# Patua Te Otaota - Weed Clippings

## Biological Control of Weeds Annual Review 2000/2001

### What's Inside:



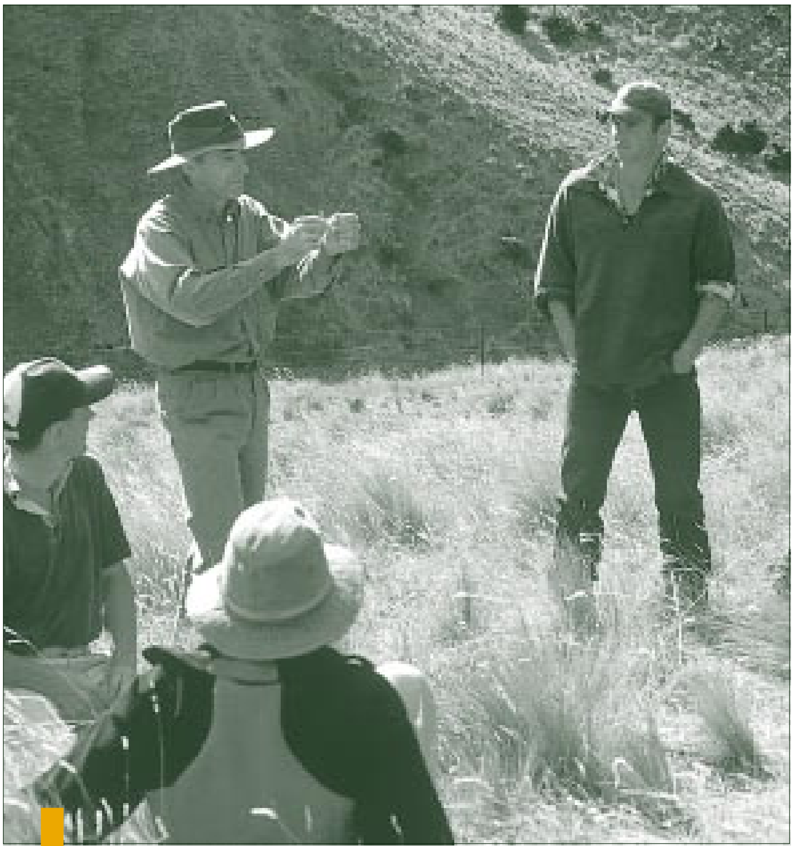

Manaaki Whenua
Landcare Research


### Introduction

- Welcome to the seventh issue of *Patua Te Otaota - Weed Clippings*, which we have published to keep clients, stakeholders, and colleagues informed about our progress in developing sustainable biological control solutions for weed problems.

### Headlines

- Researchers, taking the path less travelled, have made a series of predictions about how our *Hieracium* agents might perform, even before half of these have set foot here. We forecast a future scenario where mouse-ear hawkweed gets nibbled back severely.
- The white smut continues to knock mist flower about and mist flower gall flies are now also on the offensive. As well as reflecting on the success of this project we start to make sense of the tangled web we weave.
- First there was one but now there are two projects devoted to developing fungi into mycoherbides for woody weeds. We shed light on why two are better than one!



*Lindsay Smith updates farmers on developments in the* Hieracium *project during a field day at Mt Gladstone, Marlborough*

- While the war against alligator weed has not yet been completely won we do not believe it is time to surrender. We float some new possibilities for reducing the amount of occupied territory.

- Traditionally trees have been considered difficult targets for biological control, but buoyed up by some recent successes elsewhere we reopen this Pandora's box.

- Can a tiny leaf miner really make a difference to a vigorous climber like old man's beard? We reveal why we are cautiously optimistic.

- A survey has now confirmed what we all suspected. Woolly nightshade doesn't have any significant six-legged natural enemies here and we could really do with some!

- Heather beetles are doing what we hoped they would, gorse soft shoot moth is alive and well in New Zealand, new agents for broom are in the pipeline, and the "Biological Control of Weeds Book" is about to expand again. We bring you up to date with the latest in a series of news flashes.

- As the number of biological control agents for weeds in New Zealand continues to grow it can be hard for people to keep their heads around them all. We make this easier by collating the most important vital statistics you need to have at your fingertips.

**Control agents released in 2000/01**

| **Species** | **Releases Made** |
|---|---|
| Broom psyllid (*Arytainilla spartiophila*)<br>Broom seed beetle (*Bruchidius villosus*) | 45<br>30 |
| Californian thistle gall fly *(Urophora cardui)* | 2* |
| Gorse pod moth (*Cydia succedana*)<br>Gorse colonial hard shoot moth (*Pempelia genistella*) | 10<br>5 |
| Hieracium gall wasp (*Aulacidea subterminalis*) | 10 |
| Mist flower gall fly (*Procecidochares alani*) | 25 |
| Scotch thistle gall fly (*Urophora stylata*) | 3 |
| **Total** | **130** |

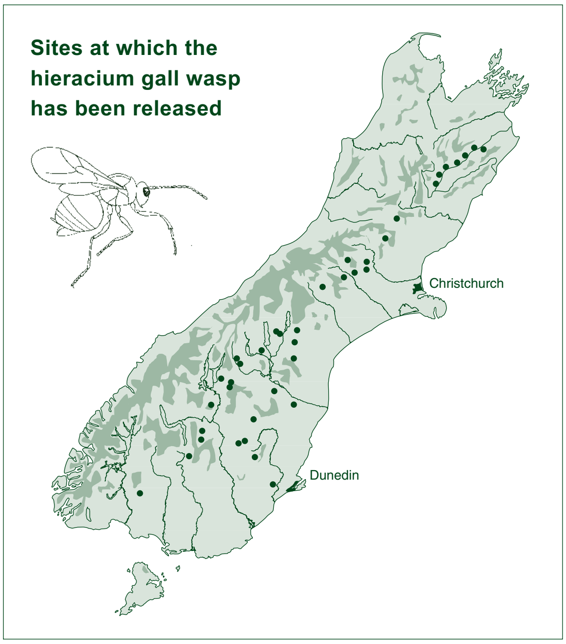
*cage rearing was also undertaken

## Future Eaters

The Hieracium Control Trust lodged a triple-banger application to release three new *Hieracium* agents with the Environmental Risk Management Authority (ERMA) in January. A public hearing was held in May, and there was much rejoicing in the high country soon after when ERMA issued its seal of approval to release a gall midge (*Macrolabis pilosellae*), and two hover flies (*Cheilosia urbana* and *C. psilophthalma*). We can now get on with importing and mass rearing these agents so that they can be mobilised into field duties as soon as possible.

