International Organization for Biological Control
Nearctic Regional Section
Organisation Internationale de Lutte Biologique
Section de la Region Néarctique

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IOBC-NRS NEWSLETTER

INSIDE THIS ISSUE:

VOTE

Biological Control is Everywhere ! From Microbes to Mammoths

While researching specific aspects of biological control, we may forget how pervasive it is.

The smallest example of biological control, size-wise, is that of bacteriophages. I daresay these organisms are the smallest parasitoids, and they offer hope in quelling problems that we in our Western medicine have created through the medical equivalent of pesticidal control, our heavy reliance on antibiotics. The way in which antibiotics have been overused in domestic animals and in humans has been confirmed by multiple panels of the US National Academy of Sciences -- as if we needed such confirmation of our medically dangerous ecological and evolutionary missteps.

The realization that we as humans have more microbes in and on us than we have cells or our own, and that these constitute important, many times valuable ecosystems which act to suppress pathogens, should come as no surprise (see also Biocontrol Musings, page 8). But, alas, it does come as a surprise, to most. Biological control must gain a higher profile with the public as well as with the scientists, medical professionals, and many others who, knowingly or unknowingly, manage the myriad ecosystems of our Earth.

And, the mammoths. At the other end of the spectrum from phages is the prevailing theory on extinction of our native North American megafauna in which we humans, as predators, using social organization and a few simple tools, preyed on the mammoths and other megamammals, arguably a very large if regrettable example of biocontrol in action. Amongst large predators today, we see the beneficial effects of predation by re-introduced wolves on the elks in Yellowstone National Park. By reducing elk residence in riparian areas, a relatively small number of wolves have restored the streamside vegetation, aquatic invertebrates, along with trout and other fish. Who would have thunk that!

Biological control is everywhere: this is the message. Study of natural enemy interactions and the ecological systems in which they occur, leads to a better understanding of interactions between organisms we seek to manage, and those which offer effective control. When we fail to consider and integrate the lessons and strategies of biological control – and this is all too often – we do so at our own peril.

Short Course on Carabids a Success

The 3rd "Natural History and Taxonomy of the Carabidae" short course was held at Oak Lake Field Station in Brookings County, SD from June 15-19, 2012. The course had a record number of students (17 total) from 10 States and 2 Foreign countries (Canada and Spain). Many of these were graduate students, but we also had representatives from industry and USDA-ARS. Five instructors, each an international expert in their area, came to the station to help with the course, reports Jon Lundgren, lead instructor and organizer.

Carabid taxonomy & phylogeny *(Kip Will, Foster Purrington, Jon Lundgren)*

We spent a lot of time in the course learning to navigate the major keys to genera of the Carabidae. The main reference for this section of the course was the Carabidae chapter in American Beetles Vol I (2001; Ball and Bousquet were the chapter authors). Students became familiar with keying out specimens from 33 genera (17 Tribes) commonly encountered in pitfall sampling. Also, Kip gave a synopsis of the current phylogeny to the Carabidae, as well as a good introduction to carabid morphology.

..... *(continued on next page)*

From the President

Biological Control and Invasive Species

Invasive species have become an everyday fact of life for most humans. For biological control scientists, the opportunity is in how we position ourselves to deal with this reality.

The pervasive extent and impact of human influence over every ecosystem on the globe has prompted many to informally deem our present age as the Anthropocene, a.k.a. the human epoch. One of the manifestations of planetary human impact is the widespread occurrence of invasive species. Trade globalization and increased human mobility have served as vectors, providing increased opportunity for species to move about the planet. In spite of our best efforts to detect and exclude non-native species, human society is increasingly hampered by the impacts of invaders. Non-native plants, animals, and diseases threaten human economies, biodiversity and ecosystem services -- the benefits we derive from biodiversity. This is an opportunity and a challenge for biological control.

The opportunities are obvious. Growing populations of invaders suggest increasing opportunities for us to research and implement biological controls to help manage them. However, concomitant with the rise in public awareness of invasive organisms, many citizens now openly question the wisdom of introducing additional exotic organisms to control others. From my perspective, therein lies the opportunity for biological control scientists to enter the debate.

