

Pollinator Friendly Plant Production 2: Controlling Insect Pests

As any experienced grower knows only too well, nursery management is a continuous process of solving problems, particularly damage caused by pests and diseases. No matter what you have in your nursery inventory, insects will prey upon the plants, making them unsightly and harder to sell. Non-native pests (insects, mites and diseases) are constantly arriving in the United States on imported plants. These pests will attack native and non-native species of plants. Native insects also interact with native plants, taking the nectar, pollen, and leaf tissue the insects need to complete their life cycles.

Providing your customers with aesthetically pleasing plants may involve using control materials that help keep insect damage to a minimum. To promote your product as pollinator friendly, you must select materials that have minimal impact on pollinators (figure 1) and other beneficial insects (figure 2).

Pollinator-friendly pest management is an integrated and preventative approach that considers the overall health of the plant and the nursery environment to prevent problems and to manage them wisely if they arise. Natural enemies offer longer-term, more satisfactory results than pesticidal chemicals. If natural enemies are not sufficient, consider the reduced toxicity materials available for control of pests on your native plant inventory. Pesticides (whether natural or synthetic) should serve as a last resort for managing pests.

This factsheet contains information that will help you manage your nursery using an integrated and preventative approach. This report is the second in a series of factsheets that also includes:

• *Pollinator Friendly Plant Production 1: Native Plants for the Nursery & Landscape Industry of Central Maryland*

• *Pollinator Friendly Plant Production 3: Propagating Native Perennials from Seed*

Natural Enemies are Beneficial Insects and Microbes that Feed on Pests

Beneficial Insects

Beneficial insects are either predators or parasites that attack pests. You can purchase them from biological supply companies or try to attract them to your nursery stock by creating habitat for them. Reservoir plantings are gardens or

meadows that you install near your greenhouses and outdoor plant production areas to serve as habitat for beneficial insects. These insects in turn, will help control pests on nearby nursery inventory. On a smaller scale, you can employ potted plants that provide food or habitat for beneficial insects. Known as banker plantings, you can place the potted plants to attract beneficial insects to specific areas in your production facility (Gill 2012a).

The reverse approach also works. If you are growing potted native plants in the greenhouse, one of the most effective ways to deal with an insect attack is to move the plants outdoors (weather permitting) where natural enemies have access to the destructive insects.

Beneficial Microbes

Beneficial microbes are usually applied as a spray. Spray applications inundate your plants with beneficial microbes. They are only effective for 3 or 4 days, then the microbes break down to naturally occurring (background) levels. Rain or overhead irrigation washes them away, although using a spreader/sticker can be helpful. Spreader/stickers are spray solution additives that enhance the active ingredient by decreasing viscosity, improving spray coverage of the target, or increasing the tackiness of the solution, improving spray adherence to the target. Unlike synthetic chemicals such as neonicotinoids, beneficial microbes have no adverse impact on pollinators that visit the plants in your customer's garden.

Bacillus thuringiensis is a bacterium commonly referred to as "Bt." When pests ingest Bt, it is converted into toxins which destroy the gut membrane. Varieties of Bt that are useful for controlling damage on your pollinator-friendly nursery stock include:

- *Bacillus thuringiensis* var. *kurstaki* (Btk) products are excellent choices to manage unwanted caterpillars (the larvae of moths and butterflies). Btk affects young caterpillars but the sprays don't harm older ones. Btk has no impact on birds, bees, and other insect and mite species. Btk is sold under many trade names, such as Dipel and Bt Worm Killer.
- *Bacillus thuringiensis* var. *galleriae* (Btg) is a relatively new Bt available to homeowners and commercial applicators to control lawn grubs and adult scarab beetles. It is sold under the name grubGone for lawns and under the name beetleGone for adult beetle control. It is useful for controlling beetle pests on nursery stock.



