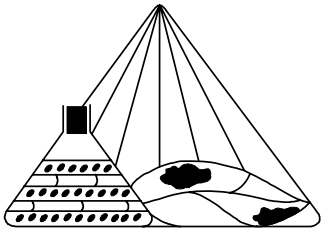
INTERNATIONAL BIOHERBICIDE GROUP

IBG NEWS



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THE CHAIRMAN'S COMMENTS

It is very pleasing to note in this issue of the Newsletter how much cooperation is going on in bioherbicide and related research on biocontrol of weeds with fungi. We have examples of cooperation between The Netherlands and Canada,The Netherlands and New Zealand, Hawai'i and New Zealand, South Africa and Australia, Australia and Brazil and the COST project in Europe. In a project based at my lab we are cooperating with scientists in Vietnam on bioherbicides for grass weeds (see in 'People & Places'). Alan Watson an Ivor Caunter visited our project in Australia and Vietnam as part of a review of the work. Out of this interaction has come wider cooperation between Malaysia, Alan's IRRI (Philippines) based project and our Vietnamese colleagues to work on promising pathogens for *Echinochloa* together. Cooperation is stimulating and I believe, vital for the future of biocontrol.

Best wishes for the New Year

Bruce Auld

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****** DEADLINE FOR SUBMITTING ITEMS FOR THE NEXT ISSUE IS 1 MAY 1998 ******

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CONTACT ADDRESSES

CHAIRMAN
Dr Bruce A. Auld, Orange Agricultural Institute, Forest Road,
Orange, NSW 2800, AUSTRALIA
Phone: +61 2 6391 3826 Fax: +61 2 6391 3899 E-mail: auldb@agric.nsw.gov.au

VICE CHAIRMAN
Dr Alan K. Watson, Department of Plant Science, Macdonald Campus, 21 111 Lakeshore Road,
Ste. Anne-de-Bellevue, Québec, CANADA H9X 1C0
Phone: 1 514 398 7897 Fax: 1 514 398 7895 E-mail: watsona@agradm.lan.mcgill.ca
OR
PO Box 933, 1099 Manila, PHILIPPINES
Phone: +63 2 818 1926 Fax: +63 2 817 8470 E-mail: awatson@irri.cgnet.com

NEWSLETTER EDITOR
Dr Louise Morin, CRC for Weed Management Systems, CSIRO Entomology, GPO Box 1700,
Canberra, ACT 2601, AUSTRALIA
Phone: +61 2 6246 4355 Fax: +61 2 6246 4362 E-mail: louise.morin@ento.csiro.au

INTRODUCING THE ELECTRONIC VERSION OF IBG NEWS

IBG News is catching up with the electronic age of communication. Starting with this issue (December 1997) we will e-mail an electronic version of IBG News to everyone who has provided us with an e-mail address. The other recipients on our mailing list will receive a hardcopy of the newsletter. We unfortunately can't continue to meet the cost of posting hardcopies

to everyone on our long mailing list. The electronic version of IBG News will be e-mailed to recipients as an attached document to the message. It is formatted as simply as possible and save as a Word version 2.0 document (which can be opened in WordPerfect and earlier versions of Word). For those who will receive a hardcopy of the December issue of IBG News and have access to e-mail, we would greatly appreciate if you could forward your e-mail address to the Editor, Louise Morin (louise.morin@ento.csiro.au) in order to be included on our list of electronic addresses. Thank you for helping us saving postage cost!

WANTED: NEW EDITOR FOR IBG NEWS

The steering committee of the International Bioherbicide Group is looking for a new editor for its six-monthly newsletter to replace Dr Louise Morin who has been editor of IBG News since August 1993. Louise will complete her term as editor with the next June issue of IBG News. Please contact the current Chairman, Dr Bruce Auld (address above), if you are interested in taking over the editorship. It's a great opportunity to get the news first hand and to establish contacts.

IV INTERNATIONAL BIOHERBICIDE WORKSHOP - CALL FOR PAPERS

University of Strathclyde, Glasgow, Scotland, UK. 6-7 August 1998

Titles and abstracts of oral presentations or posters should be submitted by **27th March, 1998**. Any topic which addresses concerns, problems or solutions to the advancement of bioherbicides will be welcome. It is proposed that a main theme for presentations and discussions will be the interactions between chemical herbicides, bioherbicides and the weed and/or pathogen. Other papers are also welcome. Oral presentations will be 20 minutes, including 5 minutes for questions. Boards (approx $1.5m^2$) will be available for posters.

Abstracts should be printed on a separate A4 sheet, included with the registration form, and must be no longer than 200 words; headed with the title and author(s) name(es) and address(es). The abstract may be forwarded on an IBM compatible floppy disc (Word 6.0) or sent by e-mail, but hard copies should also be sent.

Registration form and additional information are included at the end of this newsletter. For more information contact Drs Mike Burge or Doreen Main , Department of Bioscience & Biotechnology, University of Strathclyde, The Todd Centre, Taylor Street, Glasgow G4 ONR, UK. Phone: +44 (0) 141 548 3626 (M. Burge), +44 (0) 141 548 3824 (D. Main), Fax: +44 (0) 141 553 4115, E-mail: m.n.burge@strath.ac.uk or d.main@strath.ac.uk

RECENT MEETINGS

First Regional Conference on Miconia Control, 26-29 August 1997, Tahiti, French Polynesia.

The government of French Polynesia in collaboration with ORSTOM of Tahiti sponsored the First Regional Conference on Miconia Control. *Miconia calvescens* (Melastomataceae) is a devastating weed in the French Polynesia (Tahiti, Moorea, Raiatea), and has become established in Australia, and Hawai'i. Dr Jean-Yves Meyer, Ecologist in Tahiti, coordinated the activities of the conference which included presentation of papers and posters on the native flora of French Polynesia, the invasion of alien plant species into the native forests of Tahiti and Raiatea, and the on-going control efforts in French Polynesia and Hawai'i. Eloise Killgore (Hawai'i Department of Agricultue, Honolulu) presented a paper titled, "Prospective Biological Control of *Miconia calvescens* DC in Hawai'i with a Non-indigenous Fungus *Colletotrichum gloeosporioides* (Pens.) Sacc. f.sp. *miconiae*." The participants also traversed the island of Tahiti for three days, awed by the solid stands of miconia. Words and photos simply cannot portray the seriousness of the problem. (Source: E. Killgore)

First International Conference on Parthenium Management, 6-8 October 1997, Dharwad, Karnataka, India.

The First International Conference on Parthenium Management was held at the University of Agricultural Sciences (UAS), at Dharwad in India from the 6-8 October 1997. An opening address was given by G.B Singh (Deputy Director, Indian Council of Agricultural Research, ICAR) which highlighted biological control as an environmentally benign, self-sustaining method for management of this increasingly important weed.

In the first technical session, the "global view of Parthenium" was discussed. Papers covered the general state of the weed and the research underway in both India and Australia, "Ecology, distribution, menace and management of parthenium (M. Mahadevappa, UAS) and "Parthenium weed in Australia" (S.W. Adkins *et al*, Co-operative Research Centre for Tropical Pest Management, Queensland). The health hazards of the weed were dramatically presented, "Dermatologic hazards of parthenium in human beings" (P.D. Kologi *et al*, Karnataka, India), and the present position of biological control in India summarised "Perspectives in biological control of Parthenium in India" (S.P. Singh, Project Directorate of Biological Control, Bangalore).

The next three sessions expanded on the areas of biological control, in the first "Management of parthenium using competitive plants", was discussed. In the second session, "Management of parthenium through Insects", a summary of the insect work in Australia was given (K. Dhileepan and R.E. McFadyen, Queensland Department of Natural Resources). The importation of the *Zygogramma* beetle into India was ably defended in two papers: "Feasibility of biological control of *Parthenium hysterophorus* L. by *Zygogramma bicolorata* in the light of the controversy due to its feeding on sunflower" (K.P.Jayanth *et al*, Indian Institute of Horticultural Research, Bangalore) and "Feeding potential of freshly emerged *Zygogramma bicolorata* adults on sunflower and parthenium" (M. Swamiappan *et al*, Tamil Nadu Agricultural University, Coimbatore).

