Impact of bitou tip moth, *Comostolopsis germana*, on bitou bush in New South Wales

Royce H. Holtkamp
NSW Agriculture, Weed Biological Control Unit and Cooperative Research Centre for Australian Weed Management, RMB 944 Calala Lane, Tamworth, New South Wales 2340, Australia

Summary Bitou tip moth, *Comostolopsis germana*, was first released in New South Wales in 1990 to control the environmental weed bitou bush, which was accidentally introduced from South Africa in 1908. *C. germana* was released at over 70 sites and is now established along most of the NSW coast. It is believed that it has spread throughout all areas containing bitou bush infestations, although population levels are still increasing in some areas. Populations in excess of 400 larvae m^{-2} can occur at some sites. At many sites, *C. germana* appeared to have a significant impact on flowering and seed production of bitou bush. Experiments were conducted to quantify the impact of *C. germana*. These indicate reductions in seed production of over 50% at some sites.

Keywords Bitou bush, *Chrysanthemoides monilifera* subspecies *rotundata*, bitou tip moth, *Comostolopsis germana*, biological control.

INTRODUCTION

Bitou bush, *Chrysanthemoides monilifera* subspecies *rotundata* (DC.) T.Norl., is a competitive environmental weed of South African origin. It is primarily restricted to areas of summer rainfall (Parsons and Cuthbertson 1992) and infests coastal areas of southern Queensland, New South Wales (NSW) and Lord Howe Island. There is also a localised inland infestation at Menindee Lakes, NSW. In NSW it is common north of Sydney and occurs south to the Victorian border.

Bitou bush was first recorded in Australia from Stockton near Newcastle in 1908 (Weiss *et al.* 1998) where it appears to have been an accidental introduction in ships ballast. From 1946 to 1968 bitou bush was used as a sand stabilising plant and to revegetate coastal areas mined for mineral sands. The capacity of bitou bush to invade native vegetation was then recognised and its recommendation for coastal planting was withdrawn. However, this action came far too late and by 1976 bitou bush was naturalised along much of the NSW coast.

A survey conducted in 2001 by the NSW National Parks and Wildlife Service (NPWS) has shown bitou bush to be present on 900 km (80%) of the NSW coastline and the dominant plant on over 400 km. Over approximately two thirds of this area it could completely dominate and eventually displace most of the existing native vegetation. This current distribution represents a 36% increase in the area over which it was present in a 1982 survey which was also conducted by NPWS (Holtkamp *et al.* 1999).

The importance of bitou bush was officially recognised in early 1999 by both the NSW National Parks and Wildlife Service who listed it as a key threatening process under the Threatened Species Conservation Act 1995 and by the Commonwealth of Australia who listed it as a Weed of National Significance under the National Weeds Strategy 1997.

Bitou bush is largely an environmental weed as it is easily controlled by stock grazing and cultivation. It is primarily restricted to non-agricultural areas such as national parks, forests, coastal dune ecosystems and other recreational land. In the past, physical and chemical control and fire have been used to reduce infestations and limit spread of bitou bush. The impact and control of bitou bush have been discussed in more detail by Holtkamp *et al.* (1999) and Vranjic (2000).

A biological control program against *C. monilifera* (which includes bitou bush and boneseed, a closely related subspecies) was approved by Standing Committee On Agriculture in 1987. Surveys in South Africa have indicated that there are more than 100 species of phytophagous insects associated with the *Chrysanthemoides* species complex (Scott and Adair 1990). Eighteen of these species were identified as having potential for the biological control of *C. monilifera*.

Six of these species have now been released on bitou bush but only three have successfully established. These are: bitou tip moth, *Comostolopsis germana* Prout; bitou tortoise beetle, *Cassida* sp. and bitou seed fly, *Mesoclanis polana* Munro. The spread of *M. polana* was documented by Edwards *et al*. (1999). *Cassida* sp. has recently been recovered in close proximity to the original release sites and only in low numbers.

