WHAT'S NEW IN

# Biological Control of Weeds?

Issue 64 May 13

Green thistle beetle larvae and damage

AgResearch

## What's Inside?

Landcare Research
Manaaki Whenua

# Biocontrol for Aquatic Weeds, a Step Closer

In Issue 56 of this newsletter we suggested that classical biocontrol had been underutilised as a method for controlling aquatic weeds in New Zealand. Currently the methods used include mechanical control, habitat manipulation, herbicides and inundative biological control using grass carp (*Ctynopharyngodon idella*). Mechanical methods are sometimes unavoidable (e.g. power station screen cleaners) and are expensive to implement. Herbicides are easier and cheaper to use than mechanical methods but also have limitations, particularly for submerged aquatic weeds, where there is a risk of inadequate plant exposure and uptake. There is also a risk of increasing public opposition to their use. Sterile grass carp can be an effective tool. Grass carp can be released en masse and, because they are not able to breed, can either remain in the lake until they die or be contained in cages and later removed. The downside to grass carp is that although they have plant feeding preferences, once the most palatable species are consumed they become less selective about what plant species they eat and will feed on any remaining native vegetation too. However, using grass carp to knock weeds back can at least give native plants a chance to recover once grass carp are removed or die out naturally.

Previously it was believed that biocontrol of aquatic weeds was too difficult because it was thought that most aquatic insect herbivores and pathogens have wide host ranges. However, further research has shown this not to be the case and in the past two decades there have been many examples of highly successful aquatic weed biocontrol projects overseas. After it became clear that New Zealand was missing out on a good opportunity, we organised a meeting with key stakeholders in November 2011 to explore the level of interest in developing biocontrol for aquatic weeds. Interest was high and as a result a steering group was formed (with representatives from Landcare Research, NIWA, Ministry for Primary Industries, Department of Conservation, Auckland Council, Bay of Plenty, Waikato and Greater Wellington regional councils, and Marlborough District Council), which met in June 2012 to rank potential targets (see Table) and consider how best to progress the project.

Aquatic targets prioritised by key stakeholders.

| Plant species | Rank | Comments |
|---|---|---|
| *Ceratophyllum demersum* | Red hot | Worst aquatic weed in most regions |
| *Lagarosiphon major* | Hot | |
| *Egeria densa* | Hot | |
| *Myriophyllum aquaticum* | Warm | |
| *Elodea canadensis* | Warm | Not as bad as some other weeds, but concern it may replace *Lagarosiphon* if that weed is successfully controlled |
| *Spartina* sp. | Cold | Not yet important enough, nationally. Control efforts succeeding |
| *Vallisneria* spp. | Cold | Not yet important enough, nationally |
| *Nymphaea mexicana* | Cold | Not yet important enough, nationally |
| *Zizania latifolia* | Cold | Not yet important enough, nationally |
| *Lythrum salicaria* | Cold | Not yet important enough, nationally |

The steering group acknowledged that additional funding would be required if work on aquatic weeds was to proceed, and a number of potential new funding sources were discussed. The group agreed that a detailed proposal was needed to take to potential funders. The proposal would focus only on the top three species of interest: lagarosiphon (*Lagarosiphon major*), hornwort (*Ceratophyllum demersum)* and egeria (*Egeria densa*). These weeds displace native vegetation, and disrupt recreational activities; storms can deposit large masses of rotting vegetation on beaches; and detached stems may block water-intakes of power stations, impeding electricity generation. All three can spread between water bodies when fragments of the plant are accidentally transferred, usually as the result of human activities such as boating and fishing. Although studies on the feasibility of biocontrol for these species had been prepared in the past, they needed to be updated in light of considerable new recent developments. Quentin Paynter has recently completed this task, and below we summarise the main findings.

