

Impact of rearing method on establishment success of a biocontrol agent?

Heather beetle in New Zealand



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The way herbivorous insect biocontrol agents are reared before release into new environments may affect their ability to establish and reach population levels that are effective in controlling their host plant.

Genetic bottlenecks may reduce genetic variability, lowering potential for agents to adapt to the variety of environments throughout the target weed's range.

Artificial conditions may select for laboratory-adapted populations that have difficulty establishing or achieving high population increase in the natural environment.

Could the rearing method used to eliminate disease from imported heather beetles have affected the beetle's establishment and performance in New Zealand?

Heather beetle (*Lochmaea suturalis*) was first introduced into New Zealand in 1992 as a biocontrol for heather (*Calluna vulgaris*), an environmental weed covering large tracts of land in the Central North Island.

In its native range in north-west Europe, populations can outbreak with high levels of damage to heather stands.

Populations were sourced from England and Scotland to provide the best climatic match for Tongariro National Park.

Routine checks of imported populations of beetles in quarantine revealed high levels of a microsporidian (protozoan) disease that severely affects survival and reproduction in the laboratory.

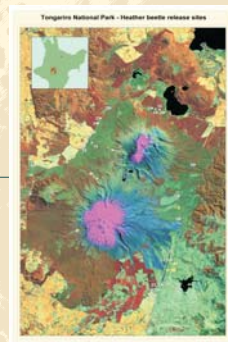
A line-rearing technique was used to eliminate the disease: offspring from individual females were kept separate in hygienic conditions and the entire line destroyed if any of the sample insects tested positive for microsporidia.

Beetles were line-reared for several generations to eliminate the disease before stocks were cleared for release.

Since first field releases in 1996, 21,400 beetles have been released at 74 sites in and around Tongariro National Park, and 3 sites at Rotorua.

All releases have established at Rotorua and large numbers of beetles are severely damaging and killing heather.

Only 3 releases have established in Tongariro National Park and the heather remains largely undamaged.



Heather beetle adult

Heather beetle larvae

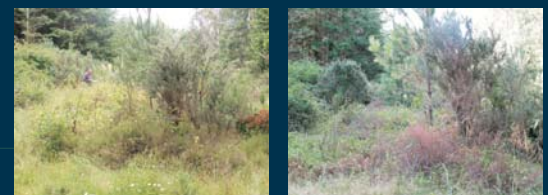


Heather frost flat
Tongariro National Park

Heather beetle damage
Scotland



Beetles line-reared in quarantine for several generations

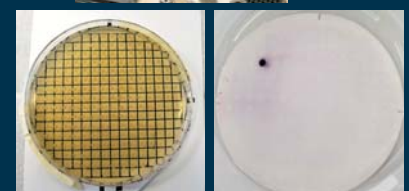


Rotorua site—before release
of beetles

Rotorua site—after release
of beetles



Development of
microsatellite
markers for DNA
studies



White bacterial colonies
containing beetle DNA

Detection of
microsatellite sequence

Why have releases established so poorly in Tongariro National Park compared with Rotorua?

Previous work has ruled out parasitism and predation.

Microsporidian disease has not been detected in the field.

Despite efforts to climate-match source populations, climate requirements may be more subtle than we anticipated.

The line-rearing method used to eliminate disease prior to release may have had a detrimental effect on heather beetle's genetic make-up by, for example, creating a laboratory-adapted population or decreasing genetic variability.

Concern that line-rearing has adversely impacted on genetic variability has led to development of microsatellite markers for DNA studies to enable comparisons of genetic diversity in beetles from line-reared stock and the native range.