We need to objectively educate ourselves and the public about the risks and benefits of biological control. Moreover, to maintain our credibility, we need to openly address cases where biological control has been practiced inappropriately, and how what we have learned from past missteps now guides our best practices. We must be clear with the public that biological control is not a panacea, and that to ensure safety and effectiveness, the necessary research and development efforts are often painfully slow. While these conversations are not always easy, in the long run they are essential to assure that biological control remains a viable option for future generations.

Douglas A. Landis, landisd@msu.edu
Michigan State University, East Lansing

Tackling the Grand Challenges

In this year's President's Messages, Doug Landis explores the role of biological control in addressing some of the grand challenges in science including food security, invasive species, and land use change.

2012 Carabid Beetle Workshop *(continued from first page)*

Carabid feeding behavior *(Jon Lundgren)*

Students were given an introduction to the various feeding ecologies of carabid beetles, the importance of linking structures to function, and how nutritional ecology shapes carabid communities. Students learned to conduct an ELISA-based gut analysis of prey that had been surface marked with Rabbit IgG protein, and we conducted nocturnal observations of carabid predation on sentinel larvae.

Communication systems of insects
(Dan Howard & Carrie Hall)

A lecture to the importance of communication systems to the biology and behavior of insects was presented. To reinforce this lecture, students participated in a range of laboratory exercises that highlighted vibrational communication systems in insects, and we recorded some of the first vibrational signals from carabid beetles using a laser vibrometer.

Invasive carabid beetles *(Kamal Gandhi)*

There are many species of exotic carabid beetles currently in the U.S., but aside from a few exceptions the ecological impacts of these invasive species are largely unknown. The lecture material from this unit focused on forest species, and how native and exotic carabids respond to disturbances in this habitat. A teaching unit (the invasive carabid board game) was used to reinforce the key ideas of how species within a carabid community respond to disturbance events.

Other units

Discussions were also focused on the gut microbiology of carabids, carabid defensive systems, and the internal gut physiology of carabid beetles (using new imaging technologies- thanks to Jake Socha for this). Gary Larson from SDSU gave a wonderful tour of the vegetation of Oak Lake Field Station.

RESEARCH BRIEF:
Brown Marmorated Stink Bug Classical Biological Control Project

by Kim A. Hoelmer, USDA-ARS Montpelier, France, and Newark, Delaware, USA

Brown marmorated stink bug (*Halyomorpha halys*) is one of four target insect pests of crop plants in my importation biocontrol research program at the Beneficial Insect Introduction Research Unit at Newark, DE (the other targets are tarnished plant bug, spotted-wing drosophila, and soybean aphid).

In 2005 we began to monitor the activity of indigenous parasitoid wasps that attacked the invasive BMSB in the mid-Atlantic states region to determine whether or not a classical (importation) biological control program would be warranted in the event the stink bug became a significant pest. Our surveys from 2005-2011 have shown that, although indigenous egg parasitoids (chalcidoid and scelionid wasps) and adult parasitoids (tachinid flies) do attack BMSB at very low levels (typically less than 5%) they do not exert significant impact on BMSB populations here. Indigenous egg parasitoids include several generalist species (*Anastatus* spp., Eupelmidae) which attack a wide range of insect orders and families without great impact, and several *Trissolcus* species (Hym.: Scelionidae). *Trissolcus* species are specialist egg parasitoids of Pentatomidae and are capable of causing substantial egg mortality, but given their low parasitism rate on BMSB the indigenous North American *Trissolcus* species (whose natural, pre-BMSB hosts are other resident stink bug species) appear poorly adapted to BMSB. The tachinid flies (several unknown species) that lay eggs on adult BMSB in the mid-Atlantic states do not complete their development on BMSB, as we only rarely rear adult flies from hundreds of adult BMSB with deposited fly eggs.

