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Organisation Internationale de Lutte Biologique
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IOBC-NRS NEWSLETTER

INSIDE THIS ISSUE:

From "Dirty Field" to "Open Beneficials Nursery": Managing Prey and Hosts for Natural Enemies

Years ago, Robert Van den Bosch had this fabulously unappealing name for a great idea – "Keep a Dirty Field", that is, keep a low number of pests (or non-pest alternative species) in the field so that natural enemies would remain available when needed to suppress pest populations. This concept is being updated and implemented in a more sophisticated manner, so that it is both more appealing and more effective in greenhouses and in agricultural fields.

On page 2, Sarah Jandricic of Cornell outlines the increasing use of banker plants in greenhouses, and on page 3, Carol Glenister of IPM Laboratories explains how her company's commercially-marketed banker plant system works for greenhouse managers.

On page 5, Charlie Pickett of CDFA describes an exciting field implementation of an "open beneficials nursery" for the braconid parasitoid *Peristenus* attacking Lygus bug, a key strawberry pest of the central coast in California. In this case, alfalfa strips function as open-air trap crops and banker plants to promote effective biocontrol for the surrounding strawberry crop.

Plants shelter hosts and prey for natural enemies in a Connecticut greenhouse, and in a Monterey County California field (photos by C. Glenister & C. Pickett)

IOBC Annual Meeting and Symposium: Biodiversity and Biological Control

On Tuesday evening, 15 November 2011, at 6 PM, IOBC-NRS will have our annual business meeting, followed by the symposium entitled "Biodiversity and Biological Control". The topic of how biodiversity — from the landscape level to the microbial diversity within an insect — contributes to the outcomes of biological control programs has received substantial attention from the scientific community in recent years. This symposium will address key developments in this topic, including how landscape structure affects biological control (Mary Gardiner), whether diversity is a source or a sink for biological control programs (Deb Finke), how food diversity influences biological control (Lundgren), and efforts to harness biodiversity within tropical systems to contribute to biological control of pests (Wyckhuys). The symposium was organized by Jonathan Lundgren and Kris Wyckhuys.

OUR annual meeting

The IOBC Mixer will follow!

Banker Plants in the Greenhouse: Giving Beneficial Insects a Helping Hand

Banker plants, or "open rearing systems" are one of the approaches researchers are exploring to make biological control of insects more efficacious and cost effective, and thus more attractive to growers. Banker plants are non-crop plants that are placed in the greenhouse to provide alternative food for beneficial insects in the form of non-pestiferous herbivore prey, or pollen and nectar. Their primary role is to aid in natural enemy establishment and reproduction in the greenhouse (Frank 2010). Ideally, this can offset the need for weekly releases of natural enemies, and decrease costs to growers. Banker plants also provide a constant source of "fresh" beneficials, which can have superior performance over those that have spent days in transit (Huang et al. 2011). With a predator or parasitoid population already present, crops can be protected from incoming pests. This has proven especially important in aphid biological control (Bennison 1992).

A number of banker plant systems are already in use in greenhouses. Non-pest cereal aphids on barley plants provide parasitoid wasps (e.g. *Aphidius colemani*) that attack pest aphids. These are currently the most commonly used banker plants in the US and Canada. *Trialeurodes variabilis* on papaya plants are hosts and prey for *Encarsia transvena* and *Delphastus* species that attack *Bemisia tabaci*. Castor bean plants produce pollen to support *Amblyseius swirskii* when preying on western flower thrips. Although adoption of banker plant strategies varies greatly between regions (Huang et al. 2011), the approach is generally successful. Some enthusiastic growers even propagate banker plants themselves.

Of course, banker plants are not without challenges. For example, hyperparasitoids of parasitoids can reduce beneficial wasp populations, especially during summer months; prey or food levels must be kept high enough on banker plants to support an effective natural enemy population; and growers must be educated about the proper care and timely replacement of banker plants. Research on these problems, and the development of new banker plant systems, is keeping growers interested and involved, and is helping to increase the adoption of this approach.

