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The Canadian Biocontrol Network – An Update

The Summer 2002 issue of the IOBC-NRS newsletter carried a description of the Biocontrol Network initiative. At the time, this multidisciplinary scientific organization was about a year old and the substance of the article was much more about the promise of the Network than its outcomes. A little more than three years later, we have not only achieved but exceeded this initial promise, primarily in science but also in other areas of special importance to biological control.

The Biocontrol Network brings together university laboratories and government research agencies across Canada. Headquartered at the Université de Montréal, its mission is to reduce chemical pesticide use in Canada's greenhouse and tree nursery industries, enterprises that generate revenues of over $2.5 billion annually. The Network achieves its goals by designing protocols based on the integrated action of natural enemies of insect pests and disease organisms. The knowledge gained from these contained ecosystems will provide valued models for applications to the open systems of farming, forestry and the larger environment.

There are 51 researchers in the Network from a broad range of disciplines: biologists, mycologists, virologists, bacteriologists and physiologists who investigate the attack strategies of insects and disease pathogens on plants; biochemists, biophysicists and cell physiologists who examine the mode of action of microbial agents and develop screening assays for pathogens active against pests; and ecologists who study the complexities of manipulating entire biological systems to control pest populations. The Network harnesses this diverse group in a coordinated, focused way to develop biologically based approaches to pest management and control. The Network researchers come from 16 Canadian universities, one college, 16 government research agencies and two non-profit research organizations (one outside Canada: CABI Bioscience Centre in Delémont, Switzerland). There are currently 82 postdoctoral fellows, students and technical assistants in the Network.

The Network is now in its last year of a 5-year, $6.6 million funding cycle supported by Canada's Natural Sciences and Engineering Research Council (NSERC) through its Research Networks Grants program. This program supports complex research collaborations between private and public sector partners working on common research themes where networking provides demonstrable added advantages. The aim is to create new knowledge and expertise from these research collaborations, transfer this to Canadian-based industries and other organizations and train highly qualified personnel for employment in the knowledge economy.

The Network Research Program

The Network's principal aim has been to understand the biological mechanisms and species interactions of contained systems like greenhouses and tree nurseries, making it easier to predict outcomes and anticipate future problems. The research was organized in three themes: 1) greenhouses; 2) tree nurseries and managed forest stands; and 3) innovation tools for discovery and testing.

Theme 1 has focused on the damage to greenhouse crops by insects and mites, and on attack on roots and leaves by diseases. Horticultural and ornamental crops are often protected by releases of one or more species of predatory, parasitic or pathogenic organisms. However, new pest problems continue to arise, necessitating the development of novel biocontrol solutions. This creates a need to better understand the dynamics of pest communities and the behavior of populations of biocontrol agents operating together, as well as for methods of manipulating these living communities. There are three programs in the Greenhouse theme: (1) plant pest-natural enemy interactions and the applications of biological control; (2) new improved microbial agents for management of insect pests; and (3) management of rhizosphere and phyllosphere ecology in greenhouse-grown crops for improved plant productivity and produce quality.

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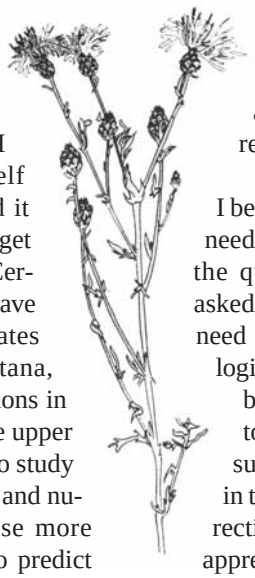
FROM the PRESIDENT

Wied-y Thoughts

It doesn't yet seem like fall in Fayetteville, despite what the calendar says. However, I do notice changes in a number of the plants around the area. The ones I am keying in on are invasive weeds, at first teasel, and now spotted knapweed. Being new to Arkansas, I had no idea that this invasive Eurasian weed was found in Arkansas. I knew of it from the western US and, in fact, spotted knapweed was one of the first targets for importation biological control in the Nearctic Region, with 13 insects released against several of the knapweeds.

