

# Caterpillar pests of bedding and pot plants

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**The aim of this factsheet is to aid the recognition of the main species of caterpillars that damage bedding and pot plants, outline available monitoring options and summarise the main cultural, biological and chemical methods for control. It primarily deals with native species of caterpillars; however important non-indigenous species that can be brought in on imported plant material are also covered.**

## Action points

- Check incoming plant material for eggs, caterpillars or caterpillar feeding damage. Inspect imported plant material for non-indigenous caterpillars and report any suspected presence to the Plant Health and Seeds Inspectorate.
- Train staff to recognise the symptoms of caterpillar feeding and provide reference wall charts and identification cards to aid identification.
- Monitor crops on a regular basis for caterpillar feeding damage and consider the use of pheromone traps if particular moth species are problematic.
- Ensure pesticides are applied as soon as damage is noted and that they are applied uniformly and in the appropriate water volume to achieve the highest levels of pest control.
- Biological control products (eg Dipel DF) and IPM compatible pesticide products (eg Dimilin Flo and Nemolt) should be applied approximately every 7 days through the main hatching period.
- Employ good nursery hygiene measures and undertake a good end of season clean up to ensure minimal pest carry over in the next season.



**1** Severe caterpillar feeding damage on primula

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## Background

Protected bedding and pot plants can be attacked and damaged by a diverse range of caterpillar species. Adult moths and butterflies themselves are harmless, it is only the larval stage or caterpillar that damages plants. Attacks are often sporadic but over recent years the incidence of damage has increased. This may be a result of warmer temperatures in the summer and milder winters experienced over the past few years.

Adult moths and butterflies enter glasshouses mainly through open vents or doors. Whilst the main pest butterflies are host specific, moths will lay eggs on a wide range of bedding and pot plant species and invasion can occur over a period of several weeks.

Early symptom recognition and rapid implementation of control measures are essential since caterpillars can develop rapidly and cause extensive crop damage. The severity of the damage will depend upon the level of caterpillar infestation and the stage of

development of the crop being attacked. Crops close to marketing can be made rapidly unsaleable by caterpillars feeding on the upper foliage or flowers.

Older, larger caterpillars are generally more difficult to control than the younger, smaller ones as they tend to hide under plug trays, packs, pots etc. during the day so away from any direct spray coverage. Many species are also well camouflaged and are very difficult to spot, even when the damage to plants has been noticed.

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## Damage symptoms

Damage varies according to the type of caterpillar involved, but the most common symptom is holing of the foliage, which may be variable in both size and extent. When young leaves are damaged, the holes can often expand in size as the leaf develops.

The earliest damage, from the smallest caterpillars is often missed, as they generally feed on the lower leaf surface and this may not be seen immediately from above. This type of feeding leads to 'windows' in the foliage, the upper leaf surface temporarily remains as a transparent layer before dying and falling out. The presence of frass (droppings), left behind by the caterpillars, is a good sign that they are present even if the caterpillars cannot actually be found.

Holing damage symptoms can be extremely variable and must be distinguished from holing caused by other factors, such as mechanical damage (transplanter fingers), shot holing due to bacterial infection or slug and snail feeding. In the latter case, the leaves are usually damaged from the edge inwards and holes in the centre of the leaf are unusual. A slime trail is also often associated with slug and snail damage.

Other damage symptoms include tying or rolling of shoots, growing points and leaves by tortrix caterpillars and cutworm damage where whole plants are cut off at the stem base. The latter symptom is sometimes mistaken for rodent damage.



2 'Feeding windows' in the foliage of pansy, a result of caterpillar feeding on the underside of the leaf



3 Tortrix caterpillar feeding damage on pelargonium – note the remnants of its silken feeding structure

## Sources of infestation

These are varied and include heaps of old plant material outside the glasshouse, nearby weeds and uncultivated fields, uncontrolled infestations in other glasshouses,

where the pest was able to over winter successfully, and in the case of imported cuttings, eggs arriving on plant material.