References:

Bennison, J.A. 1992. Biological control of aphids on cucumbers. Use of open rearing systems or "banker plants" to aid establishment of *Aphidius matricariae* and *Aphidoletes aphidimyza*. Mededelingen Faculteit Landbouwwetenschappen Rijksuniversiteit Gent 57: 457-466.

Frank, S.D. 2010. Biological control of arthropod pests using banker plant systems: Past progress and future directions. Biological Control 52: 8-16.

Huang, N., Enkegaard, A., Osborne, L.S., Ramakers, P.M.J., Messelink G.J., Pijnakker, J., and Murphy, G. 2011. The banker plant method in biological control. Critical Reviews in Plant Science 30: 259-278.

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Ornamental pepper ("black pearl" variety) provides *Orius insidiosus* (minute pirate bug) with pollen, keeping them in the potted cyclamen crop in order to attack western flower thrips and other pests. Photo, Ronald Valentin, Biobest USA Inc.

Barley plants (upper left, hanging) hosting *Rhopalosiphum padi* for *Aphidius colemani* in a pepper greenhouse. Photo, Dave Gillespie, Agriculture and Agri-Food Canada

Aphid banker plant tucked into pot of plants chosen to provide habitat for natural enemies such as *Orius insidosus* and *Aphidius colemani* in an outdoor nursery at Michaels Greenhouse in Cheshire, CT. Photo, Carol Glenister, IPM Laboratories

The News on Biocontrol is local, and it's about people

Message From the President: Biocontrol in the News

In the past few IOBC-NRS Newsletters, I have been encouraging us to consider how we communicate our science to stakeholders. To explore this topic myself, I decided to see how the news media covers biological control and what we might learn from an examination of recent history. To get an idea of what's being covered and how, I ran a GOOGLE NEWS search on the terms "biological control" and "biocontrol" and found a surprising number and variety of reports. For example, as I write this there have been 7 news reports on biological control in the past 24 hours alone (one in the last minute), ranging from the use of *Trichogramma* versus rice stem borer in India, to use of *Bacillus thuringiensis* against cabbage white butterfly larvae in Irish home gardens. Even confining ourselves to the Nearctic region, we find US Senator Kay Bailey Hutchison applauding the use of salvinia weevil on a Texas National Wildlife Refuge, and an Ontario farmer awarded for innovation in using habitat management to enhance pest control in grape vineyards.

Digging a bit deeper, I found 72 articles that included the phrase "biological control" in the past 30 days, of which only seven were irrelevant (e.g. biological control of a physiological process, etc.). Of the relevant articles, 43% addressed biocontrol of insects, 32% biocontrol of weeds, and 8% biocontrol of vertebrates with one article each on biocontrol of slugs and plant diseases. The remainder addressed topics such as biological control in a more general way, e.g., as a pesticide alternative, or

Virtually all articles had some local spin (e.g., new pest threatens local crops, or biocontrol releases proposed in a specific locale). Quite a few articles were aimed at homeowners or gardeners and mentioned biological control options for specific pests. Others reported on active or anticipated biocontrol release efforts. Many of these featured quotes from land managers who generally spoke favorably about the use of biological controls. Negative comments about biological control generally addressed the chance for unintended or non-target effects, or in one case the potential for a costly failure. About half the articles mention scientists or scientific research, and in somewhat of a surprise to me, politicians were quoted just as frequently as were scientists!
So what are the take-home lessons? 1) On average worldwide, the media feature biological control several times per day. Not bad, I guess; however, a similar search for "Lindsey Lohan" produces 115-fold more hits! 2) It appears that, like politics, all biocontrol is local; suggesting that for overall success stakeholder buy-in is critical. 3) Finally, as much as we love the science, it is people that the media report on -- and to. Figuring out "who cares" about your story seems to be a key to getting our science into the public media.

Looking forward to seeing you all at the IOBC-NRS Symposium Tuesday evening November 15th in Reno!

