mobile, their natural dispersal rate is slow. This is further exacerbated by the presence of hymenopteran parasitoids. However, dispersal rates can be augmented by human intervention. Successful examples of biological control using manual dispersal of coccids include *Dactylopius* spp. (Hemiptera: Dactylopiidae) and *Hypogeococcus festerianus* (Lizer y Trelles) (Hemiptera: Pseudococcidae) on cactus species in Australia (Hosking *et al.* 1988) and *Dactylopius austrinus* De Lotto on *Opuntia aurantiaca* Lindley (Cactaceae) in South Africa (Moran and Zimmermann 1991).

Austrotachardia sp. has now been spread to over 300 properties by supplying infested cuttings of *C. arcuata* to interested landholders. It is hoped that landholders possessing these

scale insects will further aid their spread by moving infested cuttings within their properties when crawlers are being produced.

The use of chemical treatment to kill parasitoids before distribution of cuttings is also to be investigated. This treatment may provide a parasitoid-free environment for scale establishment.

Acknowledgments

We thank Peter Wykes, "Daydawn," Kerrs Creek via Orange for allowing us to conduct experimental work on his property. Drs R. Gunning and J. Hosking provided useful comments on the manuscript.

References

Campbell, M.H. 1977. Assessing the area and distribution of serrated tussock (*Nassella trichotoma*), St John's wort (*Hypericum perforatum*) and sifton bush (*Cassinia arcuata*) in New South Wales. *NSW Agriculture & Fisheries Technical Bulletin* 18.

Campbell, M.H. 1990. Distribution, ecology and control of *Cassinia arcuata* (sifton bush) in New South Wales. *Australian Journal of Experimental Agriculture* **30**:215-20.

Campbell, M.H., I.J. McGowen, B.R. Milne and D.T. Vere. 1990. The biology of Australian weeds. 22. *Cassinia arcuata* R.Br. *Plant Protection Quarterly* **5**:162-8.

Campbell, M.H. and P.J. Wykes. 1991. Possible bio-control of sifton bush by scale insects. *Proceedings of the 6th Conference of the Grassland Society of New South Wales*, Orange, Australia, pp. 101-2.

Hosking, J.R., R.E. McFadyen and N.D. Murray. 1988. Distribution and biological control of cactus species in eastern Australia. *Plant Protection Quarterly* **3**:115-23.

Moran, V.C. and H.G. Zimmermann. 1991. Biological control of jointed cactus, *Opuntia aurantiaca* (Cactaceae), in South Africa. *Agriculture, Ecosystems and Environment* **37**:5-27.