# What's New In Biological Control Of Weeds?

## What's Inside:


| | |
|---|---|
| Moth Hogs the Limelight | 1–2 |
| Hot Gossip | 3 |
| Leaf miner springs into action | |
| Expected new arrivals | |
| Kia Ora Nick! | 4–5 |
| A Turn Up for the Books | 5 |
| Trawling the Murky Depths | 6 |
| Things To Do this Autumn | 7 |
| Broom Takes a Beating | 8 |



Issue 23 February 2003
ISSN 1173-6356



Manaaki Whenua
Landcare Research


## Moth Hogs the Limelight

When we decided to put out a press release in November telling people about the successful establishment of one of our newer agents, the gorse colonial hard shoot moth (*Pempelia genistella*), we were once again reminded how that five-letter word "gorse" still has the power to really get people going! Despite a century of effort to control the plant there is still too much of the wretched stuff around for many people's liking. Within minutes our phones began ringing and email messages started arriving, as reporters and landowners wanted to know more. So just in case you missed the splurge of publicity, here are all the details again.

We first imported the colonial hard shoot moth from Portugal in 1995 after extensive testing showed that it could only survive on gorse and was extremely unlikely to damage any other plant species. The green-and-brown-striped caterpillars are the damaging stage and they live together in communal webs and graze on gorse foliage in the autumn, becoming inactive as the weather cools down. With the arrival of spring the caterpillars take on a new lease of life and feed on young gorse buds, shoots and flowers.

Like many other lepidoptera we have worked with, this moth has proven difficult to mass-rear in captivity so only a limited number of releases have been made so far and we do not yet know the fate of most of them (see table). We are continuing to mass-rear the moths as long as demand continues (enquiries to Lynley Hayes, hayesl@landcareresearch.co.nz).

**Gorse colonial hard shoot moth releases to date**

| Year | Place | Fate |
|---|---|---|
| 1998 | Constable Rd, Auckland | Unknown |
| | Lincoln, Canterbury | Established |
| | Redcliffs, Canterbury | Established |
| 2001 | Brodies Rd, Canterbury | Unknown |
| | Parewanui Rd, Manawatu-Wanganui | |
| | Uriti, Northland | |
| | Mokau Rd, Taranaki | |
| | Norfolk Rd, Wellington | |
| 2002 | Kauritatahi, Western Bay of Plenty | Unknown |
| | Ratana, Manawatu-Wanganui | |
| | Slaughterhouse Rd, Southland | |
| | Mokau Rd, Taranaki | |
| | Paraparaumu, Wellington | |
| | Titahi Bay, Wellington | |

We were delighted to discover this spring that the moth is now thriving in the wild at one of the earliest release sites (1998) in a coastal suburb of Christchurch. Previously the only place that the moth could be found was on a tiny patch of gorse at our Lincoln campus. We had checked the Redcliffs site (and the Constable Rd site) previously and not seen any sign. So what have we learned from this experience?

- It might take four or more years before you can easily find the moths at a release site and it's probably not worth even looking until more than 2 years have elapsed.
- The best time to look is likely to be the end of October/early November. This is because the caterpillars have achieved a reasonable size by this stage of the year and the webs are not yet obscured by new growth. Once the plant begins to put on new growth it becomes much harder to find webs, even when you know they are there.
- The moths are already more abundant at Redcliffs than you would typically find in their native Portugal (probably because their own specialist natural enemies do not occur in New Zealand), which bodes well for the future. It should be possible to start harvesting moths from this site next spring.

*Gorse colonial hard shoot moth*

The colonial hard shoot moth should not be confused with the two other moths we have released to attack gorse. The gorse soft shoot moth (*Agonopterix ulicetella*) attacks new growth in the spring and is established but rare in New Zealand. The gorse pod moth (*Cydia succedana*) feeds on the seeds and is becoming common and widespread throughout New Zealand. Then there is the other seed feeder, the gorse seed weevil (*Exapion ulicis*) and the two other foliage feeders: gorse spider mites (*Tetranychus lintearius*) and gorse thrips (*Sericothrips staphylinus*) as well. We hope that with time all six agents will achieve good coverage and our combined biological control will reduce the vigour of gorse, and eventually lead to its decline. Modelling predictions suggest that biological control stands a good chance of being successful in the longer term.