Douglas A. Landis
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A Commercial Aphid Banker Plant System: The Aphid Guard ™

IPM Laboratories started producing aphid banker plants in 2006. The product consists of a block of approximately 3 inch by 6 inch foam sheet media covered with densely seeded young barley plants infested with the bird cherry-oat aphid, *Rhopalosiphum padi*. Growers buy the plants, divide and replant them into pots in separate pots. The sheet of barley is planted too densely to survive its own allelopathic effects, so division and replanting is essential. The product includes additional barley seed for growers to produce more barley and more aphids.

Even though there are 5 to 10 thousand aphids on each block of barley, they must reproduce for another 2 weeks after arrival at the grower to have enough aphids to survive the attack of the aphid parasitoid, *Aphidius colemani*, or the aphid midge, *Aphidoletes aphidimyza*. Thus the natural enemies are shipped in a separate order two weeks after the banker plants. The virus-free aphids are shipped under an APHIS permit to move live plant pests, which accompanies every shipment.

Healthy banker plants produce a constant supply of aphids which in turn support continuous reproduction of aphid parasites and/or the aphid midge. Greenhouse growers benefit by having a reproducing natural enemy population in the greenhouse that can find and attack pest aphids on the crop as soon as they appear. It also reduces their costs for regular shipments of natural enemies via overnight freight.

Growers willing to do the extra work must care for the barley plants differently than their crop because the plants have greater water requirements (top photo front page) and keep a separate caged aphid parent culture free from natural enemies. They are advised not to maintain the plants in late summer, to avoid carrying hyperparasites through the winter.

Carol Glenister,
IPM Laboratories, Locke, New York, www.ipmlabs.com

Biodiversity and Biological Control Short Course a success in Cali

The IOBC-sponsored shortcourse Biodiversity and Biological Control was held near Cali, Colombia on September 12-17, 2011 at CIAT (International Center for Tropical Agriculture) and Yotoco Nature Preserve (operated by Universidad Nacional). The short course, part of the IOBC-NRS education curriculum, was also supported in part by IOBC-Global and was a coordinated effort of the Nearctic and Neotropical Regional Sections.

Students came from four countries, and learned a series of topics from world experts. Specific units of the course focused on the importance of biological control in tropical production systems (led by Kris Wyckhuys), tropical ant ecology in biological control (Inge Armbrecht), natural history of scale insects (Demien Kondo), landscape ecology and its implications for biological control (Tatyana Rand), whitefly biological control (Maria Manzano), and food diversity and biological control and how to diagnose feeding behavior (Jonathan Lundgren).

Additionally, the students were immersed in Colombian culture and spent two nights in a tropical forest.

above: participants at CIAT

left: inspection of sentinel prey in forest

right: Organizer Wyckhuys examining plants in the lab

far right: In the pitaya (dragonfruit) plantation

Biocontrol Musing: Oecophylla weaver ants provide multiple benefits to humans

Weaver ants in the genus *Oecophylla* are native to the old-world tropics, where they have been used as biological control agents of orchard pests for millennia. In fact, the oldest known cases of manipulative biological control involved spanning bamboo rods between citrus trees in China over 2,000 years ago so that the ants could more easily spread throughout the entire grove. All students of biological control are familiar with this story. This and similar strategies have stood the test of time since they continue to this day in tropical Asia, Africa and Australia. As important as *Oecophylla* are as biological control agents, their benefits go beyond just killing orchard pests. When farmers in the Mekong Delta of Vietnam were asked why they favored *Oecophylla* on their citrus trees, the response was that the ants improved fruit quality – not indirectly by suppressing herbivores, but directly by defecating on the fruit! In their words, 'ant urine' improved the appearance and taste of oranges and pomelos, leading to a higher market value. This hypothesis was supported experimentally by a study in which the quality of fruit from trees with and without ants was compared. The interpretation was that presence of *Oecophylla* alters tree physiology in some way (perhaps through defecation) such that the fruit becomes shinier and juicier. The authors of this study deemed it unlikely that the effect was due to indirect benefits of herbivore suppression but could not definitively rule this out. Beyond this purported benefit, *Oecophylla* are favored as a delicacy for humans and pets, used to add spice to chutneys, and also used in traditional medicines (and yes, biological control and harvesting for these purposes can be compatible). All in all, the beneficial qualities of *Oecophylla* seem to be quite multifaceted!

