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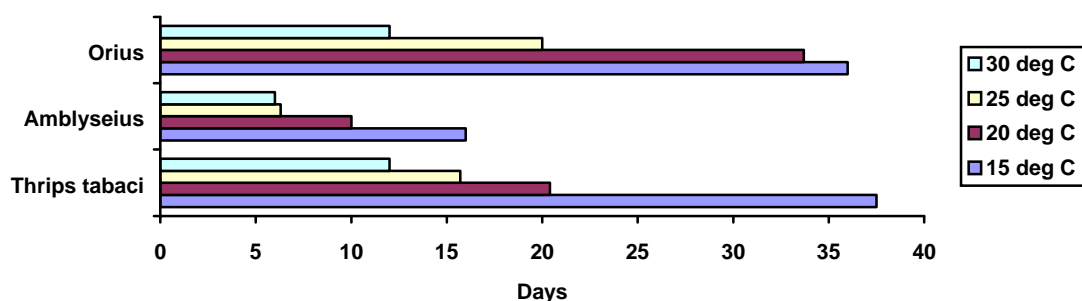
Biological Control - THRIPS

There are many species of thrips found in Britain, several of which may occasionally attack crops. However the most common thrips found on protected crops are *Thrips tabaci* and more recently *Franklinella occidentalis* the western flower thrips (WFT). These pests feed on many types of crops causing damage to leaves and scarring to both flowers and fruit. Thrips damage to leaves can be recognised by the appearance of white flecks with black spots in them. If damage is severe, leaves become totally "silvered" and many young and adult thrips can be seen underneath the leaf and in the flowers. Thrips can also transmit viruses such as tomato spotted wilt virus, which is damaging to a range of crops.

LIFE CYCLE OF THRIPS

Adult thrips lay their eggs beneath the leaf cuticle. The eggs hatch, and the young wingless larvae start to feed on the leaf surface and in the flowers. After a number of larval stages the pre-pupal larvae usually fall to the floor and find a sheltered place in which to pupate. The next generation of adults emerge from the pupae and fly onto the plants, start to feed, and lay eggs. At any time in an established population a large proportion of the thrips are pupating and it is in this way that the pest is carried over from year to year.

EXAMPLES OF PEST AND PREDATOR LIFE CYCLES



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BIOLOGICAL CONTROL

There are a number of different predators available to control thrip species at larval, pupa and/or adult stage.

1. *Amblyseius cucumeris*: a predatory mite – applied to the foliage
2. *Amblyseius swirskii*: a predatory mite – applied to the foliage
3. *Orius laevigatus*: a predatory bug – applied to the foliage
4. *Steinernema feltiae*: a nematode – applied as a drench into the compost
5. *Hypoaspis miles*: a predatory mite that thrives in the top few centimetres of compost
6. *Macrocheles robustulus*: a new introduction of predatory mite similar to *H. miles* - applied to the compost

1. *Amblyseius cucumeris*

This is a predacious mite, which feeds on immature stages of thrips, spider mites and pollen. This predator can only feed on young thrips and is not well suited to life on plants. These limitations can be overcome by frequent introductions. Release *Amblyseius* into the crop over an extended period of up to two months depending on the conditions in the glasshouse.

2. *Amblyseius swirskii*

This is also a predacious mite and introduced into the UK in 2005. It can survive on pollen and honeydew if thrip populations are low and are well suited to warm and humid climate conditions. The critical relative humidity (RH) is approximately 70% and the optimum temperature for *A. swirskii* is between 25 and 28°C. The development from egg to the adult phase takes only five to six days at 26°C. If sufficient food is available, *A. swirskii* lays an average of two eggs per female per day. The predatory mite does not go into diapause (hibernation) in response to shorter days or lower temperatures. This means that the predatory mite is also active on shorter days (with less than 12 hours of light) but it becomes inactive below 15°C.

A. swirskii eats the first larval phase of thrip. A female mite can consume up to five young thrip larvae per day at 25°C. It can develop on plants much more quickly than *A. cucumeris* if prey is available.

Amblyseius CRS System

This system supplies *Amblyseius* in small sachets that can be hung amongst the foliage. Make sure they are in contact with the plant and perforate the sachet just below the hook to allow the mites to escape. Avoid direct sunlight exposure or direct heat from heating pipes. Use within 18 hours of delivery and store at 10-15°C.

Amblyseius shaker bottles

Amblyseius can also be supplied as a mixture in bran, which can be sprinkled over the crops, or applied in a small pile to the base of some rockwool grown crops. These are supplied in bottles, each containing 50,000 predators; a guide for the introduction is 2.5 per m².

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3. *Orius* sp.

