Number 19 November 2001

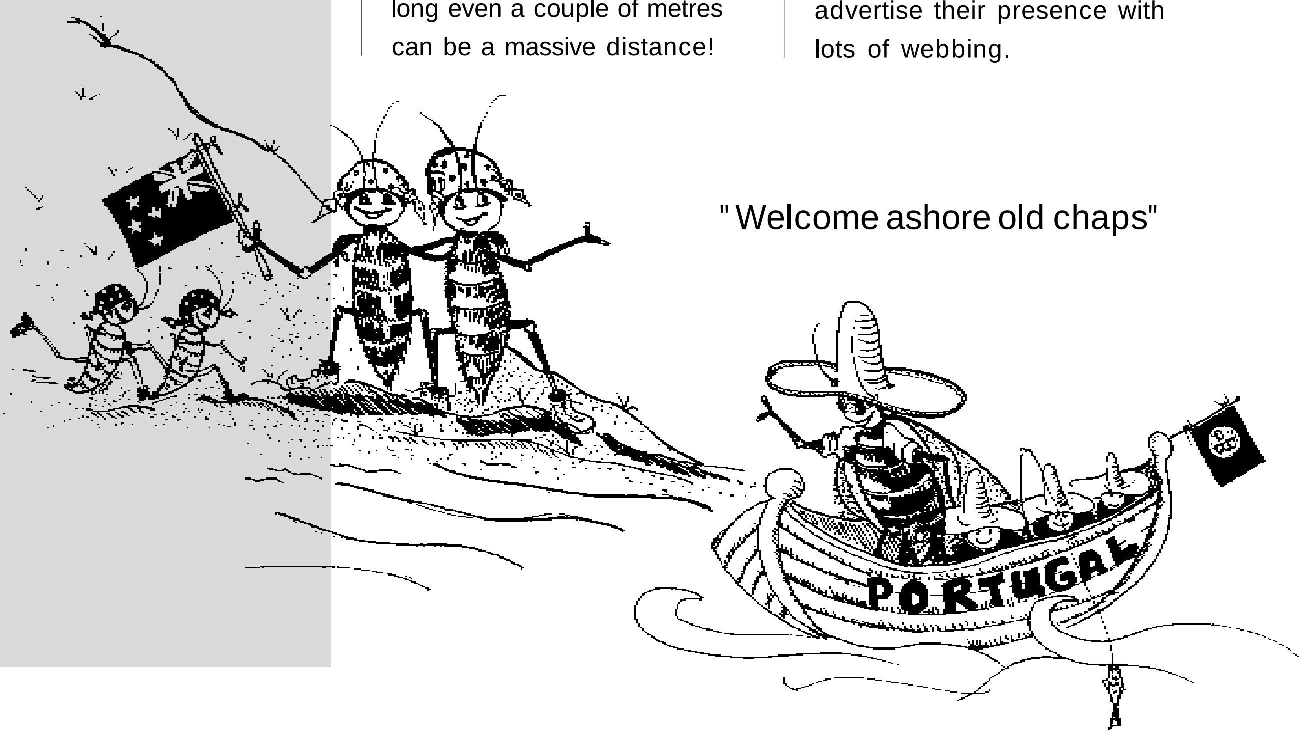
What's New In Biological Control of Weeds?

What's Inside?

New Thrips in Town

Gorse thrips (*Sericothrips staphylinus*) take out the award for being the slowest moving of all the biological control agents we have released. While it is nice to know that if you revisit a release site 10 years after the big event there is a good chance of finding the little blighters right where you left them (provided the plant is still there and you can still identify it!), it can be disappointing to discover that they haven't ventured out much beyond the immediate vicinity. The trouble with gorse thrips is that they are usually wingless, so if they want to get anywhere they have to walk – when you are only 1–2 mm long even a couple of metres can be a massive distance!

"It didn't take us long to realise that if we were ever going to get any mileage out of this agent then a big redistribution effort was going to be required," reflected Hugh Gourlay. Unfortunately, there has been an almost universal reluctance for people to get involved in harvesting and shifting the thrips around. Because this agent is so tiny many people feel less confident (or inspired) about working with them. Gorse spider mites (*Tetranychus lintearius*) are a similar size, but at least they are brightly coloured, clump together and advertise their presence with lots of webbing.



