

What's New In Biological Control of Weeds?

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Manaaki Whenua
Landcare Research

Love Potion Number Two

In previous issues of this newsletter we told you about our exciting breakthrough in finding a pheromone that would attract gorse pod moths (*Cydia succedana*). The moths can be difficult to see on dull days and at low densities, but suddenly we had a tool that would flush them out and make them come to us.

For years we have struggled to monitor the establishment success of another moth for gorse, the soft shoot moth (*Agonopterix ulicetella*). This moth is even more difficult to find in the field because the adults are nocturnal, small larvae are almost undetectable, and larger

larvae are only really visible for a narrow window of about a fortnight before they pupate and drop out of sight.

Combined with the dense growth habit of gorse at many sites and the ability of the adults to disperse widely, we are still none the wiser about the fate of the soft shoot moth at many of our release sites, apart from odd sightings of tantalisingly chewed tips.

Fortunately, Max Suckling of HortResearch has come up trumps again. Max contacted his colleagues in Hungary, who specialise in brewing up love potions for insects, and obtained six pheromone mixtures that they thought might do the trick. Hugh



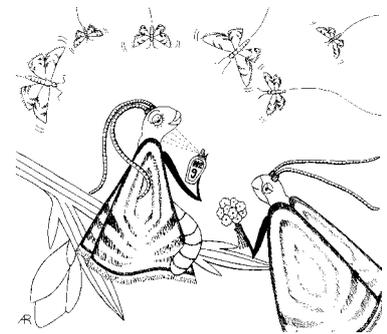
Gorse soft shoot moth caterpillar

Gourlay sent these mixtures off to one of our colleagues in Hawai'i where the moth is well established and abundant. Pat Conant (Hawai'i Department of Agriculture) set out traps on Hilo and soon reported back the good news that the moths were indeed flocking to one of the mixtures.

The next step is to put out traps in Hawai'i again to make sure the initial results weren't just a fluke, and to assess the best concentration of the pheromone mixture to

use. Once we have this information we will arrange to put out traps at all sites in New Zealand where the soft shoot moth has been released. The moths do not become sexually active, and hence attracted to the pheromone, until they have had a chilling period over the winter. We expect that in New Zealand the moths will have received their obligatory winter and become active about August. This chilling requirement helps to ensure that the moths lay their eggs at the right time of the year. The caterpillars

can only develop on the soft new growth that gorse puts on in spring. If the moths laid their eggs too early or too late, then the caterpillars would starve. At this stage it seems likely that we will be ready to put out traps in New Zealand in August 2000.



Hot Gossip

In the February issue of this newsletter we told you that the **old man's beard leaf miner** (*Phytomyza vitalbae*) seems to be dispersing faster than any previous biological control agent we have experienced before. The leaf miners have even outstripped gorse spider mites (*Tetranychus lintearius*) with the speed at which they have found and colonised their host plant all over New Zealand. Since then two more amazing examples of the leaf miner's ability to quickly seek out its host plant have come to our attention. Hugh Gourlay discovered both the leaf miner and **old man's beard leaf**

fungus (*Phoma clematidina*) on a small infestation of old man's beard near Greymouth on the West Coast of the South Island. To get there these agents have either travelled from the east coast of Canterbury across the plains and over the mountains or, perhaps a more likely scenario, they have moved down from Nelson through the Buller Gorge. Either scenario involves a trip of more than 200 km and leapfrogging large areas that are free of the host plant. Chris Winks reports that the only old man's beard plant he knows of in the Auckland Region has also been attacked

by both agents. Old man's beard is rare in the top half of the North Island, with the nearest major infestations to Auckland being in Waikato and the Bay of Plenty. There can be few old man's beard infestations left now that are free of at least one of the pair!

