



# A GUIDE TO GARDENING WITHOUT PESTICIDES





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# Introduction

In order to assist home gardeners in moving away from the use of potentially harmful pesticides, PAN UK has compiled this guide to dealing with some of the most commonly found garden pests. More and more people are moving towards a more organic approach in growing flowers and food crops. We hope that this guide will assist both those that are already growing without pesticides and those that wish to explore the possibilities.

We would be delighted to hear from you if you feel there is something missing from this guide, or if you know of a technique for dealing with one of the pests mentioned that has not been already covered.

The focus of this particular guide is on insect pests and diseases that can be problematic for growers in the UK. There will be further publications looking at general techniques, including weed control, and also on problem pests such as mice, mosquitoes and fleas.

The list is presented in alphabetical order for convenience. None of the recommendations for products or alternative measures implies the endorsement of PAN UK.

## General Points

Healthy growing works on the principle of prevention, rather than cure. Always maintain a healthy, active soil with plenty of nutrients, using compost and manures. Crop rotation helps to prevent diseases from building up in the soil so vary where you plant your vegetables year after year. Growing flowers with vegetables attracts beneficial wildlife, such as caterpillar-eating birds and aphid-eating insects. Using toxic chemicals kills not only the pest, but creates health hazards for the beneficial wildlife that play a part in controlling the pests in your garden. Choose plants and varieties that are suited to the site and soil as they will have a better chance of being strong enough to fight off pests and diseases. Finally, be vigilant, keep out pests, such as slugs, caterpillars and pigeons, by constantly checking your barriers, traps and covers. Especially after rain or in damp conditions.



# Aphids

Aphids are small, usually 2-5 mm long, pear-shaped, soft-bodied insects and are one of our most common garden pests. They are commonly known as greenfly or blackfly, but there are actually many different species which come in many different colours, e.g. green, black, yellow or white. They are slow-moving with two specialised cornicles projecting from their rear. They come in both winged and wingless forms. The winged form can fly weakly but may travel long distances on wind currents.

Aphids have sharp mouthparts which pierce plant tissue allowing them to feed off plant sap. They subsequently secrete a sugary honeydew over leaves. Some aphids can feed off several different plant species while others are limited to only one. They may attack all parts of the plant but the tender new growth is much more vulnerable. Aphids have many generations each year and life cycles are very complex. They generally overwinter as eggs but in mild winters adults may survive. When temperatures increase in the spring adults give birth to live young which are all female allowing populations to multiply rapidly. When lots of aphids are present on a plant the winged form may be produced which can then fly to new plants. Aphids are often 'farmed' by ants for their honeydew and ants may move them to previously unaffected parts of the plant.

Although aphid infestations may not damage plants, in large numbers they cause serious problems. They may reduce the overall vigour of a plant. Sooty moulds can grow on the honeydew and, although these do not directly harm the plant, they block sunlight from reaching the leaves. Also, the saliva of some aphids may be toxic and can cause distortion or discoloration of leaves. Most significantly some aphids may transmit viruses to plants, such as cucumber mosaic virus.



Here are some ideas for ways to reduce an aphid attack.

- ◆ Avoid synthetic fertilisers. These supply too much nitrogen to the plant, allowing lush soft growth which is more susceptible to attack.
- ◆ Encourage insects, birds and bats which eat aphids.
- ◆ Cover plants with horticultural fleece to keep aphids off.
- ◆ Remove aphids mechanically using a strong stream of water.
- ◆ Spray a dilute solution of fatty acids or soft soap on affected leaves and rub the aphids off with your fingers. This will probably have to be repeated once or twice a week but as the plants age their tissue becomes tougher and less vulnerable to attack.
- ◆ Smear bands of grease around trees or plants to prevent ants from moving aphids around (fruit tree grease can be purchased online).
- ◆ Plant species naturally resistant to the viral diseases transmitted by aphids.
- ◆ Prune affected parts of plants.
- ◆ Plant a trap crop such as nasturtiums. Blackfly love nasturtiums which can be pulled out when they are infested.
- ◆ Use an oil-based spray on trees in the winter to smother overwintering eggs.

# Apple Scab

The fungus *Venturia inaequalis* affects both fruit and leaves of apples causing scab. Initially, fungal spores cause dark velvety green patches on the leaves. The fungus eventually dies leaving brown patches of tissue. On fruit the fungus causes scarred scabby lesions that do not expand at the same rate as healthy tissue during ripening. This can cause misshapen and cracked fruit. Rots such as brown rot or *Penicillium* can enter through these cracks. If infection occurs close to harvest it may only be apparent as dark sunken spots appear on the fruit in storage.

The fungus spreads by rain splash and wind within different parts of a tree or between neighbouring trees. The fungus overwinters in fallen leaves, releasing spores the following spring. The disease spreads most rapidly when there are frequent showers in spring and early summer. Spore discharge and infection occur under precise conditions of temperature and humidity known as 'Mills periods'.

Affected fruit are still edible although generally unmarketable for commercial growers. Damage to foliage causes leaf fall which reduces tree vigour and cropping in future years.

Some steps can be taken to reduce the incidence of scab.

- ◆ Clear up and destroy or compost fallen leaves.
- ◆ Prune trees to maintain an open centre which increases air circulation.
- ◆ Choose apple cultivar with some resistance to scab, such as Discovery, Ellison's Orange, King of the Pippins.
- ◆ Avoid particularly susceptible cultivars, such as Cox's Orange Pippin.
- ◆ Avoid planting trees in damp sites with poor drainage.

A related fungus *Venturia pirina* causes scab in pears. It can be dealt with in the same way as apple scab.



# Asparagus Beetle

Asparagus beetles, *Crioceris asparagi*, eat both the leaves and bark of asparagus plants. If the damage to the bark extends all the way around the stem the plant will dry up and turn brown above the damaged area. Adult asparagus beetles are 6-8 mm long and are black/blue with six yellow spots on their wing cases. The adults can survive over winter, emerging from the soil in May and June to lay black eggs on asparagus spears and foliage. Eggs are laid singly or in groups of three to eight. They hatch into grey larvae which have three sets of legs towards the head end. The larvae can grow to 10 mm in length and after about 15 days migrate down to the soil to pupate.

Both the larvae and adult insects do damage to asparagus plants. The principal damage is due to the loss of leaves which reduces the plants ability to photosynthesise. There are two generations between May and September.

To reduce the chance of an infestation

- ◆ Burn old stems at the end of the year to destroy any overwintering beetles.
- ◆ Pick insects and larvae off asparagus plants from late spring onwards.



# Blight - tomato and potato

Tomato and potato blight are both caused by the fungus *Phytophthora infestans*. Spores of the fungus survive over winter on infected potato or tomato plants from the previous season. They then spread with wind and rain and can germinate when humidity remains above 89% for 11 hours and temperatures above 10°C for 48 hours.

Symptoms may first appear in early summer as brown/black spots on leaves which spread to other parts of the plant. Spores falling on the soil from potato plants will infect tubers. The tubers then turn brown and often rot. Tomato plants have similar symptoms and the fruit will turn black. The disease is very serious and can lead to total loss of both potatoes and tomatoes.

