INTERNATIONAL BIOHERBICIDE GROUP

IBG NEWS

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MEETINGS

(Joe Neal joe_neal@ncsu.edu)

IXth International Bioherbicide Group Workshop
8 & 9 February 2009

The 2009 IBG Workshop is scheduled for 8 February 2009 in Orlando, Florida, USA, in conjunction with the Weed Science Society of America's (WSSA) annual meeting. More details will be available in early 2008.

Tentative Agenda:

Sunday 8 February --	IBG workshop: volunteer and invited presentations
Monday 9 February --	Field trip to weed biocontrol project sites
Tuesday 10 February --	WSSA meeting begins
	A WSSA symposium on biological control of weeds with plant pathogens has been proposed

The WSSA meeting will continue through Thursday, 12 February with poster and oral sessions on weed ecology, physiology, management, education, and another 1/2 day session on biocontrol.

Venue:
The venue for the workshop and WSSA meeting is the Hilton Hotel, Walt Disney World Resort. http://www1.hilton.com/en_US/hi/hotel/ORLDWHH-Hilton-located-in-the-WALT-DISNEY-WORLD-Resort-Florida/index.do The hotel is, of course, in the Walt Disney World Resort, so you may want to bring the family and schedule some extra time. If the resorts are "not your thing", central Florida offers many other interesting attractions. Here is a link that provides information about the region: http://www.orlandoinfo.com. The weather in central Florida in February is generally sunny and pleasant with average high temperatures of 23° C.

To aid the organizing committee in planning, if you believe you will be attending please send an email to Joe Neal (joe_neal@ncsu.edu). This is just to get an idea of the potential attendance numbers for logistics and planning. A call for papers and formal invitation will be sent in early 2008.

So, mark your calendars and start planning to attend!

PEOPLE & PLACES

During April and June, 2007, **Alan Watson** and family were the guests of Dr **Sheng Qiang** and the Nanjing Agricultural University in Nanjing, China as part of a collaborative project on biological control and bioherbicide development. Prof. Qiang and his staff organized an International Workshop on Weed Science and Agricultural Production Safety at which both Alan Watson and Gary Peng (Agriculture & Agri-Food, Saskatoon, SK, Canada) presented invited papers on bioherbicide research. Alan and family are looking forward to return to Nanjing in 2008 and continue our collaborative efforts.

(Alan Watson - alan.watson@mcgill.ca)

Prof. **Yang Qian** (Harbin Institute of Technology, P. R. China) visited the All-Russian Institute of Plant Protection (Pushkin, Saint-Petersburg, Russia) to find opportunities to collaborate in biotechnological aspects of the development of products against pests organisms including weeds. The memorandum of agreement was established for preparing a collaborative project.

Dr. Oleg Yuzikhin and Prof. Yang Qian in
Ekaterininskiy park in Pushkin,
a suburb of St. Petersburg

Dr. **Yuriy Chikin** (Tomsk State University, Russia) obtained short-term fellowship to study techniques of isolation of bioactive herbicidal metabolites and evaluation of potential biocontrol agents at our lab.

Two PhD students, **Sofia Sokornova** and **Svetlana Kustova** (supervisor: Dr. Berestetskiy) will defend their theses soon. I hope they will prepare abstracts of their theses for next issue of IBG News Letter. Sofia studies possibility for production and formulation of mycelium of *Stagonospora cirsii*, a potential bioherbicide for control of *C. arvense*. Svetlana's work devoted to variability in *Stagonospora cirsii* and *Septoria cirsii* as a basis for selection of highly aggressive strains. In summer 2007 three undergraduate students complete their research on enhancement of *S. cirsii* against *C. arvense* through selection of cold-tolerant strains of *Stagonospora cirsii* and evaluation of *Alternaria* spp. against *S. arvensis*. Now

five new students are trying different formulations to achieve good stability and efficacy of the mentioned biocontrol agents.

