Biocontrol Files

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Canada's Bulletin on Ecological Pest Management

Shipping biocontrol agents across the U.S. border – the good, the bad, the ugly

PPQ Plant pathologist/identifier

The events of September 11th, 2001 triggered great changes to regulatory systems in the U.S. The Department of Homeland Security (DHS) was established and the Homeland Security Act passed. Imported shipments of live "biological" materials into the U.S. began to receive greater scrutiny. These changes created some initial problems and some ongoing headaches for companies which ship commercial biocontrol agents into the U.S.

Richard Ward, Managing Director of Biobest Canada and President of the Association of Natural Biocontrol Producers (ANBP), explains that, between November 2001 and March 2002, Biobest Canada was not allowed to ship *any* beneficial insects into the U.S. The company took a significant economic hit. By March 2002, the company and U.S. regulators had formulated a rather complicated scheme which enables Biobest Canada to continue shipping commercial parasitoids and predators to its U.S. customers.

First, Biobest's products are shipped by bonded carrier from the company's plant in Leamington, Ontario to the border crossing at Detroit. The carrier then transports the products from Customs and Immigration to the Detroit airport, where they are inspected by staff from the Plant Protection and Quarantine (PPQ) program, a division of APHIS (Animal and Plant Health and Inspection Service), itself part of the United States Department of Agriculture (USDA). From there they are taken to Biobest's U.S. subsidiary for distribution. In the five months prior to this arrangement, Biobest's American customers simply had to find other companies to supply them.

Applied Bio-Nomics, based on Vancouver Island, uses FedEx for all U.S. shipments, according to general manager, Brian Spencer. While they are happy with FedEx's services, the company has lost 30% of its business since 9/11 because regulatory changes have resulted in a 2-day rather than a 24-hour transport period to U.S. customers.

Freshness is vital to biocontrol agents. Delays can result in partial or total loss of product. Spencer points to research conducted by Guy Boivin of Agriculture and Agri-food Canada which found that, for egg parasitoids from the genus *Anaphes*, storage time is associated with poorer learning and response to the host. This translates into overall poorer performance. Recognizing the importance of freshness, Applied Bio-Nomics offers a product called *Encarsia* Max, a non-refrigerated 24-hour old product shipped directly to growers. The product is only available in Canada - the company just can't promise delivery within 24 hours to U.S. customers. It should be pointed out that there is no insurance that will cover the industry.

Angela Hale of The Bug Factory, also on Vancouver Island, explains that, post 9/11, her company was unable to use the courtesy permit system they had used earlier. Instead, they were required to use stickers which feature the language: "contains plant pest or pathogens." This is not actually a new rule, says Hale, just an enforcement of the permit conditions. Nowhere do these labels indicate that the shipment contains beneficial insects; thus they are treated like first time introductions of exotic insects. Says Hale about the sticker system, "…it automatically red-flags the shipment that there's something dangerous when in fact these agents have a complete safety record for decades and are ubiquitous all over the U.S." The requirement to use a bonded carrier has increased costs for Hale's company as well, while longer shipping times have resulted in some cases in writing off product shipments.

Companies exporting beneficial organisms to the U.S. can ship products only during normal PPQ staff working hours. According to Ward, Biobest must make arrangements for officers to work after hours and cover their overtime pay if the shipment is delayed or falls on a U.S. holiday. In Hale's case, if the company has prior notice of an officer's unavailability, they notify their customers that shipment will be delayed. Lacking such notice - for example if the officer is sick - the shipment sits in the PPQ office until the next working day.

To promote their interests, the ANBP has retained a lobbyist and a lawyer based in Washington, D.C. According to Ward, their efforts are making a difference.

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Biocontrol Files: Canada's Bulletin on Ecological Pest Management is a quarterly publication which reports on tools and developments in ecological pest management. The co-publishers World Wildlife Fund Canada, the Biocontrol Network and Agriculture and Agri-Food Canada welcome additional partners and sponsors committed to advancing knowledge and adoption of ecological pest management.

Submissions and letters to the editor are welcomed. Guidelines for submission are available on request from biocontrol-network@umontreal.ca.