The new imports will join three agents already here. Hieracium rust (*Puccinia hieracii* var. *piloselloidarum*) is now widely established and, given the right conditions, can stunt the growth of susceptible mouse-ear hawkweed (*Hieracium pilosella*) plants. The hieracium gall wasp (*Aulacidea subterminalis*) has proven relatively straightforward to rear so extensive releases have been made throughout the South Island in just two short years (see map). Even better, galls are showing up in many places already! These galls mean that fewer daughter plants are being produced. By contrast the plume moth (*Oxyptilus pilosellae*) is proving quite a challenge. "I have to keep the tiniest imaginable larvae alive for many months over the winter, so losses can be high," explained Lindsay Smith. "We have only made one release so far, but things are looking up as we have just imported some more moths from Switzerland to start a new rearing colony."

Biological control researchers have traditionally tended to play their cards fairly close to their chests when asked to speculate on success during the early days of a programme. "However, it is becoming more popular to stick one's neck out and make some predictions," revealed Pauline Syrett. A series of predictions about the *Hieracium* programme have been made based on what is known about the agents in their homeland and the results of safety-testing:




- The six agents will work together in unison by attacking different parts of the plant.
- All six have a good chance of establishing throughout the range of mouse-ear hawkweed in New Zealand and, because of reduced parasitism, will become more common here than in their homeland. The plume moth may not do well in areas prone to summer drought, and the gall wasp may struggle when plants produce few stolons.
- All five weedy hawkweed species will be attacked to some extent. All six agents will damage mouse-ear hawkweed. Three will target king devil hawkweed (*H. praealtum*) and four of them should get stuck into field hawkweed (*H. caespitosum*). Three or four agents should damage orange hawkweed (*H. aurantiacum*).
- The combined impacts of the six agents may significantly reduce the spread and impact of mouse-ear hawkweed.
- Only one agent, the root-feeding hover fly, will attack tussock hawkweed (*H. lepidulum*) so further agents are likely be needed to control this non-stoloniferous species.

Now we have to wait and see if they come true!

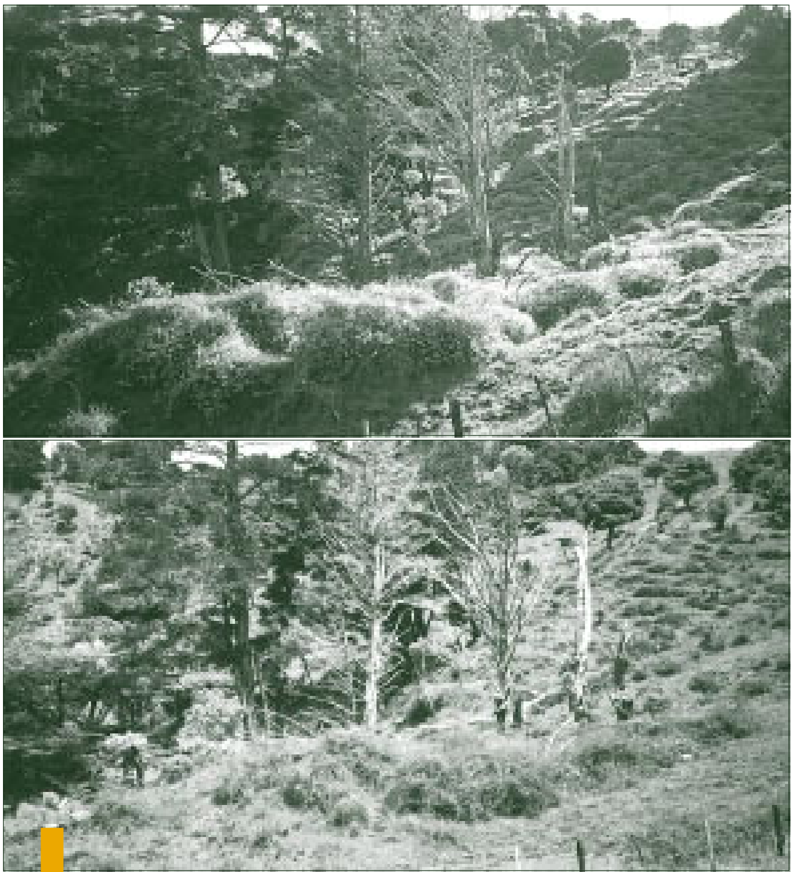
*This project was funded by the Hieracium Control Trust.*

## Show No Mercy

**Closing the gaps**

Since its release towards the end of 1998 the mist flower fungus (*Entyloma ageratinae*) has spread relentlessly. After it had been in the field a year we told you that the white smut was all over Northland and the Waitakere Ranges, and had even reached Great Barrier Island. "By the end of 2000 infected plants had been found dotted in between (Mangawhai, Tawharanui Peninsula, Puhoi, and Muriwai)," reports Alison Gianotti. The fungus is also on the move further south. "The white smut has been seen at Awhitu Peninsula, Raglan (92 km from the closest release site at Paeroa), and throughout the Hauraki and Coromandel districts."

There has already been a noticeable reduction in mist flower cover at eight of the nine original release sites (see photos). After the first year of attack we calculated that the white smut had caused around 40% defoliation at all but one site. Mist flower swiftly retaliated by putting on strong new growth, but about half of this soon became infected too. This year slightly less defoliation (27.4% on average) was observed, but there was less regrowth too, probably because the plants weren't trying to replace as many lost leaves. The smut again lost no time in attacking the regrowth to a similar degree as before. "The effort required to bounce back is costly for the plant and we expect regrowth to decrease as time goes by," suggests Alison.



