Managing Pests In Small Greenhouses

The small greenhouse is not immune to insect and mite infestations: Growers must discover the best combinations and use multiple strategies to prevent plant injury and economic loss.

By Colleen Armstrong

Top: *Preventing algae growth will help reduce the number of shore flies in a greenhouse.* ***Bottom:*** *Quick count trap cards provide an excellent representation of the kinds of pests living in the greenhouse. (Photos: Colleen Armstrong)*

Over the past 30 years, I've managed all kinds of greenhouses and a common characteristic has been their modest size — smaller or equal to 2,500 sq.ft. Insect problems can be challenging because a grower can experience multiple pest problems in close proximity to one another and at the same time. Keeping pest control costs to a minimum requires the grower to stay one step ahead of the pests. Also, if the greenhouse doubles as a production and retail operation, there may be additional constraints and concerns about environmental safety for consumers and co-workers.

Control Sanitation And Temperature

Sanitation will give you more bang for your buck than any other practice. Weeds both inside and outside of the greenhouse can harbor aphids, thrips, spider mites and whiteflies. They can be a source of diseases, too. Planting narrow-bladed grasses such as fine fescues around the outside perimeter of the greenhouse will discourage thrips from relocating inside the greenhouse. Broadleaf weeds or ornamental perennials near the greenhouse can be a reservoir for thrips.

Research gathered from weekly scoutings conducted by Tom Doubleday and Michael Brownbridge from the University of Vermont Entomology Research Laboratory indicate that during the early winter months, an empty, frozen greenhouse does not guarantee seasonal thrips protection. Thrips will survive in the greenhouse after extended cold periods. They cling onto weeds and debris while dormant and successfully transition into the next generation once temperatures begin to rise.

A better tactic for thrips prevention is to turn the thermostat to 90° F and let the empty greenhouse cook for 5-10 days before closing it down for the season. Immediately afterwards, put in a few sacrificial marigolds. Hungry and thirsty thrips migrate onto the plants: After a few days, pull out the thrips-infested marigolds.

Eliminate stagnant pools of water on the floor and prevent algae blooms. Shore flies (*Scatella stagnalis*) require algae for food; without the green micro-fodder, shore flies cannot survive. In early spring, their numbers start small, but they can escalate quickly in the warmer months.

Remove any sentimental plants that harbor recurring populations of aphids, thrips, spider mites or scales. This could be a decade-old mandevilla, 'Ponderosa' lemon or hibiscus. They may thrive in ample sunlight and high relative humidity, but they don't belong in a production greenhouse.

Scout For Problems

Designate a section of your greenhouse or, even better, a separate greenhouse for new plants and plugs coming into your operation from other producers. Scout weekly for two weeks before integrating those plants into the entire greenhouse. If you identify a problem, contact the grower. Inquire about their recent spray program and select a pesticide that has a different mode of action from the producer's most recent applications.

Most everyone uses yellow or blue sticky trap cards because they're a quick, easy method to detect the first flush of insect populations. Yellow cards are the most popular because they snag winged aphids, thrips, whiteflies, fungus gnats and shore flies. However, sticky cards should only supplement regular plant inspections. Weekly scouting is mandatory, especially during springtime. ➧

WHAT TO PLANT WHERE THE SUN DOES NOT SHINE?

New *Alternanthera* cultivars offer a colorful alternative to the same old shade bedding plants.

'Cognac', 'Crème de Menthe', 'Grenadine' and 'Partytime' are new Flower Fields introductions through Yoder Brothers. Bred by Itsaul Plants in Georgia.

Bobby Saul says these are for shade only and bring to the shade garden what *Coleus* bring to the sunny border. Pennsylvania trials bear him out. All four grew steadily to form full, shrub-like plants by summer's end. Like *Coleus*, the color source is foliage, not flowers.

'Cognac' (PPAF) – Medium to dark maroon, glossy foliage. Plant height is 12 inches.

