The Nursery Papers

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EDITED BY IAN ATKINSON. NATIONAL INDUSTRY DEVELOPMENT MANAGER. ISSN:1326-1495

NIAA

HRDC

ISSUE NUMBER: 2000/13

Fungus gnats – common and damaging!

Fungus gnats are a pest of production nurseries, hydroponic growers, media suppliers, and plant retailers throughout Australia. Both adults and larvae can damage plants - by direct feeding of the larvae on roots, and by spreading fungal diseases. A key to fungus gnat management is to improve drainage and avoid over-watering. Biological controls are commercially available and effective as part of a management program.

Appearance

Adult fungus gnats (*Bradysia* spp., Sciaridae) are small (~2.5 mm long), dark, mosquito-like flies, with delicate long legs and antennae and one pair of wings. (see Fig.1) Adults are weak fliers, typically found drifting around nursery plants, under benches, or running over the pot or media surface.

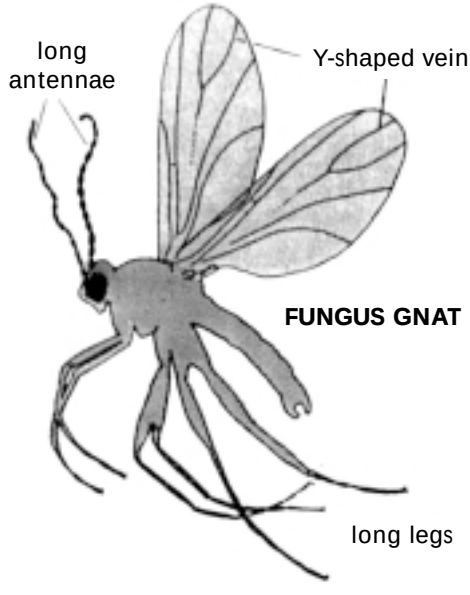

Fig.1 – Adult fungus gnats have long legs, beaded antennae and a distinctive Y-vein pattern on their wings.

The eggs are minute, shiny white, and rarely seen without the aid of a microscope. They are deposited close to the surface of the growing medium or at the base of seedlings and plants.

The larval stage is a tiny legless, soil dwelling maggot (~5 mm). (See Fig.2) Maggots are white, translucent, shiny and with a distinctive black head. A good 10x hand lens is needed to detect their presence.

Fungus gnats pupate in the growing medium.

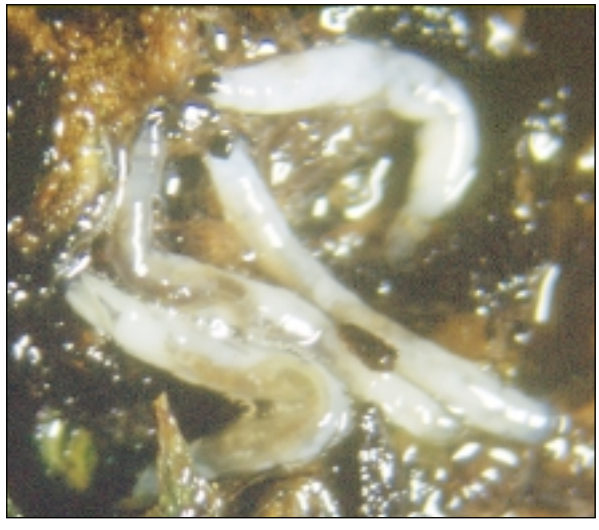

Fig.2 – Fungust gnat larvae. Note the black head. (photo: Marilyn Steiner)

Damage

The damage caused by fungus gnats is often confused with seedling "damping off", and other fungal diseases, phytotoxicity or nutritional problems. (See Fig.3)

Fig.3 – Fungus gnat damage to seedlings may be mistaken for poor germination or 'damping off.' (photo: Stephen Goodwin)

Maggots may be found throughout the pot media profile or burrowing into the plant stem near the soil line. Adults are attracted to moist media high in organic matter and which contains good populations of microorganisms, particularly fungi. Rotting plant material acts like a magnet. Maggots feed primarily on fungi and other microorganisms, but will also attack soft plant tissue such as root hairs, seedling stems and the base of cuttings.