Lagarosiphon is a submerged aquatic plant – native to southern Africa – that has become invasive in parts of Europe and Australia as well as in New Zealand. The plant was first recorded in New Zealand in 1950 and is now patchily distributed throughout most of the country. Lagarosiphon is dioecious, having male and female plants, but male plants are only known to occur in South Africa. The plant only reproduces asexually here and does not produce seeds. Quentin found that there are no native New Zealand plants closely related to lagarosiphon (which belongs in the Hydrocharitaceae family). "This makes it a good candidate for biocontrol as host-range testing is relatively straightforward," said Quent. Lagarosiphon is also a problem in Irish waterways and a biocontrol project began there in 2008. A number of potential agents were identified in the plant's native range including a leaf-mining fly (*Hydrellia lagarosiphon*) and a shoot-tip mining midge (cf. *Polypedilum* sp.). Host-range testing of these agents is well progressed and the fly already appears to be sufficiently specific for release in New Zealand. Only a small amount of additional testing would be required to confirm this. However, more extensive testing of the midge would be required to assess its suitability for release in New Zealand.

The fly lays its eggs on vegetation growing at the water's surface, whereas the midge has larvae that can swim, so it should be capable of attacking lagarosiphon growing in deeper water. Studies showed that the fly is capable of reducing lagarosiphon biomass by 50–70% after 134 days of exposure, and sustained herbivory over multiple generations reduced shoot biomass production by nearly 100%. The damage caused by the midge is purportedly even more harmful to the plant than that caused by the fly. Quentin has estimated that the cost of gaining approval for the fly as a biocontrol agent for New Zealand would be in the region of $145,000–$165,000 and the cost of gaining approval for both the fly and the midge would be ~$220,000–$260,000; pretty cheap when you compare it with the annual cost of controlling lagarosiphon in New Zealand, which was recently estimated to be nearly $1.5m.

Another *Hydrellia* fly looks to be a promising potential agent for egeria. Egeria (also known as Brazilian waterweed) is native to South America, but has now established in a number of countries around the world including Chile, Mexico, the United States, England, and Australia. It is most commonly encountered in the Waikato Region but occurs throughout the North Island. Egeria is at an early stage of spread in the South Island and is restricted to a small number of still, shallow and slow-moving water bodies. Surveys for potential biocontrol agents that might be suitable to release in the USA against this weed began in Argentina in 2005. The most promising species found was the *Hydrellia* fly, which can cause heavy defoliation. The fly has been well studied and work conducted at the USDA/ARS/South American Biological Control Laboratory indicates it has a narrow host-range, confined to the Hydrocharitaceae family. Although New Zealand has no native plants in this family, it would be prudent to test a small number of additional native New Zealand plants, but based on previous results none of these are likely to be attacked. A second *Hydrellia* fly has also been identified as possibly having potential against egeria but it has not been well studied yet.

Less is known about potential biocontol agents for hornwort (*Ceratophyllum demersum*). Hornwort (also known as coontail) has a near-global distribution and is considered native to most countries, with New Zealand being one of the few exceptions. Hornwort was thought to have been introduced as an aquarium plant from North America, and was first recorded in New Zealand in 1961. However, as part of our feasibility study, samples were collected from around New Zealand and sent to Gary Houliston who extracted DNA from the specimens and compared it with sequences from GenBank. "This indicated that hornwort in New Zealand comes from Australia and not the USA," said Quent. NIWA considers hornwort to be New Zealand's worst submerged weed and many other stakeholders seem to agree. Hornwort has been in the North Island for some time, and although all known infestations in the South Island have recently been successfully eradicated, this weed still presents a major threat to South Island water bodies. Given little is known about the natural enemies of hornwort, surveys would need to be undertaken, beginning in Australia and then possibly extending to other parts of the native range, depending on what is found.


