Beating bridal creeper and other *Asparagus* weeds

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Summary Bridal creeper (*Asparagus asparagoides*) is considered one of Australia's worst environmental weeds and has been a Weed of National Significance (WoNS) since 2000. During this time there has been a number of achievements, including the successful establishment of biological control agents, an improved understanding of bridal creeper's impacts and other strategic control programs. Despite these gains there are still opportunities to prevent further spread of bridal creeper and the associated environmental impacts, but achievements will be dependent upon early action to prevent changes to native plant communities and ecosystem processes that may be difficult to reverse. There is also much work to be done on managing other *Asparagus* weeds if we are to avoid repeat invasion scenarios, including areas where bridal creeper has been effectively managed with biocontrol.

Keywords Bridal creeper, weed impacts, biocontrol, containment, eradication.

INTRODUCTION

Bridal creeper (*Asparagus asparagoides* (L.) Druce) is considered one of Australia's worst environmental weeds and has been a Weed of National Significance (WoNS) since 2000 (Thorp and Lynch 2000). This status has been key to a number of achievements, including (i) the development, implementation and recent review of the National Bridal Creeper Strategy, (ii) appointment of a national coordinator and management group, (iii) a high level of general awareness, (iv) best practice information and (v) targeted on-ground action, including eradication programs. The national program has also focused on other invasive *Asparagus* species, acknowledging the critical need to understand and manage their impacts.

Following a highly successful biological control introduction and redistribution program the rust fungus agent (*Puccinia myrsiphylli* (Thuem.) Wint.) is now established across the range of bridal creeper, with long term monitoring data demonstrating a reduction in bridal creeper growth and reproduction capabilities (Morin *et al.* 2006a,b). The improved understanding of bridal creeper's impacts gained in recent years indicates that additional management may be required post control to overcome increased soil nutrient levels, secondary weed growth and physical barriers to native species regeneration. Restoration will be more complex and costly at sites with a long history of weed invasion (Cherry *et al.* 2010). Whilst biological control can effectively manage core infestations where alternate management options may be limited due to scale and resources, it is essential to control new outbreaks of bridal creeper to avoid residual impacts associated with older infestations.

Whilst bridal creeper impacts are now relatively well documented the same cannot be said of other *Asparagus* weeds, where invasive behaviour and loss of diversity are often observed by land managers but rarely quantified, a scenario common to many environmental weeds (Downey 2006). Whilst lack of data has not hampered control efforts by weed managers, limited understanding of a weed's impacts has implications for effective resource allocation; targeted restoration activities post control and the resilience of ecosystems to withstand subsequent perturbation.

This paper summarises the achievements of the five year national bridal creeper program, provides a snapshot of local and regional action to manage other *Asparagus* weeds and analyses priorities for *Asparagus* weed management now and into the future.

BRIDAL CREEPER

The national bridal creeper program has set out to achieve three main goals:

- Raise the awareness of bridal creeper and encourage commitment to its management,
- Eradicate and prevent bridal creeper spread, and
- Reduce bridal creeper's impacts (ARMCANZ *et al.* 2001).

Steady progress toward these objectives has resulted in a high level of awareness of the invasive nature of bridal creeper within the natural resources management community, with many home gardeners and other members of the public able to identify it as a problem plant. Actions at the local, regional and national level have also contributed to best practice management

techniques, which have been collated in the Asparagus Weeds Best Practice Management Manual (DWLBC 2006) and widely distributed across bridal creeper's range of southern Australia. Additional extension material has been developed, including an Asparagus WEEDeck and other locally produced brochures.

From a management perspective the key weapon against bridal creeper is the rust fungus, which was released in 2000 and has since been distributed to over 2100 sites throughout southern Australia. Redistribution methods have been refined over time, and the development of the spore water technique (Overton and Overton 2006), which enables rust spores to be suspended in water and sprayed over infestations at large or small scales, has been enthusiastically adopted by weed managers. Several thousand kilometres of roadsides are frequently sprayed with spore water during the peak of a region's biocontrol program.

Results of impact monitoring studies demonstrate that the rust fungus significantly reduces the reproductive ability and growth parameters of bridal creeper, with fewer shoots, above ground biomass and fruits and seeds compared to uninfected plants (Reid *et al.* 2008a). Trials also indicate that rust infected plants have fewer tubers, shorter rhizomes and a reduced relative growth rate (Reid *et al.* 2008a).

Dramatic reductions in bridal creeper cover due to rust infection can be seen relatively quickly (a decrease from 50% to 10% over 2 years) (Turner *et al.* 2008), offering a reprieve from the columns of bridal creeper that smother trees, shrubs and understory species. However, studies have also found that a reduction in bridal creeper cover can be followed by an increase in the cover of other exotic species and/or little or no change to the cover of native plant species (Turner and Virtue 2006), which may be explained by dominance of weed species in the seed bank (Reid *et al*. 2008b, Turner *et al*. 2008). This is at odds to the management objective of improved biodiversity value and indicates the need to take into consideration the impact that bridal creeper is having on ecosystem processes.

Such impacts have been well explained by recent studies, with evidence of raised soil nutrient levels, such as phosphorus, creating conditions that favour weed growth (Turner 2008, Turner and Virtue 2009). When coupled with the physical barriers to native plant germination resulting from the long term persistence of large, tuberous root mats (Turner and Virtue 2006, Turner 2008) the argument for assisted recovery of native plant communities and ecosystem function becomes stronger. Research is needed to better understand the relationship between weed control and other management interventions that may be required to assist with ecosystem recovery (Cherry *et al.* 2010).