As with many pests, hygiene is important and weeds should be controlled both inside and around the perimeter of glasshouses. However, even with good hygiene measures in place, moths

and butterflies can fly long distances and can still enter protected structures to lay eggs on crops.

## General life cycle

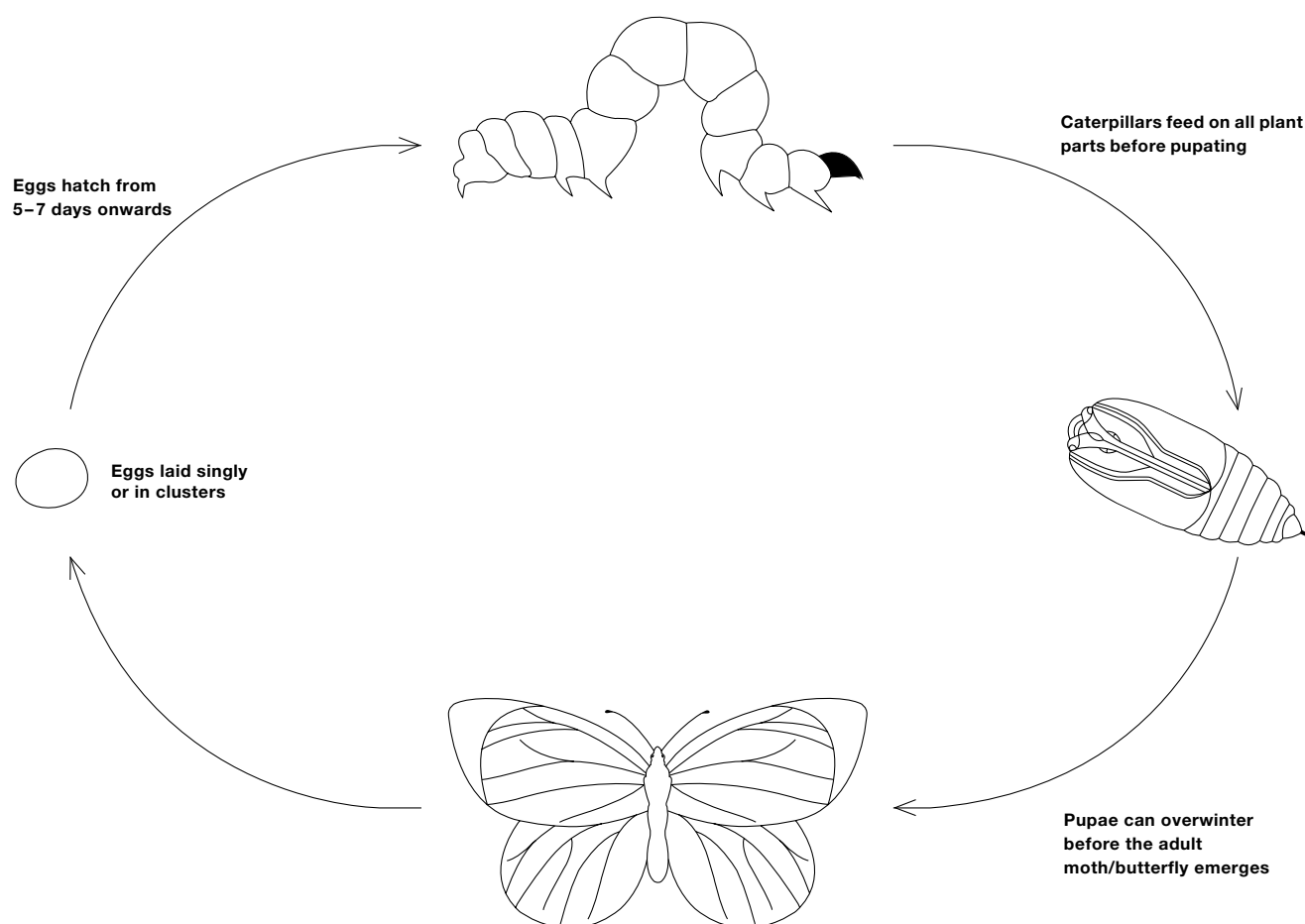
Adult moths and butterflies vary in size and colour, but most species have two pairs of wings that are covered with flattened scales that are easily rubbed off when handled. In some species eggs are laid singly on leaves or stems, but the majority of species deposit their eggs in a cluster or egg mass on the lower or upper leaf surface. The eggs are often shiny white in colour or translucent. Eggs