After hearing of interest locally in using biological control against knapweed in the Ozarks, through movement of some of the agents from Montana, Wyoming and other areas in the northern Great Plains, I started thinking about the wisdom of just moving agents from one region of the country to another. We had faced the same issue in Illinois, when one of the county Forest Preserve Districts bought a box containing a mix of *Apthona* beetles from Montana to release against leafy spurge in northern Illinois, where the weed had made a recent entry. Although I was pleased that the land managers wanted to pursue biological control (they were primed after seeing successes with purple loosestrife biocontrol), I also saw a quandary: if the beetles worked, it was because the Forest Preserve District had the prescience to intervene and ward off the invader before it spread throughout the state. However, if the project failed, I knew biological control itself would have been blamed, and it would have been difficult to get these partners back on board. Certainly the *Apthona* flea beetles have been highly successful in states further west (Dakotas, Montana, etc.), but doubtless the conditions in Illinois differ from those in the upper Plains. So, our response was to study the plant community, the soils and nutrients rather than just release more beetles; the goal was to try to predict which of the agents made sense to release.



So, is simply moving weed agents from one region of the Nearctic Regional Section to another with different biotic and abiotic conditions wise without some investigation ahead of time? This question was reiterated when considering biological control of spotted knapweed in Arkansas – even though the plant is distributed throughout much of the continental US, no doubt the climatic conditions in the Ozarks will be very different than those in Idaho, Wyoming and Montana, and agents selected for conditions in those states may not be appropriate for consideration in other climates. Likewise, there may be a different suite of related non-target plants to consider. Especially for some of the old-time projects, there may have been less consideration of non-targets from different areas of the country than is required in newer projects.

I don't have an answer, but I believe these sorts of questions need to be addressed by us; if not, the questions certainly will be asked by others. We practitioners need to be the advocates for biological control, but we should not be blind zealots. And we ought to be doing all we can to ensure the likelihood of success in these sorts of new-area resurrections of old-time projects. I'd appreciate hearing any comment from the membership – whether in support or opposition.

I hope you are all planning to be at the IOBC Annual Meeting and Symposium, Tuesday, November 8, and visit with your colleagues and fellow members. The program George Heimpel put together looks great – "Biological control in support of conservation biology" (see page 3). I look forward to seeing you there.

—Rob Wiedenmann

***If you move**, please send your new address to the Secretary/Treasurer or Corresponding Secretary so this newsletter will continue to reach you.*

ON THE WEB

Biocontrol Files

Biocontrol Files: *Canada's Bulletin on Ecological Pest Management* is an exciting new electronic resource on biological pest control. This publication is a unique collaboration between an environmental NGO (World Wildlife Fund-Canada), a pan-Candian network of academic and government researchers (the Biocontrol Network), and the Canadian federal agriculture department (Agriculture and Agri-Food Canada). Additional partners and sponsors committed to advancing knowledge and adoption of ecological pest management would be welcomed.

This quarterly publication is an 8-page resource which reports on tools and developments in ecological pest management. It focuses on providing practical information on biological pest control products, raising public awareness of the principles and benefits of biological pest control, and delving into the policy, technical and social issues which impact the field of biological pest control.

Biocontrol Files is available in both English and French. Please visit *Biocontrol Files* at www.biocontrol. ca. Click on the "Biocontrol Files/Dossiers Biocontrôle" button to enter the home page of the Files, and then click on either the "English" or "Français" button to access these issues in the language you prefer.

Also, consider adding a link on your website to the *Biocontrol Files* website and inform colleagues and other interested persons about *Biocontrol Files*.

Biocontrol at the Entomological Society Meetings, 2005

Plan to attend the 2005 IOBC Symposium, *Biological Control in the Support of Conservation Biology*, to be held at the Entomological Society of America meeting in Ft. Lauderdale, Florida, November 6-9, 2005.

The Symposium on Tuesday night begins at 7:30 p.m. with the Business Meeting of the IOBC-NRS, including presentation of the IOBC-NRS Distinguished Scientist Award (*in absentia*, since the awardee will be unable to attend) and the IOBC-NRS Student Award. The symposium will be followed by a reception and mixer. Both events will be held in the " Palm B" room on the second floor of the Convention Center.

