



Patua Te Otaota - Weed Clippings

Biological Control of Weeds Annual Review 1998/99

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Manaaki Whenua
Landcare Research

Introduction

- Welcome to the fifth issue of *Patua Te Otaota - Weed Clippings*, which we have published to keep clients, stakeholders, and research colleagues informed about our progress in the development of biological control programmes for weeds.

Headlines

- Rejoice in the news that the mist flower white smut is now out and about. Read of our plans to keep tabs on its whereabouts.
- Sit back and marvel at the old man's beard agents, which have broken all previous speed records for

finding and colonising their host plant throughout the country.

- Check out the new tricks we have up our sleeve for controlling New Zealand's commonest and only perennial thistle.
- Discover some of the insights that broom agents are teaching us about the science behind biological control.

- Reflect on what millennium bugs might be in store when you read about the prospects for biological control of bone-seed, climbing asparagus, and nassella tussock.
- Digest the ins and outs of testing the safety of our prototype mycoherbicide, GOB-stopper.
- Read about the extra troops the army has called upon to assist in the war against heather. Explore their plans to combine chemical and biological warfare.
- Get up to speed with what's happening with all the different agents that have been released around the country.

impact of control agents — the plots thicken.

- Meet the famous five, poised to make a meal out of hieracium.

- Sympathise with our closest neighbour's gorse problem, and find out what we've got that the Aussies want.

Control Agents Released in 1998/99

Species	Releases Made
Broom psyllid (<i>Arytainilla spartiophila</i>)	3
Broom seed beetle (<i>Bruchidius villosus</i>)	22
Gorse pod moth (<i>Cydia succedana</i>)	11
Gorse thrips (<i>Sericothrips staphylinus</i>)	27
Nodding thistle gall fly (<i>Urophora solstitialis</i>)	6
Old man's beard leaf fungus (<i>Phoma clematidina</i>)	12
Old man's beard leaf miner (<i>Phytomyza vitalbae</i>)	13
Scotch thistle gall fly (<i>Urophora stylata</i>)	2
Total	96

- Make sure you have the latest instalments of "The Biological Control of Weeds Book".
- Once you've read the book, keep an eye out for the video "Natural Born Weed Killers", coming soon to a field day near you.
- Catch up on the latest progress in assessing the



Neil Mickleson (Horizons.mw) and Paul Peterson (left) looking for elusive heather beetles



Getting the Measure of Mist Flower

We are hoping for great things from the mist flower fungus (*Entyloma ageratinae*). The fungus has done a wonderful job of controlling mist flower in Hawai'i and we expect it to find the conditions here to its liking. Jane Fröhlich and Alison Gianotti unleashed the white smut on New Zealand for the first time this year at nine sites in Auckland, Northland, and Waikato. They have also set up a comprehensive monitoring system that will enable us to track the progress of the fungus here.

They plan to keep tabs on the white smut in three ways. They will check as many of the release sites as possible at regular intervals and determine the spread of the fungus between individual plants and patches of plants. "So far we have found smut spores and secondary infections at all nine sites, so establishment looks promising," said Jane. An intensive study of one release site in the Waitakere Ranges, near Auckland, is also underway. All four of our Auckland-based staff (Jane, Alison, Simon Fowler, and Chris Winks) and two Auckland Regional Council staff (Chris McKain and Greg Hoskins) tramped through the Waitakere Ranges Park to estimate the percentage ground cover of mist flower there.

Extrapolating these results is quite horrifying as it suggests that mist flower occupies at least 24 156m² of the park. This survey will be repeated annually to assess any subsequent changes in the mist flower population. Finally, to get a handle on the bigger picture, Jane prepared a questionnaire asking people where they have seen mist flower infestations throughout New Zealand. This information will be used to construct a map of the weed's distribution that can be modified in future to monitor any changes in the distribution of the weed, the white smut, and also the mist flower gall fly (*Procecidochares alani*).

Mist flower gall fly larvae feed inside mist flower stems prompting the plant to make galls, which retard stem elongation and reduce the weed's competitive ability allowing more desirable plants to take over. Tests conducted on the gall fly, prior to its release in Hawai'i and Australia, showed that the insect is highly host specific. The only plant (apart from mist flower) that the flies laid eggs on in these tests was a close relative, Mexican devil weed (*Ageratina adenophora*). These eggs hatched, but the resulting larvae could not develop properly and no galls were formed. Additional testing of 25 plant species of significance to New Zealand was completed this year.

Sixteen were tested on our behalf by colleagues in Hawai'i, and the other nine were tested by Chris Winks inside the quarantine facility at Mt Albert.

These results suggest that the fly is safe to release in New Zealand. It is important to have this second agent to back up the fungus in case some areas prove to be unsuitable for good infection. An application requesting permission to release the gall fly is being prepared, and the Auckland Regional Council will submit this to the Environmental Risk Management Authority before Christmas.

This work is funded by the Auckland Regional Council, Environment Waikato, Northland Regional Council, and the Northland Conservancy of the Department of Conservation.



Jane Fröhlich releasing the mist flower white smut on Waiheke Island.