To reduce the likelihood of infection

- ◆ Potatoes - many potato varieties show some blight resistance, e.g. Remarka, Verity, White Lady, Arran Victory, Spunta and Stirling Tomatoes - Ferline F1 shows moderate blight resistance although will succumb eventually during a heavy infestation.
- ◆ Good hygiene - don't leave tomato plants/potato tubers in the ground from the previous year. Remove infected plant material immediately (bag it or burn if off site, only compost if you're sure your compost heap gets very hot).
- ◆ Consider your planting times. The earlier you plant your early potato varieties the less likely they will be infected by blight from a neighbouring crop.
- ◆ Grow tomatoes in a greenhouse (they will get blight much less frequently).
- ◆ Water the soil, not the foliage – especially when growing in a greenhouse.







# Blossom End Rot

This disease most commonly affects tomatoes although it may also affect peppers. A sunken patch develops on the blossom end (away from the stem) of developing fruit. This patch becomes tough and then darkens as the cells inside collapse. This condition does not necessarily affect all fruit on a truss, or all trusses on a stem. Blossom end rot is a disease caused by physiological problems arising from a deficiency in calcium. Calcium is a macronutrient required in relatively large amounts for normal cell growth. Insufficient calcium during growth will cause cells to collapse.

Calcium deficiency can arise for different reasons. Commonly it is due to inconsistent watering. Dry conditions around the plant roots prevent the plant taking up calcium and when this is followed by excessive watering blossom end rot often follows. Another cause of blossom end rot is a lack of available calcium in the soil. This may be due to a low ratio of calcium relative to some other competing nutrients such as potassium or nitrogen. Blossom end rot is more likely to develop in acidic soil conditions.

Although blossom end rot is not caused by an infectious organism microorganisms may subsequently grow in the rotting part of the fruit.

Blossom end rot can effectively be prevented by taking a few relatively easy precautions

- ◆ Ensure tomato plants are watered consistently and regularly.
- ◆ Mulch soils to prevent water loss and encourage more consistent moisture levels.
- ◆ If your soil is acidic add lime to increase the pH to around 6.5 - 7.0.
- ◆ Grow varieties which produce small tomatoes as these are less affected.





It affects many varieties of fruit and vegetables and usually attacks through wounds, weakened tissue, or damaged areas. It mainly causes blossom blights and fruit rots but can also affect other parts of a plant, causing stem cankers and rots, bud rot, leaf spots or blights, bulb rots and tuber or root rots. Botrytis is also one of several fungi which can cause damping off, a disease of seedlings, whereby the bases of their stems darken and thin just above the soil causing them to fall over.

Although botrytis is common in the soil, infection can be prevented by good management techniques:

- ◆ Remove dead and injured parts of plants before they can become infected.
- ◆ Don't leave plant debris lying around - compost it immediately.
- ◆ Carry out regular inspections in the greenhouse, removing infected plant parts immediately and cutting back to healthy growth. Such inspections should not be carried out while plants are wet as this would favour further spread of the disease.
- ◆ Burn infected plant parts or remove them from the site, carefully washing hands or tools that have come into contact with the infected plant material.
- ◆ Don't overwater greenhouse plants, particularly seedlings.
- ◆ Avoid overhead watering, rather water around the base of plants.
- ◆ Allow plenty of space between plants and seedlings to promote rapid drying of plants.
- ◆ Use dry straw under strawberry plants to prevent damp and botrytis spread.

# Botrytis

Botrytis (or grey mould) appears as a fungal growth on affected plants. Symptoms include a brown-grey discolouration, and a fuzzy grey mould. Although it can be caused by several species the most frequent is *Botrytis cinerea*. *Botrytis cinerea* is extremely common and can survive on most living and dead plant material. Its spores are almost always present in the air.

Growth of the mould is favoured by cool moist conditions with little or no wind. Cool, damp, poorly ventilated greenhouses are ideal. It is common in cool spring and autumn weather when greenhouse vents are closed at night to retain heat. Outdoors it can occur after extended periods of overcast weather, fogs, light drizzle or heavy dews. The spores or conidia of the fungus can spread in the air or through rainsplash.

# Box Tree Caterpillars

In recent years there has been an upsurge in populations of the box tree caterpillar, *Cydalima perspectalis*. It was first found in the UK in 2008 and has since developed into a real problem causing serious damage to species of box tree, including those found in garden squares.

There are a number of ways to deal with infestations and the key is prevention rather than cure. Spraying with an insecticide would be considered a 'cure' and can only happen once there is already an infestation. Insecticides can be extremely harmful to non-target organisms such as bees and butterflies and should only be used, if at all, as a very last resort to deal with an infestation if other measures have proven ineffective.

PAN UK recommends the use of pheromone traps that can work both as an early warning system for the presence of box tree caterpillars and as an effective preventative measure. If you start to discover moths of the species in the trap you then know to look for infestations. Routine inspections for eggs and other evidence and then removing affected areas of vegetation will help to keep infestations under control.

The use of nematodes can also provide an effective form of defence against box tree caterpillars. Nematodes are a type of worm that will attack and kill caterpillars and help to keep populations in check. Both pheromone traps and nematodes are available to purchase from numerous outlets in the UK.





photo by Mark Willis

# Cabbage Root Fly

The cabbage root fly, *Delia radicum*, is found all over Europe. They are 0.5-1cm long, grey, and resemble common houseflies. As the weather warms up in spring the flies hatch from over-wintering pupae in the soil. The flies feed on nectar and lay small white eggs (1mm in diameter) near the surface of soil next to brassica plants. After about 6 days, eggs hatch producing white maggots which eat the finer roots of brassica plants and which may tunnel into their main stem. Larvae feed for about 3 weeks and when fully fed may be around 0.9-1cm in length. Fully-grown larvae form reddish brown pupae in the soil. These hatch into the adult flies after another 20 days. Around three generations of eggs may be laid each year between mid-spring and early autumn. The generations overlap, resulting in the continuous presence of flies.



The larvae of the cabbage root fly attack cauliflowers, broccoli, Brussel sprouts, spring and autumn cabbage, savoy cabbage and kale. They may also burrow into radish, swede and turnip. Affected plants tend to grow more slowly and may wilt on sunny days. Adult plants survive attack quite well but young transplants are vulnerable and may be killed.

To prevent attack by cabbage root flies

- Place squares of cardboard, roofing felt, or carpet around the stems of newly transplanted brassica seedlings. Make a cut from the edge of the square (10cm diameter) into the centre. Then place the square around the transplant so that the soil around the young brassica plant is covered. Flies lay eggs on the squares instead of the soil. Exposed eggs dry up and die.
- Completely cover beds with horticultural fleece to prevent the flies laying eggs near plants.
- Encourage populations of predatory beetles as these eat cabbage root fly larvae.

# Cabbage White Butterfly

The juvenile caterpillar stage of the cabbage white butterfly affects all varieties of brassicas, not just cabbages. They eat the leaves, causing holes which increase in size as the leaves grow. The caterpillars are very common and are often found along with their excrement on home-grown or allotment grown brassicas.

