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# factsheet

# Biological control of weeds: release and establishment

Rust infection on blackberry leaf.
Photo: CSIRO



## Background

Biological control (biocontrol) aims to manage the target weed by use of natural herbivores or pathogens, so as to reduce the weed's economic and environmental impact. Evaluating and testing potential biocontrol agents is expensive and time-consuming, so it is particularly important that the release and establishment stage is successful.

## What is the issue?

A successful biocontrol agent must have biological features which give it the best chance of thriving in its new environment and of suppressing target weed populations (see factsheet on *Biological control of weeds: selection of agents*). Thus, choosing the right agent is the first and most vital step. Potential agents are then subjected to detailed host-testing (see factsheet on *Biological control of weeds: host testing*) and review. Only those few selected agents which have passed these hurdles will be approved for release in Australia. It is therefore extremely important that the best possible methods are used for mass-rearing and field releases to ensure that these agents have the maximum chance of successfully establishing in the field and contributing to control of the target weed.

Rearing agonosoma for the control of bellyache bush.
Photo: Kelli Pukallus

## Key principles

### 1. Rearing

It is important to mass-rear the agent in clean conditions, free from other diseases or pests. Insect agent colonies need to be genetically diverse to avoid inbreeding. Fungal agents may need to be grown on living plants, in cultures or under special conditions. Direct release of agents from the country of origin may be permitted where local rearing proves too difficult.

### 2. Ecology

Understanding the agent's ecological preferences is vital to successful release and establishment. Stage of growth of the host plants may affect the agent, for example tip-borers will need growing shoots, so timing of releases is important. The agent's other needs, for example flowers for adult feeding, or moist soil for pupation, need to be taken into consideration when planning releases as do the agent's mating and dispersal patterns.

### 3. Release conditions

Computer modelling can help identify areas with the most favourable climate for agent releases. When releasing agents, weather conditions and time of day must be evaluated with care to give the best chance of survival. Most fungi for example, require humid conditions and insect larvae do better in the cool late afternoon or evening.

### 4. Site selection

Choosing the right sort of weed infestation is key to helping the agent establish successfully: some prefer dense stands, others scattered clumps. Suitable microhabitats can aid survival and reduce losses due to predation. Soil type and moisture levels are also critical issues, especially in dry seasons.

Social factors play a big part in site selection as it is important for landholders to clearly understand the aims of the biocontrol program, recognise the agent, be supportive and not have unrealistic expectations. An 'agreement of cooperation' helps to cement a good working relationship.

### 5. Numbers

Choosing the right number of agents to release is critical to successful establishment. Some insects require larger numbers, others fewer. The optimum release size will give the greatest number of successful establishments for a given number of agents, and is usually determined by field trials. Where the optimal number is not known, a mixed strategy is best with some large releases and some small ones. Release numbers will also depend on how easy the agent is to rear.

### 6. Predation

Many biocontrol agents fall victim to ants, birds and parasitoids. As a general rule, mature adult agents have a better chance of initial survival. Pilot releases can determine whether predation is an issue, and baiting, spraying, netting or other protective strategies can be devised to counter it.

### 7. Plant condition

Long-term survival of the agent may be threatened by very dry conditions with no plants available. Watering of small 'nursery' patches can help in the early stages when agents are not widespread. This is particularly important for agents that do not disperse readily over long distances.

### 8. Evaluation

Evaluating the success of establishment is vital (see factsheet on *Biological control of weeds: impact evaluation*). This involves monitoring the site before, during and for a considerable time after the release, to determine long-term survival and spread of the agent. This includes counting the numbers of agents and assessing damage to the target weed.

### 9. Distribution

Once field populations of the agent have built up they can be harvested for distribution to other sites, using cages, traps or through collection of infested plants. Nursery sites should be carefully chosen for ease of access and favourable conditions, and the best time to harvest and redistribute agents should be determined. Biosecurity and hygiene requirements must be observed.

## Other considerations

Community groups, especially those involved in natural resource or weed management, can be a big help in the release of biocontrol agents. They can identify suitable release sites, erect fencing or cages, carry out releases, monitor establishment and handle redistribution. Schools sometimes take on the rearing and supply of biocontrol agents to the local community. It is important to ensure participants are well trained and supported.

Community participation has enormous benefits, as groups can carry out multiple releases and so speed up the delivery and spread of a biocontrol agent. At the same time, the community learns more about biocontrol and how it works, and gains a sense of ownership of the program.

Collecting ragwort flea beetles for redistribution using a vacuum machine.
Photo: Tasmanian Institute of Agricultural Research

## ...case study

## Gorse thrips

Gorse is a major weed of agriculture and forestry in Tasmania and south eastern Australia. Four biological control agents have been released for gorse, of which the gorse thrips, a tiny insect, was first released in 2001. Several studies have been conducted to determine the optimal number and pattern of releases of this agent. The optimal release size for this agent is 250 individuals per release. The quality of the host plant has been determined to be important for successful establishment of thrips. So far, thrips are establishing well where they have been released but their size and biology make them difficult to detect after release, so particular recommendations for their post-release monitoring have been developed.

A gorse thrips.
Photo: Tasmanian Institute of Agricultural Research

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## Further information


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For further information visit the following websites:

**CRC for Australian Weed Management**
www.weedscrc.org.au

**Weeds in Australia**
www.weeds.gov.au

**Australian Quarantine and Inspection Service**
www.daffa.gov.au/aqis


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