Figure 1. Many customers purchase native plants to attract pollinators to their home gardens. Through careful use of pollinator-friendly control methods, you can provide customers with pollinator-safe plants. Some pollinators that you may have on your nursery stock include: **Bees:** Recent studies suggest that native bees may be even more sensitive to neonicotinoids than honeybees. The bumble bee (left) is on woodland sunflower. The solitary bee (center) is on butterfly milkweed. *Can you find the predatory beneficial hiding in the orange blossoms?** **Butterflies** are less efficient pollinators than bees are. This pearl crescent butterfly is nectaring on mistflower (right). Some pesticide labels include restrictions to protect pollinators, for example, directing spray away from flowers or not applying spray when a plant is in bloom. **Look for an orange crab spider to the immediate left of the bee.*



Figure 2. The predatory beneficial insects in your nursery stock help control pests at your production facility. You can encourage even higher populations by keeping natural areas, native gardens, or native meadows nearby. Your customers may be planting native plants to attract beneficials to their own garden. **Beetles:** Adult soldier beetles are pollinators (the one shown at left is nectaring on gray goldenrod), but their larvae are voracious predators. **Wasps:** Adult scoliid wasps feed on pollen and nectar (center, on narrow-leaf mountainmint). Adult females hover over turf looking for scarab beetle grub larvae, especially Japanese beetle larvae, on which to lay their eggs. **Flies:** Syrphid flies are pollinators as adults, but as larvae (right), they are predators of small insects. The larva in the photo is feeding on an oleander aphid, a common pest of milkweeds.

- ***Bacillus thuringiensis* var. *israeliensis* (Bti)** is a mosquito and gnat control product which kills the aquatic larvae of these pests. Sold as Mosquito Dunks or Gnatrol, they are applied to the water directly. Native wetland plants are often grown in standing water. To reduce the spread of mosquito-borne diseases such as Zika virus, use Bti for control of larvae in standing water. Bti, applied as a soil drench, can be used to control fungus gnats in potted plants (although cutting back on watering will also help).

Beauveria bassiana is an insect-killing fungus sold under the names Botanigard and Bioceres. It is used as a drench to target soil-dwelling insect larvae such as fungus gnats or root weevils like the black vine weevil. Used as a spray, it is effective against foliar-feeding insects, including some aphid species. Humidity facilitates mycelial growth; more humidity makes *B. bassiana* fungus more effective. The fungus has minimal impact on pollinators and beneficials when applied directly to a pest.

Bug-killing Nematodes (Entomopathogenic Nematodes) are microscopic relatives of roundworms. They occur naturally in soils but at background levels. Although they are not beneficial microbes, bug-killing nematodes are tiny beneficial microbe delivery systems. They prepare their host insect for consumption by releasing lethal bacteria into them. By applying large numbers of nematodes to your plants, you provide excellent soil-dwelling pest control. For example, the nematodes are effective against black vine weevil larvae and other non-native grubs feeding on the roots of ornamental plants. Bug-killing nematodes are mostly available on a mail order basis. Grubstake, Heteromask, and Gardens Alive Hb Nematodes are common brands. *Steinernema* species and *Heterorhabditis* species are two major types of nematodes available.

Spinosad is a short-residual fermentation product of the bacterial species *Saccharopolyspora spinosa*. It is extremely effective in controlling thrips and caterpillars. It does not need to be applied directly to target pests. When an insect pushes its mouthparts into treated vegetation, it picks up the toxin. To make the product safer for bees, avoid spraying it on open blossoms. Spinosad is sold under the name Bulls-eye Garden insecticide.

Weather Influences Insect Activity Levels

In a rainy year, such as 2018 in the Eastern United States, there are lower populations of the thrips and spider mites that plague so many plants. Excess moisture supports larger populations of beneficial microbes, both bacterial and fungal, which keep these pests in check. Conversely, during a hot drought year, you will need to closely monitor plants for thrips and spider mites. Apply biocontrols early based on the pest activity you observe during your regular monitoring program.

The use of resistant plant varieties is a basic tenet of Integrated Pest Management (IPM). Resistant varieties reduce the need for any kind of control. However, the use of resistant varieties generally does not apply to working with native plants. They have a role to play within their ecosystems, which includes use by insects. Varieties of native plant species that are insect resistant may not be fulfilling the customer's desire to support the web of life within their yard. Furthermore, if genes of the

resistant varieties establish in the wild via seed dispersal or cross-pollination, resistance could have adverse impacts on insects in natural areas.

Naturally Derived Chemicals

At the time of application, naturally derived chemicals can be toxic to non-target insects. However, in many cases, naturally derived chemicals such as pyrethrums, are short residual. This makes naturally derived chemicals safer for all insects, including pollinators and natural enemies, soon after application. To be successful, it is critical to apply naturally derived chemicals during the initial stages of a pest outbreak. A good Integrated Pest Management (IPM) plan, including regular monitoring, will help you catch pest problems before they get out of hand.