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Guest author Angela Hale

Regulated movement of commercial biological control organisms

For 15 years, producers of commercial augmentative biological control organisms - including beneficial insects, mites and nematodes - have struggled with restrictive and varied procedures and documentation requirements for international movement of their products. After 9/11 and the formation of the Department of Homeland Security (DHS), U. S. authorities reviewed importation procedures for living organisms. The consequence of this review was strict enforcement of permit conditions, with the result that commercial beneficial organisms are labeled as "plant pests or pathogens" and, like first time introductions of exotic organisms, are sent directly to a plant quarantine station. Industry representatives have requested the North American Plant Protection Organization (NAPPO) to develop recommendations to regulatory authorities on how commercial biological control agents (BCAs) with a history of safe use might be handled differently from organisms which represent a higher risk.

The Association of Natural Biocontrol Producers (ANBP) Conference featured a keynote session in which a panel of government and industry representatives from Canada, the U.S. and Mexico presented their views on this subject.

Presentation summaries

Robert Flanders from the U.S. Department of Agriculture's Plant Protection and Quarantine (PPQ), reviewed current rules for importation into the U.S. via PPQ 526 permits. Imports may enter the U.S. only via bonded carriers and will be cleared by Customs only if addressed to a PPQ inspection station. PPQ officers confirm that contents do not represent a plant pest risk and are not contraband, and then forward the shipment to its destination by bonded carrier. In the near future, shipments traveling through the U.S. en route to another country will require transit permits. The U.S. may begin accepting phyto- or zoosanitary certification to confirm identity, purity, origin and absence of plant pests.

Hugo Bernal of the National Centre for Biological Control in Mexico explained that, to bring BCAs into Mexico, importers must be Mexican citizens and import documents must include the name and address of the importer and the scientific name of the organism. The origin of the BCA is extremely important and must be stated as the country where it is reared. Each shipment must include a valid import permit, a certificate of origin and a certificate of purity. Mexico is not as stringent in its requirements as the U.S., but does take precautions to protect plant health and follows existing NAPPO guidelines.

Doug Parker of the Centre for Plant Quarantine Pests, Canadian Food Inspection Agency (CFIA), stated that Canada follows much the same procedures as Mexico, with importation of BCAs governed under the Plant Protection Act. Canadian rules regulate "living organisms" and do not distinguish "plant pests" as a category. There is no formal process for importing entomophagous insects; these organisms have been considered less risky since they don't directly feed on plants, although that viewpoint is changing. Generalists and non-specific BCAs are considered less favourably than specialists. New permit applications must conform to NAPPO guidelines. A major problem in Canada is the lack of specialists who can identify insects and mites. In the 1960s, more than 40 such specialists were on staff in the Canadian National Insect Collection at Agriculture and Agri-Food Canada. Today there are only 16.

Roger West of the U.S. Customs Border Patrol (CBP), Department of Homeland Security, reported that, post 9/11, the DHS was formed and Customs, Immigration, Border Patrol and Agricultural Inspection combined to form the CBP. The role of Agricultural Inspection and Policy is to ensure that USDA policies are implemented at all points of entry. However, there is a shortage of qualified people to staff points of entry. Although CPB must enforce USDA policies on importation, West indicated that a process for expediting the flow of cargo for companies with good track records might be applicable to BCAs.

Brian Spencer is a Canadian industry representative on the NAPPO Biological Control Panel. The Panel is currently developing a "Guideline to Expedite the Safe International Movement of Biological Control Agents." The first draft is finished and a second will be available soon. For international movement, the guideline requires specific information about the BCA: where it was reared, where it completed its last life cycle, where it was packaged, and where it was last exposed to possible contamination. The new guideline envisions some form of pre-clearance to expedite movement of commercial goods across borders, with severe consequences for non-compliance.

Although the development of NAPPO guidelines and their tri-lateral acceptance (followed by policy development and implementation) probably will take several years, attendees seemed optimistic that the NAPPO Biological Control Panel is the vehicle to make it a reality. ■

Report on a Regulatory Session, presented at the Association of Natural Biocontrol Producers (ANBP) Conference and AGM, October 15, 2005 in Guadalajara, Mexico.

Angela Hale is a managing director of the Bug Factory on Vancouver Island, and the Chair of the Association of Natural Biocontrol Producers Program Committee

Inspecting produce imported into the U.S.