(Alexander Berestetskiy - aberestetski@yahoo.com)

Students working in biological weed control projects

Ronny Groenteman, PhD student, Canterbury University
rgr51@student.canterbury.ac.nz

Testing the idea of "multi-targeting" in weed biological control using thistles in New Zealand as a case study

Mike Cripps, PhD student, Lincoln University
crippsm2@lincoln.ac.nz

Testing the idea that multi-trophic interactions can enhance weed biological control using the *Cirsium arvense* / *Puccinia punctiformis* / *Apion onopordi* system as a case study in New Zealand

(Graeme Bourdôt - graeme.bourdot@agresearch.co.nz)

Last month we have a great visitor from BBCA (Italy) Dr. **Massimo Cristofaro** who is working on weed biocontrol by insects. The results of his trip was I think fruitful. He did his first visit in the province of Khorasan (Mashhad and Shiravan) and also present an excellent presentation for our students and staff regarding weed biocontrol. He believes that Iran has good biodiversity for biocontrol agents. I hope we can have more collaborations and research projects about weed biological control.

My first MSc student, Mr. **Ehsanolah Zaidali** graduated last week. He worked on biological control of *Convolvulus arvensis* for his thesis (the abstract is attached). I have another MSc student who is working on *Orobanche* biocontrol and he prepared his first paper for Iranian weed Science conference to be held in Mashhad at 29-30 January 2008.

A PhD student, Mr. **G.A. Asadi**, who is working on biocontrol of *Cirsium arvensis* by insect, presented a poster in Montpelier during 21-27 April 2007 and a paper will be presented in the Iranian weed Science Conference to be held in Mashhad at 29-30 January 2008.

(Reza Ghorbani - reza.ghorbani@newcastle.ac.uk)

I would confirm what Reza said about my feeling regarding Iran. I returned back from my first trip in Iran with a great feeling regarding the biodiversity in that country. Moreover, as I mentioned to my co-operator Urs Schaffner (CABI Europe - Switzerland), who funded my first travel to Iran, I also found a wonderful hospitality and a great scientific structure at the Ferdowsi University of Mashhad. For these reasons, CABI and BBCA are setting a formal cooperation signing a Memorandum of Understanding in order to develop together with Dr. **Reza Ghorbani** and his team programs on biological control of weeds. Personally, I am anxious to return back to Iran again: I am planning my next trip during the spring of 2008 (end of April-beginning of May)

(Massimo Cristofaro - mcristofaro@casaccia.enea.it)

BIOHERBICIDE RESEARCH - STATUS REPORTS

Bioherbicide news from AgResearch, Lincoln, New Zealand

Graeme Bourdôt - graeme.bourdot@agresearch.co.nz

Biological control of giant buttercup (*Ranunculus acris*)

The naturally-occurring fungus, *Sclerotinia sclerotiorum*, sporadically kills giant buttercup plants in dairy pastures in New Zealand, and AgResearch scientists, students and commercial partners have, since 1992, been trying to find a way to commercialise this lethal plant pathogen a "mycoherbicide". Such a product, when broadcast onto a pasture, would enable many more giant buttercup plants to be killed by the disease than is possible from natural infections.

It would be safe to adjacent susceptible crop plants because the pathogen's wind-borne spores, formed the year after applying the mycoherbicide to a pasture, are trapped within the pasture. And it would not damage either the grasses or clovers in the pasture because neither are hosts to this pathogen.

Because this pathogen cannot infect its host without an energy source, much of the research effort has focussed on finding its best "food". To that end field trials on dairy farms in the Takaka valley (and in Taranaki) over the last seven years have proven that spent barley from the brewing industry is ideal. A product formulated in this way, and applied through a spreader, gave on average, 50% reduction in the cover of giant buttercup from a single application in spring time.

An analysis of historical experiments with MCPA and MCPB revealed that this level of control is similar to that achievable with MCPA and better than with MCPB. But, the cost of the spent barley and its sterilisation precluded commercialisation. Alternative cost-effective fermentation and formulation systems have been developed but the resultant liquid product performed poorly when sprayed under field conditions.

A new study by a post-doctoral researcher is now underway at Lincoln University to try and discover why such a lethal plant pathogen as *Sclerotinia sclerotiorum* does not always infect and kill its host. The scientists anticipate that by answering this question they will be able to successfully harness the weed-killing power of this pathogen in a mycoherbicide product for dairy farmers.

Biological control of gorse (*Ulex europeaus*)

Twenty four gorse (*Ulex europaeus* L.) bushes each about 1m tall in a grazed hill pasture in Canterbury, New Zealand, were cut to near ground level in May 2005 before applying three treatments to determine if the stumps could be artificially infected with the fungus *Chondrostereum purpureum* (Pers.) Pouzar. The stumps of eight of the plants were treated with the mycelium of the fungus on agar, a further eight were treated with

mycelium formulated as a slurry, and the remaining eight plants were left untreated. One year after treatment, fruiting bodies of the fungus (basidiocarps) were present in large numbers on 15 of the 16 treated stumps. Seventeen months after treatment (November 2006), half of the *C. purpureum*-treated stumps were dead, with an overall reduction in the volume of regenerating shoots of 64% as compared to the untreated bushes. These results confirm that *C. purpureum* has potential as a biological control agent for gorse.