2005 IOBC SYMPOSIUM PROGRAM:

Biological Control in Support of Conservation Biology

- Graduate Student Award: Trophic and behavioral connections in a conservation biocontrol food web. (R.P. Prasad, W.E. Snyder)
- Biological control of purple loosestrife – a pioneering project in the service of conservation biology. (L. Skinner)
- Biological control of invasive salt cedar. (R. I. Carruthers, C.J. Deloach, D.W. Bean, and G.L. Anderson)
- Biological control of invasive cordgrass by a native herbivore. (D. Strong)
- Fire ant biological control and potential benefits for conservation biology. (S.D. Porter)
- Biological control against exotic marine pests: who are the natural enemies? (A. Kuris)

In addition to the IOBC-sponsored symposium, there are several section symposia related to biological control, many sessions of ten-minute papers, and numerous display presentations (daily in Hall A from 7:00 a.m. to 6:00 p.m., except Wed.when it closes at 3:00 p.m.). IOBC members are also encouraged to attend the Subsection Ca (Biological Control) Preliminary Business Meeting (Room 113) from 5:30 to 6:00 p.m. on Monday evening. Consult your printed schedule or the Personal Scheduler on the ESA website (esa.confex.com/esa/2005/scheduler/) for specific titles of presentations in the sessions included below:

	8:30 AM-12:00 PM	1:30 PM-5:30 PM
Sun Nov 6	Symposium: Weed Biological Control in Natural Areas (Room 315)	Ten-Minute Papers, Section Ca. Biological Control, Cd. Behavior, Ecology, Ce. Insect Pathology, Microbial Control, Cf. Quantitative Ecology (Room 125)
Mon Nov 7	Student Competition, Section Ca1 and Ce1. Biological Control and Insect Pathology and Microbial Control (Room 207-208) Student Competition, Section Ca2 and Ce2. Biological Control and Insect Pathology and Microbial Control (Room 220) Student Competition, Section Ca3 and Ce3. Biological Control and Insect Pathology and Microbial Control (Room 221)	Ten-Minute Papers, Section Ca. Biological Control, Cd. Behavior and Ecology (Room 114) Ten-Minute Papers, Section Ca. Biological Control, Cd. Behavior and Ecology (Room 304) Ten-Minute Papers, Section Ca. Biological Control, Cd. Behavior and Ecology, Ce. Insect Pathology and Microbial Control, Cf. Quantitative Ecology (Room 220)
Tues Nov 8	Section C Symposium: Incorporating Natural Enemies Into Crop Protection Decision Making (Palm B) Symposium: Advances in Home and Garden Pest Management: Biological Control and Biopesticides (Room 125) Ten-Minute Papers, Section Ca. Biological Control, Cb. Apiculture and Social Insects, Cd. Behavior and Ecology, Ce. Insect Pathology and Microbial Control (Room 223)	Symposium: Augmentation Biological Control: A Path to the Future (Room 315) Ten-Minute Papers, Section Ca. Biological Control, Cb. Apiculture and Social Insects, Cd. Behavior and Ecology (Room 220)
Wed Nov 9	Ten-Minute Papers, Section Ca. Biological Control, Cb. Apiculture and Social Insects, Cd. Behavior and Ecology (Room 220) Ten-Minute Papers, Section Ca. Biological Control (Room 223)	Ten-Minute Papers, Section Ca. Biological Control, Cc. Insect Vectors in Relation to Plant Disease, Cd. Behavior and Ecology (Room 113) Ten-Minute Papers, Section Ca. Biological Control, Cc. Insect Vectors in Relation to Plant Disease, Cd. Behavior and Ecology (Room 220)

Newly Described Moth Attacks Invasive Fern

The search for natural enemies of an invasive weed that threatens Florida's wetlands has led to a stem-boring moth that attacks ferns. The moth, *Siamusotima aranea*, was found in Thailand in stems of a native fern, *Lygodium flexuosum*, by USDA-ARS scientists and colleagues seeking biological controls of the Old World climbing fern, *Lygodium microphyllum*. Scientists in the ARS Australian Biological Control Laboratory at Brisbane and colleagues have searched Southeast Asia and Australia for natural enemies of this fern since 1998.

While there are many stem-boring moths, *S. aranea* is the first to be identified among fern-feeders in Asia. The moth is unique in a number of ways. For one, its caterpillar looks more like some beetle larvae. The moth has armored segments on its rear similar to those on beetles but unlike anything seen before in a moth. And the adult moth may mimic spiders giving rise to its common name of *Lygodium* spider moth.

This discovery expands possibilities for biological control of the Old World climbing fern in the US. Entomologist Robert Pemberton of the ARS Invasive Plants Research Laboratory in Fort Lauderdale, Fla., is culturing *S. aranea* to test its effectiveness against the Old World climbing fern.

