Towards an integrated management system for blackberry (*Rubus fruticosus* L. agg.)

Proceedings of a workshop held at Charles Sturt University, Albury, New South Wales on December 15–16 1997. This is the fifth in a series of workshops sponsored by the Co-operative Research Centre for Weed Management Systems.

Editors: Richard H. Groves, Jann Williams and Sharon Corey

Introduction

R.H. Groves, CSIRO Plant Industry and CRC for Weed Management Systems, GPO Box 1600, Canberra, ACT 2601, Australia.

Summary

Blackberry was introduced deliberately to Australia about 150 years ago, and has arguably become one of the worst weeds in the south of the country. Various methods of control have been applied successfully to blackberry infestations in perennial pasture systems. Blackberry still remains a serious weed, however, especially in natural ecosystems. The aim of this workshop was to discuss how different methods of control for the species complex known as 'blackberry' may best be integrated into a management system for natural vegetation in southern Australia. New insights into this challenging topic are provided by examining recent developments in the taxonomy, ecology and management of blackberry. Recommendations will also be made for areas of research that may refine an integrated management system for blackberry.

Introduction

The first known record of blackberry being cultivated in Australia is from Adelaide in 1842 (Parsons and Cuthbertson 1992). As early as 1851 nine species of blackberry were being cultivated in the Melbourne Botanic Gardens (Amor *et al.* 1998). With hindsight, and our knowledge of the serious weed blackberry has become, it is hard for us to empathize with the mental perspectives of Australian settlers 100 years ago; for instance, von Mueller in 1895, reported that 'a Melbourne horticultural firm spends now already a large sum annually for (blackberry) bramble-leaves as part material of bouquets, wreaths, garlands and gravecrosses' (Mueller 1895, as quoted by Parsons and Cuthbertson 1992). Von Mueller, in the same publication and as Government Botanist of Victoria, was still advocating the deliberate naturalization of blackberry 'on the rivulets of any ranges', despite it having already been legally declared noxious in part of Gippsland in the same region in 1894! (Parsons and Cuthbertson 1992). Ever since that time, the impact of blackberry has been contentious. Is blackberry a weed or is it a desirable fruit crop? Is it a significant food source for honey bees early in the season in Tasmania? As recently as the 1980s, for instance, attempts were made to prevent a new program of biological control of blackberry, because of its perceived value to horticulture and apiculture. Many of us still enjoy blackberry jam on our morning toast and blackberry pie to finish our evening meal. There is little doubt, however, that blackberry is a weed of national significance and is arguably the worst weed of southern Australia in terms of its impact on natural ecosystems, forest plantations and perennial pastures.

The common name blackberry, as used generally in Australia, refers to a still-unknown number of plant species and taxa. Whenever the name blackberry is used subsequently in these proceedings it refers to the taxon *Rubus fruticosus* L. agg. – the 'agg.' meaning an aggregate of a number of somewhat-similar species. In a revision of Victorian species of *Rubus*, Amor and Miles (1974) identified eight species and one group of hybrids on the basis of a range of vegetative characters including the density and shape of prickles, with which anyone who has harvested blackberries will be intimately familiar. On the basis of more recent taxonomic treatments, there is probably at least one further species in Tasmania and South Australia. Another species in Australia is *Rubus alceaefolius* Poir., of south-east Asian origin and now naturalized in one area of northern Queensland. Further, four native species in Australia and as many as five native species in New Zealand may also be called blackberry. There are also the large number of commercially grown blackberry and related berries derived from North American *Rubus* species. Whilst the origins of these taxa are well known genetically and taxonomically (see McGregor 1998), the taxonomy of the weedy European blackberry aggregate is still not as well known. Hence these proceedings commence appropriately with a report of work in progress on the taxonomy of southern Australian blackberries with a synthesis of classical morphology and a first look at molecular genetic relationships of the major species groups within the *Rubus fruticosus* aggregate (see Evans *et al.* 1998). A better taxonomic understanding of this complex species-aggregate and the inter-relationships between taxa is essential for weed management systems for blackberry and especially for its control by biological means.

Attempts to control blackberry in perennial pastures rely heavily on the use of herbicides. From about 1940, hormone-derived herbicides such as 2,4-D and 2,4,5-T were used, until the latter chemical was banned. Triclopyr and some other herbicides are now used either alone or in various commercial mixtures with picloram (see Milne and Dellow 1998). In pasture areas, the use of herbicides to control blackberry has been more effective when combined with other methods of control, such as the strategic use of fire and the promotion of competitive pasture species. Goat grazing may also limit new growth of blackberry and be an economical means of limiting populations in pasture (Vere and Holst 1979a, 1979b). Since the 1980s, two strains of the rust *Phragmidium violaceum* have been released for blackberry control in southern Australia – one illegally so and the other through the appropriate legal channels. For some *Rubus* taxa in some high-rainfall situations, this fungus is progressively limiting the spread and productivity of blackberry (see Mahr and Bruzzese 1998). All these methods, either alone or in some combination, are effective in reducing the impact of blackberry in pasture situations, as presented in these proceedings.

Blackberry remains a major weed of natural ecosystems, however, despite some previously successful research. The workshop posed the following questions:

- Is blackberry still a problem on pasture land because the message from research is not reaching landholders?
- What is the optimum combination of existing control methods for use in different situations?
- How can these existing methods be adapted to areas of natural vegetation, which often abut waterways or are inaccessible for conventional methods of herbicide application to be used?
- What novel methods of control may be developed for such ecological situations, such as mycoherbicides?
- Do we need to look anew in drier areas of Europe for strains of rust better adapted to drier southern Australian climates?
- What native plant and animal species are at risk from encroaching blackberry thickets?
- Which native plant species will be strongly competitive with weakened blackberry plants as a result of implementing control?
- How much will all this extra research cost?
- Who will pay for this additional research?

