Factsheet 08/02

Ornamentals

Project No. PC 147 and 147a

Horticultural Development Council

Bradbourne House
East Malling
Kent ME19 6DZ
T: 01732 848383
F: 01732 848498
E: hdc@hdc.org.uk

Control of Sciarid flies in protected ornamentals

by John Buxton, ADAS Rosemaund

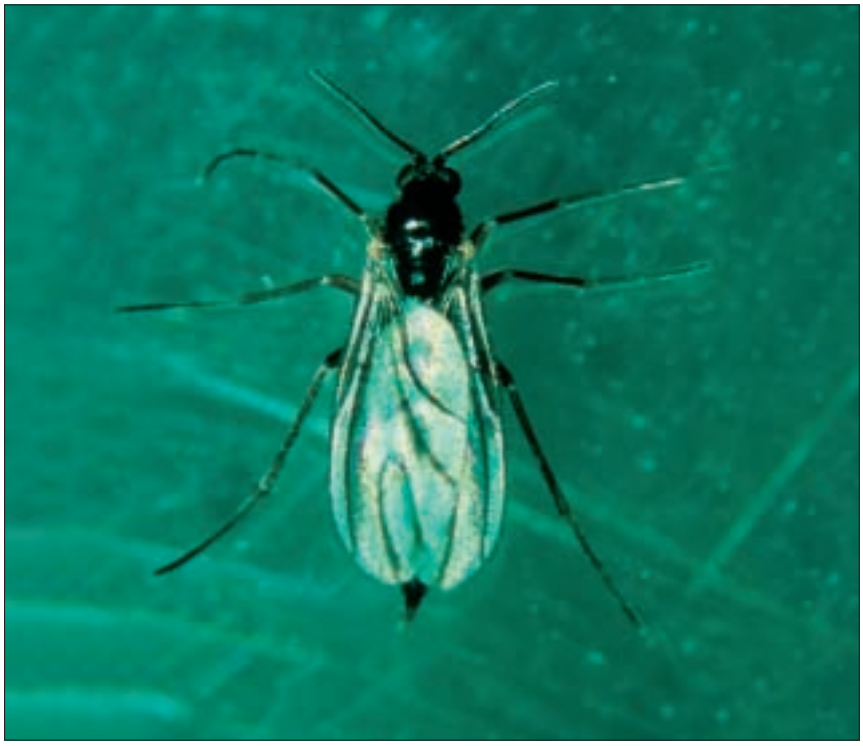
The HDC has recently funded two projects on the control of sciarid flies (PC 147 and PC 147a). This factsheet aims to summarise the key findings from these projects, together with an overview of the biology and economic importance of this pest to growers of ornamental plants.

Sciarid flies - characteristics of the pest

Sciarid flies, also known as fungus gnats *(Bradysia paupera)* are one of the commonest insects caught on yellow sticky monitoring traps in greenhouses. The flies are about 5 mm long, with long legs and antennae and dark wings. They are not strong fliers and are often seen running round the top of a pot or flying just above the plants. Research has shown that they can carry spores of pathogenic fungi (such as *Pythium*) around the nursery.

The female sciarid fly lays between 100 and 200 eggs and the larvae which subsequently hatch are creamy white, with a black head capsule. The life cycle duration depends directly on temperature. Development from egg to adult takes 3 to 4 weeks during summer. In protected environments, the pest survives all year round. When fully fed, larvae pupate in the compost and emerge after 4 to 6 days as new adults.

Shore flies *(Scatella stagnalis)* are often confused with sciarid flies, both on crops and when examining sticky traps. Shore flies are basically harmless, although in high numbers they can be a nuisance and mark sensitive plants (such as Begonia and Pansy) with small black faecal specks. Shore flies are larger than sciarid flies, with a stout body and short antennae. It is worth ensuring that you and your staff can easily distinguish between sciarid and shore flies.



1 Adult sciarid fly

2 Adult shore fly

Crop damage and economic importance

Sciarid flies are attracted to damp organic matter of any kind, such as peat, coir, bark and especially compost containing recycled waste material. Plants that are dying off or are infected with fungal rots are also very attractive. Females lay their eggs into cracks in the compost, and the larvae feed voraciously on organic matter, plant roots, fungi etc. Thus, sciarid flies can either be primary plant pests, or secondary invaders of senescing or diseased tissue.

