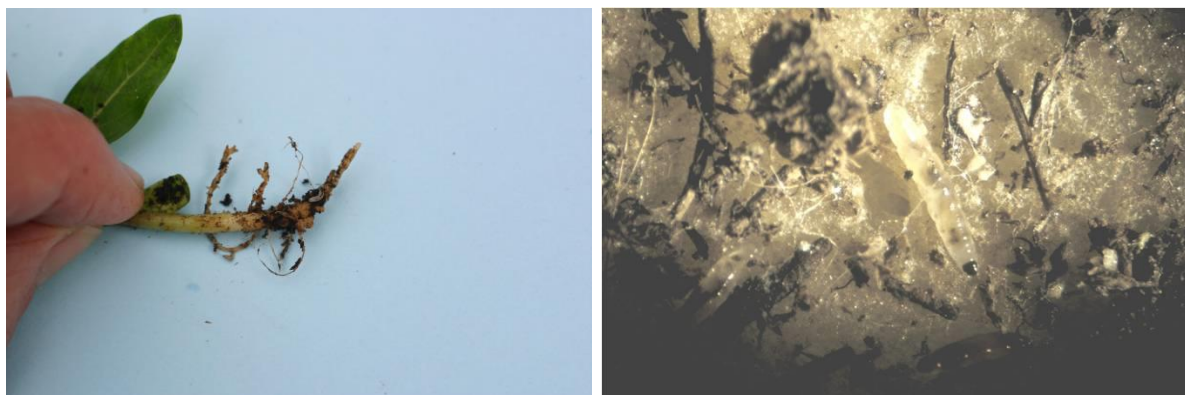


Biological Control of Fungus Gnats

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

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. On left, fungus gnat adults are within circle. Shore flies are also on the 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.

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 growing media. Applications can also be directed to the soil under greenhouse benches. Avoid mixing *S. scimitus* into the growing media prior to planting which will 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 with 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 close to plant stems.

Rove Beetles

Rove beetles, *Dalotia coriara* are generalist predators that feed upon the larvae of fungus gnats, and shore flies in the growing media. However, 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 from 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.

Rove beetle's 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.) 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. A breeding bucket system may be available 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 for on farm use.



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 hide 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, 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.

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. 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

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.

Hunter Flies

Hunter flies (*Coenosia attenuata*) may be seen on yellow sticky cards. 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

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, latest revision 2024

References

- Buitenhuis, R. 2014 Grower Guide: Quality Assurance of Biocontrol Products: Vineland Research and Innovation Centre.
<https://www.vinelandresearch.com/wp-content/uploads/2020/02/Grower-Guide.pdf>
- Cloyd, R. and N. Herrick. 2017. Ecology and Role of the Rove Beetle, *Dalotia coriaria*, and Insidious Flower Bug, *Orius insidiosus*, in Greenhouse Biological Control Programs. *Advances in Entomology*. (5):115-126.
- Hoebeke, E. R., E. Sensenbach. J. Sanderson and S. Wraight. 2003. First Report of *Coenosia attenuata* Stein (*Diptera: Muscidae*), an Old World 'Hunter Fly' in North America. *Proc. Entomol. Soc. Wash.* 105(3):769-775.
- Jandricic S.E., Scott-Dupree CD, Broadbent A.B., Harris C.R., Murphy G. 2006. Compatibility of *Atheta coriaria* with other biological control agents and reduced-risk pesticides used in greenhouse floriculture IPM programs for fungus gnats. *The Canadian Entomologist* 138: 712-722.
- Sanderson, J., T. Ugine, S. Wraight, and E. Sensenbach. 2009. Something for Nothing. *Grower Talks*. September 2009.
<https://www.growertalks.com/Article/?articleid=17305>
- Tourtois, J. and M. Grieshop. 2014. On Farm Rearing of the soil predator *Dalotia coriara*. MSU Organic Pest Management Laboratory.
<https://cerestrust.org/wp-content/uploads/MSU-Rearing-Dalotia-coriaria.pdf>
- Van der Ent, S., M. Knapp, J. Kkapwijk, E. Moerman, J. van Schelt, and S. deWeert. 2017. *Knowing and recognizing the biology of glasshouse pests and their natural enemies*. K Girard and K. Strooback (Eds). Koppert Biological Systems, The Netherlands. 443 pp.

Disclaimer for Fact Sheets: The information in this document is for educational purposes only. The recommendations contained are based on the best available knowledge at the time of publication. Any reference to commercial products, trade or brand names is for information only, and no endorsement or approval is intended. UConn Extension does not guarantee or warrant the standard of any product referenced or imply approval of the product to the exclusion of others which also may be available. The University of Connecticut, UConn Extension, College of Agriculture, Health and Natural Resources is an equal opportunity program provider and employer.