In the final of the three sessions "Management of parthenium through pathogens", two talks covered the use of classical agents for parthenium control: "The potential of neotropical fungal pathogens as classical biological control agents for management of *Parthenium hysterophorus* L." (H.C. Evans, International Institute of Biological Control, IIBC, Ascot) and "Safety testing of the rust *Puccinia melampodii* as a potential bio-contol agent of *Parthenium hysterophorus*" (M.K .Seier *et al*, IIBC). The final two talks of the session looked at native Indian pathogens as potential bioherbicides: "Evaluation of *Fusarium pallidoroseum* (Cooke) Sacc for the bio-control of *Parthenium hysterophorus* L." (L.P. Kauraw *et al*, National Research Centre for Weed Sciences, Jabalpur) and "Epidemiology and host range studies on powdery mildew (*Oidium parthenii* S&U) of *Parthenium hysterophorus* L." (given on behalf of K. Manickam *et al*, Tamil Nadu Agricultural University, Coimbatore); several poster presentations also examined the potential of bioherbicides.

A session on the "Utility values of parthenium", consisted of two papers highlighting potential benefits from the use of parthenium, but these could not detract from the overwhelming agreement for the need to control parthenium. The final technical session was presented by S. Dearden of the Parthenium Action Group Inc. (Rolleston) on "Extension strategies for weed management: Needs stakeholder participation" (S. Chamala *et al*, University of Queensland, Brisbane).

In the address to the plenary session, R.S Paroda (Director General, ICAR) summarised the economic importance of parthenium as an agricultural weed as well as its impact on human health. He stressed the use of biological measures to solve the problem of spread of the weed, the necessity for further research into the biology and ecology of parthenium and the need to educate people on its control. He also strongly endorsed the recommendations of the delegates: That a Parthenium International Network (PAIN) be established and a steering committee be elected; that a database of involved scientists be set up and a monograph of parthenium literature be published; and that an International workshop be held within three years and continued on a regular basis.

Dr V.C. Patil (UAS) is to be congratulated on his efficient organisation of the conference. Its undoubted success was due to the commitment of the UAS staff and the support of ICAR management in helping focus attention on the actual and potential threat posed by Parthenium weed to agriculture, biodiversity and human health and encouraging research on strategies for its management.

All principal papers are professionally reproduced in the conference proceedings (ed. M. Mahadevappa & V.C. Patil, UAS, 107pp.), and a second volume covering the posters and additional papers is promised shortly. (Source: J. Harvey)

UPCOMING MEETINGS

British Mycological Society International Symposium : The future of fungi in the control of pests, weeds and diseases
Southampton University, UK, 5 – 9 April 1998.

This meeting will provide an excellent opportunity for mycologists to discuss the relevance of fungi as biocontrol agents of pests, weeds and diseases. The meeting will provide a platform for the initiation of future research themes and outline strategies for the successful development of fungi as sustainable, environmentally benign crop protection agents. The main symposium will last four days - the first two days will be conducted in general session and be devoted to basic research topics, while the second two days will concern specific issues related to application and registration.

Outline of Programme

Sunday April 5: Registration / President's Reception

Monday April 6: Overviews of fungal biocontrol agents / Mechanisms of fungal pathogenesis / Offered paper session / Workshop I – fungal toxins

Tuesday April 7*:* Improving virulence and ecological fitness of fungal biocontrol agents / Distribution and survival of fungal biocontrol agents in the environment / Offered paper session / Poster session

Wednesday April 8*:* Production, formulation and application / Biocontrol fungi: progress, problems and potential / Conference Dinner

Thursday April 9*:* Risk assessment and registration (EU COST 816 sponsored session in collaboration with BMS) / Workshop II – registration of fungal biocontrol agents.

Invited speakers include:
Dr G. Riba (France), Dr J. Whipps (UK), Prof P.E. Kolattukudy (USA), Prof O. Yoder (USA), Prof I. Chet (Israel), Prof R. St. Leger (USA), Prof J Deacon (UK), Dr Y Couteaudier (France), Dr S. Wraight (USA), Dr N. Fokkema (Netherlands), Prof R. Lumsden (USA)

Those interested in offering papers and / or posters should inform Dr Chris Jackson by 31 December 1997. Completed registration forms should be returned by 31 January 1998. For further information please contact the local organiser : Dr Chris Jackson, School of Biological Sciences, University of Southampton, Bassett Crescent East, Southampton SO16 7PX, UK, Email: cwj@soton.ac.uk, http://www.ulst.ac.uk/faculty/science/bms

S-268 Meeting: Evaluation and Development of Plant Pathogens for Biological Control of Weeds
Ft. Detrick, Frederick, MD, USA, 28-29 April 1998.
Contact: Dr Bill Bruckart, USDA-ARS, Ft. Detrick Bldg 1301, Frederick, MD 21702, USA.
E-mail: bruckart@asrr.arsusda.gov

7th International Congress of Plant Pathology, Edinburgh, UK, 9-14 August 1998.
Contact: P.R. Scott, Division of Crop Protection and Genetics, CAB International, Wallingford, Oxon OX10 8DE, UK.
Fax: +44 1491 833508, E-mail: p.scott@cabi.org
An evening workshop is scheduled during the Congress on 'Beneficial uses of plant pathogens, biological control of weeds'. For more information contact the organizers Drs W. L. Bruckart (bruckart@asrr.arsusda.gov) and S. Shamoun. (sshamoun@pfc.forestry.ca)

6th International Mycological Congress, Jerusalem, Israel, 23-28 August 1998
Contact: Secretariat, Sixth International Mycological Congress, PO Box 50006, Tel Aviv 61500, Israel.

Joint Meeting of the American Phytopathological Society and the Entomological Society of America
Las Vegas, Nevada, USA, 8-12 November 1998
Contact: Joan Schimml, 3340 Pilot Knob Rd., St. Paul, Minnesota 55121-2097, USA. Fax: +1 612 454 0766,
E-mail: ZZZ6882@vz.cis.umn.edu. Web site: http://www.lasvegas24hours.com/

Annual Meeting of the Canadian Phytopathological Society
Fredericton, New Brunswick, Canada, 20-24 June 1998

14th International Plant Protection Congress, Jerusalem, Israel, 25-30 July 1999
Contact: Congress Secretariat, O.O. 50006, Tel Aviv 61500, Israel. Fax: +972 3 514 0077 or 517 5674,
E-mail: ippc@kenes.com Web site: http://www.kenes.co.il/IPPC

Joint Meeting of the American Phytopathological Society and the Canadian Phytopathological Society
Montréal, Québec, Canada, 6-12 August 1999. Web site: http://www.cum.qc.ca/octgm/

12th Biennial Conference of the Australasian Plant Pathology Society
Canberra, Australia, 27 September-1 October 1999
Contact: Dr Louise Morin (see address above).

TRAINING COURSE IN INSECT PATHOLOGY

Third Lincoln Training Course, AgResearch, Lincoln, New Zealand, 23-26 February 1998.

An intensive course on insect pathology and microbial control of insect pests will be presented at Lincoln on February 23-26, 1998. The course is designed for researchers with some background in microbiology and/or entomology who are seeking to widen their skills in this expanding science area. The course will be highly interactive and involve a number of top specialists working in the area.

The course is organized by the Microbial Control Group of AgResearch at Lincoln who have more than 16 years experience in microbial control of soil dwelling pests. The group developed 'Invade' for control of the grass grub *Costelytra zealandica*, the world's first microbial insecticide based on a bacterium from the Enterobacteriaceae. Course leaders include Drs Trevor Jackson, Travis Glare, Drion Boucias and Maureen O'Callaghan. The course is scheduled to follow the *Fourth International Lincoln Workshop on Microbial Control of soil Dwelling Pests* to be held at Lincoln on 17-19 February 1998.

For more information contact: Dr Trevor Jackson, AgResearch, P.O. Box 60, Lincoln, New Zealand. Phone: +64 3 325 6900, Fax: +64 3 325 2946, E-mail: jacksont@agresearch.cri.nz

RECENT BOOKS OF INTEREST

Aldrich, R.J. & Kremer, R.J. 1997. Principles in Weed Management. Iowa State University Press, Ames, IA. 472 pp. *Contains chapters on Biotic Agents in Weed Management, Allelopathy in Weed Management, and A Total Weed Management Program.*

Brown, J.F. & Ogle, H.J. (eds) 1997. Plant Pathogens and Plant Diseases. Rockvale Publications, Armidale, Australia. 556 pp.

Mills, D., Kunoh, H., Keen, N. & Mayama, S. (eds) 1996. Molecular Aspects of Pathogenicity and Resistance. APS Press, St. Paul, MN. 312 pp.

Schurtleff, M.C. & Averre, III, C.W. 1997. Glossary of Plant-Pathological Terms. APS Press, St. Paul, MN. 368 pp.

Vidhyasekaran, P. 1997. Fungal Pathogenesis in Plants and Crops - Molecular Biology and Host Defense Mechanisms. Marcel Dekker, Inc. New York. 568 pp.

