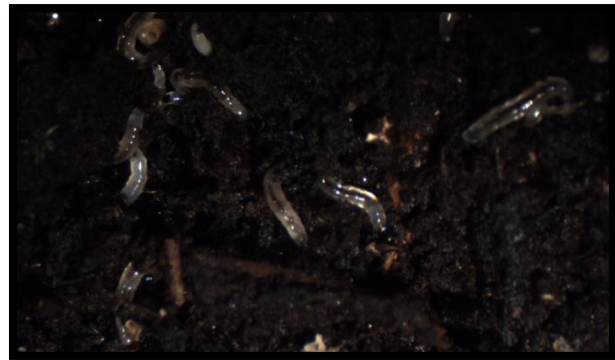


Biological Control of Fungus Gnats

Fungus gnats (*Bradysia spp.*) are a common greenhouse pest, especially in the moist environment common in propagation greenhouses. Fungus gnat larvae feed upon young cuttings and plugs, causing root injury and death. The larvae create wounds that could allow for the entrance of soil borne fungi. Fungus gnats may also help spread soil borne pathogens such as *Phytophthora*, *Pythium* and *Thielaviopsis*. Adults can also carry airborne fungal spores from *Botrytis* on their bodies.



Figures 1 & 2: Fungus gnat larvae root feeding injury on *Catharanthus* (Annual Vinca) and close-up of fungus gnat larvae. Photos by L. Pundt

Biology and Life Cycle

The fungus gnat's life cycle from egg to adult may be completed in as little as three to four weeks depending on the temperature. Eggs are laid in cracks and crevices in the media surface and mature in four to six days. Fungus gnat larvae feed and develop for about two weeks at 72°F.

Pupation occurs in the soil. After four to five days, adults emerge. Overlapping and continuous generations make control difficult. Fungus gnats are a common problem on annual vinca, geraniums, begonias, poinsettias, sedum, and bulb crops, especially with growing medium with a high percentage of peat moss or composted bark. Peanut hulls used in growing media also provide an ideal hiding place.

Scouting

A regular monitoring program is needed to insure the success of a biological control program. Use yellow sticky cards placed horizontally at the media surface to attract adults.



Figures 3 & 4: Adult fungus gnats on sticky card. Photos by L. Pundt

Check yellow sticky cards weekly. For more see: [Identifying Some Pest and Beneficial Insects on Your Sticky Cards](#) on the UConn Greenhouse IPM website.

Place potato chunks or plugs on the media surface to attract larvae. Inspect potato slices after 2 days. Inspect root systems for overall health and for signs of damage from fungus gnat feeding (blunt root tips).



Figures 5 & 6 Fungus gnat feeding damage to poinsettia plug (left) and signs of larvae feeding on leaves (right). Photos by L. Pundt

Cultural Controls

Cultural controls (avoiding overwatering, avoiding puddling on the floors, rigorous weed controls, and controlling algae) are critical before starting a biological control program for fungus gnats.

Biological Controls

Soil dwelling predatory mites (*Stratiolaelaps scimitus*), the rove beetle (*Dalotia coriara*) and entomopathogenic nematodes (*Steinernema feltiae*) can all be used in your biological control program. The growing medium should be moist before applying these natural enemies.

Although not commercially available, predatory hunter flies (*Coenosia attenuata*), and the parasitoid *Synacra pauperi* may help to manage fungus gnats.

Predatory Mites

A native, soil-dwelling generalist predatory mite, *Stratiolaelaps scimitus* feeds on fungus gnat larvae, thrips pupae, springtails and shore fly larvae. However, *S. scimitus* prefers to feed upon the first instar fungus gnat larvae. If small prey insects are scarce, these predatory mites can survive by scavenging on plant debris and algae. *S. scimitus* inhabits the top ½ inch of soil and does not survive in standing water. Adults are tan in color and less than one mm. long.

S. scimitus is shipped in an inert carrier with all stages of the predatory mites with bran or mold mites that are a food source for the predatory mites. Distribute this carrier over the media surface, especially when pots are placed close together. Apply to moist not saturated growing media. Applications can also be directed to the soil under greenhouse benches. Avoid mixing *S. scimitus* into the growing media prior to planting for this decrease their survival.

S. scimitus life cycle from egg to adult is about 18 days at 68°F. They do not go into diapause in the winter. *S. scimitus* predatory mites are best used before fungus gnat populations become established or while numbers are still low. If fungus gnat populations are established, use with *Bacillus thuringiensis* subsp. *israelensis* or entomopathogenic nematodes.

Tips for *S. scimitus* use

- Use preventatively, at planting time.
- Do not refrigerate. They do not store well.
- Do not mix into the growing media because they will not survive.
- Minimum media temperature is 60°F, they become inactive below 59°F
- Media should be moist, not wet.
- If you have dirt floors, it may be helpful to treat those areas also.
- Treating the perimeter of the greenhouse may also help.