Shipping biocontrol agents…(page 1 continued)

Also helpful is the fact that ANBP has a relatively good working relationship with the various governing bodies in the United States. Though the situation is far from ideal, Ward says that USDA and APHIS have been working with the biocontrol industry in an effort to minimize the financial impact associated with shipping products into the U.S. "What we as an industry would like to see," explains Ward, "is a change in the "guilty until proven innocent" notion. We think that, if you are a proven company that's been conducting your business for a number of years without any slaps on the wrist, you should be allowed to continue doing things the way you have been."

North American regulators are considering various options to improve the situation, including a method similar to a Phytosanitary certificate, essentially a document which certifies that imported plants are free from regulated pests. But it could take upwards of three years before any changes are fully in place. Says Ward: "In the short term, anyone who is shipping product to the United States is required to ship via bonded carriers. I honestly don't see how, from a legal standpoint, the United States can demand that you ship products into their country by bonded carrier. If you're shipping from Canada into the U.S., you have to use Immigration and Customs, so why do we have to use the bonded carrier? It's an added expense, and to me it is not a necessary expense." In the meantime, U.S. farmers don't have assured supplies of biological control agents from international producers. ■

These issues were a main topic of discussion at the recent ANBP annual conference. For a summary of these discussions, read Angela Hale's report on page 2.

IR-4 and biopesticide research and registration

The U.S. IR-4 program is a unique collaboration between the United States land grant universities and the Department of Agriculture. The main objective of the program is to collaborate with growers, scientists and commodity organizations to address pest control needs in specialty crops. In 1982, the IR-4 began its Biopesticides Research Program, which aims to assist in the development and registration of biopesticides for specialty crops or for minor uses on major crops.

The biopesticides program:

- develops research protocols and assists in obtaining research,
- assists in good laboratory practice (GLP) procedures so that data collection complies with regulatory standards,
- funds field efficacy and residue trials,
- prepares and submits petitions for tolerance exemptions, and
- develops efficacy data to expand registration to additional crops and uses.

Since the expansion of the program in 1995, the IR-4 Biopesticide Program has invested nearly $3.4 million dollars in research and development for new biopesticide products. This work has resulted in over 300 biopesticide clearances. IR-4 has expanded its relationships to work with producers in Canada, Mexico and Germany, assisting with the resolution of trade irritant issues and pursuing global registrations for minor crops. IR-4 has also registered biopesticides from Canada, Italy and the Netherlands with U.S. Environmental Protection Agency (EPA).

Though most requests for assistance come from federal and state researchers or extension scientists, IR-4 also receives requests directly from growers and commodity organizations. Requests for assistance are submitted electronically, with accompanying data on the crop, proposed pest management tactic, target pest, etc., along with any preliminary data available. Projects are reviewed, rated, ranked and, if the project proposal is successful, appropriate funding assigned.

Total funding for the Biopesticide program in 2005 is approximately $575,000, with most successful grants receiving from $5,000 to $20,000. In 2004, the success rate for the different grant stages – Early, Advanced and Demonstration - ranged from 20 to 62 percent. The Biopesticides and Pollution Prevention Division of U.S. EPA contributed $100,000 in funding for the Demonstration Research Program.

Although it is difficult to estimate the economic impact of the biopesticides IR-4 has helped register, a conservative estimate is over $35 million. This would appear ample justification for the $3,500,000 project investment and the regulatory support provided to registrants.

Funding for IR-4 comes from the U.S. Department of Agriculture, the Cooperative State Research, Education and Extension Service (CSREES), the Agricultural Research Service (ARS), and state land grant universities. Headquarters are at Rutgers University. Each state has an IR-4 State Liaison at their land grant university. Four regional IR-4 research centres are maintained at Cornell University, Michigan State University, University of California, Davis and the University of Florida. ■

Regulating the import of biocontrol agents

An interview with Peter Mason, Agriculture and Agri-Food Canada

Biocontrol Files: How has the regulatory system for importing biocontrol agents (BCAs) changed over time in Canada?

Peter Mason: The Acts that govern importation have not changed. Plant protection laws are appropriate for regulating BCAs because they are designed to address movement of living organisms associated with plants. The Canadian Food Inspection Agency [CFIA] continues to have the mandate and the authority for importation and for approving releases. However, CEPA 1999 and the new Pest Control Products Act are sweeping enough that biocontrol agents could be scrutinized under both of those pieces of legislation.