While chatting about gorse-related matters with colleagues in Hawai'i, it became apparent that there might be another way around the problem. Like us, Hawai'ian researchers have imported and released thrips from the UK with similar results. However, they also took the precaution of importing a strain from Portugal. The Portuguese thrips outperformed their British cousins, managing to thoroughly infest one 6,000-ha gorse infestation in Hawai'i in just 6 years. "We need some of those here too!" thought Hugh Gourlay. The wheels were put in motion and Hugh was swiftly off to Hawai'i to get his hands on a starter colony. The new thrips were safely installed in quarantine at Lincoln by the end of July 2001.

So why do the Portuguese thrips move so much faster than their British counterparts? No one knows for sure. Maybe more of them develop wings, or perhaps they are just plain more adventurous?

Whatever the mechanism, let's hope they do it here too! So far the project has moved along at a good clip. We got permission to release the Portuguese thrips in double quick time seeing as they were classed as a species already present in New Zealand and not something completely new. Mass rearing is already underway and the first releases of the new thrips should be under starter's orders soon after Christmas.

Getting Around

Continuing in a similar vein, we have recently carried out a study in North Canterbury's Amuri Basin to find out how quickly broom seed beetles (*Bruchidius villosus*) and broom psyllids (*Arytainilla spartiophila*) are able to colonise areas after release. This was part of an Agmardt* project, administered by the Amuri Broom Group, to enhance biological control of broom in this severely infested area.

We found that dispersal began to occur 2 years after releases were made. "In the first year we could usually find both agents within 5 m of the release point but only in low numbers," explained ecologist Trevor Partridge. A year later both insects looked to be more firmly established but were still staying fairly close to home, generally within 10 m of the release point. "Once dispersal gets underway it happens at an increasing rate," revealed Trevor. By the third year populations had built up to the point where individuals were starting to turn up tens of metres of away, and in

Adult broom psyllid

later years hundreds of metres away.

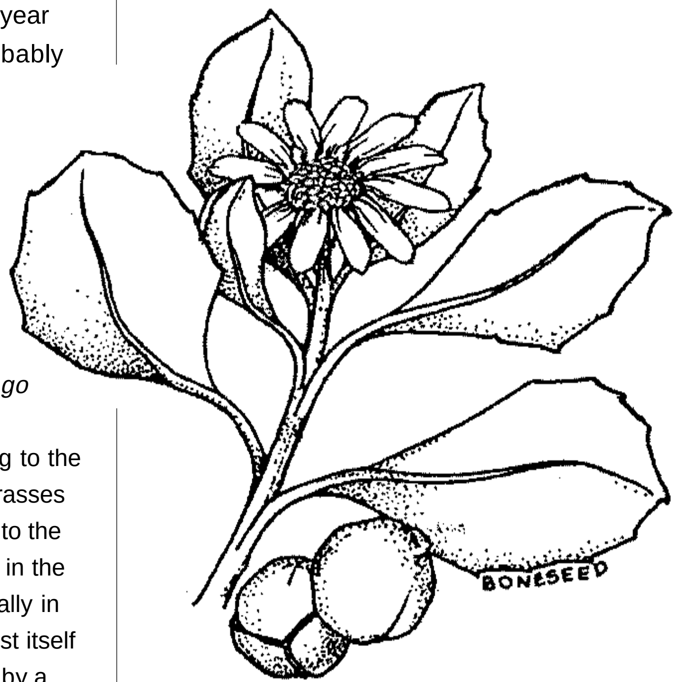
Surprisingly neither insect seemed to show any particular preference for direction, regardless of prevailing wind patterns or whether the terrain was flat or sloping. Gaps between broom plants were not a problem for the insects unless large. Small gaps (<50 m) such as streams or pasture proved no obstacle to dispersal at all. The insects also managed to get across larger gaps (up to 700 m wide), but there was usually a delay of about a year while populations built up at the edge of the barrier – this increased the chances of at least some safely making it across. We estimate that at top speed the majority of broom seed beetles probably travel less than 1 km a year and broom psyllids probably only several hundred metres. Therefore Trevor recommends, people will be able to achieve coverage of both agents more quickly if they harvest and release them in a strategic way, keeping in mind their likely dispersal rate.

*Agricultural and Marketing Research and Development Trust

Hot Gossip

Chris Winks has had a stint working in Cape Town, South Africa, this spring. Chris has been involved with host-range testing the bone-seed leaf roller ('*Tortix*' sp.). This moth can cause considerable damage to bone-seed in South Africa and is the most promising of the insect agents available. The bone-seed leaf roller has recently been released in Australia and we are hoping that it will prove safe to release here too. More on the outcomes of this testing in future newsletters.