Adrian Spiers (HortResearch) reports that he has found another species of *Phoma* in New Zealand. This newly discovered fungus is similar to the old man's beard fungus, but it attacks **Californian thistles**. Adrian noticed patches of dying thistles on a couple of farms in the Manawatu/Rangitikei area in



the lower North Island. He isolated this new *Phoma* sp. from the diseased plants and sprayed it onto some healthy patches of thistles. The fungus caused leaf and stem necrosis then dieback and rotting of the underground roots.

plants because he does not have any funding to do this work and is constrained by it being the wrong time of year for such tests. If some funding could be found, then Adrian could give this project the attention it deserves. If

which damages the stolons (the long runners that the plant uses to reproduce and invade new areas), was released at two sites in the South Island's Mackenzie Country in February. The **hieracium plume moth**



Hieracium gall wasp

Adrian reports that "it will kill 1-2 ha patches of Californian thistles in 2-3 years". This new fungus sounds like it could be just the answer that many farmers are looking for! While this apparently new natural introduction appears to be host specific, Adrian has not yet tested it against any other

you could help or would just like to know more about this project, then contact Adrian by phoning 06 356 8080 or sending an email message to aspiers@hort.cri.nz.

The first two insects for hieracium are now "out there". The **hieracium gall wasp** (*Aulacidea subterminalis*),

(*Oxyptilus pilosellae*), which damages the centre of the rosette plants, was liberated at one site in the same area in March. Lindsay Smith is working hard at mass-rearing both agents so that widespread releases can be made as soon as possible.



Winter Activities

Winter is traditionally a quiet time on the biological control front, when the agents are best left to their own devices. The end of May is usually the cut-off time for harvesting ragwort flea beetles (*Longitarsus jacobaeae*), although it may be possible to collect nodding thistle crown weevils (*Trichosirocalus horridus*) as late as June. As gorse pod moths are now present in good numbers at many sites around the country, it should be possible for some of you to transfer infested pods during May/June, as well as in spring. Please refer to "The Biological Control of Weeds Book" for advice about how to shift this seed-feeder.

Winter can be a good time to check nodding thistle crown weevil release sites. While some weevils may lay eggs all year round, the bulk of them begin to lay in the autumn and the damage to the rosettes becomes more noticeable as the winter progresses. As the grubs feed in the crown they produce a black waste substance (frass), and the ribs of the surrounding leaves take on a reddish-brown colour at the base. The leaves of damaged rosettes become less prickly and start to look a bit like dandelion leaves. You may see rosettes that look like this at any time of the year, but the damage is usually most

obvious later in the winter and in early spring. If you can dig a damaged rosette out of the ground and cut it in half with a pocket knife, you should be able to see the white grubs feeding inside.

Remember to use the winter time to make plans for the coming busy spring season. Start thinking about suitable release sites for any new agents that you may be receiving from us, and planning harvesting operations for broom seed beetles (*Bruchidius villosus*), gorse pod moths, and gorse thrips (*Sericothrips staphylinus*).



Nodding thistle rosette under attack by the crown weevil (note the blackened centre)



Going, Going, Gone

The three nodding thistle agents, together, have made a great job of cleaning up nodding thistles in many places, especially in the South Island. The receptacle weevil (*Rhinocyllus conicus*) and the gall fly (*Urophora solstitialis*) seriously interfere with the plant's ability to make viable seeds. Any new plants that do grow, either from the few seeds that the plants still manages to make or from the reservoir of seed present in the soil, are at risk of being attacked by the crown weevil (*Trichosirocalus horridus*). Heavily infested rosettes die. Any rosettes that manage to survive a crown weevil attack are stunted and produce fewer flowering stems and hence fewer seeds. Many people have observed that nodding thistles soon begin to buckle under this tripartite attack and, having lost their competitive edge, quickly begin to decline. A mathematical model developed by Katriona Shea (CSIRO, Australia) explains why this happens. The model predicts nodding thistle populations will decline if 65% or more of the seeds are destroyed, and we have already observed higher levels of seed predation than this in the field.