hatch from about 5–7 days onwards (depending upon temperature). Caterpillars are the soft fleshy larvae that emerge. They have three pairs of true legs on the thorax and a variable number of false legs (prolegs) on the abdomen. The number of prolegs along with the colour, pattern of spots and stripes and presence of hairs on the body of the caterpillar are used in species identification.

Once development is complete, caterpillars spin a silken cocoon,

which may be hidden, and pupate inside it, before emerging as an adult moth or butterfly.

**Diagram 1 General moth/butterfly life cycle**





## Main problem moth and butterfly species

Caterpillars that damage ornamental plants can be divided into the following categories:

- 1 Foliage feeders
- 2 Leaf tying/rolling species
- 3 Cutworms

### 1 Foliage feeders

Most caterpillar species belong to this group of general foliage feeders. Feeding produces holes of varying sizes in leaves, flowers etc. Such species generally only feed at night, hiding under plant pots, trays etc. during the day. The most common and

important species include silver y moth (*Autographa gamma*), cabbage moth (*Mamestra brassicae*), diamond back moth (*Plutella xylostella*), tomato moth (*Laconobia oleracea*), angle shades moth (*Phlogophora meticulosa*), cabbage white and lesser cabbage white butterflies (*Pieris brassicae* and *P. rapae*).

#### Silver y moth

This is a large greyish-brown moth (wingspan 3–4 cm) with a distinctive silver y mark on the forewings. They are active fliers and often fly during the day. The caterpillars are 4–5 cm long, pale green with a pale lateral line along the length of the body and have only two pairs of prolegs.

They are termed 'looper' caterpillars as they move by arching their body

upwards and then extending as they move forward. Caterpillars of this species are nocturnal and may be very hard to find during the day as they are normally well hidden. Common host plants include pelargonium, carnation, antirrhinum, chrysanthemum and herbaceous plants. Feeding damage is visible from the end of June/July until the end of October or later in the South or South West. This species is unable to survive winters outdoors.

#### Cabbage moth

This is also a large (4–5 cm wingspan) dark greyish-brown moth but has obvious kidney shape white rimmed marks on its forewings. The caterpillar is about 4–5 cm in length and is usually pale green but can be quite variable in colour (some are brown)



4 Adult silver y moth with distinctive silver y mark on the forewings



5 Silver y caterpillar showing pale lateral line along the length of the body



6 Cabbage moth caterpillar showing broad yellow stripe down the sides

but all have a broad yellow stripe down the sides.

It feeds on a similar range of host plants as the silver y moth, but almost any plant species may be attacked, including ornamental kale. Damage tends to occur mainly from June/July onwards until late September and even into October.

#### **Diamond back moth**

This is a small narrow moth (wingspan 12–15 mm), pale brown in appearance with a white diamond shaped mark on the upper wing surface. This species is a major pest of cruciferous crops (including wallflower, stocks etc) all over the world and has developed resistance to many insecticides over recent years.

The caterpillars are pale green in colour, maturing to pale brown and

feed within growing points and shoots, creating holes which become visible as leaves expand. The caterpillars are small, up to 5 mm long and feed at any time of the year in heated glasshouses, although the most active feeding period is between June and September.

#### **Tomato moth**

This is a large red-brown moth species (wingspan 4–5 cm), but can be identified by distinctive kidney shaped red marks on its forewings. Caterpillars are up to 4 cm long, usually pale green or brown with a light brown head and sometimes have a yellow stripe down their sides.