Freda Anderson has been employed by the Weeds CRC in Australia to investigate promising fungal control agents for nassella tussock (*Nassella trichotoma*) and Chilean needle grass (*Nassella neesiana*) in Argentina. This year we are also providing some funding to ensure that Freda can work full-time on the project and maximise progress. Three promising agents have been found to date: a rust (*Puccinia nassellae*), a smut (*Ustilago* sp.), and an unidentified mushroom species belong to the genus *Corticium*. Both grasses appear to be susceptible to the rust, which can kill plants in the field in Argentina, especially in shady areas where the rust itself is not subjected to attack by a hyperparasite (*Sphaerellopsis filum*). Host-range testing of this potential control agent is now underway but progress has been a little slower than expected. Last summer was extremely hot and dry in Argentina so rust inoculum was hard to come by. The *Corticium* species can also be responsible for severe dieback, and infected plants are much easier to uproot. The smut attacks the inflorescences, replacing seeds with fungal spores, and could help to reduce spread. While both these last two candidates are known to damage nassella tussock, it is less certain whether they will also attack Chilean needle grass. A number of test plants have been exposed to the smut in the glasshouse, but Freda will not know whether any have been infected until flowering in the spring. Test plants have also been exposed to the *Corticium* species, and are being monitored for signs of disease.



Honey, I Shrunk the Weed

Banana passionfruit has wound its way around 50,000 ha of forests in Hawai'i. The plant, commonly referred to there as banana poka, had become such a serious problem that a biological control programme was initiated in the 1980s. A foliage-feeding moth (*Cyanotricha necryia*) was released in 1988 but failed to establish, possibly due to high levels of predation and parasitism. A second moth (*Pyrausta perelegans*) that mainly attacks the buds, but also feeds on the leaves, shoot tips and young fruit, was released in 1991. This moth has established, but appears to be hampered by parasites as well, and by all accounts is not yet common or easy to find. However, it has been a case of third time lucky!

A leaf spot fungus (*Septoria passiflorae*) was released in 1996 and is starting to cause much excitement and optimism about the future of banana poka control. As usual the project started slowly but took less time than usual to gather momentum. One year after the fungus was released, low levels of disease could be seen on some inoculated plants but it had not yet spread to neighbouring plants. Light disease epidemics were observed in 1998 causing visible defoliation at some sites, but the reduction in plant biomass at this time was estimated to be less than 10%. However, by 1999 the fungus was starting to hit hard with widespread disease epidemics causing biomass reductions of 50–95%. Biomass reductions of 80–95% were recorded over more than 2,000 ha!

As well as killing the leaves this leaf spot fungus also invades succulent lateral vines and tendrils and kills them too. As a consequence it has been estimated that fruit production of banana passionfruit at Hilo Forest Reserve has decreased

Septoria passiflorae *greatly reduced banana passionfruit at Hilo Forest Reserve, Hawai'i between 1996 and 2000.*

by more than 90% since the fungus took hold. The fungus also appears to be spreading quickly under its own steam. Monitoring, with the use of helicopters, has already confirmed disease epidemics throughout 5,000 ha of this reserve alone. The canopy of native *Acacia koa* trees (25–30 m high), which was previously covered and shaded by the weed, is now open to sunlight again, and debilitated trees have already responded by producing new growth. It is predicted that with time this leaf spot fungus will reduce banana passionfruit infestations to insignificant levels and help to ensure the continued survival of many threatened species.

For all of you readers who are thinking “how can we get some of this magical stuff?" don’t worry, we are on to it! With your help we are hoping to be in a position to begin host-range testing next year. Watch this space!

