Number 16 November 2000

What's New In Biological Control of Weeds?

What's Inside?

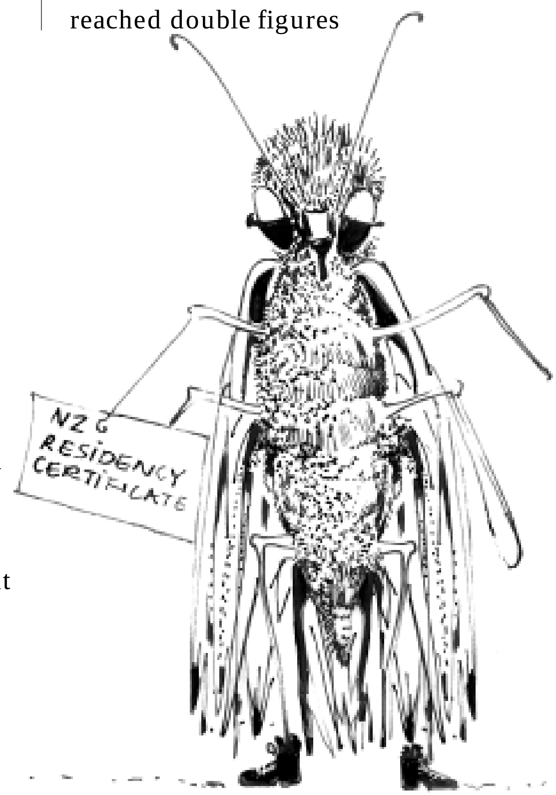
The Sweet Smell of Success

Looking for a gorse soft shoot moth (*Agonopterix ulicetella*) in a gorse patch can be like looking for a needle in a large and prickly haystack. That is, until we play the moths at their own game by using sex to lure them from their hiding places.

Although the moths have been released at more than 50 sites during the past decade, it has been very difficult to determine whether or not they have taken up permanent residency. The adults prefer to operate under the cover of darkness and hide away during the day, proving almost impossible to find, especially when numbers are low. Up until now we have relied on painstaking, and often fruitless, searches for caterpillars feeding on new spring growth.

Now that we have a new tool at our disposal, life has become a lot easier. During the winter Hugh Gourlay sent our newly developed pheromone traps to all release-site caretakers. " The idea was to have the traps in place when the moths were beginning to sense spring in the air and were getting ready to mate," explained Hugh. " The males use scent to search for the females and are lured into the traps by the promise of sex, only to meet a sticky end instead."

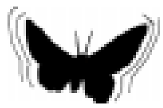
By the end of September Hugh had received back the contents of most of the traps. He cast an expert eye over them and was soon grinning from ear to ear as he found moths trapped from 10 sites (Table 1). "The number of moths caught reached double figures



in a few cases, with as many as 37 in one trap from Treasure Downs, North Canterbury," revealed Hugh. "The beauty of this method is that it is sensitive enough to detect moths at sites where no signs have been found before, and minimal effort is required to set up and remove the traps." Many thanks to everyone who helped with this breakthrough. We can now be confident that the moth is firmly established in New Zealand, and will hopefully go on to bigger and better things.

Table 1. Where were the moths found?

Site Name	Region	Date of Release	No. Moths (2 traps)
Murupara	Bay of Plenty	18/12/92	2, 2
Ashley Forest	Canterbury	23/12/92	0, 1
Cones Nursery	Canterbury	5/11/97	3, 2
River Rd	Canterbury	12/12/96	4, 2
Treasure Downs	Canterbury	13/12/96	37, 24
Uretiti	Northland	26/10/94	0, 3
Allanton Block	Otago	8/1/96	17, 4
Waikouro	Southland	24/12/96	8, 21
Granville Forest	West Coast	21/12/92	7, 2
Granville Forest	West Coast	12/1/95	1, 2



Steps to Success — A Truly Collaborative Effort!