Biological control of Californian thistle (*Cirsium arvense*)

A field experiment was conducted from October 1992 until March 1997 in a sheep-grazed pasture in Canterbury, New Zealand, to determine the effects of the fungus *Sclerotinia sclerotiorum* on the long-term dynamics of a population of *Cirsium arvense*. The pathogen was applied in mid spring either once or in 3 consecutive years when the *C. arvense* shoots were vegetative rosettes, using a granular, mycelium-on-wheat preparation that lodged on the *C. arvense* leaves, stems and in the leaf axils. The single application caused disease in the *C. arvense* that was confined to the application year. The disease resulted in a temporary (17-month) reduction in population size through initial mortalities among treated shoots and resultant reductions in root growth, adventitious root bud, subterranean shoot and subsequently, aerial shoot population sizes. The soil seed bank was 80% lower in the treated plots than in the control plots in the first year. Seedlings were never found. The annually repeated application of *S. sclerotiorum* did not result in the expected continuing decline in the *C. arvense* population relative to the control population.

This granular formulation of *Sclerotinia* and subsequent refinements of it have proven to be too costly to manufacture to be commercially successful. A gel formulation has been developed using a liquid (rather than solid) state fermentation. However, while effective against *Cirsium arvense* (see photo) and several other weed species under controlled conditions, these have not been efficacious under field conditions.

We have recently discovered a new fungal pathogen on *C. arvense* in New Zealand pastures. It sporulates readily in liquid culture, and the spores, when applied to healthy tissues of young plants, infect and kill the plants within a few weeks. We are looking further into the mycoherbicide potential of this exciting new pathogen on this thistle.

All-Russian Institute of Plant Protection (Pushkin, Saint-Petersburg, Russia)

Alexander Berestetskiy - aberestetski@yahoo.com

After completion of EU project "Enhancement and Exploitation of Soil Biocontrol Agents for Bio-Constraint Management in Crops" (www.2e-bcas.org) in 2006, research work on development bioherbicides against perennial weeds is continuing at our institute. Particularly, it is due to funding by International Science and Technology Center (ISTC, project # 2939) and the grant of President of Russian Federation to Alexander Berestetskiy.

Main target weeds are remaining *Cirsium arvense* and *Sonchus arvensis*. We are looking for new candidates for biological control of this weeds. Some of them looks prospective, for instance:

Stagonospora cirsii for both weeds, and several respective large-spore *Alternaria* spp. Moreover, we found these fungi to produce highly active phytotoxic metabolites. Some of them had been characterized (see below the list of recent publications).

We are looking for collaboration in frames of international projects (e.g. FP 7) focused on biocontrol of weeds using plant pathogens and their metabolites. Preferable targets are *Cirsium arvense, Sonchus arvensis, Convolvulus arvensis, Elytrigia repens, Ambrosia* spp., *Galium aparine, Heracleum mantegazzianum* and *H. sosnowskyi*. These weeds are very important in Russian Federation. Also we would be glad to receive fungal strains for the evaluation of their biocontrol potential against these weeds and production of bioactive metabolites.

Sarritor

Alan Watson - alan.watson@mcgill.ca

Sarritor Inc. is planning a limited launch of its bioherbicide in the spring of 2008. The new product is based on the *Sclerotinia minor* technology developed by Dr. Alan Watson at McGill University and will eliminate dandelions without harming the surrounding grass. In April 2007, the Pest Management Regulatory Agency (PMRA) of Health Canada notified Sarritor Inc. that they approved the product for sale at the professional and retail levels in Canada. The product is a dry granular (1.4 – 2.0 mm in diameter) that can be broadcast or spot applied to the weeds. The product was tested in extensive field trials in Toronto and Halifax during 2007. The results showed that the product is very effective at controlling broadleaf weeds. Sarritor Inc. is a McGill University spin-off biotechnology company based in Montreal, Canada. Visit www.sarritor.ca or contact Alan Watson.

