Patua Te Otaota - Weed Clippings

Biological Control of Weeds Annual Review 1997/98

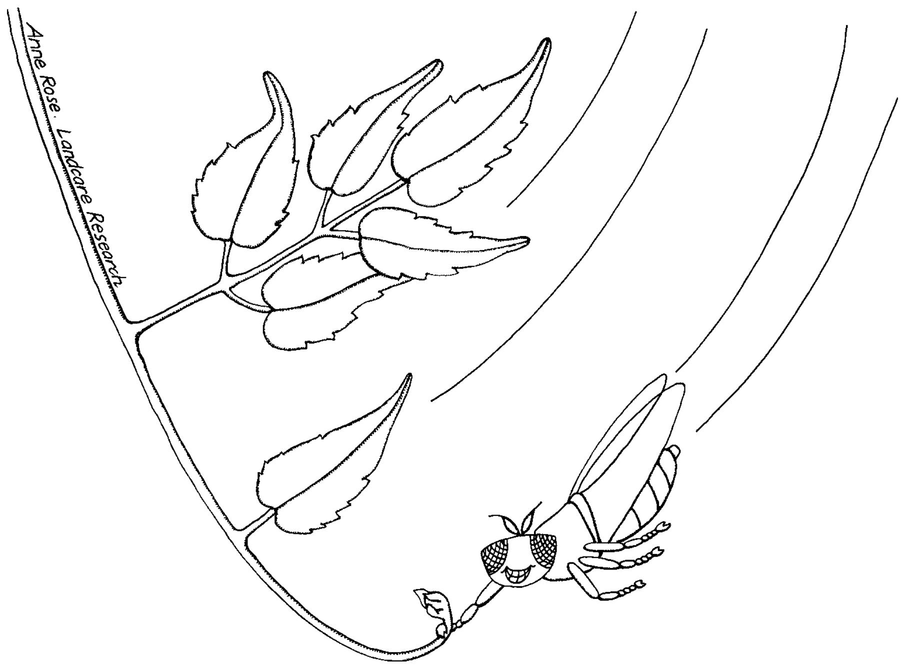
What's Inside:

Introduction

- Welcome to the fourth 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

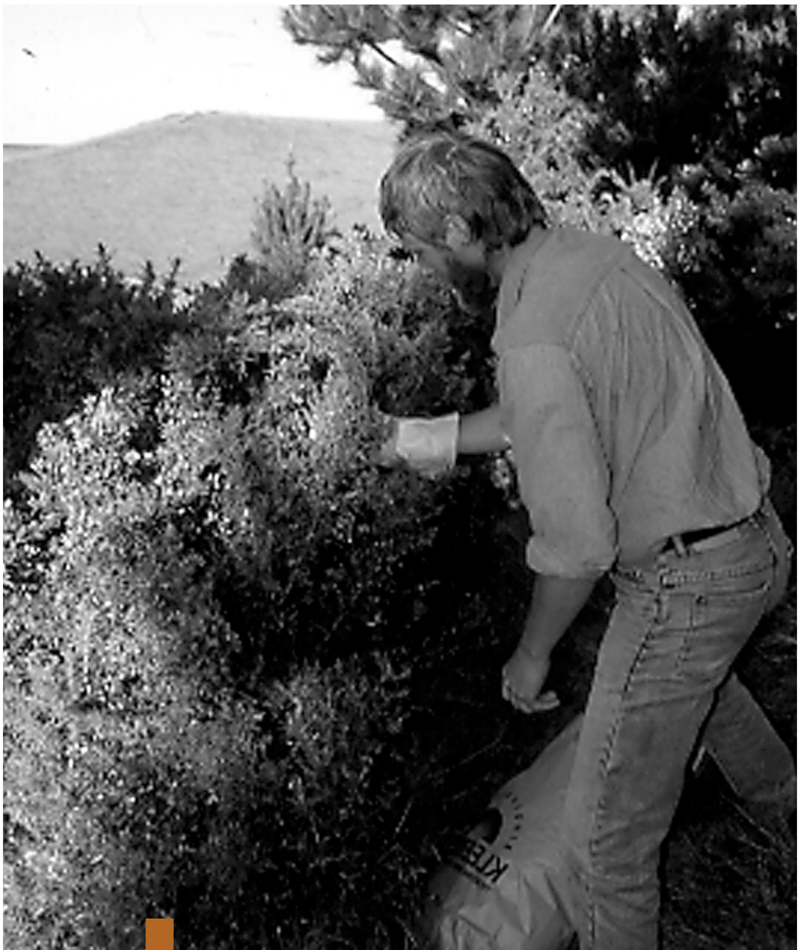
- Meet the smut that we are hoping no one will disapprove of!
- Rejoice in the news that the old man's beard agents are already beginning to fight back. Marvel at the incredible distances that these tiny agents have already covered.
- Read about the insects that are poised to launch an attack on hieracium soon.
- Discover how to get broom seed beetles, gorse pod moths, and nodding thistle gall flies every place you want them to be, and make plans to start this coming spring.
- Master a simple new assessment technique that you can use to scientifically evaluate the impact of ragwort flea beetle on your own patch — white lab coats optional!



- Follow up the fate of George and Mildred, and the other broom psyllids and gorse thrips that have donated their bodies to science so that we can develop even more efficient release strategies.
- Peruse the fate of all the control agents that have graduated from quarantine and made their way out into the world.
- Catch up on the latest in the war against heather in Tongariro National Park.
- Find out about another gall fly that we are hoping to release, this time for Scotch thistle.
- Digest recent progress in developing the mighty mycoherbicide for gorse and broom, GOB stopper.
- Understand the dilemma caused by the broom leaf beetle and what we plan to do about it.
- Get up to date on the latest glossies and posters available on biological control of weeds.