In terms of actual, practical implementation, the testing [of biocontrol agents] has become much more stringent in the past 10 years. Committees have been set up to review petitions for release of agents – for weeds and entomophagous insects - and essentially it is a peer review of a scientific argument in favour of release.

BF: Has anything changed in Canada or the U.S. both legislatively and on a practical basis since 9/11?

PM: While I don't speak for CFIA, my perception is that the regulatory oversight in Canada is sufficient so that no changes are necessary. In the U.S., on the other hand, the Homeland Security Act came into play and all importations have been more carefully scrutinized because they're looking for pathogens that are terrorism agents [*ed: see also Angela Hale's article on page 2*]. So shipments have to go through designated containment facilities, and must be handled by designated Homeland Security personnel. In the past, scientists could get a permit and hand carry agents across the border - that's no longer permitted. For commercial shipments, there's been mortality of product, which has been devastating to the Canadian business. This undermines the value of biocontrol – people start saying it doesn't work.

BF: Do you see any gaps or inadequacies in the regulatory systems in Canada, the U.S. or Mexico?

PM: In terms of regulatory oversight, in Canada there are no issues. I think the danger we're looking at is that inappropriate models may be used for regulation. If we treat biocontrol agents in a stream where they're regulated as chemical pesticides and require the full array of toxicity tests, this is inappropriate. In the U.S., there is a gap because oversight for entomophagous insects is not in place yet. But it's being developed, and there is a contingency plan in place. In Mexico, like Canada, the oversight is just fine.

Another issue is cost. As regulatory scrutiny increases, it's more costly to get commercial agents to market. With classical biocontrol, the increased scrutiny makes it more costly to do the evaluations, and it takes more time. Which means that there are fewer agents that can be brought into play.

BF: How is it more costly?

PM: We have to do host-range testing, for example. In the past, it was acceptable for scientists to simply do a literature review. Now there's a requirement to do lab tests and field surveys in the country of origin, which costs a lot more money.

BF: In your opinion, are the more stringent requirements necessary, and if so, are there mechanisms by which researchers and businesses can be reimbursed for these costs?

PM: Normally, government funds classical biological control projects; they're considered a public good. So reimbursement is not a consideration. But obtaining funding to do this kind of work is exceedingly difficult. Some funders are ready to take on downstream work, but because it takes ten years or so to develop a classical agent, they're not willing to fund the beginning part of the process. Because evaluation is so lengthy, producers must find other control methods in the interim, methods that may be harmful to the environment and which may also be costly. For commercial agents, more stringent testing means that costs are going up; there are really no mechanisms for reimbursement.

BF: Do you think that this increased scrutiny is going to result in increased confidence, because there's lesser negative impact?

PM: Less negative impact *and* more effective agents. I think that there is merit in increased scrutiny, because we want to ensure that the BCAs that are used in Canada and the U.S. have as little impact as possible, particularly those that are released into the environment. Generalist predators like *Harmonia axyridis* would no longer be approved for introduction – and that's a very, very positive thing. Also, the biocontrol community has taken the lead on developing techniques for generating the information that's required to address the increased scrutiny, and that certainly is a positive thing. I would say biocontrol has a positive future. ■

For more information, see Mason, P.G., R.G. Flanders and H.A. Arrendondo-Bernal. 2005. How can legislation facilitate the use of biological control of arthropods in North America? Pp. 701-714. In Hoddle, R.G. (Compiler), Proceedings of the 2nd International Symposium on Biological control of Arthropods, Davos, Switzerland, 12-16 September 2005, United States Department of Agriculture, Forest Service, Morgantown, WV, FHTET-2005-08,Vol II

Fighting fire with…

A devastating disease

Fire blight, caused by the bacterium *Erwinia amylovora*, is the most damaging and economically serious disease of apples and pears in Canada. It is particularly problematic in the warm, humid climate of southern Ontario, but periodic outbreaks also occur in the Okanagan Valley and other growing areas. Fire blight can kill infected trees, which must then be removed. In severe cases, whole sections of orchards must be destroyed, an economic disaster from which some growers may never recover.

Fire blight has always been a major threat to pear plantings, but its importance to apple production has grown with the shift toward the more lucrative fresh fruit market. New susceptible cultivars, much higher tree densities, and susceptible dwarfing rootstocks all increase susceptibility to fire blight. Up to 89% of all apple and pears produced in Canada come from fire blight-susceptible cultivars, and annual Canadian losses to fire blight may be as much as $4 million.

