Australian Government

Biocontrol of weeds
Spring 2017 update

New biocontrol solutions for sustainable management of weed impacts on agricultural profitability

Weeds threaten Australia's natural environment and rural industries. They displace native species, contribute significantly to land degradation, and reduce agricultural productivity.

AgriFutures Australia, through the Australian Government Rural R&D for Profit Program is working with departments of agriculture in NSW, Queensland and Victoria, and the CSIRO to develop new biocontrol agents to target 10 weed species that are significant on a national level — weeds that are difficult to control with current methods and have substantial impacts across agriculture sectors.

The *New biocontrol solutions for sustainable management of weed impacts to agricultural profitability* project aims to improve the long-term profitability of primary producers affected by the target weeds by developing novel biocontrol solutions that will reduce recurrent costs of control.

The target weeds are: African boxthorn, cabomba, prickly acacia, sagittaria, silverleaf nightshade, fleabane, sowthistle, mother-of-millions, giant rat's tail grass and ox-eye daisy.

Learn more
agrifutures.com.au/weeds-biocontrol

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ABOVE: Host-specificity testing of prickly acacia gall thrips in quarantine in Australia.

Photo credits (clockwise from above): DEDJTR, Michael Widderick, QDAF

ABOVE: Raelene Kwong (left) and Greg Lefoe (right) inspecting infestations of saggitaria in Texas.

BELOW: Several populations of common sowthistle are showing herbicide resistance.

Why biocontrol?

Successful targeted and integrated biocontrol programs deliver long-term solutions to soil, water and natural resource management problems.

Australia has been a world leader in weed biocontrol since the prickly pear success of the 1930s, with average benefit-cost ratios on R&D investment in the order of 23:1.

Weed biocontrol programs involve: identifying new effective agents (Phase 1), assessing the risk and efficacy of such agents (Phase 2), followed by approval for release in Australia, mass-rearing, large-scale release and redistribution of these agents (Phase 3).

The *New biocontrol solutions for sustainable management of weed impacts to agricultural profitability* project specifically targets Phases 1 and 2. When Phase 3 is supported and agents approved for release, the anticipated outcomes from the project will reach nation-wide.

The project brings together biocontrol expertise from four Australian and multiple international research agencies to support the development of these new agents.

Why these weed species?

Consultation with industry stakeholders identified and prioritised 10 target weed species. The criteria included addressing significant impacts across multiple industry sectors and the likelihood of successful control.

The target weeds impact cropping (fleabane, sowthistle, silverleaf nightshade), pasture (African boxthorn, mother-of- millions, ox-eye daisy, giant rat's tail grass, prickly acacia)
and water resources (cabomba, sagittaria), and collectively their impacts cost Australian agriculture more than $400 million/year.

Approval process and next steps

Approval for the release of biocontrol agents requires thorough assessment of impact and risks. This includes a detailed evaluation of the risks of the proposed release (including host-specificity testing), including pest status across each state, possible implications of the weed's biological control for affected industries and public consultation.

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African boxthorn

African boxthorn, a spiny shrub from South Africa, was introduced to Australia during the mid-1800s as a hedge plant. It has since spread into pastures, neglected areas, roadsides, railways and waterways.

It produces a dense thicket armed with spines that can form an impenetrable barrier to domestic stock; restricting access to water and displacing native vegetation.

African boxthorn has been recognised in Australia as a Weed of National Significance.

A literature review of African boxthorn has identified 49 organisms that attack or feed on the plant.

Native range surveys in South Africa have identified a number of potential candidates and a previously identified rust pathogen, has been imported into quarantine in Australia and is undergoing testing.

Researchers

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Photo credit: John Heap, PIRSA

Cabomba

Regarded as one of the worst aquatic weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts, cabomba is choking waterways along Australia's east coast. The weed grows quickly, producing a bulk of vegetative material, which can significantly reduce water storage capacity and taint drinking water supplies. The plant is fully submerged, except for occasional floating leaves and flowers above the water surface.

Cabomba is extremely persistent and can take over a water body, excluding native plant species. A dense mass of underwater stems and leaves also provides a hazard for recreational water users. When this vegetation dies off, decomposition causes dramatic oxygen reductions and foul-smelling water.

A promising insect for the control of cabomba has been identified in South America, where host specificity testing is being undertaken while permits for the export of this agent are being sort from the relevant regulatory authorities.

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Photo credits: CSIRO

Fleabane

Fleabane is a major weed in cropping systems, which competes for soil water in both crop and fallow phases. Fleabane can germinate throughout the year, but is most common during spring and early summer before harvest. This staggered emergence pattern hinders control efforts.