Old Man's Beard Project Goes Ahead in Leaps and Bounds

Overtaken by events

Unlike many unwanted pests, most biological control agents are painfully slow at finding their way around. For this reason we now put more effort into developing simple methods, early on, that people can use to speed up dispersal. Being such a tiny fly (1–2 mm long) we didn't expect the old man's beard leaf miner (*Phytomyza vitalbae*) to prove the exception to the rule, and we began to investigate harvesting techniques almost as soon as we began to release the fly. Ironically by the time that we had developed a suitable technique, the fly had already colonised most old man's beard infestations in New Zealand! Minimal effort will be required to increase the distribution of this agent so

you can all put your feet up and relax. However, just in case anyone still needs to shift leaf miners next spring, we have described our discoveries below.

It is not practical to collect the flies from the field — they are just too small and delicate to handle easily and too difficult to distinguish from other flies. Nor is it feasible to collect pupae from old man's beard leaf litter during the winter. We recommend shifting the leaf miner by cutting infested leaf material and taking this to new sites. Leaf miner larvae and pupae can complete development on cut leaf material, but the eggs cannot unless the cut material is preserved in some way, e.g. put in florists' Oasis®. You can collect leaf material anytime during the warmer months when you can easily see good numbers of brown squiggly leaf mines on the leaves. Avoid shifting leaf

miners late in the autumn as this is less likely to result in successful establishment. At warmer sites where the plant does not lose its leaves, it may be possible to shift leaf miners early in the spring. For example, a rubbish bag of leaf material collected in Nelson in August 1998 produced 600 flies a couple of weeks later.

Gone with the wind

The old man's beard leaf fungus (*Phoma clematidina*) has also surprised us with the speed it has travelled around. This year infected plants were seen in many places (e.g. Auckland, Otago, and the West Coast) that are all some distance (as much as 200 km) from the nearest known release sites. "Quite often when I turned up to release the fungus at sites in the North Island I found that it was already there", reports our Auckland-based staff member, Chris Winks. With the dry conditions still being experienced throughout much of the country this moisture-loving fungus has only had a chance to show its true colours in the autumn. However, with the way this fungus appears to be multiplying and spreading, we eagerly wait to see just what it can do when we move back into a wetter weather pattern.

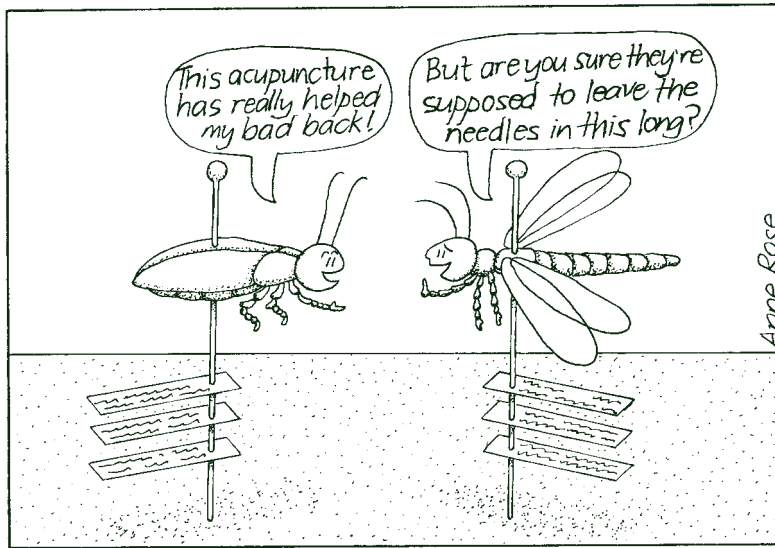
A saw point

To date we have only been able to release the old man's beard sawfly (*Monophadnus spinolae*) at the Department of



Simon Fowler scales great heights to check on the old man's beard leaf miner





Conservation's Kaituna Reserve, on Banks Peninsula. We are not yet sure if the fly has survived there or not. We had hoped to release the flies at several more sites this year but events conspired against us. Hugh Gourlay has been struggling to rear this third agent for old man's beard. "These leaf-feeding wasps pupate in the soil, and there appears to be high mortality at this part of the life cycle," said Hugh. "I waited and waited but only 25 adult wasps emerged, and they turned out to all be males so that was the end of the mass-rearing programme for the year," he said. To solve the problem of having no girls and just too few bodies in total, we have requested another shipment of sawflies from CABI Bioscience in Switzerland. This shipment is expected to arrive in June 1999, and will give Hugh another opportunity to cut his teeth on mass-rearing this new agent.

This project is funded by the Foundation for Research, Science and Technology and participants in our Technology Transfer Programme.

Two-Pronged Californian Thistle Attack

Californian thistle is the most common thistle in New Zealand, but it has not been easy to find solutions or ready money to deal a mortal blow to this perennial nuisance. Three agents have been released in New Zealand to date, two foliage-feeding beetles (*Lema cyanella*, *Altica carduorum*) and a gall fly (*Urophora cardui*), but they are not sufficiently damaging to make a difference to this persistent problem on their own. More agents are needed to strengthen the attack and help might soon be on its way.