University College Dublin

Leaf mining fly *Hydrellia lagarosiphon.*

The feasibility studies also address some areas of concern raised previously. Biocontrol could lead to increased physical fragmentation of aquatic weeds, which could give rise to more plants. However, in the case of lagarosiphon, this has been investigated as part of the Irish project with researchers finding that fragments damaged by the fly had significantly reduced viability. So fragmentation may not be such a big issue after all. Another potential downside to biocontrol still needs further consideration. There is potential for degraded lakes to suffer a further decline in health following the removal of weeds when they are the only remaining vegetation, and this will need to be planned for and managed through activities such as restoration of native vegetation. However, overall the prospects of achieving some really good environmental and economic outcomes relatively cheaply with aquatic weed biocontrol remain bright. Landcare Research and NIWA are joining forces to work on a detailed proposal, and it is hoped that funding can be secured soon that will allow this new collaboration, and the opportunities it provides, to be realised.

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# Introducing Mike Cripps

Michael Cripps joined the Weed & Pest Management team at AgResearch Lincoln last year. His position is primarily focused on pasture weed management, with an emphasis on biocontrol research. Before joining AgResearch Mike gained substantial experience in weed biocontrol from postgraduate research carried out in North America, Europe, and New Zealand. His research career began during a summer internship at CABI Switzerland in 2001, which led to a Master's degree project at the University of Idaho, and later a PhD based at Lincoln University in New Zealand (both in collaboration with CABI Switzerland). Much of his research focused on testing plant invasion mechanisms and underpinning theory of weed biocontrol by comparing invasive weeds in their native and introduced ranges. After his PhD, Mike took on a postdoctoral fellowship at Lincoln University, investigating potential extended effects of endophytes of pasture grasses in New Zealand. In his new role at AgResearch Mike is back investigating biocontrol options for weed management, with a current focus on thistles. Below Mike shares two stories with us related to his current work on Californian thistle (*Cirsium arvense*).


AgResearch

Mike Cripps applying rust infected debris.

# Beetles Decimate Californian Thistles at Lincoln

The green thistle beetle (*Cassida rubiginosa*) is attracting a lot of attention, not surprisingly, since it can cause impressive levels of damage on Californian thistle (*Cirsium arvense*), one of the worst agricultural weeds in New Zealand. The beetle was first released here 5 years ago and is now well-established. Where the beetle occurs, anecdotal reports of severe and extensive feeding on Californian thistle are encouraging, and suggest great potential for this biocontrol agent. Although it is still early years for this beetle in New Zealand, it appears to be the most successful biocontrol agent released for control of Californian thistle to date.

At Lincoln, near Landcare Research a small population of green thistle beetles caused some striking damage to Californian thistles this past spring/summer. The adult beetles emerged in early October and quickly began laying egg masses. Within a few weeks the first instar larvae had emerged, and were greedily feeding on the thistle leaves. By mid-November feeding damage was obvious, but this was only from the first and second larval instars. The most extensive damage was apparent by late December, caused by the larger third to fifth larval instars. The larvae tend to move steadily up the growing thistle shoots, consuming all the green leaf tissue. In some cases, all that remained were dead, skeletonised shoots. Californian thistle is the primary target of this biocontrol agent, but an additional advantage is that it also feeds on other thistle species. At the Lincoln site, damage to Scotch thistle (*Cirsium vulgare*) was observed, but not nearly to the same degree as on Californian thistle.

"The damage observed on Californian thistle at Lincoln was impressive, and greater than anything I saw while working with this beetle in its native range of Europe," said Mike Cripps of AgResearch. The greater damage in New Zealand compared to Europe is intriguing, and Mike suspects it's due to "enemy-free space" experienced by the beetle here, allowing for the maintenance of higher beetle densities and a longer duration of sustained feeding. "In Europe, I recorded approximately 50% mortality one week after a field release of hundreds of green thistle beetle larvae. In Contrast, at Lincoln I noted constant densities of larvae for a month on the same shoots," explained Mike.