1. **October 1998**, we consult the guru Max Suckling, of HortResearch, and he advises us that pheromones have been developed for other *Agonopterix* species and that it is likely a sex attractant for the gorse soft shoot moth could be found.
2. **February–May 1999**, a range of lures, prepared in Hungary, are tested for us by colleagues in Hawai‘i where the moth is well established. Of the 36 different blends used, several were successful at trapping male soft shoot moths.
3. **August 1999**, back in New Zealand, we trial the most successful blends at a local site, Jimmy's Knob. One blend attracts the moths but it is not the same as the one that worked best in Hawai‘i.
4. **January 2000**, HortResearch colleagues make further refinements to the blend and dose rate and Hawai‘ian researchers trial the finished product, just to be sure.
5. **July 2000**, we're ready to roll! Traps are mailed out to all concerned.
6. **September 2000**, the traps are returned for analysis. Traps from 10 sites have a positive result!

Many thanks to the following people who collaborated with us on this work:
Max Suckling and Andy Gibb, HortResearch, Lincoln, New Zealand
Pat Conant, Clyde Hirayama, and Rosemary Leen, Hawai‘i Department of Agriculture, USA
G Szöcs, Plant Protection Insitute of the Hungarian Academy of Sciences, Hungary

Hot Gossip

Congratulations! **The mist flower gall fly** (*Procecidochares alani*) has successfully negotiated the Environmental Risk Management Authority's (ERMA) process for release - the first of our agents to be put foward! The formal hearing (which allows the public to participate in the decision-making process) to consider the release application was held in August. The Auckland Regional Council contributed greatly to this positive outcome by making a sterling job of the, at times, demanding role of applicant. As soon as we were notified of ERMA's decision, we requested a shipment of gall flies from Hawai'i. Once they arrive, they will remain in quarantine in Auckland until they have completed one generation (approximately 6 weeks). Chris Winks will then rear and release as many as possible throughout Auckland and Northland this summer. The gall fly is expected to complement the **mist flower fungus** (*Entyloma ageratinae*), which is already out and about doing wonderful things (see "Drawing Enemy Lines" p5).

Mist flower gall fly

The larvae feed inside mist flower stems causing deformities (galls) that stunt and weaken the plant.

Other colleagues of ours have been improving weed control strategies by sharing knowledge with researchers from other countries. **Graeme Bourdôt** and **Shona Lamoureaux** (AgResearch, Lincoln) attended an Australian **nassella (serrated) tussock** workshop in August. The workshop was organised by the Australian Co-operative Research Centre for Weed Management Systems, and there were 24 participants. Nassella tussock (*Stipa trichotoma*) is a serious weed in both Australia and New Zealand. Shona presented her nassella population modelling work, and Graeme gave a summary of the history of nassella control in New Zealand and the current population monitoring study in Canterbury. The meeting highlighted our poor understanding of the population ecology of this weed, and its response to herbicides and other forms of management, including potential biological control agents. The demographic studies and population modelling being conducted by Shona in New Zealand, with parallel studies now underway in Argentina and Australia, are seen as the way foward to improving management of this weed.

Still on the Australian theme, many of you will be interested to hear that **bridal creeper rust** (*Puccinia myrsiphylli*) has now been released at more than 50 sites in southern Australia, where bridal creeper, or smilax as it commonly known in New Zealand, is a problem. “Disease epidemics are developing steadily at release sites, and there are already some signs of natural spread,” says Louise Morin (CSIRO, Canberra). Field observations of the rust in South Africa suggest that it is likely to have a major impact on bridal creeper in Australia. Severely diseased plants shed infected leaves prematurely and produce few or no fruits. Bridal creeper rust is the second agent to be released to control this weed. The first, a **leafhopper** (*Zygina* sp.), was released in Australia in June 1999.