One feature of sciarid fly larvae is that they can be found at various depths in the compost, but the majority occur in the upper most 5 cm. However, they also occur in the airspace between the outside of the root ball and the inside surface of the plastic pot. Growers may often see these larvae on the inside surface of the pot, when a plant is knocked out to examine root development. Because of their location, these larvae are extremely difficult to control and even when insecticide granules have been incorporated into the compost, they may still be common and noticeable. The exact degree of root damage they cause in this situation is not known, but in susceptible plants such as poinsettia, there may be some root hair damage which may allow entry of pathogens.

Well established plants with good root systems can tolerate low levels of sciarid fly in most cases. The susceptibility of plants varies with both species of plant and degree of root development. In the propagation stage, most cuttings or seedlings are very susceptible, especially slower-rooting HNS species such as ceanothus, azalea, etc. Similarly, some species of pot plant, such as pelargonium, fuchsia or poinsettia are very prone to attack by sciarid larvae. When numbers are high, larvae can tunnel into the stem and kill the cutting outright, or at least weaken the cutting and delay rooting and therefore decrease quality. Poinsettia cuttings are generally rooted under mist, and bottom heat, where conditions for sciarid are ideal. Losses of up to 50% of cuttings of some varieties are not uncommon if the pest is not controlled adequately.

3 Sciarid fly larvae

Control strategy

Growers can choose between a strategy based entirely on biological controls, or on insecticides, or a combination of the two in an integrated pest management (IPM) programme. Whatever strategy is chosen, growers must combine this with good hygiene measures on the nursery.

Chemical and biological controls used by growers may be ineffective if the plug stage used for potting on is already infested with sciarid larvae. This problem is particularly common with poinsettias, where even if plugs are potted up in insecticide-treated compost, plants may die due to sciarid damage, because larvae are protected inside the plug.

Conditions favouring the build up of sciarid flies

- Warm temperatures, plenty of moisture, and the presence of organic matter such as peat
- Type of compost: coir, peat or bark-based composts are all favourable to sciarid fly development
- Decaying plant material
- Organic matter build-up beneath the benches and on capillary matting
- Over-watering
- Poor ventilation.

Pest monitoring

Effective IPM requires routine monitoring of pest levels in order to identify damage thresholds at which intervention with control measures are required. Sciarid flies are attracted to yellow sticky traps, and most growers use these to monitor populations in their greenhouses. Blue traps also catch sciarid flies, but are less attractive than yellow. Ideally numbers caught should be counted and recorded weekly; this gives a picture of the pest density in various locations in the greenhouse and enables growers to tailor controls to pest levels during the season. Traps are normally placed at about one per 200 m^2 bench or floor area, and should be placed just above the crop for maximum effectiveness.

In high risk areas, such as in propagation, monitoring should also include checks for the presence of larvae in the compost.

Making the most of naturally occurring enemies of sciarid flies

Where growers are not using broad-spectrum insecticides, natural enemies often build up and help control this pest, but they do not always ensure economic control. The parasite *(Synacra holconata),* lays its eggs in sciarid larvae and is commonly found on yellow sticky traps. Growers may also notice large, pale brown, fast moving mites on the compost surface. These are Gammasid mites, which feed on any small prey on and in the compost. They look similar to the commonly used *Hypoaspis spp.* predatory mites.

Over the past few years, many growers of pot and bedding plants have reported a naturally occurring fungus which attacks sciarid larvae. The infected larvae turn milky-white and rise to the compost surface to die. The factors which allow this fungus to appear are not known at present.

4 Sciarid fly larvae infected by naturally occurring fungus

Biological control options

Nematodes

Insect parasitic nematodes *(Steinernema feltiae)* are available from several suppliers; they are applied as a drench to the compost surface and can give effective control.

Nematodes work best when the compost is moist and temperatures are in the range of 15°C to 25°C. High temperatures (above 25°C for extended periods) are detrimental to the nematodes. Application should ideally take place on a dull day as the nematodes are sensitive to high levels of UV radiation. Under the correct conditions they can give extremely good control of sciarid fly larvae, but have no effect on adult flies.

Recommended rates are 0.5 x 1.0^6 per m^2 as a preventative application, or 1.0 x 10^6 per m^2 as a curative.

One application can often be sufficient but in slow growing or potted on crops, repeat applications may be made at 4 – 6 week intervals. Nematodes should not be tank mixed with pesticides or fertilisers.