Review papers

Special Programme Reviews Issue - COST 816. A coordinated European Research Programme: Biological Control of Weeds in Crops. 1997. *Integrated Pest Management Reviews* **2** (2).

PEOPLE & PLACES

Recent appointments

Dr Thouraya Souissi recently completed her postdoctoral appointment in Bob Kremer's program at the University of Missouri. She successfully completed characterizations of rhizobacteria and leafy spurge interactions and identified potential biocontrol strains. She will be joining the faculty of the National Institute of Agriculture of Tunisia in Tunis as an assistant professor of crop protection.

Dr Jane Fröhlich began employment as a plant pathologist with the applied entomology and pathology team of Landcare Research in Auckland, New Zealand. Jane is continuing Louise Morin's work on a potential mycoherbicide based on *Fusarium tumidum* for control of gorse and broom. She is also working on the classical biological control of *Hieracium pilosella* (mouse-ear hawkweed) and *Ageratina riparia* (mist flower) using a rust and a smut respectively.

Dr Neal Spencer has been appointed Research Leader of the USDA-ARS Rangeland Weeds Laboratory in Sidney, MT, USA, effective sometime in mid-July 1998, and Dr Chuck Quimby was recently appointed as Director of the USDA-ARS European Biocontrol Laboratory, Montpellier, France. Dr Quimby expects to arrive in Montpellier by late January/early February, after various formalities are completed. Among his new duties, he will be overseeing the construction of a new laboratory building (which will be located near the CSIRO Entomology European Laboratory at Baillarguet), the funding for which awaits the President's signature as of this writing.

Dr C.Y. Chen has joined the Weed Biocontrol Group of Agriculture and Agri-Food Canada in Saskatoon. Dr Chen is working on transformation of *Colletotrichum gloeosporioides* f.sp. *malva* and other fungi with Dr Karen Bailey.

Invited speakers

During the month of July, Dr Raj Prasad (Pacific Forestry Centre, Natural Resources Canada, Victoria, B.C.) was invited by the 21st Brazilian Weed Society (XXI Congresso Brasileiro Da Ciencia Das Plantas Danihas, 06 A 11 De Julho De 1997, Hotel Gloria, Caxambu, M.G.) to present a scientific talk on Biological Control of Forest Weeds and then to tour the newly afforested areas with several species of conifer and eucalyptus.

On August 9-13, 1997, Dr Simon Francis Shamoun (Pacific Forestry Centre, Natural Resources Canada, Victoria, B.C.) was an invited speaker by the Biological Control Committee at the American Phytopathological Society (APS) Meeting in Rochester, New York, where he presented a scientific paper on: *Chondrostereum purpureum* a wood rotter for control of forest vegetation. Also Dr Shamoun attended the Biological Control Committee meeting of the APS, where he will serve on this committee for 3 year term effective, August, 1997.

Dr Louise Morin was invited to present a one-hour seminar on 'Biological control of weeds using rust fungi' at a Rust Workshop on 29 September 1997 in Perth, Australia (which preceeded the 11th Biennial Conference of the Australasian Plant Pathology Society).

Visiting scientists

Dr Charudattan (University of Florida) was invited by the Weed Biocontrol Group at Saskatoon to visit the facilities at Agriculture and Agri-Food Canada from September 9 to 14, 1997. He presented the first seminar for the Research Centre's annual seminar series for 1997/98. The title was "Bioherbicides: The mirage vs. the reality" to a full-house. In the afternoon, there was a meeting of government, industry, and university researchers (approximately 40-50 people) who have interests in biological control. Drs. Charudattan and Boyetchko presented background information and led two discussion topics: i) Niche Markets vs. World Markets; and ii) Field Evaluation and Implementation: How do we overcome inconsistent field performance". The following day was spent visiting local industries involved in various aspects of biological control.

Drs Ivor Caunter (Universiti Sains Malaysia) and Alan Watson (McGill University & IRRI) recently visited Australia and Vietnam with Drs Shane Hetherington and Bruce Auld (Orange Agricultural Institute), and Paul Ferrar (Australian Center for International Agricultural Research - ACIAR). Drs Caunter and Watson were invited to review the ACIAR funded project on bioherbicides for grass weeds in rice (Vietnam) and wheat (Australia). In Vietnam cooperators include Drs N. V. Tuat (National Institute of Plant Protection, Hanoi), P.V. Kim (Cantho University) and D.V.Chin (Cuu Long Rice Research Institute). In both countries promising fungal isolates have been found for the major weeds. The review recommended that the project continue into a second three year phase to develop the fungi into bioherbicides.

GRADUATE STUDENTS

PLEASE send us your name and address with a short description of your project

Jianmei Li, University of Missouri, Columbia, Missouri USA.
Project (M.Sc.): Influence of agroecosystem on rhizobacteria associated with plants.
Description: Effects of cropping system on naturally-occurring deleterious rhizobacteria will be evaluated. Information will be collected to determine if rhizobacteria suppressive toward weed growth can be enhanced in activity and/or numbers by manipulating crop management. This is expected to lead to recommendation of management techniques to promote effective levels of deleterious rhizobacteria on weeds.
Supervisor: Dr R.J. Kremer

Studies completed

Gabriela S. Wyss, Swiss Federal Institute of Technology, Switzerland.
Project (Ph.D.): Quantitative resistance in the weed-pathosystem *Senecio vulgaris* L.-*Puccinia lagenophorae* Cooke
Description: Quantitative resistance of *Senecio vulgaris* to the rust fungus *Puccinia lagenophorae* was investigated in terms of underlying mechanisms and relevance for biological weed control following the system management approach. The infection process of *P. lagenophorae* on *S. vulgaris* was studied by light, fluorescence and scanning electron microscopy. The infection process was quantified using component analysis. The most sensitive phase of the infection process was the development of a penetration peg from an appressorium. Resistance was determined at this stage of the infection process. Three plant lines of *S. vulgaris* were tested for resistance to *P. lagenophorae* in an experiment using four *P. lagenophorae* lines. The results of the experiment, which was repeated twice, indicated that resistance was race non-specific. An aggressive strain of *P. lagenophorae* might control *S. vulgaris*. The use of an aggressive strain does, however, not eliminate differences in resistance between plant lines and, so, resistance to *P. lagenophorae* might increase in *S. vulgaris* populations due to biological weed control. (This study was carried out within the framework of the Cost action 816 "Biological control of weeds in crops")
Supervisor: Prof. Heinz Müller-Schärer, Prof. Martin S. Wolfe and Dr Jos Frantzen.

Mathew A. Campbell, University of New England, Armidale, Australia.
Project (Ph.D. 1996): The bioherbicide potential of the seed-borne pathogen *Pyrenophora semniperda* for control of annual grass weeds in cereal crops.
Description: Annual grass weeds are a major limitation to cereal production throughout the world and reproduce and spread only by the production of seed. One strategy for the control of annual grass weeds may be the inundative application of indigenous seed-borne pathogens as mycoherbicides to curb seed production and therefore re-infestation. A feasibility study was undertaken to investigate the potential of the seed-borne pathogen *Pyrenophora semeniperda* for bioherbicidal control of the grass weed *Bromus diandrus*. The requirements for optimal growth and sporulation were defined. Growth and sporulation were optimal at 23.2°C and 19.2°C respectively when grown on modified alphacel medium with a pH of between 4.7 and 5.7. *Pyrenophora semeniperda* required mycelial wounding and an alternating light/dark sequence for best sporulation with light wavelengths shorter than 500 nm. The variation in growth and sporulation of isolates of *P. semeniperda* was investigated after using single-spore and mass transfer isolation techniques and storage. Some variation occurred but was attributed to chance

and not genetic make-up. Conidia stored in aqueous suspension retained viability and pathogenicity for three months. *Pyrenophora semeniperda* was shown to produce toxic metabolites under *in vitro* conditions. Using a bioassay which used coleoptile and radicle length as an assay of toxicity, it was shown that filtrates of *P. semeniperda* cultures had a severe impact on seedling growth of both wheat and *B. diandrus*. Infiltration of leaves with culture filtrates resulted in symptoms similar to those produced by conidial inoculation. The infection process of *P. semeniperda* on seedling and adult leaves of wheat and *B. diandrus* and floral tissue of wheat was investigated. Appressoria were formed as an essential component of the infection process on leaf material but not on floral tissue. Resistance to infection was associated with the formation of papillae. Infection hyphae ramified intercellularly in spaces of the mesophyll in leaf material and within the confines of the epidermis and integuments of developing caryopses. The environmental and physical factors influencing infection of wheat leaves and florets and *B. diandrus* leaves tested were dew period temperature, dew period duration, light requirements during the dew period and physiological age of host. The optimum temperature for lesion development on wheat leaves was 20.6 ± 0.6°C. A dew period of 21 h and 48 h duration was required for maximal infection of wheat leaves and seeds respectively. An initial dark phase during the dew period was a requirement for infection of wheat and *B. diandrus* leaves. Infection of wheat seeds occurred at all stages of inflorescence development tested with a maximal proportion when inflorescences were inoculated at the end of anthesis (GS 70). The infection of field grown and inoculated grass species was investigated in three trials in Armidale, NSW and one in Orange, NSW. In one trial 73% of *B. diandrus* seeds were infected by the fungus. Several different inoculum types were trialed. Application of conidia resulted in the greatest level of infection and application of mycelium resulted in moderate levels of infection. *Pyrenophora semeniperda* was able to infect a variety of annual grass species under field conditions.
Supervisor: Dr Richard Medd (Orange Agricultural Institute) and Associate Professor John Brown (University of New England)