In excess of 200 releases of *C. germana* were made between 1990 and 1997 at 72 sites in NSW ranging from the Queensland border to Tathra. It is now established along most of the NSW coast and it is believed that this insect has spread throughout all bitou bush infestations, with population levels still increasing in some areas. Populations in excess of 400 larvae m^{-2}

have occurred at some sites (Holtkamp unpublished data) despite the presence of two Hymenopteran parasitoids, one of which parasitises up to 50% of *C. germana* larvae (Holtkamp 1993). In many areas, it was apparent that *C. germana* was having a significant impact on flowering and seed production of bitou bush. To quantify this impact, an experiment was conducted in Botany Bay National Park in Sydney using a chemical exclusion technique.

METHODS

A site was selected in a stand of mature bitou bush at Botany Bay National Park in Sydney (33°59'44"S 151°14'59"E). Forty 2 m × 2 m blocks were marked out and randomly assigned either control or sprayed treatments. Blocks were sprayed monthly from July 1998 to June 2000 using the chemical exclusion technique described by Adair and Holtkamp (1999). Each month counts were made of number of *C. germana* larvae m^{-2} and bitou bush fruit numbers m^{-2}.

RESULTS AND DISCUSSION

Population levels of *C. germana* only rarely exceeded 100 larvae m^{-2} during this experiment resulting in bitou bush seed production often being reduced by more than 50% and on a few occasions by more than 80%.

The success of *C. germana* has important ramifications for managers of lands infested by bitou bush. Lower levels of seed production will significantly reduce recruitment into soil seed banks, which degrade to relatively low levels after three years (Weiss *et al.* 1998). The continued presence of biological control agents at a site for a number of years means that if existing bitou bush plants can be then removed there should be less regeneration of bitou bush from buried seed, allowing native species to be more competitive.

It is thus apparent that the answer for long term control of bitou bush would be the integrated weed management (IWM) approach discussed by Vranjic (2000). This includes such strategies as biological control, physical removal, herbicides and fire.

The interactions between biological control agents and herbicides were discussed by Ainsworth and Holtkamp (1999) who reached the conclusion that herbicide application was unlikely to significantly affect *C. germana*. However, any integrated program which incorporates biological control will need to consider all biological control agents present at the time of treatment to ensure that sufficient agents remain to allow re-establishment.

Unfortunately there is no possibility of eradication of this weed. Bitou bush will always be present in the Australian landscape, perhaps only as a minor component of invaded vegetation.

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REFERENCES

Adair, R.J. and Holtkamp, R.H. (1999). Development of a pesticide exclusion technique for assessing the impact of biological control agents for *Chrysanthemoides monilifera*. *Biocontrol Science and Technology* 9, 383-390.

Ainsworth, N. and Holtkamp, R.H. (1999). Integrating herbicide use with biological control of bitou bush. Proceedings of the 12th Australian Weeds Conference, Hobart, pp. 275-278.

Edwards, P.B., Holtkamp, R.H. and Adair, R.J (1999). Establishment and rapid spread of the bitou seed fly, *Mesoclanis polana* Munro (Diptera: Tephritidae), in eastern Australia. *Australian Journal of Entomology* 38, 148-150.

Holtkamp, R.H. (1993). Parasitoids of *Comostolopsis germana* (Lepidoptera: Geometridae). *Journal of the Australian Entomological Society* 32, 387-388.

Holtkamp, R.H., Edwards, P.B. and Adair, R.J. (1999). Biological control of bitou bush: just around the turn of the millennium? Proceedings of the 12th Australian Weeds Conference, Hobart, pp. 667-669.

Parsons, W.T. and Cuthbertson, E.G. (1992). 'Noxious weeds of Australia'. (Inkata Press, Melbourne).

Scott, J.K. and Adair, R.J. (1990). The commencement of biological control of bitou bush and boneseed (*Chrysanthemoides monilifera*). Proceedings of the 9th Australian Weeds Conference, Adelaide, South Australia, pp. 126-9.

Vranjic, J. (2000). Best Practice Management Guide 3. Bitou bush, *Chrysanthemoides monilifera* subsp. *rotundata*. CRC for Weed Management Systems, Adelaide.

Weiss, P.W., Adair, R.J. and Edwards, P.B. (1998). *Chrysanthemoides monilifera* (L.) T.Norl. *In* 'The Biology of Australian Weeds, Vol. 2', eds F.D. Panetta, R.H. Groves and R.C.H. Shepherd, pp. 49-61. (R.G. and F.J. Richardson, Melbourne).