Current management practices

Fire blight is best controlled with an integrated approach. Horticultural practices that minimize susceptibility and disease spread and reduce the amount of inoculum in the orchard are combined with predictive models to determine the potential for blossom infections and well-timed applications of bactericides. The problem is that there are very few bactericides registered - antibiotics, copper, some biological control agents and growth regulators.

Streptomycin, an antibiotic, provides the most effective and consistent control. But the overuse of streptomycin has led to resistance problems in many countries, including the USA and Canada (B.C.), making control of this disease almost impossible. While several other products are also registered, field tests indicate that these only suppress the disease. Although some integrated approaches are used for control of fire blight, new products, better uses of existing products, and an overarching long-term control strategy are clearly needed.

A long-term strategy

Through the Canadian Horticultural Council's apple working group, the Canadian apple and pear industry is developing a long-term strategy to manage fire blight. Supported by Agriculture and Agri-Food Canada's Pesticide Risk Reduction program, three key areas are being explored: research, technology transfer/grower education and testing of newly registered products.

Research is needed to develop and test new tools. While current levels of funding for primary, applied research must be maintained and enhanced, and existing programs and staffing levels maintained, new research is needed in the following areas:

- evaluation of SAR (Systemic Acquired Resistance) inducers and foliar nutrients to bolster tree health and immunity,
- development of mechanisms for honeybees to disperse bacterial antagonists, and
- evaluation of repeated low-rate copper applications after crop loss to minimize further spread and infection.

Increased cooperation between Cornell University and the University of Guelph is needed to field test new rootstocks for resistance to fire blight, and for potential commercial production. Although transgenic materials are being bred at Cornell, commercial release is still several decades away. Market acceptance is an ongoing public issue, and resistance by the public and consumer groups may mean that GMO apples will never be planted.

Fire blight damage in orchard

Technology transfer/grower education: Developing new approaches and strategies is all very well. Getting producers to use these strategies effectively and in a timely fashion is equally necessary. New technologies must be readily available to growers, and training in their use is crucial to success. Within the terms of the long-term strategy, industry and private IPM practitioners will be responsible for delivery of such new technology. For example, computer-based models have been developed to predict fire blight outbreaks, and recommendations for suitable rootstocks are being developed.

Testing of new products: In Canada, most growers rely exclusively on streptomycin, and very few "suppression" tools are currently registered. Some suppression tools must be applied at very specific phenological stages in order to work. As new materials are registered, growers will need to become comfortable with their use and with how they fit in an integrated strategy. To accomplish this, IPM practitioners and industry might conduct workshops and IPM schools, followed by on-farm demonstration trials and one-on-one consultations. It should be noted that, although the industry is supportive of registering new tools to suppress fire blight, continued access to streptomycin is critical while tools are in development and until alternative control products are discovered.

Regulatory strategies

A national Ad-hoc Fire Blight Working Committee, with representatives from industry, provincial government, AAFC and the Pest Management Regulatory Agency (PMRA), is helping to create an action plan for the long-term management of fire blight in Canada. The plan may eventually include the following:

- coordination and funding of efficacy testing of new products,
- development of strategies for encouraging companies to register products in Canada,

(continued on page 6)

Fighting fire with…(page 5 continued)

- support for joint registration of products in the U.S. and Canada,
- development of technology transfer programs, and
- access to funding for research and technology transfer priorities.

Articles in coming issues of *Biocontrol Files* will highlight some of the most promising new biological tools which are being developed to manage this devastating disease.

Summarized from Bernt Solymar (Earthtramper Consulting): *Fire Blight of Apple and Pear in Canada: Economic Importance and a Strategy for Sustainable Management of the Disease,* April 2005; and *Fire Blight, An Economically Important Disease of Apple and Pear: A Review of the Pathogen (Erwinia amylovora), Disease Occurrence, Biology and Management,* February 2005.

Beating back a balsam fir pest with biocontrol

Dr. Chris Lucarotti, an insect pathologist working for the Canadian Forest Service (CFS) in Fredericton, New Brunswick, has spent the better part of a decade developing a biocontrol agent to rid western Newfoundland of a major balsam fir sawfly (BFS) infestation. Now the quest to develop and register this virus-based agent, AbietivTM, is almost at an end.