Orius belongs to the *Anthocorid* family, which are well known as voracious feeders on a range of small insects, mites and pollen. There are a number of different species of *Orius*, out of which *O. laevigatus* appears to be the best of the indigenous UK species.

Orius are supplied as adults in a bran-like carrier which reduces cannibalism in transit. The carrier and *Orius* are sprinkled onto the crop, in much the same way as *Amblyseius*. The highly active *Orius* will soon begin to feed on any thrips, mites etc. which it finds on the drop. A guide to introduction rates is 1 per m².

4. *Steinernema feltiae*

The nematode *Steinernema feltiae* is a commonly occurring species that is capable of parasitising a range of pest larvae and pupae including thrip.

The *Steinernema feltiae* are small, unsegmented worms. There are four larval stages, the first one of which develops inside the egg. Second stage larvae emerge from the egg. Nematodes in the third larvae stage, the infectious stage, enter their host through one of its body openings or through the skin. The intestines of the nematode release bacteria into the host which spread and multiply very quickly. The pests are killed within 48 hours due to blood poisoning.

The *Steinernema feltiae* cannot withstand drought. The soil/compost to which they are applied must be kept as moist as possible. They keep for only a short time and should be applied using watering equipment. High humidity and a temperature of 15°C are necessary for effective control using nematodes.

Application rates

The product consists of a bottle containing beneficial nematodes in a water dispersible granular formulation. Conventional spray equipment can be used, but should be washed through before use. Do not allow the pressure in the sprayer system to exceed 3 bars (45psi) or you can damage the nematodes through pressure and ensure good agitation during application. The size of the sprayer is not important because the application is a product to area ratio NOT water to area. The recommended rate is 500,000 nematodes per m².

5. *Hypoaspis* mites

This small, soil-dwelling mite inhabits the top few centimetres of compost; it can also live in rockwool bags and on capillary matting. Sciarid larvae, springtails and other insects or mites associated with its habitat are its usual source of food. Female mites are up to 1mm long, and like males, have pale brown dorsal shields.

The mite is delivered in an inert media, which can be sprinkled evenly over the surface of trays or be placed in small heaps on larger pots. For treating rockwool slabs, a small mount of medium must be placed on one plant in each slab.

Hypoaspis has shown a high tolerance to starvation as it can survive for 6 to 8 weeks in the absence of food although water is required. Temperatures below 11°C cause inactivity and a cessation in egg hatch, whereas activity remains high at up to 30°C. There is also potential for control of thrips larvae and pupae.

Application rates

100 per m² for protected crops including bedding plants.

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6. *Macrocheles robustulus*

Visually similar to *Hypoaspis miles* but a more voracious predator that will eat the pupal stages of thrips as well as springtails and all growth stages of sciarid flies. The adult is 0.6-0.8mm long and brown; the larva is white.

- The mites work well in moist well-drained compost and soils at temperatures of >15°C.
- *M. robustulus* does not enter diapause (dormancy) in response to shorter days.
- Covering the compost surface with a mulch can help the predators establish.

Application rates

250 per m².

EXAMPLES OF FUNGICIDE USE WITH PREDATORS

Fungicide	Amblyseius swirskii			Orius		
	eggs	adult	Persistence (wks)	nymph	adult	persistence (wks)
Amistar*		S		S		0
Fubol Gold WG*						
Nimrod	MH	S	0	S	MH	0
Reflect*	S	S	0			
Switch		S	0			

Fungicide	Steinernema		Hypoaspis		
	adult	persistence (wks)	nymph	adult	persistence (wks)
Amistar*	0	0			
Fubol Gold WG*					
Nimrod	S	0	S	S	0
Reflect*					
Switch					

EXAMPLE OF INSECTICIDE USE WITH PREDATORS

Insecticide	Amblyseius swirskii			Orius		
	eggs	adult	persistence (wks)	nymph	adult	persistence (wks)
Azatin		MH	0	MH	S	0
Conserve	VH	VH		H	MH	<1
Decis Forte	VH	VH	8-12	VH	VH	8-12
Dynamec	VH	VH	<1	VH	H	1-6
Hallmark WZT*	VH	VH	8-12	VH	VH	8-12
Mainspring	S	S		S	S	0

Insecticide	Steinernema		Hypoaspis		
	adult	persistence (wks)	nymph	adult	persistence (wks)
Azatin	S	0	S	S	0
Conserve	S	0	S	S	
Decis Forte	VH	VH	VH	VH	8-12
Dynamec	VH	1	MH	MH	
Hallmark WZT*	VH	8-12	VH	VH	8-12
Mainspring	S				

Key

Blank cell = unknown effect/persistence

S = safe

VH = very harmful

MH = moderately harmful

SH = slightly harmful

* Extension of Authorisation for Minor Use (EAMU) required

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