GROWERTALKS

Features

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A Constant Scourge

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Fungus gnats, *Bradysia spp.*, are insect pests of greenhouse-grown horticultural crops and are one of the few insect pests where the damaging life stage—larvae—is located in the growing medium. Fungus gnat larvae cause plant damage under moist conditions when plants are young. Fungus gnat adults don't cause plant damage, but can be a nuisance when flying around. Adult females lay eggs in the growing medium. The larvae that emerge from the eggs cause direct plant damage when feeding on the roots.

Biology

The fungus gnat life cycle consists of an egg, four larval instars (stages between each molt), a pupa and adult. A generation can be completed in 20 to 28 days, although development time depends on the temperature of the growing medium. Fungus gnat adults have wings and are 3 to 4 mm (0.011 to 0.015 of an inch) in length, with long legs and antennae (Figure 1). Adults fly around the surface of the growing medium and live from seven to 10 days. After mating, adult females lay 100 to 200 eggs into the cracks and crevices of the growing medium.

Table 1. Common name and trade name of insecticides labeled for use against fungus gnat larvae.

Common Name (Active Ingredient)	Trade Name
Bacillus thuringiensis subsp. *israelensis*	Gnatrol
Chlorfenapyr	Pylon
Cyromazine	Citation
Diflubenzuron	Adept
Pyriproxyfen	Distance/Fulcrum

White, translucent, legless larvae that are approximately 6.0 mm (0.023 of an inch) long emerge from the eggs. A diagnostic characteristic of fungus gnat larvae is the black head capsule (Figure 2). Fungus gnat larvae are generally located at a depth of 2.5 to 5.0 cm (1 to 2 in.) in the growing medium, however, depth varies depending on growing medium type. Fungus gnat larvae feed on the roots and root hairs of young plants and/or seedlings. Fungus gnat larval populations thrive in moist growing media and the larvae require certain bacteria and/or fungi as a supplemental food source to complete development.

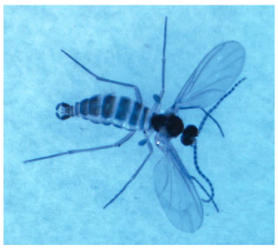
Damage

Fungus gnat larvae direct feeding damages developing root systems, which interferes with the ability of plants to uptake water and nutrients. Direct damage results in stunted plant growth and wilting. Larvae can also cause indirect damage during feeding by predisposing plants to infection from soil-borne diseases by creating wounds that allow entry of soil-borne plant-pathogenic fungi.

Management

Fungus gnat management entails scouting, cultural practices, applying insecticides and releasing biological control agents.

Scouting: Scouting helps detect the presence of fungus gnats early in production before populations reach plant-damaging levels. Yellow sticky cards positioned near the growing medium surface will capture fungus gnat adults, which will aid in detection. Potato disks or wedges placed on the surface of the growing medium for 48 hours will detect the presence of fungus gnat larvae that congregate underneath the potato disks.









Clockwise from top left: • Figure 1. Fungus gnat adult. • Figure 2. Fungus gnat larvae. Note the black head capsule. Photo by Raymond Cloyd.
• Fungus gnat larval feeding damage to poinsettia roots (left) and cuttings (right).

Cultural practices: Water management (i.e., irrigation) will help alleviate problems with fungus gnats. Water accumulation and the presence of algae provide ideal conditions for fungus gnat populations to thrive resulting in potential damage to plants. Allowing the upper 2.5 to 7.6 cm (1 to 3 in.) of the growing medium to dry out will reduce issues with fungus gnat larvae. In addition, the dry surface of the growing medium is less attractive to adult females for egg laying and any eggs laid will likely desiccate due to insufficient moisture content.

Applying insecticides: Insecticides can be used to manage fungus gnat larvae. (A list of insecticides labeled for use against fungus gnat larvae is provided in Table 1.) Insecticides are applied early in production to mitigate plant damage caused by fungus gnat larvae. The microbial (bacterial-based) insecticide, *Bacillus thuringiensis* subsp. *israelensis*, can be used in organic production systems to manage fungus gnat larval populations. However, fungus gnat larvae must ingest the bacterium to be killed. Consequently, make applications early in the crop production cycle because the bacterium is more effective on the 1st and 2nd instar larvae than the 3rd and 4th instar larvae.

Releasing biological control agents: The release of biological control agents is the primary means of managing fungus gnat larval populations in horticultural crop production systems because of the commercial availability of three effective biological control agents, including the soil-predatory mite, *Stratiolaelaps scimitus*; the predatory rove beetle, *Dalotia coriaria*; and the entomopathogenic nematode, *Steinernema feltiae*. All three biological control agents are applied early in the production system before fungus gnat larval populations reach plant-damaging levels.

Here are descriptions of each of the biological control agents:

• *Stratiolaelaps scimitus* feeds on fungus gnat larvae, more so than eggs and pupae. The larvae, nymphs and adults are predacious with adults consuming one to five fungus gnat larvae per day. Adult females are brown and 1 mm (0.04 of an inch) long. All the life stages (egg, larva, nymph and adult) reside in the top 2.5 to 5.0 cm (1 to 2 in.) of the growing medium. Development time of the life cycle, from egg to adult, is dependent on temperature. For example, the life cycle takes 34 days at 59F (15C) and 10 days at 82F (28C). *Stratiolaelaps scimitus* will resort to eating each other (cannibalism) in the absence of a food source.

• *Dalotia coriaria* feeds on all instar stages (1st through 4th) of fungus gnat larvae. *Dalotia coriaria* adults are glossy, dark brown and 3 to 4 mm (0.11 to 0.16 of an inch) long. Adults are mobile, but tend to spend most of their time in the growing medium. Young larvae are white and become yellow-brown as they mature. Development time from egg to adult takes approximately 17 days, but varies depending on growing medium temperature. Like *S. scimitus*, *D. coriaria* will eat each other in the absence of a food source. The ability of *D. coriaria* adults to manage fungus gnat larval populations is affected by cultural practices, such as growing medium type and watering practices.

• *Steinernema feltiae* is a beneficial nematode 0.5 mm (0.015 of an inch) in length and transparent. *Steinernema feltiae* enters a fungus gnat larva through natural openings, such as the mouth, anus and/or breathing pores (spiracles), and releases a bacterium, *Xenorhabdus spp.*, that kills the fungus gnat larva within 48 hours. The bacterium serves as the food source for *S. feltiae*, which allows the beneficial nematode to complete development inside the dead fungus gnat larva. The ability of *S. feltiae* to infect a fungus gnat larva depends on growing medium type and moisture content. Application rate, application timing and growing medium temperature can influence the effectiveness of *S. feltiae* in managing fungus gnat larval populations. **GT**

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For more information on fungus gnat management: Cloyd, R. A. 2010. Fungus gnats: management in greenhouses and nurseries. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF2939. Kansas State University, Manhattan, KS. 4 pages.