This year we assisted a group of farmers from some of the

worst affected areas, Otago and Southland, to make a successful application to the Agricultural and Marketing Research and Development Trust (AGMARDT) for funds to push along this worthy cause. The AGMARDT money will be spent over the next 3 years in two main areas. Firstly, we are joining an international consortium (with the USA and Canada) that is funding CABI Bioscience, in Switzerland, to search for potential new agents in previously unexplored parts of the weed's native range in eastern Europe and western Asia. Secondly, we plan to look at how we can maximise the impact of the three agents that have already been released here.

A potential new agent has also been discovered here in New Zealand. Adrian Spiers, HortResearch, has found a new fungus (*Phoma* sp.) attacking Californian thistles. He noticed patches of dying thistles on a couple of farms in the Manawatu / Rangitikei area in the lower North Island. The fungus was causing leaf and stem necrosis, then dieback and rotting of the underground roots. Next year Adrian plans to run tests to make sure that the fungus won't damage other plants and to develop suitable application methods.

This project is funded by the Californian Thistle Action Group (through an AGMARDT grant, and by the Hawke's Bay and Southland regional councils.



Broom Project Offers Insights

George and Mildred live on
In 1994, Otago Regional Council staff helped us to set up a collaborative experiment with British Scientist, Jane Memmott, that involved releasing sap-sucking broom psyllids (*Arytainilla spartiophila*) at 55 sites along a transect across Otago. The point of the exercise was to develop a better understanding of the reasons that biological control agents fail to establish and, in particular, the effect of release size. The number of psyllids released at each site varied from just two (one of each sex) to 270. As expected, establishment was more likely when larger numbers of broom psyllids were released. However, sometimes even the tiny releases were successful. "We were amazed to find offspring of one of the pairs, George and Mildred, but we didn't think these populations would ultimately persist," explained Pauline Syrett. "Five years down the track we were pleasantly surprised to find this population is still thriving."

Environmental factors seem to play a greater role in determining whether or not biological control agents survive than release size, and we should not underestimate the impacts of human activities. Even though "safe" sites were chosen for this experiment, nearly half of them have since been sprayed, ploughed, cut,

or burnt. Another transect, involving 40 sites, has been set up in the Amuri Basin, North Canterbury. The aim of this experiment is to investigate whether the establishment success of broom psyllids is enhanced by topping up release sites with additional insects over a number of years.

Slowly does it

The Otago trial has told us that, as a general rule, broom psyllids do not disperse quickly. After 5 years, they have not ventured much beyond 50 m of the original release bushes. The psyllids seem to have a "why get up and go when you have everything you need right here" sort of approach to life. However, once numbers begin to build, and the original release bushes become less desirable, then the psyllids may be prompted to go further afield. Obviously it is

going to be important for people to assist with dispersal of this agent, and we have begun to investigate the best way of going about this.

Firstly, we need a way of assessing when there are enough of the suckers at a site to begin harvesting. The tiny (2-3 mm long) adults and nymphs are only around for a couple of months of the year and even then they can be quite difficult to see. They produce a sticky honey dew as a waste product, but this cannot be used to estimate population density because rain tends to wash it off. We found that the best way of assessing population density was to beat branches over a collecting tray and count how many adults and nymphs were dislodged.

So far we have always released the adult stage because we



Some light relief was called for after Jeremy Sheat and Damien Coup had set up a large broom trial (see Two's Company). You need have no "reservations" about the quality of this research!





Broom psyllid nymph

suspected that the nymphs were not as good at transferring onto new plants. However, if it is possible to successfully shift the nymphs, then it would greatly increase the window of opportunity for redistributing this agent. This year we tried some nymph releases, and we will check on their progress next year. So far the best way of collecting either stage for redistribution seems to be by cutting infested plant material. Adults can also be collected quite readily using a garden-leaf vacuum, but we still need to test whether or not these delicate insects get damaged in the process.

Two's company?

This year we also began another experiment to investigate whether or not establishment success of a new agent may be affected by competition with an existing agent for the same resource. These days it is rare to find a stand of broom in New Zealand that is not infested with the broom twig miner (*Leucoptera spartifoliella*). When twig miner populations become large, they can knock broom hard. The foliage becomes

brown, and flowering, pod formation, and growth are all severely retarded. The success of the twig miner may make it difficult for us to establish other agents for broom. This year we have begun a long-term experiment at Lincoln to test this idea, using

broom psyllids, and also to measure the impacts that these two agents have on the growth of broom plants. "We chose to use psyllids because we suspect that they are particularly vulnerable to competition from twig-mining caterpillars," explained Simon Fowler. "This is because their eggs need to survive the winter under the surface of green broom stems, and these are actively mined by the caterpillars at this time". In the natural order of things psyllids lay their eggs in the new growth first. Already we have observed that the twig miners don't seem to be fussy about laying eggs on stems that already have psyllid eggs on them.