Barzman, M. S., N. J. Mills, and N. T. T. Cuc. 1996. Traditional knowledge and rationale for weaver ant husbandry in the Mekong Delta of Vietnam. Agriculture and Human Values 13: 2-9.

Crozier, R. H., P. S. Newey, E. A. Schluns, and S. K. A. Robson. 2010. A masterpiece of evolution - *Oecophylla* weaver ants (Hymenoptera: Formicidae). Myrmecological News 13: 57-71.

Offenberg, J. 2011. *Oecophylla smaragdina* food conversion efficiency: prospects for ant farming. Journal of Applied Entomology 135: 575-581.

Offenberg, J., and D. Wiwatwitaya. 2010. Sustainable weaver ant (*Oecophylla smaragdina*) farming: harvest yields and effects on worker ant density. Asian Myrmecology 3: 55-62.

Sribandit, W., D. Wiwatwitaya, S. Suksard, and J. Offenberg. 2008. The importance of weaver ant (*Oecophylla smaragdina* Fabricius) harvest to a local community in Northeastern Thailand. Asian Myrmecology 2: 129-138

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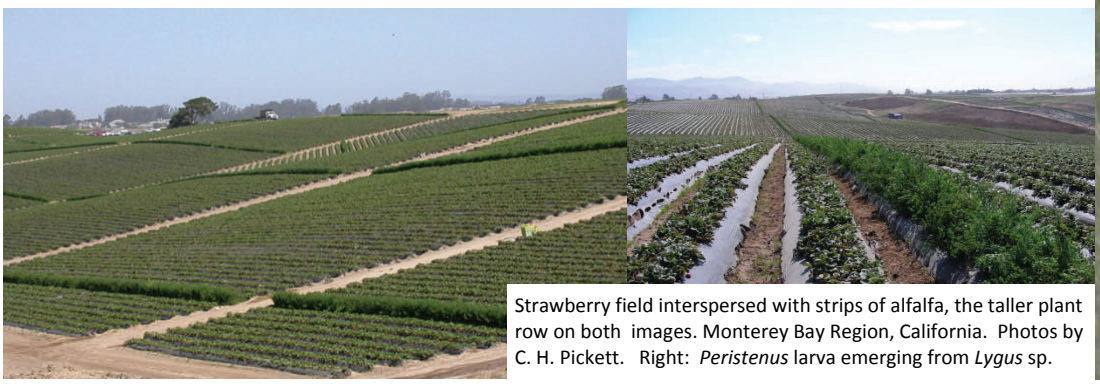
RESEARCH BRIEFS

Strawberries, Trap Crops, and Parasitoids



Strawberry field interspersed with strips of alfalfa, the taller plant row on both images. Monterey Bay Region, California. Photos by C. H. Pickett. Right: *Peristenus* larva emerging from *Lygus* sp.

Trap crops as a concept have been around a long time. Their actual implementation for pest control, however, has until now seen little mileage. With the rapidly expanding farm acreage dedicated to organic produce, the demand for pesticide free alternatives has greatly escalated. This demand has led to the resurrection of an old idea, but in a very novel way.

