Symposium Abstracts: Biological Control — A Safe Approach to Pest Management

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Biological control in cannabis
Amanda Brown, Biobest Canada Ltd.

I presented an overview of the beneficial insects that are currently used in indoor *Cannabis* production in Canada and the USA. Biological control programs are widely used because of the limited number of pesticides that can be used for insect pest control in order to comply with Health Canada and state regulations. The main pests in this crop are thrips, spider mites, fungus gnats – and occasionally russet mites, broad mites, and root aphids. Many biocontrol agents – including predatory mites, soil predators, minute pirate bugs, nematodes and parasitoids – are used for successful control of these pests.

Insect pathogens as biological control agents
Jenny S. Cory, Department of Biological Sciences, Simon Fraser University, Burnaby, British Columbia

Insect pathogens have been studied for over 100 years, initially because of their negative effects on insects of economic interest, such as silkworms, and more recently as agents for pest management. The most studied insect pathogens are the entomopathogenic fungi, bacteria belonging to the *Bacillus* species, baculoviruses and entomopathogenic nematodes. All of these pathogen groups occur naturally in insect populations and many can cause wide-scale epizootics in their hosts. For example, when the locally common western tent caterpillar, a cyclic species, periodically reaches very high numbers, they will invariably die of a baculovirus infection. The insect pathogens used for pest management have narrow host ranges; all are restricted to insects, most only infect a few species and many are host specific. The most commercially successful microbial insecticide is the bacterium *Bacillus thuringiensis*, but representatives of all the major pathogen groups are available commercially. Insect pathogens tend to be used like chemical insecticides in that they are applied to high density pest populations. They are commonly used in forestry and for greenhouse crops, and they have also been widely used in crops such as maize, soybean and cotton and have been developed for fruit crops such as apples and pears. Their main advantages are that they are not toxic and have a narrow host range, and thus do not cause environmental damage or have health effects on humans. They could potentially be used more widely with the development of more novel pest management strategies which use their ecology, for example, their capacity to be dispersed and re-cycle naturally in pest populations.

Invasive insects: Is biological control an option?
Tracy Hueppelsheuser, British Columbia Ministry of Agriculture

Invasive species impact North American ecosystems both managed and unmanaged in significant ways. The Centre for Invasive Species Research in California states that invasive species cost California $3 billion/year, every 60 days a new invasive enters California, and 6 new invasive species establish each year in California. Many new species to BC come up from initial introductions in California. Additionally, An Invasive Alien Species Strategy for Canada (2004) states that invasive alien species are the second most significant threat to biodiversity, after habitat loss. Canada has a long history of non-native introductions. The earliest record is Codling Moth (*Cydia pomonella*) in Ontario in 1635. The Canadian Food Inspection Agency states that invasive introductions are on the increase due to increasing volume of trade, access to international markets, tourism and other travel, and decreasing transportation time.

The population of a new species in a new niche or location follows a sigmoidal curve, with the first few years being sub-detection, followed by some years of rapid increase in numbers which is usually when the new species is detected, and finally after some years will reach the carrying capacity of the new environment. Biological control agents, either naturally occurring or introduced, can play a role in decreasing the carrying capacity of the new environment, and ideally keeping the new species below acceptable levels where it doesn't cause significant damage. New or invader species may be more or less prone to control with biocontrol agents in the new environment, but most will fall somewhere in the middle.

Some examples of major new invaders to North America which are having an impact on agriculture crop production as well as urban landscapes are Spotted Wing Drosophila (*Drosophila suzukii*), Brown Marmorated Stink Bug (*Halyomorpha halys*), other stink bugs and leafhoppers. In all these cases, biocontrol probably has the best fit as part as a multi-faceted systems approach to overall crop and ecosystem management. For example, many ideas are being explored or currently contributing to *D. suzukii* management, including more precise insecticide use, cultural and mechanical methods, exploitation of insect behaviour, in addition to exploring impacts and utility of entomopathogens, predators, and parasites on this new pest to berries and stone fruit. In the case of *D. suzukii* and *H. halys*, biological control with native parasitoids is low, generally less than 2%. Reasons include the fact that parasitoids aer not used to searching for hosts in the new niche that *D. suzukii* utilizes (ripe fruit vs decaying fruit), and that *D. suzukii* is especially good at encapsulating parasitoids, preventing them from developing. In the case of *H. halys*, native parasitoids do recognise the egg masses as suitable and oviposit in them, but unfortunately, the progeny cannot develop. Though it is a long and arduous process, biologically and from a regulatory perspective, there are significant efforts by researchers in the USA and Canada to screen and test suitable specialist parasitoids from the countries of pest origin in Asia. Suitable candidates will confer much higher levels of parasitism, and enable classical or innundative release as a practical component of pest management.

Understanding insect oviposition behaviour and its influence on purple loosestrife biocontrol success

Alida F. Janmaat, Biology Department, University of the Fraser Valley

Patterns of oviposition can be used to elucidate the role of biotic and abiotic factors in the oviposition decisions made by insect biocontrol agents. Findings from a longterm study on the oviposition patterns of *Galerucella calamariensis*, leaf-feeding beetles released to control purple loosestrife, were presented. These findings coupled with laboratory experiments suggest that female oviposition choices made on the level of an individual plant may provide explanations for variation in biocontrol success observed across sites. Furthermore, the relationships observed suggest that cannibalism may play an under-appreciated role in the persistence of biocontrol insects in the field.

What is biological control and why do we need it?

Judith H Myers, Biodiversity Research Centre, University of British Columbia, Vancouver, BC

Biological control broadly defined is any non-chemical control. Generally biological control involves the use of natural enemies to control pest species. Five types of biological control were discussed at the symposium: 1. natural control, 2. augmentative control based on the release of natural enemies that have been collected or reared for this purpose, 3. conservation control in which habitat is preserved to maintain populations of natural enemies in the vicinity of agricultural fields, 4. microbial control using fungus, bacteria, virus or nematodes, and 5. classical biological control of exotic insects and

weeds through the release of natural enemies from the area where the pest is native. Classical biological programs are expensive and are taken on when there is evidence that the problem is of sufficient economic or ecological cost to warrant the expense and there is wide support for the program. Although host testing precedes releases of biological control agents, concerns about nontarget impacts have resulted in fewer programs being initiated in the last 20 years. Classical biological control programs have been successful in British Columbia for the weeds hounds tongue, tansy ragwort, diffuse knapweed, St. John'swort, and Dalmatian toadflax and for the winter moth. Currently programs for the release of biological control agents on knotweed and spotted wing drosophila are underway. It is important that classical biological control remains in the toolbox for dealing with exotic pests in the future.