- To evaluate quality, place a small sample of the mites on a sheet of white paper. *S. scimitus* will be tan and will move quickly. The bran mites are translucent, white and move slowly.
- Apply to the media surface, not too near the plant stem.

Rove Beetles

Rove beetles, *Dalotia coriara* are generalist predators that feed upon the larvae of fungus gnats, and shore flies in the growing media. They prefer fungus gnat larvae compared to shore fly larvae or thrips pupae.

Adults are slender, dark brown to black hairy beetles, about 1/8 of an inch long, with short wing covers that are less than the length of their body. Because adults can fly, this helps them disperse in the greenhouse from the release sites. Larvae are cream-colored to brown, depending upon their age. Both stages are primarily found in the growing media, especially in cracks and crevices. Once established in a greenhouse, they will be there year-round, but population levels vary depending upon fungus gnat populations.



Figures 7 & 8 Rove Beetle Adult (left) and adult compared to larvae (on right). Photos by L. Pundt

Rove beetles life cycle from egg to adult is 17 days at 79° F. Females live for about 48 days and males about 60 days. Adult females lay an average of 90 eggs. Eggs hatch in 3 to 4 days into creamy white larvae. (There are three larval stages after which they pupate.) Because rove beetles are generalist predators, they may feed upon *S. scimitus*. Temperatures between 65-80 °F and a relative humidity of 50 to 85% are optimum for their survival. Rove

beetles are commercially available as adults and larvae mixed in inert material. One supplier sells a breeding bucket system for the rove beetles, which consists of media, beetles and a supplier food source. Exit holes allow the beetles to exit into the greenhouse. These buckets are placed in shaded areas under the greenhouse benches. Growers can also make their own rearing systems. (See reference regarding on farm rearing).



Figures 9 &10: Application of Rove Beetles in piles (left) and breeder bucket system (right). Photos by L. Pundt

Tips for *Dalotia coriara* use

- Adults are nocturnal so are best released in the evening.
- They tend to hid in cracks and crevices in the growing media, so may be difficult to find when scouting.
- Rove Beetles are compatible with beneficial nematodes.

Entomopathogenic Nematodes

Nematodes are small, colorless, unsegmented, cylindrical round worms that occur naturally in soils throughout the world. Entomopathogenic means to cause disease (pathogenic) to insects (entomon from the Greek word for insect). Insect parasitic nematodes are primarily found in the families *Steinernema* and *Heterorhabditis*. Different species may work best against different pests. *S. feltiae* is primarily used against fungus gnat larvae, and thrips pupae in the soil.

The nematode's life cycle consists of eggs, four larval stages and the adults. The third instar juvenile stage is the infective stage. This stage searches out susceptible insect hosts by detecting excretory products, carbon dioxide and temperature changes. *S. feltiae* enter the insect host through body openings. They multiply within the host and release a symbiotic bacterium (*Xenorhabdus*)

whose toxin kills the fungus gnat larvae. The larvae are killed in one to two days by septicemia (blood poisoning) and are difficult to find. More than one generation of nematodes may develop in dead host insect. The infective juveniles exit the dead body and search for new hosts to infect. The nematodes will stay active in the media for about 10 to 14 days. *S. feltiae* (NemaShield, Nemasys or Entonem) are applied as a soil drench treatment against fungus gnat larvae. Preventative applications to moist soils work best on cloudy, overcast days' work best. See Beneficial Nematodes: [An Easy way to Begin Using Biological Control in the Greenhouse](#) for specific tips on their use.

Natural Enemies Not Commercially Available

Hunter Flies

Growers may notice hunter flies (*Coenosia attenuata*) on their yellow sticky cards. Hunter flies may be introduced into your greenhouses on new plant material. The hunter fly is in the same family as a housefly but is smaller. Hunter flies may be confused with shore flies, but hunter flies are about twice the size of shore flies. They also have wings that are clear and may appear iridescent as the hunter fly adults perch on plant leaves, pipes or other objects in the full sun. The female has a dark gray body with black legs while the male has yellow legs. These aerial predators will catch fungus gnats or shore flies on the wing. Adults lay their eggs in the growing media and their larvae prey upon fungus gnat larvae and shore flies in the growing media.



Figure 11: Close-up of adult hunter fly perching on a leaf. Photo by L. Pundt



Figure 12: Adult hunter flies on sticky card. Photo by L. Pundt

Parasitic Wasps

Parasitic wasps (Synacra flies) are a natural enemy of fungus gnats and may be seen on yellow sticky cards, especially in unsprayed greenhouses.

Entomopathogenic nematodes, soil dwelling predatory mites, rove beetles are all part of a biological control program for fungus gnats. For growers just starting biological controls, beginning with biological control of fungus gnats is often one of the easiest ways to begin.

By Leanne Pundt, UConn Extension, 2007, Revised 2019

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