Number 13 November 1999

What's New In Biological Control of Weeds?

What's Inside?

As this is the last newsletter for 1999 the team at Landcare Research would like to take this opportunity to wish everyone a very happy Christmas and a memorable New Year. See you in the new millennium!

Manaaki Whenua
Landcare Research

International Hot Gossip

In July a New Zealand contingent travelled to the Wild West American State of Montana (known affectionately as "the last best place") to take the opportunity to live, breathe, and sleep biological control of weeds with researchers from all over the world. This international symposium is held every 3–4 years and is an extremely important way of maintaining the excellent international collaboration that biological control of weeds is renowned for. Below, we have listed some of the pearls of wisdom gleaned from this meeting that are of particular interest to New Zealand.

Chelsea Helps to Purge Spurge

After a week of non-stop talking about biological control projects, at the Montana State University in Bozeman, it was great to get out in the field and see some of these projects in the flesh. The post-symposium field trip was also a wonderful opportunity to experience the breathtaking scenery and wildlife of the Rocky Mountains and a bit of Wild West culture. In our travels we visited a 45,000 acre Aberdeen Angus cattle ranch where a major pest, **leafy spurge** (*Euphorbia esula*), is being successfully controlled using a combination of beetles (*Apthona* spp.) and a small flock of sheep. The sheep have to be guarded 24 hours a day by a shepherd and three dogs to keep them safe from bears, cougars and coyotes! Much to our surprise we ran into **Chelsea Clinton** doing work experience on the ranch. She had spent the day mending fences and doing her bit to

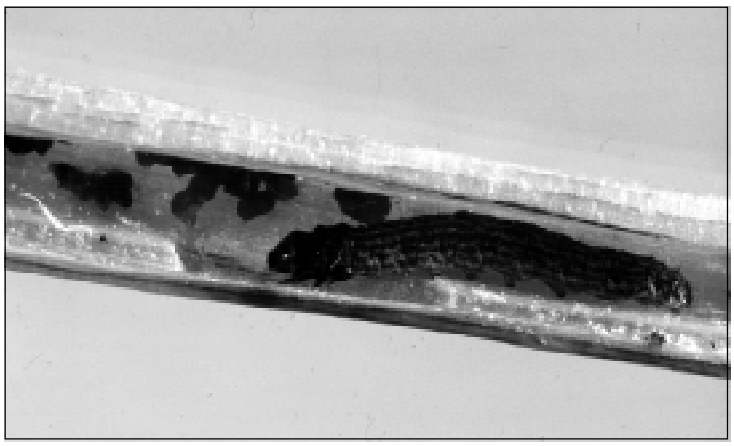
A rancher shows biological control experts from around the world the agents that are successfully reducing his leafy spurge problem

purge spurge by collecting beetles for redistribution. Our American colleagues hoped that she would go home and put in a good word about biological control with father Bill.

Alligator Weed — The Crunch is Yet to Come!

Partial control of **alligator weed** (*Alternanthera philoxeroides*) has been achieved down under with a beetle (*Agasicles hygrophila*) and a moth (*Arcola malloi*), but they are not effective in all situations, and in particular terrestrial infestations continue to be problematic. It has recently come to light that people on both sides of the Tasman have mistaken alligator weed for *A. sessalis*, a popular leafy herb in Sri Lanka, and they have been cultivating and spreading it around. Australian researchers tell us that since they discovered alligator weed being sold at vegetable markets and even available by mail order they believe they are sitting on a time bomb. It can only be a matter of time before new infestations appear in new areas, and when it comes to the crunch we are going to need better tools to be able to deal with them.

