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Fungus gnat management in greenhouse crops

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Fungus gnats (*Bradysia* sp. Sciaridae) are a common problem in greenhouse crops, as they like high levels of organic matter and moisture.

Figure 1. Fungus gnat on yellow sticky trap.

Adult fungus gnats can be found sitting on the surface of plastics and media, and flying around the bottom of plants. They are small (5 mm) black flies with long legs and antennae, with a single pair of wings. Under a microscope, a Y-shaped pattern can be seen in the veins on the end of the wings.

Larval fungus gnats are clear to white worms about 5–8 mm long and have a small black head. They can be found near the surface of potting media, feeding on seedling stems and roots, soil fungi, algae and other organic matter.

Fungus gnats worsen in cool wet weather, and where greenhouses have poor drainage and excess fertiliser. Trials conducted at the Gosford Primary Industries Institute (Goodwin and Steiner, 2004) prove that fungus gnats prefer media like compost mix, cocopeat and sawdust that is high in organic matter, rather than inorganic media such as rock wool and perlite. Repeated use of media for a number of crops worsens the situation, as the level of organic matter held in the media increases crop by crop.

Figure 2. Fungus gnat larva.

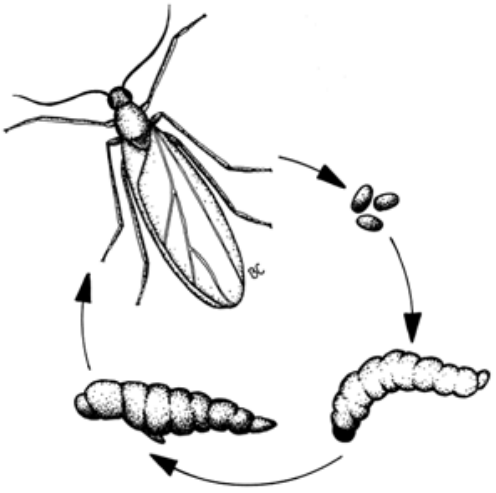

Figure 3. Fungus gnat lifecycle – ranges from 18 to 27 days. (Drawing courtesy of Briony Cowper,)

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Cultural control

Basic greenhouse hygiene practices will lessen the incidence of fungus gnats. Prior to a new crop being planted it is essential that the greenhouse is cleaned out thoroughly and all algae and green waste removed. Clean out all irrigation lines, drippers, irrigation spikes and channels, with chlorine based solution so that they are free from algae, as algae is the primary food source of fungus gnats, and if that food source is removed then half the battle is won.

Reduce the potential to support fungus gnats by choosing an inorganic growing media that is less likely to support algal growth such as rock wool or perlite instead of growing media that has high organic materials like composted bark, cocopeat and sawdust.

Figure 4. Algal growth on sawdust media.

Monitor the runoff channels for signs of algae build up and treat it once algae is present and use new growing media more often if fungus gnats are a persistent problem.

The availability of successful controls for this pest will enable growers to improve management of root diseases, particularly Pythium and Fusarium that worsen in crops with high fungus gnat populations. This is because adult fungus gnats can carry Fusarium spores from stem to stem, and larval fungus gnats feeding on the roots provide an entry point for disease spores to infect. If there are no fungus gnats, root diseases can still cause damage, however the losses will not be as severe.

To monitor for fungus gnats, place yellow sticky traps above the media. Change these traps weekly; count the gnats and record the numbers on a chart. When the weekly trap count exceeds 50 flies, undertake control measures.

Figure 5. Sticky trap placed low in the crop and evidence of algal growth in run-off channel.

There are four commercial products available to manage fungus gnats. These should be used along with improvements to crop hygiene, drainage and nutrition in order to get the best results.

- Predatory mites
- Predatory beetles
- Nematodes
- Biological insecticide.

Predatory mites

Some growers may notice very small spider-like mites in the media bags. Some mites feed on the larvae of fungus gnats, among other pests. One of these mites is commercially grown; it can be purchased to release into media bags to manage fungus gnats. It is sold as *Hypoaspis miles* and formally known as *Stratiolaelaps scimitus* (pictured).

Figure 6. Hypoaspis miles *predatory mite. (Image courtesy of Dennis Crawford)*

Application

Hypoaspis mites prefer the temperature between 12º and 30ºC. They should be applied to the media at planting, before numbers of fungus gnats rise too high. Two separate releases one or two weeks apart should be made when fungus gnats are present. A single release may be made as a preventative control in new media.

When the mites arrive, they should be released as soon as possible, kept no longer than 12 hours before releasing. The mites travel by express post from Biological Services in South Australia.

Mites should be released at a rate of 25 mites per bag. There are 15 000 mites in each litre pack. Often, the mites are posted in 2L packs to save postage. A delivery order note is sent with the mites to check the quantity received.

For a standard tunnel polyhouse, the following rate is calculated:

Treatment area: 500 bags

Treatment rate: 30 mites per bag

No. of mites needed: 500 bags x 30 mites
= 15,000 mites, 1L per tunnel house

Compatibility

When using Hypoaspis to manage fungus gnats, it is advisable to use other methods of biological control for other key pests in the crop. This is partly because some pesticides are not compatible with Hypoaspis. If pesticides have been applied to the media in the past, it is best to wait a few weeks, and monitor Hypoaspis numbers to ensure establishment. If Hypoaspis has not been seen, and fungus gnat numbers begin to rise on weekly sticky traps, then it is possible that a pesticide has affected them. See the alternate management options listed below. For more information, see the *Bugs for Bugs* book and *IPM in Greenhouse Vegetables: Information Guide*.