Below:
adult *Trissolcus* egg parasitoid. Photo: M. Buffington/ ARS SEL

We also record levels of predation of BMSB egg masses. Although our surveys were not designed to capture and identify predators, we have found that predators include generalist predators such as ants, earwigs, lacewings, etc. In 2010 as BMSB populations skyrocketed we also observed significant levels of egg predation by BMSB itself. Apparently they are not above eating their own kin when hungry. Our monitoring surveys to date have concentrated on landscape and ornamental host plants, but together with cooperators in the recently-formed BMSB Working Group surveys are being expanded to include different crop types (fruits, vegetables and soybeans), as it is possible that levels of natural enemy activity will vary according to habitat and plant host.

Beginning in 2005 I also initiated foreign exploration in Asia (China, Japan and South Korea) to find natural enemies adapted to BMSB in its native range. Tachinid flies are known to attack BMSB in Asia, but without much apparent impact. Egg parasitoids appear to be the most promising agents and we currently have in culture at our quarantine facility in Newark a dozen populations comprising four species of Asian *Trissolcus* obtained from BMSB in Asia. The *Trissolcus* species attacking BMSB in Asia typically cause very high rates of parasitism (50-80%) and are clearly well-adapted to BMSB. At present there is little knowledge in Asia of the full host range of these species beyond BMSB, and without field studies in Asia we cannot be certain of their realized host range in nature. Such information would be very helpful in conducting our own host range evaluations in North America.

To prepare for potential requests to release Asian *Trissolcus* species, we have initiated host range/specificity experiments in our quarantine at Newark, and have begun testing a variety of North American pentatomids. Results are still preliminary and more extensive evaluations that include a broader range of species are required before any agents can be identified as suitable for field release. We hope to have sufficient data to support a release petition within the next year or two if host range results are satisfactory.

For further information, please contact any one of us:

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Candidates for the IOBC NRS Election

(*first page of four!*)

President-Elect

Donald Weber

Don has worked on environmentally friendly pest management in a variety of fruit and vegetable systems such as apple, cranberry, cole crops, sweet corn, and cucurbits. He holds a Masters from UC Berkeley and PhD from UMass Amherst. His research with USDA ARS at Beltsville, Maryland, focuses on biological and pheromonal control of chrysomelid beetles and other vegetable pests. This includes cultural controls to enhance conservation biological control, semiochemical manipulation both of natural enemies and of pests, and diel patterns of predation. His recent focus on small farms and urban gardens will allow some interesting studies as to how scale and different types of diversity affect small agroecosystems which may be distant from or close to surrounding ecosystems and their services such as biological control. He is currently IOBC NRS Corresponding Secretary.

From the By-laws: The President-Elect shall serve two years as President-Elect and the following two years as President. The President-Elect shall assume the office of President at the close of the annual meeting held at the end of the term of the incumbent President. A vacancy in the office of the President-Elect shall be filled as soon as practical by written ballot. The President-Elect is the chair of the membership committee.

Secretary-Treasurer

James Harwood

James is an Associate Professor of Insect Ecology within the Department of Entomology at the University of Kentucky. His research interests lie at the interface between food web ecology and biological control, with a particular focus examining predator-prey dynamics in agroecosystems. After a B.Sc. (Hons.) and Ph.D. from Cardiff University (1997, 2001), James continued developing his interests in biological control with postdocs in the United Kingdom and U.S. before joining the faculty at the University of Kentucky in 2007. A member of IOBC-NRS since 2004, Harwood served as a Member-At-Large from 2006-2008 and has held various positions within the Entomological Society of America (International Branch President 2010, International Affairs Committee Chair 2009, Membership Committee Chair 2012). He is also a current Editor of Biological Control and serves on the Editorial Board of Functional Ecology and Agricultural & Forest Entomology.

From the By-laws: The Secretary-Treasurer shall have custody of all accounts, securities, property, and records of the Region. The Secretary-Treasurer shall prepare an annual budget, maintain membership and fee records, and pay the annual global membership fee and member subscriptions to BioControl.