## Weed Ecology Workshop

We are organising a weed ecology workshop for the 2nd of April at Lincoln. This is an opportunity for our weed ecologists to share with you some of the insights they have learnt through their research. Some of the topics that we expect to cover include: are invasions all bad news, gorse and broom dispersal, how to prevent wilding conifer spread and control existing infestations, plus woody weeds and native shrubland restoration in Central Otago.
This weed ecology workshop is free of charge and open to all interested people. To secure a place at this workshop please contact Lynley Hayes (Ph 03 3256 701 ext 3808, hayesl@landcareresearch.co.nz).

## Hot Gossip

Lindsay Grueber (Tasman District Council)

*Heavily mined new growth at Nelson*

Last autumn we reported serious damage to old man's beard by the **old man's beard leaf miner** (*Phytomyza vitalbae*) in Marlborough. Early last spring we were alerted to heavy leaf miner attack on new growth in **Nelson**. At a site near Richmond the leaf miners appeared to be having a major impact on the young leaves, many of which were quite brown. Owing to the mild winters experienced in this part of the world, old man's beard does not lose its leaves and we suspect that the leaf miners are able to keep breeding all year round. In most parts of the country the leaf miners spend the winter resting as pupae and we suspect that mortality is quite high during this time. Later in the spring at the Richmond site, when the old man's beard put on a major growth spurt, the leaf miner damage became less noticeable. However, any damage to new growth early in the season is still likely to be having some impact on the old man's beard plants. We know from laboratory studies that 2–3 mines can stunt the growth of small plants by 50%. We hope to begin to measure the impact of old man's beard agents in the field this autumn.

The Environmental Risk Management Authority (ERMA) has given us permission to import four **banana passionfruit agents** into quarantine for safety-testing. They include a moth that feeds on the flowers, fruit and leaves (*Pyrausta perelegans*), a foliage-feeding moth (*Cyanotricha necyria*), a bud-feeding fly (*Zapriothrica* nr. *nudiseta*), and a seed-feeding fly (*Dasiops caustonae*). **Hugh Gourlay** will be responsible for overseeing the testing. Testing of the leaf fungus (*Septoria passiflorae*) will also be carried out this year, but over in Hawai'i since we don't have a suitable pathogen-proof quarantine facility here in New Zealand.

Another hopefully imminent arrival to our quarantine facility at Lincoln will be a new agent for **Californian thistle**. The **root-feeding weevil** (*Apion onopordi*) has been selected as the next candidate to put under the spotlight because of its ability to vector the **rust fungus** (*Puccinia punctiformis*). Research overseas has shown that the females actively transfer rust spores from plant to plant and inoculate them during feeding. In fact they seem to prefer to lay their eggs on rust-infected plants, and progeny raised on these plants do better (they are bigger and lay more eggs). The rust is common here and can be quite damaging, but it is limited in its ability to infect plants. If the weevil can be successfully established in New Zealand, then it may be possible to create widespread rust epidemics here. A population of the weevils has been collected in Europe and is being held by CABI Bioscience in Switzerland until ERMA gives us the go-ahead to import them. **Hugh Gourlay** will also be responsible for safety-testing the weevils.

**Kahili ginger** (*Hedychium gardnerianum*) biocontrol expert **Rob Anderson** will be visiting New Zealand in early April. We have organised to get Rob out here under a New Zealand/Hawai'i scientific exchange scheme. Regional councils will be organising a series of field days that will allow as many people as possible to get the chance to meet Rob and hear about his novel approach to ginger control using a bacterium (*Ralstonia solanacearum*). We are investigating whether this technique might be suitable for use here too. Watch out for details of a field day being held somewhere near you.