*Above: White smut release site at Omapere, Northland, in December 1998 at the time of release. Below: Same site 2 years later, and mist flower cover has noticeably declined*

**Fly no slug**

This year we achieved another important milestone in the mist flower project. Thanks to the Auckland Regional Council, who successfully rose to the challenge, the mist flower gall fly (*Procecidochares alani*) was the first weed biological control agent to negotiate the demanding Environmental Risk Management Authority (ERMA) process for release. As soon as we were notified of ERMA's decision, in December 2000, we promptly imported a shipment of gall flies from Hawai'i. Happily the flies proved easy to breed in captivity and we were able to release them at more than 20 sites in the two worst-affected regions a couple of months later.

The mist flower gall fly astounded its liberators by getting straight down to business. "As soon as we opened the lid the flies wasted no time in making a beeline for their host and laying eggs right in front of our eyes," enthused Chris Winks. Their damage, the characteristic swellings that stunt the plant's growth, began showing up in the field in March. We expect the fly to play a useful role in hindering the plant's attempts at regrowth after defoliation by the white smut.

With such a promising start you might think the mist flower gall fly is certain to do well here, but it really is too early to tell. Before making their final decision ERMA considered whether releasing the gall fly could have negative consequences. The likely effects of parasitic wasps already present in New Zealand and any indirect effects on similar native flies were carefully weighed up. During this task it became clear that information about the interactions between parasitic wasps, gall flies and their host plants in New Zealand is almost as rare as hen's teeth. To complicate matters further we can't easily tell the parasitic wasps apart — our present knowledge only allows us to identify them to genus not species level.

To get a feel for likely parasitism we investigated the fate of a similar gall fly (*Procecidochares utilis*) that was released to attack Mexican devil weed back in 1958. "Galls collected from Coromandel show that this insect suffers a moderate level of attack by a parasitoid, *Megastigmus*," explained Simon Fowler. This parasitoid is thought to have arrived from Australia about 10 years after the gall fly was introduced. "We suspect that it is only a matter of time before *Megastigmus* bangs into the mist flower gall fly, but we don't know when or where, or how much fallout there will be," Simon said. Rest assured we will be checking to find out! We still expect the gall fly to have a useful impact on mist flower despite this expected setback. Parasitism is after all a natural process and it is rarely severe enough to render a biological control agent completely useless.

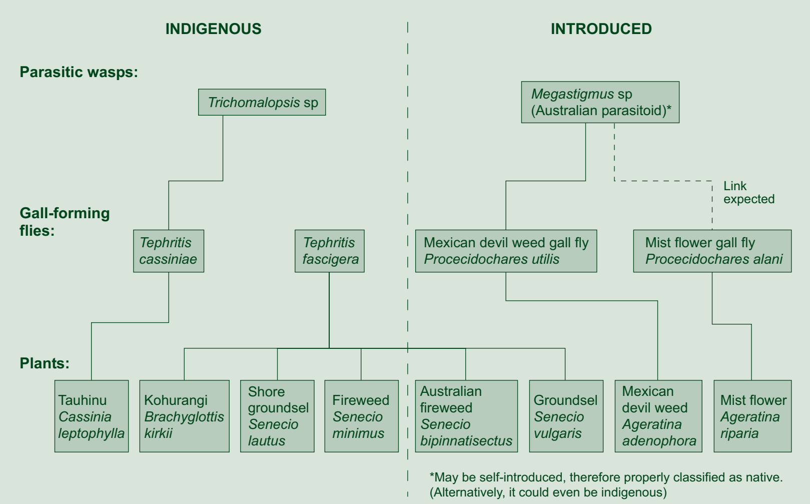
"With the help of a colleague, Nick Martin (Crop & Food Research), we searched deep into the literature and the Waitakere Ranges and found that the mist flower gall fly is likely to have two native gall flies as neighbours here," revealed Simon. "We wouldn't be a bit surprised if the Australian parasitoid also attacks one of these native gall flies, *Tephritis fascigera*, but we haven't got any concrete evidence so far." Its close relative, *T. cassiniae*, (which only lives on the native shrub *Cassinia leptophylla*), is known to be parasitised by at least one wasp. This parasitoid is probably indigenous, but we can't be certain, because of the taxonomic difficulties. We plan to check if they harm the mist flower gall fly too.

**Simon's web**

Drawing up a food web is a good way of simplifying a complex tangle of information about species interactions like these. Simon has put together a simple version (see below) that only deals with "who eats what", rather than the strength of the interactions, which we know less about. But it is a good starting point and has opened our eyes to a number of interesting issues and areas for future study. Experts agree that any non-target effects caused by the mist flower gall fly are likely to be small, but rest assured we will be looking for them, and measuring their size over the next field seasons.

*This project was funded by the Auckland and Northland regional councils, and the Foundation for Research, Science and Technology.*

**A Food Web of Selected Native and Introduced Gall Flies and Their Parasitoids and Host Plants in New Zealand**



## Show No Mercy

**Myco what?**

Plant pathogens can be used to control weeds in a similar way to chemical herbicides. When the active ingredient used in a herbicide is a fungus, the product is called a mycoherbicide. Mycoherbicides can be applied in several ways, e.g. as aerial sprays, through “cut and paste” application, or in a powder applied to the soil.

**Subtle differences**

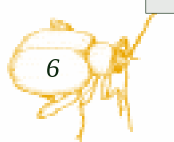
The fungi involved usually occur naturally in the area where they are used, and are not specially imported. Under natural conditions disease epidemics occur and damage plants from time to time, but the potential of these fungi is frequently limited, e.g. the environment is not always conducive to good disease development. Developing a mycoherbicide formulation allows people to overcome some of these constraints and create disease epidemics when and where they want. After application the fungi do not usually persist at high levels for long and have often returned to background levels 1–2 years later. This means that, like other herbicides used to kill plants, mycoherbicides often need to be reapplied. Fungi used in inundative control often do not need to be as highly host specific as classical biological control agents because their use can be restricted to certain areas.

**A potted history**

Research into developing mycoherbicides began in the 1940s. Since then more than 100 projects have been undertaken worldwide, but only a small percentage of these has resulted in commercially available, registered products (Table 1). This is not surprising given that the chemical industry routinely screens thousands of inorganic compounds to find a single commercially feasible new chemical herbicide.