— Adapted from an August 17, 2005 ARS Press Release by Luis Pons at www.ars.usda.gov/is/pr/2005/050817.htm

Competitive Interactions Among Predators of Hemlock Woolly Adelgid in the Laboratory

Competitive interactions among two specialist predators, *Laricobius nigrinus* and *Sasajiscymnus* (*Pseudoscymnus*) *tsugae*, and a generalist predator, *Harmonia axyridis*, of hemlock woolly adelgid, *Adelges tsugae*, were studied in the laboratory. The two specialist predators are part of a biological control program that has been initiated for *A. tsugae*, and the potential for competition among these species and polyphagous established predators is unknown.

Studies in environmental chambers simulated early spring and late spring conditons. Predator feeding trials using conspecific and heterospecific eggs showed that *L. nigrinus* and *S. tsugae* eggs were consumed by all species, and predation was decreased with increased *A. tsugae* density. Eggs of *H. axyridis* were eaten almost exclusively by conspecifics, at high rates, regardless of *A. tsugae* density. Survival, feeding on *A. tsugae*, and net egg production of single predators and groups of three conspecifics and heterospecifics were also examined. Survival for all species was not significantly affected by the presence of additional predators. In conspecific groupings, only *H. axyridis* showed significant reductions in feeding on *A. tsugae*, whereas all species had significantly reduced net egg production with conspecifics. In heterospecific groupings, no significant effects on *A. tsugae* predation or net egg production were detected. The only significant negative competitive interactions detected in these assays were among conspecifics, whereas heterospecific combinations showed noninterference.

— Flowers, R. W., S. M. Salom and L. T. Kok. 2005. Competitive Interactions Among Two Specialist Predators and a Generalist Predator of Hemlock Woolly Adelgid, Adelges tsugae *(Homoptera: Adelgidae), in the Laboratory. Environ. Entomol. 34(3): 664-675.*

A Strain of the Fungus *Metarhizium anisopliae* for Controlling Subterranean Termites

Current control methods for subterranean termites involve slow-acting, nonrepellent termiticides and baits. Insect pathogens are used in baits, but may be limited because of removal of the pathogen by termites by grooming and isolation of infested members of the colony. An isolate of *Metarhizium anisopliae*, ESC 1, has been commercialized as a mycoinsecticide (BioBlast) for termites, but caused only moderate rates of mortality of Formosan subterranean termite (*Coptotermes formosanus)* alates in this study.

A group of Formosan subterranean termite alates collected in a light trap in New Orleans, LA during the 2002 swarming season showed unusually high, rapid mortality and were quickly covered with fungal mycelia and conidia. Several fungal strains isolated from the cadavers were purified individually. One of the five strains of *M. anisopliae*, C4-B, caused significant and rapid mortality among alates and workers.

In a preliminary experiment to determine the efficacy of C4-B in a field test, mortality of alates collected from treated areas reached 94% in 3 days, whereas mortality of untreated alates was only 34% on the same day. By day six all of the exposed alates were dead, while there was a maximum of only 65% mortality of untreated alates. (This relatively high mortality rate is normal for alates maintained in the laboratory.)

Existing control measures for Formosan subterranean termites are directed primarily against workers. Strain C4-B, although rapidly killing alates, is also lethal to workers. This strain has the potential to be produced in large quantity and formulated for control of termites in an integrated pest management system.

— Wright, M.S., A. K. Raina and A. R. Lax. 2005. A Strain of the Fungus Metarhizium anisopliae *for Controlling Subterranean Termites. J. Econ. Entomol. 98(5): 1451-1458.*

Biological Control of Tarnished Plant Bug and Western Flower Thrips by *Beauveria bassiana* Vectored by Bee Pollinators

This Ph.D. Thesis abstract, submitted in 2004 by Mohammad S. Almazra'awi, University of Guelph, promotes a new novel method for the application of microbial biocontrol agents for pest control in both field and greenhouse crops. Some of the publications from this work should be starting to come out early next year.