Hydrilla

Christopher Dunlap - Christopher.Dunlap@ARS.USDA.GOV

I would like to let others know about a large biocontrol demonstration project I am working on to control Hydrilla using *Mycoleptidscus terrestris*. My role in the project is to develop new formulations of the fungus to improve stability and efficacy. I work closely with Dr Mark Jackson (USDA), Dr Judy Shearer (US Army Corps of Engineers) and Dr Mark Heilman (Sepro Inc) on the project. A summary of the biocontrol project and it's objectives can be seen at http://plants.ifas.ufl.edu/osceola/element3.html . The project is a good example of bringing federal, state and local resources combined with academic, government and commercial scientists together to identify solutions to difficult problems. The site of the demonstration project is conveniently located near Orlando, FL, site of the next IBG meeting.

Berlin foresters make use of Dutch invention: Control of *Prunus serotina* in forests with the fungus *Chondrostereum purpureum*

Meindert de Jong, Piet Scheepens & Barend de Voogd - Meindert.dejong@wur.nl

Prunus serotina is a native of North America, but has become a nuisance in Europe, where it is often present as a monoculture, in the under story of coniferous forests. Lack of species diversity and

problems with re-forestation are the main reasons to control it on certain locations. Trees and shrubs are cut. Control is only effective if cuttings are treated with the herbicide glyphosate, but the use of herbicides is prohibited in many forests.

For several years, *Chondrostereum purpureum* for control of *Prunus serotina* appeared to become the first European microbial herbicide. We demonstrated that it could be as effective as glyphosate under a range of environmental conditions, if we applied mycelium to fresh wood cuttings of the weed in Dutch forests. It was taken into production by a private company. The company decided that the costs would be too high to justify registration as a microbial pesticide in The Netherlands. Instead, mycelium of the fungus was sold as a "wood rot promoter", without registration. However, the Dutch Authority did not accept this interpretation. After an end user got a ticket for using an unregistered pesticide, the "wood rot promoter" was no longer sold in The Netherlands. During the period it was sold, a few failures were reported, probably because of inappropriate weather conditions shortly after application.

In Germany, *Chondrostereum purpureum*, as a control of *Prunus serotina*, has been put on an exception list. This means that the end-user may apply it without registration, but he is not allowed to buy it from a commercial party. Berlin forestry has much interest in using the fungus, and, in the person of Malte Münte, came to us for advice how to use it. Together we decided that, despite ample evidence of the fungus' efficacy, we would start once again some smallscale experiments to demonstrate its effect in the forest. In these experiments we used a strain from Switzerland. We also looked at the effect of adding vegetable oil on adverse environmental conditions.

Information and pictures can be found at:
http://www.bfs.wur.nl/UK/Documents/Fermentation+unit+to+produce+mycoherbicides/

Pacific Forestry Centre,Victoria,Canada

Raj Prasad - RPrasad@pfc.cfs.nrcan.gc.ca

Dr Raj Prasad even though retired recently, continues to work as an emeritus scientist at the Pacific Forestry Centre, Victoria, Canada and is trying to complete several unfinished manuscripts and publish them. One aspect of the research pertains to ecology, biology and management of alien- invasive weeds (*Cytisus scoparius*, *Daphne laureola*, *Hedera helix* and *Ulex europaeus*) in coastal forestry of BC. He has discovered bioherbicides (Phomopsis sp nov) which show very good potential/ promise for control of the Daphne spurge.

Cytisus scoparius

Daphne laureola

Hedera helix

Ulex europaeus

MSc thesis

Reza Ghorbani - reza.ghorbani@newcastle.ac.uk

Biocontrol of Field bindweed (*Convolvulus arvensis*) with plant antagonist pathogens