Local knowledge

This year we moved a step closer towards developing integrated control for broom. We are more likely to be successful at controlling weeds if we can use all the tools available to us. The problem is that no one really knows a lot about how various control techniques affect each other. "First of all we needed to find out how people in the field are actually controlling broom at

present," said Jeremy Sheat. "With the assistance of social scientist Margaret Kilvington, the Amuri Broom Group, forestry workers, the Department of Conservation, and Canterbury Regional Council staff, who helped us to formulate the right questions, we sent out 170 questionnaires to farmers in the North Canterbury area and got 100 replies back." As a small incentive all the people who returned the questionnaire went in a draw to win 20 litres of glyphosate herbicide. Congratulations to the winner, Rotheram farmer, David Orpwood! "We were amazed to get such a good response," said Margaret. "It demonstrates the high level of concern that people in North Canterbury have about this rampant weed, and their desire to do something about it." The information is being collated and, while many people seem to have their own special tactics, generic control techniques are being identified. Field trials will be set up next year to look at the interactions between popular control techniques and biological control agents, so that the best solution for combating broom can be identified.

This research is funded by the Amuri Broom Action Group (through an AGMARDT grant), the Foundation for Research, Science and Technology, Landcare Research's Non-Specific Output Funding, the Leverhulme Trust, and by participants in our technology transfer programme.



Millennium Bugs

Due to popular demand we delved into the prospects for biological control for another six weeds this year. They are banana passionfruit, bone-seed, Chilean needle grass, climbing asparagus, nassella tussock, and woolly nightshade. This information is crucial for helping all the organisations that are responsible for weed control in New Zealand to decide on directions and priorities for the new millennium. Six feasibility studies have been produced, and the main findings of three of these are reported below. The other three will be summarised in future newsletters. Copies of the feasibility studies are available from Lynley Hayes (see back page).

Bone-seed (*Chrysanthemoides monilifera* ssp. *monilifera*)

You notice an invasive shrub glowing with bright yellow flowers. You ask yourself, is it gorse, is it broom? Then you realise it's something else! Bone-seed is widely established in New Zealand, especially in northern and eastern areas. In 1988 it did not feature in the top 50 candidates for biological control, but since then it has begun to spread its range from traditional coastal and urban areas to inland pasture and conservation areas. For large infestations traditional control measures are prohibitively expensive or environmentally unacceptable.

Bone-seed, and a close relative bitou bush (*Chrysanthemoides monilifera* ssp. *rotunda*), are the targets of biological control programmes in Australia. Surveys in South Africa identified at least eight potential biological weapons to use against these plants. The initial results from Australia are promising and New Zealand is in a good position to take advantage of progress made there. In our favour we do not have any plant species of economic or conservation importance that are closely related to bone-seed in New Zealand. Also the potential agents are highly specific so the likelihood of running into difficulties over non-target impacts would be low. Furthermore the parts of New Zealand where bone-seed occurs are reasonably well matched ecologically with South Africa.

There are at least four agents that may be suitable to release in New Zealand. These include a defoliating caterpillar (*Tortrix* sp.) that deforms the growing tips and causes plants to die prematurely, a seed-feeding fly (*Mesoclanis magnipalpis*) that may help stop bone-seed from spreading, and a tip moth (*Comostolopsis germana*) whose caterpillars feed on shoots, reducing flowering and fruiting. Also, a promising systemic rust fungus (*Endophyllum osteospermi*), which causes malformation of growing tips and the death of branches and whole bushes, is available.

Climbing asparagus (*Asparagus scandens*)

Climbing asparagus is a problem in bush remnants and urban areas where it kills trees by ringbarking them, and prevents regeneration by forming a carpet of vegetation more than 2 m thick. Birds can drop seeds in dense bush giving rise to new infestations. In a recent weediness ranking, carried out by the Auckland Regional Council, this plant was ranked 6th out of 47 environmental weeds. Climbing asparagus is already widespread in many areas of the North Island, and has the potential to invade a much larger area. Herbicidal controls are available, but these are of limited use in native forests.

Like bone-seed, climbing asparagus is also native to South Africa. No biological control programme for this weed has been attempted elsewhere, and no known biological control agents are available. A programme is underway in Australia for a close relative, bridal creeper or smilax (*A. asparagoides*), which is also a problem weed here too. They have identified at least four promising potential agents: a leaf hopper (*Zygina* sp.), a leaf beetle (*Crioceris* sp.), a seed-feeding wasp (*Eurytoma* sp.), and a rust fungus (*Puccinia myrsiphylli*). However, only one of these, the wasp, is likely to attack climbing asparagus and it may also harm the fruits of cultivated asparagus (*A. officinalis*).

Photo: Alistair MacArthur



Ruth Bunney, Auckland Regional Council, wades through a sea of climbing asparagus at Whakanewha Regional Park (Waiheke Island)

prospects have been found heavily damaging nassella tussocks in Australia (*Zinzipegasa argentinensis* and *Fusarium* sp.). A model is also being developed by AgResearch scientists that may help us decide which agents might be most useful.

Some damage to climbing asparagus was noticed during surveys for potential agents for bridal creeper. If biological control options are to be pursued for this weed, then a survey would need to be carried out in South Africa to follow up on these leads. Any potential agents would also need to be specific enough not to harm cultivated asparagus. We can take heart from the knowledge that agents with these qualities exist for bridal creeper, and that we do not have any native plants in the Asparagaceae family to contend with.