UPDATE ON THE COST ACTION 816 PROJECT

COST is the acronym for the French equivalent of 'European Co-operation in the Field of Scientific and Technical Research'. It is, principally, a framework for R & D co-operation, allowing for both the co-ordination of national research projects and/or the participation of third countries in Community programmes. Today, COST co-operation involves 25 member countries, including the fifteen EU Member States. COST Actions consist of basic and pre-competitive research as well as activities of public utility.

COST Action 816 is a co-ordinated European research programme on biological control of weeds in crops. It is the result of a Swiss proposal submitted to the COST Secretariat in Brussels in May 1992. The draft Memorandum of Understanding (MoU), which forms the legal basis of the Action was approved by the COST Committee of Senior Officials in June 1993. The MoU was signed in Brussels on 2 February 1994 by Belgium, Denmark, Germany, Hungary, Switzerland, The Netherlands and the United Kingdom, thus constituting the official start of COST 816. The Action was approved to extend over a five year period for the initial phase of the project. During the first two and a half years of the Action, 25 institutions from 13 countries (the above mentioned plus Croatia, France, Norway, Spain, Italy, Slovak Republic) and the Weizman Institute of Science, Rehovot, Israel (a non-COST country) have joined the Action.

Co-operation within the framework of COST has allowed establishment of well co-ordinated research procedures and efficient project management (through workshops, management- and working group-meetings). The concentration of activities to only a few target weed species has greatly stimulated co-operation and facilitated technology transfer between the research groups.

The following six objectives underlined the COST Action 816:

1) to bring together European Institutions interested in co-operative investigation of the potential of biological weed control in crops;

2) to promote a programme for scientific research and exchange: in order to concentrate efforts, only four weed complexes of major importance were designated for detailed study in the initial programme. These were selected according to their abundance and economic importance in European crop systems and their suitability for biological control. They are: 1) *Senecio vulgaris* (Asteraceae), 2) *Amaranthus* species (Amaranthaceae) (*A. retroflexus*, *A. hybridus*, *A. cruentus*, and *A. bouchonii*), 3) *Chenopodium album* (Chenopodiaceae) and 4) *Convolvulus arvensis* and *Calystegia sepium* (Convolvulaceae). These species also allow consideration of a wide spectrum of applications with regard to i) the biology and origin of the target weeds (annuals/perennials and native/introduced), ii) the target crop systems (annual/perennial), and iii) methods used in biological weed control.

3) to draw up a general protocol for biological weed control in Europe: with regard to research procedure, production and commercialisation of microbial herbicides, the importation of foreign control agents into Europe and their establishment in various European countries.

4) to integrate biological control into general weed management strategies: this involves the co-operation of scientists from private industry, universities and research stations working in areas such as plant population biology, genetics, physiology,

weed science, agronomy, plant pathology and entomology, as well as formulation and fermentation chemistry. In order to increase the stress on the target weed, special attention must be given to various interacting factors such as crop-weed resource competition via choice of crop variety, crop spatial arrangement, crop population density, irrigation placement and timing, and fertility sources and placement in order to elaborate crop- and site-specific solutions.

5) to establish a protocol to resolve potential conflicts of interest: assessment of the status of a particular plant species which may differ between government agencies, agricultural and recreational associations, and individuals. Increasingly in recent decades, such conflicts have entered the legal and political arena. Public responses need to be invited on proposed biological control programmes, in order to allow decisions which are in the common interest.

6) to establish a list of further agricultural weed species in Europe for biological control, such as parasitic *Orobanche* species or grasses like *Alopecurus myosuroides* and *Bromus sterilis*, with the aim of initiating new projects. Because of their great importance in Mediterranean countries and lack of effective control methods, a working group on *Orobanche* spp. is being formed in COST Action 816.

Further information on the Action, including details on recent and planned activities are available on Internet (http://www.unifr.ch/plantbio/cost816). (Source: H. Müller-Schärer & P. Scheepens)

BIOHERBICIDE RESEARCH - STATUS REPORTS

This is by no means a complete account of all research projects on bioherbicides.

Pacific Forestry Centre, Natural Resources Canada, Victoria, B.C., CANADA

Evaluation of some fungi for bioherbicidal potential against Scotch broom (*Cytisus scoparius*) under greenhouse conditions. Laboratory and greenhouse experiments were conducted using conidial/mycelial suspensions prepared from three fungi, *Fusarium tumidum* 222959, *Pleiochaeta setosa*, and *Chondrostereum purpureum*. These suspensions were used to spray the weed Scotch broom at three stages of growth; germination, three month, and six month. Along with spraying Scotch broom plants, the potency of these fungi were evaluated on two indigenous conifer species, Douglas-fir - *Pseudotsuga menziesii* and red cedar - *Thuja plicata*. Results demonstrated that *F. tumidum* has potential for forest weed control and no bioherbicidal effects were observed on the conifer seedlings. (Source: R. Prasad)

Plantwise, Lincoln, NEW ZEALAND

The biological control of nightshade weeds in processed pea crops. This project is proceeding into field experiments this season, targeting both black and hairy nightshade in processed peas. These weeds produce berries that, when immature, are very similar in size, shape and colour to peas and are thus very difficult to remove from the product in the process line in the factory. A mixture of the bacterial speck pathogen - *Pseudomonas syringae* 'pv. tomato' and an organo-silicone penetrant rapidly defoliates the fully expanded leaves on the inoculated nightshade. However, two applications appear to be required to produce the desired reduction in weed height, flowering and berry set.

The early blight fungus - *Alternaria solani* is also being evaluated for nightshade control, but although possibly more acceptable to organic growers than the above treatment, may not gain universal acceptance because of the possibility of spread or carry-over to tomato or potato crops. Field trials are in progress, and initial assessments of the inoculations indicate that the level of infection and weed defoliation in the field is comparable to that obtained previously in greenhouse experiments. (Source: I. Harvey)

Orange Agricultural Institute, Cooperative Research Centre for Weed Management Systems, NSW Agriculture, Orange, NSW, AUSTRALIA

Potential bioherbicide for wild oats in wheat cultivation: Research to develop a bioherbicide aimed at controlling annual grass weeds associated with wheat cultivation commenced at the beginning of 1995. Initially, emphasis was placed on surveys of fungal pathogens infecting the grass weeds wild oats and annual rye grass. These surveys were carried out during the wheat growing seasons of 1995-96 and 1996-97. They focussed on the NSW wheat belt but also incorporated wheat growing areas in Western Australia and Victoria. The surveys identified *Drechslera avenacea* as the most widespread non-obligate fungal pathogen having the greatest impact on wild oats in the field. Isolates of all fungi found during the survey were tested against wheat (cv. Rosella) and wild oats (*Avena fatua*). *Drechslera avenacea* did not infect wheat and was subject to an extended host range testing. Six cultivars of wheat, two cultivars of barley and four cultivars of cultivated oats were tested for susceptibility to 12 isolates of the fungus. Wheat and barley were highly resistant in all cases. Cultivated oats was more resistant than wild oats.

Two isolates were chosen for further experiments. The dew period requirements of the fungus were between 10 and 16 hours at 24°C. Maximum disease severity could be reached with an inoculum concentration of 2×10^5 conidia / ml. The above

ground dry weight of plants between 2 and 4 weeks post emergence was reduced following inoculation under optimal conditions. This was particularly the case for 3 week-old plants.

A number of experiments have investigated novel ways of increasing the severity of the disease. They aimed to determine whether *D. avenacea* in combination with low rates of herbicides could control wild oats. Cultures of the fungus grew and sporulated on media amended with the Group A (Dim) herbicides 'Grasp' and 'Achieve'. Both of these herbicides are capable of reducing plant growth at reduced application rates. Future research will examine the effects of these two in combination. Further, experiments have shown that the Group A (fop) herbicides selectively reduce wild oat growth and have a smaller effect on in-vitro growth of *D.avenacea* than other herbicides. Experiments will be conducted looking for ways of integrating these two as a means of weed control.