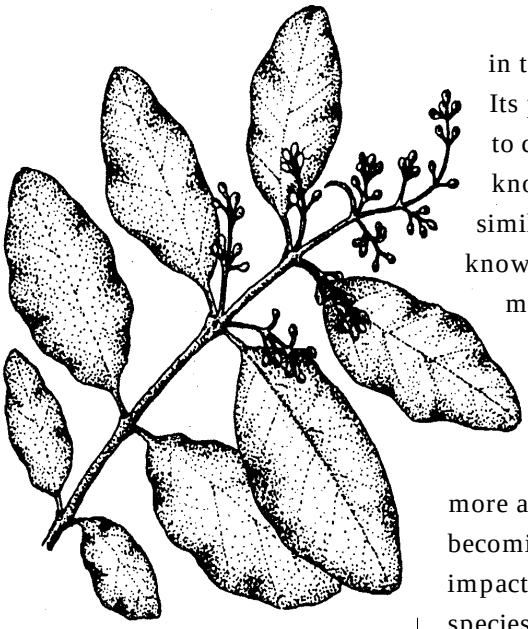
A discussion group was held one evening to discuss water weeds and the ongoing problem of alligator weed came up. Apparently surveys in South America in the 1960s revealed at least 60 insect species associated with alligator weed, but little, if anything, is known about most of these species. There is a good chance that further surveys would turn up many potential biological control agents. Other potential agents already exist. For example, American colleagues told us that a thrips (*Amynothrips andersoni*) that damages terrestrial infestations is showing some promise. Also the terrestrially orientated flea beetle (*Disonycha argentinensis*) might be worth giving another try. The beetle previously failed to establish down under, but it can often take several attempts to establish a control agent. There is also the possibility of finding suitable pathogens to attack alligator weed, and a damaging fungus (*Nipia alternaria*) has already been identified in Florida. A lot more could be done to add teeth to the alligator weed programme.



Alligator weed moth larva

Gorse Spider Mites Take A Nose Dive

In issue number 9 of this newsletter we showed you some spectacular photos of **gorse spider mites** (*Tetranychus lintearius*) in Oregon, USA. We were green with envy that the mites, which we had supplied them with, were so much more spectacular than their relatives back here in New Zealand. At the time the photos were taken the colonies were free from predators, but this is no longer the case. History has repeated itself and the same predatory mite (*Phytoseiulus persimilis*) and little black ladybird (*Stethorus* sp.) that attack gorse spider mites in New Zealand are now chomping into the American ones and unfortunately limiting their effectiveness too.



Chinese tree privet

Privet Gets Up People's Noses

Every year regional councils' phones ring red hot with people complaining that **tree privet** *(Ligustrum lucidum)* and **Chinese privet** (*Ligustrum sinense*) are giving them hay fever and asthma. While it has been easy to point the finger at privet, it has been more difficult to prove that these plants are indeed the culprits, since both are insect-pollinated and do not produce the sorts of wind-blown pollen commonly associated with these conditions. However, our UK colleagues told us that other members of the Oleaceae family have been shown to produce pollen that is harmful to humans. For example, the European olive (*Olea europaea*) is an important cause of snuffles and wheezes in the Mediterranean area. Its pollen has been found to contain an allergen known as Ole e-I, and similar substances are known to exist in other members of the Oleaceae family that could well be allergenic too.

Around the globe more and more people are becoming concerned about the impacts of various privet species, and the plant now has pest status in Argentina, Australia, Brazil, southern USA, and on the islands of Mauritius and La Réunion. *Ligustrum robustum* ssp. *walkeri* is so invasive on La Réunion that a biological control programme has been initiated to try to save the island's forest ecosystems. A discussion group was held during the symposium where several countries talked about the possibility of collaborating to expand this privet work. As a first step towards this potential collaboration we will produce a report this year on the feasibility of implementing a biological control programme in New Zealand.

A Thorny Issue

Canadian colleagues tell us that they too are disappointed with the performance of the **Californian thistle leaf beetle *(Lema cyanella)*.** Because this foliage-feeding beetle might also attack some of their native thistles, they are going to cut their losses and try to eradicate it! There was a lot of talk at the symposium about the impact of the nodding thistle receptacle weevil ***(Rhinocyllus conicus)*** on native thistles in North America, and we saw the evidence ourselves while exploring Yellowstone National Park. Even though safety testing showed that the native thistles were at risk, a decision was made in the 1960s to release the weevils anyway. It wasn't until nearly 30 years later that the risk became a reality. Thank goodness we don't have any native thistles in New Zealand to complicate matters!