'Crème de Menthe' (PPAF) – Creamy white and mint-green foliage brightens shady spots. Plant height is 15 inches.

'Grenadine' (PPAF) – Reddish-pink leaves with white highlights and dark veins. Plant height is 14 inches.

'Partytime' (P.P.#14789) – Provides a riot of color. Green leaves are generously splashed with shocking pink and white coloration. Plant height is 14 inches.

Plant heights given are based on Pennsylvania first-year trial performance. USDA Hardiness Zones 8-11.

ALTERNANTHERA!

Grower tips

- Grow as annuals or tender perennials, depending upon location.
- Very easy to grow and a fast grower.
- Plants are multi-branching. One pinch is recommended to provide a fuller appearance.

Selling points

- Great for high shade areas.
- Very versatile for use in combo containers, hanging baskets and as a groundcover.
- Good mixer for planting with impatiens.

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Bio-rational Pesticide	Trade Name	Common Name	Manufacturer/ Marketer	Target Pest	Biological Control Agent
IGR juvenile hormone mimics	Enstar II	Kinoprene	Wellmark International	Whitefly	Harmful to many parasitoids.
	Distance	Pyriproxyfen	Valent U.S.A. Corporation		Compatible with green lacewing (*Chrysoperla carnea*) and *Orius spp.*
IGR ecdysone antagonists	Azatin/ Ornazin	Azadirachtin	OHP/SePRO Corporation		Harmful to green lacewing. Compatible with eggs and adult *Phytosieulus persimilis* and *Amblyseius cucumeris.*
	Confirm	Tebufenozide	Dow AgroSciences	Caterpillar larvae	Compatible with green lacewing.
IGR chitin synthesis inhibitors	Talus	Buprofezin	SePRO Corporation	Two-spotted spider mite	Compatible with many parasitoids.
	Adept	Diflubenzuron	Chemtura Corp.		Harmful to early larval stages of green lacewing. Compatible with *Leptomastix dactylopii*.
	Pedestal	Novaluron	Chemtura Corp.		Harmless to *Hypoaspis miles.*
Nicotinic acetylcholine receptor antagonist	Conserve	Spinosad	Dow AgroSciences	Thrips, two-spotted spider mite	Compatible with many predatory insects and mites.
Insecticidal soap	M-pede	Potassium salts	Dow AgroSciences	Aphids, whitefly, mealybug	Direct applications are harmful to most beneficial insects and mites. Short residual time and less harmful.

Figure 1. Bio-rational pesticides and biological control agents for greenhouse production.

If you are short on time and think it is impossible to scout the greenhouse, conduct a "quick count." Look at a section of the trap card instead of counting the entire card. When using a 3x5-inch trap card (assuming the 5-inch side is the width), draw a 1-inch column down the center of the card. Count the insects and multiply by 10. (There are five 1-inch columns on each side. Two sides x five 1-inch columns = 10.) In most cases, the center section of the trap card is an excellent representation of what is in the greenhouse.

Vertical sticky trap cards should be near the crop's new terminal growth and horizontal cards should be placed near the root medium for trapping adult fungus gnats (*Bradysia spp.*). Female adult fungus gnats fly low and near the soil surface to lay their eggs into the root medium. One sticky card per 250-1,000 sq.ft. is the standard recommendation; however, I use one vertical and one horizontal card per 250 sq.ft. during springtime or whenever fungus gnat numbers begin to increase.

Media, Moisture and Feed

What's the connection between media and pest control? Healthy plants withstand attacks from insects and disease. During University of Vermont's plant propagation course, students evaluate different seed germination media for sweet pepper seedling production. The proportions and contents of the media vary from light to heavy and are specialized by various manufacturers.

Often, students find fungus gnats hovering around seed germination mixes with hefty proportions of peat moss or compost because they retain a lot of water. Fungus gnat eggs and larvae complete their life cycle in the top inch of media, and they require lots of moisture. Allowing the media to dry to 50-percent moisture content between watering intervals can prevent fungus gnats from completing their life cycle. It is a delicate balance of enough moisture and aeration for maximum seed germination and healthy root development. Conversely, the combination of super light media and thirsty, mature seedlings can lead to wilt and stress. Wilted plants also are more vulnerable to disease, insect infestation and poor development.