Two different species of cabbage white butterfly exist, the large cabbage white, *Pieris brassicae*, and the small cabbage white, *Pieris rapae*. They overwinter as pupae with adult butterflies emerging to mate in spring. Male butterflies have a single dark spot on their midwing while females have two spots.

The females lay yellowish eggs on the undersides of plants of the crucifer (mustard) family, particularly favouring cabbage and broccoli. Some other plants such as nasturtiums are also affected.

The eggs hatch into caterpillars which tend to stay on the undersides of leaves. Caterpillars of the large cabbage white are yellow with black markings. Their bodies are hairy and grow up to 40mm long, feeding mainly on the outer leaves of brassicas.

Caterpillars of the small cabbage white are pale green and grow up to 25mm long, preferring to eat the inner leaves. Both species have two generations each year with caterpillars occurring from spring to early autumn. The caterpillars pupate on the host plant or on nearby fences, walls etc.

The most effective ways to reduce damage from cabbage whites is to:

- ◆ Regularly monitor the undersides of brassica plant leaves, picking off and crushing eggs and young caterpillars.
- ◆ Cover brassica beds with horticultural fleece as soon as seedlings are planted out. Ensure there are no gaps, even at ground level.



# Carrot Root Fly

When planting carrots it is worth taking steps to protect them from their main pest, the carrot root fly, *Psila rosae*. These small black flies, approximately 8mm in length, lay eggs in the soil near carrots. About a week later, larvae emerge and begin feeding. First symptoms are a reddening of the carrot leaves which begin to wilt. If you lift the root you will see tunnels eaten by the creamy coloured larvae which are about 1cm in length.

There are usually two generations of flies, with eggs first laid by over-wintering adults in April/May and a second generation laid in July/August. Carrots growing in the ground at these times are vulnerable to attack and more damage is caused by the second generation.

Preventing damage from carrot root fly

- ♦ Cover the crop with a barrier to prevent the flies from laying eggs near the carrots. Fleece works well but remember to bury the edges of the fleece to prevent the flies from getting in. Mulching the ground with a layer of grass clippings will also make it more difficult for the flies to lay eggs.
- ♦ The carrot root fly stays low in flight so surrounding the carrot bed with a barrier of polythene, extending at least 60cm in height, can deter them.

- ♦ It is thought that carrot root flies detect carrots by their smell which is particularly strong during thinning. Various strategies may minimise this smell:

- » Plant at least four rows of onions or garlic between each row of carrots (rosemary, sage or wormwood may also work).
- » Sow sparsely to avoid having to thin seedlings.
- » Dust with calcified seaweed to disguise the smell.
- » Remove thinnings and other waste from the area.

- ♦ Time plantings so that roots are not in the ground during egg laying periods.

- ♦ Sow a resistant variety. 'Carrot F1 Fly Away' and 'T&M Fly Away' have resistance to larval attack. 'Sytan' is also less susceptible to larval attack. Ibiza and Parano are other resistant varieties.

- ♦ Avoid particularly susceptible varieties such as 'Autumn King'.

- ♦ Carrot root flies are not strong fliers so planting in an exposed, windy site can also prevent their attack.

This troublesome pest can affect related crops (in the *Apiaceae* family) such as parsnips, celery, celeriac, parsley, coriander.



# Damping Off

Damping off is probably the most significant disease to affect young seedlings and can be caused by a number of fungi, most typically *Rhizoctonia solani* and various species of *Pythium* and *Phytophthora*. These fungi feed off the cells of dying seedlings, growing through the infected tissue and killing the plant in the process. The most characteristic sign of damping off is that seedlings fall over. You may also notice the base of stems becoming thin and brown, with a white fluffy fungus developing. However, the fungi can also attack seedlings below the ground accounting for poor stands in many crops. In these cases damping off may be mistaken as poor seed viability.

The fungi responsible for damping off are common in soils. They are stimulated to grow and infect seedlings by the nutrients they release. The fungi like cool, damp conditions and seedlings that are over-crowded or over-watered are most at risk. A wide range of vegetable and ornamental species are affected.

If seedlings are affected there is no way to rescue them. Affected plants and compost should be discarded carefully by burning, binning or burying on spare ground. If only a few seedlings are affected from a tray you may be able to rescue the remainder by removing those affected. Any tools that have come into contact with the infected material should be washed thoroughly in hot water.

Good garden hygiene can prevent damping off.

- ◆ Ensure potting compost used for sowing seeds is disease-free. Commercial compost/soil mixes are sterilised. There is a risk that home-made compost/soil mixes will carry spores of fungus. Soil can be sterilised in an oven at 120°C for 15 minutes.
- ◆ Ensure that potting mixture is free draining to avoid waterlogging. Drainage can be improved by mixing with horticultural grit or perlite.
- ◆ Sow seeds thinly and ensure the area is ventilated.
- ◆ Never over-water seedlings. Water thoroughly, allowing the soil to dry out in between.

- ◆ Wash all seed trays in hot water and dry immediately after use. Exposing them to the sun on a hot day will help to sterilise them.
- ◆ Do not plant seedlings into cold, damp soils. Wait until the soil has warmed up.
- ◆ If possible, adhere to a strict crop rotation and avoid planting the same crop in the same place in consecutive years.

Damping off fungi may cause root rots in older plants. However, the fungi are less able to grow through older tissue. They rarely kill older plants but can affect productivity.



# Downy Mildew

This is a fungal disease that causes yellow or discoloured areas on upper leaf surfaces. Each of these areas corresponds to a slightly fuzzy, greyish-white or purplish growth on the underside of leaves. It may spread to affect entire leaves. Younger plants are more sensitive and seedlings may be killed. It is often confused with powdery mildew which is distinct as it tends to cause a more powdery growth on the tops of leaves.

Downy mildew is caused by a range of related species of fungus. Most will only affect one particular plant species and will not spread to others. However, one or two downy mildew species affect whole plant families and, unfortunately for allotment gardeners, one of these, *Peronospora parasitica*, affects brassicas and related plants and weeds such as wallflower, stock, and shepherd's purse. Other species significant for allotment gardeners are *Peronospora destructor* (on onions), *Peronospora farinosa* f. sp. *spinaceae* (on spinach), *Peronospora viciae* (on pea), *Bremia lactuca* (on lettuce), and *Plasmopara viticola* (on grape).

Downy mildew likes mild, damp weather and humid conditions, and so, crops grown in greenhouses or in other protected areas are particularly vulnerable. Spores can spread on air currents or water splash.

They germinate on wet leaf surfaces penetrating the leaf's cells. They will only grow on living tissue but thick-walled resting spores can be produced inside the plant and may survive in dead leaf debris.

Spread of downy mildew can be limited by:

- ◆ Removing infected leaves immediately.
- ◆ Improving air circulation around the plant by increasing plant spacing and good weed control.
- ◆ Increasing ventilation in greenhouses.
- ◆ Avoiding overhead watering.
- ◆ Growing resistant lettuce varieties, such as Avoncrisp, Avondefiance, Beatrice, Court, Debby, Lakeland, Musette, Plenty, Saladin.
- ◆ Removing all debris at the end of the season.