The degree of damage observed at Lincoln will likely cause population declines in Californian thistle. However, quantitative data from controlled field experiments under realistic pasture management systems in New Zealand are still lacking. Now that this biocontrol agent is established there are many new research questions to be answered. What level of impact does it have on Californian thistle, and other thistles here, and what limits the beetles' population numbers in New Zealand? To properly evaluate the effectiveness of this biocontrol agent substantial financial investment will be required to support on-farm experiments carried out at several sites over multiple years. "Given that thistles are among the worst pastoral weeds in New Zealand, causing tremendous productivity losses, the importance of understanding this biocontrol agent, its effectiveness, and how to best utilise it for thistle management cannot be overemphasised," concluded Mike.

# Breakthrough with the Californian Thistle Rust

For over a century the fungal rust pathogen, *Puccinia punctiformis*, of Californian thistle (*Cirsium arvense*) has been considered a promising biocontrol agent, but utilising this pathogen effectively has been hampered by an incomplete understanding of the disease cycle. The rust is highly host specific, infecting only Californian thistle, and is present everywhere in the world where the thistle occurs, including New Zealand. The rust disease occurs in two forms, localised and systemic. Localised infections have minimal impact on the weed, whereas systemic infection results in severely distorted growth and eventual death of the shoot. Understanding the natural disease cycle of the fungus, particularly how systemic infection is initiated, is key to manipulating it for greater effect.

Recently an important breakthrough with this pathogen has been achieved through an international collaboration of scientists led by Dr Dana Berner (USDA, Maryland) and including AgResearch. Field experiments conducted in the United States, Russia, Greece and New Zealand, following the same simple protocol, have routinely generated systemic rust disease in populations of Californian thistle. “We believe this is a step in the right direction towards a greater understanding of the fungus, and therefore our ability to utilise it for biocontrol purposes,” explained Mike Cripps of AgResearch.

But before we get to the breakthrough here is a brief overview of the history of research, successes and setbacks that have brought us to this point. The life cycle of the rust is complex, involving all five possible spore types (spermatia, aeciospores, urediniospores, teliospores and basidiospores). The questions concerning the life cycle of this fungus that have persisted for decades are: which spore type causes systemic infection, and how and when does it encounter the host plant at a susceptible growth stage?

The teliospore stage of the fungus was always the likely candidate for causing systemic disease, but during early research in the 1950s the difficulties encountered in getting teliospores to germinate led some researchers to believe that that this spore type could not account for the amount of systemic disease observed in the field. They postulated that urediniospores might be responsible, but this explanation was unsatisfactory since it would have required an atypical genetic process. By the 1990s it had been discovered that stimulants from the host plant were required for teliospores to germinate. This explanation conformed to the known processes of rust spore development, and was generally accepted. However, the question of how and when the teliospores encountered a susceptible infection site on the plant still remained. The working hypothesis was that teliospores were dispersed on the soil surface and contacted adventitious shoot buds emerging from the roots of the thistle plant. However, the movement of teliospores through the soil and the haphazard contact with root buds was unlikely, and other explanations were sought. An idea that captured some attention was that stem-mining weevils (like *Ceratapion onopordi*) might vector the pathogen and inoculate the plant via egg deposition in the thistle shoot. To further muddle the story, the proponents of the weevil vector hypothesis also reinvoked urediniospores as the causal spore type of systemic infection, since these are the most common type encountered by the weevils in spring. But the importance of insect vectors in the disease cycle was called into question after surveys carried out in Europe and New Zealand showed equivalent frequencies of rust disease in both regions, with and without stem-mining weevils, respectively.

So the focus went back onto teliospores again. Teliospores are produced in summer, corresponding with the death of diseased shoots. In autumn there is always a flush of new thistle rosettes emerging after the summer growth has senesced. “We believed it was likely that debris bearing teliospores from old shoots landed on the autumn cohort of thistle shoots,” explained Mike. Infection could then take place with the fungus overwintering in the roots, followed by the expression of systemic disease appearing in spring. To test this hypothesis, researchers gathered diseased shoots in summer and inoculated rosettes in autumn with debris bearing teliospores.