E. Zaidali, R. Ghorbani, A. Koocheki, N. Azadbakht and V. Jahanbakhsh

Abstract
Field bindweed is an important perinial weed of agricultural crops word-wide. In order to find sufficient biocontrol agent that can control field bindweed in crops without damage them, a study was carried in Faculty of Agriculture, Ferdowsi University of Mashhad and Center of Agriculture and Natural Resource Research of Lorestan during 2006-2007. The experiment was designed based on a Completely Randomized Design by factorial arrangement with four replications. Infected field bindweeds were collected from two regions of Khorramabad and Mashhad. After culturing and isolating of exiting fungi from infected tissues of field bindweed, *Fusarium* sp. and *Alternaria alternata* were recognized with good effect. One droplet of fungi suspension of 10^7 spores per ml was put on field bindweed leaf in laboratory. Field bindweed plants at different growth stages (cotyledon, 4-leaf, 6-leaf, 9-11-leaf stages) were sprayed with a suspension of 10^7 spores/ml of fungi in the greenhouse. *Alternaria alternata*, isolate of A2, isolated from infected field bindweed of wheat farm in Mashhad showed promising infection level without any damage in Wheat, Tomato, Maize, Sugar beet and Kidney bean crops. In addition, 4-leaf stage plants had more susceptibility to this pathogen. Another expriment was performed in Agricultural and Natural Research Center of Lorestan in a Completely Randomaize Design by factorial arrangements to study different spore consentration (10^4,10^5,10^6 and 10^7 spores in ml) and dew periods (6, 12, 24 and 48 hours) on disease development at 4-leaf growth stage of field bindweed. A. alternata caused minimum dry weight at consentration of 10^7 spore per ml disttiled water and 24 and 48 hour dew periods.
Key Words: Biological control, Bioherbicide, Phenology, Spore concentration, Saturation humidity.

Registered Bioherbicides

Jacques Drolet - jacques_drolet@hc-sc.gc.ca - www.pmra-arla.gc.ca

In Canada the registered actives are:

COLLETOTRICHUM GLOEOSPORIOIDES F.SP. MALVAE

CHONDROSTEREUM PURPUREUM (STRAIN: HQ1):
CHONDROSTEREUM PURPUREUM (STRAIN: NORTH AMERICAN; PATHOVAR: PFC2139)

SCLEROTINIA MINOR IMI 3144141

CLASSICAL BIOLOGICAL CONTROL OF WEEDS WITH PATHOGENS

Status Report on Research Using Pathogens for Biocontrol of Weeds at Landcare Research New Zealand

Jane Barton - jane.barton@ihug.co.nz

Alligator Weed/*Nymbia* sp. and *Sclerotinia sclerotiorum*
There is an Australian initiative, through Ross Gilbert (undertaking a PhD), to develop the leaf pathogen *Nymbia alternantherae* as a mycoherbicide against Alligator weed (*Alternanthera philoxeroides* (Hayes, 2003)). This fungus already occurs in New Zealand (NZ) and is the most common leaf pathogen associated with the weed in its terrestrial habit. The strains Landcare Research have isolated to-date are only moderately pathogenic; they caused superficial leaf damage but not plant death (Nick Waipara, Landcare Research pers. comm.). More virulent isolates would be needed, and there are no immediate plans to search for these.

Sclerotinia sclerotiorum was also trialled against this weed, with highly variable results. Although leaf infections and necrosis were observed with a formulation developed by AgResearch, damage was not considered high enough to warrant further testing (Waipara et al., 2006). There was some evidence of synergy between *Sclerotinia* and *Nymbia*, but this needs further investigation.

Banana Passionfruit/*Septoria* sp.
In Hawaii, a fungus known as *Septoria passiflorae* has been very successful as a classical biocontrol agent against weedy *Passiflora* species. In NZ we hoped to replicate this success but have come up against two obstacles. Firstly, there is more than one *Septoria* species found on *Passiflora* hosts world-wide, including one that already occurs in NZ. Initial morphological and genetic studies undertaken by Helen Harman (Landcare Research) suggest that the *Septoria* released in Hawaii is not the same as the one in NZ (*Septoria passifloricola*) but we suspect the Hawaiian taxon has been mis-named (Barton, 2005). Secondly, host range tests undertaken in Hawaii by Nick Waipara found it had a wider host range than originally thought, and that it might therefore threaten *Passiflora* species that are grown commercially in NZ (Waipara et al., in press). Consequently, this fungus is no longer being considered for biocontrol of weedy *Passiflora* spp. in NZ

Barberry/Bioherbicide and Pathogen surveys

There are two species of barberry that are being considered as biocontrol targets in NZ: barberry (*Berberis glaucocarpa*) and Darwin's barberry (*Berberis darwinii*). Bua Charuchinda is currently undertaking a Masters project with Nick Waipara to investigate novel formulations of *Colletotrichum acutatum* and *C. gloeosporioides* using isolates found causing disease on the leaves, flowers and fruit in a NZ survey of barberry (Waipara et al., 2007). Natural outbreaks disease caused by *Colletotrichum* species are observed on the weed in the field. Bua's project is to improve the virulence of these isolates through formulation. She is also screening *Colletotrichum* and *Phoma* isolates for their efficacy against old man's beard and tradescantia (Waipara et al., 2007).