Californian thistle leaf beetle

Wilding Pines

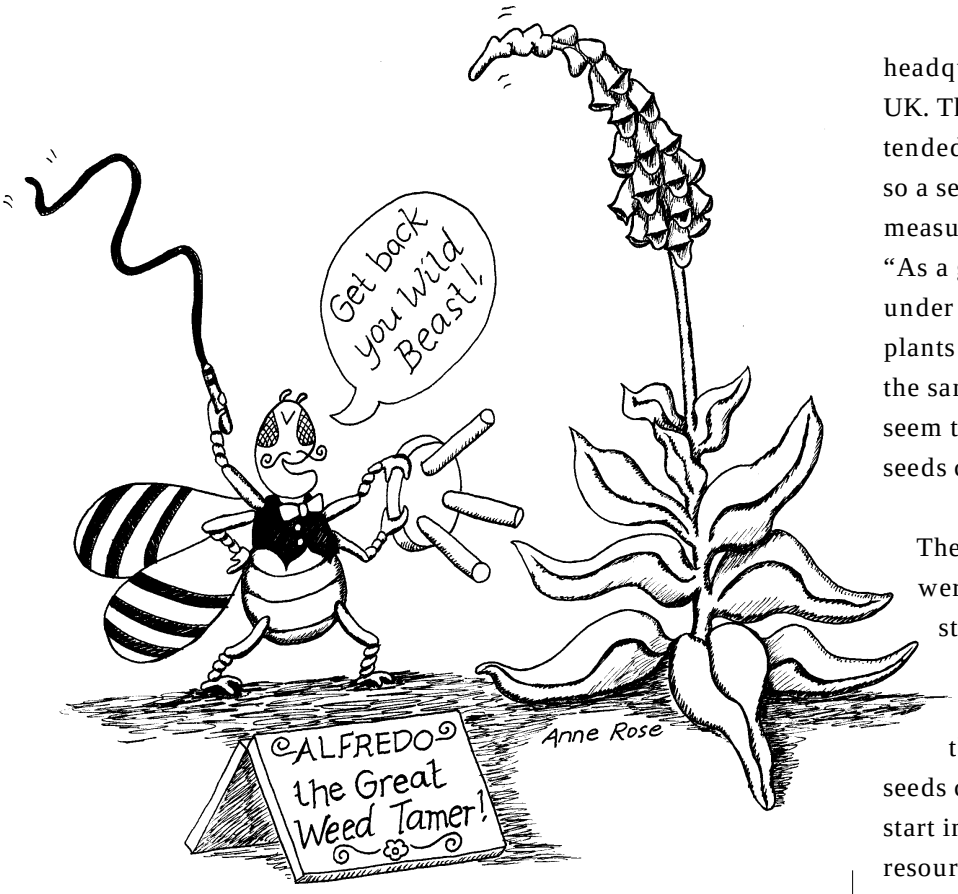
In issue number 11 of this newsletter we told you about the South African project to control wattles which are, amongst other things, sucking their rivers dry of water. Wattles aren't the only culprits and other trees must be controlled too. South African researchers told us that they are exploring the possibility of developing biological control for **wilding pines.** They intend to focus on finding seed-feeding agents to prevent both the spread of invasive pines into new areas and to prevent areas, which have been cleared at great expense, from becoming reinfested. A number of issues are being worked through with the forest industry, such as the protection of seed orchards and the possibility that biological control agents might spread tree diseases. Since New Zealand also has a significant problem with wilding pines, we will be following their progress closely.

Local Hot Gossip

Simon Fowler surrounded by diseased mist flower in the Waitakeres

There have been big smiles all round as the **mist flower fungus** (*Entyloma ageratinae*) exceeds expectations. The white smut was released for the first time last summer and there were promising results by autumn when it looked as though it was successfully establishing at all nine release sites. Knowing that the fungus is most active in warmer temperatures, we expected it to be dormant over the cooler winter months and did not expect to see any spectacular damage until the following spring. However, this has not proved to be the case! The white smut has been busy during the winter and large patches of mist flower are already severely defoliated at some sites. Damaged mist flower plants are attempting to regrow, but new growth, and seedlings, are quickly becoming infected too. Even more pleasing is the sight of young native plants coming away where once there was only mist flower!

The Four Country Comparison from Hell



If you cast your memory back several years you may remember that we asked people to send in weed seeds for an international experiment affectionately referred to as "The four country comparison from hell". For years people have speculated about whether plants become more invasive when grown outside their native range because they evolve into more aggressive strains, or whether they are simply responding to more benign environmental conditions and, in particular, freedom from their natural enemies. Dr Tony Willis of CSIRO, Australia, and Dr Jane Memmott of Bristol University, UK, designed some experiments to come up with some answers to this age-old question.