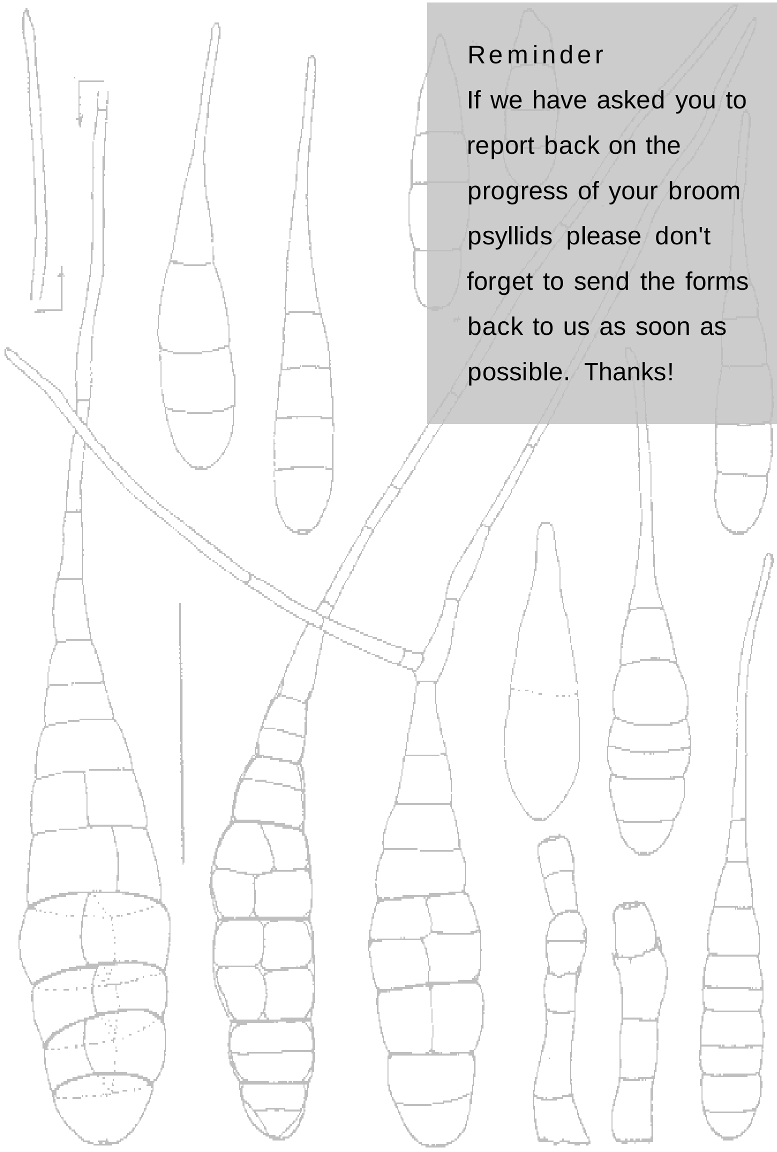
What’s That on Woolly Nightshade?

In the last issue of “Weed Clippings” we told you about a nationwide survey to find out what lives on woolly nightshade in New Zealand. On the insect side of things we found that while lots of species will have a bit of a go at the plant, their combined impact is pretty minimal. The results on the pathogen side of things are now in and, while woolly nightshade does not appear to host a diverse fungal fauna, at least one of the species found on it may turn out to be useful.

If you have ever noticed yellowish or brown spots on woolly nightshade leaves, then it is likely that the fungus *Mycovellosiella brachycarpa* was responsible. “This fungus was first recorded damaging woolly nightshade here in 1987 and was found to be common and widespread on the weed during our survey,” reports Jane

Reminder

If we have asked you to report back on the progress of your broom psyllids please don't forget to send the forms back to us as soon as possible. Thanks!



Alternaria tomatophilia *conida and conidiophores, courtesy of "Mycotaxon".*

Fröhlich. When plants are heavily infected whole leaves can turn yellow and die. *Mycovellosiella brachycarpa* is known to be specific to *Solanum* species and researchers considered its potential as a biological control agent more than a decade ago. Since the fungus was already widespread in New Zealand and good at getting around under its own steam, there seemed to be little to gain from assisting its spread. The strain we have here also appears to be quite a damaging one, so searching for a more aggressive strain overseas didn't seem necessary either. According to Jane, "the possibility of mycoherbicide development was also ruled out as this species grows poorly in culture."

This may not be the case for the other fungal species of significance that turned up in one sample collected from Wanganui. "We found an *Alternaria* sp. on woolly nightshade that looks similar to the fungus that causes tomato blight (*Alternaria tomatophila*). However, since the tomato blight fungus is not known to attack any hosts other than tomatoes there is a good chance that this is a new, previously undescribed species for New Zealand," predicts Jane. The only way to be sure is to send samples to an expert overseas. The *Alternaria* sp. causes small (1–3 mm), deep red to black lesions on the leaves, with yellow halos. These lesions are easy to distinguish from the more common *Mycovellosiella brachycarpa* ones which, although a similar size, are brown and fuzzy, and are most obvious on the undersides of the leaves. Other *Alternaria* species have successfully been developed into mycoherbicides (e.g. *Alternaria cassiae* has been used against sickle pod (*Cassia obtusifolia*) and coffee senna (*Cassia occidentalis*) growing in soybeans and peanuts in the USA) so this appears to be a useful line of enquiry to follow through on. Therefore, we would be interested to hear from anyone who thinks they may have come across a woolly nightshade plant with symptoms of this new *Alternaria* disease. Please contact Jane (Ph 09 815 4200 ext 7082, or email frohlichj@landcare.cri.nz).