**Table 1: Fungi that have been successfully developed into commercial products**

| Place/Time | Target Weed | Product: Agent | Status |
|---|---|---|---|
| USA 1981 | Strangler vine (*Morrenia odorata*) in citrus orchards | DeVine®: *Phytophthora palmivora* | Commercially available |
| USA 1982 | Northern joint vetch (*Aeschynomene virginica*) in rice and soybeans | Collego™: *Colletotrichum gloeosporioides* f. sp. *aeschynomene* | Commercially available |
| Canada 1992 | Round-leaved mallow (*Malva pusilla*) control in wheat, lentils and flax | BioMal®: *Colletotrichum gloeosporioides* f. sp. *malvae* | No longer commercially available |
| China 1963 | Dodder (*Cuscata* spp.) in soybeans | Lubao: *Colletotrichum gloeosporioides* f. sp. *cuscutae* | Commercially available |
| South Africa 1997 | Black wattle (*Acacia mearnsii*) in river beds | Stumpout™: Basidiomycete | Commercially available |
| USA 1960 | Persimmon trees (*Diospyros virginiana*) | *Acremonium diospyri* | Distributed free of charge |
| Canada | Woody weeds, e.g. black cherry (*Prunus serotina*) | BioChon™ / Chontrol™: *Chondrostereum purpureum* | Undergoing registration |
| USA 1983 | Sickle pod (*Cassia obtusifolia*) and coffee senna (*Cassia occidentalis*) in soybeans and peanuts | CASST™: *Alternaria cassiae* | Development stopped due to lack of commercial backing |



**Kiwi ingenuity**

Researchers in New Zealand have also been getting in on the act. Our Auckland-based plant pathologists have been beavering away for a number of years, with help from Forest Research, to develop a product (GOB-stopper) for gorse and broom. Work to date has focussed on using fusarium blight (*Fusarium tumidum)* as an aerial spray. It works best on soft foliage and usually kills young plants up to 2 months old. Older, woodier plants can usually survive. "Developing a reliable formulation is proving tricky but we haven't given up yet," Jane Fröhlich commented.

This year a series of experiments began on another fungus (*Chondrostereum purpureum)*. This is a wood-inhabiting fungus that grows on the dead logs and stumps of many tree species. The fungus also causes silver leaf disease of fruit trees such as plum and cherry, so it's common name is silver leaf fungus. The fungus only infects trees with fresh, open wounds. Research has been carried out in the Netherlands and Canada to develop the fungus into a mycoherbicide for woody weeds (e.g. black cherry (*Prunus serotina*)). A "cut and paste" product called BioChon™ has been developed in Europe and Chontrol™ in North America. These products are currently going through the registration process.

Our pathologists are collaborating with AgResearch to look at the feasibility of using silver leaf fungus against gorse and broom. In contrast to fusarium blight, silver leaf fungus works best on older, woodier plants, so in theory the two should complement each other perfectly. Some field trials were set up in May to put this theory to the test and to find out the best time of year for inoculation. We will keep you posted on the outcomes in future newsletters.

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

*Chris Winks sets up a weather station as part of the mycoherbicide field trials*

**Steps in developing a mycoherbicide**

1. Look for suitable pathogens (if not already known).
2. Identify highly pathogenic (disease-causing) isolates that produce no or few toxins.
3. Develop an efficient way of mass producing the spores and ensuring their stability and shelf life.
4. Determine the optimum conditions for infection and disease development.
5. Check that the pathogen can be used in a manner that will minimise the risk of serious damage to any susceptible non-target plants.
6. Develop an appropriate formulation and application technology.
7. Test in the field and improve formulation if necessary. Developing a workable formulation is often the stumbling block. It can be extremely difficult to get living organisms to behave predictably and reliably in the field given the variety of conditions they encounter.
8. Obtain registration for the product. Each country has its own rules and meeting the requirements for registration can be an expensive and drawn-out process (e.g. it took 5 years to register BioMal®).
9. Find commercial backing for producing, marketing and distributing the product. This can also be difficult, especially if the target market is small and the product is extremely effective (if the product does not need to be reapplied, its market gets smaller).

## *Plants Behaving Badly*

**A little more bite...**

Alligator weed (*Alternanthera philoxeroides*) is rumoured to have got its name because it forms mats on top of water bodies that are thick enough to allow alligators to lie on top and bask in the sun! The plant was first recorded in New Zealand around the turn of the century in an area near Dargaville where ships dumped their ballast. Nowadays this aquatic weed is common throughout Northland and parts of Auckland, and is creeping down into the Waikato and Bay of Plenty. Single sites are known to occur as far south as Taumaranui and even Christchurch. A computer model (CLIMEX) suggests that the weed has not achieved anything like its potential in New Zealand, and that's even before global warming scenarios are taken into account. The plant isn't just confined to aquatic habitats either as it also creeps out onto land, where it can cause a photosensitivity reaction in stock and smother kumara and watermelon crops. Recently a landlocked infestation was unexpectedly found in the lawns of a new subdivision in Hamilton!

*A youthful Oliver Sutherland strips off for a good cause—releasing alligator weed beetles back in the early 1980s*

Alligator weed is also a pesky nuisance in many other places (Australia, USA, China, India, Puerto Rico, Myanmar, Thailand, and Indonesia), so there has been a lot of effort devoted to finding ways of controlling it. Chemical control has always proved difficult and expensive, as the plant's nodes limit translocation. Mechanical control provides only temporary relief and can give rise to new infestations if any fragments get washed downstream. Biological control has always been an attractive option and alligator weed was the first aquatic plant to be tackled in this way.

Spurred along by promising results in other places, three biological control agents were introduced to New Zealand between 1981 and 1988. The alligator weed beetle (*Agasicles hygrophila*) and alligator weed moth (*Arcola malloi*) successfully took up residence while another beetle (*Disonycha argentinensis*) sank without a trace. The two successful agents do a great job of controlling the weed in some situations, especially on lakes and dams in warmer areas. They are not able to do their stuff in cooler areas, on terrestrial infestations, or in flowing water (especially if floods occur regularly and wash the insects away). For a number of years people thought that this level of control might be as good as it gets, but wait there's more!