The phenomenon of declining nodding thistles is illustrated in these photos. The first

shows the extent of an apparently intractable nodding thistle problem on a mid-Canterbury farm in Ashburton when gall flies and crown weevils were released there in 1993 (the receptacle

weevil was already present). The second and third photos show the same site four and five years later. In the land owner's words "the nodding thistles have gone from being a carpet to just a smattering".



1993, the problem



1997, thistles going



1998, problem solved

Photo courtesy of The Ashburton Guardian



Twig Miner Makes Presence Felt

A small white moth was first collected at Taupo nearly 50 years ago, but it wasn't until 30 years later that it was formally identified as the broom twig miner (*Leucoptera spartifoliella*). This European moth is believed to have come in accidentally on ornamental broom, and these days it is rare to find a stand of broom in New Zealand that it does not call home. The larval stage feeds under the surface of green stems and characteristic brown mines form as a result. When twig miner populations become large, then broom is knocked hard. The foliage becomes brown, and flowering, pod formation, and growth are all severely retarded.

We were first alerted to particularly heavy outbreaks of the twig miner causing significant damage in Canterbury in the summer of 1992/93. Large areas of broom in the Waiau riverbed



Broom heavily damaged by twig miner, flowers turning brown

in North Canterbury looked like they had been sprayed, and they have not been able to bounce back and regain their former vigour in the interim. More recently, similar damaging twig miner outbreaks have been

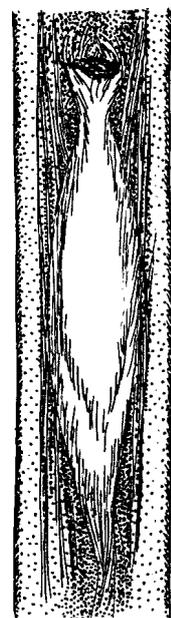


Broom heavily damaged by twig miner



Broom suffering from twig miner attack

reported in mid- and south Canterbury, and just this last summer in Otago (see photos). We would be interested to hear from others who have noticed their broom browning off recently.



Apart from the mining on the foliage, it is easy to recognise a heavy twig miner presence by the number of white cocoons plastered along the undersides of branches. You should be able to find cocoons (either full or empty) on heavily infested broom plants all year round.

The success of the twig miner may make it difficult for us to establish other agents for

broom. This year we have begun an experiment at Lincoln to see if it is more difficult to establish broom psyllids (*Arytainilla spartiophila*) when twig miner already has its foot in the door. Psyllids were thought to be particularly vulnerable to competition from twig-mining caterpillars because their eggs need to survive the winter under the surface of green broom stems, and these