The ability of honey bees, *Apis mellifera*, and bumble bees, *Bombus impatiens*, to vector the fungal agent *Beauveria bassiana* to canola and greenhouse peppers to control the tarnished plant bug (TPB), *Lygus lineolaris*, and the western flower thrips (WFT), *Frankliniella occidentalis*, was investigated. Factors affecting acquisition of *B. bassiana* by honey bees were studied in the laboratory. For vectoring studies, a dry formulation consisting of fine corn flour (45 - 90 **F**m) and conidia was used. Possible effects of *B. bassiana* on honey bees were evaluated in the laboratory using caged workers and in the field using honey bee hives. *B. bassiana* caused high mortality for caged bees when applied at high concentrations, but was safe for honey bee hives under field conditions. Vectoring of *B. bassiana* to canola, *Brassica rapa* and *B. napus* by honey bees was evaluated using screened cages in the greenhouse and in the field. Experiments with bumble bees and greenhouse sweet pepper, *Capsicum annum*, were conducted using cages inside greenhouse compartments. The bees effectively vectored the dry formulation to canola and greenhouse sweet pepper as indicated by large amounts of *B. bassiana* detected on leaves and flowers of both crops as well as on the captured TPB and WFT. Mean mortalities of TPB collected from canola caged with honey bees and *B. bassiana* ranged between 30 to 56% compared to 9 to 22% in the controls. Mean mortalities of TPB and mean infection rate of WFT collected from greenhouse peppers caged with bumble bees and *B. bassiana* ranged between 34 to 45% and 35 to 40% compared to 9 to 15% and 2 - 3% in the controls, respectively. These results indicate that bees provide a novel way of applying microbial control agents for pest control in the field and in greenhouses that integrates different agroecosystem components i.e. pollinators, biological control agents and pollination for pest management.

IPM and Biological Control in Honduran Subsistence Agriculture

This Ph.D. dissertation summary was provided by Kris Wyckhuys, an IOBC member since 2001 and former Ph.D. student with Dr. Robert O'Neil (Purdue University). Kris is now a postdoctoral researcher at the University of Minnesota where he is working with Dr. George Heimpel. Even though his work —determining host specificity of candidate parasitoids for control of the soybean aphid Aphis glycines*—is both fascinating and challenging, Kris remains on the outlook for a more permanent job in the international scene.*

This project on social and ecological contributions to IPM and biological control in Honduran subsistence agriculture had 3 key objectives. The first objective was to quantify pest infestation levels and characterize abundance and diversity of natural enemies in small-scale maize fields in Honduran hillside environments. Research mainly focused on the fall armyworm (FAW), *Spodoptera frugiperda*, a key pest of Central American maize. The second objective was to assess the extra-field contribution towards arthropod predator abundance in maize. Linkages were explored between certain habitat features, their spatial arrangement at an agro-landscape scale, and abundance of natural enemies recorded within maize fields. The third objective was to gauge farmers' understanding of ecological processes in their fields and specifically of biological control. Farmers' agro-ecological knowledge was subsequently linked to pest management decision-making and their training background in IPM. A side-project also quantified the role of pesticide information sources and social connectedness in the diffusion of IPM technologies through smallholder communities.

FAW populations in Honduran subsistence maize were low, with infestations below regionally defined economic thresholds and mainly determined by altitude and in-field abundance of natural enemies. Associations were found with FAW population dynamics for various predators including ants, earwigs, social wasps, spiders and ground beetles. The earwig *Doru taeniatum* comprised up to 70% of the predator complex observed in maize. In-field predator abundance was linked to features of the extra-field environment. Earwigs reached high abundance in fields surrounded by grasslands, while spiders and ground beetles were common in fields embedded in late-successional habitat. In general, farmers did not treat FAW infestations unless necessary. Local knowledge of biocontrol only partially reflected the ecological processes occurring within their fields, with farmers' tendency to draw on the role of abundant, conspicuous or culturally important predatory organisms. However, increased understanding of the ecological concepts underpinning biological control was associated with increased familiarity with pesticide alternatives and lowered likeliness to revert to unsustainable options. IPM training strengthened farmers' knowledge, molding it partially to its environmental context. Distilling from this work and connecting social aspects with ecological facets of IPM adoption, a set of guidelines are currently being formulated for the design of IPM extension packages in developed as well as developing countries.

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Theme 2 has addressed the problems besetting tree nurseries and managed forest stands. Tree seedling production and planting are major business enterprises in Canada, with upwards of 600-700 million seedlings (mostly conifers) being produced in nurseries for reforestation programs every year. Seedlings are grown under intensive management in nurseries (managed stands to a lesser extent) and are attacked by root diseases, especially root rot and damping-off pathogenic fungi, and foliar pests such as sawflies. Researchers focused their efforts in three areas: (1) the discovery or development of novel biological control agents of nursery diseases; (2) the evaluation or development of nucleopolyhedroviruses as biocontrol agents of sawflies in tree nurseries and managed tree stands; and (3) biocontrol of insect pests in Christmas tree plantations for better understanding of cyclical insect pests and natural enemies.