By the time you are reading this the **8th International Congress of Plant Pathology** (Christchurch, 1–7 February) will have been and gone and the countdown to the **11th International Symposium on Biological Control of Weeds** (Canberra, 28 April – 2 May) will be underway. Watch out for reports on the main highlights and stories to come out of these two important events, in future issues of this newsletter.

## Kia Ora Nick!

Just before Christmas we welcomed a new plant pathologist to our team. Nick Waipara is based at our Auckland office, and is in a sense returning to his roots, seeing as he was born in the City of Sails. However, shortly afterwards Nick's parents whisked him away down south and he spent his formative years in North Canterbury. Nick has strong links with Ngati Porou and Rongowhakaatua and has enjoyed spending numerous Christmas holidays feasting on kaimoana (seafood) on the East Coast of the North Island.

*"I think I'm destined to keep crossing paths with thistles until we can find some better ways of controlling them"*

Nick will be helping us with a number of projects, including ones on Californian thistle, tradescantia, banana passionfruit and moth plant. "There is something about thistles and me," said Nick. "They keep coming back to haunt me. Soon I will have worked on Californian thistle under the auspices of three different crown research institutes, and I guess there must be some kind of karma at work here. I think I'm destined to keep crossing paths with thistles until we can find some better ways of controlling them." Nick first got involved with Californian thistles in his student days when he was employed to help Graeme Bourdôt and Ian Harvey at AgResearch, Lincoln, carry out a survey on pathogens found on Californian thistles in Canterbury. Later he studied two of the pathogens found during the survey (*Phoma* sp. and *Verticillium* sp.) as part of his honours degree at Canterbury University. Nick then spent a year working with Ian Harvey on the *Sclerotinia sclerotiorum* mycoherbicide project.

Taking a break from thistles for a while, Nick then completed a PhD on the fungal taxonomy of pathogens of white clover in the Waikato. "I spent many hours roaming the hillsides in what many people now affectionately refer to as The Shire and Hobbiton," revealed Nick. He then took up a postdoctoral position in Norway doing something completely different again, but still pathogen-related. "I was involved in research to find better ways of providing sterile environments for operating theatres and organic food production. But I didn't manage to pick up much Norwegian," explained Nick. "My colleagues wanted to speak English all the time."

After the Norwegian experience it was time for Nick to tackle some fresh challenges. He returned to New Zealand to take up a position at AgResearch, Ruakura, to study the impacts of various land management practices (e.g. fertiliser application, dairy shed effluent) on soil microbes, and diseases affecting pasture plants. A couple of years later Nick was lured back to Lincoln to assist HortResearch with studies on berryfruit diseases and building-health issues (e.g. fungi that grow inside leaky buildings). Because of his track record it wasn't long before Nick got roped back into thistles again. This time to investigate the potential of a new arrival, phoma leaf blight (*Phoma exigua* var. *exigua),* as a biocontrol agent (see "A Turn Up for the Books").

Outside of work Nick is an avid traveller, and sampler of "long blacks". A self-confessed "sucrologist" he not