In fact Chris Winks has recently unearthed a lot more possibilities. "About 60 insect species were found during surveys in South America during the 1960s and 70s, but many of these were never followed up," he revealed. Further study could yield even more potential candidates. Then there are other better known agents that other countries have already trialled. "These include a species of thrips (*Amynothrips andersoni*) that originally got bad press because it was small and slow moving (a bit like our gorse thrips (*Sericothrips staphylinus*)), but it has recently caught people's attention by decimating the weed along the banks of a channel in Florida," reports Chris. While the thrips favour terrestrial growth they will also attack floating mats, and are more cold tolerant than our resident agents. It might also be worth giving the beetle that failed to establish another try because, in biological control, persistence often pays off.

Chris recommends that there are also some pathogens worth considering. "A leaf spot fungus (*Nimbya alternantherae*) can cause premature leaf fall and stem necrosis, and studies have begun in the USA to evaluate its potential as a mycoherbicide. Preliminary tests on a terrestrial infestation found that one application of this fungus killed all the above-ground growth." Another fungus (*Cercospora alternantherae*) also causes the leaves to shrivel and fall off, but has not yet been well studied. Rest assured this battle ain't over yet!

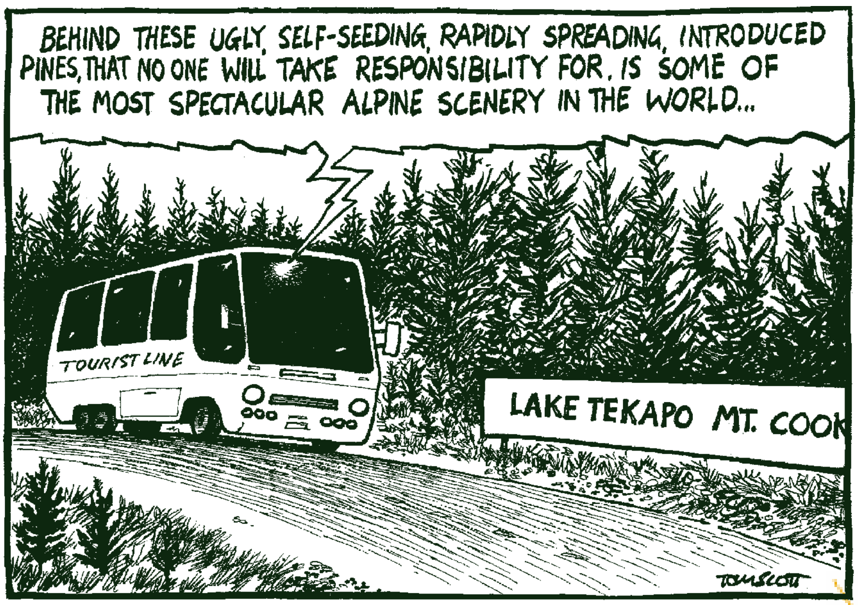
**Call of the wild**

Biological control – a possibility for pine trees in New Zealand? Far from being a wild idea, the prospects for reducing the environmental threats posed by wilding conifers in this manner are good. Not so long ago, any sensible biological control researcher would have dismissed a tree project as too difficult to entertain on two counts: the long-lived perennial nature of trees and the fact that most have some redeeming features. However, some recent successes overseas have shown that trees can be just as successfully targeted for biological control as smaller and less desirable plants.

"The key to gaining acceptance for the idea is to choose highly selective agents that only attack the seeds and cones and not the rest of the tree," explained Peter McGregor, who has been looking into this issue. "Black wattle (*Acacia mearnsii*) and mesquite (*Prosopis* spp.) are economically valuable trees in South Africa but also serious weeds. Introduced seed-feeding insects have reduced the invasiveness of these trees without affecting their useful attributes." Spurred on by this success, South African researchers are now investigating whether they can apply the same technique to invasive pines.

In New Zealand, the same idea had already been tossed around by colleagues at Forest Research a couple of years ago and they concluded that the prospects were good, particularly for the worst offender, *Pinus contorta*. Ecke Brockerhoff and Nod Kay found at least three insects that deserved further investigation. They did not consider fungal pathogens, but these can be highly specific and suitable candidates are likely to exist. Despite strong arguments made in favour of proceeding, the Forest Research proposal was strongly opposed by commercial foresters. Clearly, biological control of wilding conifers is a sensitive issue. In-depth discussions need to take place between all affected parties, including regional councils and other organisations that care for the environment. If the current conflicts of interest can be resolved to everyone's satisfaction, then a biological control programme for wilding conifers may in future be a reality and not just a pipe dream.

*These feasibility studies were funded by the Auckland, Hawkes' Bay, and Northland regional councils; and Environments Canterbury and Waikato.*




Tom Scott / Evening Post

## *Sitting on a Gold Mine?*

Once all the excitement about the amazing establishment success and dispersal powers of the old man's beard leaf miner (*Phytomyza vitalbae*) had begun to die down, people started to ask the hard question: can it actually do any good? After all, what does a bit of leaf damage mean to a large and robust climber? Other leaf miners adversely affect the growth of glasshouse and field crops, but none has ever successfully been used as a biological control agent.

*This picture is typical of the results achieved 3 weeks after plants were exposed to either no leaf miner flies at all (left), 8 females (centre), or 32 females (right) for 2 days.*

It is never easy to assess the field impact of biological control agents. You must tease out the effect of the agent from all the other environmental influences that affect weed growth. This problem is worse with old man's beard because of its size, chaotic growth habit, and huge amount of natural variation. Sometimes you need to be able to walk before you run, so we decided to begin by tackling the simpler question of whether we could demonstrate impact on small plants under controlled conditions. If the answer was no, then we wouldn't need to bother with more complicated studies. However, the answer turned out to be yes!

"Although we restricted ourselves to small plants (5–15 cm high) even these quickly became difficult to work with. Some shoots grew as much as 60 cm in 3 weeks!" exclaimed Hugh Gourlay. However, it turned out that the leaf miner was quite capable of stunting these smallish plants. Even one insignificant-looking mine per leaf was enough to reduce their growth by 17%. "Extrapolation of the results suggests that 2–3 mines per leaf would reduce growth by 50%," revealed Richard Hill (Richard Hill & Associates), the driving force behind the importation of the fly.