Theme 3, the development of innovative tools for discovery and testing, has aimed at new technologies based on DNA microarrays as well as screening models and assays. The two programs have centered on: (1) microarray analysis of cellular responses as it relates to investigations of the molecular and cell biology processes involved in the interactions among plants, pests and biocontrol agents; and (2) development of cell and tissue models and assays for the study of the mechanism of action and the screening of pathogens using advanced optical and electrophysiological techniques to test for novel biocontrol agents.

A History of Scientific Success

There are many success stories to report since the Network's inception. Some examples:

- A better understanding of the optimal use pattern of the generalist predator *Dicyphus hesperus* for control of greenhouse whitefly and other pests, particularly the use of mullein as banker plants to maintain predator populations when pest populations are low. This strategy has since been adopted by British Columbia growers.
- Confirmation that a nucleopolyhedrovirus (NeabNPV) used to control balsam fir sawfly in Newfoundland specifically attacks this insect and does not pose a threat to the environment. The registration package is in the final stages of evaluation by the Canadian Pest Management Regulatory Agency (PMRA).
- Significant contributions towards understanding the ecology, mode of action, and implementation of *Sporodex*, a unique biofungicide based on *Pseudozyma flocculosa* used to treat powdery mildew. The product was granted temporary registration in 2002 by the PMRA and the US EPA and will soon be registered in the EU.
- Demonstration of the efficacy of the biofungicide *Prestop* (*Gliocladium catenulatum*) against *Pythium* and *Fusarium* diseases in Canadian greenhouses. This product was registered in 2003 in the first minor use exercise of Agriculture & Agri-Food Canada's new Pest Management Centre.
- Collaboration with the Victoria-based company, Mycologic Inc., in obtaining temporary Canadian and US registrations for its re-sprouting inhibitor *Chontrol*, based on the fungus *Chondrostereum purpureum*. The Network and Mycologic research has also used the company's solid-state fermentation facility to generate large research samples for field trials of new microbial agents for disease management in tree nurseries.
- Development of a one-step molecular tool to detect and identify parasitoid species for potential classical biocontrol against *Lygus*, a major pest in many agricultural systems, in partnership with CABI Bioscience Centre in Delémont (Switzerland).
- Development of a new genomics approach to profile tree nursery rhizosphere which may be scaled up for high throughput screening of biological control agents.
- Success in crossing European and native Canadian parasitoid species has led to fertile hybrids with an extended host range, enabling mass production and the potential to use the parasitoid in forest IPM strategies.
- Discovery through DNA microarrays that cell suicide genes are induced in Eastern spruce budworm midguts in response to sub-lethal levels of *B. thuringiensis*. Network researchers also designed an oligonucleotide-based DNA microarray for fast screening of new *B. thuringiensis* isolates with potential insecticidal activity.

Creating a Biocontrol Community

Networking in the science, training, education and communications, and technology transfer areas has been crucial to the success of the Network.

Science: A key ingredient has been the networking among the Network scientists. Two-thirds of them collaborate with four or more other members in at least one research program. As a result, more than half the papers published by the Network in 2004 were co-authored by two or more Network scientists, a figure which will likely exceed 70% in 2005.

The networking process has been nurtured by many different meetings of scientists: there have been regular annual meetings to date; interactions have also been promoted with scientists outside the Network, both in Canada and on the international scene; a number of Network researchers are participants in the *Réseau québécois de recherche en phytoprotection* (Plant Protection Research Network), an offshoot of the Network in the province of Quebec; the Network co-organized an international symposium on "Pesticides and Health" in 2003; there was the Joint Meeting IOBC – NRS / Biocontrol Network in 2005; the Network was responsible for several workshops and symposia at the annual meetings of the Society for Invertebrate Pathology (SIP); the Network organized the 6th Pacific Rim Conference on the Biotechnology of *Bt* and its Environmental Impact this fall; the Network will be in charge of organizing the SIP meeting in Quebec in 2007.