# Flea Beetles

These are small, 2-3 mm in length, dark shiny beetles which jump like fleas and are sometimes striped. They are members of the *Chrysomelidae* family and are pests of Brassica crops, such as cabbages, kale, radish, and mustard. The adults overwinter in long grass or plant debris and lay eggs in the soil near vulnerable plants in May/June. The larvae often eat leaves and, after hatching, the adult eats leaves too giving them a characteristic lacy appearance. Flea beetles are most active in dry weather.

They can be quite damaging to young seedlings but cause mainly cosmetic damage to older plants.

To prevent or reduce damage from flea beetles:

- ◆ Encourage rapid growth by making sure young seedlings are healthy when planted out and are grown in fertile soil.
- ◆ Young seedlings are most vulnerable when stressed for water so water regularly until the seedlings are well established.
- ◆ Cover seedlings with horticultural fleece immediately after planting. Some suggest stretching old tights over cabbages.
- ◆ Yellow sticky traps will catch a lot of jumping beetles.
- ◆ Diatomaceous earth can be sprinkled around sensitive plants to reduce the population of flea beetles.
- ◆ Radishes are apparently the crop of choice for the discerning flea beetle so one or two rows can be planted as a trap crop to distract the beetles from more precious crops.
- ◆ Removing, or incorporating, crop debris over winter can reduce places for adults to hibernate, reducing next year's population.

# Gooseberry Sawfly (iris, apple, rose)

The larvae of the gooseberry sawfly are one of the most serious pests of gooseberries. They are pale green and caterpillar-like, are up to 25 mm long and most have dark spots and dark heads. They eat their way through gooseberry leaves and can rapidly defoliate an entire bush by the time the berries ripen. Red and white currant bushes are also affected. The larvae do not eat berries; however, damage from sawfly in one year can weaken the plant and reduce the gooseberry harvest in the following year.

Three species cause damage. The common gooseberry sawfly *Nematus ribesii* is the most frequent offender, but the lesser gooseberry sawfly *Nematus leucotrochus*, and the pale gooseberry sawfly *Pristiphora pallipes* can also cause damage. The sawfly overwinter as cocoons in the soil. In April they hatch into adult flies that lay their eggs on the undersides of leaves in a characteristic pattern along the leaf veins. The pale green/white eggs are about 1 mm in diameter and are laid on leaves low down in the centre of the bush so eggs and larvae are initially not easy to spot.

After hatching the larvae eat their way upwards and outwards. Damage is initially seen as small holes in leaves which expand until the whole leaf has been eaten. After feeding for about three weeks the larvae drop into the soil and form cocoons. There may be three generations a year, with the larvae active in May to June, July, and then again from August to September. The cocoons either hatch into adult flies or remain as cocoons in the soil over winter, hatching the following spring.

To prevent gooseberry sawfly damage:

- ◆ Inspect gooseberry and currant bushes regularly from mid-Spring onwards, picking off and squashing any larvae, eggs, and badly infested leaves.
- ◆ Clear debris from around the base of gooseberry bushes in the autumn. Exposing cocoons will help birds find and eat them.

If sawfly is a regular problem it may be easier to grow gooseberries as cordons to make regular inspections easier.





# Leatherjackets

Leatherjackets are a common pest that affects lawns; there are over 300 species of leather jacket in the UK. They are the larval stage of the cranefly ('daddy long legs'). They attack grass roots, causing yellowing and eventual die off.

There are a number of techniques that can be adopted for both prevention and cure of infestations:

- ◆ Many bird species feed on leatherjackets. Encouraging starlings, thrushes, rooks and blackbirds into your garden will help to control infestations.
- ◆ Leatherjackets can be coaxed to the surface following overnight rain by covering areas with black plastic. They will move to the surface and can then be removed by hand.
- ◆ Nematodes such as *Steinernema feltiae* can be used as a control.



# Leek Moth



Photo by Charles Dowding

The leek moth, *Acrolepiopsis assectella*, is mainly a pest of leeks and onions, but can also affect chives, garlic and shallots. White or brown patches develop on leek and onion leaves where internal tissues have been eaten by the caterpillar stage of the moth. As the damage becomes more extensive, leaves start to turn yellow with brown patches. Badly infested plants are often killed by secondary rots.

In the UK there are two generations per year, the first in May-June and the second in August-October. Adult moths overwinter in plant debris. In April/May as temperatures rise they start to lay with each female producing up to 100 eggs on host plants. The caterpillars hatch about a week later and tunnel into leaves to feed. They consume the softer internal tissues of the leaf leaving the outer skins intact. They may also bore into the stems of leeks and bulbs of onions. The caterpillars feed for about a month before crawling back up the leaves to pupate inside net-like silk cocoons spun on the foliage. As they develop into adults they start laying eggs and a second, more abundant generation of caterpillars emerges to cause damage between August and October.

The caterpillars are pale yellowish-green with brown heads and up to 12mm (0.5in) long. The pupae are reddish brown and the adult moths are small and brown. Leek moths were previously just a problem in coastal areas of England but are now found further inland in southern and eastern England and may be spreading north.

Damage from leek moths can be reduced or prevented by:

- ◆ Growing plants under fleece to prevent the moths laying eggs.
- ◆ Digging over the soil to disturb overwintering adults and pupae.
- ◆ Removing the plant debris which protects adult moths over winter.
- ◆ Planting late (after May) to avoid the first generation of moths.
- ◆ Keeping leeks watered in summer to ensure strong growth; larger plants are more tolerant of damage and can survive to produce usable crops. The affected growth can be cut off damaged leeks and they will regenerate.