Host plants include polyanthus, primula, dianthus and chrysanthemum. The caterpillars of this species are adept at hiding in inaccessible

places, for example under plastic floor covering. Caterpillar feeding occurs from June to late September, although in heated glasshouses this species can cause damage for most months of the year.

#### **Angle shades moth**

This is a large (4–5 cm wingspan) moth with pale pinkish brown forewings, each with a darker base and a large inverted triangular mark. The caterpillars are velvety yellowish green or brown with darker mottling. Fully grown caterpillars are 3.5–4 cm long.

Host plants include pansy, viola, chrysanthemum, dahlia, pelargonium, fuchsia and cineraria. Feeding damage occurs mainly in the latter part of the summer, from July into September and beyond.



7 Adult diamond back moth with characteristic diamond shaped mark on upper wing surface



8 Small, pale green diamond back moth caterpillar



9 Tomato moth caterpillar can be pale green or brown with a light brown head and sometimes a distinct yellow side stripe



10 Mottled, yellowish green or brownish angle shades moth caterpillar



### Cabbage white and lesser cabbage white butterflies

These are well known common garden pests. They only damage brassica plants, such as ornamental kale and cabbage. The white winged adults are easily recognisable and the caterpillars of these species usually damage outdoor grown crops, although adults can enter glasshouses and lay eggs on crops under protection. Egg masses are bright yellow and laid on the upper leaf surface.

Caterpillars of the cabbage white butterfly grow to about 3.5 cm in length, are yellow-green in colour and hairy. They sometimes have distinct black mottled markings and yellow lines down the back and sides. Ornamental kale and cabbage can be rapidly defoliated if this pest is not spotted early, as the caterpillars tend to feed gregariously. Those of the lesser cabbage white are smaller (maximum 2 cm in size), a

uniform pale green colour and they feed individually rather than gregariously. Feeding damage occurs from late June onwards until the first frosts of autumn.

### 2 Leaf tying/rolling species

Leaf tying/rolling species mainly belong to the family tortricidae and feed within rolled up growing points, leaves and shoots, covering themselves with silk. Important species include the carnation tortrix moth (*Cacoecimorpha pronubana*) and the cyclamen tortrix moth (*Clepsis spectrana*). These species are adapted to a Mediterranean climate and can only survive over winter in unheated or heated glasshouses or polythene tunnels, except in the mild climate of South West England where they can survive outdoors in most winters. They survive the winter as pupae or caterpillars, remaining inactive until the

spring. Normally they only have two generations per year, but some strains have adapted to the environment inside glasshouses and can breed all year round as long as temperatures are suitable.

### Carnation tortrix moth

This is a small (15–20 mm) pale brown moth with a distinctive delta wing shape when at rest. The wings are coloured with broad brown stripes, but when in flight, the bright orange hind wings can be seen. The adult moths fly by day and night. The egg mass is translucent and is usually laid on the lower leaf surface.

The caterpillars are pale green, about 15–20 mm in length and normally feed within a silken structure. Like all tortrix caterpillars they can be easily recognised by their habit of wriggling rapidly backwards when disturbed. A very wide range of host plants is attacked including dianthus, pelargonium, diascia,



11 Adult cabbage white butterfly



12 Yellow-green, hairy cabbage white caterpillar with black mottling and yellow lines down sides



13 Adult carnation tortrix moth with broad brown stripes on wings

hedera, and fuchsia. Feeding occurs from early spring onwards.

#### **Cyclamen tortrix moth**

This is a yellow brown moth with two dark markings on each forewing (wingspan being 15–25 mm). The caterpillars (15–25 mm) are dark green to pale brown and have the typical habit of tying leaves up in silk, which gives protection to the caterpillar. Host plants include roses and cyclamen. Feeding occurs from early spring onwards.

### **3 Cutworms**

Cutworms are large caterpillars of several moth species that can burrow into the growing media or hide under matting and emerge at night to feed on the stem bases of plants, often killing young plants outright. They can be hard to find and their damage can be mistaken

for that caused by rodents. However, their droppings or frass can sometimes be seen on the host plant, and this is an indication that caterpillars are present. Cutworm species include the large yellow underwing moth (*Agrotis pronuba*), heart and dart moth (*Agrotis exclamatoris*) and the turnip moth (*Agrotis segetum*).