Control Agents Released in 1997/98

Species	**Releases Made**
Broom psyllid (*Arytainilla spartiophila*)	10
Broom seed beetle (*Bruchidius villosus*)	12
Californian thistle gall fly (*Urophora cardui*)	5
Gorse soft shoot moth (*Agonopterix ulicetella*)	8
Gorse pod moth (*Cydia succedana*)	7
Gorse thrips (*Sericothrips staphylinus*)	8
Nodding thistle crown weevil (*Trichosirocalus horridus*)	10
Nodding thistle gall fly (*Urophora solstitialis*)	11
Old man's beard leaf fungus (*Phoma clematidina*)	11
Old man's beard leaf miner (*Phytomyza vitalbae*)	1
Total	**83**



Chris Winks releasing gorse thrips.

Beauty & the Beast

When witnessing a battle between a fungus and a pretty plant you might reach for some fungicide. However, when the flower is the invasive weed mist flower (*Ageratina riparia*) and the white smut fungus (*Entyloma ageratinae*) has been especially imported as a biological control agent from Hawai'i, you might like to make an exception!

Do not be deceived by mist flower's slender purple stems and clusters of small white flowers. The plant is slightly toxic, fast-growing and aggressive — each plant can produce as many as 100,000 seeds annually. In 1988, mist flower infestations were common north of Auckland and localised in south Auckland, Lower Hutt, and Wellington City. Ten years on, mist flower has extended its range to Gisborne, Waikato (Coromandel Peninsula), Bay of Plenty, and a number of islands including Waiheke and Little Barrier.

In 1995 the Auckland Regional Council asked Landcare Research to evaluate the feasibility of copying a successful Hawai'ian biological control programme, where a white leaf smut was used to quickly subdue mist flower. This fungus penetrates the leaf surfaces and grows in the spaces between the cells. Infected plants develop lesions and fungal spores cause the undersides of these spots to appear white — hence the common name, white smut.

First of all we had to decide if the fungus could thrive in New Zealand. Richard Hill and Louise Morin compared environmental conditions where the fungus had been effective in Hawai'i with mist flower-plagued areas here. They concluded that New Zealand was both warm and wet enough for the leaf smut to do its stuff.

Then we had to make sure that the fungus was safe to unleash upon the environment. The host-range of the mist flower leaf smut had already been tested thoroughly by several countries, but we asked our colleagues in Hawai'i to test some of New Zealand's unique daisies. Of the 89 plant species that have now been exposed to the smut, only one close relative, Mexican devil weed (*Ageratina adenophora*), has shown a mild response. "As Mexican devil is potentially a troublesome weed in its own right, the evidence suggests that the mist flower smut poses no threat to the New Zealand environment," plant pathologist Jane Fröhlich explained.

The results reported here have been written up in an importation impact assessment which was submitted to MAF in February. If our findings on the usefulness and safety of the mist flower smut fungus are accepted, then this spring you may be able to cheer on a beautiful smut as it battles with a beastly flower.

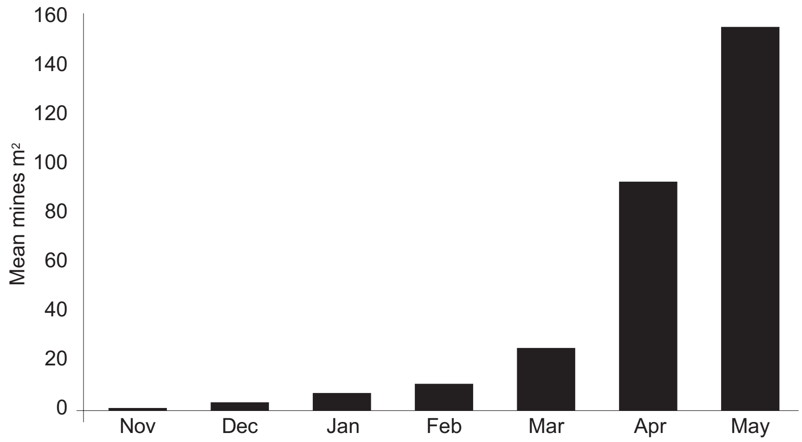
This research is funded by the Auckland Regional Council, Department of Conservation (Northland Conservancy), Environment Waikato, and Northland Regional Council.

The mist flower white smut fungus

Old Man's Beard Wars - the Agents Strike Back

The incredible journey

This year we anxiously went out to check the sites where we had released the old man's beard leaf miner (*Phytomyza vitalbae*) the year before. The leaf miners had looked promising in the autumn after their release but the question uppermost in our minds was had they survived the winter? Anticipation quickly turned to elation as we confirmed that the leaf miners were alive and well in the Bay of Plenty, Gisborne, Hawke's Bay, Manawatu-Wanganui, Wellington, Tasman, Marlborough, Canterbury, and Southland regions. "We have been blown away by the speed with which the flies seem to be dispersing, given their tiny size (1–2 mm long), " said Hugh Gourlay. So far Lindsay Grueber, of the Tasman District Council, holds the record for the most mobile leaf miners. Lindsay found mined leaves at the Sherry River which is 30 km south of the Dove River Bridge where they were released. He also found the miners 20 km away at Pangatotara in the opposite direction, as well as on old man's beard infestations in between.



The mean number of mines made per square metre by the old man's beard leaf miner at Ashburton River during 1997/98.

Initially it appeared that leaf miners had turned up their toes at the Monowai site in Gisborne, as several checks failed to turn up even the slightest trace. However, it turned out that leaf miners had not perished but shifted from this shady damp isolated infestation to another they liked better. "I was quite startled to find the leaf miners when I was checking on the progress of the old man's beard leaf fungus at a site 5 km away, " reported Chris Winks.

A detailed study at our Ashburton river bed site has revealed that, as well as mines becoming more widespread, the number of mines per square metre of leaf material is on the increase (see graph).