# Leek Rust

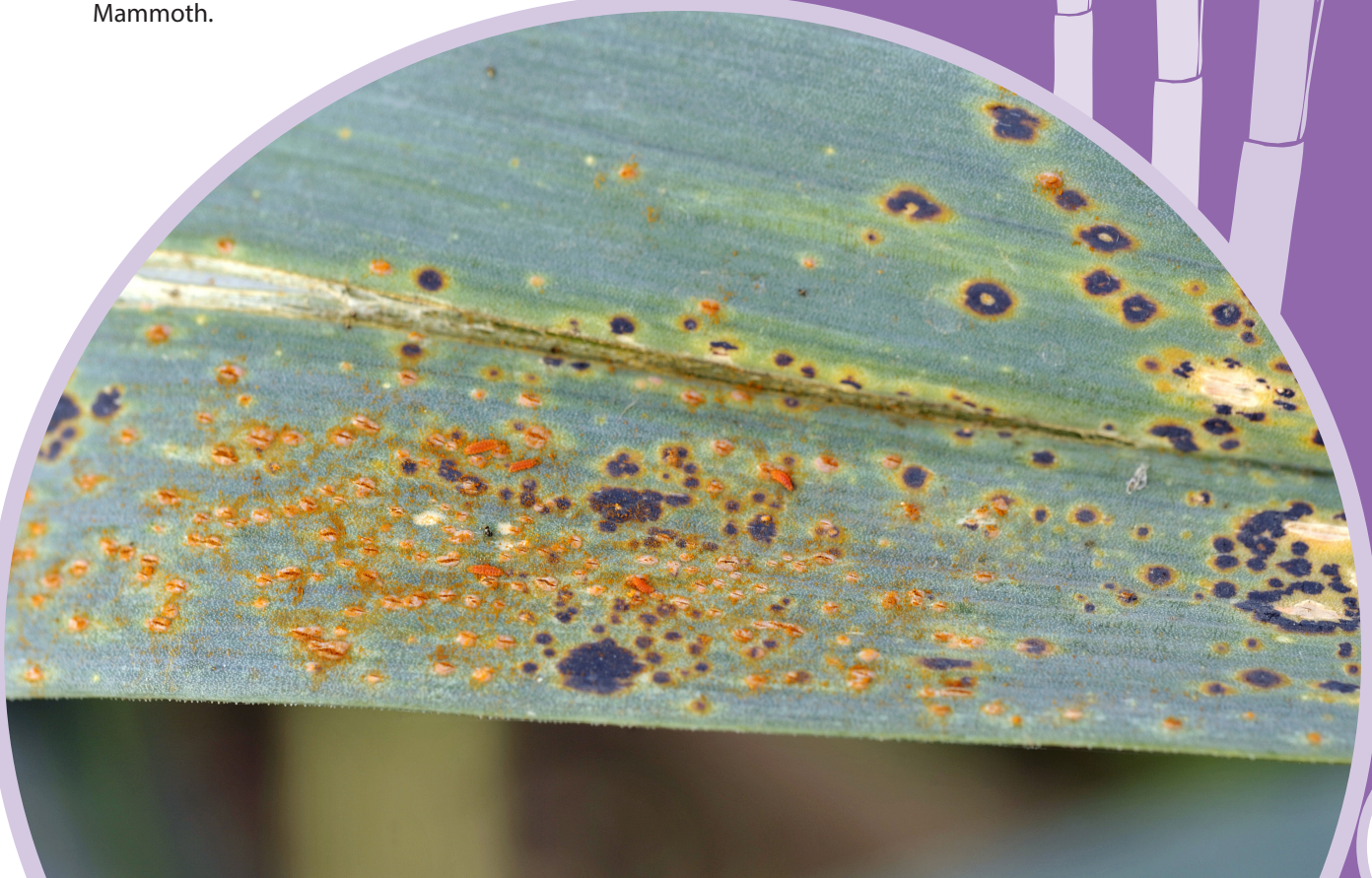
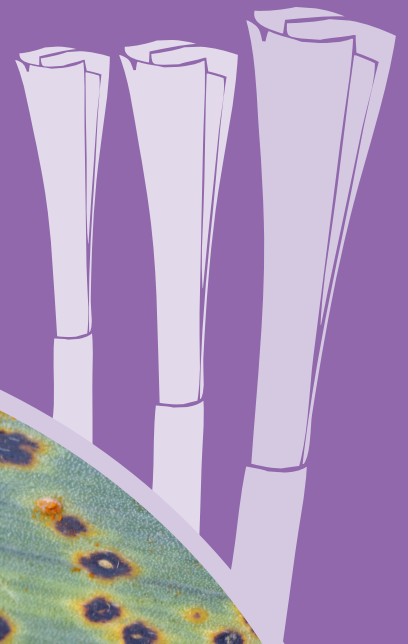
This is a common disease of leeks. Mild infections do little damage but severe infections may kill plants. Infections are clearly visible on leaves as orange or brown pustules which may be round or elongated. They are caused by the fungus *Puccinia allii* (also known as *Puccinia porri*). Pustules contain millions of spores which spread easily by wind to neighbouring plants. Warm and humid conditions encourage the fungus to spread.

The incidence and spread of rust on leeks can be reduced by a number of straightforward measures:

- ◆ Good hygiene on your plot - make sure that any infected plant material is removed from your site rather than composted.
- ◆ Early action - if you spot an infection remove infected material from your plot (make sure you wash your hands and anything else that might have been in contact with the infected plant tissue).
- ◆ Spacing - increasing spacing between leeks will allow better air flow and keep humidity from building up.
- ◆ Improve drainage on your site - this will keep humidity down.
- ◆ Variety selection - although all leeks can be infected with *Puccinia allii* some varieties have partial resistance, such as Ardea, Porvite, Splendid, Walton Mammoth.

- ◆ Avoid excessive nitrogen inputs - lush growth caused by excessive nitrogen is more susceptible to rust infection. Complex organic material, such as compost, releases nitrogen slowly over a long period and so it is better to use compost than a synthetic fertilizer.
- ◆ Make sure you have enough potassium - low potassium soils can be supplemented with a seaweed dressing or an organic tomato fertilizer.
- ◆ Crop rotation - make sure leeks are planted as far away from last year's growing site as possible.

*Puccinia allii* can infect other plants in the allium family, such as garlic or onions. Rusts affect other plants such as beans, plums and some ornamentals (e.g. hollyhocks, iris). However, these are caused by different types of fungus and will not spread to leeks, onions or garlic.



# Mealy Bugs

Mealybugs are mostly a problem in the UK for greenhouse and house plants as they prefer warm moist conditions. Whilst a pest in their own right they can also be a vector for some types of plant disease.



There are a number of ways to control mealybugs:

- ◆ Always inspect new plants before introducing them to a house or greenhouse, they may already be infested.
- ◆ Always remove clippings or dead plant materials from greenhouses as they may have mealybugs present on them.
- ◆ Ladybirds are an effective natural predator and can be purchased from a number of online suppliers.
- ◆ Mealybug infestations can be controlled by keeping an affected plant in the cold for a period of time – make sure the plant can cope with the cold conditions before doing so.



# Onion White Rot

This is one of the most serious diseases affecting onions and other allium family members and is caused by the fungus *Sclerotinium cepivorum*. The first signs are yellowing and wilting of older leaves. A white fluffy mycelium and black specks then develop around the base of the leaves and the bulb. During a high infestation the onion may wilt and die. The black specks are sclerotia and these survive in the soil or on diseased plant material over winter. They will germinate in the spring if onions or their relatives are planted and will invade onion roots. The fungus usually affects a few plants in a row and then spreads through contact between roots. Long distance transport is generally via movement of infested soil on boots, tools, or onion sets. The sclerotia are extremely hardy and can survive for at least 15 years in the soil even without any onions being planted. Infestations are most severe in cool, moist soils (10°C - 20°C) and are less of a problem in warmer soils.

White rot is almost impossible to eradicate but the likelihood of infestation can be reduced or its severity minimised.

- 🔥 Minimise movement of soil between plots on boots, tools, or on onion sets.
- 🔥 Diseased onions and surrounding soil should be dug up and either burnt, buried deeply or landfilled. Diseased onions should not be composted (unless you are absolutely certain your heap will reach and stay at 50°C to 60°C for several days).
- 🔥 Increase spacing between onions to prevent white rot spreading between roots.
- 🔥 Buy your garlic/onion sets from a reputable supplier or grow onions from seed instead.