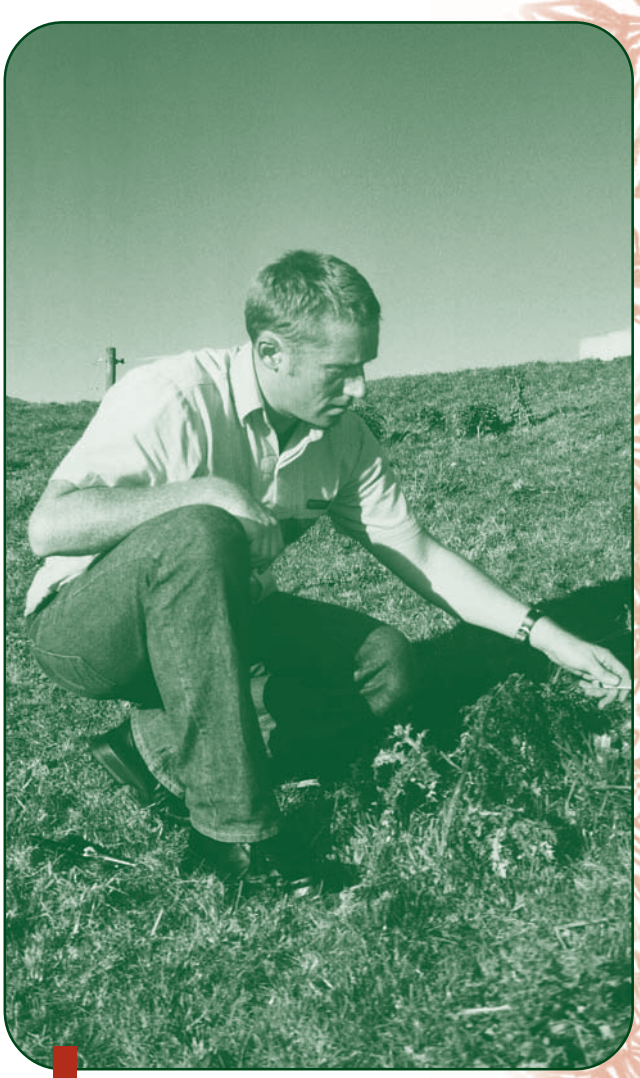
*Who let the plug out? Nick and friends resort to sailing the sand pit.*

only collects those dinky little packets of sugar from all the cafes where he samples the "long blacks", but vinyl too. Apparently you can still buy records these days! "The sound is better and so is the artwork on an album cover compared with a little CD," professed Nick. "I've got thousands of records, covering everything imaginable and I really enjoy poking around to see what I can find in secondhand shops." Nick is also into sports fitness in a big way. Although he has given up triathlons and gym instructing these days, he still works out regularly. With such a diverse background and range of interests we are sure that Nick will prove to be a real asset to biological control of weeds in New Zealand!

## A Turn Up for the Books

From time to time useful organisms turn up in New Zealand that can assist with weed control (e.g. broom twig miner (*Leucoptera spartifoliella*), hemlock moth (*Agonopterix alstromeriana*) and blackberry rust (*Phragmidium violaceum*). This is why we always survey a weed thoroughly when embarking on a new project. In 1999 some unusually sickly looking Californian thistle plants were noticed in the Manawatu, and the pathogen phoma leaf blight (*Phoma exigua* var. *exigua*) was isolated from them. Since then people from other parts of the country have from time to time reported severe damage to a range of thistles. With funding from AGMARDT, Landcare Research, HortResearch, Heinz Watties, horizons.mw, and the Hawke's Bay Regional Council, Nick Waipara was able to look this "gift horse" in the mouth and investigate ways of harnessing its potential.

A brew of the fungus was prepared and sprayed onto thistles in the Manawatu, Wanganui, North Waikato and Waihi during 2000/01. This technique proved to be a successful way of establishing the fungus, as it was subsequently recovered from all the sites treated in this way. The following year inoculations were repeated at some of the sites to assess the level of damage that could be achieved by this approach. Phoma leaf blight has proved to be a highly variable pathogen. "Although infection was present at all our study sites, the severity and spread of the disease ranged from very low to moderately high," explained Nick. The summer of 2001/02 was unusually wet and may have favoured the thistles at the expense of the fungus. "Strong healthy thistles tend to be more resilient and resistant to infection." However, at some sites there was evidence that the fungus is indeed capable of inhibiting thistle growth and seeding.



*Nick inspecting his trial plots for signs of phoma leaf blight.*

More work now needs to done on finding ways to allow phoma leaf blight to achieve its potential. In the trials described above the fungus was applied in late November and again in March. There is some evidence from overseas that Californian thistles may be more susceptible to the disease when they first emerge, so it would be worth experimenting with applications earlier in the spring. Lincoln University researchers have also found that wounding the thistles may increase the severity of the infection, so a pretreatment such as mowing may prove to be useful too. Hopefully funding can be found in the near future that will allow us to find ways of getting better mileage out of this fortuitous new arrival.

