

A Biological Approach

Biologicals and biorationals are an emerging method of control; find out more about them and how to use them.

By Christine Casey



Left: *Aphidius colemani*. Right: *Hypoaspis miles*. (All photos courtesy of Biobest)

Managing insect and mite pests on ornamental plants is no longer just a matter of using the same pesticides that you've always relied on. A large array of biological and biorational pest management options are now available to growers. There are several reasons to consider adding these to your toolbox.

- They work. Biologically-based controls may not necessarily work the same way as traditional pesticides, but when used properly they can effectively control pests.

- They help preserve the useful life of traditional pesticides. Pesticide rotation is essential to prevent resistance. Adding other tactics to the rotation mix, including biologically-based methods, should be part of your resistance management plan.

- Your workers will appreciate it. No more "I've had to spray more than anyone else" arguments. Fewer nagging concerns about whether all those pesticides are really safe. And pregnant employees may be more willing to retain pest management responsibilities.

- Scheduling pest management will become easier. Biological controls are not subject to the Worker Protection Standard, so they have no re-entry interval, while biorational pesticides typically have a 4-hour re-entry. This facilitates scheduling around worker or retail hours.

Biorational and biological pest management options for key pests are described below. Biologically based pest management options tend

to work more slowly than conventional chemicals, so they need to be used when pest populations are low. If you try starting this approach in the middle of a significant outbreak you are most likely to fail. If you have never used these products before, it is a good idea to make trial applications to a small area to become comfortable with how they work. Order small quantities of natural enemies before they are needed to assess the quality of material that your supplier is providing. And remember that a good monitoring and record-keeping system is essential to evaluate control efficacy.

APHIDS

Two common species of aphids in greenhouses and nurseries are the green peach aphid and the melon/cotton aphid. Other aphids occasionally seen include the chrysanthemum aphid, cabbage aphid, foxglove aphid and tulip bulb aphid. Besides direct damage, aphids can also transmit viruses to ornamental plants.

Biorational products. Neem (Azatin, Ornazin), BotaniGard, insecticidal soap, horticultural oil and pyrethrums are biorational insecticides that can be used for aphids.

Biological controls. Parasitoids (e.g., *Aphidius colemani*) and predators (e.g., *Aphidoletes aphidomyza*). Both can be purchased from natural enemy suppliers, and parasitoids may move into the crop naturally during summer if there is limited pesticide use. Parasitized aphids develop a swollen,

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papery appearance. If parasitoids are to be purchased, identify the aphid species first to ensure an appropriate match.

How to use. Soap and oil kill on contact and have no residual activity, so good coverage is essential. BotaniGard is a pesticide that contains spores of the insect pathogen, *Beauveria bassiana*. The spores germinate, and the fungus grows into the aphid's body the same way a plant-infecting fungus infects its host. Aphids grow too quickly during periods of peak reproduction for effective fungal infection, so reserve BotaniGard for other times.

Natural enemy suppliers will provide information on use of parasitoids and predators. It will take at least one week after the initial release until control starts to be observed.

CATERPILLARS

Many species of caterpillars may occur as pests in the greenhouse. These include loopers, armyworms, cutworms, leaftiers and leafrollers. Loopers are generally the most common. These insects enter on infested plant material or as adult butterflies or moths. Adults of some species are attracted to the lights in the greenhouse. Some species are also attracted to pheromone traps.

Biorational products. DiPel, Gypcheck, neem (Azatin, Ornazin).

Biological controls. None.

How to use. Adult butterflies and moths do not feed on plant tissue but instead remove nectar from flowers. If they are seen, examine plants for young larvae about 7-10 days after adult activity is first observed. This is when DiPel (*Bacillus thuringiensis kurstaki*) should be sprayed. Gypcheck is a strain of an insect virus that is specific to gypsy moths. Some greenhouses have achieved success against other species by grinding up infected caterpillars (these will be limp and ooze fluid), mixing them with water and spraying the resulting liquid in the greenhouse.

FUNGUS GNATS

Organic-based growing media (including peat-lite or bark), compost piles, areas of high moisture and weedy spots under greenhouse benches all favor fungus gnats. Fungus gnat larvae can cause slow plant development, wilted foliage (even with adequate watering), leaf yellowing and leaf drop. Feeding injury will be visible on roots and stem bases. Fungus gnats can also carry spores of root system pathogens.

Biorational products. Gnatrol (*Bacillus thuringiensis israelensis*), BotaniGard applied to the soil may give some control.

Biological controls. *Hypoaspis miles*, nematodes (e.g., ScanMask, NemasysH), *Atheta coriaria*.

How to use. The first step in fungus gnat control is to avoid excess water. The soil-dwelling predatory mite, *Hypoaspis miles*, is easily released and can provide long-term control. Simply shake the mites from the container. This predator will also feed on thrips pupae.

Nematodes (e.g., ScanMask, NemasysH) are also effective. Their release is more complicated, as they must be mixed and sprayed like a pesticide. Be sure to remove filters from nozzles so the nematodes can pass through.

Atheta coriaria is a predatory beetle that feeds on fungus gnat larvae and second-instar thrips larvae. Release *Atheta coriaria* onto the grow-



ing media and soil floors when fungus gnat levels become unacceptable. All mobile stages of this beetle are predatory.

The biopesticide Gnatrol (*Bacillus thuringiensis israelensis*) is also effective, although multiple applications may be needed, and some people find the odor disagreeable. Do not use nematodes and *Hypoaspis miles* together.