Heavy maggot infestations can cause seedling collapse through root or stem damage. Severe infestations of cuttings and established plants may lead to poor callus formation, root establishment and development, and subsequent wilting or death. Most importantly the maggots spread fungal pathogens when feeding and may greatly increase crop losses due to diseases caused by ***Pythium***, ***Phytophthora***, ***Chalara, Fusarium, Rhizoctonia*** and ***Verticillium*** fungi.

Adult gnats do not feed on plants but may spread fungal diseases including ***Chalara*** and ***Botrytis*** from pot to pot, and between production areas. Large numbers of adults are a nuisance to staff and a frequent cause of customer complaints when they emerge from pots after sale.

Life Cycle and Biology

The complete life cycle from egg to adult is about 3 weeks, faster in warm weather, slower when cool. Adults mate soon after emergence and the female begins egg laying within a few days. She lives only about one month but can lay over 100 eggs. There will typically be all stages of development present at any time (overlapping generations) which makes control difficult.

Management

Fungus gnat management requires an integrated pest management program that includes management of diseases, media, irrigation, drainage and hygiene. Good drainage is essential.

Look beyond Chemicals

- Follow recommended management practices for fungal diseases to minimise sources of pathogens that can be spread by fungus gnats
- Avoid using potting media high in organic matter such as peat, which favours fungus gnats
- Avoid excessive watering - the majority of nurseries overwater
- Keep growing surfaces, below benches and walkways free of water, weeds, plant waste and spilled potting mix
- Speedily remove unsold remnants of previous infested crops
- Improve media porosity to reduce water holding capacity
- Improve drainage throughout the nursery and ensure that drains are well graded and free flowing
- Fine gravel or vermiculite as a mulch on the media surface may deter egg laying
- Improve ventilation of greenhouses and spacing of plants to maximise air movement and minimise unnecessary surface water
- Avoid over-fertilising to discourage growth of algae on mats, benches and nursery surrounds
- Disinfest growing surfaces and paths to remove algae
- Cover unused potting media to prevent gnat contamination
- Inspect incoming plants and media before purchase or on arrival for signs of infestation
- Pasteurise all recycled mix to prevent reintroduction of gnats and the spread of fungal pathogens
- Quarantine incoming stock as per NIASA Best Practice Guidelines to enable monitoring for fungus gnat adults and larvae before moving stock to production areas

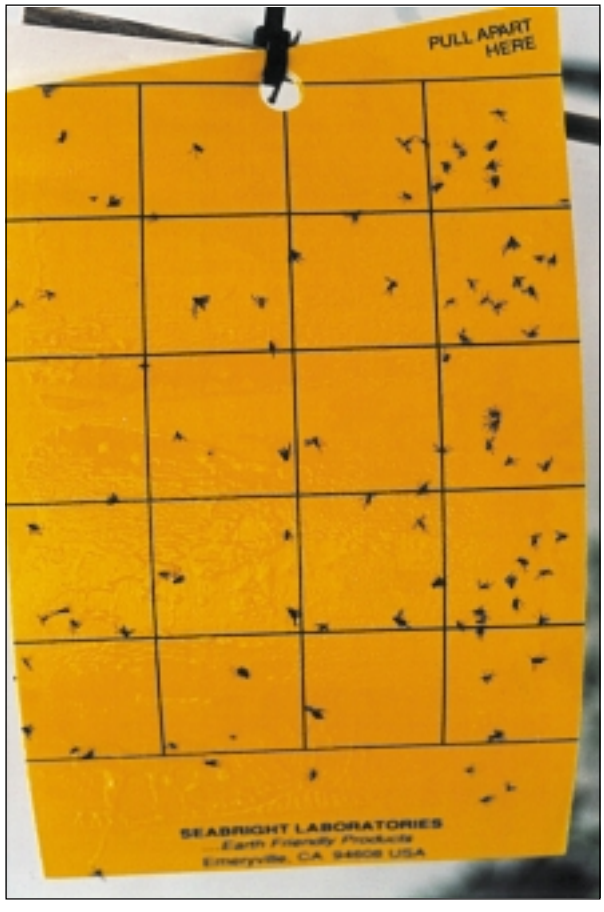

Fig.4 – Fungus gnat adults can be monitored using yellow sticky cards (photo: Anne Frodsham).