## Trawling the Murky Depths

We have only attempted biological control for one aquatic plant, alligator weed (*Alternanthera philoxeroides*), with partial success. Overseas a number of aquatics have been successfully targeted in this way, e.g. water lettuce (*Pistia stratiotes*), salvinia (*Salvinia molesta*), and water hyacinth (*Eichhornia crassipes*), providing huge financial and social benefits to many countries. Recently we have been asked to advise on the potential for developing biological control programmes for some of our worst aquatic weeds. Darren Ward, Alison Gianotti, Peter McGregor, and Hugh Gourlay have trawled through available information on hydrilla (*Hydrilla verticillata*), oxygen weed (*Egeria densa*), hornwort (*Ceratophyllum demersum*), and lagarosiphon (*Lagarosiphon major*), and have come up with some recommendations. But first some background…

At present hydrilla is confined to four lakes in the Hawke's Bay. Oxygen weed and hornwort are well established in the North Island and are beginning to rear their ugly heads in South Island water bodies too. Lagarosiphon is widespread throughout the country. All can form vast, dense, underwater meadows that displace smaller native aquatic plant species and reduce the amount of habitat suitable for aquatic animals. When large clumps become dislodged they can cause flooding and, if washed ashore, can create a terrible stench during decomposition. These weeds also retard water flow and affect irrigation schemes, urban water supplies, and power generation. Last but not least they can also put a huge dampener on activities such as boating and fishing.

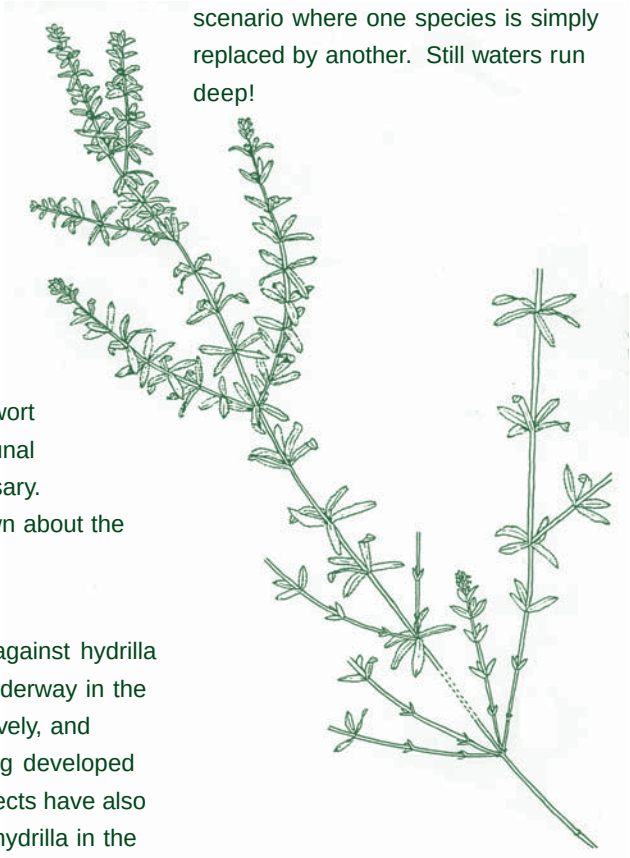
All four species reproduce asexually and spread by fragmentation. Hydrilla also propagates by tubers and turions (buds that detach). Existing mechanical and chemical control methods tend to be expensive, not practical over large areas, unable to provide lasting control, and can have adverse effects on the environment. Grass carp have provided good control of oxygen weed and hydrilla in some places here, but they unfortunately also feed on desirable plants.

*"Developing biological programmes against these weeds would not be all plain sailing."*

Luckily it turns out that we don't have any native plants that are closely related to these weeds, and no economically or culturally important plants that are likely to throw a spanner in the works either. This would in theory make it relatively straightforward to find suitably host-specific agents. However, developing biological programmes against these weeds would not be all plain sailing. Little is known about the natural enemies of hornwort and lagarosiphon, so faunal surveys would be necessary. Fortunately more is known about the other two.