#### **Turnip moth, heart and dart moth and large yellow underwing moth**

These are all very similar in appearance being large, dull brown moths with a wingspan of 4–6 cm. The large yellow underwing moth is easily recognised in flight by its bright yellow hind wings. The caterpillars of each species vary in appearance, large yellow underwing caterpillars have distinct black chevron markings on the back, while the turnip moth and heart and dart moth caterpillars are pale brown, with tiny black speckles on the back. Fully grown caterpillars are large, up to 4–5 cm long

and capable of damaging even well grown, mature plants.

The three cutworm moth species behave in a similar manner; moths enter the glasshouse and lay eggs in batches on the growing media or on the base of the plant. The caterpillars feed at first on aerial parts of the plant, but this damage is insignificant and may be missed. Later caterpillar stages burrow into the growing media and emerge at night to feed on stems and roots. Bedding plants such as primula and polyanthus may be completely severed at ground level. This is often mistaken for rodent damage, as the caterpillars are not easy to find. Other plant species are also affected, including pansy/viola and a range of herbaceous plants. Damage usually occurs from late June or July, although a second generation can cause damage under protection into September and beyond, depending upon the season.



14 Pale green carnation tortrix moth caterpillar



15 Pale brown, speckled turnip moth caterpillar



### Notifiable cutworm species

There are several non-indigenous caterpillars that can occur on imported plant material. The main species involved are the Mediterranean climbing cutworm (*Spodoptera littoralis*), the Egyptian cutworm (*Spodoptera exigua*) and the old world bollworm (*Helicoverpa armigera*). If their presence is suspected then the batches of infested plant material should be quarantined and the Plant Health and Seeds Inspectorate (PHSI) notified ([www.defra.gov.uk/planth/ph.htm](http://www.defra.gov.uk/planth/ph.htm)).

The most common non-indigenous species found in the UK is the **old world bollworm**. This species is found throughout tropical and subtropical regions of the world, and can be a major pest in propagation nurseries in coun-

tries such as Kenya, Ethiopia, and the Canary Isles. It can feed on many host plants but is a particular pest of pelargoniums (zonal, regal and ivy leaf varieties). It may be imported accidentally on imported ornamental cuttings as eggs or caterpillars. The caterpillars develop rapidly during the rooting phase, and their feeding causes severe damage to all parts of the plant. This species along with the **Mediterranean climbing cutworm** and the **Egyptian cutworm** are resistant to many insecticides and are difficult to control. If the presence of any of these species is suspected, the local PHSI officer must be notified.

The adults of all three non-indigenous moths are similar, but the appearance of the caterpillars varies. The caterpillar

of the old world bollworm, varies in colour from dark brown to green, although it has three distinctive dark bands with several lighter wavy lines along the sides of its body.

The caterpillar of the Mediterranean climbing cutworm varies from pale to very dark brown with numerous small white spots whilst the caterpillar of the Egyptian cutworm is also variable in colour from greyish red to greyish yellow with four triangular black dots on the side of the body.



16 Old world bollworm caterpillar with distinctive dark bands and lighter wavy lines along the sides of its body



17 Greyish yellow Egyptian cutworm caterpillar



**Table 1 Butterfly/moth species and corresponding caterpillar occurrence on bedding and pot plant crops**

Species	Month of the year											
	Jan	Feb	Mar	April	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Silver y moth						■	■	■	■	■	■	
Cabbage moth					■	■	■	■	■	■	■	
Diamond back moth					■	■	■	■	■	■	■	
Tomato moth				■	■	■	■	■	■	■	■	
Angle shades moth					■	■	■	■	■	■	■	
Cabbage white butterfly					■	■	■	■	■	■	■	
Carnation tortix moth			■	■	■	■	■	■	■	■	■	
Cyclamen tortix moth			■	■	■	■	■	■	■	■	■	
Turnip moth					■	■	■	■	■	■	■	
Heart and dart moth					■	■	■	■	■	■	■	
Large yellow underwing moth					■	■	■	■	■	■	■	