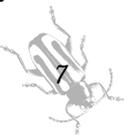
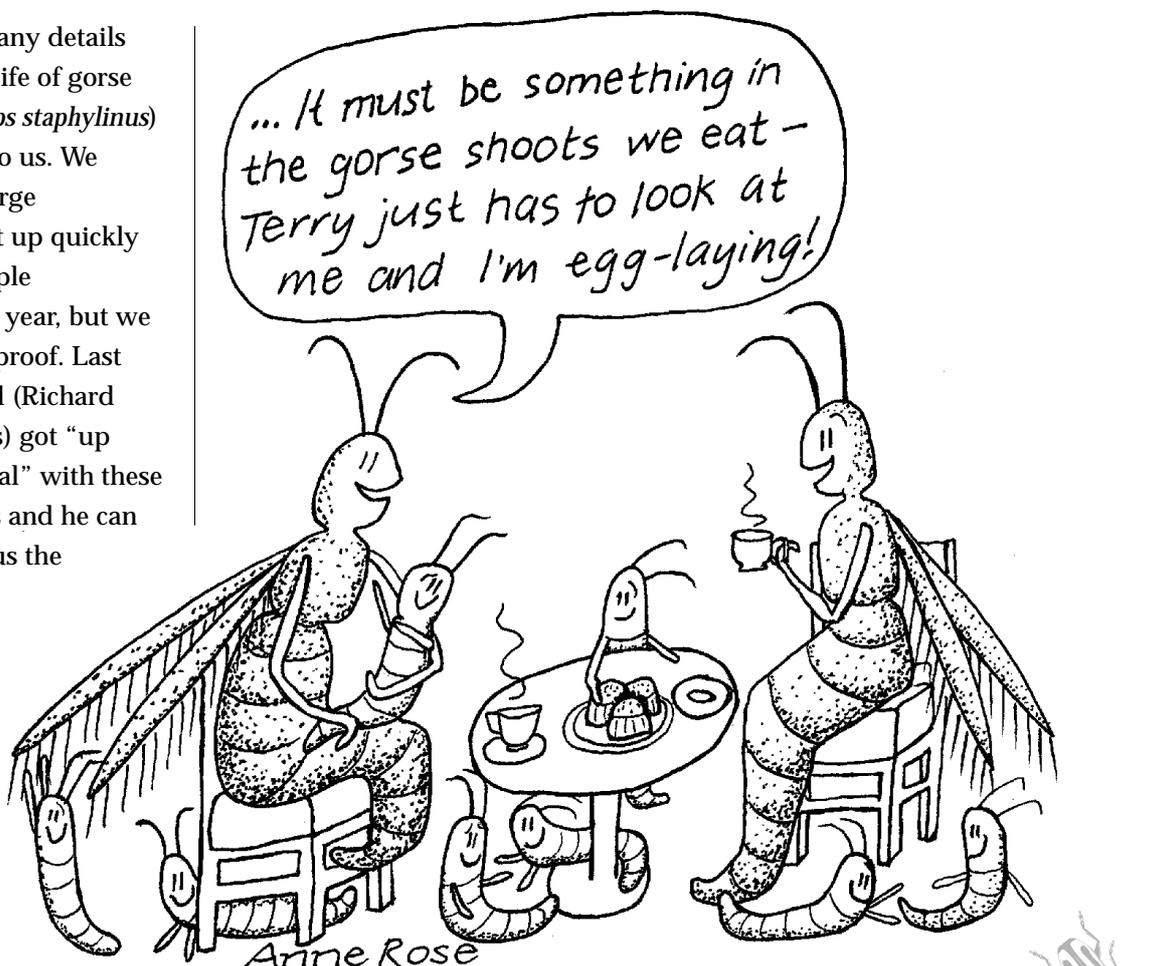
are actively mined by the caterpillars at this time.

Another lesson we can learn from the twig miner is one of patience. Because it has largely been left to disperse passively, it has taken more than 40 years for broom twig miner to show its true colours in New Zealand. If we judge biological control agents too soon, then we are in danger of enormously underestimating their true potential.

Five Facts About Gorse Thrips

Until recently, many details about the secret life of gorse thrips (*Sericothrips staphylinus*) were a mystery to us. We suspected that large populations built up quickly because of multiple generations each year, but we didn't have any proof. Last year Richard Hill (Richard Hill & Associates) got "up close and personal" with these tiny gorse agents and he can now share with us the following facts:

- When kept on healthy young plants at 19°C, females lay about 2 eggs per day, and each one lays



about 70–80 eggs in total during their life time. This is on a par with the fecundity measured for gorse spider mites. Fecundity may be lower if the thrips are on gorse plants that offer poorer quality food. The females lay the pale-coloured eggs one at a time in slits in the young gorse stems of the host plant. Don't bother trying to look for them without a microscope as they are too small (0.3 mm) to see with the naked eye.

- Gorse thrips develop through several larval stages, and you may see these juvenile forms if you beat thrips-infested foliage. At 19°C the eggs take about 3 weeks to hatch into delicate cream-coloured larvae. After a couple of days they moult into a more robust yellow-coloured larval stage, with pigmented eyes. The thrips larvae feed and grow for about a fortnight and then moult into a prepupal form, with short antennae, that remains mobile but does not feed. After about 3 days the prepupae become immobile pupae that can be distinguished from their predecessor by their longer antennae, which curve back

over their body. Both the prepupae and pupae are found on gorse, unlike other thrips species that may move off their host plant onto leaf litter, moss etc. to pupate. The total time for development from egg to adult takes about 42 days at 19°C.