The experiment may underestimate the old man's beard leaf miner's potential. Flies were allowed to attack the plants for only a limited time, which meant that leaves produced afterwards were not damaged. In the field we would expect leaves to suffer more continuous bombardment by the flies.

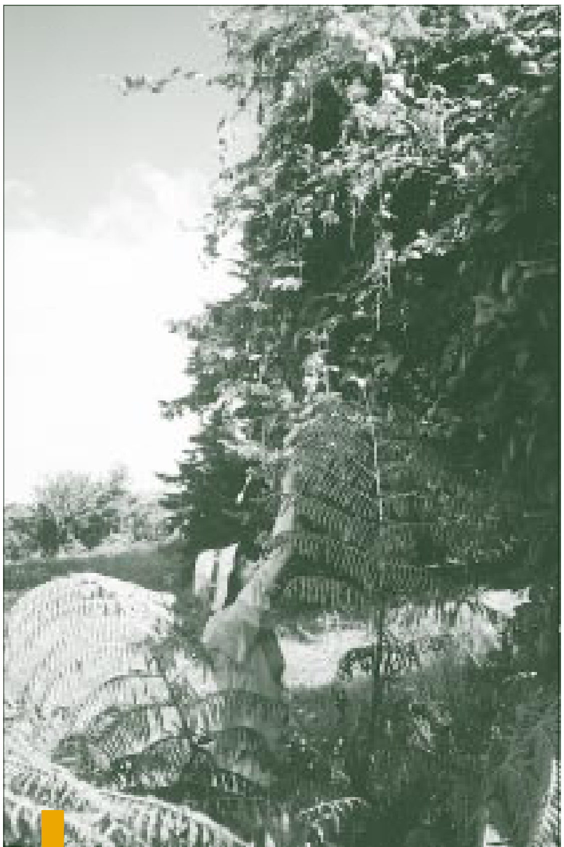
"This study suggests that the current levels of attack commonly seen in the field (1–2 mines per leaf) might be enough to reduce the vigour of old man's beard plants, particularly small plants invading cleared areas," claims Richard. Its role in suppressing large plants is less certain, as they may be more resilient. To have maximum impact the leaf miner attack needs to be relentless throughout the growing season. Early indications suggest that the leaf miner might be a little slow off the mark in the spring. However, given the short time since they were first released (1996) it is also likely that fly numbers are still building and they may yet make their mark in years to come.

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

## Highly Recommended

Last year we looked into the feasibility of developing biological control for woolly nightshade (*Solanum mauritianum*). After weighing up all the pros and cons we concluded that biological control was worth pursuing for this new target and made some recommendations about what to do next. One of the top priorities was to carry out a survey to make sure that no useful natural enemies had already found their way here. New species turn up in New Zealand all the time so it never pays to be complacent. We also need to know if any native or generalist species have taken a liking to the plant. This information helps us to make the best decisions about which biological control agents might work in best with, and not be out-competed or even eaten up by a species already present.

Woolly nightshade is common north of Taupo with scattered infestations throughout the rest of the North Island and around the top of South Island. In order to do a thorough job Chris Winks covered a fair bit of country sampling the weed from Kerikeri in the north to Collingwood in the south. "The only insect I found that we would class as being abundant (200+ individuals collected from 10 or more sites) was the passion vine hopper (*Scolypopa australis*), which is also a fan of other weeds like banana passionfruit," explained Chris. Leaf roller caterpillars (Tortricidae) and long-horn beetles (Cerambycidae) were quite common but only caused minor damage. Spider mites (*Tetranychus* sp.) sometimes stippled the foliage and thrips (*Hercinothrips bicintus*) occasionally made silvery-coloured patches. Snails often damaged saplings and the green vegetable bug (*Nezara viridula*) and the New Zealand vegetable bug (*Glaucias amyoti*) were found on the fruit.



*Alison Gianotti inspects banana passionfruit for any signs of disease*

While woolly nightshade is attacked by lots of tiny creatures, their combined impact does not generally seem to amount to much. Chris has concluded that there is considerable scope for introducing specialised feeders to take the wind out of the plant's sails, and they are unlikely to run up against significant competition from any of the current residents.

As well as looking for creepy crawlies on woolly nightshade we scanned the plant (and banana passionfruit (*Passiflora* spp.) too) for any signs of disease. Once a spotty leaf has been collected it can take some time to isolate and identify the guilty culprit(s), so you will to have to wait until our next newsletter for the sequel to this story!

*These surveys were funded by Environments Bay of Plenty and Waikato; Hawke's Bay, Northland, and Wellington regional councils; Marlborough and Tasman district councils, and horizons.mw. Detailed reports on these surveys are available from Lynley Hayes (see back page).*

## News Flashes

*Gorse damaged by the soft shoot moth in Hawai'i, showing what this agent is capable of*

**Beetle Comes Up Trumps**

This year while newspapers in the UK were sadly reporting that plagues of hungry heather beetles (*Lochmaea suturalis*) have been decimating their beloved heather (with as many as 271,350 ha of moorlands affected), we were celebrating the first signs that the beetles might be just as damaging here! It took 4 years after the beetles were first released in Tongariro National Park to find any concrete evidence that they had even survived, but this year we too had an outbreak. Simon Fowler and Paul Peterson found a patch of dead and dying heather infested with thousands of beetles at Te Piripiri in November. "In fact there were so many beetles that they appeared to be in mortal danger of eating themselves out of house and home, so we relocated nearly 7000 adults and larvae to other areas in the park," Simon said. While safety-testing had suggested that the beetles are extremely host specific, it was also really pleasing to see that the Te Piripiri beetles were not attacking any of the precious native plants whose existence has been threatened by the encroaching heather. Approximately 50,000 ha of Tongariro National Park and adjacent army land is heavily infested with heather. "Our heather beetles should easily be able to cope with an infestation of this size, given that their UK cousins damaged an area over five times this size last summer," remarked Paul.