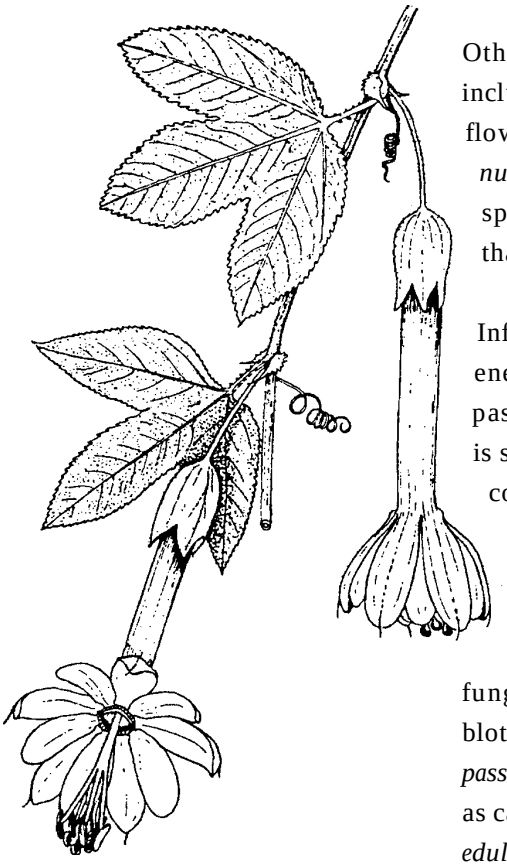
Tony and Jane decided to test four plant species — foxglove (*Digitalis purpurea),* viper's bugloss *(Echium vulgare),* nodding thistle *(Carduus nutans),* and ragwort *(Senecio jacobaea)* — that are native to the UK and continental Europe and introduced weeds in New Zealand and Australia. Some of the seeds sourced from each part of the world were planted out side by side in a special plot at the CABI Biosciences headquarters at Silwood Park, UK. The resulting plants were tended lovingly until maturity so a series of comparative measurements could be made. "As a general rule, when kept under identical conditions the plants all grew pretty much the same," said Jane. "It didn't seem to matter where the seeds came from."

The balance of the seeds were used in a tandem study in which one of Jane's students, Adam Birchall, compared their relative sizes. Large seeds can give plants a head start in life by providing extra resources for germination and early growth of seedlings. If the seeds collected from down under could be shown to be larger than equivalent seeds from the UK and Europe, then this could explain differences in behaviour. However, no significant difference in the size of the seeds was detected.

These findings lend support to the hypothesis that plants become weeds in some countries because they are simply responding to more benign environments and support the basic premise behind biological control that we can tame weeds by making their lives a little less comfortable.

More Millennium Bugs

Hopefully you will all have read the "Millennium Bugs" story in the last issue of "Weed Clippings" where we summarised the prospects for biological control of bone-seed (*Chrysanthemoides monilifera* spp. *monilifera*), climbing asparagus (*Asparagus scandens*), and nassella tussock (*Nassella trichotoma*). In this item we are going to continue along this theme and take a look at the feasibility of biological control for another three plants: banana passionfruit (*Passiflora* spp.), wild ginger (*Hedychium* spp.), and woolly nightshade (*Solanum mauritianum*).



Banana passionfruit

Banana Passionfruit

Two similar species of **banana passionfruit** (*Passiflora mixta, P. mollissima*), which originate in the high Andes of South America, are becoming serious invasive weeds in New Zealand. These should not be confused with the black passionfruit (*P. edulis*) that is grown commercially for its fruit. The weedy ones can be controlled by cutting and herbicide treatment, but this is not the total answer because of damage to non-target plants and regrowth from roots and shoot fragments. Banana passionfruit is also a serious weed in Hawai'i, where it is known as banana poka. A biological control programme has been underway there for a number of years and two moth species and a fungus have been released so far. One of the moths (*Pyrausta perelegans*), which attacks the buds, leaves, shoot tips, and young fruit, has established but not yet had a significant impact on the plant. "The fungus [*Septoria passiflorae*] was only released in 1996, but has already substantially defoliated banana poka at some sites and looks promising," reports Simon Fowler, who has been investigating this project.

Other agents in the pipeline include a fly that feeds on the flower buds (*Zapriotheca* nr. *nudiseta*) and two moth species (*Josia fluonia, J. ligata*) that defoliate the plant.