Nassella tussock (*Nassella trichotoma*)

People have been battling with nassella tussock in the drier parts of New Zealand for more than five decades. This South American weed currently only

occupies about a quarter of its potential range here, and as dry conditions seem likely to become more prevalent, this problem is unlikely to be overcome with the current tools available. Grubbing remains the primary method of control, but prospects for biological control options are now looking bright.

An Australian programme is underway for this weed too! In August researchers plan to expand the search for suitable control agents in Argentina, after exploratory surveys found nine species of fungi attacking nassella tussock there. Two of the most promising of these (*Corticium* sp. and *Puccinia* sp.) cause dieback and/or declining populations in Argentina, while two other good

Plant systematists now suggest that nassella tussock is less closely related to New Zealand native stipoid grasses than was previously thought, and all the *Nassella* spp. in New Zealand are currently or potentially serious weeds. This improves our chances of finding safe and politically acceptable biological control agents. However, because nassella tussock is a grass, a large number of other plants would need to be screened against any potential agents. Not surprisingly the Australians are keen for us to collaborate with them and share the costs of host-range testing.

These projects were funded by Auckland, Canterbury, Northland, and Wellington regional councils, Environment Waikato, and Marlborough District Council.



Is *Fusarium* a Fussy Blighter?

Fusarium tumidum spores are the active ingredient of GOB-stopper, the mycoherbicide being developed against gorse and broom. These spores can be lethal to gorse and broom plants in glasshouse tests, but what effect do they have on other plants? This is what Jane Fröhlich and Alison Gianotti have been trying to work out.

In New Zealand fusarium blight has only been recorded attacking gorse, broom, and an unidentified *Lupinus* species. These three hosts are closely related members of the legume family (Fabaceae). Closely related plants tend to be susceptible to the same diseases because they have many attributes in common, e.g. defence mechanisms against pathogens. “We had a hunch that fusarium blight would be restricted to the legume family,” said Jane, and “we designed some experiments to check this.”

Obviously Jane and Alison couldn't possibly test every plant in New Zealand, so they selected a representative sample. So far, they have tested the 10 plant species most likely to come into contact with the mycoherbicide, and be susceptible to it, if it is applied in a plantation forest. A further 10 species, that are either

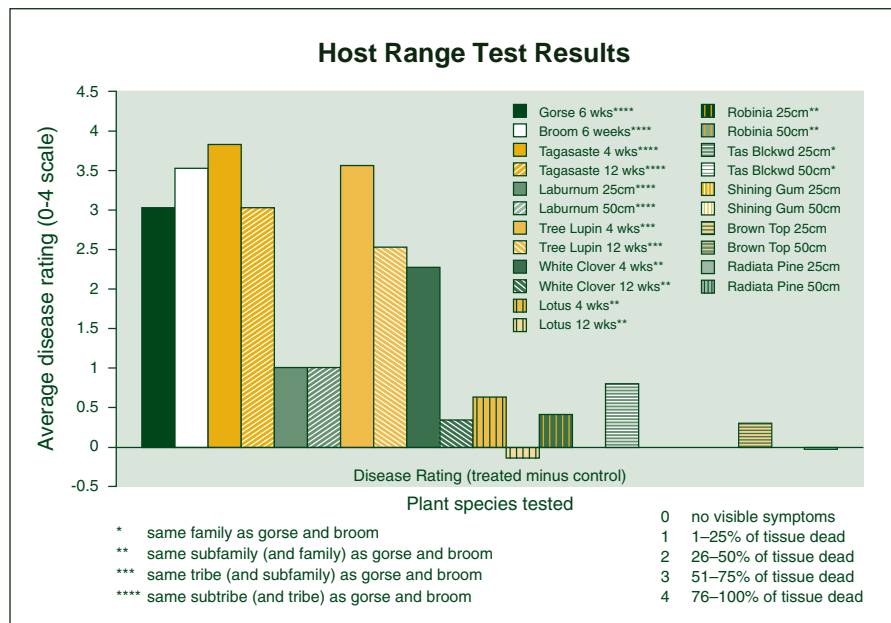
commercially and/or environmentally important, will be tested in the next couple of months.

Large numbers of *F. tumidum* spores were liberally applied to test plants kept under ideal conditions for infection in the laboratory. A week later the disease symptoms of each test plant were assessed (see graph). Jane reports, “As expected the species most severely affected, tree lucerne and tree lupin, were among the closest relatives of gorse and broom. Plantation tree species (e.g. laburnum) turned out to be less susceptible than ground covers (e.g. tree lupin), because the fungus can kill soft foliage and stems, but not tough, woody stems. Younger plants tended to be more susceptible than older plants. For example, young white clover (4 weeks old) showed disease symptoms while older

clover (12 weeks old) was hardly affected. Fortunately pine species (*Pinus radiata*) of any age appear to be safe.”

These results suggest that, under ideal conditions, fusarium blight could damage other legumes. “Since fusarium blight occurs naturally here, and no problems have been reported to date, it is unlikely that the fungus would damage non-target species under field conditions unless it is applied directly, or close to them, in unnaturally high concentrations,” said Jane. “This means that we will need to put warning labels on Gob-stopper to ensure that susceptible plants are not sprayed directly with the fungus — we would not expect it to cause problems outside sprayed areas.”