Corresponding Secretary

Jana Lee

Jana is a Research Entomologist at the USDA ARS Horticultural Crops Research Unit in Corvallis, Oregon. Her laboratory studies the behavior of insects to develop biologically-based pest control on spotted wing drosophila, brown marmorated stink bug, raspberry aphid, and black vine weevils. Jana focused on conservation biological control for her MS and PhD at Michigan State Univ. and Univ. of Minnesota, and on bark beetle IPM for her postdoctorate at UC Davis / Forest Service. Jana has been a member of IOBC since 2003.

From the By-laws: The Corresponding Secretary shall be responsible for publication of the Regional Newsletter and shall act as a liaison for Regional information to be included in the global newsletter. The Corresponding Secretary shall also keep minutes of annual meetings and meetings of the Governing Board. [NOTE: Duties now include website maintenance.]

Candidates for Vice President in the IOBC NRS Election

Stefan Jaronski

Stefan Jaronski obtained his M.S. (1972) in parasitology and Ph.D. (1978) in entomology (insect pathology) from Cornell University, where he studied Microsporida in blowflies and mosquitoes, respectively. After two postdoctoral appointments concerning biocontrol of mosquitoes, he did an abrupt left turn leaving the academic community for industry, and changing from medical entomology to agricultural pests. Jaronski worked at Abbott Laboratories from 1983 to 1992, during which time his research involved commercial development of *Beauveria bassiana*, then *Bacillus thuringiensis* against a wide variety of insects. From 1992 until 2000 he worked at Mycotech Corp., Butte MT, a small venture biotech group commercializing Beauveria-based mycoinsecticides, and was involved in all aspects of commercial development, from early, basic research through field efficacy trials to generation of registration data, from basic mycology to formulation chemistry, from science to marketing. Jaronski joined USDA ARS Northern Plains Agricultural Research Laboratory in Sidney MT in March 2000 as Research Entomologist. Jaronski's research at Sidney centers on microbial control of grasshoppers on U. S. rangeland (as well as a lot of fingers in a lot of other pots). Jaronski has been a member of Nearctic Regional Section since 1993, serving as member-at-large 2000-2002, and Secretary-Treasurer 2002-2012. In addition he is currently Chair of the Microbial Control Division within the Society for Invertebrate Pathology.

Raul Medina

Raul F. Medina is an Associate Professor at Texas A&M University. He obtained his PhD on Entomology in 2005 from the University of Maryland and joined Texas A&M as an Assistant Professor in 2006. His research interests explore the role that ecological factors play in insect population genetics. He is studying how host-plant and bacterial associations, pheromone production, and mating behavior influence the way insect populations are genetically structured. He has organized several symposia on the role of ecology and evolution in understanding insect pests. He regularly teaches general entomology and integrated pest management at Texas A&M University.

From the By-laws:
The Vice-President serves as the program chair for the Regional Section. In case of the inability of the President to serve, the Vice-President shall become President for the remainder of the current term of office.

Cynthia Scott-Dupree

Cynthia Scott-Dupree is a Professor in the School of Environmental Sciences at the University of Guelph, and has been a faculty member since 1986. She received her Master of Pest Management (1983) and her Ph.D. (1986) from the Dept. of Biological Sciences at Simon Fraser University, Burnaby, B.C. Her research interests include developing and improving integrated management programs for insect crop pests using environmentally compatible control tactics, and the impact of agroecosystems (e.g., horticultural and greenhouse) on non-target beneficial insects such as pollinators - honey bees, bumble bees and native bees, and biological control agents. She has been a member of IOBC for many years and is currently a Member-at-Large for IOBC-NRS.