Following harvest fleabane has little competition for light or moisture and grows rapidly, especially after summer rain. By the time there is a window for control, fleabane plants are often large with an extensive root system and a reduced leaf area, which renders the plants tolerant of most herbicides.

A literature review has identified 71 organisms that attack or feed on fleabane.

Fleabane samples collected from 17 sites throughout Australia are being compared with samples from South America (where fleabane is believed to have originated) in order to refine the native range survey areas for biocontrol agents. Several rust fungi and insect herbivores have been recorded in Colombia and Brazil and these agents are in the process of being classified.

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Photo credit: CSIRO

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Giant rat's tail grass

Rat's tail grasses belong to a group of invasive grasses species often referred to as 'weedy Sporobolus grasses'. Four introduced Sporobolus species are invasive plants in Queensland and New South Wales: giant rat's tail grass (*Sporobolus pyramidalis* and *Sporobolus natalensis*), American rat's tail grass (*Sporobolus jacquemontii*), and giant Parramatta grass (*Sporobolus fertilis*).

Distribution maps within Australia have been generated and native and introduced species collected from the field.

A total of 84 pathogenic fungi have been recorded on 25 Sporobolus species worldwide. Two field surveys in Africa have found insects and pathogens on Sporobolus species, which were collected and curated. Additional surveys will be undertaken to collect more of the most promising insects.

Native Sporobolus pathogen surveys have identified 27 pathogens, which are currently undergoing DNA sequencing.

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Photo credit: QDAF

Mother-of-millions

Mother-of-millions, a native of Africa and Madagascar, was introduced to Australia as a garden plant. It is a serious weed in both NSW and Queensland.

Mother-of-millionsis poisonous to stock, humans and household pets, with dogs being particularly susceptible. If livestock eat a large amount of the plant they can die suddenly of heart failure (about 5kg will kill an adult cow). The toxins can be cumulative and if animals have eaten smaller amounts over several days, they may develop diarrhoea (sometimes bloody), drool saliva, dribble urine and then die. The toxins are present in all parts of the plant, however flowers are five times more poisonous than leaves and stems.

A potential biological control agent for mother-of-millions has been introduced into Australia where it has adapted well to quarantine conditions. Two agents are currently in quarantine in Australia— the stem-boring weevil (*Oshphilia tenuipes*) at NSW DPI's Orange facility and the root-feeding flea beetle (*Rhembastus* sp.) at QDAF's Brisbane facility.

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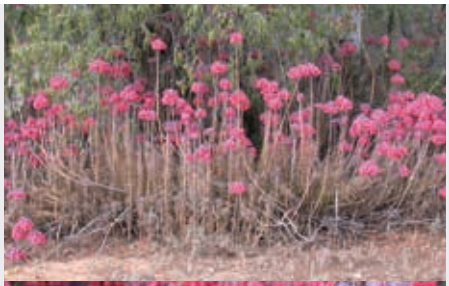

Photo credits: NSW DPI

Ox-eye daisy

Ox-eye daisy is a perennial herb from Europe, which spreads primarily by seed, but also by rhizomes (shallow, creeping roots). Part of the daisy family, mature plants can produce up to 26,000 long-lived seeds, dispersed by animals, vehicles and water — 80% of seeds remain viable for six years and some up to 39 years.

The weed is not palatable to cattle and affects pastoral lands by reducing carrying capacity. Dense infestations exclude other plant species. In NSW, ox-eye daisy is present in tableland regions, such as the Northern Tablelands, Barrington Tops, Central Tablelands and the Southern Alps.

Within the Tantangara Area of Kosciuszko National Park, the population has spread rapidly since bushfires in 2007.

A promising insect control agent (*Dichrorampha aeratana*) was imported from Switzerland during March 2017 and feeding trials are underway to determine host specificity and likelihood of the agent attacking non-target species. Pre-release field sites will be established in NSW, ACT and Victoria to monitor plant population dynamics and soil seed banks.

Researcher

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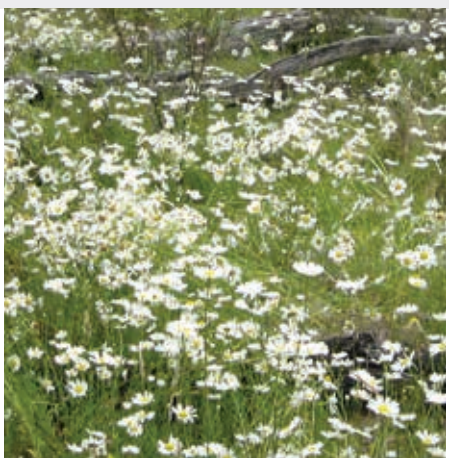

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Sagittaria

Sagittaria is an aquatic plant native to North America, introduced as an ornamental plant. It was first identified in Australia during 1959 near Brisbane, and then in Victoria during 1962. During the 1980s Sagittaria spread rapidly and it is now widely dispersed across southern NSW, particularly in the Murray Irrigation District, and is common in waterways around Sydney and Newcastle.