Summer Activities

Summer is a good time for harvesting 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 rather than plant material. 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.

Whodunnit?

The Biosecurity Act (1993) requires local authorities to assess the effectiveness of their pest control strategies. However, this can be easier said than done – even experienced scientists often struggle to get it right. A long-term commitment and high level of diligence are essential, and even then you may not get useable data. However, nothing ventured, nothing gained! Anecdotal evidence has accumulated over a number of years that suggests ragwort flea beetles (*Longitarsus jacobaeae*) are getting on top of ragwort in many places, so this seemed like a good place to start. We identified the simplest possible method we could think of that local authorities could use to assess the impact of the beetles*. Because the beetles were widespread, we recommended removing some from small areas (with insecticide) and comparing these with plots still under attack.

Trials were set up throughout the country in the autumn of 1999. One year later we had to admit that flea beetles weren't behaving quite as expected. "Adults were found throughout the year at most sites and it seems likely that in many areas the beetles are now completing two generations a year instead of one," revealed Peter McGregor, who has been responsible for overseeing the trials. This is good news for ragwort control because it means that plants may be attacked all year round. It wasn't such good news for the people running the trials, as they had to start protecting their plots from beetle attack all year round instead of just part of it! Recently Peter has scrutinised data collected during the second year of the trials. The number of beetles found during routine sampling has varied enormously throughout the trials, even within sites. For example, in Auckland 200 beetles were collected from five plants in May 2000 but only eight beetles were collected off the same number of plants in May 2001. "The amount of ragwort present has also varied enormously from 0 to 14 plants per square metre," explained Peter. It appears that once ragwort has been suppressed the recruitment of new ragwort seedlings may be extremely low and that the beetles may quickly kill any that try to poke their noses through. This is also good news for ragwort control because it appears that, once large numbers of beetles have controlled ragwort in an area, smaller numbers can subsequently keep it clear.

"After the first year it was apparent that Orthene® was not preventing the beetles from attacking plants as effectively as we had hoped so we warned

Peter McGregor explains to regional council staff how to set up their assessment trials, January 1999.

participants to switch to Halmark®, " said Peter. Some of the councils were only able to maintain their trial plots for a year and were not able to show beetle impact in this short time frame. As expected, some good results started to show up during the second year. Two of the trials sites (Auckland and Manawatu-Wanganui) were able to prove conclusively that the beetles there were indeed suppressing ragwort.

No impact on ragwort has yet been measured at the Southland site, despite high beetle numbers. This seems to be due to Orthene® failing to adequately protect plants from attack in the first year and grazing management creating an ideal environment for ragwort recruitment. Likewise no suppression by the beetles was detectable at a second Auckland site where kikuyu grass has now invaded many of the plots and not given ragwort a look in since.

As well as providing a few surprises the assessment trials have reinforced what we already knew. Assessment trials are tricky. You need to have your wits about you, a disciplined approach, patience, and a fair dose of good luck. Oh, and given a fair chance, the flea beetles really can do a fantastic job of cleaning up ragwort!

A detailed report on the outcomes of these assessment trials is available from Lynley Hayes (see back page for contact details).

* this method is described in "The Biological Control of Weeds Book"

Australian Nodders Hang Their Heads

Nodding thistle (*Carduus nutans*) has been the subject of successful biological control programmes in New Zealand and North America, and now Australia looks like following suit. Nodding thistle has so far restricted its activities across the Tasman to about one million hectares in the tablelands of New South Wales, and small areas in Queensland, Victoria, and Tasmania. It now seems unlikely that it will get the chance to expand its empire any further.

The seed-feeding receptacle weevil (*Rhinocyllus conicus*), which is so common here now, was first released in Australia in 1988. It was joined by a seed-feeding gall fly (*Urophora solstitialis*) in 1991, and the crown weevil (*Trichosirocalus horridus*) in 1993. All three agents have come up trumps. Both seed feeders are now common throughout the weed's range, and the rosette

Eggs laid on a nodding thistle flowerhead by the receptacle weevil.