Proper watering is the best practice to protect plants from fungus gnat, shore fly or drain fly (*Psychoda sp.*) infestation. Frequent, light watering triggers shallow root development and excess moisture levels.

Excess nutrient fertilization will exacerbate aphid and thrips infestations. When seedlings have luxuriant growth with excess nitrogen, insects feeding on them become beefier and more fecund. Adult females bear more immature insects than expected averages, and the next generation's numbers quickly rise. ➧

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Plant Bugs						
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Know Your Enemy

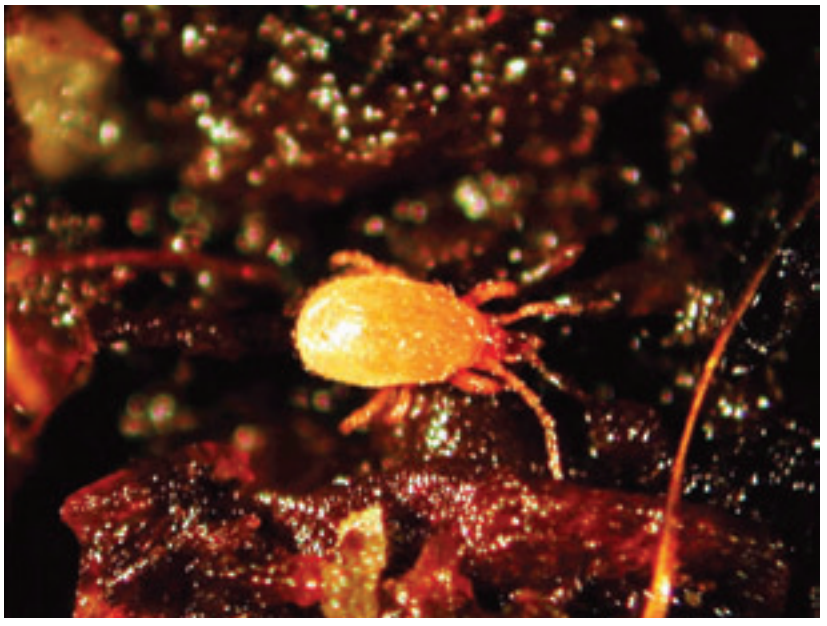
Proper insect identification can be difficult but it is more important than ever because we often encounter different species of a pest, such as greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia argentifolii*) and banded-winged whitefly (*T. abutilonea*). To make matters worse, we have different strains or biotypes of a particular species, for example, B biotype sweet potato whitefly (*Bemisia tabaci B biotype*) and Q biotype sweet potato whitefly (*B. tabaci Q biotype*). Growers report that Marathon (imidocloprid, OHP) continues to be effective against greenhouse whitefly, but that silverleaf whitefly has developed resistance to the material. Get the most out of your pesticide by proper identification.

Newer pesticides are selective to specific pests and a misidentification can be costly. Endeavor (pymetrozine, Syngenta Professional Products) disrupts aphids from feeding but has no value against mealybugs. If you are using biological controls, identification is essential. A tiny wasp, *Aphidius colemani*, parasitizes green peach aphid (*Myzus persicae*) and melon aphid (*Aphis gossypii*), but it will not bother with potato aphid (*Macrosiphum rosae*) or foxglove aphid (*Aulacorthum solani*).

Introduce Beneficial Insects

Every year, I can expect certain recurring insect problems in our greenhouses. I'll find spider mites on tropical ornamentals in late winter and fungus gnats on bedding plants in the spring. Because we keep our scouting records from the previous year, I can review them and pinpoint when the previous year's problems occurred. Our planting schedules are generally predictable, and I coordinate regular introductions of beneficial insects with seasonal planting and crop production.