Fig.5 – Poorly drained areas under benches are a haven for fungus gnats (photo: Anne Frodsham)

Regular scouting and monitoring is critical

1. Yellow sticky traps in all sensitive production and propagation areas will rapidly attract fungus gnat adults. Use a minimum of one trap per 100 sq.m. placed about 10 cm above the crop canopy near susceptible crops, doorways and vents. Traps should be inspected at least weekly and changed every two to four weeks. Numbers of less than 20 flies trap/week may not present an economic problem but this threshold will vary with the sensitivity and value of the crop.

2. Learn to identify fungus gnats on sticky traps. A 10x hand lens is sufficient.

3. Infested pots, trays, media or root masses placed in a clear plastic bag or bottle for a few days will trap emerging adults to give a definitive idea of the size of a population.

Potato baits

Monitor larval populations by pressing moist skinless, 2.5 cm diameter by 1.25 cm thick potato discs into potting media. Leave the disc, with top level with soil surface, for at least four hours before quickly lifting and counting larvae on and under the disc.

Barriers

Insect proof screens fitted to glasshouses and polyhouses can prevent fungus gnats from entering. This may be an option for protecting particularly sensitive crops or propagation areas. Barriers will only be effective if incoming plants and media are free of gnats.

Biological Controls

Biological controls are commercially available in Australia for use against fungus gnats and are being used by many nurseries, including an increasing number of plug and seedling growers. Liaise with the suppliers to ensure the maximum benefit from purchased biological controls. Most biological control agents will not tolerate insecticide applications and may be adversely affected by residues of previous sprays.

Predatory Mites

Hypoapsis ***(Stratioaelaps miles)*** is a soil dwelling predatory mite that feeds on fungus gnats, thrips pupae, springtails and other small insects that inhabit the soil. Adult Hypoapsis are 0.5 - 1 mm long and light brown.

The mites live in the top 1 - 2 cm of soil or media and move rapidly in search of eggs and young larvae. Mites will consume from 1 - 5 fungus gnat larvae per day. They can survive up to 4 - 5 months with food and for 7 weeks without live prey, feeding on organic debris and nematodes. They do not harm plants or humans.

Nematodes

Entomopathogenic (insect eating) nematodes are microscopic worm-like creatures that actively seek out their hosts in moist soil or media, enter the insect body, killing the insect. *Steinernema feltiae,* is commercially available for use against fungus gnat larvae.
Nematodes prefer slightly moister and cooler conditions than the predatory mites. Several nurseries successfully use a combination of mites and nematodes for year round control.

Parasitic wasps

A naturally occurring parasitic wasp *(Synacra sp.)* has been found attacking fungus gnats in some low pesticide nurseries. The wasps are dark brown and ant-like. They are about the same size as adult fungus gnats and crawl over the surface of the media searching for larvae to parasitise. They may be detected on yellow cards used to monitor pest populations. This wasp is not commercially available but will contribute to control where not killed by insecticides.

Bacillus thuringiensis (Bt)

Various formulations of this bacterium are marketed commercially (for example for caterpillar control) but the strain effective against fungus gnats, mushroom flies and mosquitoes *(Bacillus thuringiensis israeliensis)* is not yet registered for use against fungus gnats in Australia.

Chemicals

Insecticidal drenches can be effective against fungus gnat larvae but must be applied correctly - the media must be thoroughly drenched to reach all larvae in a pot. There is evidence that some fungus gnat populations are resistant to insecticides such as diazinon.

Repeated application of chemicals may damage many ornamentals. Check InfoPest and other sources of current registrations for information on alternative products for larvae and for adults.

The Bottom line

Fungus gnats are frequently overlooked as a nursery pest but can cause significant crop damage. As their name suggests, they are often associated with fungi, so both need to be managed correctly using a combination of control tactics. These include choosing the right media, good site drainage and hygiene on site monitoring and the use of commercially available biological control agents.

Further Reading

Stanton Gill and John Sanderson, 1998. Ball Identification Guide to Greenhouse Pests and Beneficials, Ball Publishing, USA. 244pp. Goodwin, S. et al, 2000. Integrated Pest Management in Ornamentals: Information Guide. NSW Agriculture, 217pp.

Acknowledgments

This paper was prepared by Anne Frodsham, South Australian Nursery Industry Development Officer, in collaboration with Keith Bodman, South Metropolitan College, Western Australia, and Marilyn Steiner and Stephen Goodwin, NSW Department of Agriculture.