Paint it black

Shady and damp might not be great for leaf miners, but it is ideal for the moisture-loving old man's beard leaf fungus (*Phoma clematidina*). In the spring we armed ourselves with garden sprayers and let old man's beard have it. Adrian Spiers (HortResearch) grew batches of the leaf fungus for us in his laboratory in Palmerston North. We then mixed the fungus with water and sprayed it liberally onto old man's beard infestations throughout the country. The El Niño weather pattern, that has gripped most of New Zealand in baking hot, tinder dry conditions, has been less than ideal for the leaf fungus, but it has still managed to heavily damage old man's beard at some sites. "So far the fungus has exceeded all my expectations," reports Adrian.

Richard Harris visited a release site near Palmerston North with Adrian in May. "All of the plants had blackened, dead and dying leaves and stems, and it looked as though whole vines had been killed," said Richard. Similar damage has been seen at other sites in the Manawatu-Wanganui region, namely Taihape, Ohakea, and Awapuni (the bulk of release sites will not be checked until spring 1998). Badly infected vines have not set any seed,

Hugh Gourlay releasing old man's beard fungus.

and many of the seed heads that did form were destroyed by the fungus. "The dead leaves are just packed with inoculum so the results next season should be even more impressive," said Adrian. The fungus can also survive on the soil surface where it can attack any seedlings that germinate. The leaf miner is not the only old man's beard agent to be quickly getting around. Adrian has found that the fungus has already spread from the Ohakea site to Hunterville 30 km north — the fungal spores are naturally spread by water splash, wind, and rain. We also believe that the fungus can be vectored by the leaf miner. "I have noticed that the fungal infections are more severe where insects are damaging the leaves, especially at drier sites,"said Adrian.

This year we helped Adrian to "think big" and investigate the possibility of bulk aerial application of the fungus. Adrian cultured a large batch of fungal spores on malt agar. He mixed up the fungal-infested agar with water in a blender, and then used a helicopter to apply 400 l of the resulting mixture over a 50-m stretch of old-man's-beard-infested gully at Taihape. Uniform infection has since appeared throughout the site, so the technique will be developed further. Adrian reports that he is now working with Industrial Research to develop a practical way of mass-producing the fungal spores.

Sawfly cuts the mustard

This year we were granted permission to release a third agent for old man's beard, the sawfly (*Monophadnus spinolae*). In late January, Hugh Gourlay and Richard Hill made the first field release at the Department of Conservation's Kaituna Reserve, on Banks Peninsula. Sawfly larvae damage old man's beard by feeding on the leaves. Hugh Gourlay is developing rearing techniques that will allow us to make widespread releases of this agent in the near future.

To be or not to be

This year the fate of the old man's beard bark beetle (*Xylocleptes bispinus*) was decided. The bark beetle showed much promise because of its ability to destroy whole stems. Old man's beard stems in Switzerland rarely exceed 5 cm in diameter, and it is believed that the bark beetles may be responsible for killing any larger stems. Safety-testing of the bark beetle proved to be a challenge, and at the end of the day we have been unable to prove that this agent would confine its activities to old man's beard. The tests showed that the beetle is unlikely to attack any plants outside of the *Clematis* family, but that it has a range of hosts within this family, including native New Zealand species. While it is disappointing that we will not be able to use this agent, safety issues must always take precedence.

This work is funded by the Department of Conservation, the Foundation for Research, Science and Technology, and participants in the Technology Transfer Programme.

The old man's beard bark beetle has been rejected as a possible control agent for New Zealand.

Simply the Best

Penny Stephens cutting broom pods infested with broom seed beetles.

If most biological control agents are left to disperse under their own steam, then it will be many years before they become widespread. However, we can reduce the waiting time by giving the agents a helping hand. This year we completed three studies to figure out the best way of harvesting and relocating broom seed beetles, gorse pod moths, and nodding thistle gall flies, so make plans to start this spring! The techniques are described briefly below and will be covered in more detail in the next batch of pages for “The Biological Control of Weeds Book”, due to be published in August 1998.

Broom seed beetle

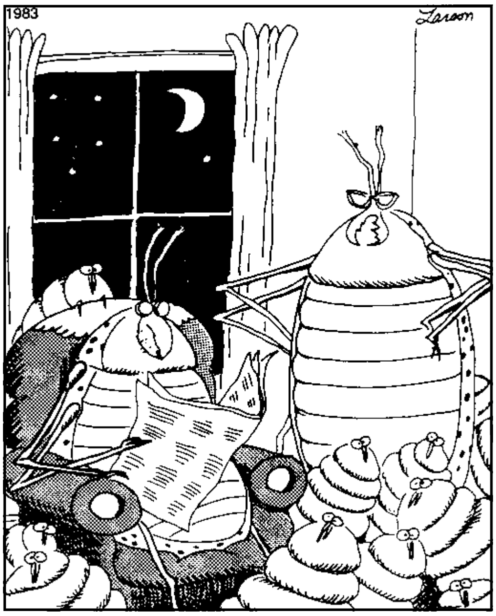
You will normally have to leave a newly established release site for at least 4 years before there are enough beetles for you to begin harvesting them. You can either harvest beetles in the spring or infested pods in late summer. If you intend to harvest beetles, go to the site in the spring when between one-third and one-half of the bushes are flowering. Beat some broom flowers with a stick over a large piece of white material or cardboard for 5–10 seconds, and then collect any beetles that have been dislodged with a pooter attached to a compressor. Repeat until you have at least 500 beetles. If it takes you longer than an hour to collect this many beetles then you should leave the site undisturbed for at least another year.

