

# FUNGUS GNATS

*Integrated Pest Management in the Home, Garden and Landscape*

Fungus gnats are small flies that infest soil, potting mix, other container media, and other sources of organic decomposition. Their larvae primarily feed on fungi and organic matter in soil, but also chew roots and can be a problem in greenhouses, nurseries, potted plants and interior plantscapes. Adult fungus gnats may emerge from houseplants indoors and become a nuisance.

## IDENTIFICATION

Fungus gnats (*Orfelia* and *Bradysia* species), also called darkwinged fungus gnats (Sciaridae), are dark, delicate-looking flies similar in appearance to mosquitoes. Adult fungus gnats (Figure 1) have slender legs with segmented antennae that are longer than their head. Their long antennae distinguish them from the more robust shore flies, which are also found in greenhouses, associated with algae and decomposing organic matter, but have short bristle-like antennae (Figure 2). Although a few species are up to 1/2 inch long, fungus gnat adults commonly are about 1/16 to 1/8 inch long. Wings are light gray to clear, and the common *Bradysia* species have a Y-shaped wing vein (Figure 3).

Because adult fungus gnats are attracted to light, you first might notice these pests flying near windows indoors. However, in comparison with more active species such as the common housefly (*Musca domestica*), fungus gnats are relatively weak fliers and usually don't move around much indoors. Fungus gnats often remain near potted plants and run across (or rest on) growing media, foliage, compost, and wet mulch piles.

Females lay tiny eggs in moist organic debris or potting soil. Larvae (Figure



Figure 1. Fungus gnat adult caught in a yellow sticky trap.



Figure 2. Fungus gnat adult (left) and shore fly (right). Note the more robust body and shorter antennae on the shore fly.

4) have a shiny black head and an elongated, whitish-to-clear, legless body. They eat organic mulch, leaf mold, grass clippings, compost, root hairs, and fungi. If conditions are especially moist and fungus gnats are abundant, larvae can leave slime trails on the surface of media that look like trails from small snails or slugs (Figure 5).

## DAMAGE

Adult fungus gnats don't damage plants or bite people; their presence is primarily considered a nuisance. Larvae, however, when present in large numbers, can damage roots and stunt plant growth, particularly in seedlings

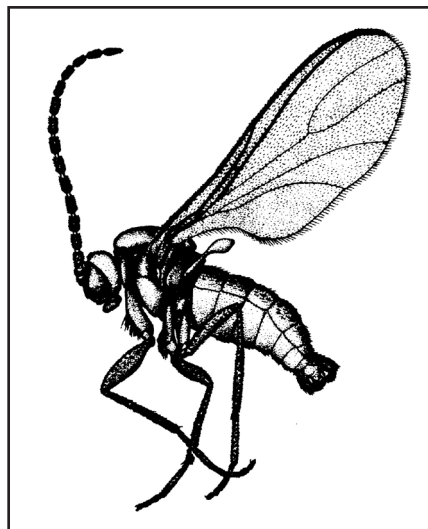


Figure 3. A Y-shaped wing vein distinguishes common fungus gnats from most other small flies in the home and greenhouse.



Figure 4. Fungus gnat larvae.



Figure 5. Shiny trails on the soil surface made by fungus gnat larvae.

# PEST NOTES

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and young plants. Significant root damage and even plant death have been observed in interior plantscapes and in houseplants when high populations were associated with moist, organically-rich soil. Thus, a houseplant that is wilting may not indicate a lack of water, but rather root damage by fungus gnat larvae or (more commonly) other causes of unhealthy roots. However, too much or too little water, root decay fungi, and improper soil conditions (e.g., poor drainage, or waterlogging) are much more common causes of wilted plants.

Serious fungus gnat damage is more common in greenhouses, nurseries, and sod farms. Although larvae also feed on plant roots outdoors, they don't usually cause serious damage.