Trap crops of alfalfa interspersed into strawberry fields along the central coast of California are being used to manipulate the spatial distribution of lygus bugs, a key pest to this highly sought after commodity. Alfalfa is used to attract lygus bugs out of, or away from, strawberries. High spatial concentrations of lygus bugs in alfalfa have several impacts. First, they can reduce the number of lygus bugs feeding on strawberries and make their removal (via vacuum) more efficient. Secondly, high concentrations of lygus bugs could benefit the introduced lygus bug parasitoid *Peristenus relictus*. As with many specialized parasitoids, there is a density-dependent response by *P. relictus* to lygus bug numbers. Hence, a clustered distribution of lygus bug nymphs provides pockets of high host densities that help elevate parasitism rates and subsequent numbers of *P. relictus* adults. The high concentrations of *P. relictus* in these strips spill out and attack the remaining, much lower densities of lygus bugs in adjacent rows of strawberries.

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University of California, Santa Cruz
James Hagler, USDA ARS, Maricopa, Arizona

Classical biological control of cabbage maggot revisited

Cabbage maggot, *Delia radicum*, is of European origin. It has long been a pest of brassicaceous vegetables in North America, and since the 1980s has caused losses in canola in Canada. Classical biological control in Canadian vegetable crops was attempted in the 1950s and abandoned when the introduced agents were found to be already present under different names. Insecticidal control in vegetables is the norm, but is not feasible in canola. Therefore, my students and I at the University of Manitoba, in collaboration with Ulli Kuhlmann, CABI Europe-Switzerland, are re-examining classical biological control of *D. radicum* with a focus on the canola system.

Initially, we compared the Nearctic and Palearctic parasitoid communities of *D. radicum* to identify gaps in the Nearctic community. As a result, the staphylinid beetle, *Aleochara bipustulata*, was selected for study. Adult *A. bipustulata* eat D. radicum eggs and the larvae parasitize *D. radicum* pupae. The species definition of *A. bipustulata* is recent, and the literature reports Nearctic records; so with taxonomic help from both sides of the Atlantic, all available Nearctic specimens were examined, to avoid repeating the errors of the 1950s' program.

We found no evidence that *A. bipustulata* occurs in North America. We have characterized the habitat preferences and host range, and predict that if introduced, *A. bipustulata* will parasitize a narrow range of Diptera in crops and similar habitats. Current studies of cues for host and habitat selection, and on the fitness of *A. bipustulata* that emerge from non-target hosts, will further delineate threats to non-target species. The prey range of adults appears to be remarkably narrow. We are investigating interactions among natural enemies of *D. radicum* to assess whether addition of *A. bipustulata* to the Nearctic natural enemy community will indeed increase *D. radicum* mortality and so tend to reduce populations of the pest.

Aleochara larva attacking puparium
Photo Lars Andreassen

A. pustulata adults and *Delia* larva
Photo Kim Riley

Neil Holliday
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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).

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New, free e-books on Canadian grassland arthropods

The Biological Survey of Canada (http://www.biology.ualberta.ca/bsc/english/overview.htm), a non-profit promoting awareness of Canada's arthropod species, recently published two books on arthropods of Canada's grasslands. Volume 2 will probably be of greatest interest to biocontrol researchers. One chapter provides an exhaustive summary of biocontrol agents released in Canada against weed and arthropod pests (see photos, page 7). Another summarizes the programs and legislation that exists to protect 'species at risk' (including arthropods) in Canada, which has potential implications for the release of biocontrol agents. Further chapters are devoted to pest and beneficial arthropods associated with stored grain products, crops, and livestock.

Each book is freely available in PDF format via the links below:

Shorthouse, J.D. and Floate, K.D. (eds). 2010. Arthropods of Canadian Grasslands (Volume 1): Ecology and Interactions in Grassland Habitats. Biological Survey of Canada, Ottawa, ON. 358 pp. (http://www.biology.ualberta.ca/bsc/english/grasslandsbook.htm)

Floate, K.D. (ed.). 2011. Arthropods of Canadian Grasslands (Volume 2): Inhabitants of a Changing Landscape. Biological Survey of Canada, Ottawa, ON. 371 pp. (http://www.biology.ualberta.ca/bsc/english/grasslandsbook2.htm)

Hard copies can be purchased via a 'print on demand' option for a small fee.