- Both the adults and larvae feed on the mesophyll tissues (just below the surface) of gorse foliage. At high densities of thrips the removal of this layer produces pale, stippled areas on gorse leaves, spines, and stems. Combined with the covering of black waste (frass) droplets, the gorse takes on a mottled appearance, which can be readily distinguished from the uniformly bleached appearance of foliage damaged by gorse spider mites. Thrips of all stages feed on all green gorse foliage, but they avoid actively growing shoot tips.
- The adults spend the winter on gorse plants and live for at least 10 months. They can probably complete several generations in a year, but the first generation in the spring is by far the largest, possibly because gorse

foliage is much higher in nutrients at this time.

- Despite their tiny size (females measure about 1.0 – 1.2 mm long and males measure about 0.7 – 0.9 mm long) they can put the likes of Carl Lewis to shame by jumping 5 cm or more.

STOP PRESS!

Ragwort Flea Beetle Assessment Trials Reminder

If you are carrying out insecticide exclusion trials to assess the impact of your ragwort flea beetles (see Ragwort Flea Beetle Assessment Technique in "The Biological Control of Weeds Book"), you should have your plots set up by now! If you haven't, get onto it straight away, and if you have any queries then contact Peter McGregor (Ph. 06 356 7154) or email: mcgregorp@landcare.cri.nz



Chewing the Fat

I hope that some of you tried subscribing to the discussion groups that I listed in the last issue of this newsletter. If you did and are now hooked, here are some others that you might like to try. Remember

that all you need to do to get started is to send a message to the relevant email address with a special command in the body of your message (see below). Do not put the command in the subject line,

and if you have an automatic signature at the end of your message, then you need to turn it off. If the volume of mail you receive gets to be too much, then you can unsubscribe at any time.

Topic	Description	Email Address	Command
Aliens	This is the list server of the Invasive Species Specialist Group of the IUCN Species Survival Commission, managed by the Department of Conservation here in New Zealand	ssc-mgr@indaba.iucn.org Aliens-L	subscribe
Biological Control of Weeds	This discussion group has been established to facilitate the exchange of information about biological control of weeds. It is based at the USDA Agricultural Research Service, Weeds Science Laboratory in the USA	bcweeds@ggpl.arsuda.gov	subscribe
Exotic Plants	This is a mailing list managed by the California Exotic Plant Council and the Pacific North West Exotic Pest Plant Council based in California, USA	majordomo@igc.org	subscribe exotic plants
Weeds	This is a mailing list managed by the US Department of Agriculture's Animal & Plant Health Inspection Service based in Riverdale, Maryland, USA	majordomo@info.aphis.usda.gov	subscribe weeds
World Weeds	This discussion group was initially set up to focus on the debate about the establishment of a database of weeds of the world and has become a general weed discussion group based at Oxford University in the UK	maiser@plants.ox.ac.uk	subscribe WWD-L



Trading Biological Control Agents

The following register lists agents that are now so abundant in some regions that the councils are prepared to share (or swap them) with other councils. If you also have agents that you would like to trade, please contact Lynley Hayes so you can be included in the next newsletter.