# Pea and Bean Weevil (or pea leaf weevil)

Attack by pea and bean weevils are seen as U-shaped notches around the leaf margins of peas, broad beans and other leguminous plants. This damage is caused by the adult of the pea and bean weevil, *Sitona lineatus*. Adult pea and bean weevils are small, greyish-brown beetles about 5 mm long, with a typical weevil snout. They overwinter in leaf litter, other organic debris, or among leguminous plants. In early spring the females lay eggs in the soil around pea and bean plants. The larvae, which hatch two weeks later, are white with a brown head, legless and live in the soil feeding on root nodules. The larvae cause more serious damage than the adults and can actually kill seedlings. Heavy infestations can also reduce yields, and reduce the protein content of peas and beans. However, this is not often a problem and for the most part older plants are not affected significantly.

After feeding for about a month the larvae pupate in the soil. This is usually around the end of June.

Adults emerge after two or three weeks.

If pea or bean plants have already been harvested, adult weevils will move around to find other suitable plants to feed on.

When the temperature drops in the autumn they will look for winter shelter.

Damage to adult plants is not generally severe especially if the plants are strong. However, it should be possible to keep populations of pea and bean weevil low by:

- ◆ Placing a fleece barrier over pea or bean nets immediately after sowing to keep the adult weevils away.
- ◆ Pea and bean weevils feed off other leguminous plants such as clover, vetch or tares. There is a danger that such plants will provide an attractive place for the weevils to hibernate if grown over winter as a green manure crop.





# Pea Moth

The pea moth, *Cydia nigricana*, is 6mm long with a 12mm wingspan. It is an olive brown colour with black and white bars on the front edge of its forewings and long antennae. Between 5 and 11 days after adult moths emerge, they lay flat transparent/white eggs (size of a pinhead) on the leaves, pods, flowers or stems of pea plants. After 1 - 3 weeks (depending on temperature) minute, yellowish/white caterpillars with dark heads emerge. These migrate to, and bore into, young pea pods. Larval development lasts from 18 to 30 days, after which the fully grown caterpillars (12mm) bore back out through pod walls and drop to the ground to spin cocoons containing particles of soil. They hibernate over the winter in these cocoons.

There is one generation per year. Overwintering pea moths pupate inside cocoons and emerge to look for pea crops from the end of May to the end of July, coinciding with flowering time. Each caterpillar can damage up to 6 seeds although usually damage only 1 or 2. They chew irregularly shaped holes in the peas contaminating them with frass (insect faeces). Attacked pods may yellow and ripen prematurely, but damage is generally not detected until the pea pods are shelled revealing the frass, silk and sometimes the larva. Damage is easily distinguished from that of the pea weevil, which makes smooth, round holes in peas. Pea moths attack field and garden peas along with sweet peas and vetch. Damage from the pea moth is a big problem for commercial growers, but gardeners can easily discard the damaged peas when shelling pods.

Levels of infestation can be minimised by:

- ◆ Planting early or late to miss the flight period of the pea moth. Don't delay harvesting peas.
- ◆ Cover peas with horticultural fleece to keep moths off the growing crop.
- ◆ Pea moth pheromone traps interfere with normal mating signals, reducing their ability to mate successfully.
- ◆ If infestation is severe, avoid planting any pea moth hosts (including sweet peas and vetch) for a couple of years. This is much more difficult on an allotment where neighbouring plot holders are likely to grow peas.



photo by Paul Parsons

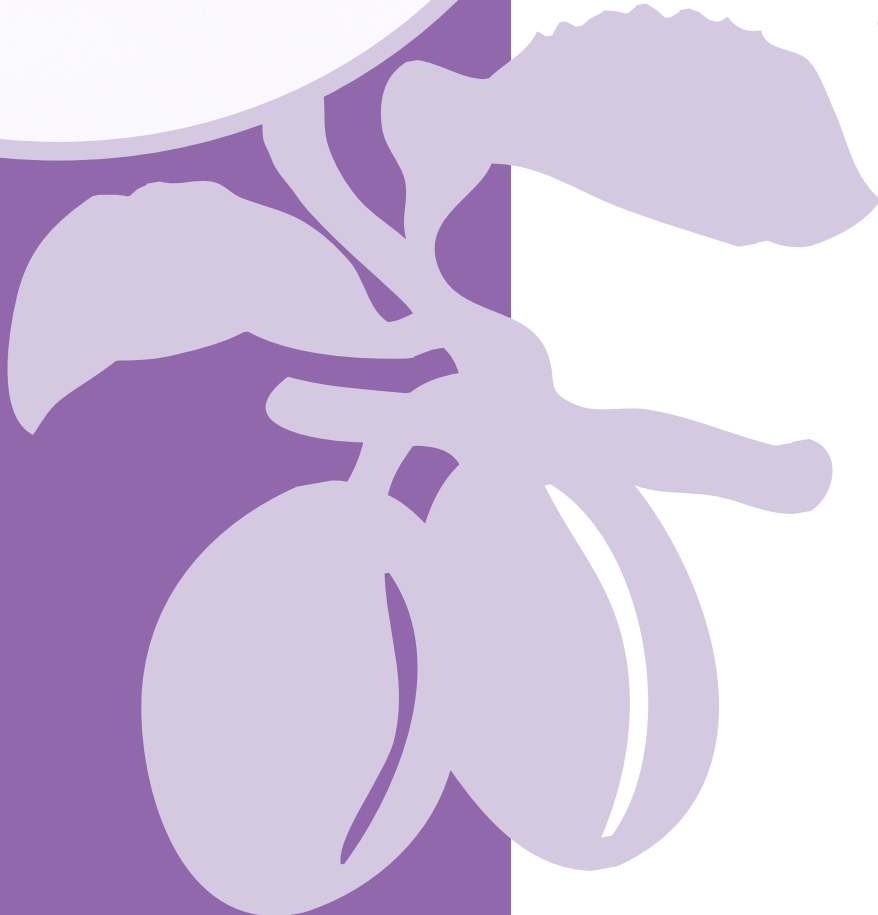


# Plum Moth



The plum moth, *Cydia funebrana*, is a close relative of the codling moth and can attack all types of plums, including damsons and gages. Ripening fruit contain a pinkish-white caterpillar, up to 12mm long, and the fruit may be misshapen. The area around the fruit stone will have many small, orange-brown pellets, which are the caterpillar's excrement. Fruit damaged by plum moth often ripens prematurely. At the beginning of the picking season, it may appear that the whole crop is ruined. However, fruit which ripens later is likely to have a much lower level of infestation.

The adult moth lays eggs on developing fruit in June-July. After hatching, the caterpillar tunnels into the fruit and feeds around the stone. In late July-August, the caterpillar emerges, overwintering under loose flakes of bark. It pupates the following spring. On isolated trees, a plum moth pheromone trap may catch enough males to prevent some females mating, resulting in fewer viable eggs being laid. However, this is unlikely in places where there are plum trees in other nearby gardens or allotments. The traps are available from most garden centres and should be hung in the tree in mid-May, when the adult moths are emerging. If an infestation with plum moth is suspected it is advisable to cut open plum fruits before eating/cooking! Plum moths have become more widespread over the last 20 years.



# Rosemary Beetle

These dark, metallic green beetles have five purple strips on each wing case and are about 9mm long. They originated in southern Europe and were first seen in the UK at RHS Garden Wisley, Surrey, in 1994. The rosemary beetle is an invasive species and has become a problem in the south of England, although there have been sightings further north.