Alternatively, if you prefer to harvest pods, keep an eye on how they are maturing at the site over the summer. It is important to leave the pods on the plant until they are mature and blackish-brown in colour. If you cut the pods too early then the beetles may not be able to complete development and may die. However, if you leave it too late then the pods will burst open and the beetles will escape. Cut off branches with ripe pods and either put them into sacks or wrap them in a tarpaulin — be careful that you do not inadvertently spread seed around the countryside. You need to shift at least 1000 beetles, so conservatively you will need to shift several thousand pods (10–20 branches) to each new site. Transport your infested pods as quickly as possibly to the new site, and wedge them into the bushes growing there.

Gorse pod moth

You will usually need to leave a newly established release site for at least 3 years before there are enough moths for you to begin harvesting them. You can harvest infested pods in the spring or autumn — but the moths are more abundant in the spring. Go to the site when the gorse is flowering to check whether you can see good numbers of moths fluttering about the site. If the day is cloudy and cool and / or you cannot see many moths, then you will need to use a pheromone trap to decide if harvesting is feasible.

Keep an eye on how the pods are maturing at the site. It is important to leave the pods on the plant until they are leathery and green to light-brown in colour. If you cut the pods too early then the caterpillars may not be able to complete development and may die. However, if you leave it too late then the pods will be empty. Cut down whole bushes if possible, otherwise just remove branches and wrap them up in a tarpaulin — be careful that you don’t inadvertently spread seed around the countryside. You need to shift at least 100 moths to each



"I'm leaving you Charles . . . and I'm taking the grubs with me."

new site, so conservatively you will need to shift several hundred pods in the spring or at least 1000 pods in the autumn. Transport your infested pods as quickly as possibly to the new site. Wedge the infested material into the uninfested bushes or leave it on the ground if there is no danger of it getting blown away.

Nodding thistle gall fly

If your gall flies do well then you may be able to begin harvesting them after 1–2 years. Check for infested flower heads in the autumn — they are obvious because the shiny white pappus hairs remain attached to them. If you pinch these heads between thumb and forefinger you will notice that they are lumpy and almost impossible to break open. You will need to release between 50 and 100 flower heads at each new site and you should leave at least 100 flower heads at your collection site. Using secateurs, or simply thick gloves, cut or pull the infested flower heads off the plants.

We recommend that you put the flower heads in an onion bag or similar — something that is strong enough to last the winter, that has holes in it large enough to let the flies get out in the spring, but is not so large that the flower heads fall out. Divide your flower heads up amongst several bags and securely tie them up off the ground (where mice cannot get them). Over the winter check occasionally that the bags are still as you left them. The flies should begin to emerge once nodding thistles are beginning to produce flower buds in late spring.

If you have had difficulty establishing nodding thistle gall fly then you may wish to try another technique. The gall flies have to compete with the nodding thistle receptacle weevil for the first primary flowers. Competition is less intense for the secondary flowers so time the emergence of gall flies to coincide with these. Collect the flower heads as above and then store them inside paper bags in a fridge or cool store. Remove the flower heads from the fridge in late November and tie them up in onion bags, off the ground, at your release site. The adult flies will emerge in December when nodding thistles are producing secondary flowers.

This research was funded by participants in the Technology Transfer Programme.

Lynley Hayes with infested nodding thistle flower heads being held over the winter in chicken mesh bags.

Judgement Day for Ragwort Flea Beetle

Paul Peterson measuring the density of ragwort plants in trial plots.

All organisations spending money on biological control programmes need to be able to justify the value of this investment. Until recently this has been a tall order as the sort of experimental work required to provide meaningful results has been out of their reach. Landcare Research carried out one such elaborate and long-term study in Canterbury, Otago, and Hawke's Bay to corroborate anecdotal evidence that ragwort flea beetles (*Longitarsus jacobaeae*) are doing a good job at cleaning up ragwort. However, because the effectiveness of any agent will vary throughout the country, the results obtained in this trial cannot be taken as gospel by managers in other parts of the country.

Recently we have been working to remedy this problem. This year Peter McGregor and Paul Peterson finished developing a technique that anyone can use to measure how big an impact ragwort flea beetles are having on their own patch. "Our technique is much faster and simpler than any others currently available," said Paul. This assessment technique is described in detail in the next lot of pages for "The Biological Control of Weeds Book", due out in August 1998. Peter and Paul will also run a hands-on training session early in 1999 to make sure that those people intending to undertake their own ragwort flea beetle audit are completely au fait with what is required.

"The technique that we have developed involves removing ragwort flea beetles from small areas and measuring any subsequent resurgence in ragwort," said Peter. The first step is to choose a site where ragwort flea beetle is well established. "It's not necessary for the beetles to be apparently causing a decline in the ragwort; if they are not having an impact then the technique will show that," explained Peter. Next at least twenty plots (1 x 0.5 m each) are marked out with pegs. Half the plots are sprayed with Orthene® insecticide (mixed with water) at monthly intervals, beginning in late February and finishing in late July. This treatment will protect the plants in these plots from attack by ragwort flea beetles. The remaining plots are sprayed with water to act as a control. Because most ragwort plants are biennial the treatment needs to be carried out for two consecutive years. During this time regular checks are made to confirm that the ragwort flea beetles are still present at the site, outside the treated areas, and to estimate their abundance. The density of small, large, and multicrown ragwort plants in the plots is also measured and recorded every 3 months. "The data will be sent to us for analysis and we will then report back on the results, " said Paul.

In future we hope to build on this work by developing other user-friendly techniques that people can use to evaluate the usefulness of other control biological agents.

This research was funded by participants in the Technology Transfer Programme.

Beating about the Bush

Dr Jane Memmott, of Bristol University, returned to New Zealand again this year to check on some long-term experiments involving broom psyllids (*Arytainilla spartiophila*) and gorse thrips (*Sericothrips staphylinus*). With our help, Jane is trying to put her finger on some of the reasons that biological control agents fail to establish, and develop some rules of thumb that will enable us to improve our release strategies in the future.