■ Adult activity – monitoring should be undertaken      ■ Caterpillar feeding activity – control action may be required

## Crop and pest monitoring

The earlier caterpillar feeding damage is detected on a crop, the easier it is to control the problem. Although small amounts of feeding damage can be tolerated on younger plants, as new growth will mask old feeding damage, damage to crops that are close to marketing can lead to downgrading and rejections. Heavy caterpillar infestations or attacks by cutworms can lead to plant losses on a moderate level.

Higher levels of caterpillar feeding activity are usually noted from July through to October, so regular (at least weekly) crop monitoring at this time of year is important. Where appropriate, permanent nursery staff should be trained to recognise pest and disease symptoms, including caterpillar feeding damage. Staff may often spot damage when carrying out routine tasks such as watering, spacing etc, so it's useful to have a reporting system so that they can report the nature of the damage, and its location on the nursery, to

supervisors. Wall charts and identification cards for all the common caterpillar pests in glasshouses are available and should be accessible to staff (see 'Further information'). As soon as damage is seen, curative action should be taken. Where damage is found but caterpillars are not visible, check under trays, packs, pots, plastic floor covering if possible, on the underside of leaves,

under rims of pots etc to confirm that caterpillars are the cause of the damage symptoms seen.

As well as physical crop monitoring, pheromone traps should also be considered especially if a particular moth species has been problematic on the nursery in the past. The traps consist of a plastic triangular structure with a sticky plate on the base.



**18 Pheromone traps should be considered particularly for problematic caterpillar species**

A chemical lure contained in a plastic plug or vial is located on the base of the trap and emits a synthesised version of the sex attractant of the female moth over a period of time, generally 2–3 weeks. Males are attracted from long distances and as they enter the trap get caught on the sticky plate.

These systems can be very effective but they do not normally give control,

rather, they act as ‘early warning’ systems to warn that a moth egg laying period is imminent and more frequent crop monitoring should be undertaken. Each pheromone is specific to one species of moth/butterfly, so will generally only be effective with that particular species.

Pheromones are available to attract the following species; tomato moth,

cabbage moth, turnip moth, large yellow underwing moth, carnation tortrix moth, cyclamen tortrix moth, diamond back moth, large cabbage white and lesser cabbage white butterflies, silver y moth and old world bollworm. Further details can be obtained from your local distributor or biological control supplier (see Further information).

## Control options

### Cultural control

Basic cultural control measures include good crop husbandry, inspection of incoming cutting material and plants for eggs, caterpillars or feeding damage, disposal of old or unmarketable stock, disposal of crop debris from between pots and trays and under benches and maintenance of good levels of weed control both inside the glasshouse and around the perimeter. A thorough end of season clean up programme, including the use of disinfectants as appropriate, should also be undertaken.

### Integrated pest management (IPM)

#### Dipel DF

The main biological control agent for use against caterpillars is the bacterial insecticide Dipel DF (*Bacillus thuringiensis*). Dipel DF is applied as a spray and the product acts on target caterpillars after they have fed on treated foliage. It is an effective product that is specific to caterpillars and is safe to use within IPM programmes.

It must be sprayed in sufficient water volume evenly over the crop, ideally at the first signs of damage when the caterpillars are still small. When caterpillars ingest foliage treated with the bacterium, toxins are produced by the bacterium that paralyse the caterpillar within a few hours and death usually occurs within 1–3 days of ingestion. Dead caterpillars can often be seen hanging from the plant.

Dipel DF is not persistent, being broken down rapidly by UV light, so must be applied at 7–10 day intervals through the hatching period for best control. It should be stored under cool,

dry conditions and preferably used up within two years of opening/purchase.