The residual impacts of bridal creeper invasion necessitate prompt action to prevent expansion of any new infestations that are occurring outside of core areas. Whilst bridal creeper is widespread throughout much of Australia there are still regions where infestations are sparse or uncommon. These areas are a priority for the national bridal creeper program, which encourages early action to eradicate or contain bridal creeper in such circumstances. For example bridal creeper is relatively uncommon in Tasmania, where an eradication policy and program has been in place since 2003. Emphasis is placed on raising community awareness and active surveillance in order to locate infestations that may increase the risk of re-invasion of treated sites. Opportunities exist for targeted control in northern and central New South Wales (NSW), where bridal creeper occurs as small infestations in town parks and gardens. Containment of these populations will not only prevent potential spread into suitable habitat in NSW, but also support the eradication aims of the Queensland government, where bridal creeper is known from only a few locations. Consideration should also be given to the recent spread of bridal creeper in the wheat belt region of Western Australia (WA). Although widespread in the higher rainfall parts of the State, bridal creeper is now extending into areas where habitat clearance and salinity are already exerting pressure on a heavily fragmented landscape. The impact of the rust fungus is reduced in these drier, inland areas (Morin *et al.* 2006a), adding weight to the argument to manage these sites in the early stages of invasion.

OTHER *ASPARAGUS* WEEDS

The national bridal creeper strategy (ARMCANZ *et al.* 2001) acknowledges the need to contain other, newly emerging *Asparagus* weeds to prevent them from becoming as damaging as bridal creeper. Whilst some of these species have not yet reached their complete range, many are regionally widespread or noticeably expanding their distribution (Scott and Batchelor 2006). Given the long term residual impacts of bridal creeper this again highlights the necessity for prompt action on any new infestations of other *Asparagus* species.

Bridal veil (*Asparagus declinatus* L.) for example, whilst occurring sparsely at locations in WA and Victoria, has naturalised in South Australia, prompting the establishment of a State-wide working group to strategically manage this weed. Activities have included distribution mapping, awareness campaigns and herbicide trials, although physical removal is often still the preferred treatment as the leaf structure of bridal veil makes chemical application difficult and

regrowth from the tuberous root system is common (Winkler and Taylor 2006).

Asparagus fern (*Asparagus scandens* Thunb.) has been the focus of community groups and land managers in south west WA, where it is viewed as a significant threat to the region's biodiversity. Whilst not declared under State weed legislation the WA government has provided assistance to manage populations where they threaten national parks, reserves and native species. The environmental weed status of asparagus fern provides little incentive for commercial herbicide trials, although community groups have undertaken small scale trials with herbicide and fire, which now provide some guidance for management.

Of particular concern along the east coast of Australia is the widespread coastal weed *Asparagus aethiopicus* L., also known as asparagus fern or ground asparagus (previously misapplied as *Asparagus densiflorus* (Kunth) Jessop). Occurring from Queensland to NSW (and scattered in Victoria, SA and WA) this weed has the potential to spread further inland as it tolerates a range of conditions and invades exposed headlands, dunes rainforests and woodlands (Vivian-Smith *et al*. 2006). Extensive control work has been undertaken along the east coast using both herbicide and physical control techniques, but the scale of the invasion is large. Holistic management programs are required to target multiple weed species as *A. aethiopicus* frequently invades areas where other weeds have been removed, such as bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata* (DC.) Norl.) (Mason and French 2007) and bridal creeper. Frequently other *Asparagus* weeds are observed to invade following a reduction in bridal creeper's cover by biocontrol. The widespread nature of *A. aethiopicus* also warrants investigation into biocontrol options into the future.

FUTURE DIRECTIONS

A recent review of the national bridal creeper program indicates that much has been achieved since its listing as a WoNS, with many of the objectives of the national strategy implemented and local, regional and state management programs in place. The National Asparagus Weed Management Committee acknowledges several key gaps or actions that remain to be achieved.

Outstanding priorities include:

1. *Research into ecosystem restoration post bridal creeper control*. Strategies to manage impacts such as elevated soil nutrient levels, the persistence of dead tuber mats and native species regeneration need to be investigated. Investment in bridal creeper programs needs to be followed with management that effectively targets secondary weed invasion (including other *Asparagus* weeds) or progress towards site restoration will be stymied.
2. *Eradication and containment programs for outlier infestations of bridal creeper*. This will ensure that the ecosystem impacts associated with older, more established infestations are prevented.
3. *Researching potential biocontrol agents for other Asparagus weeds*. This is of high importance for some of the more widespread *Asparagus* weeds, such as *A. aethiopicus*, where resources are not available for intensive management of core infestations.
4. *Developing more robust herbicide controls for Asparagus weeds*. The large, tuberous root systems of bridal creeper and other *Asparagus* weeds make it difficult to achieve effective herbicide control in one season. Some *Asparagus* weeds also have waxy or fine leaves (or cladodes) that inhibit herbicide uptake.
5. *Nomination and assessment of other Asparagus weeds as Weeds of National Significance*. Recognising and quantifying the significant environmental impacts of other *Asparagus* weeds is an important step in this process, which will encourage a more strategic and resourced approach to management.

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