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Upcoming Meetings 2011-2012

6-9 November

Entomological Society of Canada & Acadian Entomological Society Joint Meeting, Halifax, Nova Scotia http://www.acadianes.ca/2011jam/

13-16 November

Entomological Society of America Annual Meeting, Reno, Nevada. Email meet@entsoc.org http://www.entsoc.org

22-24 November
Canadian Weed Science Society Annual Meeting, Niagara Falls, Ontario. http://www.weedscience.ca

6-9 February
Weed Science Society of America Annual Meeting, Big Island, Hawaii. Email KCounter@allenpress.com http://www.wssa.net.

27-29 March
7th International IPM Symposium, Memphis, Tennessee. Contact: E. Wolff, Conferences & Institutes, Wolff1@illinois.edu 217-333-2880 http://www.ipmcenters.org/ipmsymposium12/

4-8 August
American Phytopathological Society Annual Meeting, Providence, Rhode Island. Email BFord@scisoc.org 651-454-3848 http://www.apsnet.org

19-25 August
24th International Congress of Entomology, Daegu, South Korea. Email president@int-cong-ent.org http://ice2012.org

Biological Control: Symposia at 2011 ESA Meetings

***** Ctrl-Click on any title to see details of that Symposium *****

Editor's note: I realize there are many other presentations and posters addressing biological control topics and research. This list is just to make sure you don't miss out on whole symposia of interest. See you Tuesday night at the IOBC meeting & symposium!

Mogulones crucifer (above left), a rapid success in the biocontrol of houndstongue (*Cynoglossum officinale*) (above right), a pest of rangelands in southwestern Canada. Photos, R. De Clerck-Floate, AAFC, Lethbridge, Alberta. From the free e-book Arthropods of Canadian Grasslands (Volume 2); description on page 6.

Sunday morning, November 13:

Greenhouse Pest Management: Past, Present, and Future
Raymond A. Cloyd and Luis A. Cañas (organizers)

Identify and Clarify: Regulatory Compliance for the Rearing, Releasing, Shipping, and Studying of Arthropods in Today's World: Part 1: Demystifying the Permit Process-Understanding the Black Box
Colin Stewart and Kevin Hoffman

Sunday afternoon:

Identify and Clarify: Regulatory Compliance for the Rearing, Releasing, Shipping, and Studying of Arthropods in Today's World: Part 2: Regulatory Compliance for Rearing, Releasing, Shipping, and Studying Arthropods
Scott W. Myers and Lisa Gail Neven

Tuesday morning, November 15:

New Approaches to Mass Production and Augmentation Biological Control
Walker Jones, Sasha M. Greenberg and Norman C. Leppla

Entomopathogenic Nematodes: Their Biology, Ecology, and Application. A Tribute to the Dynamic Career of Harry K. Kaya.
Michael G. Klein, Lynn M. LeBeck, Ed Lewis and David Shapiro-Ilan

Tuesday afternoon:

Biological Control of Invasive Wood Borers: Feasibility, Potential, Progress and Challenges
Jian J. Duan and Juli Gould

Ten-Minute Papers, P-IE Section, Biocontrol - Entomopathogens and Weed Management
John F. Tooker, B. Rogers Leonard and Bonnie B. Pendleton

Tuesday Evening, 6:00 to 8:25 PM (mixer follows)

IOBC Meeting and Symposium - Biodiversity and Biological Control
see page 1 for details

Wednesday morning, November 16:

Evolution and Biological Control
Ruth A. Hufbauer, George Roderick, M. Navajas and Marianna Szucs

Insect Research on the Urban Frontier: Biocontrol and Pollination Services in City Landscapes
Mary M. Gardiner and Donald Weber

New Containment Procedures and Technology for Quarantine and Rearing of Arthropods
Jay S. Bancroft and Jian J. Duan

Wednesday afternoon:

Biodiversity, Global Change and Insect-Mediated Ecosystem Services
Rachael Winfree, Neal Williams and Deborah L. Finke