Biocontrol programmes against hydrilla and oxygen weed are underway in the USA and Brazil, respectively, and mycoherbicides are being developed for each target. Four insects have also been released to attack hydrilla in the USA. Two leaf-mining flies (*Hydrellia balciunasi, H. pakistanae*) have established and are having a significant impact at some sites in the southern USA.

The general feeling seems to be that before we should proceed any further, a raft of ecological studies needs to be carried out. The consequences of releasing agents that may increase stem fragmentation (and potentially spread the weed further) need to be better understood, and could limit the range of potential agents. It is also essential to gain a better understanding of the effect of removing any or all these weeds – in some situations their removal may further degrade, rather than rehabilitate, those habitats. It is possible that in order to make a difference we would need to target all four species to avoid the scenario where one species is simply replaced by another. Still waters run deep!



## Things To Do This Autumn

Autumn can be a busy time on the biocontrol calendar before things quieten off again over the winter period. Some of the things you might need to plan for include:

- Checking release sites where gall-forming agents, like the hieracium gall wasp (*Aulacidea subterminalis*), mist flower gall fly (*Procecidochares alani*), and Californian thistle gall fly (*Urophora cardui*) have been released. The plant deformities (galls) caused by these agents develop over the warmer months and are usually most obvious in early autumn. If galls are present in good numbers, then you can harvest them for release in other areas.

- Checking gorse infestations for the presence of gorse pod moth (*Cydia succedana*). We suspect that this seed feeder is quietly getting on with the job of dispersing throughout New Zealand, so take some time to check any gorse infestations you come across. You may see the small brown moths fluttering about the gorse, especially on sunny days. They have a characteristic twirling flight and a tendency to suddenly drop down onto plants. Look inside pods for the creamy caterpillars feeding on the seeds or for empty pods where all the seeds have been consumed and the culprit has moved on to greener pastures. The good thing about checking at this time of the year is that there will be no danger of confusing pod moths with gorse seed weevils (*Exapion ulicis*). If you can find areas of gorse that have not yet been colonised by the moth, then simply harvest infested pod material from established sites and wedge it into gorse in these areas.

*Gorse pod moth*

- Harvesting and redistributing ragwort flea beetle (*Longitarsus jacobaeae*) and nodding thistle crown weevil (*Trichosirocalus horridus*). Be careful to avoid sealing up ragwort flea beetles with large quantities of ragwort in non-breathable containers in hot weather as this has proven to be a lethal combination in the past. Also be careful to take the time to sort through any material you collect so that you don't inadvertently spread any pests, like the clover root weevil (*Sitona lepidus*), at the same time.

- Harvesting and redistributing nodding and Scotch thistle gall flies (*Urophora solstitialis & U. stylata*). Look for mature flowerheads that have an unusual fluffy appearance. Carefully squeeze them between your thumb and forefinger to check if they are hard and lumpy (a dead give away that they are infested). You can cut these flowerheads and shift them to new sites, where they will gradually break down over the winter allowing the adult flies to emerge in the spring. It is best to hang them in an onion bag (or similar) on a fence out of harm's way.

- Also keep an eye out for old man's beard fungus (*Phoma clematidina*) damage. This often shows up most strongly in the autumn. Look out for leaves and stems that have a black, slimy appearance. Plants that have been under attack often have the appearance of having had a bad haircut, as if someone has taken to the ends of vines with hedge trimmers.

Remember to read up the relevant pages in "The Biological Control of Weeds Book" before embarking on any of these activities!

