



## Minor pests of Brassicas

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There are about 50 potential pests of Brassica crops (flies, beetles, aphids, bugs) but most of these rarely cause significant damage and the majority are generally considered to be ‘minor’ pests. However, certain circumstances can increase problems with these pests, temporarily or more permanently, and these can be due to weather, changes in growing practices or changes in pest susceptibility to insecticides applied. This factsheet covers four ‘minor’ pests of Brassica crops: cabbage stem weevil, leaf miner, pollen beetle and swede midge. The factsheet provides a summary of the biology and life cycle of each pest and provides information on resistance and the effect that climate change could have on populations. There are gaps in our knowledge about the biology and life cycles of all of these species. Some of the information available comes from studies overseas and it is possible that certain aspects of the life cycle may differ between certain parts of the world.

### Cabbage stem weevil

#### Introduction

The cabbage stem weevil (*Ceutorhynchus pallidactylus*) is a pest of winter and spring oilseed rape and horticultural Brassica crops (Figure 1).

#### Damage

Larval tunnelling within the petioles and later within the stems causes loss of plant vigour. Damage to the stems also facilitates infection by fungal diseases (Figure 2).



1. Cabbage stem weevil damage on Brassica petioles



2. Larvae tunnel into the petioles and stems causing loss of plant vigour and increase the chance of fungal disease infection



3. Cabbage stem weevil larvae emerging from a Brassica stem



4. Stem weevil adults lay eggs in May by boring holes in the petioles of the Brassica leaf

### Identification

<b>Adult</b>	3-4mm long and greyish-brown with brown-red legs. It has scattered white scales over its body and fine hairs on the elytra (outer pair of wings). A denser group of scales at the base of the elytra form a white rectangular spot.
<b>Egg</b>	Smooth, shiny and translucent, 0.7mm long and 0.6mm wide.
<b>Larva</b>	The larvae are white with brown head capsules, 'C' shaped, legless and up to 6mm long (Figure 3).
<b>Pupa</b>	Pupates in earthen cells – about 5mm long.

### Life cycle

The cabbage stem weevil has one generation per year and overwinters as an adult. Overwintering ends when soil temperatures reach 8-9°C. Adults emerge from their overwintering sites in April in the south of the UK and can be caught in traps until the end of June. After arrival in the crop, there is a period of time before egg laying can begin. This period is determined largely by daily temperatures. Most eggs are laid in May and the female bores a hole in the base of a petiole of a Brassica leaf to lay several eggs at a time (Figure 4). Eggs hatch after six to eleven days. The larvae tunnel upwards and downwards into the midrib of the leaf and, as they get bigger, move to the main stem and the growing point. The larvae feed for three to six weeks and when fully-grown they bore their way out of the stems and drop down into the soil to pupate. New generation adults emerge after about three weeks, from mid-July onwards, and feed on cruciferous plants, grazing on the undersides of leaf petioles and veins before overwintering. They overwinter outside the crop under plants and plant debris.

### Monitoring and forecasting

Adult cabbage stem weevils can be captured in yellow water traps or on yellow sticky traps. There is a computer-based decision support system called proPlant which incorporates weather-based models for the six major pests of oilseed rape in Europe including the cabbage stem weevil. The models have now been validated for several European countries. The system predicts the start and course of pest infestation and provides site-specific crop protection treatment decisions, a selection of suitable chemicals, computes optimum dates and rates for application and evaluates the efficacy of past applications.

### Climate change effect on population

The cabbage stem weevil has a wide geographical distribution and has been found in Europe, Africa, Asia and the USA. A study in Luxembourg suggested that climate change will lead to earlier emergence of adults in the spring with a possible prolongation of both emergence times and the main migration period to Brassica crops. Under future climate conditions, emergence of cabbage stem weevil was predicted to occur about three days earlier per decade and the main migration period of the weevil to Brassica crops about two days earlier per decade. From the limited information available, it appears that the weevil has only one generation per year wherever it occurs and so it seems unlikely that, in the UK, another generation would occur as a result of climate change. It is not clear which factors are the main regulators of abundance (eg weather conditions or natural enemies), so it is impossible to say whether overall abundance will increase as a result of climate change.

### Resistance

In a German study in 2005, one out of eight samples of *C. pallidactylus* showed a lower level of sensitivity to pyrethroid insecticides. There is no evidence of insecticide resistance in this species in the UK.