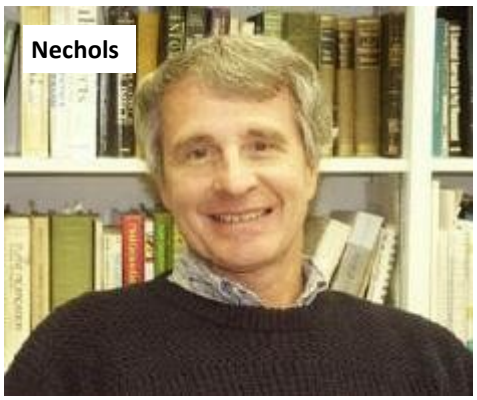
Right: Larva of *Stethorus*, a coccinellid specializing on tetranychid mites as prey

Candidates for Member at Large in the IOBC NRS Election

(*three to serve on the Governing Board; continues on page 7*)

Rose Buitenhuis

Rose Buitenhuis is a Research Scientist in Biological Control at the Vineland Research and Innovation Centre, Ontario, Canada. She is responsible for the development and implementation of bioprotection technologies for arthropod pests supporting sustainable crop management practices for ornamental and production horticulture. Rose received her MSc in Biology at the University of Leiden in the Netherlands in 1997 and her PhD in Entomology at Laval University, Québec in 2003. She worked as a post-doctoral fellow at Agriculture and Agri-Food Canada in Harrow (2004-2007) and at the University of Guelph (2007-2009) on biological and cultural control of western flower thrips in greenhouse flower crops. Current projects and interests include integrated pest management in greenhouse and nursery ornamentals, berry crops and ethnic vegetables with a focus on biological control. Rose has been a member of IOBC since 2005.



Steven Frank

Dr. Steven Frank has been an Assistant Professor in the Department of Entomology at North Carolina State University since 2008. His Master's and Ph.D. research at the University of Maryland focused in the area of conservation biological control. At NCSU he conducts research to improve IPM and biological control in urban landscapes, nurseries, and greenhouses. He is particularly interested in the environmental and ecological processes that cause biological control to succeed or fail. Dr. Frank is currently president of the North Carolina Entomological Association and has been a member of IOBC since 2002.

James Nechols

Jim Nechols is a Professor of Entomology at Kansas State University. His research specializations are biological control, ecology and behavior of enemy-pest interactions, and alternative pest management. He has been a member of IOBC for many years and served on the Executive Board as Secretary-Treasurer in the mid-1980s. Jim has worked on several biological control projects involving arthropod pests and he also led two projects on biological control of weeds. The majority of his research is focused on interactions of natural enemies with their biological and physical environment. Currently Jim is subject editor (biological control section) for Environmental Entomology, and previously served as principal editor for Crop Protection. Jim has co-edited two books on biological control.

Kevin Heinz

Dr. Kevin M. Heinz's major research focus has been to advance biological control in greenhouse horticultural systems through a fundamental understanding of basic ecological principals. By elucidating the fundamental principles associated with parasitoid sex allocation behavior and foraging strategies, Dr. Heinz has significantly advanced the adoption of biological control at the grower level. This approach of conducting discovery research with an idea on how this research can be

applied to real world problems has generated an outstanding peer-reviewed publication and grantsmanship record, as well as a strong record of delivering feasible, science-based recommendations to biological control practitioners. Dr. Heinz received his Ph.D. in entomology from the University of California, Riverside in 1989. He first became an assistant professor of entomology at Texas A&M University in 1994 and continues to be on the faculty as Professor of Entomology where he maintains an administration, teaching, research, and service appointment.

Candidates for Member at Large in the IOBC NRS Election

(*three to serve on the Governing Board; continued from page 6*)

Cesar Rodriguez-Saona

Dr. Cesar Rodriguez-Saona is an Associate Professor and Extension Specialist in Blueberry and Cranberry IPM at Rutgers University. He received his M.S. degree from Oregon State University and his Ph.D. from the University of California, Riverside. Prior to joining Rutgers University, he worked for the USDA-ARS in Phoenix, AZ, University of Toronto, and Michigan State University. The goal of his research program is the development and implementation of cost-effective and reduced-risk IPM practices for blueberries and cranberries that are compatible with biological control agents. He is pursuing this goal by integrating chemical, behavioral, and biological methods in insect control and by gaining a better understanding of the ecology of pests and their natural enemies. His extension program delivers current and critical IPM information to growers. The specific areas of expertise within his research program include Biological Control, Tri-trophic Interactions, Integrated Pest Management, Insect Chemical Ecology, Insect-Plant Interactions, and Host-Plant Resistance.