LEAFMINERS

The female leafminer deposits her eggs into leaves, leaving small brown puncture wounds that may be mistaken for a disease. As the larvae develop, they feed inside the leaf, creating a disfiguring, serpentine-shaped mine.

Biorational products. Neem (Azatin, Ornazin).

Biological controls. *Diglyphus isaea*.

How to use. Biological control with the parasitoid, *Diglyphus isaea* is most effective in cut flowers where some level of foliage damage can be tolerated.



Diglyphus isaea

MEALYBUGS

The presence of fluffy, white masses on a plant is a sign of mealybug infestation. The longtailed mealybug, the citrus mealybug and the obscure mealybug attack a variety of ornamental plants.

Biorational products. A combination of insecticidal soap and BotaniGard.

Biological controls. The predator, *Cryptolaemus montrouzieri* and the parasitoid, *Leptomastix dactylopii* are recommended.

How to use. Mealybugs are such a difficult insect to control that a combination of tactics is required. Monitor regularly to catch infestations while small. Mealybugs can survive on pots, benches, etc., so strict sanitation should be used when working with infested plants. Using a soap/BotaniGard combination may lead to better fungal penetration because the soap disrupts the mealybug's external skeleton.

Biological controls can be effective in greenhouses because they can reach

mealybugs that are in leaf axils and other protected areas more effectively than pesticides.

SHOREFLIES

Adult shoreflies spread pathogens within greenhouses and thrive in the same wet conditions that are attractive to fungus gnats. High populations of shoreflies can be annoying. Large populations of shoreflies leave quantities of unsightly dark specks (droppings) on flowers, foliage and plant labels.

Biorational products. None.

Biological controls. Naturally-occurring parasitoids may sometimes enter the greenhouse if there is minimal pesticide use; *Atheta coriaria*.

How to use. Release *Atheta coriaria* onto the growing media and soil floors when shorefly levels become unacceptable. This predatory beetle will feed on shorefly larvae as well as fungus gnat larvae and second-instar thrips larvae. ▶

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Atheta coriaria

TARSONEMID MITES

These yellowish-white mites are visible only under high magnification through a microscope. The cyclamen mite can cause severe damage to African violet, cyclamen, gloxinia, delphinium, vinca, New Guinea impatiens and other plants. The broad mite occasionally attacks a number of greenhouse plants, including begonias and impatiens. Neither of these mites produces webbing.

Biorational products. None.

Biological controls. Some growers make prophylactic releases of the predatory mite, *Amblyseius cucumeris* on highly susceptible crops.

How to use. Release *A. cucumeris* at a rate of six mites per 10 square feet as soon as pest mites are seen.

TWO-SPOTTED SPIDER MITES

Two-spotted spider mites attack many kinds of plants. These mites can blow in from outside a greenhouse or nursery or move from older infested material to clean plants. They are also easily spread by workers, as they move between plants. Two-spotted spider mites are about $\frac{1}{16}$ inch long and green to red in color, with two distinctive black spots.

Biorational products. Horticultural oil, neem products.

Biological controls. *Phytoseiulus persimilis*; *Amblyseius californicus*.

How to use. Use oil or neem when mites or eggs are first observed. Horticultural oil kills on contact and has no residual activity, making good coverage essential. *Phytoseiulus persimilis* is also released when mites are first observed. *Amblyseius californicus* can feed on other prey or pollen and can also go for longer periods without food than *P. persimilis* can. It is sometimes used instead of *P. persimilis* during the winter when spider mite populations are typically lower and thus harder for *P. persimilis* to find.

WESTERN FLOWER THRIPS

Thrips damage usually appears as scarred, stunted or distorted foliage or flowers or as white areas on leaves or petals. Black fecal material is often visible on damaged tissue. Thrips are also a concern as vectors of impatiens necrotic spot and tomato spotted wilt viruses.

Biorational products. Neem products; BotaniGard; Garlic Barrier.

Biological controls. *Amblyseius cucumeris* has been successfully used in bedding plant production.

How to use. Neem and BotaniGard can be used in a pesticide rotation with conventional chemicals for thrips control. Because BotaniGard will not kill its thrips host until the infection process has taken place, it is best used in the spring and fall when thrips numbers are typically lower. Greenhouse temperatures may be too low in the winter for effective infection rates.

Garlic Barrier does not kill thrips but acts as an effective repellent. It should be used preventatively and will need to be reapplied.


Amblyseius cucumeris should be released at the beginning of the crop. One or two additional releases are made depending on thrips populations. Once thrips begin to move into the greenhouse from outside, levels typically become too high for effective biological control.

WHITEFLIES

Two species of whitefly, the silverleaf whitefly and the greenhouse whitefly, are of concern. Whiteflies often remain in a greenhouse after the poinsettia season, living on weeds, hanging baskets or stock plants.

Biorational products. Horticultural oil; insecticidal soap; BotaniGard, neem (Azatin, Ornazin).

Biological controls. Parasitoids are also available and have been most widely tested in poinsettias and cut gerbera daisies.

How to use. Oil, soap or BotaniGard should be sprayed when whiteflies are first seen. Oil and soap have only contact activity, so good coverage is essential. Parasitoid release rates and timing will vary with the crop, so consult your biological control supplier for this information. *Encarsia formosa* is used for greenhouse whitefly, and *Eretmocerus eremicus* is used for silverleaf whitefly. 

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