Pre-publication version
Presented at the 58th Annual Meeting of the Western Region of North America – International Plant Propagators' Society, October 17-20, 2017, Wilsonville, Oregon, USA

Biological control in propagation

Moriah LaChapell Schalock[a]
Wilbur-Ellis, 640 NE 10th S., McMinnville, Oregon 97128, USA.

Biological control involves the release or application of natural enemies, including parasitoids (parasitic wasps), predators, and pathogens (entomopathogenic fungi and nematodes) to regulate an existing pest population. There are many benefits to releasing beneficial insects in any growing environment. For propagators, the benefit is an increase in plant health and a reduction in pest pressure that has the potential to remain until the plants are sold.

BENEFITS OF BIOLOGICAL CONTROLS

Combat difficult-to-control pests

Beneficial insects can help reduce difficult-to-control pests, such as fungus gnats, aphids, and thrips. A well-timed application when cuttings are placed in media will prevent heavy infestations of insects. Plants are especially prone to pests in the moist environment required for rooting.

Resistance management tool

There are cases where a previously effective insecticide loses potency over time. Beneficial insects can be an additional tool that allows for an increase in efficacy of other products as a rotational tool.

Reduce labor

Effective scouting and releasing beneficial insects ahead of heavy infestations will reduce the number of pesticide applications required. Reducing application frequency will reduce labor and pesticide cost.

Produce sellable crops

Ultimately, the goal for any propagator is to produce sellable crops. Biological control is another tool to accomplish the task of producing quality plants.

Marketing "bee friendly" plants

Implementing biological control can reduce the need for neonicotinoids and other systemic insecticides. There is a direct benefit to the consumer when marketing biological control at the retail garden center.

HOW TO APPROACH BIOLOGICAL CONTROL

There is no cookie-cutter approach to successfully implementing biological control. Every growing location comes with a different set of challenges. Three factors that need to be considered are:

1. Type of pest(s)
2. Pest pressure
3. Tolerance level for plant damage

[a]E-mail: mlachapellschalock@wilburellis.com

Beneficial Insect Performance Factors

It is critical to communicate pest type and production specifications to the supplier of beneficial insects. Another step is to check the vitality of the beneficial insect and contact the supplier right away if there is low survivorship or poor searching behavior. The safest approach is to release beneficial insects preventatively, ahead of infestations. It is also important to discuss insecticide history and spray programs with your supplier. These steps will increase the likelihood of success.

Limit exposure to noncompatible pesticides

Direct exposure of an insecticide to a beneficial insect is a lethal dose that results in immediate death. Indirect exposure of an insecticide to a beneficial insect is a sublethal dose which can reduce fecundity, foraging behavior, or progeny survival. For example, an organophosphate is more likely to immediately kill a beneficial insect, whereas imidacloprid has a longer-term residual effect that will lead to death over time.

Selecting compatible products

Beneficial insects are more likely to thrive on the plants if the pesticides applied have a shorter persistence or residue. A good example of a compatible product is BotaniGard for thrips control. It will not kill predatory mites and has a short residual period. Spot treatments based on scouting data can also help maintain existing beneficial insect populations. Another consideration is working with propagators to secure liners that are produced with biological control or compatible pesticides.

The benefit of working with a supplier who uses biological control

Iwasaki Nursery is a large commercial nursery that maintains an extensive biological control program. A melon aphid infestation was controlled by the predatory wasp *Aphelinus abdominalis*. The predator had not been released at the nursery and most likely came in on purchased plants.

Evaluating beneficial insect suppliers

There are ongoing trials with biological control at Iwasaki Nursery to evaluate supplier beneficial insects and the control of *Bemisia tabaci*. The ongoing trial is being conducted in six different ranges with three suppliers. BioBest's *Eretmocerus* mix appears to be most effective, but Bioline's *Eretmocerus* mix is more affordable. The pest pressure has been low so far in 2017. The iris whitefly and the banded whitefly are occurring, which might not be controlled by *Eretmocerus*. Applied Bionomic's *Encarsia* are an important addition.

NOTES ON SEVERAL BIOLOGICAL CONTROLS

Q-type *Bemisia tabaci* control

Eretmocerus eremicus is a tiny parasitic wasp (about 1 mm in length) that is indigenous to the southern desert areas of California and Arizona and is an important parasitoid of whiteflies. *Delphastus catalinae* is a small ladybird beetle which preys on all species and stages of whitefly.

Thrips management

Additional tools to combat thrips include introducing the predatory mite *Stratiolaelaps* to the soil. This is a beneficial predatory mite that will feed on fungus gnat larva and the soil stage of thrips. You can also drench the soil with the beneficial nematode Nemasys® (*Steinernema feltiae*). Releasing the predatory mite *Amblyseius* (*Neoseiulus*) *cucumeris* and *Amblyseius swirskii* can help manage the leaf-damaging stage of thrips.

Foxglove aphid management

Aphidius ervi is originally a European wasp species, but it has been widely introduced into North America, South America, and other regions in recent years as part of biological control programs for aphids on a variety of crops. Once a female finds an individual aphid or aphid colony, she will palpate the aphids with her antennae. If the aphid she is examining is of the correct size and

has not already been parasitized, she rapidly curls her abdomen under her body and stabs the aphid with her ovipositor.

Two-spotted spider mite management

Predatory mites will eat pest mite eggs and adults. They kill by inserting their mouth parts in eggs or adults and sucking out the contents. *Phytoseiulus persimilis* is blind and relies on odor to locate prey. Predatory mite species thrive in different temperatures and relative humidity. It is important to select biocontrol that is suitable for the environment.

All predatory mites are not created equal

Type I predatory mites are specialist (specialized) predatory mites because they feed and survive only on spider mites in the family Tetranychidae (also referred to as Tetranychid), which includes the two-spotted spider mite, *Tetranychus urticae*. An example is *Phytoseiulus persimilis*.

Type II predatory mites are selective predatory mites with a broad host range. These predators will eat various prey and pollen. They are less likely to cannibalize in adverse conditions. Examples are *Neoseiulus californicus*, *N. fallacis*, and *N.* (*Amblyseius*) *cucumeris*.

Type III predatory mites are generalist predators that feed on eriophyid and broad mites. They will also feed on pollen, honeydew, and plant exudates. They are more likely to cannibalize in adverse conditions. An example is *Amblyseius swirskii*.