Information about natural enemies attacking banana passionfruit in New Zealand is scarce. This year regional councils are funding a survey to find out whether any potentially useful agents are already here. For example, a fungus known as septoria blotch (also called *Septoria passiflorae*) has been reported as causing losses to the *P. edulis* industry in New Zealand. "However, we suspect that, although it has been given the same name, it is not the same species as the one being used as a biological control agent in Hawai'i, and it is important to clear up this confusion as soon as possible," said Simon.

"We only have one native member of the Passifloraceae family in New Zealand, kōhia [*P. tetandra*], and since neither this plant nor commercially grown passionfruit belong to the same sub genus as the weedy passionfruits, then there is a good chance that we can find biological control agents that won't attack them."

Wild Ginger

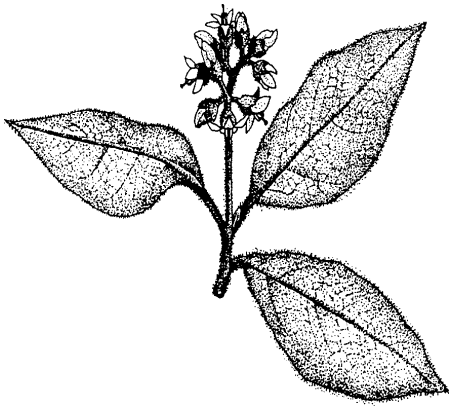
Kahili ginger (*Hedychium gardnerianum*) and yellow ginger (*Hedychium flavescens*) originate from the Himalayas. These fragrant, showy garden escapees have become particularly invasive in the warmer parts of New Zealand. Wild ginger species can be controlled with herbicide, but this is only cost-effective and environmentally safe for controlling small infestations. Biological control options have been investigated in Hawai'i because this is now considered the only practical approach for the long-term management of kahili ginger in native forests. "A wilt-causing bacterium, *Ralstonia (=Pseudomonas) solanacearum*, that occurs on wild and cultivated ginger (*Zingiber officinale*) in Hawai'i, is showing some potential as a control agent there," reports Hugh Gourlay, after a recent visit. This soil-borne pathogen gets into the plant through wounds where it causes severe wilting after about 3–4 weeks and death and decay of the rhizomes after about 4–5 months. Recent research has shown that it is effective at a range of temperatures and might therefore be of use in New Zealand.

Not much is known about other insects and pathogens that attack wild ginger. Because of its economic importance, a lot more is known about the wide range of natural enemies of cultivated ginger. Some of these pests and diseases will also attack wild ginger, for example, a shoot borer *(Conogethes puctiferalis)* and a leaf roller *(Udaspes folus)* have been found on *Hedychium* sp. in India. Several potentially useful fungi have been recorded on species of wild ginger, and rot-causing fungi have been found attacking ginger rhizomes in New Zealand.

Both wild ginger species belong to the plant family Zingiberaceae. We have no native plants in New Zealand that belong to this family. The most important members of this family overseas are the cultivated spices *(*such as ginger, cardamom, and turmeric*)* and, with the possible exception of myoga ginger (a Japanese culinary delicacy), cultivation of these is not commercially viable in New Zealand at present. This is good news as the process of developing biological control agents for ginger would be much trickier if it had close relatives of importance to New Zealanders.

Overall the prospects for finding suitable biological control agents for wild ginger look promising. The next step would be to survey wild ginger throughout New Zealand for insects and diseases, and at the same time study wild ginger in its native India. The pathogens already found on ginger in New Zealand could be assessed for their potential as mycoherbicides, and the Hawai'ian bacteria could be tested to see if it would be suitable to bring into New Zealand.

Hawai'ian researcher, Rob Anderson, examines a transect where he infected wild ginger with a wilt-causing bacterium. Note in the centre of the picture the ginger has been killed and regrowth is stunted compared to healthy plants in the background



Woolly Nightshade

Woolly nightshade has spread beyond its native range in South America to become naturalised in Africa, Australasia, India, and on numerous small islands. This small poisonous tree (up to 10 m tall) is particularly common in the north of New Zealand. It fruits prolifically throughout the year, and birds feeding on these berries continually spread viable seeds. The plant grows quickly and can fruit and flower within a year of germination, forming dense thickets that crowd out other beneficial plants. Areas cleared of the weed quickly become reinfested, making long-term control a real headache.

