

Biological Control Agents for Belowground Pests

Question: *I often hear about the biological control agents including parasitoids, predatory mites and predatory bugs for use against aboveground insect and mite pests such as aphids, thrips, whiteflies and spider mites. However, what are the biological control agents for pests that reside in growing media?*

Answer: There are a number of commercially available biological control agents for use against insect pests that inhabit growing media including: *Stratiolaelaps scimitus* (formerly *Hypoaspis miles*), *Dalotia* (formerly *Atheta*) *coriaria* and *Steinernema feltiae*. These biological control agents primarily target the larval stage of fungus gnats (*Bradysia* spp.), and the pupal stages (pre-pupa and pupa) of western flower thrips (*Frankliniella occidentalis*).

Stratiolaelaps scimitus is a soil-dwelling predatory mite that preys on fungus gnat larvae, and the pupal stages of the western flower thrips. Females are larger

than the males and possess a white stripe on the end of the body. Adult females are brown and 1/25 inch (1 mm) in length. Females lay one to three eggs per day. All stages (egg, larva, nymph and adult) reside in the top 1 to 2 inches (2.5 and 5.0 cm) of the growing medium, with a preference for moist growing media with an “open structure.” The larvae, nymphs and adults are predacious.

The predatory mite primarily preys upon fungus gnat larvae, whereas eggs and pupae are less preyed upon. Adults can consume one to five fungus gnat larvae per day. In addition, *S. scimitus* can prey upon the pupal stages (pre-pupa and pupa) of the western flower thrips. Development time of the life cycle, from egg to adult, depends on temperature. For example, the life cycle takes 34 days at 59° F and 10 days at 82° F. In the absence of a food source, the predatory mites will resort to eating each other (cannibalism).

Dalotia coriaria is a predatory rove beetle that resides in the growing medium and preys upon fungus gnat larvae and the pupal stages of western flower thrips. Adults are glossy, dark-brown, and approximately 1/8 to 1/4 inches (3 to 4 mm) in length. The adults are mobile although they tend to spend most of their time in the growing medium. Larvae are initially white and turn yellow-brown as they mature.

Development time from egg to adult takes approximately 17 days although development time will vary depending on soil temperature. Adult rove beetles feed on all instars (first through fourth) of fungus gnat larvae. The ability of rove beetle adults to effectively regulate fungus gnat larval populations can be influenced by cultural practices including: growing medium



▲ *Stratiolaelaps scimitus* adult (Photo: GreenMethods.com).

◀ Beneficial nematodes *Steinernema feltiae* (Photo: Raymond A. Cloyd).

type and watering practices. Rove beetles are widely used by greenhouse producers throughout the U.S. to regulate fungus gnat populations.

Steinernema feltiae is an entomopathogenic (beneficial) nematode that is 1/4 inch (0.5 mm) long, slender in shape and transparent. Beneficial nematodes require moist growing media for survival. They are effective in regulating fungus gnat larval populations. *Steinernema feltiae* enter fungus gnat larvae through natural openings; such as, mouth, anus and/or breathing spores (spiracles), and then release a bacterium (*Xenorhabdus* spp.) that kills the larvae within 48 hours.

The bacterium is a food source for *S. feltiae*, which allows the beneficial nematode to complete development inside the dead fungus gnat larva. The beneficial nematode, like all biological control agents, must be released before fungus gnat populations build-up to damaging levels. The ability of *S. feltiae* to regulate fungus gnat populations may be contingent on a number of factors; such as, application rate and application timing.

Furthermore, infectivity (ability of a pathogen to establish an infection) of *S. feltiae* on fungus gnat larvae may vary depending on growing medium type and moisture content. Growing medium temperature can influence regulation of fungus gnat larvae by *S. feltiae* with temperatures between 47 and 86° F required for infection, and 50 and 77° F required for reproduction. [gpn](http://gpn.org)



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