All these and other questions arose during the planning of the workshop. Answers to such questions need not necessarily follow, but I hope the definition of future research directions and the extension of those existing and new research results will flow from the following proceedings.

References

Amor, R.L. and Miles, B.A. (1974). Taxonomy and distribution of *Rubus fruticosus* L. agg. (Rosaceae) naturalized in Victoria. *Muelleria* 3, 37-62.

Amor, R.L., Richardson, R.G., Pritchard, G.H. and Bruzzese, E. (1998). *Rubus fruticosus* L. agg. *In* 'The Biology of Australian Weeds', Volume 2, eds. F.D. Panetta, R.H. Groves and R.C.H. Shepherd, pp. 225-46. (R.G. and F.J. Richardson, Melbourne).

Evans, K.J., Symon, D.E. and Roush, R.T. (1998). Taxonomy and genotypes of the *Rubus fruticosus* L. aggregate in Australia. *Plant Protection Quarterly* 13, 152-6.

Mahr, F.A. and Bruzzese, E. (1998). The effect of *Phragmidium violaceum* (Schultz) Winter (Uredinales) on *Rubus fruticosus* L. agg. in south-eastern Victoria. *Plant Protection Quarterly* 13, 182-5.

McGregor, G. (1998). Relationships between weedy and commercially grown *Rubus* species. *Plant Protection Quarterly* 13, 157-9.

Milne, B.R. and Dellow, J.J. (1998). Herbicide responses of blackberry (*Rubus fruticosus* agg.) in the Central Tablelands of New South Wales. *Plant Protection Quarterly* 13, 180-1.

Mueller, F. (1895). 'Select extra-tropical plants, readily eligible for industrial culture or naturalization', 9th edition, p. 475. (Victorian Government Printer, Melbourne).

Parsons, W.T. and Cuthbertson, E.H. (1992). 'Noxious weeds of Australia', 692 pp. (Inkata Press, Melbourne and Sydney).

Vere, D.T. and Holst, P.J. (1979a). Using goats to control blackberries and briars. *Agricultural Gazette of New South Wales* 90, 11-13.

Vere, D.T. and Holst, P.J. (1979b). The economics of using goats to control *Rubus fruticosus*. Proceedings of the 7th Asian-Pacific Weed Science Society Conference, pp. 207-9.

Taxonomy and genotypes of the *Rubus fruticosus* L. aggregate in Australia

K.J. Evans[A], D.E. Symon[B] and **R.T. Roush[A]**

[A] Department of Crop Protection and CRC for Weed Management Systems, University of Adelaide, Waite Campus, PMB 1, Glen Osmond, South Australia 5064, Australia.

[B] The Botanic Gardens of Adelaide and State Herbarium, North Terrace, Adelaide, South Australia 5000, Australia.

Summary

Blackberry (*Rubus fruticosus* L. aggregate) is an important weed of agricultural and natural ecosystems in Australia. Weed managers require accurate taxonomic keys for *Rubus* so that they can identify which taxa are contributing to the weed problem. Blackberry comprises a few diploid sexual species (e.g. *R. ulmifolius*) and a large number of polyploid agamospecies (e.g. taxa in Australia named *R. polyanthemus, R. laciniatus* and the widespread *R.* affin. *armeniacas* (= *R. discolor sensu auct. aust. non* Weihe & Nees)). We review the status of *Rubus* taxonomy in Australia and present some new information regarding existing taxa based on collections made in South Australia and examined by *Rubus* specialists in Europe. The utility of *Rubus* taxonomy for research workers and weed managers is also examined. Whereas the biological species concept may be useful for weed managers, research workers often require more precise information regarding the amount and distribution of genetic variation within *Rubus*. We present the use of DNA fingerprinting as a tool for (i) determining the genotype of an individual plant, (ii) estimating the genetic variation within and among *Rubus* taxa, and (iii) clarifying some taxonomic problems in the genus *Rubus*. Twenty different genotypes were identified among 13 different *Rubus* taxa. No genetic variation was observed among 50 plants of *R.* affin. *armeniacas* sampled from 29 locations throughout Australia, suggesting that this common blackberry is probably a single clone. In contrast, seven different genotypes were observed among 26 plants of *R. ulmifolius sens. lat.* sampled from six locations in Victoria. Two of these genotypes were sampled from a single thicket of *R. ulmifolius sens. lat.* We illustrate the utility of genotyping *Rubus* plants in studies to identify virulent strains of the European rust fungus for improved biological control of blackberries.

Introduction

Blackberry (*Rubus fruticosus* L. agg.) is an important weed of natural and agricultural ecosystems in Australia and is widely distributed in the high-rainfall regions of each State. Weed managers use the common name 'blackberry' to encompass all the *Rubus* taxa that comprise this aggregate. An ability to recognize the different *Rubus* taxa is a skill weed managers could use to monitor the colonization and spread of individual taxa. New approaches for blackberry management, such as biological control, require a knowledge of blackberry taxonomy because biocontrol agents may provide more effective control of some taxa when compared with the level of control of other taxa. Taxonomic keys for *Rubus* are available in each State, but there are inconsistencies among the States in the names provided.

The status of *Rubus* taxonomy in Australia is explained partly by the general taxonomic problems encountered in the genus *Rubus*. In Europe, only a few diploid blackberries, including *R. ulmifolius*, can be treated as true sexual species. The remaining taxa in *R. fruticosus* L. agg. are a complex of polypoid and apomictic biotypes (Asker and Jerling 1992, Nybom 1995, Weber 1996). Apomixis, however, is facultative, which means that a small proportion of seed may be produced sexually as a result of hybridization between apomicts or between apomicts and sexual