A biological control programme for woolly nightshade has been underway for several years in South Africa, where it is known as 'bug weed'. "The programme has been dogged by complex host-specificity issues," reports Peter McGregor, who has been in touch with South African researchers. "There has been a frustrating tendency for many of the potential control agents studied to damage other *Solanum* species (particularly eggplant) in laboratory tests even though they have never ever been known to attack those plants in field situations in their native countries." Laboratory tests in small cages subject the agents to extreme and unnatural conditions and may give misleading results. For example, when hosts and non-hosts are placed close together in a small confined space, odours from the host plant may confuse insects into attacking the non-hosts too. In South Africa eggplant crops are not usually grown close to woolly nightshade, and they are also heavily sprayed with pesticides and grown in rotation with other crops. For these reasons the risk of damage from woolly nightshade agents is considered insignificant and permission was granted recently to allow the first agent, a sap-sucking lace bug (*Gargarphia decoris*), to be released there.

Although woolly nightshade belongs to the genus *Solanum*, it is not closely related to other, desirable species of that genus in New Zealand (see table below). It should therefore be possible to find suitable agents to introduce here, provided the host ranges issues can be resolved to everyone's satisfaction. We will be keeping a close eye on the lace bugs' every move in South Africa!

Subgenus	**Members**
Brevantherum	Woolly nightshade + three other weedy species e.g., Jerusalem cherry
Archaepsolanum	Three native, but not endemic (do not occur naturally anywhere else), species (e.g., poroporo)
Potatoe	Potato, pepino
Lycianthes	Eggplant

Biological Control of Weeds Book

The fourth set of pages for the "Biological Control of Weeds Book" was distributed in August 1999, covering the topics of safety and success plus a new miscellaneous section. If for some reason you did not receive these pages, then please contact Lynley Hayes (details on back page). Also, additional copies of the ragwort pages have been printed and are now available if anyone's stocks are running low.

Tell Me More...

Question: Has the old man's beard leaf miner taken to feeding on brassicas?

No! Reports of leaf miners damaging brassica crops first appeared in the 1960s, and the culprit is a European fly (*Scaptomyza flava*). This fly is only a minor pest in Europe, but it can be a major pest of brassicas and peas here.

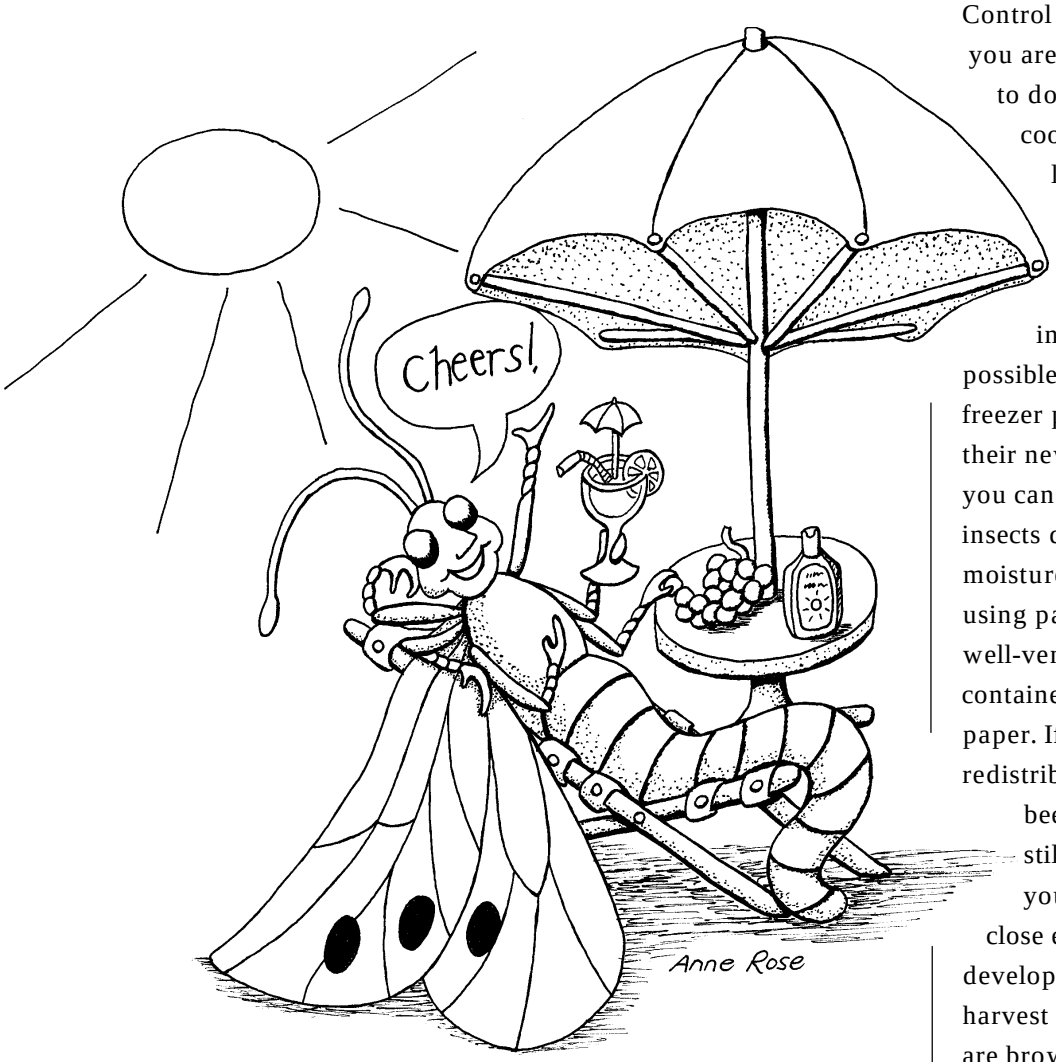
The old man's beard leaf miner (*Phytomyza vitalbae*) will only attack old man's beard (*Clematis vitalba*) and possibly cause some slight damage to ornamental *Clematis* species that are closely related to old mans' beard. Native *Clematis* are not believed to be at risk — they are occasionally mined by a native leaf miner (*Phytomyza clematadi*).

