Biocontrols for Fungus Gnats

Fungus gnats (*Bradysia* spp.) are a familiar nuisance to container seedling growers, but it wasn't until fairly recently that their pest status was fully recognized. This is because the adult gnats themselves don't directly attack seeds or seedlings; instead, it is their small larvae that live hidden in the growing media that cause the most damage. Although it was only suspected until recently, the true role of the adult gnats as vectors of fungal pathogens has now been firmly established. A recent article confirmed that fungus gnats are now considered to be the third most destructive greenhouse pest.

As is true for all pests, you should understand the entire pest complex before starting to think about controls.

Hosts.
The larvae feed on various forms of organic matter, including moss and algae, but will also attack fleshy seeds and the fine roots of young tree seedlings and cuttings. All species and age classes of plants are susceptible if they are found in warm, wet environments containing abundant organic matter. Unfortunately, this describes almost all greenhouse crops.

Diagnosis/Damage.
The first evidence of a problem is the presence of the small [2 to 4 mm (0.08 to 0.16 in.)] adults which hover around the crop and fly when disturbed. There are several flies that are common in greenhouses, however, and growers need to be able to distinguish between them to determine if control is warranted. Fungus gnats are small, dark, mosquito-like flies which can be identified by a "Y-shaped" vein at the top of the transparent wing (Figure 9 A). The larvae are around 0.5 mm (0.02 in.) in length, legless, and semitransparent to white in color with black heads (Figure 9 B). I've found a few of the larvae in growing media, but they are extremely difficult to locate, so it's easier to make the identification from the adults. Plant symptoms include seeds that do not germinate, and seedlings or cuttings which wilt and lose vigor. Examine seeds and the tips of the root system with a hand lens. The larvae completely consume fine roots but just the exterior cortical tissue of larger ones, leaving the stripped vascular tissue. These symptoms are very similar to fungal root rot,

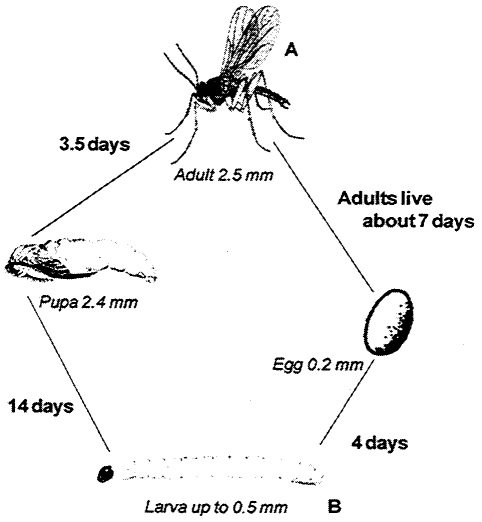

Figure 9 A/B. The life cycle of the fungus gnat only takes a few weeks, so populations can build up rapidly. (Sketch courtesy of J.R. Baker, North Carolina Cooperative Extension Service, Raleigh, NC 27695-7613).

but the presence of the adult gnats is diagnostic. Quick diagnosis is critical because by the time symptoms become common, damage is usually so severe that control is difficult. Instead, the adults should be controlled as soon as they are noticed.

Fungus gnats have been shown to vector several fungal root rots, including *Pythium* and *Fusarium,* and even foliage pathogens like *Botrytis* and *Phoma.* This vectoring of plant pathogens actually may prove to be more damaging than the direct feeding injury of the larvae, and further stresses the need for early treatment.

Life Cycle.
Just how these insects first get into the greenhouse is uncertain, but like *Botrytis cinerea,* fungus gnats seem to appear whenever conditions are favorable. The eggs or pupae survive between crops on moss, algae, and weeds around the nursery, so a source is always present. The adult fungus gnats live only about a week, and then the females lay their eggs on any moist surface that is high in organic matter. They particularly love damp, highly organic peat-

vermiculite growing media, especially when it is kept too wet. The eggs hatch in about 4 days, the larvae feed for a couple of weeks, and then they pupate in the top layers of the growing medium. After a few days, the adults emerge and the entire cycle, which takes less than a month, starts all over again.

New Biocontrols.

Although most common insecticide sprays are effective, it is difficult, if not impossible, to completely control fungus gnats with chemicals alone. Keeping a clean greenhouse is imperative, and cultural controls such as using a well-drained growing medium and being careful not to overwater are crucial to a good integrated pest management program. Now, in just the last couple of years, several new biocontrol options have come on the market (Table 5).

If you decide to try biocontrols, then you should use them in an integrated pest management context: scouting, proper identification, establishing action thresholds, and most importantly, keeping good records. Using the proper release strategy is also important (Table 5). Inoculative releases are made when pest populations are low, so that the biocontrol organisms can establish, reproduce, and suppress the pests before they reach damaging levels. Inundative releases, on the other hand, are more in tune with traditional pesticide mentality because the biocontrol agents are released when gnats become a problem. Both types of biocontrols require time to work. For example, Gnatrol® contains bacterial endospores and toxin crystals that are ingested by the larvae as they feed. Because the adults are not killed, growers must be patient and make several applications before the fungus gnat life cycle is broken and populations of the adults decrease. Pre-emptive applications are the most effective but require good scouting and lower action thresholds than those for chemical pesticides.

So, you can see that biocontrols require some adjustments in your pest management mentality and strategies. They also offer many benefits over traditional pesticides: negligible applicator risk, minimal re-entry intervals, low phytotoxicity, and no problems with pesticide runoff.

Sources:

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Table 5. Types of biocontrol agents for controlling fungus gnats.

Type of Organism		Product Name	Release Strategy	Application Method
Bacteria	*Bacillus thuringiensis* var. *isrealensis*	Gnatrol®	Inundative	Soil Drench through Irrigation System
Mite	*Hypoaspis miles*	Order by Species	Inoculative	Apply to soil surface in vermiculite carrier
Nematodes	*Steinernema feltiae*	*X-Gnat*®	Inundative	Soil Drench through Irrigation System