This research was funded by the Foundation for Research, Science and Technology.



Heather Project Calls for Reinforcements

Our armed forces have become involved in the battle to control heather in the central North Island. The land surrounding Waiouru Army Camp is seriously infested with the plant, and the New Zealand Army spends a lot of money each year fighting this particular invader. This year we provided our armed forces with some extra recruits, in the shape of heather beetles (*Lochmaea suturalis*). The beetles were released at two sites on army land. Many more releases of these natural born weed killers are planned for the future.

The army currently manages their heather problem by aerially spraying with Pasture Kleen® (2,4-D ester) and spot spraying with Tordon Brushkiller®. This year the army funded some work to see what effects these chemicals might have on the beetles, so that a beetle-friendly strategy can be devised to maximise their potential. Pasture Kleen® was found to be toxic to heather beetle larvae if they come into direct contact with this chemical. However, adult beetles were not affected unless the herbicide was applied at 10 times the normal application rate. The beetles may still suffer from sub-lethal effects at lower concentrations and more trials would be necessary to evaluate these.

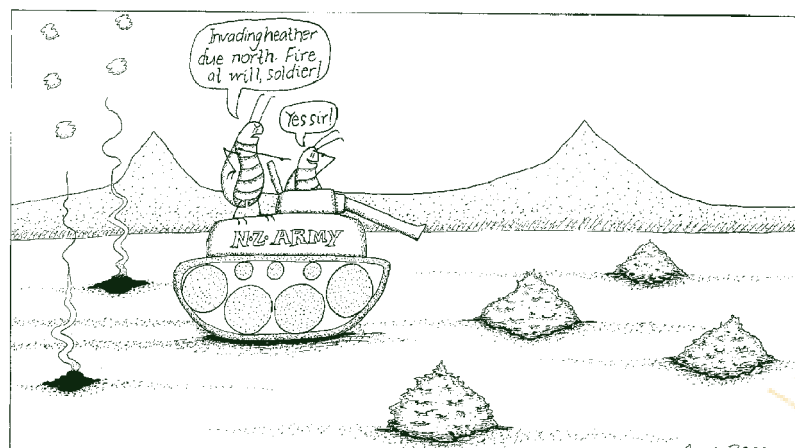
On the other hand Tordon Brushkiller® was not lethal to either adults or larvae, either through direct contact with the herbicide or by eating sprayed plant material, even when applied at 10 times the usual application rates. Beetles sprayed with this herbicide appeared to eat more and survive longer than counterparts sprayed with water. This may be because some herbicides can make plants more palatable to insects. These preliminary observations suggest that Tordon Brushkiller® might be a useful component in an integrated approach.

Also this year we went back to check the Department of Conservation sites where the heather beetle was released in Tongariro National Park in 1997. The adult beetles are difficult to find amongst the heather when they are in low numbers, especially since they have a tendency to drop to the ground when disturbed. This meant that we had to search for larvae by cutting branches off heather bushes and beating

these into a white tub. "Despite careful searching at each of the release sites we did not find any live heather beetle larvae or adults," reports our man on the spot, Paul Peterson. At one site we found two dead adults in the litter layer and one dead adult at another site. "Although this was a disappointing result, we were probably being a bit optimistic expecting to find the insects only one season after release," said Paul. Many control agents take several years to establish and become common enough for us to find them.

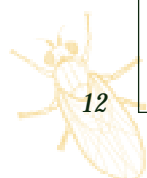
A vegetation survey of Tongariro National Park was done by Ian Atkinson in 1994–95. This year additional data were collected that will allow us to monitor the impact of the heather beetle over a wide area if it does establish and start to spread.

This project is funded by the Department of Conservation, the Foundation for Research, Science and Technology, and the New Zealand Army.



Quarantine Graduates — Where Are They Now?