Drechslera avenacea can also be applied as a soil inoculum. Pilot experiments have shown that where the fungus has an adequate nutrient source in the soil, it is capable of causing a selective pre-emergence damping off. Future research will examine the practicality of combining *D. avenacea* with biosolids (applied to topsoil of wheat cultivation) and the effect of this on wild oat emergence. This project is funded by ACIAR (Australian Centre for International Agricultural Research) and has recently been reviewed with a view to extending the research another 3 years.

Formulation and delivery of bioherbicides: Dr Cheryl McRae rejoined the bioherbicide research team at Orange, NSW, in February 97. The focus of her research is to find ways of delivering fungal spores to the surface of weeds with sufficient water for the appropriate dew period to maximise disease development and hence maximise weed control. Emulsions, gels and film forming agents are being evaluated as a means of reducing evaporation or retaining water on the surface of weeds. The model system for the research is the fungus *Colletotrichum orbiculare* as the control agent of *Xanthium spinosum*. Other potential mycoherbicide agents under consideration are *Drechslera avenacea*, *Rynchosporium alismatis* and *Alternaria zinniae*. Cheryl is funded by the CRC for Weed Management Systems.

Potential projects: Many other potential projects are waiting and there is opportunity for post graduate training, although funds in Australia are severely limited so potential candidates should have already organised sufficient funding or sponsorship to cover bench fees and subsistence. Such projects include, for example: a survey of naturally occurring pathogens on wild radish (*Raphanus raphanistrum*) in Australia and their evaluation for biological control; the mass production of *Colletotrichum orbiculare*; optimising the efficacy of the fungal seed-borne pathogen, *Pyrenophora semeniperda*, for control of annual ryegrass (*Lolium rigidum*). Expressions of interest to Drs Dick Medd or Bruce Auld, Orange Agricultural Institute, Forest Road, Orange, NSW, Australia. Fax: 61 63 91 3899. E-mails: meddr@agric.nsw.gov.au; auldb@agric.nsw.gov.au.
(Source: C. McRae, S. Hetherington, B. Auld, R. Medd)

Manaaki Whenua - Landcare Research, Auckland, NEW ZEALAND

Work continues at Landcare Research on a project to develop the fungus *Fusarium tumidum* as a bioherbicide against gorse (*Ulex europaeus*) and broom (*Cytisus scoparius*) in New Zealand. Neither gorse nor broom is native to New Zealand, and the management of these weeds results in large costs to the country's plantation forest industry. Although *F. tumidum* occurs naturally on both gorse and broom plants throughout the country, severe disease development in the field is likely to be limited by environmental constraints, such as insufficient dew to support spore germination and infection of the host.

Efficacy, toxicity and selection of *F. tumidum* isolates. In common with many *Fusarium* species, *F. tumidum* produces mammalian toxins (trichothecenes) as secondary metabolites. The relationship between toxin production and pathogenicity was investigated for 29 isolates of *F. tumidum:* 14 isolates originally collected from gorse, and 15 from broom. Both pathogenicity and toxin production were found to vary greatly between isolates. As a result, two isolates originally isolated from gorse (G34 and G268) which were highly pathogenic, yet produced low levels of toxin, were selected as potentially suitable for a prototype mycoherbicide.

Mass production of *F. tumidum* inoculum**.** For economic reasons, it is advantageous if the active ingredient of a bioherbicide can be produced in submerged culture. Consequently, Landcare Research subcontracted AgResearch to determine the optimum conditions for production of *F. tumidum* spores by submerged fermentation using shake-flask culture and defined liquid media. *Fusarium tumidum* was found to grow and sporulate well in submerged culture and the addition of V8 vegetable juice was shown to significantly enhance spore production in the liquid medium under investigation. The scaling up of spore production was also investigated using a 10 litre bioreactor and acceptably high spore numbers were produced. More work is now necessary to confirm that the spores produced in liquid culture are highly pathogenic, to optimise spore production and to develop a cost-effective medium for industrial bioreactors.

Formulation. Emulsions of water-in-oil (invert emulsions) have produced the most promising prototype formulations of *F. tumidum* to-date (compared with nutrient solutions, humectants, oil-in-water emulsions and "pesta" granules). Spores suspended in invert-emulsions do not dry out, and can cause severe disease and kill plants in the absence of dew.

Application. Landcare Research (and FRI under subcontract) are also developing a method of applying *F. tumidum* spores to the weeds. The most promising formulations (the invert emulsions) are very difficult to atomise because their paraffin wax

content makes them highly viscous. Reducing the percentage of wax in the mixture from 5% to 3% decreases the viscosity of the formulation, but also, increases the rate of water loss from spray droplets, thus reducing the effectiveness of the solution. An increased rate of water loss can be compensated with droplets of larger initial volume, but droplets of sufficient size to retain moisture for 24 hours (with an invert emulsion with reduced wax content) can not be produced by most conventional nozzles. At present, work is continuing on the modification of a commercially available nozzle which produces large droplets, but has too wide a swathe for laboratory use.

Stability and shelf-life**.** Fresh spores of *F. tumidum* quickly germinate if left in liquid formulations and consequently, cannot be easily stored when wet. Landcare Research developed a wettable powder formulation (using kaolin) which allows the spores to be stored dry, and then rehydrated later for application. The viability of *F. tumidum* spores in wettable powder that was stored at room temperature decreased slightly, from 78% to 60%, in the first three months. However, viability then decreased more rapidly, to only 4%, after 6 months of storage. In contrast, the viability of spores (in wettable powder) stored at 4°C was still 55% at 6 months, and 34% after 12 months. All batches of spores with high enough viability to be tested on gorse plants were found to have remained highly pathogenic throughout the trial. This is a very positive result, as it suggests that a mycoherbicide based on *F. tumidum* spores would have a commercially acceptable shelf-life, providing it was stored appropriately.

Future work. While preliminary tests have already been conducted to determine the susceptibility of several tree and cover-crop species to *F. tumidum* isolate G34, more extensive host-range tests are planned for later this year. Once a scaled-up experimental system has been finalised for the mass-production of *F. tumidum* spores, the levels of toxic trichothecenes present in the inoculum and waste involved in this system will be measured to ensure the prototype product is safe to use in field trials. Field trials will then be carried out in order to determine the efficacy of *F. tumidum* on gorse and broom plants outside the laboratory and the glasshouse. This program is funded by the Foundation for Research, Science and Technology. (Source: J. Fröhlich)

Agriculture and Agri-Food Canada, Saskatoon Research Centre, Saskatoon, Saskatchewan, CANADA

Greenhouse and field trials were run to examine herbicide synergy with a foliar agent for control of Canada thistle. Preliminary results indicate that enhanced efficacy and longer lasting control of Canada thistle can be achieved by using reduced rates of glyphosate with the biocontrol agent as compared to the use of glyphosate alone (Source: K. Bailey and T. Wolf).

Dr Wenming Zhang, working as a post-doc with Dr Tom Wolf, is investigating the use of adjuvants with foliar biocontrol agents. The goal of the project is to identify principles for adjuvant selection based on fungal characteristics. Results so far have shown that there are genus-specific responses to adjuvants, and that adjuvants compatible with a wide range of species and genera could be identified. Overall, fungi in Coelomycetes were more sensitive to surfactants than those in Hyphomycetes. It is hoped that at the conclusion of the project, a rational selection process of adjuvants for biocontrol agent formulations can be developed. Drs. Zhang and Wolf are also developing an oil-based formulation system for a fungal agent on Canada thistle. This new formulation has provided good Canada thistle control in the absence of dew in field and greenhouse trials. Ongoing research will focus on reducing the oil content of this formulation and developing suitable application methods. Anticipated impacts in the crop safety with the new formulation will also be investigated (Source: T. Wolf, W. Zhang).

Zoological Institute of Russian Academy of Sciences, St. Petersburg, RUSSIA

In 1997 bioherbicide research by the Biocontrol Group of the Zoological Institute continued to be focused on biological control of the illicit drug plants *Papaver somniferum* (opium poppy) and *Cannabis sativa*. Laboratory screening for virulence was made with 135 fungal isolates recovered from opium poppy and cannabis samples collected in 1996 in numerous regions of Russia. Promising isolates were also tested for host specificity and then the best 13 isolates (11 from opium poppy and 2 from cannabis) were evaluated for efficacy in the field. These included 12 isolates of *Fusarium* spp. (*F.oxysporum*, *F. culmorum*, *F.solani*) and one of isolate of *Rhizoctonia callae*.

