How do we achieve effective biological control of invasive European Blackberry?

Dr Robin Adair, Australis Biological & Dr Rae Kwong, Biocontrol Scientist, DEECA

In Australia, invasive European blackberry consists of a complex of around 18 recognised species and a range of hybrids, which collectively are amalgamated into *Rubus fruticosus* sp. agg. The first introductions to Australia were made for pragmatic and sentimental reasons by our early colonisers, but the species quickly naturalised and spread more aggressively than perhaps they ever envisioned.

Now European blackberry is one of Australia's worst environmental and agricultural weeds where substantial losses of biodiversity and production occur. The vast extent of infestations across southern Australia and lack of access to many areas restricts conventional control methods, which has precipitated the acceptance and development of classical biological control. This control method utilises natural enemies collected from the region of origin of blackberry (Europe) for suppression of the host plant in areas where it is problematic (Australia).

Natural enemies of blackberry are numerous in Europe and consist of a diverse range of fungal pathogens, arthropods (invertebrates), viruses and bacteria. Many of these organisms are known to be generalist feeders, and therefore are unsuitable for biological control. High levels of host specificity and impact are critical traits required for a successful biological agent, particularly where closely related commercial crops or native plants are present in the area of intended introduction. And Australia has plenty of these to consider.

The commercial *Rubus* berry industry and native plants belonging to Rubus are key considerations in the development and evaluation of potential biological control agents.

In the 1970's, biological control of European blackberry in Australia commenced with the selection and testing of the blackberry rust fungus, *Phragmidium violaceum*, a defoliating pathogen that can weaken infected plants by reducing stem growth, flower and leaf production, and ultimately reduce crown size. Infected plants are less vigorous than those uninfected by the fungus. Extensive host testing of the pathogen prior to its introduction demonstrated commercial Rubus cultivars were not at risk of damaging infections, and the agent was approved for release in 1991.

Subsequently, eight additional strains of the rust with greater effectiveness against the most invasive European Blackberry species have been imported and released in Australia. The pathogen is now widely established throughout southern Australia, and in seasons where cool summers and consistent summer rainfall occurs, the rust has proven to be highly effective. However, Australia is a continent of climate extremes with regular droughts and hot summers that limit the impact of blackberry rust.

In addition to this, the rust is relatively ineffective on blackberry growing under a canopy of taller competitive plants such as native forests, which limit production of new growth of blackberry. Therefore, the

vast infestations of blackberry on public land, National and State Parks and forestry production zones, for example, remain unchallenged by biological control.

The search for additional biological control agents to supplement conventional control methods and the blackberry rust fungus continues and is an important element in the strategy for achieving effective, broad-scale and reliable biological control of invasive blackberry. Several new potential agents are under consideration, with Victoria, leading the development of the new generation of biological control agents.

The systemic and potentially fatal pathogen *Septocyta ruborum* (purple blotch disease) has been under consideration for over a decade. The pathogen causes a decline in plant health by disruption of the host's vascular system leading to eventual death. The pathogen is closely allied to the more common pathogen *Mycosphaerella rubi* (formerly *Septoria rubi*), a leaf spot disease widely distributed in commercial and wild blackberry populations in Australia and New Zealand, and refined DNA testing protocols developed by RMIT University and the Victorian Blackberry Task Force, are required to reliably distinguish the two organisms.

A recent field survey of commercial Rubus farms and wild infestations in Victoria and Tasmania determined that only the leaf spot disease, M. rubi is present in Australia. An extensive testing regime is required to select and evaluate potential strains of purple blotch disease suitable for release in Australia, a program that would be undertaken initially in the UK or France where the disease is endemic. As the disease is not reliant on production of new growth, an essential prerequisite for rust fungus outbreaks, the purple blotch disease has considerable potential to effect control in natural ecosystems in Australia.

The cane-boring sawfly, *Phylloecus faunus* (formerly *Hartigia albomaculata*) is another potential agent that is currently under scrutiny as a potential biological control agent, and this was discussed in an earlier article published in the Spring 2021 edition of this journal. The sawfly larvae develop within the first-year primocanes where they feed on pith and supporting

***Septocyta ruborum* on a blackberry stem.** Photo credit: Rasbak, commons.wikimedia.org

tissues. Structural integrity of the cane is weakened, and cane collapse occurs which reduces the plant's capacity to produce new leaves, fruit, and daughter canes.

In a project funded by Meat and Livestock Australia, the sawfly has been recently imported from France into Agriculture Victoria's insect quarantine facility in Melbourne where it will undergo rigorous screening against commercially important Rubus species and cultivars, and other closely related species including native plants. Collaboration with CSIRO's scientists based in southern France has been critical to the blackberry biocontrol research, through their local knowledge and expertise in sourcing wild populations of sawflies.

Effective biological control of invasive blackberry in Australia is likely to involve a range of suitable agents working in synchrony to selectively reduce the vigour of wild infestations. Reduction in the size and health of the subterranean crown of the plant, which is an important organ for regeneration and survival, is considered an important step in achieving successful biological control.

Agriculture Victoria is also looking further afield to natural enemies attacking blackberry in the UK, with the galling fly (*Lasioptera rubi*), the bramble-feeding moth (*Thyatira batis*) and an eriophyid leaf buckle mite (*Aceria* sp.) showing promise, thanks to additional funding provided by Forests and Wood Products Australia.

Classical biological control will never eliminate wild blackberry in Australia. Such an outcome is unachievable. But effective biological control could be achieved by significant reduction in the size of plants by reduction of stem and leaf production rates, crown size, and capacity to spread by fruit and daughter cane production.

Australia has progressed positively in this direction, but further suppression is required. The outcome we seek is to weaken wild blackberry by selective suppression with negligible, if any, impact on our important commercial Rubus cultivars and native plants.

We thank the Australian Rubus industry for the support given in working towards these objectives and the Federal Government's 'Weeds and Rabbits Project' funding for development of the PCR diagnostic tool for Septocyta ruborum.

For more information please contact:

Dr Robin Adair, Australis Biological | robin.adair@australisbiological.com.au

Robin Adair is Director of Australis Biological an ecological consultancy company that specialises in management of native vegetation. Robin has 32 years as a botanist and entomologist with specialities in the use of insects and pathogens as biocontrol of invasive plants. Robin is a scientific advisor to the Victorian Blackberry TaskForce and has been an active member for 15 years.

Dr Raelene Kwong, Agriculture Victoria | rae.kwong@agriculture.vic.gov.au

Raelene Kwong is a leading biological control scientist with DEECA and is currently working on biocontrol solutions for a number of important target weeds, including European Blackberry.

VICTORIAN BLACKBERRY TASKFORCE