Alligator weed beetle (<i>Agasicles hygrophila</i>)	Established* widely, and damages alligator weed throughout Northland and Auckland, and at one site in Waikato.
Alligator weed beetle (<i>Disonycha argentinensis</i>)	Released widely in Northland and Auckland in the early 1980s, but failed to establish.
Alligator weed moth (<i>Vogtia malloi</i>)	Established and damages alligator weed at several sites in Northland, and one site in Auckland.
Broom psyllid (<i>Arytainilla spartiophila</i>)	Established in all broom-infested regions except for Northland (not yet released there) and the West Coast (only recently released there).
Broom seed beetle (<i>Bruchidius villosus</i>)	Established in all broom-infested regions except for Northland, and the West Coast (beetles have been recovered from these areas).
Californian thistle flea beetle (<i>Altica carduorum</i>)	Possibly established at one site in Southland. Signs of the beetle have been seen at 12 other sites throughout the country.
Californian thistle gall fly (<i>Urophora cardui</i>)	Released at 11 sites throughout the country. Galls have been seen at seven of these sites.
Californian thistle leaf beetle (<i>Lema cyanella</i>)	Established in low numbers at sites in Auckland, Canterbury, and Manawatu-Wanganui. Signs of the beetle have also been seen at 17 other sites throughout the country.
Gorse colonial hard shoot moth (<i>Pempelia genistella</i>)	Released at two sites in Auckland and Canterbury but not seen since. Further releases are planned.
Gorse hard shoot moth (<i>Scythris grandipennis</i>)	Failed to establish from the small number released at one site in Canterbury.
Gorse pod moth (<i>Cydia succedana</i>)	Established now in all regions except Southland and dispersing quickly.
Gorse soft shoot moth (<i>Agonopterix ulicetella</i>)	Established in low numbers at sites in Canterbury (3), Gisborne, and Bay of Plenty. Also found at five other sites throughout NZ.
Gorse spider mite (<i>Tetranychus lintearius</i>)	Six strains are widely established throughout NZ and cause noticeable damage at many sites.
Gorse thrips (<i>Sericothrips staphylinus</i>)	Established widely throughout NZ, but dispersing extremely slowly.
Hieracium gall wasp (<i>Aulacidea subterminalis</i>)	Released this season at two sites in Canterbury's Mackenzie country. Mass-rearing is underway to allow widespread releases to begin soon.
Hieracium plume moth (<i>Oxyptilus pilosellae</i>)	Released this season at one site in Canterbury's Mackenzie country. Mass-rearing is underway to allow widespread releases to begin soon.



Heather beetle (<i>Lochmaea suturalis</i>)	Released at 18 sites in and around Tongariro National Park. Their fate is unknown.
Mist flower fungus (<i>Entyloma ageratinae</i>)	Released this season at nine sites in Auckland, Northland, and Waikato. Secondary infections were seen at each site several weeks later.
Nodding thistle crown weevil (<i>Trichosirocalus horridus</i>)	Established widely throughout NZ and kills rosettes at many sites.
Nodding thistle gall fly (<i>Urophora solstitialis</i>)	Established now in all nodding-thistle-infested regions except for Manawatu-Wanganui, and Southland.
Old man's beard leaf fungus (<i>Phoma clematidina</i>)	Established in all old-man's-beard-infested regions. Causing noticeable damage at many of the damper sites and dispersing rapidly.
Old man's beard leaf miner (<i>Phytomyza vitalbae</i>)	Established in all old-man's-beard-infested regions and becoming common even on isolated infestations. Dispersing extremely rapidly.
Old man's beard sawfly (<i>Monophadnus spinolae</i>)	Released at one site in Canterbury. Mass-rearing techniques are being developed to allow widespread releases to begin soon.
Scotch thistle gall fly (<i>Urophora stylata</i>)	Released at two sites in Auckland in November-December 1998. Galled flowerheads recovered in January 1999.
Cinnabar moth (<i>Tyria jacobaeae</i>)	Established patchily throughout NZ and causes obvious damage in some areas.
Ragwort flea beetle (<i>Longitarsus jacobaeae</i>)	Established widely throughout NZ and reduces ragwort rosette densities at many sites.
Greater St John's wort beetle (<i>Chrysolina quadrigemina</i>)	Progeny of the 1991 releases have been seen at two sites in Canterbury. Not checked recently.

* Univoltine agents are recorded as established when they are found in increasing numbers for 2 or more years after release. Multivoltine agents are recorded as established when they are found after one winter and have completed several generations.



News Flashes

Natural Born Weed Killers — the movie!

While it's not in the same league as "Star Wars", or "The Titanic", "Natural Born Weed Killers" will fill an important niche in educating the general public about biological control of weeds. This educational video was funded by a consortium of 14 regional and district councils, made with the assistance of a Nelson-based company, Digital Media Communications, and features a cast of millions (insects that is). The storyline is simple. A school boy, George, has been given an assignment on biological control of weeds, so he gets onto the Internet and taps into a wealth of information. He leads us through a series of the most commonly asked questions and all is revealed. Look out for "Natural Born Weed Killers" at an A&P show or field day near you. Enquiries to Lynley Hayes (see back page).

The Biological Control of Weeds Book - Te Whakapau Taru

This year we produced the third set of pages for "The Biological Control of Weeds Book" describing the life and times of the various agents available for broom and old man's beard. We also prepared pages on the best way of harvesting gorse pod moth and nodding thistle gall fly, and assessing the impact of ragwort flea beetle.

The fourth set of pages for the

book are well in hand, and should be available in September 1999. They will include some additional material for the Basics section on safety issues

and success stories, pages on Californian thistle, Scotch thistle, and mist flower agents, and a new miscellaneous section describing such diverse agents as blackberry rust, hemlock moth, and St John's wort beetles. Because there are now quite a few pages to keep track of, an index is also being prepared.

The plots thicken

In January, regional council staff from around the country converged on Palmerston North for a special workshop. For a while now regional councils and Landcare Research have been grappling with finding ways to quickly and effectively assess the impact of control agents. This is not as easy as it sounds because, to be scientifically rigorous and meaningful, proper trials must usually be set up that are identical in every way bar one — they are either infested or not with a particular agent. These trials can be time-consuming and easy to ruin, resulting in expensive, useless data.