In natural systems the vigorous, choking habits of Sagittaria threatens native aquatic flora and fauna. Dense infestations restrict water flow and can substantially affect biodiversity and stream health. In irrigation systems it can reduce flow and efficacy of water delivery. Infestations also have detrimental impact on recreational activities and reduce visual amenity of waterways.

Three insects have been identified for Sagittaria biocontrol and host specificity testing of two weevils is underway in Victoria. Initial results have confirmed that plant species outside the family to which Sagittaria belongs are not acceptable hosts of a crown-boring weevil. Testing of a fruit-feeding weevil has produced promising results, with few eggs being laid on any of the related native species, except for starfruit (*Damasonium minus*).

Researcher

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Photo credits: DEDJTR

Prickly acacia

Prickly acacia is a small, thorny, spreading tree generally growing to about 4–5m high and occasionally to 10m. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts. At present more than 6.6Mha of arid and semi-arid Queensland are infested with prickly acacia. Prickly acacia could potentially infest vast tracts of grasslands and woodlands throughout Australia.

The economic impacts of prickly acacia on Queensland's grazing industry are estimated at $5 million per year. Even at medium densities, it halves the primary productivity of grasslands, interferes with stock mustering and restricts stock access to water. Control costs considerably outweigh its benefits as a shade tree and drought fodder.

A gall thrip sourced from Ethiopia has been exported into a high-security quarantine in Brisbane, Australia for colony establishment and host specificity testing.

A gall mite from Ethiopia was also imported to South Africa for colony and host specificity testing. Native range surveys have been carried out in Senegal and three prospective biocontrol agents have been sent to a quarantine facility in Pretoria, South Africa for identification.

Photo credit: QDAF

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Silverleaf nightshade

Silverleaf nightshade, is one of the most difficult agricultural weeds to kill. The weed's extensive root system enables the plant to draw moisture and nutrients from a large volume of soil and to compete effectively against other species.

Silverleaf nightshade competes with summer-growing crops and pastures, and reduces the production of winter crops, such as cerealse. The plant's spiny leaves and coarse stems can lower the quality of hay taken from infested areas, resulting in contaminated product, which may be rejected for sale. All parts of the plant's fruit, are toxic to animals.

The Foundation for the Study of Invasive Species, Argentina, has been engaged to carry out surveys and preliminary screening trials for potential biological control agents from South America. A 'natural enemy survey' is underway in Texas, USA.

A potential release site has been identified in NSW, with further sites in NSW, SA and Victoria to follow.

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Photo credit: John Heap, PIRSA

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Sowthistle

Common sowthistle (or milk thistle) is widespread across the grain-growing regions of Queensland and northern NSW. Sowthistle uses stored soil water during fallows and interferes with crop harvest, adding green matter to harvested grain.

Common sowthistle is ranked as the fifth most difficult weed to control in winter crops, with several populations showing herbicide resistance. Once considered winter-dominant, the weed is now found all year round.

Western Europe (including Morocco) seems to be the main centre of diversification for sowthistle.

The France-based CSIRO staff and collaborators from other organisations, have started field collections of the plant. To date, material has been collected from several sites across France, Italy, Portugal and Morocco. When identified, the range of insects and fungi found during the sowthistle surveys will undergo preliminary host specificity testing and promising agents will be imported into quarantine in to Australia for further testing.

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Photo credit: Michael Widderick, QDAF

Research organisations

CSIRO
Sowthistle, African boxthorn, cabomba, fleabane

DEDJTR
Silverleaf nightshade, sagittaria

QDAF
Prickly acacia, giant rat's tail grass, mother-of-millions

NSW DPI
Mother-of-millions, ox eye daisy, giant rat's tail grass

Photo credits: Greg Lefoe, DEDJTR, John Heap, PIRSA, NSW DPI, QDAF

Partner organisations

PIRSA
SEQ Water
GRDC
Ravensthorpe Shire
USDA
Goulburn Murray Water
Murrumbidgee Irrigation
Coleambally Irrigation
Goulburn Broken Catchment Management Authority
North Queensland Dry Tropics
Wyong Shire
Murray Local Land Services
Murrumbidgee Landcare
Central Murray County Council
NSW Office of Environment and Heritage
NSW National Parks and Wildlife Service
NSW Biocontrol Taskforce
Bundaberg Council
North West Local Land Services
Gladstone Council
HQ Plantations

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Learn more
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