Left: Bridal creeper infected by rust. Right: close-up of infected leaf

Linda Wilson, from the University of Idaho, USA, is working out of our Lincoln office for 5 months until December. Linda leads a consortium that is interested in using biological control to combat **field hawkweed** (*Hieracium caespitosum*), which is becoming a serious problem in western areas of the United States and Canada. We have been sharing information with North American researchers about our programme for 4 key species of *Hieracium* and now they would like to initiate a biological control programme too. Linda has taken on the task of gathering as much information as possible, and is learning from our experiences, before launching into introducing hieracium agents back home. She is making contact with New Zealand researchers (from various institutions) to learn more about the complexities surrounding the ecology and genetics of hieracium, and is also gaining valuable hands-on experience with hieracium agents. Linda is also hoping to strengthen this international linkage by developing a co-operative research programme, which could involve student exchange.

Linda Wilson

Drawing Up Enemy Lines

"Know your enemy" is an important consideration when attempting to control a weed. That includes knowing all the places that need to be rescued from a weed's clutches and those most in danger of being invaded next. Thanks to the help of our readers we are now a lot wiser about where mist flower (*Ageratina riparia*) is found. Knowing that many pairs of eyes are better than one we sent out a questionnaire with the November 1998 edition of this newsletter. Thanks to all the people who replied. Your collective wisdom has been stored in a database and, with the help of Debra Emmett and John Leathwick (Landcare Research, Hamilton), used to draw a map of the current distribution of the weed (Figure 1). "Similar surveys can be done in the future to show if mist flower has advanced or retreated," says Jane Fröhlich.

We have scrutinised in detail the kind of conditions that suit mist flower and expressed these as a range of climatic conditions (Figure 2). This "climate envelope" has allowed us to predict a possible worst-case scenario (Figure 1). At present mist flower is most common in the northern half of the North Island. The weed is found as far north as Cape Reinga and as far south as Wellington. However, mist flower has the potential to occupy a much larger territory! Areas most at risk include much of Northland, Auckland and Coromandel. Large infestations are also predicted for northern and coastal parts