In New Zealand, the autumn inoculations of rosettes resulted in systemic disease appearing in approximately 50% of the treated plots compared with 15% ambient disease in control plots. This result was highly significant, and similar successes were achieved at the other field trials around the world. This combined international study will be reported in a scientific journal later this year. “The study in New Zealand is ongoing and we will continue to monitor disease progress, and changes in the thistle population densities,” said Mike. There is still much to learn about the interactions of this pathogen with its host plant, but now we at least have a simple method of initiating systemic disease that we can build upon to improve the biological control of this important weed.

*Both studies were supported by funding from the Ministry of Business, Innovation and Employment through the Undermining Weeds Programme.*

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# What Do Zebra Chips Have to Do with Broom Biocontrol?

Let's start with "zebra chip" potatoes. In 2009 a team of scientists, led by Lia Liefting of the Ministry for Primary Industries (MPI), examined tissue from hot-house tomato (*Solanum lycopersicum*) and capsicum (*Capsicum annuum*) plants that had been attacked by the tomato potato psyllid (*Bactericera cockerelli*) and had disease symptoms. In the USA and other countries, the tomato potato psyllid was known to be associated with diseases that led to "zebra chip" (literally light and dark stripes in chips), but no causative pathogen had been identified. Exhaustive testing for a range of possible pathogens, including fungi, bacteria, viruses, viroids and phytoplasmas, drew a blank. Transmission electron microscopy was used by MPI to look at sections of leaf tissue and revealed a possible culprit. A bacterium-like organism, restricted to the phloem of the plants, was discovered that proved to be unculturable, i.e. it refused to grow on medium in a Petri dish like other bacteria. DNA was extracted from the plant tissue containing the unculturable bacterium, and molecular tests determined that this was a novel species closely related to *Liberibacter* species that are vectored between plants by psyllids (sap-sucking insects in the family Psyllidae). This was the first time that the link had been made between the tomato potato psyllid, a pest that arrived in New Zealand in 2006, and a disease-causing organism. It was named '*Candidatus* Liberibacter solanacearum*'* (Lso) – the "candidatus" term referring to its unculturable nature, as bacterial taxonomy requires organisms to be cultured.

Plant and Food Research

Zebra chips.

The tomato potato psyllid has caused major damage to tomato and potato crops, particularly in the northern parts of New Zealand. Plant and Food Research (PFR) scientists are actively researching ways to manage these serious problems. They have discovered that the pest psyllid has spread Lso into several other plant species. These include the weed boxthorn (*Lycium ferocissimum*) and native poroporo (*Solanum aviculare*). Intriguingly, Lso does not so far appear to behave like a pathogen in poroporo, i.e. it seems to be a symptomless "endophyte" – an organism that can live within a plant without causing any harm. Nevertheless, both the exotic and indigenous plant species act as reservoirs for Lso from which tomato and potato crops can potentially be infected via their shared psyllid vector.

There are now six species of *Liberibacter* known worldwide, all vectored by different psyllid species, and they are associated with some serious plant diseases. '*Ca. L. asiaticus*', '*Ca. L. americanus*' and '*Ca. L. africanus*' are associated with citrus greening in Asia, the Americas and Africa. This disease has been known for nearly 100 years but was only associated with *Liberibacter* with the advent of molecular genetic techniques. Early in 2011, an Italian group reported the pear psyllid pest (*Cacopsylla pyri*) hosts and vectors '*Ca. Liberibacter europaeus*' (Leu henceforth). The Italians believe that Leu in pears also behaves as a symptomless endophyte, rather than a pathogen, because despite high counts of the bacterium in the pear plant tissue, no specific disease symptoms could be observed in the infected plants, at least in the short term.