Agent	Available from
Alligator weed beetle	Peter Joynt, Northland Regional Council, Ph 09 439 6662
Cinnabar moth	Greg Hoskins, Auckland Regional Council, Ph 09 412 7637 Lindsay Scott, Manawatu-Wanganui Regional Council, Ph 06 374 6700 Kevin Worsley, Wellington Regional Council, Ph 06 378 2484
Gorse pod moth	Rob McCaw, Canterbury Regional Council, Ph 03 365 3828
Gorse spider mite	Dave Galloway, Auckland Regional Council, Ph 09 426 7643 Bob Morgan, Manawatu-Wanganui Regional Council, Ph 06 376 7758 Ken Massey, Northland Regional Council, Ph 09 438 4639 Kevin Worsley, Wellington Regional Council, Ph 06 378 2484
Nodding thistle crown weevil	Phil Crotty, Canterbury Regional Council, Ph 03 688 9069
Nodding thistle gall fly	Phil Crotty, Canterbury Regional Council, Ph 03 688 9069
Ragwort flea beetle	Laurence Smith, Canterbury Regional Council, Ph 03 314 8014 Lindsay Scott, Manawatu-Wanganui Regional Council, Ph 06 374 6700

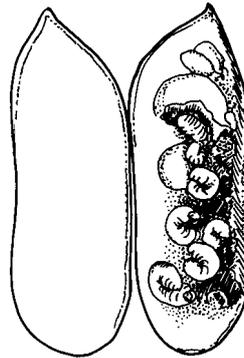
Tell Me More...

This is a new section where we will deal with some of the questions that we are most commonly asked or topical issues that have arisen. Please feel free to submit any questions you may have to Lynley Hayes (address below).

Question: *If you open up a gorse pod and find a creamy-coloured caterpillar inside, could it be anything other than the gorse pod moth?*

Answer: No. There are no other caterpillars that feed inside gorse pods. The only other species that damages the seeds is the gorse seed weevil

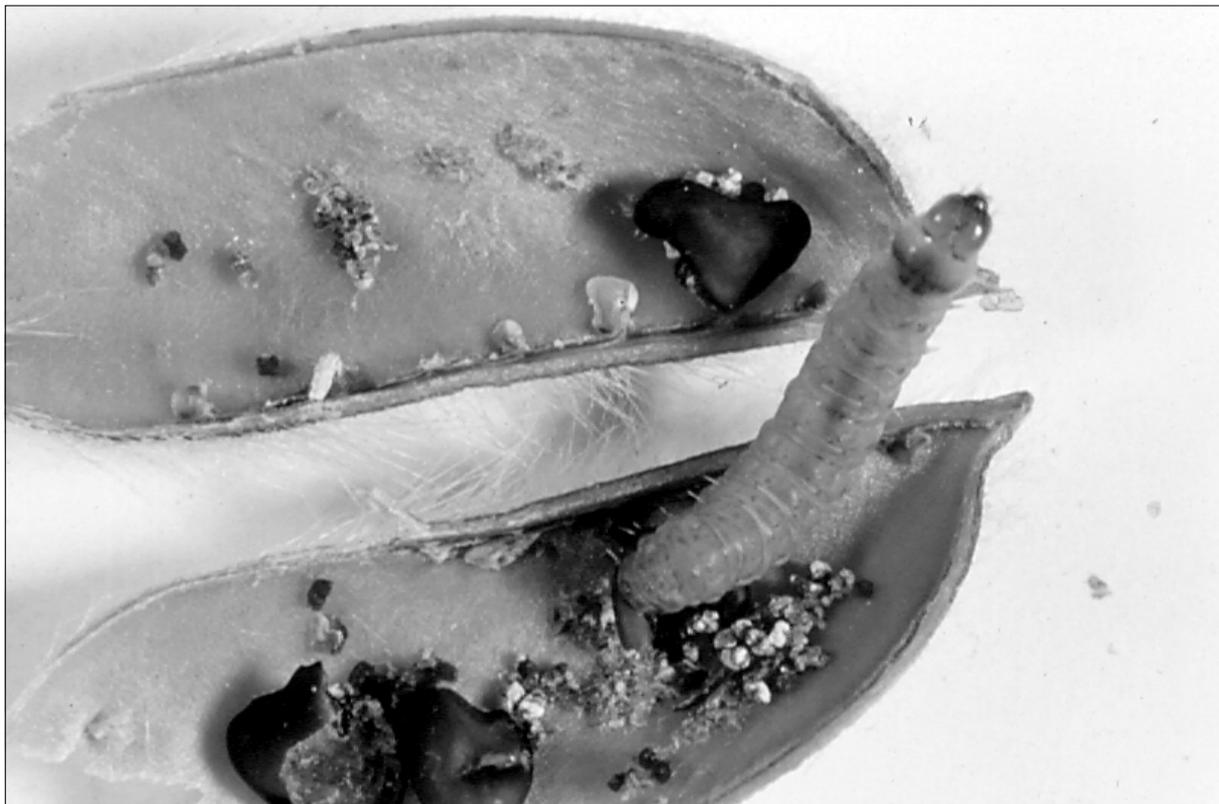
(*Exapion ulicis*), and these only attack pods produced in the spring/summer. It is easy to tell the two gorse seed-feeders