In laboratory growth chambers, we have made comparative investigations of different types of formulations for further field tests. The best isolates were evaluated with formulations based on birch sawdust mixed with the following additives at various concentrations: 1) commercially available wheat bran; 2) NH^4NO^3; 3) glycerin; 4) vegetable oil; 5) antibiotics. The best formulation was used in the field test.

A total of 200 opium poppy plots and 50 cannabis plots were established at the experimental field. Field inoculation was made at two different growth stages of the plants. Isolates of *F. oxysporum* and *F. solani* provided good control of opium poppy. *Fusarium oxysporum* caused more than 30% reduction in plant survival and 50% reduction in plant biomass, while *F. solani* caused ca. 30% reduction in both biomass and survival. Two isolates of *Fusarium* sp. were tested on Canabis and no significant effect was observed. (Source: S. Reznik)

New Zealand Pastoral Agriculture Research Institute (AgResearch), Lincoln, NEW ZEALAND

Sclerotinia sclerotiorum for Californian thistle control in pastures: This year AgResearch and Crop Care Holdings NZ Ltd are conducting large scale trials with a new slurry formulation of *S. sclerotiorum* in a variety of climate zones in the South Island of New Zealand. The product, developed by Crop Care Holdings consists of viable mycelial fragments of the fungus adhering to an organic food base, suspended in water with various adjuvants to enhance sticking, water retention and viscosity stabilisation. In the trials it is being applied to the thistle foliage under low pressure with a boom supporting a series of nylon tubes (ca. 3 mm diameter and constant in length) connected to a central manifold. This method ensures that the product is delivered at a constant and equal rate from each tube. The product falls down in relatively large drops (ca. 0.03 mls) and sticks to the leaves and stems of the thistle. The drop pattern ensure that most thistle stems receive several drops of the mycoherbicide when applied at commercially acceptable rates of 15 kg/ha. This "large droplet application" is a novel approach arising from the hypothesis generated during earlier unsuccessful trials that high spray pressures giving small droplets cause an "in-flight" separation of myclial fragments and food source.

The exceptionally hot and dry conditions this summer in Canterbury are not conducive to good infection. However the formulation is proving to be more successful in the more humid pastures of Southland and the West Coast. The trials have been running now for 5 weeks, and already 50% mortality of thistle shoots has occurred at the Southland sites.

Dr Graeme Bourdôt has teamed up with Dr Meindert de Jong from the Theoretical Production Ecology Dept., Wageningen Agricultural University, The Netherlands and Dr Donald Aylor, Plant Pathology and Ecology Dept., Connecticut Agricultural Experiment Station, USA, to write a chapter in a new TPE book. The chapter sets out a methodology for a risk analysis of a mycoherbicide, based on comparing natural and added inoculum densities, using *S. sclerotiorum* in New Zealand pastures as the example. The book is intended for advanced students in Crop Protection. (Source: G. Bourdôt)

University of Guelph, Guelph, Ontario, CANADA

A fungal isolate is being assessed for its commercial potential as a bioherbicidal agent for the control of dandelion in the home garden market. The project is a collaboration between the University of Guelph, McGill University, Nova Scotia Agricultural College, DowElanco Canada Inc., Saskatchewan Wheat Pool and the BioProducts Centre Inc. Field trials were conducted at the University of Guelph, McGill University and Nova Scotia Agricultural College. Various factors were evaluated in separate experiments including dose, timing of application, irrigation regimes, mowing and multiple applications of inoculum. The rate of inoculum required to achieve a desired level of dandelion control was determined in two experiments at the three locations. There was generally no significant difference in dandelion control when the inoculum was applied in the morning or in the evening in trials conducted in June, July or September (P=0.05). Various irrigation regimes were tested for their effect on dandelion control including zero irrigation, irrigation immediately before, irrigation immediately after or irrigation 12 h after application of inoculum. Irrigation immediately before inoculum application gave increased dandelion control at one trial location. Mowing dandelions 24 h prior to inoculum application had no effect on dandelion control. Generally there was no advantage in a double application of inoculum, although further studies are required. (Source: S. Stewart-Wade).

CLASSICAL BIOLOGICAL CONTROL OF WEEDS WITH PATHOGENS

International Institute of Biological Control, Ascot, UK

A programme to evaluate the rust *Prospodium tuberculatum* as a potential biological control agent against *Lantana camara* in Australia has been reinstated this autumn. The Department of Natural Resources (former Queensland Department of Lands) is funding the programme in collaboration with IIBC and Dr Robert Barreto (Universidade Federal de Viçosa, Minas Gerais, Brazil). Initial work will involve pathogenicity screening of the rust against a number of weedy varieties of lantana from Australia. Previous work has shown the pathogen to differentially infect the varieties within this species. The life cycle of this rust has not been fully elucidated and is currently under investigation in Brazil. The completion of host specificity testing will follow-on from this work. None of the test plant species screened so far (approx. 30) have become infected. Dr Mike Morris (Plant Protection Research Institute, Stellenbosch, South Africa) has also provided funding to include South African weedy varieties in the rust pathogenicity screening phase, as part of his lantana biological control programme. (Source: C. A. Ellison)

CSIRO Entomology, Cooperative Research Centre for Weed Management Systems, Canberra, ACT, AUSTRALIA

Bridal creeper project. Bridal creeper (*Asparagus asparagoides*) is a major environmental weed in Australia. It is effectively seed dispersed by birds and establishes itself in relatively undisturbed vegetation producing dense mats of rhizomes and tubers. This plant is not invasive in its native range in South Africa where it is severely infected by the rust fungus *Puccinia myrsiphylli* during the growing season. The rust has been recognized as a highly promising biological control agent. The initiation of host-specificity testing (which is required to demonstrate the safety of the fungus before introduction for classical biological control in Australia) has now been delayed for more than a year because of difficulties in obtaining from the Australian Quarantine and Inspection Service (AQIS) approval to import the rust in the High Security Area of the Black Mountain Quarantine Facility of CSIRO Entomology in Canberra. To comply with the new AQIS requirements we have had to document extensively the in-house management system of the quarantine facility and address the risks involved with the

importation of exotic pathogens. Our management system is currently being reviewed by AQIS and we are hoping to get approval for importation of the bridal creeper rust early in the new year.

Common heliotrope project: *Cercospora* species are reported to cause sporadic destructive epidemics on the summer annual weed common heliotrope (*Heliotropium europaeum*) in Europe and Australia. *Cercospora heliotropiicola* (formerly referred to as *C. heliotropii-bocconi*) has been investigated for many years in France as a potential biological control agent for common heliotrope in Australia. In a previous test on detached leaves an isolate of this species (#157) was found to be more aggressive than isolates of *Cercospora taurica* which naturally occur on common heliotrope in Australia. In a recent study, the pathogenicity of *C. heliotropiicola* (#157) was compared to that of an isolate of *C. taurica* from Australia (#158), using whole plants of common heliotrope. Both *Cercospora* species produced a similar number of lesions on plants exposed to the same temperatures (14, 22, 30°C) and wetness periods (8, 16, 24, 48 h) during the initial infection phase. Under optimum conditions, the pathogens had a similar impact on plant growth and reduced the dry weight of plants by 63%. However, the two *Cercospora* species differed significantly in the number of conidia produced on infected necrotic tissue placed in high humidity conditions. In the first 24 hours, *C. taurica* produced more than five time the number of conidia produced by *C. heliotropiicola*. For both species, production of conidia increased as the period under high humidity increased, although *C. taurica* always produced the highest number of conidia. Based on this study, *C. heliotropiicola* does not appear to have greater value than the endemic *C. taurica* for biological control of common heliotrope in Australia.

Boneseed / Bitou bush project: *Chrysanthemoides monilifera* is a South African plants which has become a major weed in Australia. It invades native vegetation and threatens the ecological stability and biodiversity of areas dedicated to nature conservation. Two subspecies of *C. monilifera* are present in Australia (subsp. *monilifera* - boneseed; subsp. *rotundata* - bitou bush). The systemic rust fungus *Endophyllum osteospermi* (Doidge) comb. nov., which attacks the foliage and stems of *C. monilifera*, is currently under investigation as a potential classical biological control agent for this weed. In 1-2 years after infection, plants develop witches' brooms with multiple, swollen stems and short internodes, and small and slightly chlorotic leaves. Infected branches produce little or no fruit and usually die within 1-4 years. The systemic nature of *E. osteospermi* is favourable for biological control purposes as once the fungus is established within the host, the infection is retained until the death of the plant.