Discovering Lso was a major scientific breakthrough by the staff at MPI together with PFR. This work has big implications for the horticultural industry and globally this is "hot science" at the moment. But what does this have to do with broom biocontrol? In 2011, during routine sampling of potato crops in Canterbury for Lso, PFR scientists saw what they thought were typical *Liberibacter* symptoms on nearby Scotch broom (*Cytisus scoparius*) plants. The symptoms included wilting, stunted growth of shoots, shortened internodes, leaf dwarfing and leaf curling. A large population of broom psyllid *(Arytainilla spartiophila)* was also noticed on the plants. The PFR scientists tested the broom plants and the psyllids for *Liberibacter* species, including Leu (the *Liberibacter* species discovered by the Italians in pears), although Leu was unreported from New Zealand. To their surprise, DNA extracted from both organisms revealed signatures characteristic of Leu.

The broom psyllid is highly host specific to Scotch broom and was introduced as a biocontrol agent in 1993. The psyllid is now widespread on broom throughout much of New Zealand and some significant outbreaks have been seen. Although the psyllid underwent routine testing for unwanted associated organisms before its release, this testing did not include *Liberibacter* species since they were unknown to science at the time, and the molecular techniques needed for their detection were only just being developed. In 2011, Leu was a new organism for New Zealand, so MPI was immediately informed of the discovery. It is thought that *Liberibacter* species can only be transmitted from plant to plant by psyllids or grafting. Therefore the most likely way that Leu had entered New Zealand was along with the broom psyllid.

Landcare Research, PFR and MPI immediately collaborated on a "delimiting survey", which indicated that Leu was widespread. No incursion response from MPI was therefore justified. The survey also showed that broom was only positive for Leu in areas where the broom psyllid was present, consistent with the hypothesis of broom psyllid being the vector and introduction route for Leu into New Zealand.

What does this discovery mean for New Zealand? Simon Fowler explains: "While the broom psyllid is highly host specific, Leu is not, and incidental probing by the psyllid (to 'taste' if they have the right host plant) might represent a risk of transfer to non-target plants." Such spillover effects would be minor unless there was another psyllid species that could then pick up Leu and transfer it widely to the population of non-target plants. As a precaution, Landcare Research decided to survey the nearest native relative to broom, kōwhai (*Sophora microphylla*), and the host-specific kōwhai psyllid (*Psylla apicalis*). Leu could not be found in either kōwhai or its psyllid, even in areas where the broom psyllid was common on nearby broom and both were positive for Leu. "Given the length of time that Leu has been in New Zealand, it would most likely have had time to become evident in the kōwhai population if transfer was at all probable," said Simon. Simon added, "… of course we don't know whether Leu, even if it got into kōwhai, would act like a pathogen or behave like a symptomless endophyte." Furthermore, Landcare Research scientists are unsure whether the *Liberibacter* symptoms claimed to be seen in broom in New Zealand are a result of the bacterium, or the direct result of attack by the psyllid and the broom twig miner (*Leucoptera spartifoliella*), which was also very common at the original site sampled in 2011. "However, even if Leu was harmless in broom that doesn't mean it would be harmless in other plants. We can see from Lso causing serious diseases in tomatoes and potatoes, but not in poroporo, that the disease nature of these bacteria is unpredictable," said Simon. There are still a great many unknowns and much research to undertake.

A priority is to understand what pathogens other psyllids in New Zealand are carrying. New Zealand has a rich native fauna of psyllids, as well as many self-introduced species that mostly attack *Acacia* and *Eucalyptus* species from their original home in Australia. There may be many more *Liberibacter* species yet to be discovered! Other key research questions include whether psyllids should be completely avoided in future as potential biocontrol agents because of possible associated organisms, and whether the action of the disease-causing organisms would mean that if it was possible to "clean up" the psyllids they would have reduced effectiveness as biocontrol agents. Landcare Research and PFR scientists are collaborating to work on these sorts of questions, and are looking at developing a new set of risk assessment protocols that would include screening of biocontrol agents for *Liberibacter* species.