The rosemary beetle attacks rosemary, lavender and thyme. Adult beetles live on these plants but are inactive from early to mid-summer. In late August and September the beetles resume feeding, mate and begin to lay eggs. Egg laying continues on warm winter days until spring. Eggs hatch within two weeks into greyish-white, soft-bodied larvae which grow to 8mm in length. The larvae feed for approximately three weeks before entering the soil to pupate. The pupal stage lasts for a further two to three weeks before adults emerge.

Damage is done to the shoot tips and flower spikes but is only significant during a heavy infestation. The beetles can be controlled by regular inspection of host plants, removing any beetles found.





# Scale

Scale insects are a large group of unusual insects which appear like small shells attached to the stems or undersides of leaves. There are over 100 different species worldwide and at least 25 different species in the UK. They are usually divided into soft scale (which secrete a waxy film) and armoured scale (which secrete a separate covering). All species feed on plant sap and those found in the UK are typically between 1 - 5 mm long.

In the UK they are most frequently found on houseplants or in heated greenhouses, but can also be found on some outdoor plants.

The wingless, legless adults spend their lives pressed against their host plant. Mature females lay eggs underneath the protective scale 'shells'. When eggs hatch the young leave the shell and settle down to suck sap from the host plant. Those affecting outdoor plants usually have only one generation per year, while those living in heated greenhouses may have overlapping generations with all stages visible at the same time.

Those potentially relevant for UK allotment gardeners are:

- ◆ Brown scale, *Parthenolecanium corni*, affect bush and cane fruit, and roses.
- ◆ Soft scale, *Coccus hesperidum*, affect citrus, bay, and many indoor plants.
- ◆ Hemispherical scale, *Saissetia coffeae*, affect a wide range of indoor or greenhouse ornamental plants.

Many scale insects do not cause a serious problem for their hosts but a large infestation can weaken a plant. They also excrete honeydew making foliage sticky and encouraging the growth of moulds. To reduce populations:

- ◆ Inspect plants regularly, particularly along the stem and main veins. Squash any scale you find with your nail.
- ◆ Soft scale and hemispherical scale are both controlled by a parasitic wasp, *Metaphycus helvolus*. These can be released in greenhouses, but are only effective when the temperature reaches 22°C for a few hours each day. Parasitic wasps are available to buy from a number of sellers in the UK.
- ◆ Organic sprays made from fatty acids or plant oils can be used. They are not persistent so often require repeat treatments to be effective.

# Slugs and Snails

Digging over the soil in wintertime brings slug eggs to the surface where they are more likely to be killed by frosts. The characteristic pearly white eggs are about 3mm in diameter and found in clusters. They can often be spotted while digging and killed.

In April, the increasing temperatures and showery weather provide good conditions for slugs to grow and multiply.

No single method of control will be completely effective. Try several different strategies. Here are a few suggestions:

- ◆ Hunt for slugs at dusk or dawn with a flashlight.
- ◆ Encourage slug eating animals, such as frogs, by building a pond.
- ◆ During the day slugs congregate in moist dark places. Create suitable hiding spots using roof tiles or flat stones and then gather slugs from them. Many people find over-turned grapefruit halves work well.
- ◆ The parasitic nematode, *Phasmarhabditis hermaphrodita*, specifically attacks slugs. These can be bought from several different suppliers as a powder to be mixed with water and applied with a watering can. The ground must be sufficiently warm and moist as nematodes will quickly dry out and die. The microscopic nematode worms infect slugs and kill them in about a week. Your plot should then remain slug-free for about 6 weeks. The main drawback is that the nematodes are relatively expensive to buy.
- ◆ Remove debris from your plot. This will reduce suitable slug hiding places.



- ◆ Place beer traps around the edges of beds. These can be hand-made out of yoghurt cartons by cutting 'windows' near the top of cartons for slugs to crawl through. Place sugary beer or milk in the pot, replace the lid and sink into the ground with the 'window' just above ground level.
- ◆ Slugs do not like crawling over copper, so pot plants can be protected by placing copper tape around the pots. Make sure the slugs cannot reach your pot plants by crawling up drooping stems or leaves.
- ◆ Raise seedlings indoors and plant out when they are bigger and more able to sustain attack.
- ◆ Slug killing products containing aluminium sulphate and ferrous phosphate can be used in desperate situations, but are still toxic to wildlife. Use sparingly.
- ◆ Small children, sharp stick, 1p per slug!



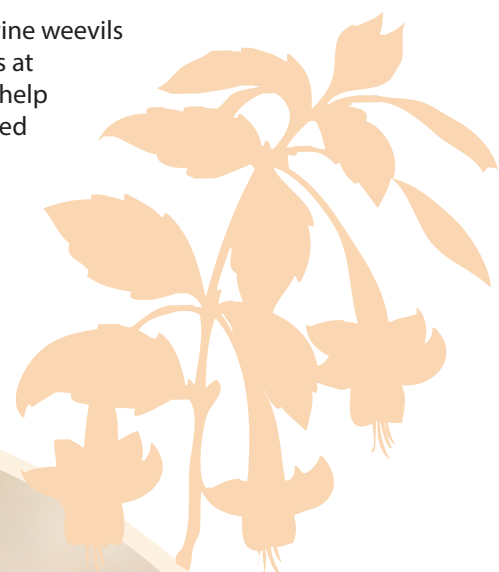
# Vine Weevil

Vine weevil larvae are up to 1cm in length with a plump, creamy white body and a brown head. They are usually curled into a C-shape. The adults, also 1cm long, are dull black in colour with a pronounced 'snout'. If seen, they tend to play dead, lying totally still, sometimes on their backs with their legs tucked in. They cannot fly, but will crawl determinedly to their favoured laying sites. The female weevil (males are rarely seen) emerges from the soil in early spring. Over a 3-4 month period each adult can lay 1000 eggs close to suitable host plants. The larvae emerge after about 2 weeks, then tunnel into the soil or compost, feeding on plant roots. They then burrow to overwinter at a greater depth. In heated glasshouses, consistent warmth enables weevils to be active all year round and to complete the cycle in less than a year.

Particularly harmful to begonia, fuchsia, cyclamen and primulas, although partial to other things too, the vine weevil, *Otiorhynchus sulcatus*, is an insidious insect that is common in the UK. Severe infestation can cause serious root damage and result in the death of plants.

There are a number of techniques to deal with vine weevils:

- ◆ The nematodes *Steinernema kraussei* and *Heterorhabditis bacteriophora* can be deployed against vine weevil. These are available from garden centres and online suppliers.
- ◆ Sticky barriers placed on the trunks of affected plants can trap weevils as they return to the soil in the day.
- ◆ Searching for vine weevils on leaf margins at night with the help of a low powered torch can help you to manually remove them from affected plants.





# Whitefly

Whitefly are 2mm long, sap-sucking insects which lay their eggs on the underside of leaves. Eggs hatch into larvae which soon insert their mouthparts into the leaf and settle into immobile scale-like nymphs. Both adult flies and nymphs are white.