Rodriguez-Saona


Tooker

From the By-laws: The Members-at-Large shall serve as chairs of special committees or projects established by the membership or the Governing Board to facilitate meeting the objectives of the Regional Section and global organization. ... Members-at-Large shall serve for a period of two years and are not eligible for a second consecutive term.

John Tooker

John Tooker is assistant professor of insect ecology and extension specialist in the Department of Entomology at Penn State University. His research and extension programs aim to improve field and forage crop resiliency through both bottom-up and top-down effects. Much of his research focuses on natural-enemy mediated pest control, often studying farming strategies and tactics that either bolster or disrupt biological control. Other research interests include plant-insect and tritrophic interactions, conservation biological control, chemical ecology, and induced host-plant defenses.

Stefan Jaronski reports: In case you haven't checked **YouTube for Biocontrol Videos**, there are quite a number on the website. Here are just a few more notable ones:

A Primer for **Biological Control Featuring Pac-Man**: http://www.youtube.com/watch?v=9mb58W25cms A video created by Rob Mitchell, a PhD candidate at the University of Illinois at Urbana-Champaign, in 2009, illustrates biological control techniques using the video game Pac-Man. According to Mitchell, "This video was designed to help students learn the principles of biocontrol by associating them with something familiar and easy to remember (and, I hope, a little humorous!)."

Koppert has created an animation, "**Biological crop protection: 2 examples**" describing *Aphidius* attacking aphids, and predaceous mites. http://www.youtube.com/watch?v=Hj3DwimxvvY&feature=related

Biobest has a video of "**Plagas y Predadores BIOBEST**" showing a range of natural enemies attacking various greenhouse pests as closeup, action images. http://www.youtube.com/watch?v=uRxU15SLVho&feature=related

USDA APHIS has its own video, "Biological Control - A Natural Alternative" at http://www.youtube.com/watch?v=XqbRumA5jeg&feature=related

Biocontrol of weeds is represented by 2012 Gorse Workshop: **Gorse Biocontrol** - Past, Present, and Future; Eric Coombs, Biological Control Entomologist, Oregon Dept. Agriculture, at www.youtube.com/watch?v=DEWPQQUWeq4

Landcareresearch has a video, "**Biocontrol Research in the United States**" at http://www.youtube.com/watch?v=M8WO0-oqd7A

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Biocontrol Musing:

The human microbiome and medical biological control

The recent large-scale characterization of microbial communities within the human body (the 'human microbiome') is a spectacular scientific achievement that will likely lead to important medical advances. And anyone reading about the new discoveries coming out of this work in either the scientific or popular literature will have noticed the ecological interpretation being given to the human microbiome, including in some cases clear allusions to biological control processes. This view of microbial interactions within the human body will bolster previous reports of 'good' bacteria suppressing 'bad' bacteria leading to good health (e.g. see my column from the Fall 2010 issue of this newsletter). The application of ecological theory to the human microbiome has begun – including discussions of how within-body 'ecosystem services' can be best managed to improve health. I think that biological control scientists

are well-positioned to make useful contributions to a new and potentially vast area of science – medical biological control. So far however, there has been little collaboration among medical microbial ecologists and biological control scientists – hopefully this will change in the near future to produce synergisms leading to better human health and a clearer understanding of ecological processes occurring within our bodies and outside of it.

Costello, E. K., K. Stagaman, L. Dethlefsen, B. J. M. Bohannan, and D. A. Relman. 2012. The Application of Ecological Theory Toward an Understanding of the Human Microbiome. Science 336:1255-1262.

Huttenhower, C., D. Gevers, R. Knight, S. Abubucker, J. H. Badger, A. T. Chinwalla, H. H. Creasy et al. 2012. Structure, function and diversity of the healthy human microbiome. Nature 486:207-214.