Contact Biological Services on (08) 8584 6977 to order Hypoaspis.

Predatory beetles

Rove beetles are generalist predators that will feed on fungus gnats, shore flies and thrips. They are an ideal control to use in an IPM program. *Dalotia (Atheta) coriaria* is one commercially grown species that are an effective biocontrol when used in conjunction with Hypoaspis they can adapt to a variety of growing media but favour cocopeat. (James Altmann, pers. comm.).

Figure 7. Dalotia predatory beetle adult and larva. (Image courtesy of Dennis Crawford)

Larvae are a creamy white at a younger stage and a pale brown when more mature. Adult rove beetles are 3-4 mm long, black to brown, shiny slender beetles. Adult rove beetles are easily distinguished by their short wing covers that expose their abdominal segments. When disturbed the adult predatory beetles quickly take shelter in soil cracks or in leaf debris. This behaviour may help them to survive in a crop during an insecticide spray.

Application

Dalotia beetles prefer a warm, wet and humid environment and have an optimum developmental temperature of 27°C.

Dalotia are shipped in a cocopeat and vermiculite mix and contain all life stages. As beetles actively fly, it is advised not to open the container until in the greenhouse. For best results apply immediately once received unless temperatures are extreme. Release when pest numbers are low, soon after planting, at a release rate of 1/m^2. The earlier the release the more successful the control will be. When used in conjunction with Hypoaspis, for an initial introduction, use at the ratio of 10L of Hypoaspis to 2 L of *Dalotia*.

Compatibility

The predatory beetles are most effective when used in combination with Hypoaspis to control fungus gnats. Although Hypoaspis may out-compete the *Dalotia* in the media, the predatory beetles are mobile enough to find its own niche in system.

Dalotia coriaria may be affected by both foliar and drench application of pesticides; avoid the use of broad spectrum chemical applications. It is advised to check side-effects information before using pesticides or releasing *Dalotia* into a treated

greenhouse. As a relatively new biocontrol agent, information is lacking on the effects of many pesticides so act cautiously.

Contact Biological Services on (08) 8584 6977 to order predatory rove beetles.

Nematodes

Nematodes are too small to see without a microscope. They control the fungus gnat larvae by infecting, feeding, reproducing inside the fly larva and ultimately killing the larva.

Figure 8. Nematodes under a microscope. (Image courtesy Ecogrow Environment).

Entomopathogenic nematodes such as *Steinernema felitae* that infect fungus gnats can be ordered by telephone and delivered to the farm. They arrive in a plastic container, cooled by an ice brick during transport but should be kept in the fridge (not the freezer) until use. Nematodes must be used within two weeks of receival.

Application

When applying nematodes, the white powder should be mixed in water for at least 20 minutes. This allows the nematodes time to activate. They can be applied as a drench or through the drippers but take care not to clog the filters.

Nematodes should be released at a rate of 150/m^2. There are 50 million nematodes in each pack. Nematodes are purchased from Ecogrow in Canberra, ACT.

For a standard tunnel polyhouse, the following rate is calculated:

Treatment area: 500 bags

Treatment rate: 20,000 nematodes per bag

No. of mites needed: 500 bags x 20,000 nematodes = 10,000,000

0.2 packs per tunnel house, 1 packet treats five standard tunnel polyhouses

Compatibility

Nematodes may be killed by direct contact with organophosphates and carbamate insecticides However, residues are not likely to affect them.

If Hypoaspis is not compatible with your crop, you should use nematodes.

Contact Ecogrow on (02) 6284 3844 to order nematodes.

Biological insecticide

A *Bacillus thuringiensis* based product that has been available for many years for mosquito control is also effective to control fungus gnats. It is sold as VectoBac® WG Biological Larvicide, and must be used according to APVMA Permit PER11472 (expires 31 May 2014) in a protected cropping situation for fungus gnats and sciarid fly control.

Figure 9. Drench each media bag to soak the top 3 cm of mix with each application.

The active ingredient is *Bacillus thuringiensis* subsp. *israelensis* serotype H14 commonly called Bt-i. It is poisonous to fly and mosquito larvae. The larvae must eat the product in order to be controlled, and effects occur up to 12 hours following ingestion. Since being permitted (March 2006) for use in greenhouse vegetables, growers who have applied the product as per the permit have had good control but many have misapplied the product and have not achieved good control. There are some important tips to ensuring effective use of VectoBac® WG.

Figure 10. Soft shower head hose fitting for drenching.

- The top 3 cm of media where most larvae are actively feeding must be soaked.
- Treat as a drench, preferably with a rosette nozzle attached to a hose wand. Please note that if applying via drip irrigation, the coverage may be compromised. Irrigation spikes will direct product to below the 3 cm depth, which is below the activity area of the fungus gnats.
- If the media is very dry, a wetting agent may be added to better disperse the product.
- Re-apply weekly for three weeks.
- The water needs to be clean with the pH close to 7, no more than 7.5 and no less than 6
- Mixes easily in water and stays suspended, avoiding continuous agitation while spraying
- Store VectoBac® below 25ºC

Compatibility

VectoBac® is compatible with all other forms of biological and chemical management options.

References

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Integrated pest management in Greenhouse vegetables: Information guide, Goodwin. S et al. May 2002

Biological Services
www.biologicalservices.com.au (March, 2010)

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Final report VG00066 Improvements to biological control systems and development of biorational chemicals for Integrated Pest Management in Greenhouse Vegetables. Section B, P66-68, Goodwin and Steiner (June, 2003)

Figure 11. Apply with a high volume, low pressure wand, not high pressure, low volume.

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