In 1994 Otago Regional Council staff helped Jane to release psyllids along a transect of 55 sites. This year Jane got straight off the plane and, accompanied by Pauline Syrett, headed for the wilds of Otago and a week of psyllid sampling. "Field work appears to be a good cure for jet lag, as for the first time in seven trips I did not suffer from it," said Jane. The sampling got off to a bad start when it rained heavily at the first release site. "We beat a damp retreat back to our motel and dried out the beating trays in front of a fan heater," said Jane. The weather forecast promised better weather inland so Jane and Pauline kept on driving towards Central Otago until the rain stopped and the broom was dry enough to sample.

The number of psyllids released at each site varied from just two (one of each sex) to 270 adult psyllids. On previous visits Jane had found that, as expected, establishment was more likely when larger numbers of broom psyllids were released. However, sometimes even the tiny releases were successful. "For the third year in a row we found George and Mildred's descendants (now great-great-grandchildren)," said Jane. The make or break time for broom pysllids appears to be the first year. If the agents can get through the first year they have a good chance of survival (barring natural disasters such as fires and unnatural ones such as farmers with spray guns).

Jane Memmott relieves the monotony of broom psyilid sampling by investigating the aerodynamics of her beating trays.

The same pattern seems to be showing up with gorse thrips. This year Jane surveyed 30 sites scattered throughout the South Island where she had released 1000 gorse thrips in 1995. "Again I'm finding that if the thrips survive the first year there is a good chance of them persisting," said Jane. Each of the release sites, kindly located for Jane by a local person, is close to a weather station and in future Jane will correlate the weather data with establishment success of the gorse thrips.

One field site did not get sampled due to the attentions of a herd of cows with calves at foot. "I managed to sample the first three bushes, but the cows were starting to behave rather like buffalo shortly before they gore a lion to death, so I decided to hoof it, " said Jane.

This work is funded by The Foundation for Research, Science and Technology, and the Leverhulme Trust.

Quarantine Graduates — Where Are They Now?

Alligator weed beetle (*Agasicles hygrophila*)	Established* widely, and damages alligator weed throughout Northland and Auckland, and at 1 site in Waikato.
Alligator weed beetle (*Disonycha argentinensis*)	Released widely in Northland and Auckland in the early 1980's, but failed to establish.
Alligator weed moth (*Vogtia malloi*)	Established and damages alligator weed at several sites in Northland, and 1 site in Auckland.
Broom psyllid (*Arytainilla spartiophila*)	Established at sites in Bay of Plenty, Canterbury (5), Otago (19), Tasman, Waikato, and Wellington
Broom seed beetle (*Bruchidius villosus*)	Established in all broom-infested regions except for Northland, Southland, and the West Coast, (some beetles have been recovered from these last 2).
Californian thistle flea beetle (*Altica carduorum*)	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 (*Urophora cardui*)	Released at 8 sites throughout the country. Galls have been found at the Bay of Plenty, Canterbury (2), Manawatu-Wanganui, and Southland sites.
Californian thistle leaf beetle (*Lema cyanella*)	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 (*Pempelia genistella*)	Released at 2 sites in Auckland and Canterbury. Rearing is underway to allow mass releases to begin soon.
Gorse hard shoot moth (*Scythris grandipennis*)	Failed to establish from the small number released at 1 site in Canterbury.
Gorse pod moth (*Cydia succedana*)	Established now in all regions except Otago and Southland.
Gorse soft shoot moth (*Agonopterix ulicetella*)	Established in low numbers at sites in Canterbury (3), Gisborne and Bay of Plenty. Also found at 5 other sites throughout NZ.
Gorse spider mite (*Tetranychus lintearius*)	Six strains are widely established throughout NZ and cause noticeable damage at many sites.
Gorse thrips (*Sericothrips staphylinus*)	Established widely throughout NZ.
Hieracium plume moth (*Oxyptilus pilosellae*)	No field releases have been made yet. Mass-rearing is underway to allow widespread releases to begin soon.
Heather beetle (*Lochmaea suturalis*)	Released at 16 sites in and around Tongariro National Park. Their fate is unknown.

Nodding thistle crown weevil (*Trichosirocalus horridus*)	Established widely throughout NZ and kills rosettes at many many sites.
Nodding thistle gall fly (*Urophora solstitialis*)	Established now in all nodding-thistle-infested regions except for Manawatu-Wanganui, Otago, and Southland.
Old man's beard leaf fungus (*Phoma clematidina*)	Released at 15 sites throughout NZ. Known to be established at 2 of these and dispersing rapidly.
Old man's beard leaf miner (*Phytomyza vitalbae*)	Established in all old-man's-beard-infested regions except Taranaki. Dispersing rapidly.
Old man's beard saw fly (*Monophadnus spinolae*)	Released at 1 site in Canterbury. Mass-rearing techniques are being developed to allow widespread releases to begin soon.
Cinnabar moth (*Tyria jacobaeae*)	Established patchily throughout NZ and causes obvious damage in some areas.
Ragwort flea beetle (*Longitarsus jacobaeae*)	Established widely throughout NZ and reduces ragwort rosette densities at many sites.
Greater St John's wort beetle (*Chrysolina quadrigemina*)	Has been seen at 2 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 1 winter and have completed several generations.

N.B.
This table only includes agents that have been, or will be, distributed by the Technology Transfer Programme.