### Reminder

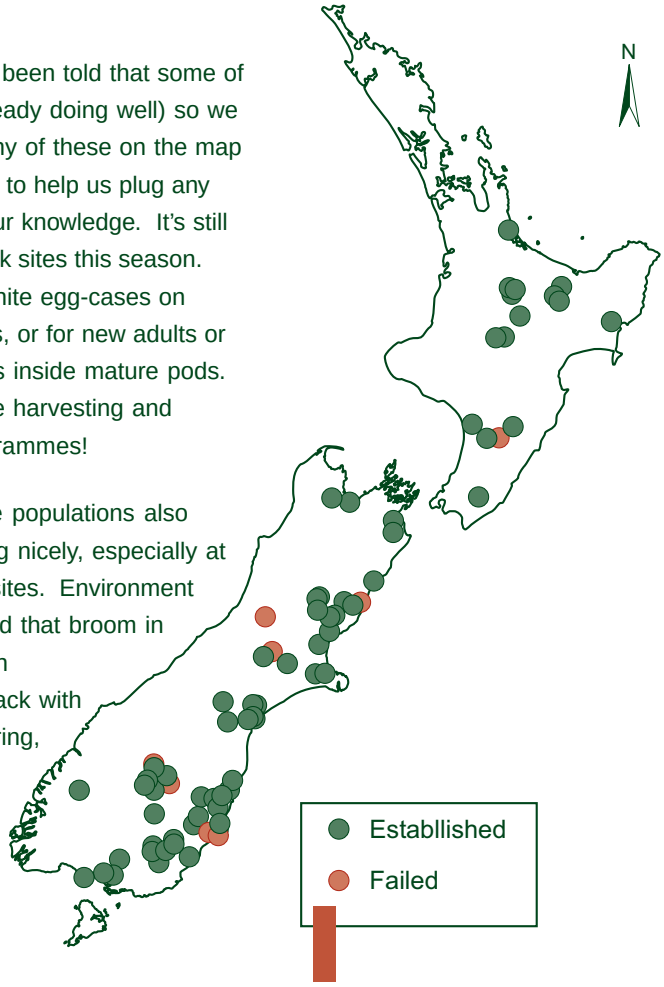
If you have any outstanding release or recovery forms relating to the past season please send them in as soon as possible.

## Broom Takes a Beating

Thank you to all the people who responded to my request to supply information about how their broom seed beetle (*Bruchidius villosus*) sites were doing. In particular I was impressed by the hard-working souls at the Otago Regional Council who managed to check 36 sites. I've now been able to update information on our database about the status of more than 80 sites, the vast majority of which had never been checked before and we knew nothing about.

The good news is that the beetles seem to be establishing fairly readily in most places. We have prepared a map (see map) showing all the original release sites where the beetle is now known to have either established or failed to take hold. This is likely to be a conservative estimate of the beetles' actual coverage as we are sure that many of the "don't knows", which we haven't included at this stage, will turn out to be establishments also. We only have sketchy information about sites set up by people redistributing beetles from the original release sites (although we have been told that some of these sites are already doing well) so we haven't included any of these on the map either. Do feel free to help us plug any gaps we have in our knowledge. It's still not too late to check sites this season. You can look for white egg-cases on brown mature pods, or for new adults or hollowed out seeds inside mature pods. Also keep up those harvesting and redistribution programmes!

Broom seed beetle populations also seem to be building nicely, especially at some of the older sites. Environment Canterbury reported that broom in some parts of North Canterbury was black with the beetles last spring, and PhD student Melanie Haines has estimated that over the past 2 years the beetles have scoffed 80–90% of seeds produced by broom plants on our patch here at Lincoln.




*Sites where broom seed beetles are now known to have either established or failed to establish.*


### Contact Addresses

**Hugh Gourlay, Lynley Hayes**
Landcare Research
PO Box 69
Lincoln 8152, New Zealand
Ph +64 3 325 6700
Fax +64 3 325 2418

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

**Nick Waipara, Darren Ward, Alison Gianotti**
Landcare Research
Private Bag 92170
Auckland, New Zealand
Ph +64 9 815 4200
Fax +64 9 849 7093



**Editor:** Lynley Hayes
**Cartoons:** Anke Stomphorst
**Thanks to:** Christine Bezar
**Layout:** Anouk Wanrooy
**Email:** surname+initial@landcareresearch.co.nz
**Web:** http://www.landcareresearch.co.nz

100% RECYCLED
PAPER STOCK
Onyx Recycled 135gsm
100% recycled
This newsletter was printed using vegetable inks.