Hypoaspis predatory mites

There are two species available commercially:

Hypoaspis miles* and *Hypoaspis aculeifer: both are essentially similar. These mites are pale to dark brown in colour and are applied to the compost surface using a shaker bottle. They feed on sciarid fly eggs, larvae and

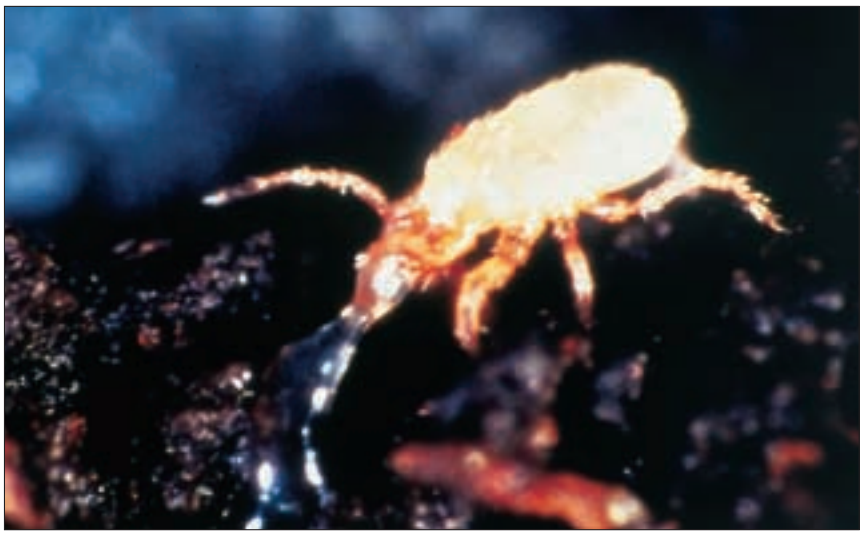
pupae but prefer smaller larvae. Often small prey such as springtails, thrips pupae and even nematodes are also eaten as *Hypoaspis* is a generalist predator. This ability enables it to persist and spread round the greenhouse, even when sciarid fly numbers are low.

Rates of use vary from 100/m^2 as a preventative rate, to be applied every 4–6 weeks, to up to 500/m^2 if there is a serious problem with sciarids and curative action is needed.

To achieve the best overall control of sciarid fly levels in the greenhouse, *Hypoaspis* should be applied under the benches as well as to the pots, capillary matting or Mypex.

Parasitic fungi

'Vertalec' and 'Mycotal' *(Verticillium lecanii)* are commercially available insect pathogens which are primarily used against aphids and whitefly respectively, but in ideal environments such as in propagation areas, where humidities exceed 95% for extended periods, infection of adult fungus gnats is common. Larvae, because they are protected in the compost are unlikely to be affected however.



5 *Hypoaspis* predator eating sciarid larva

Chemical control options

Compost incorporated insecticides

The two approved products are suSCon Indigo (chlorpyrifos) and Intercept 5GR (imidacloprid). Both are granular products which are mixed evenly into the compost before potting and give long-term control of sciarid larvae. Intercept 5GR is systemic and so also gives control of foliar pests such as whitefly, while suSCon Indigo is active only against pests in the compost as it is not systemic. The attraction of using one of these products is the ease of use, as further control measures for sciarid flies are unnecessary in most cases. Granular products can also be mixed into the growing media used for propagation and can give excellent control.

Insecticide drenches

Imidacloprid as Intercept 70WG is recommended by the manufacturers as a compost drench to control sciarid larvae. For best results, plants should have a well established root system as the activity of this insecticide is mainly dependent on systemic uptake. Other pests such as aphids and whitefly will also be controlled.

Teflubenzuron (Nemolt) is an insect growth regulator (IGR) which is widely used by growers as a drench to control sciarid fly larvae. This product interferes with the moulting process and so is only effective against larvae, with no effect on adult sciarids. There is no label recommendation for this use, however.

Broad-spectrum insecticides

Broad-spectrum pyrethroid insecticides, such as deltamethrin, bifenthrin or cypermethrin can be used as high volume sprays on ornamental plants, and will control adult sciarid flies. However, they are unlikely to have any effect on larvae in the compost and will have long-term significant adverse effects on beneficial insects introduced or naturally present in the greenhouse (eg *Synacra* parasites). These compounds are not compatible with IPM programmes.

Short-term persistence insecticides, such as pyrethrins (Py insect killer) or pyrethrins plus resmethrin (Pynosect) can provide good control of sciarid flies without long-term effects on beneficial insects present in the greenhouse.