For further information on tomato potato psyllid in New Zealand see www.biosecurity.govt.nz/files/pests/potato-tomato-psyllid/psyillid-factsheet.pdf

*Landcare Research's involvement in this project is funded by the Ministry of Business, Innovation and Employment as part of the Beating Weeds Programme.*

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*Plant and Food Research*

Left: normal broom shoots and right: broom shoots showing symptoms which may be caused by *Liberibacter* or broom psyllid attack.

# New Project to Begin

An application to develop biological control for field horsetail (*Equisetum arvense*), put forward by the Lower Rangitikei Horsetail Control Group (LRHCG) to the Ministry for Primary Industries' Sustainable Farming Fund, has been successful. The LRHCG represents a diverse group of landowners and managers who have a significant problem with field horsetail, and who have come together to try to find a better solution. Alastair Robertson chairs the group, which also includes other arable and pastoral farmers, and representatives from the aggregate extraction industry, district and regional councils, the New Zealand Landcare Trust, and Landcare Research as the science advisor.

Field horsetail is an ancient plant that goes back to the age of the dinosaurs. This plant reproduces by spores rather than seeds, and is native to Europe, Asia and North America. Field horsetail was first recorded in New Zealand in 1922 and is now a problem weed, particularly where rainfall is moderate to high, and in riparian areas. However, the plant can thrive in many habitats from wet, poorly drained areas of fields and grasslands, and stream edges, to well-drained fields, orchards and crops, and even sandy or gravelly sites like roadsides, rail tracks and beaches. Infestations have been recorded from Kawhia, Havelock North, New Plymouth, Wanganui, Lower Rangitikei, Marlborough, Nelson, the West Coast, Christchurch and Dunedin. The total amount of infested land nationwide is unknown. However, Craig Davey, of Horizons Regional Council, who helped to form the LRHCG, has described the recent rate of field horsetail spread in his area as "phenomenal and unstoppable, with vast potential for further spread".

Once established, field horsetail can form pure stands that exclude other plants. While grazing animals will often avoid eating the plant, those that do can develop "equitosis", which can prove fatal in horses. Field horsetail develops extensive underground rhizomes that are resistant to herbicides, making this weed extremely difficult and expensive to control. As well as spreading by wind-blown spores new infestations can also develop from small root or rhizome fragments spread by cultivation or flood. Biological control now appears to be the only cost-effective and sustainable management option for this plant. A feasibility study undertaken in 2008 found that field horsetail was likely to be a good biocontrol target since there are no native or economically important plants in New Zealand closely related to it, and many natural enemies are already well known.


*Horizons Regional Council*

Dense infestation of field horsetail.

"Now that funding has been confirmed, surveys in Europe will get underway very soon and we hope to collect some promising-sounding natural enemies that we would like to investigate further," explained Lindsay Smith, who is leading the search for biocontrol agents. These include a flea beetle (*Hippuriphila modeeri*), weevil (*Grypus equiseti*), and two sawflies (*Dolerus aericeps, D. pratensis*). We will keep you posted as this project develops.

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# New Agent Approved

In January the Environmental Protection Authority approved the release of a fourth biocontrol agent for tradescantia (*Tradescantia fluminensis*) in New Zealand. The latest approval is for a yellow leaf spot fungus (*Kordyana* sp.), which causes large distinctive yellow spots to form on the leaves. Auckland Council was again the applicant. The yellow leaf spot fungus is expected to complement the activity of the three tradescantia beetles that have now all been released. Releases of the leaf beetle (*Neolema ogloblini*) began in autumn 2011 and some promising signs of establishment have been seen. Releases of the stem beetle (*Lema basicostata*) began last autumn followed by the tip beetle (*Neolema abbreviata*) earlier this year. When funds permit, we will import the yellow leaf spot fungus into our pathogen containment facility and over time obtain a clean colony that can be released.

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