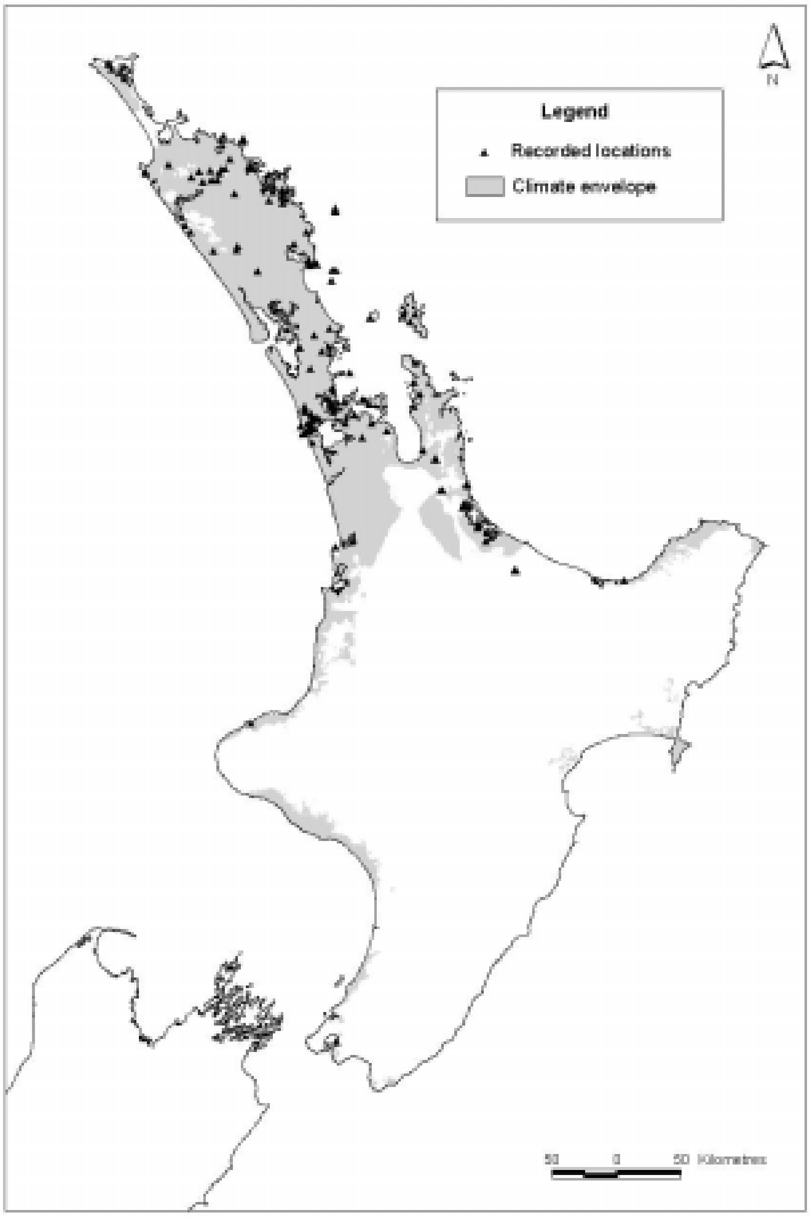


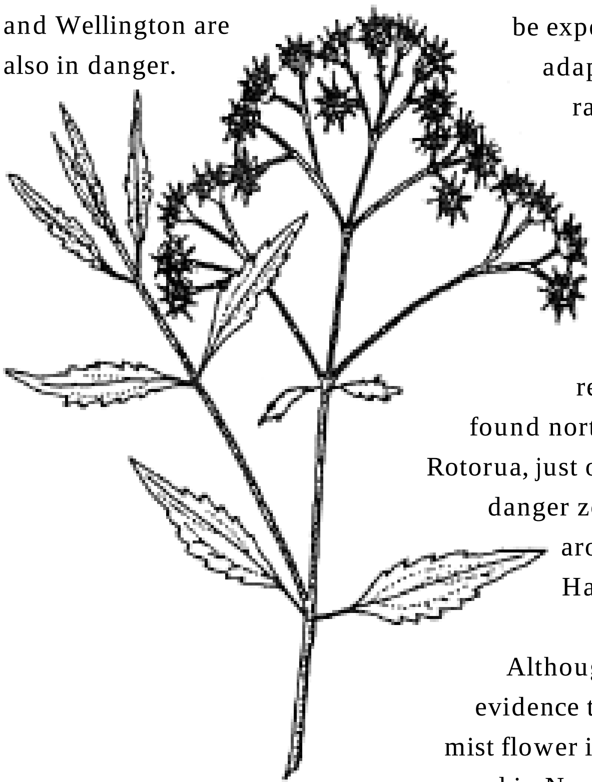
Figure 1. Current and potential distribution of mistflower

Figure 2. Climatic limits that appear to determine the distribution of mist flower

Mean annual temperature: 12.5–16.0°C
Winter minimum temperature: 4.0–8.8°C
Mean annual solar radiation: 14.2–15.4 MJ[A] / m^2 / day
Winter minimum solar radiation: 5.3–7.4 MJ / m^2 / day
Maximum vapour pressure deficit through the year (the dryness of the air): 0.44 – 0.68 kPa[B]
Rainfall divided by potential evaporation in the driest month (an index of wetness): 0.49–1.10.

[A] MJ = MegaJoules, SI unit of radiant energy
[B] kPa = kiloPascal, SI unit of pressure (1 bar = 100 kPa)

of Waikato and the Bay of Plenty. Smaller, but still substantial, areas of predominantly coastal land in the East Cape, Gisborne, Hawke’s Bay, Taranaki, Wanganui, Wairarapa and Wellington are also in danger.



Small pockets are also possible in the northern South Island, around Nelson and the Marlborough Sounds. Jane warns that the map gives a fairly conservative estimate because the weed could be expected to slowly adapt to a wider range of climatic conditions. This theory has been supported by the fact that mist flower has recently been found north of Lake Rotorua, just outside the danger zone highlighted around Tauranga Harbour.