Two species are regularly found in our allotments and gardens. The cabbage whitefly, *Aleyrodes brassicae*, is found on Brussels sprouts and other brassicas and causes little damage unless the infestation is particularly severe. However, infestations of greenhouse whitefly, *Trialeurodes vaporariorum*, can be more serious. High temperatures in greenhouses allows whitefly to multiply rapidly. When plants are infested, the leaf surfaces become sticky with honeydew secretions. Black sooty moulds grow on the honeydew secretions and during heavy infestations plants are weakened both because they are losing sap and because the black moulds block light from getting to the leaves. Whiteflies may also spread viruses. They can survive and breed all winter on indoor plants but will not survive cold winters either outdoors or in greenhouses.

There are a number of ways to reduce whitefly populations in greenhouses:

- ◆ Hang sticky yellow traps in the greenhouse just above plants in the spring before flies get too numerous (these are available from many companies).
- ◆ Release the parasitic wasps, *Encarsia Formosa*, into the greenhouse. Commercial growers of greenhouse crops often use these wasps. They can be bought from several online suppliers. The wasps should be released before the whitefly levels get too high.
- ◆ Fatty acids or dilute soft soap can be sprayed on plants.
- ◆ Neem oil can be sprayed on plants.

# Winter Moth



Winter moths, *Operophtera brumata*, are unspectacular in appearance. The males are greyish-brown and about 10 mm long with 25 mm wingspans. The females have almost no wings. They survive through the summer and autumn as pupae in the soil, with the adult moths emerging between November and January. The wingless females climb up the trunk of fruit trees (and other deciduous trees) to mate and lay their eggs. These eggs hatch into caterpillars which grow up to 25mm in length and are pale green with paler lines running lengthwise along their bodies. They move with a characteristic looping action due to the fact that they only have two pairs of clasping legs on their abdomen. From late March the caterpillars feed off tree leaves, completing their feeding by early June when they drop down to the soil to pupate.



Damaged tree leaves initially have small holes and are loosely bound with silk threads. Damage becomes more noticeable in mid-summer when the leaves are fully expanded and the holes have enlarged due to leaf growth. Blossom and developing fruits can also be damaged. At least two other moths, the mottled umber moth, *Erannis defoliaria*, and the March moth, *Alsophila aescularia*, have wingless females with a similar lifestyle but the winter moth is most significant as a garden pest.

Although significant commercial losses have been recorded trees can tolerate some leaf loss. In fact, established trees can lose up to 25% of their leaves and still bounce back. However, it is more important to protect young trees.

Winter moth damage can be reduced by taking a few relatively easy precautions:

- ◆ Grease bands should be placed around the trunks of fruit trees before the adults begin to emerge in November (don't forget to place them around tree stakes too). These should be about 45cm (18in) above soil level and will trap the females as they climb. Winter moth activity declines after January, but some species with wingless females are active until April, so grease may need to be reapplied from time to time. Ready-prepared sticky papers can be used on smooth-barked trees, while a ring of grease can be applied directly to trees with fissured bark. Both products are available from many garden centres.
- ◆ From November through January you may find the wingless females with a cloud of male moths around them in the evenings. Remove any you find.
- ◆ Look inside buds and leaf clusters for eggs or caterpillars and crush any you find.



# Wireworms

Wireworms are the larvae of the garden click beetle, *Athous haemorrhoidalis*, and the common click beetle, *Agriotes lineatus*. They attack the underground parts of plants, damaging roots, tubers, corms and stems. Potatoes are particularly susceptible but they also attack beetroots and carrots. When numbers of wireworm are high they may also attack the roots of strawberries, brassicas, beans, tomatoes and many seeds/seedlings.

Damage can occur all year but is concentrated in spring and autumn. Small holes 2-3mm across appear on the outside of tuber or root crops. Cutting them open often reveals a network of tunnels which allow other pests and diseases to gain entry. Slugs and woodlice may be found, and bacterial and fungal rots may develop making the crop unsuitable for storage. On roots and stems, small blackened pits can be seen and the plants may suddenly wilt and die. In tomato, wireworm may tunnel into the stems and upwards into the pith.

The female click beetle lays eggs just below the soil surface from May to June. They prefer grassland and weedy soil, therefore, land that is newly cultivated is more susceptible to wireworm. A month after egg-laying small white larvae hatch and feed on both living and dead plant material in the soil. They grow up to 3cm long and develop a tough golden brown skin with three pairs of short legs. The larval period can last for up to four years. Larvae move through the soil profile in response to changes in moisture and temperature. In warm soils (above 10°C) they feed close to the soil surface while in hot or cold weather the larvae move deeper in search of ideal conditions.

Most crop damage occurs in late spring/early summer, and early autumn, as the soil temperatures are most favourable at these times. Eventually the larvae construct pupal cells at about 20 to 30 cm depth in the soil, pupate over winter and emerge during the following summer and early autumn to mate.

Numbers of wireworm can be reduced by:

- ◆ Thoroughly turning soil in autumn, and before planting, to expose wireworm to their predators, such as birds, frogs and beetles.
- ◆ Checking homemade compost before use and exposing to predators if necessary.
- ◆ Harvesting susceptible crops early if the ground is known to be infested with wireworm.
- ◆ Burying raw potatoes in a number of places about 10-15cm below the soil surface. These should be removed from time to time and any wireworm destroyed.
- ◆ Burying a net of pre-soaked grain about 10cm down in the soil before planting crops (a mix of half wheat, half corn pre-soaked for 24 hours to promote germination works well). The soil around the bait can be heated by covering with black plastic. The bait should be removed regularly and wireworm destroyed. Further details available at <http://www.ipm.iastate.edu/ipm/icm/2003/4-21-2003/trapwire.html>



# Glossary

## Soft soap

Soap that is liquid or easily soluble, usually made by saponification with potassium instead of the more typical sodium hydroxide.

## Fruit tree grease bands

Bands put around the trunk of fruit and other deciduous trees that prevent female moth caterpillars from climbing the tree and laying eggs.

## Mills period

For more information see [www.dovebugs.co.uk/Scab%20Risk%20Periods.pdf](http://www.dovebugs.co.uk/Scab%20Risk%20Periods.pdf)

## Yellow sticky traps

Similar to the old fly papers. These are sticky sheets that trap flying insects.

## Diatomaceous earth

Diatomaceous earth consists of fossilised remains of diatoms and is naturally occurring. It is used for a variety of purposes including cat litter and as a mechanical insecticide.

## Pheromone traps

A type of insect trap that uses pheromones to lure insects.

## Neem oil

A vegetable oil pressed from the fruits and seeds of the neem tree, *Azadirachta indica*, an evergreen tree which is endemic to the Indian subcontinent and has been introduced to many other areas in the tropics. It is the most important of the commercially available products for organic farming and medicines.





## Pesticide Action Network UK

PAN UK is based in Brighton. We are the only UK charity focused solely on addressing the harm caused by chemical pesticides.

We work tirelessly to apply pressure to governments, regulators, policy makers, industry and retailers to reduce the impact of harmful pesticides.

Find out more about our work at:

**[www.pan-uk.org](http://www.pan-uk.org)**

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