#### Trichogramma

As part of an integrated programme with monitoring and sprays of Dipel DF, the parasitic wasp *Trichogramma* can be used. This tiny wasp (about the size of a pinhead) lays its eggs in the eggs of caterpillars of many species. Practical experience in its use is very limited in pot and bedding plants, although it has shown some promise against carnation tortrix moth under UK conditions. Parasitised eggs turn black and instead of a caterpillar, an adult parasite emerges. Species of moth that lay their eggs in clusters or egg masses may be more efficiently parasitised by *Trichogramma* than species that lay their eggs singly or in inaccessible places such as leaf axils. *Trichogramma* should be introduced at recommended rates (5–20 per m<sup>2</sup>) throughout the season, usually weekly or fortnightly.

### Chemical control

A range of insecticides have specific approval for use on bedding and pot plants and others can be used under the current Specific Off-Label

Arrangements and Long Term Arrangements for Extension of Use.

#### 1 IPM compatible pesticide products

Dimilin Flo (diflubenzuron) and Nemolt (teflubenzuron) are both insect growth regulator products that act by inhibiting moulting, so when the caterpillar tries to shed its skin, the process fails and it eventually dies. Both have contact and stomach acting properties, reasonable persistence (about 5–7 days) on treated foliage and are safe for use with the majority of biological control agents. Both must be applied thoroughly and in sufficient water volume to obtain good leaf coverage.

The active ingredient indoxacarb (product name Steward) is one of a new group of insecticides with excellent activity against caterpillars and also a good level of safety to many groups of beneficial insects and mites. It has label approval for use on protected and outdoor ornamentals.

Conserve (spinosad) is approved for the control of western flower thrips in protected ornamental crops, but recent HDC funded research (project HNS 130) has shown that it is very effective against tortrix caterpillars and may also be effective against a wide range of other species.



19 Caterpillar infected with the bacterial biological control agent, Dipel DF – an effective product that must be sprayed in sufficient water volumes, ideally when the caterpillars are small



## 2 Pesticide products not compatible with IPM

The synthetic pyrethroid products, such as Decis (deltamethrin), Toppel 10 (cypermethrin) and Gyro (bifenthrin) are extremely active against caterpillars and act as contact, residual and stomach poisons

against all sizes of caterpillar. They are active at low doses, have a rapid knock down effect and are persistent on foliage. If a caterpillar problem has not been noticed until serious damage has occurred or if an IPM programme is not in place, these products will give rapid, effective control providing the spray

application is thorough. The products are reasonably safe to most ornamental crops, however their broad spectrum activity and persistence means that they are totally incompatible with IPM programmes.

**Table 2 Products available for use under protection in the UK for caterpillar control on bedding and pot plant crops**

Product	Active ingredient	Chemical group	Product type	IPM compatibility	Comments on use
Dipel DF	<i>Bacillus thuringiensis</i>	n/a	Bacterial insecticide	Yes	Good foliage cover required, apply every 7–10 days through the hatching period
<i>Trichogramma</i>	n/a	n/a	Egg parasite	Yes	Very limited experience on bedding plants. Most effective against moth/butterfly species that lay eggs in clusters. Apply 5–20 per m <sup>2</sup>
Dimilin Flo	Diflubenzuron	Benzoylurea	Insect growth regulator	Yes	Good foliage cover required. Contact and stomach acting. Apply every 5–7 days through hatching period
Nemolt	Teflubenzuron	Benzoylurea	Insect growth regulator	Yes	Good foliage cover required. Contact and stomach acting. Apply every 5–7 days through hatching period
Conserve	Spinosad	n/a	A naturally occurring soil fungi	Yes	Good foliage cover required. Contact and stomach acting
Steward	Indoxacarb	Oxadiazine	Synthetic insecticide	Yes	Good foliage cover required. Contact and stomach acting
Decis	Deltamethrin	Pyrethroid	Synthetic insecticide	No. Harmful to beneficial insects for several weeks	Good foliage cover required. Contact, residual and stomach acting
Toppel 10	Cypermethrin	Pyrethroid	Synthetic insecticide	No. Harmful to beneficial insects for several weeks	Good foliage cover required. Contact, residual and stomach acting
Gyro	Bifenthrin	Pyrethroid	Synthetic insecticide	No. Harmful to beneficial insects for several weeks	Good foliage cover required. Contact, residual and stomach acting