Hieracium Project Gathers Momentum

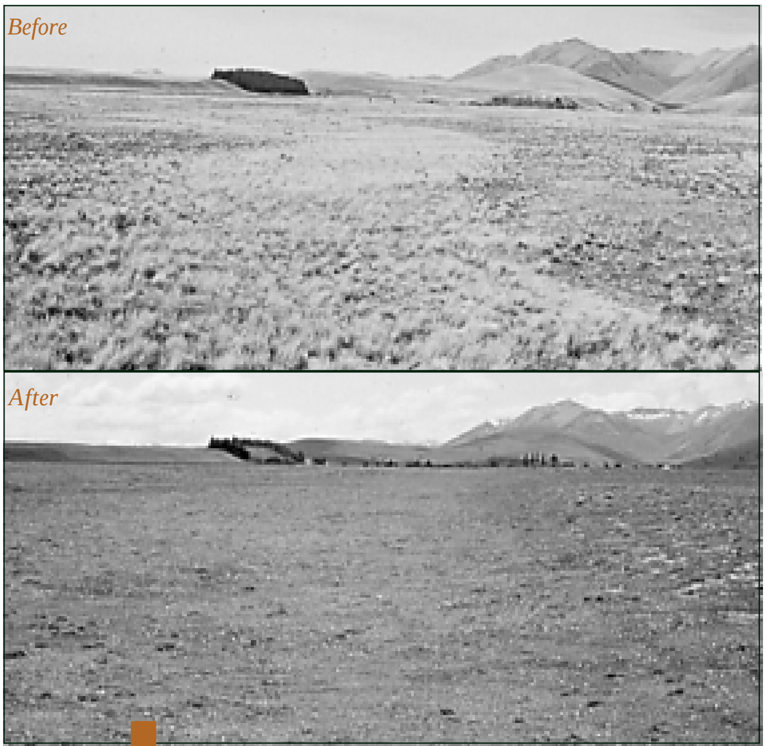
Hieracium, or hawkweed, has hijacked many native grasslands from the high country of the South Island to the central plateau of the North Island. Until recently there has been little hope of containing this menace, let alone winning the infested land back. However, this year good progress was made in the quest to find insects that might help us to turn the tide.

This year MAF Regulatory Authority gave the Hieracium Control Trust approval to release the first of the insects on our shortlist. "Our tests showed that the hieracium plume moth (*Oxyptilus pilosellae*) has a strong preference for mouse-ear hawkweed (*Hieracium pilosella*)," said Pauline Syrett. In fact this agent is so specific that it is unlikely to even damage the other weedy hieracium species: field hawkweed (*H. caespitosum*), king devil hawkweed (*H. praealtum*), and tussock hawkweed (*H. lepidulum*). "We expect that heavily infested mouse-ear hawkweed plants will grow more slowly, produce fewer flowers, have a shorter life span, and have a reduced ability to compete with other plants," said Pauline. Lindsay Smith is doing everything in his power to encourage the moths to breed so that field releases can begin next autumn.

Safety-testing of the second agent on our shortlist, the gall wasp (*Aulacidea subterminalis*) was completed this year. "As some New Zealand native plants are unavailable in Switzerland we finish off safety-testing of potential hieracium control agents inside quarantine at Lincoln," said Lindsay. The final tests this year confirmed that the gall wasp only attacks mouse-ear and orange (*H. aurantiacum*) hawkweeds. This news prompted the Hieracium Control Trust to submit an application to release the gall wasp, and they hope to get a favourable response soon. Gall wasp larvae feed on the stolons of hieracium plants. The hieracium plants use up precious resources in forming gall tissue around the larvae. The larvae do not mind and continue to feed happily inside the galls. However, the plants come off second-best being both weaker and deformed.

We hope to be able to use at least three other insects to fight hieracium. This year the usefulness of a midge and two hover flies continued to be evaluated in Switzerland. The hover flies should make a good partnership as one feeds externally on the roots and the other on all the above-ground parts of the plant. The hover flies have been installed in quarantine at Lincoln so that final safety-testing can get underway. Fingers crossed, we should be able to begin the process of winning their freedom early next year.

This work is funded by the Hieracium Control Trust.



Photos: B. Malloy

The impact of hieracium is shown in these slides taken 16 years apart at Sawdon Station in the Mackenzie Country.

News Flashes

Joining forces

The Department of Conservation (DoC) has a major problem with heather in Tongariro National Park, where it is displacing precious native plants. At present DoC sprays a minimal amount of heather each year, but sees biological control as the only long-term solution. DoC have helped to fund the introduction and release of the heather beetle *(Lochmaea suturalis)* , and this year we reared and released 4,450 beetles at sites in and around Tongariro National Park. The beetles' establishment success and dispersal will be kept under close scrutiny.

Heather also spills over onto about 10,000–20,000 ha of land administered by the New Zealand army. The army has planned a long-term programme to contain the heather by aerial and spot-spraying. Other land under the jurisdiction of the Manawatu-Wanganui Regional Council is not yet badly affected by the heather, but the council is concerned about the future potential of this weed and it sprays a buffer zone to the south of army land.

This year the three organisations worst-affected by heather met with our staff to talk about how they can join forces to tackle the heather problem. All agreed that an integrated approach was the way to go. If heather beetles and herbicides are going to be used together, then we need to test those products that are currently being used to see if they harm the beetles. We hope to be able to begin this important work in 1998/99.

Oh no, not another gall fly!

We have already released two gall flies to attack thistles in New Zealand, the nodding thistle gall fly (*Urophora solstitialis*) and the Californian thistle gall fly (*Urophora cardui*). Now we are investigating a third member of the *Urophora* family.

A group of farmers belonging to the Rodney-Kaipara Monitor Farm Group, whose land is severely affected by Scotch thistle, managed to gain funding from AGMARDT (The Agricultural & Marketing Research & Development Trust) and the Wool Board to look at biological control options. Although the nodding thistle crown weevil (*Trichosirocalus horridus*) and nodding thistle receptacle weevil (*Rhinocyllus conicus*) will attack Scotch thistle, it was felt that a third agent was needed. In Canada, and more recently Australia, the Scotch thistle gall fly (*Urophora stylata*) has been released as a biological control agent. In Canada this fly has reduced seed production by 60%.