Training: The high caliber, multidisciplinary research program of the Biocontrol Network continues to provide

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a unique environment for training. Its Educational Program is one of the most important aspects of its role and a crucial link to the future. Over 160 highly qualified personnel have been trained to date, with 82 students, postdoctoral fellows and technical assistants currently in place, half of them being co-supervised by Network researchers. The Network has run five international competitions for its prestigious postdoctoral fellowships and graduate scholarships. Two summer schools were organized, in 2004 and 2005, attracting over 130 participants. The third summer school is planned for May, 2006. The Network has awarded student grants and cash prizes to support travel to, and recognize the best presentations at various conferences in Canada and abroad (e.g. the meetings of the Entomological Society of Canada, the Canadian Phytopathological Society, the Society for Invertebrate Pathology, and several IOBC meetings).

Education and Communications: This aspect of the Network's activities has ranged over a number of initiatives and issues. In concert with its host institution, the Université de Montréal, the Network was instrumental in creating a new Canadian Research Chair in Biocontrol at a senior level, with full funding from the Canada Foundation for Innovation. The recipient of this prestigious position is Dr. Jacques Brodeur, a former member of the IOBC – NRS Board of Directors and a Network researcher and program co-leader who joined the Université de Montréal in June 2005.

The Network has set up a website (www.biocontrol.ca) which displays information on its research programs, participants, meetings and other activities; provides the first comprehensive list of biocontrol products registered in Canada, with all relevant links; links to a number of biocontrol-related websites worldwide; and has the Biocontrol Files (see page 2 for more on these Files).

The Network recently completed an extensive national survey that gauges the wider Canadian public's perceptions of biological control. The results will be published shortly and used as a basis for designing a broader public communications strategy.

Two important studies are currently commissioned by the Network: (1) evaluation of the social and economic impacts of biocontrol R&D in Canada, and (2) evaluation of barriers to commercial application of biocontrol products in Canada and alternative approaches to overcome these difficulties.

Technology transfer: Beyond the research, training and educational aspects, the Network also addresses other, more pragmatic issues that affect the biocontrol community. It has set up a social and scientific networking system that links together the various stakeholders in biocontrol across Canada. This network of partners includes 32 companies, 13 grower associations and several other organizations. The Network has already implemented a coordinated approach that pools the expertise of scientists, growers, biocontrol companies and personnel from regulatory and other agencies to deal with facilitating the process required to bring biocontrol products, either available abroad or newly developed, to registration. Under **A History of Scientific Success** above, there are examples of the more advanced projects aimed at bringing biocontrol products to market. A two-day workshop on registration of pest management biocontrol agents was held in April 2005 with over 30 participants from industry, grower organizations, regulatory agencies along with many of the Network's researchers and trainees.

Conclusions

The Biocontrol Network has become a key player in the effort to develop safe, practical, commercially viable biological control agents. In accomplishing this, it has vaulted Canada into a world leadership role in the development and use of this new technology. A '*network culture*' has emerged in the Network laboratories across Canada in which researchers have created synergies and achieved a holistic approach to the problems of protecting plants in contained, growth-intensive ecosystems.

The challenge now for the Network is to create the conditions under which it can continue as a viable organization. Everything that favors this continuance goes back to Network vision – what it is here for, what it hopes to do, and how it will go about achieving these ends. To design and set up systems with the complexities of biological control, a fundamental level of understanding is needed. While the Network has its short and mid-term objectives – pest problems in greenhouses and tree nurseries are immediate – it also looks for this deeper understanding of the interactions among plants, pests and biocontrol agents at the molecular level. This will allow it to possibly avert infestations rather than merely react to problems after the fact. With global warming and the northward movement of pests and diseases, this capacity to head off problems before they arise will grow in importance for Canadians.

A key future initiative for the Network will be an expansion of its activities to include replacing chemical pesticides used in field crops, forests and plants in other open environments. Applying the experience from greenhouses and tree nurseries to these open systems is a natural step in its development, and the increased collaborations among the scientists in this larger biocontrol community will reflect the Canadian government's general thrust to have its scientists work increasingly in larger, integrated teams towards strategic goals.

Canada needs to invest now in dealing with these larger challenges, and a key mechanism will be the support of organizations like the Biocontrol Network. It is already well advanced in developing the scientific knowledge base of biocontrol and, equally important, in turning out the young men and women required to maintain and extend biocontrol as a key part of the defense arsenal that protects Canada's food and forest resources. The Biocontrol Network is now coming to the end of its beginning, putting the final touches on the footings that will shape its future. The challenge now is to capitalize on the promise of all that groundwork.