Neem pesticides are derived from seeds of the neem tree (*Melia azedarach*—a relative of the mahogany tree). Neem pesticides containing azadirachtin (AZA) kill a broad range of insects by disrupting their growth and development. Neem pesticides are strong insect repellents as well. Many different forms of neem are available, so shopping for neem products can be confusing:

- Clarified hydrophobic extracts of neem oil are products that do not contain any AZA and are better used for fungal disease control. Trade names include Green Light Neem Oil and Triact.
- Potassium salts of fatty acids from neem seeds are insecticidal soap formulations that vary in their concentration of AZA. They produce the same results and should be used with the same care as other insecticidal soaps (see below). Trade names include Bon-Neem and Organica K+ Neem.
- Neem oil formulations containing AZA are the best compounds to use against chewing insect pests such as caterpillars, leaf beetles, and sawflies. These formulations affect the growth and development of immature insects, but not of adults. The amount of AZA present in a formulation varies widely and may reflect whether the product is a Ready-to-Use (RTU) formulation or a concentrate. Trade names include Safer Bio-Neem and Neem-Away Insect Spray.

Pyrethrum/Pyrethrins are products extracted from the pyrethrum flower, *Chrysanthemum cinerariaefolium*. These naturally derived, broad-spectrum pesticides control a wide variety of insect pests. Pyrethrum/Pyrethrins are primarily used to control sucking insects such as aphids and whiteflies. The products must be sprayed directly on target pests because they work on contact, not by ingestion. They provide control by interfering with transmission of electrical signals across synapses, rapidly stopping respiration. The spray also kills beneficial insects, so it is important to target only the pest species. The environmental persistence of pyrethrum products is short (an hour or two). Several Safer brand products, Doktor Doom, and many insecticides labeled “organic” contain pyrethrins.

Don't let the similar names cause you to confuse pyrethrum and pyrethrin products with their synthetic counterpart, pyrethroid. The latter have an added UV inhibitor so they last for several weeks. They continue to work long after your target pest is gone, killing a diversity of insects, including beneficials and pollinators.

Insecticidal Soaps are long-chain potassium salts that are specially formulated for pest control. Unlike over-the-counter dish soaps, they do not contain detergents, dyes, or perfumes that may injure plant tissues. However, insecticidal soap formulations do contain almost 30% ethyl alcohol. This leads to a risk of plant burn, particularly on plants with sensitive foliage, or on any plant at temperatures above 85° F. Insecticidal soaps control sucking pests such as aphids, whiteflies, and mites by dehydration, removing all moisture from their innards. Many companies produce insecticidal soap, but Safer is the best-known brand name.

Horticultural Oils are highly refined, narrow distillation range, paraffinic oils that are suitable for use on plant material throughout the year. They are good choices for sucking pests such as scale insects, aphids, whiteflies, and particularly for spider mites. It has been suggested that oils smother or suffocate small insects and mites that cannot crawl out of it. The disruption of cell membranes and the resulting desiccation of the pest is another mode of action. Horticultural oils work best when they are composed of tiny droplets. Total coverage is essential for effective control. Eggs, nymphs or adults that are not covered will not be killed. These products can be used throughout the growing season on plants in leaf and in flower. They can also be used during winter months, as a “dormant” oil, in which case you should increase the concentration of the oil in the solution. Dormant oil applications must cover the insects and eggs that overwinter within the crevices of the bark, around the branch collars, and on the bud union.

Let Your Customers Know Your Plants are Pollinator Friendly!

Pests on milkweed inventory include both alien (oleander aphids on swamp milkweed, left) and native (monarch caterpillar on common milkweed, right) species. Both alien and native species can make your plants unmarketable. For high-volume production, reduced toxicity control options include the beneficial microbe *Beauveria bassiana*, beneficial insects, insecticidal soap, and horticultural oil. For low-volume production, sales floor maintenance, or non-profit nurseries with volunteer labor, control options could include the more intensive techniques like hosing or squishing of aphids, and hand removal of caterpillars. Either way, your milkweeds will be safe for monarchs again by the time they reach the sales floor. This is a great selling point with the milkweed-hungry shopping public.



Additional Resources

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Sara Tangren

Stanton Gill

sgill@umd.edu

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