Although we have evidence to suggest that mist flower is continuing to spread in New Zealand, it is heartening to know that the mist flower fungus (released in November 1998) is moving even faster. The fungus is now widespread in the Waitakere Ranges, and continues to spread well in Northland, closing the gap between the Northland and Auckland regions. It is also beginning to travel around Hauraki and Coromandel. “The fungus seems to be doing well. We’re very excited by its prospects,” said Alison Gianotti. The fungus will be joined by its close ally, the mist flower gall fly (*Procecidochares alani*), this summer (see “Hot Gossip” page 3). Hopefully these two agents will in time be able stop mist flower in its tracks and then cause it to beat a hasty retreat. You can run, mist flower, but you can’t hide!

Peter Predicts Poor Prospects for Paralysing Pampas

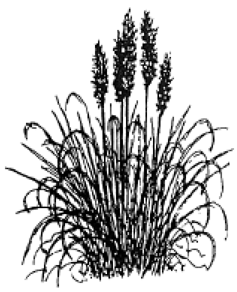
In the recent past Palmerston-North-based Peter (McGregor) pensively perused a plethora of papers for the particular purpose of pronouncing or precluding the probability of pruning and paralysing the prolific plant pampas with plague and pestilence (try saying that fast!).

Both common pampas grass (*Cortaderia sellona*) and purple pampas (*C. jubata*) are causing concern as they are already widely distributed through New Zealand and seem to be on the move. The huge number of windborne seeds they produce means that pampas grasses are experts at invading both new areas and previously cleared areas.

Although the common pampas grass is more widespread than the purple pampas grass, the latter may have greater invasive potential because of its ability to produce fertile seeds from a single plant. Both species originate in South America and have become weeds in Australia, the USA, and South Africa as well as New Zealand. Pampas grasses grow quickly outcompeting more desirable plants, particularly in native communities. The dead leaves house vermin and are a fire hazard, and the sticky seeds can downgrade the quality of horticultural produce. These overgrown tussocks are also one of the worst weeds of pine plantations in New Zealand.

At present people keep the plants at bay with chemicals, hand pulling, grubbing and grazing by cattle. The disadvantage with these methods is that they are either labour-intensive, require ongoing surveillance to prevent reinvasion, are suitable only for specific situations, or some combination of the above. At face value biological control would seem to be an attractive option. However, Peter's study has concluded that the development of a successful biological control programme would be difficult. The likelihood that a suitable insect agent could be identified is remote given the close taxonomic relationships between the introduced species and the five native species of *Cortaderia*, commonly referred to as toetoe. "No insects have been formally recorded attacking the two pampas species anywhere," explained Peter. "Presumably some insects do damage pampas grasses, but they are not likely to be specific enough to be acceptable."

" Fungal pathogens offer a better prospect as some of those that attack grasses are extremely specific, but again none have been identified and confirmed as attacking only the weedy pampas grasses," said Peter. There is a slim chance of finding a South American rust or smut fungus that might be sufficiently host-specific, but the best prospect lies in attempting to find and develop a less specific pathogen as a mycoherbicide that would not spread beyond the area of application. Given that intensive surveys in South America are needed, several countries would probably need to pool resources to make this viable. The time does not appear to be ripe for such a collaboration at present so, at least in the short term, the prospects for developing a biological control programme for pampas are poor.



Watch Out, *Microctonus* is About

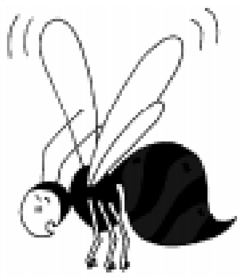
M. aethiopoides approaching *Sitona* (Photo: Mark McNeill, Agresearch)

A parasitoid wasp (*Microctonus aethiopoides*) was introduced to New Zealand in 1982 as a biological control agent of an insect pest (*Sitona discoides*) of lucerne. As such, this wasp has had a beneficial impact on New Zealand's agricultural productivity and sustainability. Unfortunately it has also taken a shine to one of our good guys, the nodding thistle receptacle weevil (*Rhinocyllus conicus*) in some agricultural environments.