— Drs. Jean-Louis Schwartz and Raynald Laprade, Network Leaders, The Biocontrol Network

MEETING CALENDAR

Association of Natural Biocontrol Producers (ANBP) Conference

Oct 14-15, 2005
Guadalajara, Mexico
The conference entitled *Beneficials Without Borders* will include numerous sessions and keynote speakers. Conference registration fee of $625 includes 3 nights accommodations, all meals, welcome reception, banquet, and more. For more information visit the ANBP conference webpage at www.anbp.org/ANBP%20Conf%202005.html or contact:
Maclay Burt, ANBP Executive Director
E-mail: execdir@anbp.org
Phone/fax: (714) 544 8295

First International Symposium on the Biological Control of Bacterial Diseases of Plants

October 23-26, 2005
Darmstadt, Germany
For more information contact Prof. Dr. W. Zeller by e-mail at symposium2005@bba.de or visit the Symposium website at www.bba.de/veranst/bcbpd_2005/bcbpd.htm

6th Pacific Rim Conference on the Biotechnology of *Bacillus thuringiensis* and Its Environmental Impact

Oct 30 - Nov 5, 2005
Victoria, British Columbia, Canada
Both talks and posters in seven specialist sessions, a reception and banquet. For more information contact Lucie Lévesque (e-mail: biocontrol-network@umontreal.ca) or visit the Conference website (www.biocontrol.ca/prc/pacrimconf.html).

International Workshop on "Implementation of Biological Control in Practice in Temperate Regions – Present and Near Future"

01-03 November 2005
Slagelse, Denmark
For more information contact Lise Stengård Hansen by e-mail at lises.hansen@agrsci.dk or visit the website at www.centre-biological-control.dk/activities_uk.htm

59th Annual Canadian Weed Science Society Meeting

Nov. 27-30, 2005
Niagara Falls, Ontario
Everything about weeds, including some biological control. For more information see the meeting website at www.cwss-scm.ca/2005_Meeting.htm

Weed Science Society of America Annual Meeting

Feb 13-16, 2006
New York, NY
Everything about weeds, including some biological control. For more information contact:
WSSA Meeting Manager
(785) 843-1235
email: WSSA@allenpress.com.

Fifth National IPM Symposium

April 4-6, 2006
St. Louis, MO
"Delivering on a Promise" sessions will address state of the art strategies and technologies to successfully solve pest problems in agricultural, recreational, natural and community settings. For more information see the Symposium website at www.ipmcenters.org/ipmsymposiumv/

To receive future notices about the symposium, send your e-mail address to ipmsymposium@ad.uiuc.edu.

California Conference on Biological Control V

July 25-27, 2006
Riverside, California
More details will become available at www.cnr.berkeley.edu/biocon/

American Phytopathological Society Annual Meeting

July 29 - Aug 2, 2006
Quebec City, Quebec, Canada
For more information see the APS website at www.apsnet.org.

International Biocontrol Industry Meeting

23-24 October 2006
Lucerne, Switzerland
The new business meeting of the Biocontrol Industry. An opportunity for manufacturers, distributors, consultants, users, also environmentalists, opinion leaders, researchers and students to meet in order to learn about new products, agents, systems, biocontrol solutions, but also discuss on common interest issues. For more information see the IBMA website at www.ibma.ch/events.html#20061023

XIIth International Symposium of Biological Control of Weeds

early June OR mid-September, 2007
Montpellier, France
The exact date is still to be determined. Visit the Symposium website www.cilba.agropolis.fr/symposium2007.htm for more details.

IOBC Membership Application 2005

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	group C countries, student members (up to PhD)*:	12 €
	group B countries:	8 €
	group A countries:	0 €
__Subscription to BioControl (normal price: 180 €):	add 94 € to membership price	

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E-mail: LiseS.Hansen@agrsci.dk

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International Organization for Biological Control of Noxious Animals and Plants
Nearctic Regional Section

Organisation Internationale De Lutte Biologique Contre Les Animaux Et Les Plantes Nuisibles
Section De La Region Nearctic

http://www.entomology.wisc.edu/iobc/nrs.htm
IOBC website: <www.unipa.it/iobc/view.php>

Send items for the

Winter 2006 IOBC-NRS Newsletter

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The International Organization for Biological Control - Nearctic Regional Section Newsletter is published 3 times a year in February, June, and October to provide information and further communication among members of the Region (Bermuda, Canada, and the United States).

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