Papa E, Docktor M, Smillie C, Weber S, Preheim SP, et al. (2012) Non-Invasive Mapping of the Gastrointestinal Microbiota Identifies Children withInflammatory Bowel Disease. PLoS ONE 7(6): e39242. doi:10.1371/journal.pone.0039242.

The Economist (unsigned) 2012. The human microbiome: me, myself, us. The Economist 404 no. 8798, pp, 9, 69-72.

artwork from: http://www.helpyourautisticchildblog.com/probiotics/385-the-benefits-of-bacteria/

George Heimpel
Department of Entomology
University of Minnesota

continued from page 7 ...

A brief 2011 video by ND SARE, "**Biocontrol on Rangeland**", highlights two biocontrol procedures used on the Ken Miller ranch near Fort Rice, ND. One is for leafy spurge and the other for biting flies. http://www.youtube.com/watch?v=_65hYQfYxOA

University of Florida has several videos regarding biocontrol. One, "**Tropical Soda Apple**: Biocontrol in Action" features a closeup video of tortoise beetles feeding on a leaf of tropical soda apple. The tortoise beetle, *Gratiana boliviana*, is an effective biological control agent in the fight against this noxious weed found in Florida pastures. http://www.youtube.com/watch?v=5UclIYaPVxU Another, "Using Beneficial Wasps as Biological Control of Pest **Mole Crickets**" at http://www.youtube.com/watch?v=dom_N-d7YuE&feature=BFa&list=ULhXiwXbuBtDM , features Howard Frank discussing *Larra bicolor*, a beneficial wasp, attacking mole crickets. In a related video entomologists Norm Leppla and Howard Frank discuss three pest biological control agents imported, and released to control pest mole crickets in Florida -- a fly, a wasp, and a nematode. "Biological Control of Mole Crickets: A Fly, a Wasp and a Nematode" at http://www.youtube.com/watch?v=WQJwyyZUesw&feature=BFa&list=ULdom_N-d7YuE

Coffee Grower Generates Video on Coffee Berry Borer Management: In September 2010 the coffee berry borer was discovered in the famed Kona Coast of Hawaii, home to a premium variety of coffee. The discovery, and subsequent documentation of the insect's widespread establishment, set off a panic among the growers, and a rapid fixation on a commercial strain of the entomopathogenic fungus, *Beauveria bassiana* for their salvation. However, as a result of USDA ARS technical advice, one Kona coffee grower, Suzanne Shriner and Kamehameha Schools, have created a video instructing farmers about creating an Integrated Pest Management program for the borer that includes the *Beauveria*, but does not depend on the microbial. A model for other systems.

There are many more to be found on the YouTube website. Try using search terms of biocontrol, or biological control.

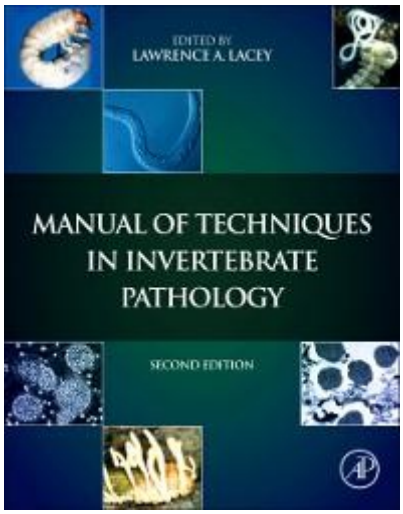
Web resource:

Directory of Microbial Pesticides for Agricultural Crops in OECD

Sponsored and hosted by Agriculture Agri-Food Canada https://www4.agr.gc.ca/MPDD-CPM/search-recherche.do?lang=eng One can search by target pest or crop, product name or active ingredient name or type, OECD country registration, and manufacturer. The database covers microbial, entomogenous nematodes, and biorational chemicals. For example, a braod search for Metarhizum resulted in:

Product Name	Active Ingredient
BIO 1020	Metarhizium anisopliae
Bio-Cane	Metarhizium anisopliae isolate FI-1045
Chafer Guard / Biogreen	Metarhizium anisopliae strain F001
Destruxin	Metarhizium anisopliae
Green Guard	Metarhizium anisopliae subsp. acridum isolate FI-985
Met52	Metarhizium anisopliae strain F52
Tick Ex	Metarhizium anisopliae strain F52 spores

The 2nd Edition of "Manual of Techniques in Invertebrate Pathology" has just been published, its editor Lerry Lacey reports. Under the Academic Press imprint (ISBN: 9780123868992) and thoroughly updated, it retails for US$149.95.