In addition, surveys looking for pathogens with potential as classical biocontrol agents for Darwin's barberry are underway now in Chile. A leaf rust has found to be common at some sites, with damage ranging from minor to severe (causing premature defoliation). A common shoot dieback has also been observed and attempts are underway to isolate the causal organism (Nick Waipara, pers. comm.).

Boneseed/Rust

Researchers in Australia (mainly Louise Morin of the CSIRO) and South Africa (mainly Alan Wood of Plant Protection Research Institute) have been working for some time on a rust (*Endophyllum osteospermi*) with potential for classical biocontrol of boneseed (*Chrysanthemoides monilifera* ssp. *monilifera*) (Wood et al., 2004). Landcare Research would like plant species of significance to NZ to be included in host range testing of this rust, but that is easier said than done. Alan Wood has completed some host range testing for the Australians and has shown that spores of the rust are able to penetrate the host tissues of some non-target species. Microscopic examination of the tissues has so far failed to reveal whether or not this penetration is likely to lead on to disease development. It looks as though full tests may have to be conducted on at least some non-target species, and the problem with that is that we can expect to have to wait two years for symptom development (Sarah Dodd, Landcare Research, pers. comm.).

Bridal Creeper/Rust

NZ has been very lucky with this weed/pathogen combination: bridal creeper rust (*Puccinia myrsiphylli*) was imported from South Africa to Australia for classical biocontrol several years ago, and it seems to have been blown across to NZ. It was found on our bridal creeper (*Asparagus asparagoides*) in November 2005 (Barton and Harman, 2006). Preliminary genetic work done by Helen Harman has confirmed that the strain of the rust found in NZ is almost certainly the same as that released in Australia. The rust is spreading naturally and is already widespread. As infections begin on new season's growth, it is causing considerable damage to weed populations in NZ (Nick Waipara, pers. comm.)

Californian Thistle/Bioherbicide and Rust

Phoma exigua var. *exigua* has been observed killing young Californian thistle plants in pasture in NZ. However disease levels are variable and the fungus causes little damage to mature plants even when they are wounded. Preliminary trials applying spores of the pathogen as a bioherbicide showed it was too slow to kill older plants (Waipara and Hayes, 2004). Recently, trials were undertaken using the fungus in combination with glyphosate (low dose herbicide applications). The herbicide was found to significantly improve infection and leaf necroses (Nick Waipara, pers. comm.). An aggressive host specific form of *Phoma exigua* has also been found on giant buttercup (*Ranunculus acris*), another pasture weed, and it is possible this could be used in combination with a bioherbicide based on *Sclerotinia sclerotiorum* that is being developed by Graeme Bourdôt (AgResearch, see 'Bioherbicide news from AgResearch' in this volume of IBG news). More effort in formulation and/or sourcing more virulent strains of *Phoma exigua* would be needed before a commercially viable bioherbicide for either weed could be developed (Nick Waipara, pers. comm.).

There is also a PhD project underway (undertaken by Mike Cripps through Lincoln University) to look at interactions between the rust *Puccinia punctiformis* and two insects with biocontrol potential against Californian thistle. The self-introduced rust is already quite common in NZ, and can be damaging on its own, but it is hoped the insects might act as vectors and help initiate epidemics (Nick Waipara, pers. comm.).

Climbing Asparagus/Pathogen surveys

Surveys are underway in South Africa to locate pathogens with potential as classical biocontrol agents for climbing asparagus (*Asparagus scandens*).

Nassella tussock and Chilean Needle Grass/Rusts

In 1999 Australians initiated a biological control project to investigate pathogens for control of *Nassella trichotoma* (serrated or nassella tussock) and *N. neesiana* (Chilean needle grass) in their home range in Argentina. This is a truly international project: most of the funding has been sourced by David McLaren of the Keith Turnbull Institute in Australia; Freda Anderson (CERZOS, Bahía Blanca) is doing the leg-work in Argentina; and Landcare Research is supplying a little of my time each year to assist Freda. The project has been beset with difficulties. While three fungi (*Puccinia nassellae*, *Ustilago* sp., and an unidentified soil fungus in the Corticaeae family) looked promising initially for *N. trichotoma*, all of them proved very difficult to work with in the laboratory/glasshouse (Barton, 2005). Consequently, the project is now focused on Chilean needle grass, and several rusts that cause considerable damage to it in the field. The most promising of these is *Uromyces pencanus*, which is currently undergoing host range testing against many grasses from Australia and NZ (Anderson et al., in press). It has not yet been possible to obtain permission to import all of the grasses on the test list into Argentina, so this project continues to prove challenging.