The males set up territories on Scotch thistles, that are about to flower, and attract the females by displaying their patterned wings. Mated females lay batches of eggs in unopened flower buds. The larvae hatch and burrow into the flower head to feed on the developing seeds and are fully grown by mid-summer. Some new adults emerge straightaway to lay eggs on late flower heads, but the majority spend the winter inside the gall and emerge the following spring.

This year our colleagues in Australia provided us with some flies so that we could carry out tests to see if the fly is suitable to bring into

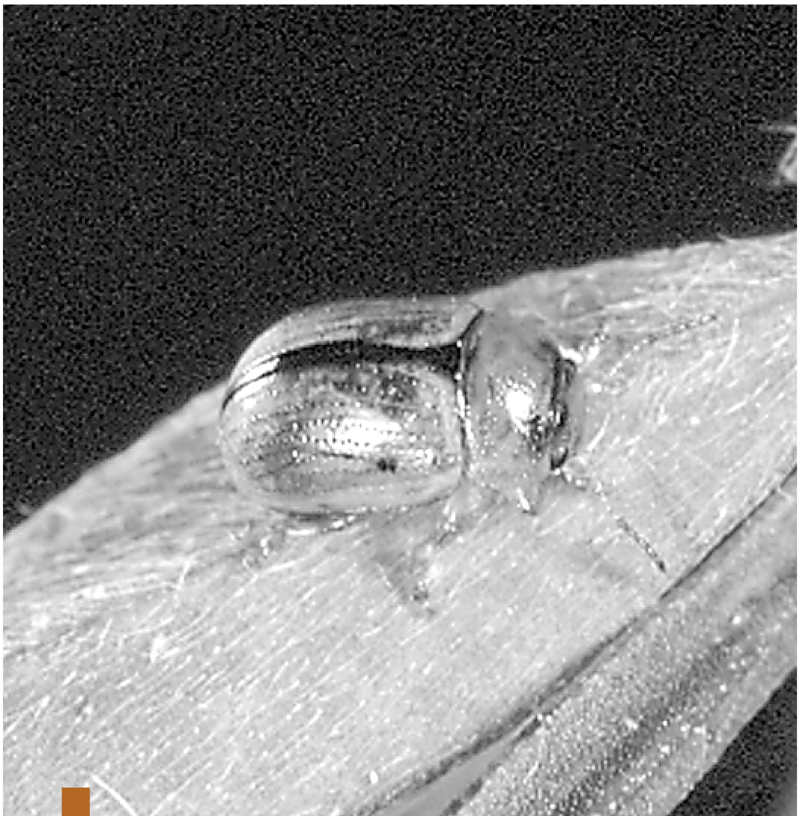
New Zealand. The testing was quite straightforward as we do not have any native thistles to contend with, and the fly had already been tested extensively by other countries. The only other plant attacked in our tests was Californian thistle, so we have begun the process of applying for permission to release this agent.

GOB-stopper rolls on

Our fledgling mycoherbicide has been given the provisional name "GOB-Stopper", which is short for "Gorse and / Or Broom-stopper". The active ingredients of GOB-Stopper (*Fusarium tumidum* spores) can kill 12-week-old gorse and broom plants in a fortnight under glasshouse conditions. This year Jane Fröhlich and Alison Gianotti overcame an important hurdle by developing a technique that enables them to mass-produce the spores and store them for up to 6 months in the fridge. They also worked with colleagues at Forest Research (formerly The Forest Research Institute) to develop a prototype field formulation that does not rely on heavy dew. "We are searching for a formulation that will prevent the spores from drying out on the plant surface, that is easy to apply, and will not damage the fungus, or non-target plants," said Jane. One such prototype formulation was trialed this year near the Forest Research headquarters in Rotorua — it looks promising, but the emulsion component used needs further work as appears to be phytotoxic. Although we are confident that GOB-stopper will only harm gorse and broom, trials are underway to make sure that close relatives and / or plants that are common neighbours in the field will not be affected.

More information required

The broom leaf beetle (*Gonioctena olivacea*) has proved to be one of the most controversial agents that we have worked with. On the positive side this beetle can cause considerable damage to broom and it is easy to rear large numbers. However, on the negative side, tests have shown that the beetle may also feed on tree lucerne and tree lupin. We are then faced with a dilemma. Is it more important to control broom or to protect two other exotic plants that have some uses, but can also be invasive weeds in their own right? We would not consider any agent that posed a serious risk to New Zealand native species, and in 1993 we rejected the broom stem weevil (*Pirapion immune*) because it might damage kowhai. This year, with the Amuri Broom Action Group (a Landcare group of farmers who have agreed to be the proponent for the broom leaf beetle), we decided it was time to ask the public how they felt about possible damage to tree lucerne and tree lupin. As expected responses were received that covered both ends of the spectrum, and several