# Swede midge

## Introduction

The larva of the swede midge (*Contarinia nasturtii*) is a sporadic pest in the UK, but has become a much more important pest in North America over the last ten years or so.

## Damage

The swede midge attacks many Brassicas and leads to swollen flowers, scarring in the growing point, on leaf petioles and flower stalks. It also causes blindness and crinkled leaves (Figure 5). It often kills the main shoot so that the side shoots grow out causing a many-necked plant.



5. Swede midge causes damage by scarring at the growing point



6. Swede midge adults are difficult to distinguish from other closely related species

## Identification

<b>Adult</b>	Tiny, greenish-yellow to light-brown fly (1.5-2mm) which is difficult to distinguish from many other closely-related midge species (Figure 6). Very hairy wings.
<b>Egg</b>	Very small (0.3mm), transparent then turns creamy white as develops.
<b>Larva</b>	Small maggots, initially 0.3mm in size before reaching final size of 3-4mm. Larvae are initially translucent become increasingly yellow until lemon-yellow at maturity.
<b>Pupa</b>	Forms cocoons in the soil, pupa is about 1.3mm long.

## Life cycle

There are usually three generations in a year. The larvae of the third generation overwinter in the soil. These pupate in the spring and then adults emerge. It is suggested that not all swede midges that overwinter become adults in the first year and that some do not emerge until the following year. Each female lays 60-120 eggs in batches of 15-20 on the younger parts of the plant, particularly the terminal bud. The eggs hatch in three to nine days and the larvae feed chiefly on the growing point but can live on almost any part of the plant within an almost liquid environment. When fully grown (after one to three+ weeks) the larvae move to the ground, form cocoons in the soil and pupate. After one to three weeks depending on the temperature the pupa works itself out of the cocoon and moves to the soil surface where the adult emerges. During periods of drought, the larvae may enter a period of dormancy, but development resumes after rainfall. Under drought conditions mature larvae make cocoons deeper than usual in the soil and, after the drought, they return to the soil surface, only to re-enter the soil and make new cocoons in which to pupate.

## Monitoring and forecasting

Pheromone traps are available. The swede midge pheromone is a sex pheromone that attracts male midges. However, the midges are small and knowledge of insect identification and a microscope are required to separate the male swede midges from other species of fly that accidentally enter the traps.

The Contapré model is a day-degree-based model developed in Europe for predicting emergence of adult swede midge. The average daily soil temperature at a soil depth of 5cm and a lower threshold value of 7.2°C for development are used to determine when adults will be flying. The model was tested under irrigated field conditions in Germany and was shown to be accurate within 2-3 days. However, this model did not work in Canada, where the midge is becoming a serious pest and an alternative forecasting system has been developed. Possible reasons for the discrepancy are that there is more than one emergence type, so that adults come out at different times and also that midge development may be delayed in dry conditions.

## Climate change effect on population

The swede midge occurs mainly in northern Europe and North America. Canadian studies indicated that the midges may be able to complete a further generation in response to climate change. Soil moisture is one of the most important driving variables in determining the potential distribution of swede midge. It is a key factor in determining when adults emerge after hibernation. Thus, rainfall patterns may also determine the distribution and timing of infestations. It is not clear which factors are the main regulators of abundance (eg weather conditions or natural enemies), so it is impossible to say whether overall abundance will increase as a result of climate change.

## Resistance

There is no evidence of insecticide resistance in UK populations, although it is believed that there is a risk of resistance developing in Canada where swede midge is becoming a serious pest.

# Leaf miner

## Introduction

Although the leaf miner (*Scaptomyza flava*) is a native species of fly, it was not regarded as a pest of economic importance until recently.

## Damage

Crop damage is caused by adult females, which puncture the leaf surface to lay eggs, and by the larvae, which produce the characteristic white 'corridor-blotch' mines when feeding between the upper and lower surfaces of the leaf (Figure 7). In smaller leaves the mine lies in the centre of the leaf and often touches the petiole, while in larger leaves the mine is to one side of the mid-rib. Green clumps of waste material are usually deposited near the margin of the mine. Several other species of leaf miner are known to attack cruciferous crops grown in Britain.