Compatibility of insecticides with biological controls in an IPM programme

When using biological controls such as *Hypoaspis* spp. for sciarid control, it is very important to check the compatibility of any insecticides or fungicides you plan to apply. All the major suppliers of beneficial insects and mites produce a 'compatability list', and this should be consulted before using a pesticide in an IPM programme.

A list of biological and chemical control options for sciarid flies in protected ornamental crops is given in Table 1.

Table 1
Biological and chemical control measures for the control of sciarid fly in protected ornamentals[1]

Biological controls			
Active ingredient	**Trade name**	**Rates of use**	**Comments**
Steinernema feltiae nematodes	Nemasys Entonem Exhibit SF	0.5 to 1.0 x 10^6/m^2	Apply as a drench. Repeat applications may be needed
Hypoaspis spp. predatory mites	Entomite Hypoline Hyposure (M)	100 to 500/m^2	Lower rates used as preventative, higher rates used curatively
Chemical controls			
Imidacloprid	Intercept 70WG	Use 0.2 g product per litre of water and drench using 100-200 mls water per litre of compost	Persistent control. Also controls aphid and whitefly
Imidacloprid	Intercept 5GR	Incorporate into compost in the plug phase or before potting at 280 g/m^3	Also controls aphid and whitefly
Chlorpyrifos	suSCon Indigo	Incorporate into compost in the plug phase or before potting at 500 g/m^3	Gives long term control for up to 4 months
Teflubenzuron	Nemolt*	Apply as a drench at 50 mls/100 litres of water	Slow acting but IPM compatible
Deltamethrin Bifenthrin Cypermethrin (Pyrethroids)	Decis* Talstar* Toppel 10*	70 mls/100 litres 62 mls/100 litres 40 mls/100 litres Apply as a high volume spray	Controls adult sciarids, but persistent and NOT IPM compatible
Pyrethrin Pyrethrins plus resmethrin	Py Insect killer* Pynosect	See label for rates. Apply as a high volume spray	Controls adult sciarids, short persistence products, IPM compatible

***No specific label recommendations for sciarid control, but approved for use on protected ornamental crops for other pests.**

[1] Not all of the products mentioned have a label recommendation for sciarid fly control; use of any product without a label recommendation is at growers own risk. Growers are strongly advised to read the product label thoroughly before using any insecticide or biological control product.

Note
Regular changes occur in the approved status of pesticides arising from changes in the pesticide legislation or for other reasons. For the most up to date information, please check with professional supplier or with the Information Office at the Pesticides Safety Directorate (PSD) Tel: 01904 640500.

- **Always read the label or the Specific Off-Label (SOLA) notice of approval as appropriate.**
- **Use pesticides safely.**
- **Check with suppliers for full details of any side effects on biological control agents.**

Recent HDC trial results on sciarid fly control

Control of sciarid flies in propagation (plug phase)

Several ornamental plants are raised in plant modules or plugs prior to potting up in the final container. Control of sciarid flies in plugs is particularly difficult due to the very favourable environment for the pest under propagation conditions, and if mist is used for rooting it can cause insecticide drenches to be leached out of the plug. The constant moisture caused by the mist can also be unfavourable for *Hypoaspis* predatory mites.

A trial was set up to evaluate effective methods of controlling sciarid fly in plugs at the propagation stage. Granules of either Intercept 5GR (imadicloprid) or suSCon Indigo (chlorpyrifos) were incorporated into Elle pots or glue plugs before poinsettia cuttings were stuck. Trials were carried out on two commercial nurseries. Control of sciarid larvae was excellent. Plant losses were much reduced and the vigour and weight of poinsettia cuttings were significantly improved compared with the untreated cuttings.

The improvement in poinsettia cutting quality can be seen in Figures 6 and 7. Glue plugs had fewer sciarid larvae than Elle pots when no insecticide granules were used. Since this project was completed, several commercial propagators have included a granular insecticide in their poinsettia plugs, at no extra cost to their customers. Unfortunately, Jiffy plugs are unsuitable for this technique, as it is not possible to incorporate an insecticide during their manufacture.