The second edition of *Manual of Techniques in Invertebrate Pathology* is written by an international group of experts that contribute a broad array of techniques for the identification, isolation, culture, bioassay, propagation, and storage of the major groups of entomopathogens. The manual provides general and specific background to experienced insect pathologists, biologists, and entomologists who work with pathogen groups that are new to them. It is also useful as a laboratory manual for courses in insect pathology and biological control and related areas of study. Safety testing of entomopathogens in mammals and complementary techniques for the preparation of entomopathogens are included as well as broader methods for the study of specimens such as microscopy and molecular techniques. This manual concentrates primarily on practical step-by-step aspects of the techniques, but also provides the reader with a short history, rationale for usage, guides to supplemental literature, plus recipes for media, fixatives, and stains.

- **The text includes:**
- Step-by-step instructions for the latest techniques on how to isolate, identify, culture, bioassay and store the major groups of entomopathogens
- New edition fully updated to address changes in the taxonomy of the vast majority of taxa
- Discussion of safety testing of entomopathogens in mammals and also broader methods such as microscopy and molecular techniques
- Provides extensive supplemental literature and recipes for media, fixatives and stains

International Organization for Biological Control Nearctic Regional Section
Organisation Internationale de Lutte Biologique Section de la Region Néarctique

Visit our website: www.iobcnrs.com
Your content and suggestions are always welcome!

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

Send items for the IOBC-NRS Newsletter to:

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MTI-2: 2nd International Symposium on Molecular Detection of Trophic Interactions May 13 – 17, 2013

Oral and poster presentations are accepted and student/postdoc presentations are particularly welcome.

The 2nd International Symposium on the Molecular Detection of Trophic Interactions will be held in Lexington, Kentucky, USA, from Monday 13 May 2013 – Friday 17 May 2013. The conference will focus on all aspects of trophic interactions in terrestrial, freshwater and marine ecosystems and build on information presented at the first international symposium, held in Innsbruck, Austria, in 2007.

http://www.ca.uky.edu/mti2/

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Upcoming Meetings 2012-13

2012

4-7 November **Entomological Societies of Canada and Alberta,** Joint Meeting, Edmonton, Alberta, Canada. Contact see: http://www.esc-sec.ca/annmeet.html

11-14 November **Entomology 2012, the 60th Annual Meeting of the Entomological Society of America,** Knoxville, Tennessee. Email Meet@entsoc.org. http://www.entsoc.org

2013

4-7 February **Weed Science Society of America Annual Meeting** (joint with NE WSSA) Baltimore, Maryland Email KCounter@allenpress.com http://www.wssa.net.

4-8 March **4th International Symposium on Biological Control of Arthropods** in Pucón, Chile, Contact Tania Zaviezo at tzaviezo@uc.cl www.isbca.org

13-17 May **2nd International Symposium on the Molecular Detection of Trophic Interactions,** Lexington, Kentucky, Contact Organizer James Harwood, James.Harwood@uky.edu; see website http://www.ca.uky.edu/mti2/

10-14 August **American Phytopathological Society** Annual Meeting, Austin, Texas. BFord@scisoc.org http://www.apsnet.org

18-24 October **150th Entomological Society of Ontario** Annual Meeting, jointly with the Entomological Society Of Canada, Guelph, Ontario Info: Nicole.McKenzie@hc-sc.ca http://www.entsocont.ca

17-20 November **Entomology 2013, the 61st Annual Meeting of the Entomological Society of America,** Austin, Texas. Email Meet@entsoc.org http://www.entsoc.org