Alan Wood from the Plant Protection Research Institute at Stellenbosch in South Africa, has been contracted by CSIRO to conduct host-specificity tests with the rust. Because of the long incubation period required before the appearance of visible symptoms of the disease, the methodology typically used for host-specificity testing of rust fungi has been modified and follows a three tier system. An initial series of tests (Tier 1) is currently being performed on detached leaves, which are inspected for microscopic signs of successful penetration a few days after inoculation. A second series of testing (Tier 2) involving the inoculation of leaves still attached to the plant will be performed for any plant species that has been successfully penetrated by the fungus in the detached leaf tests (Tier 1). Results from these tests will be compared to those obtained with the detached leaf technique. Finally, a third series of testing (Tier 3) will be conducted only for the test species that have been successfully penetrated by the fungus in tests using leaves still attached to the plants (Tier 2). Plants will be retained for up to 3 years after inoculation in an outside shade-house to allow for the fungus to colonize the plant tissue and for witches'broom symptoms to develop. Should specificity of *E. osteospermi* be confirmed in those tests, an application will be submitted for field release in Australia.

Paterson's curse project: *Cercospora echii* was discovered on Paterson's curse (*Echium plantagineum*) near Geraldton in Western Australia in July 1995, probably as a result of an accidental or illegal introduction into Australia. While the fungus may have potential as a classical biological control agent for Paterson's curse its impact has never been assessed. The pathogen has recently been isolated in pure culture from diseased plants collected in Western Australia and an efficient method to produce spores on artificial medium has been developed. A series of experiments will soon be conducted to determine the optimum conditions for disease development on Paterson's curse plants and assess the impact of the disease on the weed. The susceptibility to the fungus of key native plant species closely related to Paterson's curse will also be evaluated. Should specificity be confirmed the fungus will be released in the eastern States of Australia and its impact and natural spread will be monitored in field experiments. Studies on interactions between *C. echii* and currently available insect biological control agents may also be performed in the future if the fungus significantly affects Paterson's curse in the field. The development of a bioherbicide based on this fungus is not envisaged because of the limited market potential for such a product.

Other projects at the CSIRO Biological Control Unit in Montferrier-sur-Lez, France: The project on pathogens as potential biocontrol agents for saffron thistle (*Carthamus lanatus*) is continuing, with the assistance of Dr Mireille Jourdan. Additional surveys in Greece will be conducted in April-May 1998 to collect new isolates of *Septoria centrophylli* and the rust *Puccinia sommieriana.* Preliminary host-specificity testing will then be performed on closely-related plant species to saffron thistle such as safflower. The continuation of this project will depend on the outcome of these tests. Another brand new project will been initiated in January 1998 to identify potential biocontrol agents (particularly fungi) for wild radish (*Raphanus raphanistrum*), a major weed of cereal and oilseed crops in Australia. (Source: L. Morin)

Hawai'i Department of Agriculture & other Organizations, Honolulu, Hawai'i, USA

After a very long "dry spell", biological control forces are back in action with the field release of three pathogens for three weeds - fayatree, bush lantana, and miconia. These biocontrol activities all happened since June, 1997.

Septoria myricae, a pathogen of fayatree *Myrica faya* (Myricaceae), was released by Dr Donald Gardner (National Biological Service) at several sites within the Hawai'i Volcanoes National Park on the island of Hawai'i on 17 October 1997. This pathogen was isolated from leaves of waxmyrtle *Myrica ceriferae* in North Carolina, USA, and was shipped to Hawai'i for host range testing. *Septoria myricae* has also been recovered from leaf spots on fayatree from Venezuela. Fayatree was introduced into Hawai'i as part of a reforestation project, but became a noxious weed covering over 35,000 ha of forest and pasture lands on the major islands. *Septoria myricae* causes leaf spots followed by defoliation and is expected to be an effective biocontrol agent in the wetter areas of the fayatree infestation.

Another species of *Septoria*, a pathogen of bush lantana *Lantana camara* (Verbenaceae), was released by Dr Eduardo Trujillo (University of Hawai'i at Manoa) in the forest at Kokee on the island of Kauai on 15 September 1997. Although bush lantana has been a weed problem since the early 1900s, forming thickets in waste, pasture and forest lands, it was not until Hurricane Iniki (Kauai 1992) destroyed much of the native vegetation that the bush lantana population exploded and now covers more than 10,000 hectares at Kokee. Although many biocontrol insects have been introduced in Hawai'i, this pathogen is the first fungus to be released for control of lantana. For further information please refer to: Trujillo, E.E. and Norman, D.J. 1995. *Septoria* leaf spot of lantana from Ecuador: a potential biological control for bush lantana in forests of Hawaii. Plant Disease 79:819-821.

Colletotrichum gloeosporioides f. sp. *miconiae*, a fungal pathogen discovered on *Miconia calvescens* in Brazil by Dr Robert Barreto of the University of Viçosa, was released by Eloise Killgore at two sites on the island of Hawai'i on 25 July 1997. Future releases are currently being planned at additional sites there as well as on the island of Maui. *Miconia calvescens* (Melastomataceae) has become a nightmare for ecologists in the tropical Pacific region where it has become established - French Polynesia (Tahiti, Moorea, Raiatea), Australia, and Hawai'i. Because of its tremendous reproductive potential (a mature tree produces over a million seeds annually), and its ability to thrive in the forest understorey, then shade out other vegetation with its huge leaves and tree height of 30 m, *M. calvescens* has emerged as a very formidable weed. Biological control has just begun with the release of the *C.g. miconiae*. More miconia pathogens are being processed in the quarantine facility in Honolulu and further exploration for biocontrol agents are being planned for 1998. It will take an army of biocontrol agents to control *M. calvescens*. (Source: E. Killgore)

Manaaki Whenua - Landcare Research, Auckland, NEW ZEALAND

Mist flower project: Mist flower (*Ageratina riparia*) was subject to a highly successful biological control program in Hawaii in the 1970s which involved three organisms: a smut (*Entyloma ageratinae*), a gall fly (*Procecidochares alani*) and a plume moth (*Oidaematophorus beneficus*). In 1995 Landcare Research (Drs Richard Hill and Louise Morin) was contracted to investigate the feasibility of adapting this program to the situation in New Zealand. A feasibility study found that the temperature and annual rainfall in areas of northern New Zealand infested with mist flower should be appropriate to support high activity of the three biological control agents, especially the fungus. Consequently, the Hawai'i Department of Agriculture in Honolulu was subcontracted to conduct host range tests on the smut, and also, later, on the gall fly.

Host range testing of *E. ageratinae* was performed, in most cases, on test plants that were shipped from New Zealand as seeds, bare-rooted plants, or as cuttings, and most of this testing is now complete. Symptoms of the smut disease became visible on all control plants (*Ageratina riparia*) but on none of the 32 other plant species tested. Consequently, an Importation Impact Assessment is currently being drafted (by R.L. Hill, E.M. Killgore, L.S. Sugiyama, L. Morin and J. Fröhlich) for the introduction of *Entyloma ageratinae* to New Zealand for the biological control of mist flower. This program is funded by Auckland Regional Council, and the Department of Conservation.

Mouse-ear hawkweed project: Landcare Research was next contracted by the Hieracium Control Trust (HCT) to conduct research on methods to establish the rust *Puccinia hieracii* var. *piloselloidarum* on *Hieracium pilosella* (mouse-ear hawkweed) in the field. Field trials were carried out at 12 sites throughout the South Island at which more than 75% of plants had been shown to be susceptible to the rust in glass-house tests. Five methods for establishing the rust were tested: 1) transplanting infected seedlings; 2) inoculating with spores mixed with talcum powder; 3) inoculating with spores mixed with talcum powder and covering plants with plastic after inoculation; 4) inoculating with spores suspended in a water-surfactant solution, and; 5) inoculating with spores suspended in a water-surfactant solution and covering plants with plastic. Plants at all field sites were successfully infected by the rust using all five methods. Applying spores directly onto field plants resulted in higher levels of infection (25-35% of rosettes infected) than transplanting infected seedlings (9%). Covering plants sprayed or dusted with spores with a sheet of plastic for the first 10-12h after inoculation did not appear to enhance the incidence of disease. This suggests that there was sufficient natural dew following spore application to support germination of spores and penetration of the leaves by the fungus.

If the HCT continues to fund research on the rust/hawkweed interaction then future work will focus on the genetic basis for the observed variation in the susceptibility of *H. pilosella* plants to the New Zealand strain of *P. hieracii* var. *piloselloidarum.* (Source: J. Fröhlich)

PLACEMENT

Post doctorate opportunity in Australia

Pyrenophora semeniperda (anamorph *Drechslera campanulata*), a seed borne fungal pathogen has been under investigation in a number of collaborative studies to assess its potential for inundative seed control of a range of annual grass weeds. The studies have included a wide scale survey of the fungus in Australia, a detailed investigation of its growth and sporulation biology, infection processes in both leaves and seeds, detection and impact of phytotoxic metabolites, preliminary inundative biological control field studies and effects on wheat grain from the point of view of seedling vigour, response to fungicidal seed dressings and impact on flour and baking quality.