There are many kinds of leaf-mining insects in New Zealand including flies, moths, beetles, and wasps. To help protect the old man's beard leaf miner's good reputation we have included a table of some of other leaf miner species that you may commonly see in New Zealand. Note that as a general rule introduced leaf miners tend to only attack introduced plants and native leaf miners tend to only attack native plants.

Ragwort leaf miner

Common Name	Latin Name	Insect Type	Hosts Include
Azalea leaf miner	*Caloptilia azaleella*	moth	azalea
Beet leaf miner	*Liriomyza chenopodii*	fly	silver beet, spinach, chickweed, fathen
Convolvulus leaf miner	*Bedellia spp.*	moth	convolvulus
Griselinea leaf miner	*Peristoreus discoideus*	beetle	puka, broadleaf
Eucalyptus leaf miner	*Phylacteophaga froggatti*	wasp	eucalyptus
Hebe leaf miner	*Liriomyza spp.*	fly	hebe
Kākā beak leaf miner	*Liriomyza clianthi*	fly	kākā beak
Karamū leaf miner	*Acrocercops zorionella*	moth	coprosma
Kauri leaf miner	*Acrocercops leucocyma*	moth	kauri
Lancewood leaf miner	*Acrocercops panacivagans*	moth	lancewood
Oak leaf miner	*Phyllonorycter messaniella*	moth	oak, beech, birch
Ragwort leaf miner	*Chromatomyia syngenesiae*	fly	cineraria, sow thistle, senecio, chrysanthemum
Wattle miner	*Acrocercops alysidota*	moth	wattle

Summer Activities



Summer is a good time for harvesting gorse thrips (*Sericothrips staphylinus*), cinnabar moth caterpillars (*Tyria jacobaeae*), and broom seed beetles (*Bruchidius villosus*). Refer to the relevant pages in "The Biological Control of Weeds Book" if you are unsure about what to do. Be careful not to cook your insects by leaving them out in the sun in plastic containers or in a hot car. Keep the insects as cool as possible using chillybins and freezer pads, and get them to their new homes as soon as you can. Avoid having insects drown in excess moisture during transit by using paper bags or well-ventilated plastic containers filled with tissue paper. If you are redistributing broom seed beetles while they are still inside the pods, you will need to keep a close eye on pod development. Do not harvest the pods until they are brown and mature, but be aware that a spell of hot weather can cause the pods to ripen rapidly and burst open.

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