The parasitoid lays eggs in the adult stage of its host, which normally makes the females sterile. Whether *M. aethiopoides* is likely to reduce the potency of the nodding thistle receptacle weevil depends on a number of factors, such as how often the two actually come into contact and the resulting level of attack. AgResearch's Biocontrol and Biosecurity Group has carried out laboratory and field investigations to see just how good the parasitoid is at nobbling the receptacle weevil. Fortunately all indications suggest that the parasitoid's impact on our nodding thistle agent is likely to be low.

The pre-release host range testing of *M. aethiopoides* was carried out at a time when there was less awareness of environmental risk. As a result, the tests were more limited in their extent than would now be acceptable and did not reveal the full range of non-target hosts. More recently another closely related parasitoid (*M. hyperodae*) has been introduced against Argentine stem weevil (*Listronotus bonariensis*). In contrast to M. *aethiopoides*, this second agent was tested more rigorously, and its observed narrow host range in the field has been as predicted. Today, these issues are addressed under the Hazardous Substances and New Organisms Act (1996) before any introduction is allowed.

(For further information, contact Colin Ferguson or Barbara Barratt, AgResearch, Invermay Agricultural Centre, Private Bag 50034, Mosgiel)



Trials and Tribulations

The Biosecurity Act (1993) tells local authorities that they must assess the effectiveness of their weed control strategies. While nobody doubts that this is important and reasonable, it sometimes falls into the “easier said than done” category. Assessment studies can easily decimate an organisation’s weed control budget and can be fraught with difficulty — it’s easy to end up with data that tell you nothing. We recognised the problems that local authorities were facing in this regard and, with their support, we developed a simple method* that they could use to assess unambiguously the impact of the ragwort flea beetle (*Longitarsus jacobaeae*). Anecdotal evidence had suggested that the beetles were performing well in many places so it was time for some hard evidence.

The method involved removing flea beetles from some marked plots (with insecticide) to give ragwort the opportunity to recover, while leaving flea beetles in other plots at the same site. This is the clearest way to show whether the flea beetle is the cause of declining ragwort populations. We held a workshop in January 1999 to familiarise people with the method and warn them how to avoid some of the common pitfalls. In the months that followed, biosecurity officers set up trial plots in six regions (Auckland, Bay of Plenty, Manawatu-Wanganui, Southland, Taranaki and Wellington). By last autumn the trials had been running a full year so over the winter Peter McGregor cast an eagle eye over the data to check how they were going.

“We were surprised to find that ragwort flea beetles were not behaving quite as expected!” noted Peter. At some sites adult beetles were abundant not only in autumn, but throughout the year. In the Bay of Plenty, adults were laying eggs in spring as well as in autumn, which suggests that at least some beetle populations in New Zealand are completing two generations a year instead of the usual one. This is good news for ragwort control because it means that the odds of a plant escaping attack are reduced. However, it wasn’t such good news for the assessment trials as plots must now be protected from beetle attack all year round. “Also the preferred insecticide, Orthene® (195 g/L acephate), has not proven to be as effective at controlling the beetles in the field as it is under laboratory conditions. We are now recommending that people use Halmark® SEC (50 g/L esfenvalerate) instead,” said Peter.

To date only one of the trial plots, which had exceptionally high beetle populations and was protected from the outset with Halmark®, has yet clearly demonstrated that the flea

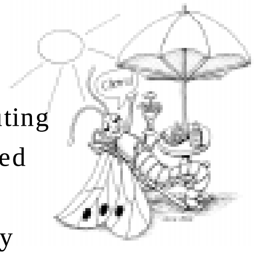
Paul Peterson measuring ragwort

beetles are causing ragwort populations to decline. A combination of the beetles being active at unexpected times, the failure of Orthene® to protect the plots adequately from attack, and the low recruitment of the seedling ragwort into plots when ragwort densities were already low seem to be to blame. "In some areas it has become necessary to take action to weaken the pasture and let ragwort get a look in!" joked Peter.

These kinds of teething problems can spell disaster for assessment trials. Fortunately in this instance they have been identified early on and if people stick to the modified protocol, then we are confident that they will begin to experience the fruits of their labour in the second year of the trials.

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

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 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.

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