The broom leaf beetle

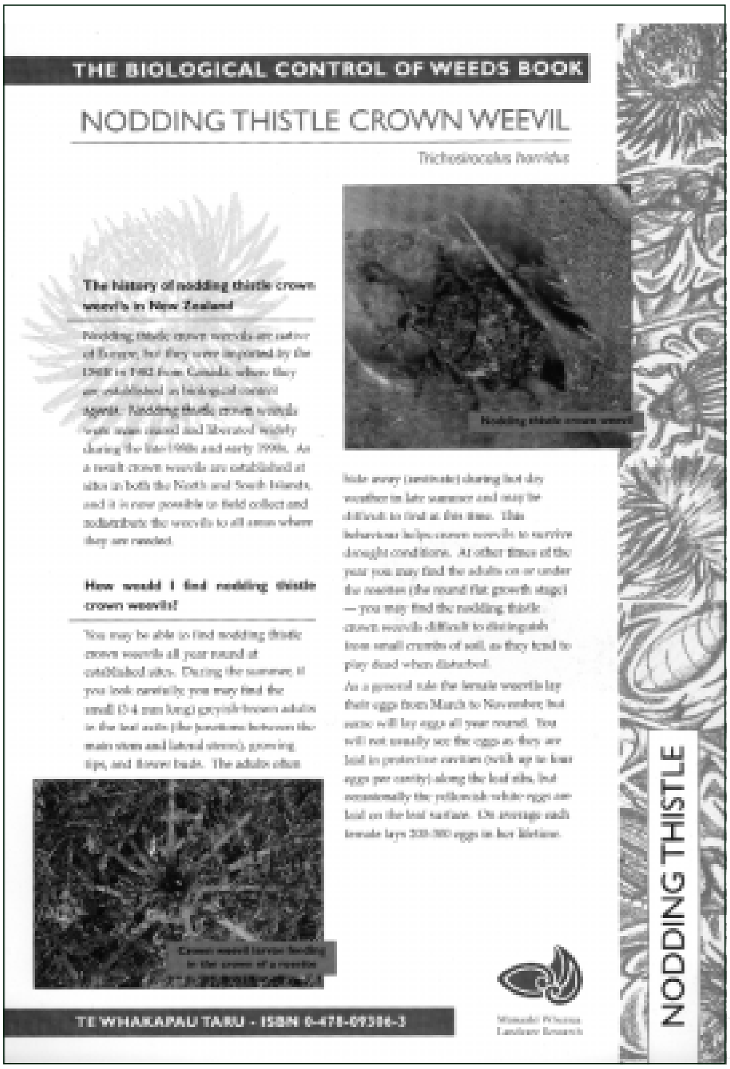
points in between. There are people who are concerned about the negative impacts of broom and are not concerned about possible damage to tree lucerne, those that fear tree lucerne could itself become a widespread weed in the future, and others who value tree lucerne highly and are wary of anything that might damage it.

Clearly the issue can not be resolved to the satisfaction of all parties without more information. Our next step is to gather better economic data on the cost of broom and on the value of tree lucerne to New Zealand. We are also trying to quantify just how much damage the broom leaf beetle might do to tree lucerne — will it be the occasional hole in a leaf or significant defoliation? We will compare the relative distributions of the two plants and find out just how often the two overlap, especially in areas where tree lucerne is valued. Finally we will investigate ways in which the impact of the leaf beetle could be minimised. For example, if tree lucerne was trimmed or grazed shortly after the beetles had laid eggs then significant damage might be avoided. In the interim the beetles are confined to quarters in our secure quarantine facility at Lincoln.

Biological control made easy

This year we produced the second set of pages for "The Biological Control of Weeds Book" describing the life and times of the various agents available for gorse and nodding thistle. We also distributed copies of the forms that we recommend people use when monitoring biological control agents. These forms have evolved over a period of time as we have become wiser about the most useful sort of information to collect, so please discard any previous versions. The third set of pages for the book, on broom, old man's beard, and harvesting techniques are well in hand, and should be available in September 1998.

This year we also produced some new colour posters to help demystify biological control. "Natural Born Weed Killers" describes how we find suitable control agents and get them established in New Zealand. "What's Eating Ragwort" and "What's Eating Nodding Thistle" summarise the various insects that attack these weeds. The posters may be borrowed, or you may purchase your own copies. Contact Lynley Hayes (03 3256 701 ext 3808) for further details.



Further Reading

Harris, R.J. 1998: **Introduction of *Urophora stylata* for biological control of Scotch thistle *Cirsium vulgare* — an importation impact assessment**.

Hill, R.L. 1997: **Turning the tide — opportunities for biological control of forest weeds**. Landcare Research Report.

Hill, R.L.; Killgore, E.M.; Sugiyama, L.S., Morin; L; Fröhlich, J. 1997: **Introduction of *Entyloma ageratinae* for biological control of mist flower *Ageratina riparia* - an importation impact assessment.**

Partridge, T.R.; Ogle-Mannering, M.R.; Hill, R.L.; Gourlay, A.H. (In Press): **Mortality and recruitment of gorse seedlings in artificially modified gorse stands in the South Island, New Zealand, and the implications for biological control**. New Zealand Journal of Botany.

Pennycook, S.R. (in press): **Blackberry in New Zealand**. Plant Protection Quarterly.

Richardson, R.G.; Hill, R.L. 1998: *Ulex europaeus* (L.). *In:* Panetta, F.D., Groves, R.H.; Shepherd, R.C.H. *eds.* **The Biology of Australian Weeds, Volume 2.** Australia, R.G. & F.J. Richardson. Pp. 269–290.

Syrett, P.; Fowler, S.V.; O'Donnell, D.J.; Shaw, R.H.; Smith, L.A. 1997: **Introduction of *Gonictena olivacea* (Coleoptera: Chrysomelidae) into New Zealand for biological control of broom, *Cytisus scoparius* — an importation impact assessment.**

Syrett, P.; Smith, L.A. 1998: **The insect fauna of four weedy *Hieracium* (Asteraceae) species in New Zealand**. New Zealand Journal of Zoology 25: 73–83.

Syrett, P.; Smith, L.A.; Grosskopf, G. 1997: **Introduction of *Oxyptilus pilosellae* (Lepidoptera: Pterophoridae) into New Zealand for biological control of *Hieracium pilosella* — an importation impact assessment.**

Syrett, P.; Smith, L.A.; Grosskopf, G. 1998: **Introduction of *Aulacidea subterminalis* (Hymenoptera: Cynipidae) into New Zealand for biological control of *Hieracium pilosella* — an importation impact assessment.**

What's New In Biological Control Of Weeds? (issues 1–9) and copies of the Importation Impact Assessments are available from Lynley Hayes (address below).

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