**Scent of a Moth**

In this day and age no one has the time or resources to waste on wild goose chases. Developing a pheromone trap revolutionised monitoring the establishment and spread of the at-times elusive gorse pod moth (*Cydia succedana*). This year a similar tool allowed us to sort out exactly where another small brown gorse moth was hiding. The gorse soft shoot moth (*Agonopterix ulicetella*) was released widely during the 1990s and has been playing hard to get ever since. The adults hide away during the day, and while the caterpillars aren't quite so shy they are only around for a short time and are not easy to find when numbers are low. Pheromone traps were put out last spring to lure any male moths in the area with sex on their minds. Positive results came back from 10 sites spread from one end of the country to the other (Northland, Bay of Plenty, Canterbury (4), Otago, Southland, and the West Coast (2)) and we are now confident that the moth is firmly established in New Zealand. We hope to use the traps again in future to get a feel for whether the moths have remained close to home or spread out far and wide and how well numbers are building up.

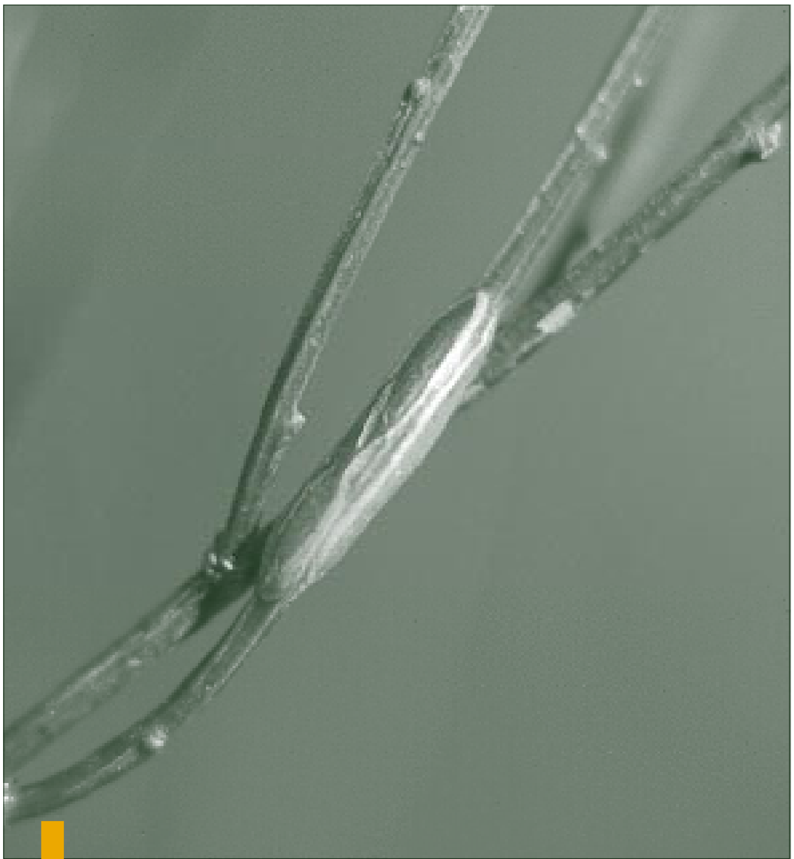
Other countries are interested in this particular agent too. Hawai'i has the jump on us as the moth is performing well there and causing noticeable damage. But we are further ahead than Australia, where the moth hasn't been released yet. Hugh Gourlay is helping our colleagues across the Tasman with safety-testing.

## Out of the Broom Closet

At the behest of New Zealand, Australia and the USA, investigations into new control agents for broom have been continuing in the south of France. This project began way back in 1981, and is currently under the wing of Rüdiger Wittenberg (CABI Bioscience) and Thierry Thomann (CSIRO). Two gall-forming flies (*Hexomyza sarothamni* and *Asphondylia sarothamni*), have been the main focus of their attention during recent times, as these flies appear to occupy niches on broom that are vacant in the countries where the plant is a problem. Host range testing and rearing of colonies of these two insects in the laboratory have been challenging because both species seem to be fussy about the conditions under which they will lay their eggs. However, testing is expected to be completed during 2001.

One of the flies (*H. sarothamni*) mines stems, resulting in conspicuous galls on new growth of broom. As well as killing individual stems, the galls are believed to stunt the growth of whole plants. Records in the literature suggest that this species has a narrow host range. Closely related leaf-mining flies are usually extremely selective in their tastes and include several economic pests that cause considerable damage to their host plants.

The other fly (*A. sarothamni*) galls other parts of the plant and has two generations per year. The first generation galls the buds. Damage is easy to recognise as the galled flower buds are deformed and swollen. Emerging adults live for one or two days and lay eggs when the plant is flowering. The second generation galls the pods. Both insects should be useful additions to the New Zealand armoury against broom.



*Damage to broom caused by a gall fly (*Hexomyza sarothamni*) that is being investigated as a possible new agent*

## Watch Out, New Pages About

This winter we have prepared the sixth batch of pages for "The Biological Control of Weeds Book". Mist flower and hawkweeds now have enough pages to form their own sections. The"Basics" section has new information on inundative control using mycoherbicides and insects commonly mistaken for biological control agents. The gorse section boasts pages on both the gorse soft and hard shoot moths, as well as native insects that commonly attack the plant. A page has been prepared on the old man's beard sawfly, four new recovery forms have been compiled, and the index has been updated to help you keep track of everything. The new pages will be distributed in August.