### LIFE CYCLE

Fungus gnats develop through four stages—egg, larva (with four larval stages or instars), pupa, and adult. The tiny eggs and oblong pupae occur in damp organic media where females lay eggs and larvae feed. At 75°F, eggs hatch in about 3 days, the larvae take approximately 10 days to develop into pupae, and about 4 days later the adults emerge. A generation of fungus gnats (from female to female) can be produced in about 17 days depending upon temperature. The warmer it is, the faster they will develop and the more generations will be produced in a year.

Fungus gnats have many overlapping generations each year. Outdoors, they are most common during winter and spring in interior areas of California, when water is more available and cooler temperatures prevail. They can occur during any time of the year in moist coastal regions and indoors.

### MANAGEMENT

Most of the fungus gnat's life is spent as a larva and pupa in organic matter or soil, so the most effective control methods target these immature stages rather than attempting to directly control the mobile, short-lived adults.

Physical and cultural management tactics—primarily the reductions of excess moisture and organic debris—are key to reducing fungus gnat problems. Commercially-available and naturally-occurring biological control agents can also control this pest. Insecticides are considered an important control option in some commercial plant production but generally aren't recommended for fungus gnat management in and around the home.

### Monitoring

Visual inspection for adults usually is adequate for determining whether a problem exists. You will see adults resting on plants, soil, windows, or walls, or you might see them in flight. Besides looking for adults, check plant pots for excessively moist conditions and organic debris where larvae feed. Yellow sticky traps can be used to trap adults. Chunks of raw potato placed in pots with the cut sides down (not the peels) are sometimes used to monitor for larvae.

### Water and Soil Management

Because fungus gnats thrive in moist conditions, especially where there is an abundance of decaying vegetation and fungi, avoid overwatering and provide good drainage. Allow the surface of container soil to dry between waterings. Clean up standing water, and eliminate any plumbing or irrigation system leaks. Moist and decomposing grass clippings, compost, organic fertilizers, and mulches are also favorite breeding spots. Avoid using incompletely-composted organic matter in potting media unless it is pasteurized first, because it will often be infested with fungus gnats. Improve the drainage of the potting mix (e.g., increase the proportion of perlite or sand in the mix). Minimize organic debris around buildings and crops. Avoid fertilizing with excessive amounts of manure, blood meal, or similar organic materials. Screen and caulk leaky windows and doors to help prevent pests from coming indoors.

If you have infested plants, don't move them to new areas where flies can emerge to infest other pots. In some cases you may wish to toss out severely infested plants.

Purchase and use only pasteurized container mix or potting mix. Commercial growers often treat potting soil with heat or steam before using it; this will kill flies and the algae and microorganisms they feed on. Home gardeners can solarize soil:

1. Moisten it.
2. Place it in a bag of transparent plastic or black plastic.
3. Make the pile no deeper than about 8 inches.
4. Place the bagged soil on a slightly elevated surface, such as a pallet in a sunny location, for about 4 to 6 weeks.

See the *Pest Note: Soil Solarization* listed in the references for details. Store pasteurized potting soil off the ground and in closed containers to prevent it from becoming infested before use.

### Trapping

In home situations where fungus gnat adults are a nuisance, it may be possible to reduce the problem by using sticky traps available at retail nursery and garden centers. Yellow sticky traps can be cut into smaller squares, attached to wooden skewers or sticks and placed in pots to trap adults. Also, raw potato chunks placed in the soil are very attractive to fungus gnat larvae. These may be used not only to check pots for larvae but also to trap them away from plant roots. After a few days in a pot, remove infested chunks, dispose of them, and replace with fresh ones.

### Biological Control

Three commercially available biological control agents can be purchased to control fungus gnats in pots or container media (Table 1). These include *Steinernema* nematodes, *Hypoaspis* predatory mites, and the biological insecticide *Bacillus thuringiensis* subspecies *israelensis* (Bti). Several Bti products (Mosquito

Bits, Gnatrol) are readily available in retail nurseries and garden centers, so these products may be the most convenient for home gardeners to use. Bti does not reproduce or persist indoors, so infestations in potting media might require repeated applications at about five-day intervals to provide control. Nematodes and *Hypoaspis* mites must be mail-ordered and are live and perishable products, requiring immediate application. Nematodes can provide relatively long-term control of fungus gnat larvae, and they can be self-reproducing after several inoculative applications to establish their populations. *Steinernema feltiae* is more effective against fungus gnats than other commercially available nematode species. Mix Bti or nematodes with water, and apply as a soil drench, or spray onto media using a hand-pump spray bottle or other spray equipment, following label directions.