Gorse/Pathogen surveys

A search is underway in Europe for pathogens that might be useful for classical biocontrol of gorse (*Ulex europaeus*) in Australia and/or NZ. The work is being undertaken by Mireille Jourdan of the CSIRO European laboratory. To date the search has not revealed any obligate parasites (e.g. rusts) that cause enough damage in the field to appear useful. Isolates of facultative parasites that were collected need to be identified and tested for their pathogenicity against gorse (Hugh Gourlay, Landcare Research, pers. comm.).

Japanese Honeysuckle/Pathogen surveys

A survey for pathogens of Japanese honeysuckle (*Lonicera japonica*) is underway in Japan in collaboration with a group at the National Institute for Agro-Environmental Sciences (NIAES, Japan). An initial exploration, which included Landcare Research staff (Quentin Paynter and Sarah Dodd), found few disease symptoms, but it is hoped that surveys planned for a more favourable time of year will be more profitable (Sarah Dodd, pers. comm.).

Lantana/Rusts

The rust *Prospodium tuberculatum* was released against *Lantana camara* in Australia in 2001. A mini survey was recently conducted in NZ to see if it had blown over to us aka the Bridal creeper rust (see above). Unfortunately, it was not found. No further host range testing would be required to get permission to import this fungus into NZ, and pathogenicity trials conducted in Queensland showed that it can infect at least two of the lantana forms present here (Sarah Dodd, pers. comm.). However, the process to get permission to release the fungus would be costly ($60,000 - $90,000), and no funding for that is presently available.

A second agent *Puccinia lantanae* has also been identified and is being host tested for release in Australia. If results of Australian host testing are promising, this may give NZ a second pathogen as an option if needed (Sarah Dodd pers. comm.).

Moth plant/Virus-based bioherbicide and Pathogen surveys

Moth plant is yet another plant from South America that is being targeted by biocontrol in NZ. Initially it was hoped that a virus that was found infecting the plant in NZ might be useful (Hayes and Waipara, 2005), but it has so far proved impossible to transmit it between plants in the glasshouse (Nick Waipara pers. comm.). Pathogen surveys are being conducted in Argentina by Rolf Delhy and his team from the National University of Bahía Blanca. Simultaneously, Carlos Villamil looked at the botany of the *Araujia* species that occur in Argentina and compared them with the taxon we have in NZ and concluded that the latter had been misnamed: We had been calling it *Araujia sericifera* when it more closely resembles *A. hortorum* (Waipara and Hayes, 2006). Surveys for insect agents are also underway. The most promising pathogens so far are a rust (*Puccinia araujia*) a *Pseudocercospora* species and an *Ascochyta* species (Rolf and Mierte Delhy pers. comm.).

Old Man's Beard/*Phoma clematidina*

In the 1990's a new strain of *Phoma clematidina* was released in NZ for biocontrol of old man's beard (*Clematis vitalba*). The pathogen was released and distributed as a solution of spores in water which was applied to the weed like a bioherbicide. Recently its efficacy was investigated because disease levels appeared low and variable in the field. Occasional outbreaks of the disease had been observed, but only after augmentation in the first few years after release. Results revealed that the *Phoma* did not always cause disease on the target weed; sometimes it was present in the leaves as an asymptotic endophyte (Paynter et al., 2006). Further, there is more than one strain of *P. clematidina* present in NZ and genetic work suggests the 'new' deliberately released strain may no longer be present (Lynley Hayes, Landcare Research pers. comm.). It is hypothesised that other pathogens, leaf saprophytes and endophytes are restricting the ability of the *Phoma* to harm the weed (Nick Waipara pers. comm.).

Tradescantia/ Bacterium and *Sclerotinia*

Pathogen surveys on *Tradescantia fluminensis* in its home range in Brazil revealed a serious shoot rot caused by the bacterium *Burkholderia andropogonis*. Unfortunately, preliminary host range testing showed the bacterium was not suitable as a biocontrol agent due to its broad host range (Nick Waipara, pers. comm.). Isolates of the same bacterium were found on hosts other than *T. fluminensis* in NZ, but inoculations determined they were not pathogenic towards the weed (Nick Waipara pers. comm.).