As a consequence of the work we consider that the fungus does have potential as a biological control agent and there is justification for further development of the seed control concept. Recently NSW Agriculture and GRDC (Grain Research and Development Corporation) have jointly filed for novel use patents in Australia, Canada and the United States of America. However, there are still many issues and difficulties to be clarified, or overcome, including the toxicology aspect, consequences of spillovers on to grain and its resultant impact on management and grain quality and formulation, given its high requirement for dew (20 hrs plus for optimal infection).

Industry has expressed a genuine interest to pursue R and D of the concept, particularly in relation to the biocontrol opportunity for annual ryegrass. It is likely that a Post Doctoral position will be funded in the near future with a tenure of 12 to 18 months, to be located with the bioherbicide group at the Orange Agricultural Institute. The position will be involved in optimising efficacy on annual ryegrass and possibly characterisation of mycotoxins.

If you are interested in this likely position your expressions of interest should be directed to:

Dr R.W. Medd, Principal Research Scientist, CRC for Weed Management Systems, NSW Agriculture, Orange Agricultural Institute, Forest Road, Orange NSW 2800 AUSTRALIA
Phone: + 61 (0) 63 91 38 27 Fax: + 61 (0) 63 91 39 75 OR + 61 (0) 63 91 38 99 E-mail: meddr@agric.nsw.gov.au

READER'S CORNER

Please feel free to use this section to ask questions and express your opinions, concerns, ideas, etc. regarding the field of weed biological control in general.

Creation of a fund for fungal identification of biocontrol significance

"The teachers, scientists and research students from the developing countries of the world are facing difficulties in getting their fungal cultures identified from the International Institutes, like IMI (UK), CBS (Netherlands) because of the identification charges which are too high and thus unable to pay. Thus their cultures remain unidentified for several years and their results remain unpublished for several years and the farmer community has to pay for this. This acts as a constraint in the development of bioherbicides. The need of the hour is to create a fund for the identification of organisms of biocontrol significance so that the scientific community and the society is benefited as a whole around the world"

Dr K.R. Aneja, Kurukshetra University, Kurukshetra-136 119, Haryana, India

Clarification about the registration of 'Biochon' in the Netherlands

"Re: your latest issue of IBG News - June, 1997 (Vol. 6, # 1). I want to make a correction and clarification about the registration of 'Biochon' in the Netherlands. According to Dr William J. Ravensberg, Head Research & Development, Koppert Biological Systems, this product 'Biochon' is NOT registered in Netherlands, but the company is selling it as wood decay promoter for control of *Prunus serotina*. As a matter of fact, Koppert has approached Pacific Forestry Centre and its industrial partner (MycoLogic Inc.) to establish some sort of collaboration to accelerate MycoLogic's efforts for Canadian registration (About 1.5 year from now!!!) to register '*Chondrostreum purpureum* , ECOclear' as first Bioherbicide for management of competing forest vegetation in conifer plantations and utility rights-of-way."

Dr Simon Shamoun, Natural Resources Canada - Canadian Forest Service, Pacific Forestry Centre 506 West Burnside Road, Victoria, BC V8Z 1M5, CANADA. E-mail: sshamoun@pfc.forestry.ca

EDITOR'S CORNER

Thank you again for your contributions. The use of electronic mail has made the preparation and editing of the newsletter much easier over the years. However, I feel that it's time for me to step down and give the opportunity to someone else to edit our newsletter. Five years is relatively a long time and there are other challenges ahead for me. Please feel free to contact me

if you want to obtain specific details about what's involved in editing IBG News. Trust me! It's not that bad. Indeed it can be a great way to be in direct contact with the main players in the field of bioherbicide research.

Best wishes for the new year. Cheers! Louise.

Deadline for contributing to the next issue: 1 May 1998.

ACKNOWLEDGMENTS

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Novo Nordisk Entotech Inc., 1497 Drew Avenue, Davis, California, USA 95616-4880

Sandoz Crop Protection Agro Inc., 975 California Ave., Palo Alto, California, USA 44304-1104

United Agri Products, PO Box 1286, Greeley, Colorado, USA 80632

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IVth INTERNATIONAL BIOHERBICIDE WORKSHOP
6/7th August 1998
Strathclyde University, Glasgow, U.K.

Main Theme
"Interactions between chemical and microbial herbicides"
Other papers are also welcome

The IVth International bioherbicide workshop immediately precedes the International Plant Pathology Congress at Edinburgh.

The workshop will begin with papers on Thursday morning and early afternoon, followed by a bus tour of the scenic Trossachs Hills, a visit to a malt whisky distillery *en route*, and ending at the University's Ross Priory (dating back to 1693), beautifully situated on the shore of Loch Lomond, for the conference dinner. Paper presentations continue on Friday morning and afternoon.

TRANSPORT

Delegates arriving at Glasgow airport may take a city-link bus for £2 which leaves at 15 and 45 mins past the hour arriving at Buchanan St. bus station in about 20 minutes. The bus station is approximately 10 minutes walk from accommodation at Chancellor's Hall. Alternatively, the taxi service from the airport is approximately £12. Strathclyde University is a short walk from the shopping centre of Glasgow. Edinburgh is 50 minutes by rail; trains depart from Queen Street Station (adjacent to the Strathclyde campus) every half hour.

CALL FOR PAPERS.

Titles and abstracts of oral presentations or posters should be submitted by 27th March, 1998. Any topic which addresses concerns, problems or solutions to the advancement of bioherbicides will be welcome. It is proposed that a main theme for presentations and discussions will be the interactions between chemical herbicides, bioherbicides and the weed and/or pathogen. Other papers are also welcome. Oral presentations will be 20 minutes, including 5 minutes for questions. Boards will be available, approx 1.5m sq., for attaching posters.

Abstracts should be printed on a separate A4 sheet, included with the registration form, and must be no longer than 200 words; headed with the title and author(s) name(es) and address(es). The abstract may be forwarded on an IBM compatible floppy disc (Word 6.0) or sent by e-mail, but hard copies should also be sent.

REGISTRATION

Registration for the workshop must be paid separately from the Plant Pathology Congress. The registration fee is £95 which will cover buffet lunches, coffee and biscuits, bus tour, distillery visit and dinner at Ross Priory. Please complete the attached form, making payments payable to "The University of Strathclyde", and send together with abstract (if applicable), by 27th March 1997 to:

Dr Mike Burge
Department of Bioscience and Biotechnology
The Todd Centre
The University of Strathclyde
Taylor Street
Glasgow G4 ONR UK

Tel: +44 (0) 141 548 3626 (Mike Burge) +44 (0) 141 548 3824 (Doreen Main)
Fax: +44 (0) 141 553 4115
E-mail: m.n.burge@strath.ac.uk or d.main@strath.ac.uk

IVth INTERNATIONAL BIOHERBICIDE WORKSHOP
6/7th August 1998, Strathclyde University, Glasgow, U.K.

REGISTRATION FORM

Name:_____

Address:_____

_____

E-mail:_____ Fax:_____

Name of any accompanying person (s):_____

Please provide the following information which will be a useful addition to the list of participants, facilitating communication between delegates:
Weed(s) you are working on:_____

Pathogen(s) studied:_____

Research category e.g. formulation, epidemiology, pathogenicity etc.: _____

PRESENTATIONS
Do you wish to present an **oral paper?** YES/NO **a poster?** YES/NO
(If there is insufficient time, would you be willing to present your oral paper as as a poster? YES/NO

ACCOMMODATION
Single *en suite* rooms are available on the campus, a short walk from the lecture room. A small number of double rooms are also available on a first come first served basis. Single rooms are £36 per night, and double rooms £24 per person, per night. If wishing to share, please indicate with whom: _____
The fee for accompanying person if attending bus tour and Ross Priory dinner will be £40
Please specify any special food requirements (e.g Vegetarian)_____

Please enclose payment (cheques to "The University of Strathclyde") as appropriate:

Registration fee:	£95
Accompanying persons fee (see above):	____
Accommodation per night (single, £36; double total £48): Weds 5th Aug	____
Thurs 6th Aug	____
Friday 7th Aug	____
Total:	____

Please forward to Dr Mike Burge, Department of Bioscience and Biotechnology
The Todd Centre, The University of Strathclyde, Taylor Street,Glasgow G4 ONR UK.