The story began in the early 1990s when the sawfly (*Neodiprion abietis*), an indigenous insect pest, began to defoliate balsam fir trees in the Corner Brook area. By 2004, damage had mushroomed to more than 40,000 hectares of infected trees. Worse, the affected tree stands had been thinned for future harvesting and represented a considerable investment for the timber industry, particularly for a local company, Corner Brook Pulp and Paper Ltd.

Lucarotti began to look at BFS in 1995 with colleagues at CFS and the University of New Brunswick. The biggest problem with the balsam fir sawfly was the lack of suitable agents to control it. The only chemicals effective against it could not be used in spraying programs and the widely used bioinsecticide Bt had no effect on the insect. "Not a lot of research had been done on the insect at the time," comments Lucarotti, "but we did know that its cyclic population crashes were due to a virus we call NPV." NPV is an acronym for "nucleopolyhedrovirus." The specific virus that gives the population controlling punch to AbietivTM is called NeabNPV.

The NPV virus seemed an ideal control candidate. After isolating the virus from infected insect larvae and confirming that it caused the BFS population crashes, Lucarotti and his colleagues proceeded with the work of transforming it into a biocontrol agent.

To grow a virus to the numbers required for use in large-scale forest spraying, you have to infect a host insect – a lot of host insects – and then harvest them to isolate the virus. Then you repeat the process on a larger scale. Lucarotti and his colleagues initially grew the virus in the sawfly host in the laboratory, isolated and accumulated it, then sprayed it over affected trees in the forest using aircraft. Each hectare of sprayed forest produced enough virus to spray 2-3 thousand hectares of forest.

The process of harvesting the virus was, as Lucarotti recounts, not technologically sophisticated. They beat the trees, collected the insects on tarps and dumped them into 40 kg sugar bags, where the insects died from infection. Then they filtered the material and cleaned the virus preparation.

From 2000 through to 2005, armed with research permits from Canada's Pest Management Regulatory Agency (PMRA) and with industry financial support, they conducted a series of field efficacy trials to prove the viral agent's effectiveness. The field results were excellent. Lucarotti and his colleagues rounded out the picture of the virus by showing that it only infects and replicates in BFS, ignoring all other species in the environment. At the same time, University of Victoria, B.C. virologist Dr. David Levin has been working to elucidate the complete NeabNPV's genome.

"There is," explains Lucarotti, "a very strict set of procedures that you have to follow in registering a biocontrol agent, and for this most of us need expert help." One key resource in this regard has been Toronto-based consultant, George Mudryj. Explains Lucarotti, "George is an expert on procedures for bringing biological control agents through the PMRA registration process. Without him, we would still be in the middle rather than at the end of registering AbietivTM." The accumulated toxicological, environmental, genomic and other data required for registration filled 12 large binders.

In January 2005, Lucarotti received a "list of deficiencies" from the PMRA, standard in such registration efforts, and with Mudryj's help, responded to all of them. Lucarotti now waits for the next step, hopefully notification of registration for AbietivTM.

Many people and agencies helped to make the NeabNPV story a success, and Lucarotti reserves special praise for the Montreal-based Biocontrol Network, an NSERC-sponsored national research network that aims to replace chemical pesticides with more environmentally friendly biocontrol agents. ■

Biocontrol News Digest

SEPTEMBER 6, DAILY STAR (dailystar.com.lb) – It is hard to think of another region like Egypt whose ecology, iconography, even identity, is so strongly linked to a single tree. Yet, unless authorities act swiftly, Egyptian date palm groves will dwindle, and heaven will be the only place the faithful can taste a date. A beetle called the Red Palm Weevil is gnawing its way though the once lush Nile Delta, its proboscis pointed south toward the Nile Valley.

Biocontrol research at Cairo's Plant Protection Center suggests that control of the Red Palm Weevil may lie in its pheromones. When a synthetic version of the beetle's sex pheromone is mixed with fermented plant fiber and placed near the trees, the weevils gather and can be killed en masse. But unless pheromones are used simultaneously over large areas, the adventuresome farmer risks inviting his neighbor's beetles home for dinner. Egypt's stated interest in biocontrol could pass from rhetoric to action: while organically grown crops lose about 25 percent to bugs that might have been controlled by pesticides, market prices more than make up the difference.

