

The Biological Control of Weeds[®]

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Biological control is a natural method of controlling the presence and reducing the nuisance value of pest plants in our environments. Weeds are highly invasive plants that arrive in a new environment without their natural predators. Biocontrol aims to redress this imbalance by introducing some of the most damaging insect predators that can be found on these plants in their native ranges.

Biological control is often the only answer that is available for many pest plant species where chemical control has proven to be too risky or ineffective. Biocontrol is self sustainable and an extremely selective form of pest plant control.

In a complete biological control of weeds programme the first stage is deciding if the pest plant is appropriate for biocontrol. This means we need to have a plant that is widespread, invasive, and unable to be controlled by other methods.

The next stage is to determine whether there are any insects attacking the plant in its introduced range as well as finding out what insects or diseases are attacking the plant in its native range. In many cases there can be around 100–200 insect species or diseases found attacking the plant in its native range. However, it is also true that only 2–10 of these are damaging and specific enough to be considered for biocontrol.

Once we have found suitable insects or diseases we test them to determine what their host range is. The host test plant list is selected by using a centrifugal phylogenetic system that allows us to select closely related, to the target plant species, economically important and related native plant species for testing.

The testing protocol is done by placing the host, target, or pest plant, into a cage plus several other closely related, native, or economically important (non-target) plant species, and then releasing several adults of the biocontrol agent into the cage to see what they will feed on and lay their eggs on. This is a 'Choice' test where the target plant and nontarget plants are available to the insect or disease. The next series of tests we do is we remove the target or pest plant from the cage and leave only the native, closely related, or economically important plant species for the biocontrol agent to feed or lay eggs on.

Next we place newly hatched caterpillars onto the target or pest plant and the nontarget plant species to see if the caterpillars can feed on and survive on the nontarget plant species. These tests are very conservative and often force insects and diseases to attack plants they would not normally attack in natural field situations. These tests are all carried out either in a quarantine facility or in the native range of the target or pest plant.

Once we have completed these tests and are satisfied that the insects or diseases will not attack any plant species other than the target or pest plant species we then apply to our authorities (the Environmental Risk Management Authority in New Zealand or Australian Quarantine and Inspection Service in Australia) presenting all the information we have on the potential biocontrol agent. This application is circulated around a number of professional organisations and is also put out for public comment. If all the evidence presented shows that the bio-

control agent is safe to introduce, then permission will be given to release it into the new environment.

Once the insect or disease has been released from quarantine we begin to mass rear it in large numbers making widespread releases of it all around the country or state.

Sometime after release we go back to these release sites and check to see if the insect or disease has established. In some cases, but this is very rare in the world of biocontrol, we are able to do some post-release experiments to determine if the new agent is having an impact on the pest plant population by reducing its presence or its spread.

Here is a list of plants that we are currently working on in New Zealand:

- Banana passionfruit (*Passiflora mollissima*)
- Old man's beard (*Clematis vitalba*)
- Ragwort (*Senecio jacobaea*)
- Broom (*Cytisus scoparius*)
- Hieracium (*Hieracium* sp.)
- Boneseed (*Chrysanthemoides monilifera*)
- Californian thistle (*Cirsium arvense*)
- All thistles (*Cirsium*, *Carduus*, *Silybum*, *Onopordum*)
- Alligator weed (*Alternanthera philoxeroides*)
- Moth plant (*Araujia sericifera*)
- Tradescantia (*Tradescantia fluminensis*)
- Wild ginger (*Hedychium gardnerianum*)
- Woolly nightshade (*Solanum mauritianum*)
- Nassella tussock / Chilean Needle grass (*Nassella* sp.)
- Japanese honey suckle (*Lonicera japonica*)
- Bridal creeper (*Asparagus asparagioides*)

Some success stories from around the world are:

- Ragwort (*Senecio jacobaea*) in Oregon, Australia, Tasmania, New Zealand (N.Z.).
- Prickly pear (*Optunia stricta*) in Australia and South Africa
- Nodding thistle (*Carduus nutans*) in NZ and the U.S.A.
- Mexican Devil weed (*Ageratina adenophora* syn. *Eupatorium adenophora*) in N.Z., Hawaii
- Woolly nightshade (*Solanum mauritianum*) in South Africa
- St John's Wort (*Hypericum perforatum*) in N.Z., U.S.A., South Africa, Australia
- Acacia species (*Acacia* sp.) in South Africa
- Alligator weed (*Alternanthera philoxeroides*) in U.S.A., N.Z., Australia
- Red sesbania (*Sesbania punicea*) in South Africa
- Mist flower (*Ageratina riparia* syn. *Eupatorium riparium*) in N.Z.