Female nodding thistle gall fly

weevil is catching up fast. "The receptacle weevil is so prolific that the gall fly hardly gets a look in during the earlier part of the flowering season, " revealed CSIRO's Anthony Swirepik. Luckily the receptacle weevil is less active later in the flowering season, which gives the fly a chance to do its thing. The fly has also had to overcome further obstacles. As sometimes happens here, hungry sheep will happily scoff the maggot-infested flowerheads, but in Australia cockatoos have also been seen sampling this new delicacy! The crown weevil is doing a great job of killing many rosette plants before they can even think about flowering.

Now that all three nodding thistle agents are out there in good numbers, Australian researchers are keen to quantify exactly how much good they are doing. A computer model has been developed that has enabled researchers to predict how many seeds need to be destroyed for the plant to begin to decline. "The magic threshold appears to be around 65% and we have measured levels of seed destruction much higher than this," proclaimed Anthony. "We have found that up to 90% of seeds are being taken out."

In contrast to many other projects where biological control has been used as a last resort, this project has been much more timely. "Nodding thistle has been estimated to cost Australia $7 million per year and the benefit of controlling it to be worth at least $56 million in the long run," revealed CSIRO's Tim Woodburn. The $4 million outlay appears to have been money well spent!

Tell Me More?

Question: Are there any additional agents in the pipeline for old man's beard?

It is possible that we might be able to strengthen the existing attack against old man's beard. Faunal surveys revealed that 31 insect, 4 mite, and 4 nematode species live on old man's beard in Europe. The six most promising of these were tested to see if they would attack 40 plant species, including our native *Clematis*, ornamental *Clematis* and other members of the Ranunculaceae (Table 1).

Potential Agent	Outcome
Bark beetle (*Xylocleptes bispinus*) Foliage-feeding moth (*Horisme vitalbata*) Foliage-feeding moth (*Melanthia procellata*) Foliage-feeding moth (*Thyris fenestrella*)	Tests inconclusive
Leaf miner (*Phytomyza vitalbae*) Sawfly (*Monophadnus spinolae*)	Safe to release in New Zealand

Table 1. The outcome of safety-testing the top six candidates for old man's beard

The two candidates that were deemed to be safe, the leaf miner and the sawfly, were subsequently brought into New Zealand and cleared for release. The other four species all proved difficult to work with and were put on hold. Funding for the project had dried up and it seemed sensible to adopt a wait-and-see approach in case additional agents proved to be unnecessary. However, it may be worth revisiting the holding pen, especially in the case of the bark beetle. In the early days of the project the bark beetle seemed to be the most promising of all of the potential agents because of its ability to destroy whole stems. In Switzerland old man's beard stems rarely exceed 3 cm in diameter, and it is believed that the bark beetles may be responsible for killing any larger ones. Safety-testing showed that the beetle is unlikely to attack anything outside the *Clematis* family, but we were not able to prove that our native species weren't at risk. The native *Clematis* plants we sent over to Switzerland for testing did not find the conditions to their liking and failed to thrive. Even after being tenderly nurtured for several years their stems remained small (<3 mm in diameter) so we could not be confident that the bark beetles did not attack them for that reason alone. Shipping over material of a suitable size did not prove feasible either because phytosanitary requirements meant that we could only send cut stem portions after we had scrubbed them within an inch of their lives and soaked them in bleach – obviously not a realistic test! If there is enough interest in pursuing this agent further, then we could survey New Zealand *Clematis* growing in botanical gardens in Central Europe for signs of attack and, if necessary, import beetles into quarantine for further testing here.

The old man's beard bark beetle.

This newsletter is produced three times a year by:
Landcare Research NZ Ltd
PO Box 69
Lincoln 8152
New Zealand
Ph +64 3 3256 700
Fax +64 3 3252 418
Website: www.landcare.cri.nz

Editor: Lynley Hayes
Email: hayesl@landcare.cri.nz
Layout: Denice Webb
Cartoons: Anouk Wanrooy

ISSN 1173-762X

This newsletter is now available online! Check out our website!

Manaaki Whenua. Manaaki Tangata:
Care for the land. Care for the people

This information may be copied and distributed to others without limitations, provided Landcare Research and the source of the information is acknowledged. Under no circumstances may a charge be made for this information without the expressed permission of Landcare Research.