SEPTEMBER 6, MEDICAL POST ONLINE, DAR ES SALAAM, TANZANIA – Spraying walls or cloth with spores of a fungus that kills mosquitoes could greatly reduce malaria transmission, according to two studies that were recently published in the journal *Science*. The fungus - *Metarhizium anisopliae* – needed to infect only 23% of mosquitoes in houses to reduce the intensity of malaria transmission by 75%.

Because mosquitoes are increasingly resistant to methods such as spraying pesticides on walls or using insecticide-treated bed nets, researchers have been investigating biological control agents, such as bacteria, fungi and viruses.

Another project found that exposing mosquitoes resting on walls or ceilings after feeding to fungi - especially *Beauveria bassiana* – killed 89% percent of mosquitoes and reduced the number of mosquitoes able to transmit malaria by a factor of 80.

SEPTEMBER 7, NORTH BAY BOHEMIAN (NEWSWISE) – It is related to the world's smallest insect, the fairy fly, but this tiny wasp, *Anagrus epos*, may single-handedly take down one of the California's wine industry's biggest bullies: the glassy-winged sharpshooter.

Anagrus epos has one goal in life: to lay its eggs inside sharpshooter eggs. In spring, the sharpshooter, which spreads Pierce's disease to thousands of acres of California grapevines, lays neat rows of 12 to 20 eggs on the underside of leaves. The wasp comes along after it and inserts up to 10 of its eggs into every one of the sharpshooter's eggs. Then, the new wasps hatch before the sharpshooter and promptly devour it.

The California Department of Food and Agriculture imported the wasp from Minnesota and is in the process of releasing it into 50,000 square miles of Southern California. Officials won't know whether or not the wasp will destroy the sharpshooter's breeding cycle until next spring.

SEPTEMBER 12, GEORGIA INSTITUTE OF TECHNOLOGY PRESS RELEASE – New research suggests that plant eaters may prefer exotic species to domestic plants. The research from the Georgia Institute of Technology suggests that plant eaters may be more adventurous than previously thought and prefer to nosh on exotic meals by a ratio of three to one. The researchers ran four separate studies with 11 herbivores and over 300 plant species collected from all around the continental United States. All four studies found essentially the same thing: native herbivores prefer consuming exotic plants.

The findings, which appear in the September issue of *Ecology Letters*, could point the way to better strategies for reducing the billions of dollars in damage that invasive species cause every year. The researchers are now working on determining whether native herbivores do in fact control exotic plant growth in field settings, an important step in determining whether biological control with native herbivores is feasible.

OCTOBER 6, AGRICULTURAL RESEARCH SERVICE PRESS RELEASE – The Old World hunter fly, *Coenosia attenuta*, also known as the "killer fly", has been identified for the first time in North America. Greenhouse pests had best beware. The fly preys on common greenhouse pests such as fungus gnats, shore flies, leafminers, fruit flies, moth flies and some leafhoppers.

Learn more about hunter fly research in the October 2005 issue of *Agricultural Research* magazine, available online at:

http://www.ars.usda.gov/is/AR/archive/oct05/pests1005.htm ■

Resources:

Books

C. Regnault-Roger et al (editors), 2005. Biopesticides of Plant Origin. Lavoisier, Cachan cedex, France. This book presents an overview based on contributions by 34 international experts in 17 chapters on the topic of plant derived crop protection agents and the potential they offer in IPM practices. From group discussions on usage in crop protection formulations, searches for new supply sources, to current and future commercial development, the hardbound work covers early botanicals to allelopathy, through to molecular chemistry and the realm of transgenic plant material. http://www.lavoisier.fr.

