e-GRO Alert

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Bio-insecticides in Greenhouse Ornamentals

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Bio-pesticides, also known as biological pesticides, are defined by the US EPA as pesticides derived from natural materials such as animals, plants, bacteria, fungi, and certain minerals. Typically, bio-pesticides have unique modes of action and are considered reduced risk pesticides. In this article, we examine several types of bio-insecticides—bio-pesticides used to control insect pests—in commercial greenhouse production of ornamental crops, including bacterial insecticides, fungal insecticides, and botanical extract products.

There are a number of advantages to using bio-insecticides in ornamental greenhouses. Bio-insecticides are usually less toxic then conventional insecticides, are compatible with biocontrol programs, and often have shorter re-entry intervals than conventional insecticides. Bio-insecticides generally affect only the target pest and closely related organisms, and often are effective in very small quantities. Because they usually have different modes of action than conventional pesticides, their use can slow the development of pest resistance to conventional insecticides. Many, but not all, are OMRI-approved, and therefore can be used in certified organic production. Bio-insecticides can be an effective substitute for conventional insecticides that consumers may be looking to avoid, such as neonicotinoids.

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Successfully incorporating bio-insecticides into a greenhouse pest management program does require some adjustment. Bio-insecticides often work best when pest populations are small, so regular scouting to catch problems early is important. Because bio-insecticides often affect just one or a small number of target pests, proper identification of the pest is critical (Figure 1). Bio-insecticides often do not work as quickly as conventional insecticides, but the patient grower should be rewarded with good results. Bio-insecticide products frequently require more careful handling compared to conventional insecticides. Keep track of expiration dates of these products, follow the storage directions on the label, and be aware of any product incompatibilities. For example, fixed copper fungicides can decrease the survival of both bacterial- and fungal-based bio-insecticides.

We often refer to the concept of the disease triangle when discussing plant disease development and control. The disease triangle also comes in handy when considering microbial (i.e. bacterial and fungal) bio-insecticides (Figure 2). In this case, instead of trying to protect a host plant from a disease organism, we are using a pathogenic organism, the microbial bio-insecticide, to kill a susceptible insect host. We may now be rooting for the pathogen over the host, but environmental conditions are still very important; microbial insecticides need favorable temperatures and humidity to infect and colonize their insect targets.

Let’s look at just a few examples of microbial bio-insecticides and botanical products that fit well in ornamental greenhouse operations.

Figure 1. Caterpillar or sawfly? Accurate identification of the pest is critical when using bio-insecticides. Bt products will control small caterpillars, but would be ineffective on the sawfly larva shown in this photo.

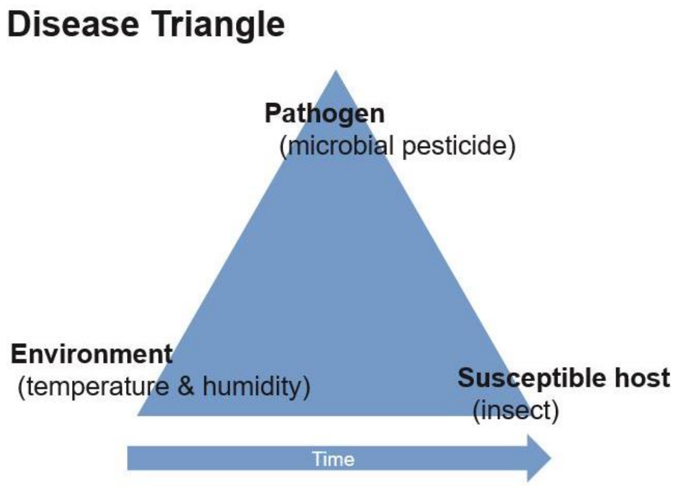

Figure 2. The disease triangle as related to microbial insecticides. In this case, if we want the susceptible host (insect pest) to die, we need to provide the right pathogen (microbial pesticide) and provide that pathogen with the right environmental conditions.

Microbial Insecticides: Bacteria

Bacillus thuringiensis (Bt). Most effective on early instar stages, Bts are stomach poisons, so must be ingested by the insect pest. This bacterial insecticide has been available for many years, but today's products are more effective and more targeted to specific insect orders. Caterpillars are controlled by the *kurstaki* strain of Bt (found in products such as Biobit, Crymax, Deliver, Dipel Pro, Javelin, and OLF) and the *aizawi* strain (e.g. Xentari, Agree). Fungus gnats are controlled by Bt *israeliensis* (Gnatrol). Thorough coverage is important when applying Bts.

Saccharopolyspora spinosa. Spinosads are natural products obtained from the fermentation of *S. spinosa* and formulated into microbial insecticide products for greenhouse use (e.g. T&O, Conserve). Spinosads act as contact and stomach poisons, and control caterpillars, leafminers, shoreflies, thrips, and some mites and beetles.

Burkholderia spp. This new bacterial insecticide, available under the tradename Venerate, works by degrading the exoskeleton of the insect, as well as by interfering with molting. It controls caterpillars, and suppresses aphids, mites, whitefly, and western flower thrips.

Chromobacterium subtsugae. Another relatively new bacterial insecticide (trade name Grandevo) controls western flower thips, aphids, spider mites, and broad mites, particularly in early instars. Functioning as a stomach poison, this product requires thorough coverage for optimum efficacy.

Microbial Insecticides: Fungi

Beauveria bassiana. While not usually effective as a rescue treatment, Beauvaria bassiana (e.g. Botanigard, Mycotrol) is effective as a preventive to keep populations of aphids, thrips, and whiteflies low (Figure 3). Beauveria can be combined with diatomaceous earth, insect growth regulators, or Bt products for increased efficacy.

Isaria fumosorosea. This fungal insecticide (e.g. NOFLY, Ancora) controls aphids, mealybugs, thrips, whiteflies, spider mites, leaf miners, and psyllids.

Metarhizum anisopliae. Available under the trade name Met52, this fungus acts as a contact insecticide, controlling thrips, fungus gnats, whiteflies, mites and ticks.

Figure 3. Western flower thrips infected with the fungal bio-insecticide Beauveria bassiana. *Photo credit:* M Brownbridge, Vineland Research and Innovation Centre, Ontario.

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Botanical Products

Neem Extracts. Two types of active ingredients with insecticidal properties are extracted from the Neem tree. The most common are formulations (and there are many) of azadirachtin, a secondary metabolite extracted from neem seed. Azadirachtin works as a stomach poison, so insects must injest it for control. Pests controlled include aphids, caterpillars, leafminers, fungus gnats (not all formulations), mealybugs, spider mites, soft scale, whiteflies and thrips (suppression). The second neem-based active ingredient is the clarified hydrophobic extract of neem oil, pressed from seeds and fruit. Similar to horticultural oils, this product works by suffocating soft-bodied insects, and can also suppress egg hatch.

Pyrethrins. Pyrethrins (e.g. Pyganic, Pyrethrum TR) are derived from chrysanthemum flowers, and are used to control aphids, caterpillars, fungus gnat adults, thrips, and whiteflies. Some non-OMRI approved pyrethrins also contain PBO for added efficacy. Note that pyrethins have the same mode of action as their synthetic analogs, pyrethroids (IRAC 3).

Botanical oils. A wide variety of botanical oil products are marketed for insect pest control. For example, a product labelled under the trade name Captiva contains capsicum oleoresin extract, garlic oil and soybean oil. The product has anti-feedant, anti-egg laying, and irritant activity, and weakens the cuticles of immature stage insects. Captiva is labeled for control of caterpillars, mites, thrips, leafhoppers, and whiteflies.

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