7. The characteristic white 'corridor-blotch' mines caused by leaf miner



8. Adult leaf miners are distinguishable by their pale appearance, faint stripes on their thorax and red eyes



9. Leaf miner larva

## Identification

<b>Adult</b>	Pale brown in colour with faint stripes on the thorax and red eyes (Figure 8). The wings are about 50% longer than the head and thorax combined. About 3mm long, wing span 6mm.
<b>Egg</b>	0.3-0.45mm long and 0.15mm wide, laid singly but quite close to one another.
<b>Larva</b>	Cylindrical larva – becomes greenish in colour 0.4-5.5mm long (Figure 9).
<b>Pupa</b>	Brown pupa – 3mm – generally in the soil.

## Life cycle

There is no definitive information on the number of generations completed by this species in the UK and it is not clear which stage overwinters, although it is likely to be the pupal stage. In New Zealand, it appears that the fly 'breeds all year' but, under dry conditions, pupae may remain inactive for up to 300 days. In the UK, adults are active between April and September with probably three or four generations. A full life cycle takes 21 days at 22°C (USA) or 28 days at 18°C (New Zealand), which might translate to 35-40 days at a mean temperature of 15°C. Adults are generally most abundant in September, though sticky trapping showed that local peaks of activity could occur in July or August. Mated females lay eggs in punctures made within the lower surface of the leaf and can lay more than 300 eggs. In the UK, mines have typically been seen between July and October. The hatching larva initially moves toward the mid-rib, creating a long corridor. Once at the mid-rib, the larva forms a large irregular blotch in the upper leaf surface with occasional excursions into the leaf blade. Several larvae may be present in the same mine and if the leaf is small the entire leaf may be occupied. Larvae usually drop to the ground to pupate before winter frosts but sometimes a separate pupation mine is used.

## Monitoring and forecasting

Yellow water traps or white sticky traps can be used to monitor adults. No forecasting systems have been developed.

## Climate change effect on population

This species is widespread in continental Europe and has become a pest in New Zealand in recent years. There is no information that can be used to predict the impact of climate change on the number of life cycles and timing of activity. It is not clear which factors are the main regulators of abundance (eg weather conditions or natural enemies), so it is impossible to say whether overall abundance will increase as a result of climate change.

## Resistance

A study by ADAS (FV 376) suggested that leaf miner has recently become a more important pest

of cruciferous crops because populations have developed resistance to pyrethroid insecticides. However it may be that this species was never susceptible to pyrethroid insecticides.

# Pollen beetle

## Introduction

Pollen beetles (*Meligethes* spp.) are also called 'blossom beetles'. The two most damaging species are *Meligethes aeneus* and *Meligethes viridescens*. They can be damaging pests of horticultural Brassicas and oilseed rape, although they do not always cause problems, and are also a nuisance to gardeners when they feed on flowers such as sweet pea.

## Damage

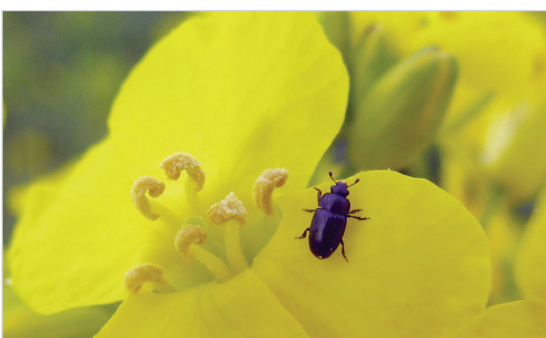
Adult beetles graze on cauliflower curds and broccoli heads (Figure 10). This usually occurs in mid-summer when the new generation of adults emerges (see life cycle). This type of damage occurs very sporadically. Proximity to crops of oilseed rape increases the risk.