Gorse seed weevil

apart. Any pods damaged in autumn/winter can be attributed to the gorse pod moth. These pods will have a

single creamy-coloured caterpillar inside, or they may be empty except for some dark brown frass — this is because the caterpillar may leave the pod once it has eaten all the seeds and go in search of another one to attack. If you look carefully at pods, you may see the small entrance/exit holes. If you open a pod in spring/summer you may see a gorse pod moth caterpillar or several white, squat, legless gorse seed weevil grubs. You may also find the grey adult weevils inside as they cannot eat their way out and have to wait until dry pods burst open to escape.



Gorse pod moth caterpillar



Question: Do you have any biological control agents that will attack Spanish heath?

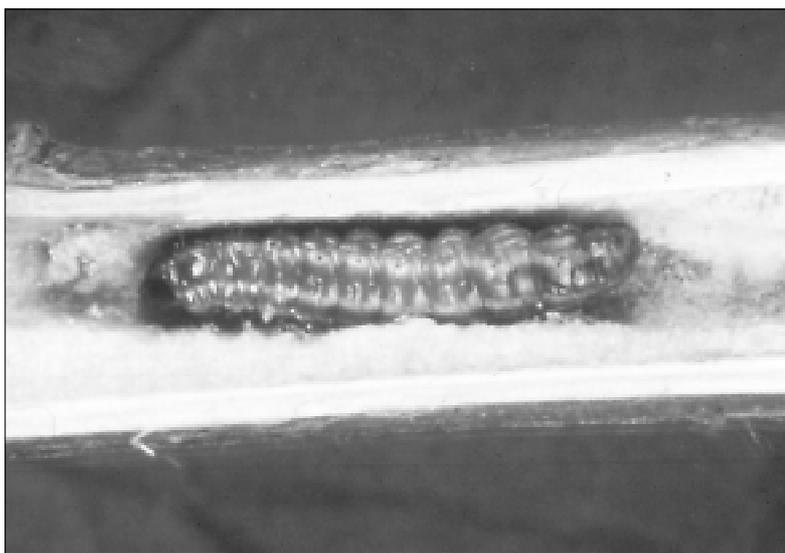
Answer: No. We are releasing a beetle (*Lochmaea suturalis*) to attack heather (*Calluna vulgaris*) but it will not feed on Spanish heath (*Erica lusitanica*).

Question: What are the insects that you commonly find feeding inside the ragwort stems?

Answer: There are two naturally occurring insects that you will commonly find inside ragwort stems. You may see the large (up to 2 cm long) larvae of the blue stem borer (*Homoeosoma farina*), which is named after its

distinctive blue-green colour, or small creamy-coloured maggots or brown-coloured pupae of a fly (*Melanagromyza senecionella*) or both. The blue stem borer is more common in the North Island, but may also

be found in the South. The fly is not considered to have much impact on ragwort, but the blue stem borer can be quite damaging, and both may make the plant more susceptible to infection by pathogens.



Blue stem borer

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