Websites

Bugwood. The award-winning network exists to gather, create, maintain, promote the use of, and economically distribute digital information as tools, primarily in the fields of entomology, forestry, forest health, and natural resources, but in fact offers much greater diversity. The Bugwood archives contain over 30,000 downloadable images and numerous text information sources. http://www.bugwood.com

Soybean Rust Information, United States Department of Agriculture. The USDA managed the development of a coordinated federal, state, university, and industry collaboration for surveillance, reporting, prediction, and management of the disease for the 2005 growing season. A major result is the USDA's Soybean Rust Information Site, said to be a one-stop information resource. A map depicts current information for areas where the pest has been found and areas scouted and still free of the pathogen, but reveals a steady northwesterly march of infection. http://www.usda.gov/soybeanrust/

Conferences

25th Guelph Organic Conference: "Living Organic – the next 25 years", Guelph, Ontario, January 26-29th, 2006. http://www.guelphorganicconf.ca/

Canadian Horticultural Council Annual General Meeting, Ottawa, Ontario, March 1-4, 2006. http://www.hortcouncil.ca/agm2006.htm

1st International Organic Apple and Pear Symposium, February 29-March 2nd, Wolfville, Nova Scotia. http://www.organicagcentre.ca/AppleSymposium/home.html

Surveys gauge attitude of Canadian public

In winter 2005, the Biocontrol Network and World Wildlife Fund-Canada conducted two separate surveys on public attitudes to biocontrol. The Network surveyed 1000 randomly selected members of the public, while WWF-Canada interviewed a small group of opinion leaders in the agri-food sector. The findings of the Biocontrol Network's survey are statistically valid within standard parameters, while WWF's survey, because of the small sample, is best viewed as a pointer towards needs for further research.

Highlights from the Biocontrol Network survey include:

- 49% of respondents reported being somewhat well informed about biological control, 47% were only poorly or very poorly informed, and 3% considered themselves very well informed
- 63% believed that biological control would be preferable to the use of pesticides
- 60% felt that there was less risk of food being contaminated with the use of biological controls compared to pesticides
- 64% reported that they would buy food where pests had been controlled with biological agents rather than pesticides
- 73% percent were in favour of using beneficial insects to control pests, as compared to 25% for pesticides and 41% for genetically modified organisms
- 46% reported feeling wary of eating food if "beneficial microbes" were used to control pests
- 87% wanted food to be labeled indicating that biocontrol agents had been used to control pests

The strength of support for biocontrol was positively associated with number of years of education. Regional differences of opinion were sometimes significant. For example, the proportion of respondents who considered themselves well informed on biocontrol ranged from a low of 34% in Quebec to a high of 76% in B.C., while the percentage who supported the use of biological agents rather than pesticides varied from 55% in the Maritimes to 81% in Quebec. Trust in government agencies to supervise pest control with biological agents stretched from 37% in Quebec to 61% for the Maritimes.

The strongest finding from the WWF survey was that efficacy, cost and availability are viewed as the major barriers to wider adoption of biological control products. There was strong agreement that the greatest benefit of biological control products is their softer environmental footprint. Perceptions of the future of biological control were on the whole positive but, for many, qualified by the need to address the barriers mentioned.

A number of trends were identified by respondents as supporting the view that increased adoption of biological pest control products is likely: the growing perception of conventional chemical pesticides as damaging to health and the environment, an aging and health-conscious generation of "boomers", and growing support for products marketed as "natural" or "organic." The scenario of older chemical pesticides going off the market, via withdrawal and other means, was also perceived as a positive opportunity for biocontrol agents.

The surveys indicate that there is work to be done to realize the potential of biocontrol. Research should concentrate on more efficacious products, identification of options for easing regulatory barriers, and establishment of enabling mechanisms for production and adoption. Further market research will be necessary, as well as communication strategies targeted to various groups (the general public, the retail food sector, growers, etc.).

Communication strategies should focus on a variety of areas, including raising public awareness of biocontrol agents, demonstrating benefits, addressing user myths and concerns regarding the value of the products, and dispelling consumer myths and concerns about the nature of the products. ■

A brief guide to scientific literature

Phrase	Translation
It has been long known	I haven't bothered to check the references
It is known	I believe
It is believed	I think
It is generally believed	My colleagues and I think
There has been some discussion	Nobody agrees with me
It can be shown	Take my word for it
It is proven	It agrees with something mathematical
Of great theoretical importance	I find it interesting
Of great practical importance	This justifies my employment
Of great historical importance	This ought to make me famous

Phrase	Translation
Some samples were chosen for study	The others didn't make sense
Typical results are shown	The best results are shown
Correct within order of magnitude	Wrong
The values were obtained empirically	The values were obtained by accident
The results are inconclusive	The results seem to disprove my hypothesis
Additional work is required	Someone else can work out the details
It might be argued that	I have a good answer to this objection
The investigations proved rewarding	My grant has been renewed