10. Pollen beetles damage caused by feeding on cauliflower curds



11. A close up view of adult pollen beetles



12. Pollen beetles lay their eggs in the flower buds of host crops

## Identification

<b>Adult</b>	'Metallic', greenish-black beetles 1.5-2mm long with short legs and distinct clubbed antennae (Figure 11)
<b>Egg</b>	White, about 0.8mm long
<b>Larva</b>	Larvae are creamy-white with a distinct brown/black head capsule and three pairs of legs. Final instar larvae are more than 4mm long
<b>Pupa</b>	Ovate, yellow-white in colour and about 2mm long

## Life cycle

Adults overwinter in the soil or leaf litter in sheltered locations such as beneath hedgerows. The adults become active when temperatures rise above about 9°C, usually in late March to early April and can often be seen feeding on dandelion flowers. They do not fly to Brassica crops until about a month later when mean daily temperatures have risen above 15°C. When they reach a suitable host (oilseed rape is the most abundant host) they feed on buds and flowers and the females chew holes in the bases of unopened flower buds and lay one to three eggs in each hole (Figure 12). These hatch in four to ten days. The larvae feed on the pollen grains in the anthers and then move to fresh buds or flowers. After 25-30 days the third instar larvae descend to the soil to pupate in earthen cells. Young beetles emerge two to three weeks later. Most beetles leave the crop to feed on other hosts and it is at this point that they can graze on cauliflower curds and broccoli spears. They move to overwintering sites when the day-length shortens.

## Trapping

Pollen beetles are very attracted to yellow surfaces and so can be captured quite readily on yellow sticky traps. A severe infestation is very obvious simply through examination of the crop.

A pollen beetle forecast, which uses soil and air temperatures, was developed with HDC funding (FV 44) and can be used to predict when adult pollen beetles emerge in mid-summer and feed on a range of host plants including horticultural Brassicas. A computer-based decision support system called proPlant incorporates weather-based models for the six major pests of oilseed rape in Europe including pollen beetle. The models have now been validated for several European countries and are now available in the UK through Bayer Crop Science. The system predicts the start and course of pest infestation and provides site-specific crop protection treatment decisions, a selection

of suitable chemicals, computes optimum dates and rates for application and evaluates the efficacy of past applications.

### Climate change effect on population

The rate at which pollen beetles complete their life cycle is temperature-dependent. They will emerge from overwintering sites and infest crops earlier following a warm spring. Dispersal is greatest when the weather is warm and humid. It is not clear which factors are the main regulators of abundance (eg weather conditions or natural enemies), so it is impossible to say whether overall abundance will increase as a result of climate change. It is unlikely that pollen beetles will complete more than one generation per year, even if temperatures rise by several degrees.

## Overall conclusion

The occurrence of 'minor' pests, and particularly, the established resistance in pollen beetles and the potential for other insects to develop resistance to insecticides emphasises the importance of considering all potential pests of Brassica crops within an Integrated Pest Management (IPM) strategy, since the application of an insecticide to control one species of pest insect is likely to have an impact on others.

## Further information

### Leaf miners

**10/11 Leaf miners cruciferous salad crops** - Provides further information on the biology and control of leaf miners in baby leaf salad crops.

**HDC Project FV 376** - Baby-leaf Cruciferae: leaf miner identification, biology and control.

### Other publications

HGCA Oilseed rape guide: Summer 2012 (G55) ([www.hgca.com](http://www.hgca.com))

Beneficials on farmland: Identification and management guidelines (G42) ([www.hgca.com/pests](http://www.hgca.com/pests))

### Resistance

In many parts of Europe, pollen beetles have become resistant to pyrethroid insecticides. In 2006, pyrethroid-resistant pollen beetles were found in the Kent, they have since been found in southern and eastern England, and are now being found in the west and north, including Scotland. The situation is dynamic and further information can be found from the UK Insecticide Resistance Action Group (IRAG) website and HGCA Information Sheet 13 'Controlling pollen beetle and combating insecticide resistance in oilseed rape'.

Whilst the occurrence of insecticide resistance may be one reason why certain 'minor' pests become more prevalent, it is also possible that these pests become more abundant because the insecticides used to control other pests on the crop have an adverse impact on natural enemies, such as parasitoids.

### Pollen beetle

**HDC Pest Bulletin** – found on the Syngenta website ([www.syngenta-crop.co.uk/pestupdate](http://www.syngenta-crop.co.uk/pestupdate)) and provides updates of pollen beetle forecasts over the summer months as the season progresses.

**HDC Project FV 44** – Horticultural brassicas: forecasting and control of pollen beetle.

**HGCA Information Sheet 13/Spring 2012** – Controlling pollen beetle and combating insecticide resistance in oilseed rape ([www.hgca.com/pests](http://www.hgca.com/pests)).

**Insecticide resistance action group** (<http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/Resistance-Action-Groups/irag>).

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