Several natural enemies help to manage fungus gnat populations in outdoor systems, such as landscapes and gardens, and indoors in greenhouses and conservatories, including the predatory hunter flies, *Coenosia* spp. These flies catch and consume adult fungus gnats in mid-air, and prey on fungus gnat larvae in soil while developing as larvae themselves. Conserve these and other natural enemies by

avoiding broad-spectrum insecticide applications.

**Chemical Control**

Insecticides are rarely warranted to control these flies in and around homes. However, if you do apply an insecticide for fungus gnats, consider using Bti or *Steinernema feltiae* nematodes to control the larvae; see the section Biological Control for more information.

If Bti or nematodes aren't available and high populations are intolerable, pyrethrins or a pyrethroid insecticide may provide temporary, fast-acting control. Spray the surface of potting soil and plant parts where adults typically rest. Do not aerially fog indoors or attempt to spray adult gnats in flight. Be sure the product is labeled for your particular use (e.g., for "house plants") and read and follow the product's directions.

Pyrethrins have low toxicity to people and pets and are the active ingredients in the botanical pyrethrum, which is derived from flowers of certain chrysanthemums. Many products include a petroleum-derived synergist (piperonyl butoxide, or PBO) to increase pyrethrum effectiveness. Pyrethroids (e.g., bifenthrin, permethrin) are synthesized from petroleum to be chemically similar to pyrethrins; they often are

more effective and persistent but are more toxic to beneficial insects. When using these products on houseplants or interiorscape containers, if possible move plants outdoors for treatment as a precaution, and wait about a day after applying the chemical before bringing them back inside.

For information on managing fungus gnats in commercial flower, nursery or greenhouse operations, see the *UC IPM Pest Management Guidelines: Floriculture and Ornamental Nurseries* and the book *Integrated Pest Management for Floriculture and Nurseries* listed in the references.

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**Table 1. Commercially Available Biological Pesticides and Natural Enemies for Controlling Fungus Gnat Larvae.**

Biological	Comments
<i>Bacillus thuringiensis</i> subspecies <i>israelensis</i> (Bti) (Gnatrol)	A naturally occurring, spore-forming bacterium produced commercially by fermentation. Bti applied at labeled rates provides temporary control and is toxic only to fly larvae, such as mosquitoes, black flies, and fungus gnats. Repeat applications commonly are needed for long-term control. This Bt is a different subspecies from that applied to foliage to control caterpillars. Bt labeled for caterpillars is not effective against fly larvae.
<i>Hypoaspis</i> (= <i>Geolaelaps</i> or <i>Stratiolaelaps</i> ) <i>miles</i>	A light-brownish predaceous mite adapted to feeding in the upper layers of moist soil. Preys on fungus gnat larvae and pupae, thrips pupae, springtails, and other tiny invertebrates. Commercial mites commonly are shipped in a shaker-type container used to apply them. Recommended rates in commercial nurseries are about 1/2 to several dozen mites per container or square foot of media. Make applications before pests become abundant. <i>Hypoaspis</i> probably won't perform very well in individual houseplants and probably isn't a good choice for use in homes.
<i>Steinernema feltiae</i>	This nematode is effective when temperatures are between 60° to 90°F and conditions are moist. You can apply it as a soil drench and to media using conventional spray equipment. Nematodes reproduce and actively search for hosts, so under moist conditions they can provide season-long control after several initial applications to establish populations.

**Note:** These materials are essentially nontoxic to people and are compatible for application in combination. Bt is available from many well-stocked nurseries and garden supply stores. Predaceous mites, Bti, and nematodes, are commercially available through mail order from special suppliers,

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To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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#### WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original, labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down the sink or toilet. Either use the pesticide according to the label, or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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