Photo: Peter Ayson

Peter McGregor explains to a group of regional council staff the right and wrong way to set up assessment plots

Peter McGregor, Paul Peterson, and Chris Winks put their heads together and devised a straightforward and quick method where people can simply remove ragwort flea beetles (*Longitarsus jacobaeae*) from small plots. The workshop in Palmerston North was convened to teach council staff how to set up their plots without bias, how to treat the plots to keep some free of beetles, and how to collect appropriate data. Council staff are sending these data to Peter and Paul for analysis and they will report back on the outcomes on both a regional and national basis. Next year Peter and his co-workers are putting their energy into developing another tool to help assess the impact of the three agents for nodding thistle.

Hieracium - the famous five

The first two insects for hieracium are now "out there" and three others are waiting in the wings. The hieracium gall wasp (*Aulacidea subterminalis*), which damages the stolons



(the long runners that the plant uses to reproduce and invade new areas), was released at two sites in the South Island's Mackenzie country in February. The hieracium plume moth (*Oxyptilus pilosellae*), which damages the centre of the rosette plants, was liberated at one site in the same area in March. Lindsay Smith is working hard at mass-rearing both agents so that widespread releases can be made as soon as possible.

appear to be quite specific to hieracium and therefore safe to introduce to New Zealand.

The two hover flies are similar in appearance but one damages the roots, while the other feeds within the leaf axils and rosette crowns. Like the gall wasp, the gall midge will deform the plant. However, while the gall wasp damages the stolons, the gall midge damages the leaves. Lindsay began some

laboratory trials this year, and he plans to set up field trials next year, to try to quantify the impact that galled stolons have on hieracium growth.

Photo: Otago Daily Times



Lindsay Smith and Pauline Syrett along with Allan Innes and John Aspinall (of the Hieracium Control Trust) celebrate the release of the first agent to attack hieracium

A triple-banger application to the Environmental Risk Management Authority is being prepared. To avoid repetition and increase efficiency The Hieracium Control Trust are requesting permission to introduce three agents at once: the gall midge (*Macrolabis pilosellae*), root hover fly (*Cheilosia praecox*), and crown hover fly (*Cheilosia psilophthalma*). The final testing, will be completed before Christmas. Early results indicate that these three agents

Testing for tassie

In October Hugh Gourlay travelled to Australia with a precious package in his hand luggage containing gorse spider mites (*Tetranychus lintearius*). This was the culmination of a project in which Hugh had carried out comprehensive tests to ensure that the mites would be safe to introduce to Australia. It was agreed that Hugh should accompany the first shipment so that he could show the Australians how to handle the mites and manage

them inside a quarantine facility. But even the best laid plans can go awry! Once safely delivered to the Tasmania Institute of Agricultural Research, the mites mysteriously began to die. A case perhaps for Mulder and Scully? No, our own investigators, Hugh and John Ireson (Tasmanian Department of Primary Industry and Fisheries), managed to identify the culprit. The brand new paint brushes bought especially for transferring the mites individually to new plants turned out to be contaminated with a chemical that was lethal to the mites! But all's well that ends well. Some extra mites were quickly bundled up at Lincoln and sent over. Their progeny are now getting stuck into Australian gorse.

This year Hugh also began testing gorse thrips (*Sericothrips staphylinus*) to check that they too will be suitable for introduction to Australia. He has been asked to test 38 plant species including native acacias and grevilleas. Hugh has done this in two ways. Firstly, he jammed test plants up against thrips-infested gorse and let thrips rain down on them. Secondly, he physically put the tiny thrips onto test plants to see if they could survive. As expected, the thrips appear to be confined to gorse and Hugh hopes to be able to hand deliver some of these to Tasmania in the spring.



Further Reading

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What's New In Biological Control Of Weeds? (issues 1–12) are available from Lynley Hayes (address below).

Contact Addresses

Lincoln Staff:

Hugh Gourlay, Helen Harman, Lynley Hayes, Richard Hill, Trevor Partridge, Jeremy Sheat, Lindsay Smith, Pauline Syrett.
Landcare Research
PO Box 69
Lincoln, New Zealand
Ph +64 3 325 6700
Fax +64 3 325 2418

Nelson Staff:

Richard Harris, Richard Toft
Landcare Research
Private Bag 6
Nelson,
New Zealand
Ph +64 3 548 1082
Fax +64 6 546 8590

Palmerston North Staff:

Peter Berben, Peter McGregor, Paul Peterson.
Landcare Research
Private Bag 11052
Palmerston North,
New Zealand
Ph +64 6 356 7154
Fax +64 6 355 9230

Editor: Lynley Hayes

Cartoons: Anne Rose

Thanks to: Christine Bezar

Layout: Kirsty Cullen

ISSN 1173-6356

Auckland Staff:

Alison Gianotti, Simon Fowler, Jane Frohlich, Chris Winks.
Landcare Research
Private Bag 92170
Mt Albert, Auckland,
New Zealand
Ph +64 9 849 3660
Fax +64 9 849 7093

Published By:

Landcare Research
New Zealand Ltd
PO Box 69, Lincoln



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