- The Long Term Arrangements for Extension of Use (LTAEU) allow extrapolation of use from a label approval or SOLA to use on an ornamental crop at grower's own risk. However, use must be in a similar manner and rate as that specified on the label or Specific Off-Label instructions; be cautious as some treatments may prove to be phytotoxic. Growers must hold a paper or

electronic copy of the SOLA before using any product under the SOLA arrangements.

- Always follow label recommendations, including rate of use, and check the range of ornamentals listed which can be safely treated.
- Contact the Pesticide Safety Directorate Information Service (01904 640500 or visit

[www.pesticides.gov.uk](http://www.pesticides.gov.uk)) or seek other professional advice if in doubt about which products are permissible on ornamentals or how to use them correctly.

- Important – Growers must always check the current approval status of products listed in this factsheet before intended use as this could have changed since it was produced.

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## Potential future pesticide products

*Runner* (methoxyfenozide) is a moulting accelerator compound approved for caterpillar control in apples and

pear production. The HDC project HNS 130 highlighted the efficacy of this product against tortrix caterpillars. It can be used under the Long Term Arrangements for Extension of Use on outdoor bedding and pot plants at grower's own risk.

However, before it can be used under protection, a Specific Off-Label Approval must be obtained.

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## Insecticide resistance

Always read the pesticide label before using an insecticide product and only

use the maximum number of sprays per season stipulated on the label. If possible, alternate between active ingredients to reduce the possible risk of pesticide resistance.

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## Further information

### Notifiable caterpillar species

If the presence of a notifiable caterpillar species is suspected the local Plant Health Inspector should be contacted, otherwise contact:

#### PHSI

Tel. (01904) 455174  
Fax. (01904) 455197  
planthealth.info@defra.gsi.gov.uk

### Useful staff training reference material and sources of further information

PHSI non-indigenous caterpillar pest posters and information sheets, available from the local PHSI officer or:

#### Defra Plant Health Division

Foss House, Kings Pool,  
York YO1 7PX  
Tel. (01904) 641000  
www.defra.phsi.gov.uk

HDC Diseases and Pests of Bedding Plants, available from:

#### HDC

Bradbourne House,  
East Malling, Kent ME19 6DZ  
Tel. (01732) 848383  
www.hdc.org.uk

CSL QWIK cards. Laminated cards with good illustrations of main caterpillar pests and their host plants.

Available from:

#### CSL

Sand Hutton,  
York YO41 1 LZ  
Tel. (01904) 462000  
www.csl.gov.uk

'Knowing and recognizing, the biology of glasshouse pests and their natural enemies'. M H Malais and W J Ravensberg. Published by Koppert BV, 2003. Covers all the major

glasshouse pests and gives details of biological control agents.  
ISBN 90 5439 126 X

A colour atlas of pests of ornamental trees, shrubs and flowers.'  
D A Alford. Published by Wolfe, 1991  
ISBN 0 7234 1643 5. An excellent book with colour plates of many common moth pests.

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### Suppliers of pheromone traps and trap systems

#### AgriSense-BCS Ltd

Unit 1, Taffs Mead Road, Treforest  
Industrial Estate, Pontypridd,  
South Wales CF37 5SU  
Tel. (01443) 841155

#### OECS Ltd

11a High Street, Kimpton,  
Hertfordshire SG4 8RA  
Tel. (01438) 832157

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## Acknowledgments

We are grateful to the following organisations for kindly supplying images for use in this factsheet:

ADAS: Figures 1,2,3,9,12,14 and 18.  
John Innes Institute: Figures 4, 5, 7 and 8.  
BCP: Figure 6. [www.insectimages.org](http://www.insectimages.org):  
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