Untreated | suSCon Indigo | Intercept

6 (above), 7 (below) Improved poinsettia cutting quality when plugs were treated with Intercept 5GR or suSCon Indigo compared with untreated control. Above, Glue plugs, Below, Elle pots (trial PC 147a)

Control of sciarid flies in propagation and in production

A second trial was set up to evaluate the effect on plant quality and on sciarid control by using control measures in the plug only, or in the final pot only, or in both. The aim was to see whether control in the plug stage alone was sufficient, or whether extra benefits in terms of pest control and plant quality could be gained by treating the pot as well.

The trial was conducted on two commercial nurseries with fuchsias and poinsettias. The treatments used in the second trial are listed in Table 2.

Table 2
Treatments used in plug and potting on stages in second trial

Plug phase treatments	Potting on treatments	Rate used
Untreated	Untreated	–
Intercept 5GR Intercept 5GR Untreated	Untreated Intercept 5GR Intercept 5GR	280 g/m^3 280 g/m^3 280 g/m^3
suSCon Indigo suSCon Indigo Untreated	Untreated suSCon Indigo suSCon Indigo	500 g/m^3 500 g/m^3 500 g/m^3
'Nemasys' (nematodes)	'Nemasys' (nematodes)	0.5 x 10^{6}m^2
Hypoaspis mites	*Hypoaspis* mites	250/m^2

Intercept 5GR and suSCon Indigo granules were incorporated into the compost for the plug phases and potting on stages as appropriate. Nematodes or *Hypoaspis* were applied to plugs during rooting, and 3 times during the first 6 weeks after potting. The aim was to achieve the best possible control of sciarids by using repeat application of these biocontrol agents.

The highest reduction in sciarid flies and highest root dry weight for fuchsia (cv. Display) was found where both the plug and pot were treated. Where *Hypoaspis* spp. had been used at a high rate (250/m^2) on 3 occasions after potting, sciarid fly control was excellent and plant quality was outstanding.

Trials with poinsettia (cv. Sonora) demonstrated the economic benefits of controlling sciarid fly in terms of improved plant growth and plant quality. A grading assessment (see Table 3) of the plants at the marketing stage showed the improved grade out where control measures for sciarid fly were used in both the propagation and production phases rather than in just propagation or production alone.

Table 3
Percentage grade 1 plants at marketing with each treatment

Treatment	% Grade 1 plants
Untreated	45
Intercept 5GR plug only Intercept 5GR plug and pot Intercept 5GR pot only	90 95 85
suSCon Indigo plug only suSCon Indigo plug and pot suSCon Indigo pot only	60 100 85
Nemasys plug and pot	95
Hypoaspis mites plug and pot	100

8 PC 147a Untreated pots

9 PC 147a, Intercept granules incorporated in plug + pot

10 susSCon Indigo granules incorporated in plug + pot

11 Hypoaspis, applied 3 times in first 6 weeks after potting

Key questions and answers about sciarid fly control

- **Why is control of sciarid fly important, and at what crop stages should I pay most attention to control?**
  Well established plants with good root systems can tolerate low levels of sciarid fly in most cases. Plants in propagation or in the first few weeks after potting are most vulnerable, and special attention should be paid to control at this stage.

- **What plants are most susceptible to attack by sciarids?**
  Almost any plant that is slow-rooting, grown in conditions of high humidity, or under stress from disease, high conductivity, etc, can be attacked. However, species such as ceanothus, azalea, cyclamen, poinsettia and pelargonium are very susceptible. You should always ask your propagator what measures have been taken against sciarids before you buy in plugs of rooted cuttings.

- **What is the cost-effectiveness of control measures for sciarid fly?**
  In terms of cost, treatment of the plug alone is extremely cost-effective. Use of a biological control agent or insecticide granules at this stage costs little, due to the small volume of compost involved. With many species of plant, this may be sufficient. However, with others such as poinsettias, an extra benefit can be gained from treatment of the final pot as well.

- **What is the best treatment for sciarids, and how much does it cost?**
  Insecticide granules such as Intercept 5GR or suSCon Indigo give effective, long-term control when incorporated into compost, for around 1p per 13 cm pot. However, in the HDC trials, the best control overall was given by a high rate of *Hypoaspis* (250/m^2), applied 3 times during the first 6 weeks after potting up. This costs around 6p per pot in total. This was a higher rate of *Hypoaspis* than is normally used by growers, but the results showed that excellent sciarid control and improvements in plant quality can be achieved by using these high rates, especially with susceptible subjects such as poinsettia.

Further information may be obtained from the HDC Project Report available from the Office.

March 2002

Design and production: HDR Visual Communication