The pathogen *Sclerotinia sclerotiorum* was isolated on tradescantia in NZ and when applied as a bioherbicide in a formulation developed by AgResearch this pathogen caused systemic necroses of shoots (Waipara et al., 2006). If a bioherbicide based on *S. sclerotiorum* could be developed it could be used against several weeds in NZ. The product would be expensive, and the pathogen has a broad host range, but there are situations where those problems are not insurmountable e.g. urban gardens and dairy farms.

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ABSTRACTS

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Integrated control of *Eichhornia crassipes* by using insects and plant pathogens in Mexico

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Abstract

Eichhornia crassipes management by using insects and plant pathogens was carried out in a small reservoir in Mexico. The total reservoir area was 7 ha and the area covered with water hyacinth was around 3 ha. A total of 9800 insects of *Neochetina eichhorniae* and *Neochetina bruchi* were released in the reservoir. One month after insect establishment, two aspersions of *Cercospora piaropi* and *Acremonium zonatum* (fungal plant pathogens) were applied. After 2 months of the described combined biocontrol application, a fresh weight reduction of 29% was observed, as well as a diminution of 59% in the number of plants per square meter. Additional observed results were a 65% reduction in the number of green leaves per plant and 85% reduction in the number of new ramets. In a period of time of 3 months the reservoir was completely free of *E. crassipes*. It is believed that some other conditions contributed to *E. crassipes* control such as the phenological stage of plants and weather conditions.

Keywords: Biological control; *Eichhornia crassipes*; *Neochetina*; *Cercospora piaropi*; *Acremonium zonatum*

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Effect of plant age, temperature and humidity on virulence of *Ascochyta caulina* on common lambsquarters (*Chenopodium album*)

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Common lambsquarters is an important annual weed of many crops world-wide. *Ascochyta caulina* is a plant pathogenic fungus that, under natural conditions, causes necrotic spots on the leaves and stems of *Chenopodium* species. The objective of this study was to evaluate the effect of weed growth stage, relative humidity, dew period, and temperature on the infection of *A. caulina* isolates against common lambsquarters. In greenhouse experiments, replicated groups of common lambsquarters plants were sprayed with different isolates of *A. caulina* 2, 3, 4, 5, and 6 wk after emergence. Both disease severity and pathogen-induced dry weight reduction decreased with plant age. The efficacy of all isolates tested was reduced by high leaf-to-air vapor-pressure deficit. Disease severity was more responsive to relative humidity than temperature. However, a minimum dew period of 6 h was required to cause significant disease severity in common lambsquarters. Among all tested *A. caulina* isolates, W90–1 gave the highest disease scores under all conditions, with the exception of temperatures ≤15 C.

Nomenclature: *Ascochyta caulina* (P. Karst) v.d. Aa & v Kest.; common lambsquarters, *Chenopodium album* L. CHEAL.

Key words: Biological control, bioherbicide, dew period, spore inocula, vapor pressure.

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ORIGINAL PAPER

'Microbigation': delivery of biological control agents through drip irrigation systems

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Abstract The uniform and precise application of microbial particles close to the target organism and to the plant to be protected can increase the success of a biological control treatment. The use of systems or technologies which are usually available in agriculture could influence the acceptability of biocontrol agents by farmers, and enlarge the market. A pilot system was realized using dripper lines, drippers, filters and other tools commonly used in irrigation and precision agriculture in the greenhouse to evaluate their suitability for applying and distributing microbial biocontrol agents. Conidial suspensions of marketed or marketable agents were used, i.e. *Fusarium oxysporum*, *F. solani*, *Trichoderma harzianum* and *Paecilomyces lilacinus*. The experiments carried out demonstrated that conidial suspensions (10^6 conidia ml^{-1}) can pass through the drippers without causing clogging, regardless of their size, and remained viable. The term 'microbigation' is here proposed for this kind of microbial application technique.

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EDITOR'S CORNER

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Many thanks to the following colleagues who have sent information and pictures that made possible to prepare this issue of the IBG newsletter, after a long time.

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Please remind that this bulletin is prepared on a voluntary basis and it contains only the information sent by the newsletter subscribers, under their responsibility, so it is not an official journal and cannot be considered exhaustive. Please also remind that the mailing list can be used as a moderated list for distributing information related to weed biocontrol at any time during the year.

I wish you Merry Christmas and Happy New Year

Maurizio