## Who's Who in Biological Control of Weeds?

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|---|---|
| **Alligator weed beetle** (*Agasicles hygrophila*) | Foliage feeder, common, often provides excellent control on static water bodies. |
| **Alligator weed beetle** (*Disonycha argentinensis*) | Foliage feeder, released widely in the early 1980s, failed to establish. |
| **Alligator weed moth** (*Arcola malloi*) | Foliage feeder, common in some areas, can provide excellent control on static water bodies. |
| **Blackberry Rust** (*Phragmidium violaceum*) | Leaf rust fungus, self-introduced, common in areas where susceptible plants occur, can be damaging but many plants are resistant. |
| **Broom leaf beetle** (*Gonioctena olivacea*) | Foliage feeder, application to release stalled while economic data on the cost / benefits of broom and tree lucerne are collated and evaluated. |
| **Broom psyllid** (*Arytainilla spartiophila*) | Sap sucker, becoming more common, slow to disperse, impact unknown. |
| **Broom seed beetle** (*Bruchidius villosus*) | Seed feeder, becoming more common, spreading well, showing potential to destroy many seeds. |
| **Broom twig miner** (*Leucoptera spartifoliella*) | Stem miner, self-introduced, common, often causes obvious damage. |
| **Californian thistle flea beetle** (*Altica carduorum*) | Foliage feeder, released widely during the early 1990s, not thought to have established. |
| **Californian thistle gall fly** (*Urophora cardui*) | Gall former, rare, impact unknown, further releases planned. |
| **Californian thistle leaf beetle** (*Lema cyanella*) | Foliage feeder, rare, no obvious impact, no further releases planned. |
| **Gorse colonial hard shoot moth** (*Pempelia genistella*) | Foliage feeder, limited releases to date, established at one site, impact unknown, further releases planned. |
| **Gorse hard shoot moth** (*Scythris grandipennis*) | Foliage feeder, failed to establish from small number released at one site, no further releases planned due to rearing difficulties. |
| **Gorse pod moth** (*Cydia succedana*) | Seed feeder, becoming more common, spreading well, showing potential to destroy seeds in spring and autumn. |
| **Gorse seed weevil** (*Exapion ulicis*) | Seed feeder, common, destroys many seeds in spring. |
| **Gorse soft shoot moth** (*Agonopterix ulicetella*) | Foliage feeder, rare, no obvious impact, no further releases planned. |
| **Gorse spider mite** (*Tetranychus lintearius*) | Sap sucker, common, often causes obvious damage. |
| **Gorse stem miner** (*Anisoplaca ptyoptera*) | Stem miner, native insect, common in the South Island, often causes obvious damage, lemon tree borer has similar impact in the North Island. |
| **Gorse thrips** (*Sericothrips staphylinus*) | Sap sucker, becoming more common, slow to disperse, impact unknown. |
| **Hemlock moth** (*Agonopterix alstromeriana*) | Foliage feeder, self-introduced, common, often causes severe damage. |

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| **Hieracium crown hover fly** (*Cheilosia psilophthalma*) | Permission to release recently granted. Rearing underway to enable releases to begin. |
| **Hieracium gall midge** (*Macrolabis pilosellae*) | Permission to release recently granted. Rearing underway to enable releases to begin. |
| **Hieracium gall wasp** (*Aulacidea subterminalis*) | Gall former, recently released throughout the South Island, establishment looks promising, impact unknown. |
| **Hieracium plume moth** (*Oxyptilus pilosellae*) | Foliage feeder, only released at one site , establishment unknown, further releases will be made if rearing difficulties can be overcome. |
| **Hieracium root hover fly** (*Cheilosia urbana*) | Permission to release recently granted. Rearing underway to enable releases to begin. |
| **Hieracium rust** (*Puccinia hieracii* var. *piloselloidarum*) | Leaf rust fungus, self-introduced?, common, may damage mouse-ear hawkweed but plants vary in susceptibility. |
| **Heather beetle** (*Lochmaea suturalis*) | Foliage feeder, released widely in Tongariro National Park, establishment looks promising, impact unknown. |
| **Mist flower fungus** (*Entyloma ageratinae*) | Leaf smut, becoming common, spreading fast, often causes severe damage. |
| **Mist flower gall fly** (*Procecidochares alani*) | Gall former, only recently released but establishment looks promising, impact unknown. |
| **Nodding thistle crown weevil** (*Trichosirocalus horridus*) | Root and crown feeder, becoming common on several thistles, often provides excellent control in conjunction with other nodding thistle agents. |
| **Nodding thistle gall fly** (*Urophora solstitialis*) | Seed feeder, becoming common, often provides excellent control in conjunction with other nodding thistle agents. |
| **Nodding thistle receptacle weevil** (*Rhinocyllus conicus*) | Seed feeder, common on several thistles, often provides excellent control of nodding thistle in conjunction with the other nodding thistle agents. |
| **Old man's beard leaf fungus** (*Phoma clematidina*) | Leaf fungus, common, often causes obvious damage. |
| **Old man's beard leaf miner** (*Phytomyza vitalbae*) | Leaf miner, becoming common, impact unknown. |
| **Old man's beard sawfly** (*Monophadnus spinolae*) | Foliage feeder, only released at two sites, establishment success unknown, further releases will be made if rearing difficulties can be overcome. |
| **Scotch thistle gall fly** (*Urophora stylata*) | Seed feeder, limited releases to date, appears to have established north of Auckland, impact unknown. |
| **Cinnabar moth** (*Tyria jacobaeae*) | Foliage feeder, common in some areas, often causes obvious damage. |
| **Ragwort flea beetle** (*Longitarsus jacobaeae*) | Root and crown feeder, common in most areas, often provides excellent control. |
| **Ragwort seed fly** (*Botanophila jacobaeae*) | Seed feeder, established in the central North Island, no significant impact. |
| **Greater St John's wort beetle** (*Chrysolina quadrigemina*) | Foliage feeder, common in some areas, not believed to be as significant as the lesser St John's wort beetle. |
| **Lesser St John's wort beetle** (*Chrysolina hyperici*) | Foliage feeder, common, often provides excellent control. |
| **St John's wort gall midge** (*Zeuxidiplosis giardi*) | Gall fomer, established in the northern South Island, often causes severe stunting. |

## *Further Reading*

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**What's New In Biological Control Of Weeds? (issues 1–18) are available from Lynley Hayes (address below). This newsletter is also available on the web.**

### *Contact Addresses*

**Lincoln Staff:**
**Hugh Gourlay, Helen Harman, Lynley Hayes, Lindsay Smith, Pauline Syrett.**
Landcare Research
PO Box 69
Lincoln 8152, New Zealand
Ph +64 3 325 6700
Fax +64 3 325 2418

**Nelson Staff:**
**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

**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

**Editor:** **Lynley Hayes**
**Cartoons:** **Anouk Wanrooy, Tom Scott**
**Thanks to:** **Christine Bezar**
**Layout:** **Kirsty Cullen**

**Email:** surname+initial@landcare.cri.nz
**Web:** http://www.landcare.cri.nz

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