In preparation for beneficial insects and mites, I stop using pesticides with lengthy residual effects, and I replace them with bio-rational pesticides that are compatible with the natural enemies. Only a few years ago, this information was difficult to find, but that is no longer true.



Predaceous mite Hypoaspis miles *can help adult fungus gnat problems but they may not arrive right away. Using a bio-rational pesticide reduces the problem quicker. (Photo: Biobest)*

Pesticide and natural enemy compatibility charts can be found in your regional university extension pesticide recommendation publications or at Web sites such as www.koppert.nl/e005.shtml (click on "side effects"). Select the insecticides that you have been using and the beneficial insect or mite you plan on introducing into the greenhouse. Check the number of weeks the insecticide is persistent and lethal to the natural enemy.

In late winter, I introduce a fast-searching, predaceous mite, *Phytoseiulus persimilis*, to prevent two-spotted spider mite (*Tetranychus urticae*) infestations. If I've applied Avid (abamectin, Syngenta Professional Products) for thrips or spider mite control, I must wait two weeks before releasing the beneficial mite. If I have used Talstar (bifenthrin, FMC Corporation), I must wait 8-12 weeks before introducing the predaceous mite. Both pesticides are very harmful to *P. persimilis* nymphs and adults, but abamectin is harmful to the predator for a much shorter time period (see Figure 1, page 30).

Take Action

Growers have better success with natural enemies when they attack pests at low population densities. When a problem is identified, decide the course of action. In practical terms, a moderate or high level of a pest infestation demands immediate action and most likely, a conventional pesticide treatment is necessary. A small problem can be managed with spot treatment of a bio-rational pesticide, and if the grower is committed to a biological control, releasing a suitable natural enemy would follow.

When I first detect adult fungus gnats buzzing around bedding plants, I place an order for the predaceous mite *Hypoaspis miles* from a reliable

supplier. Because I can't expect the beneficial mites to arrive for seven to 10 days, I select a bio-rational pesticide to reduce the problem as soon as possible.

You can nip a problem in the bud by taking immediate action and spraying a small area before the pest spreads into a larger area. Aphids, even in small numbers, are a concern on young plants. If the prospect of spraying the entire greenhouse seems unattainable, treat the localized problem area. Use spot treatments of an insecticide to short circuit a potentially explosive outbreak. Weekly plant inspections and trap card checks are essential follow-ups for any spot treatments. Even small areas must be posted for a pesticide application. Low residual pesticides with short-term restricted entry interval allow for evening applications without interrupting the daily routine.

Use Sentinel Plants

Not to be confused with sentimental plants, sentinel plants are individual plants set within a crop area and monitored to provide early detection of a problem. They can be flagged or marked crop plants that you return to and check on every week. If an insect problem develops, the sentinel plants help you determine whether you need treatment or not or whether your control regime is effective or not. When the problem occurs, write the date and description on the colored tape or marker. Return to the sentinel plants throughout the production cycle and assess if any additional treatments are necessary.

Conclusion

The small greenhouse is certainly not immune to insect and mite infestations, and the grower must use multiple strategies to prevent plant injury and economic loss. The newer, more selective pesticides are expensive, and beginning a biological control program can be costly at the start. Cultural methods are long-lived and tested practices. Each small-scale grower must discover the best combination of strategies for their own greenhouse IPM program.

Incorporating cultural practices such as strict sanitation measures, proper media selection and accurate nutrient fertilization programs will discourage pest outbreaks. If a problem arises, use current publications, professionals, county diagnostic services or online resources to identify the pest. If biological control is one strategy in your IPM program, consider making prophylactic introductions of natural enemies such as predaceous mites for two-spotted spider mite or fungus gnat control. Become familiar with bio-rational insecticides and miticides for early action treatments and compatibility with natural enemies. Take advantage of quick spot treatments to reduce a potentially threatening problem and use sentinel plants as your "easy-to-spot" indicators of insect or mite infestation. GPN

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