

GARDEN ENTOMOLOGY

In the UK most people live in urban and suburban areas, which cover a significant proportion of the land area of the country. Consequently, gardens make a vital contribution to biodiversity, providing a haven for many animals and plants that are rapidly declining in intensively farmed areas.



Insects are by far the most diverse and ecologically important group of animals in these artificial habitats, with hundreds of species to be found in almost every garden. Although some insect species have the potential to be garden pests, most are harmless or beneficial.

In this guide we pick out some of the insects that you are likely to see, share some of the amazing facts that entomologists have uncovered about them, and suggest ways that you can help maintain insect biodiversity in your garden.

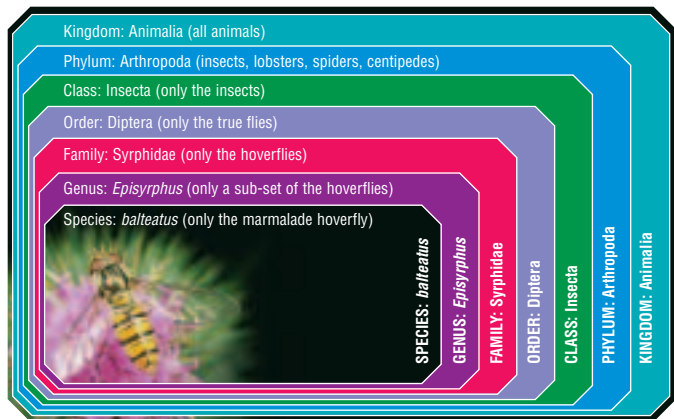
Above: Holly blue *Celastrina argiolus*

This is the most common blue butterfly seen in gardens, and its attractive sky-blue colour makes it easy to spot. Eggs are laid on holly and ivy, while the adults feed on aphid honeydew and plant sap flows. It emerges earlier than other blue butterflies, with adults first seen in late spring, and their offspring emerge as adults in early autumn. Recent mild winters and warm summers have resulted in an increase in the abundance and distribution of this species, which is now found throughout the southern half of the UK, with scattered populations further north and in Ireland.

The world of insects

WHAT IS THAT INSECT?

Identifying insects is often thought to be difficult, but a little practice will soon pay dividends, and most gardeners know more about insects than they realise. We must be able to put a name to an insect if we want to find out about its natural history, and whether it is likely to be a friend or foe in the garden. The trick is to keep things simple, and build up experience slowly. One place to start is by understanding how taxonomists classify insects, so that insect identification books become less daunting. (Taxonomy is the science of naming and classifying organisms in a way that reflects their natural relationships.) Taxonomists categorize organisms into separate groups (taxa; singular taxon), based on how they look and (increasingly) their DNA. Organisms within a given taxon have common features, and are thought to have evolved from a common ancestor. For example, the marmalade hoverfly can be classified under a number of different headings, depending on how exclusive we want to be. The figure below illustrates this.



The table opposite shows the traditional classification of the common taxa of garden insects. In total, there are between 26 and 29 living insect orders. The exact number changes over time as new evidence on evolutionary relationships comes to light. The majority of people will recognise many of these orders, at least by their common names. Others, such as the Hemiptera, may not be so familiar, but this order includes the aphids, which are known to all gardeners.

One route to insect identification is to concentrate on a group with relatively easily identified members, such as the butterflies or dragonflies. There are lots of guides to these groups in your local bookshop or library. The second route is more difficult, but in turn more rewarding. Buy a good general insect guide, such as Michael Chinery's *Insects of Britain and Northern Europe* (Collins), which has an excellent key. Learn to rely on the key, rather than the pictures. This will help you identify your insect to at least family level, and at the same time you will learn a huge amount about your insect. For those who really enjoy identifying insects in their gardens, the Field Studies Council runs a series of popular courses, and local Wildlife Trusts often run field trips to suit people at all levels.

<p>Sub-Class Apterygota:</p> <p>Wingless, primitive insects</p>	<p>Order Thysanura</p>	<p>Silverfish – more common in damp sheds than in the garden, medium sized, flattened, silvery scaled.</p>
	<p>Order Collembola</p>	<p>Springtails – the most common insects in soil, small, possess a jumping organ, some taxonomists do not include these with the Insecta.</p>
<p>Sub-class Pterygota:</p> <p>Winged insects</p> <p>Division Exopterygota:</p> <p>Wings develop externally, and the young (nymphs) look like small, wingless adults</p>	<p>Order Ephemeroptera</p>	<p>Mayflies – mainly aquatic, found near rivers and ponds, large wings, three 'tails', large compound eyes.</p>
	<p>Order Odonata</p>	<p>Dragonflies – acrobatic aerial predators, can be very large, grasping 'raptorial' jaws to capture prey.</p>
	<p>Order Orthoptera</p>	<p>Crickets and grasshoppers – often found in larger gardens where grass and native trees are allowed to go a little wild, feed on plants.</p>
	<p>Order Dermaptera</p>	<p>Earwigs – found under rocks in most gardens, brown, elongate and dorso-ventrally flattened.</p>
	<p>Order Hemiptera</p>	<p>True bugs – feed on plant sap, using their specialised piercing, sucking mouthparts, can be large.</p>
<p>Sub-Class Pterygota:</p> <p>Winged insects</p> <p>Division Endopterygota:</p> <p>The larvae look very different to the adults, and undergo metamorphosis in a pupa, where the wings develop internally</p>	<p>Order Neuroptera</p>	<p>Lacewings – common predators of other insects, including aphids, relatively large wings.</p>
	<p>Order Coleoptera</p>	<p>Beetles – the most diverse group of organisms on Earth, some are important predators of garden pests.</p>
	<p>Order Diptera</p>	<p>True flies – recognised by having just one pair of wings, the second pair are modified into halteres, which act as balancing organs.</p>
	<p>Order Lepidoptera</p>	<p>Butterflies and moths – the most easily recognised garden insects, herbivorous, larvae (caterpillars) feed on plants, adults feed on nectar through a long proboscis.</p>
	<p>Order Hymenoptera</p>	<p>Bees, ants and wasps – critically important pollinators in every garden, many small wasps are parasitic, others induce galls on plants. Some show very complex social behaviours.</p>

Order : Thysanura

SILVERFISH AND OTHER BRISTLETAILS

Bristletails are wingless, primitive insects of up to 20mm in length. There are 23 species in Britain. Their bodies are carrot-shaped, more or less flattened and covered with scales. They also have three characteristic long, segmented tails. Unlike many insects, when the young hatch from the egg they resemble the adults, but without the scales. They then continue to grow as adults by moulting up to ten times, which is similar to the way that crustaceans grow (e.g. crabs, woodlice and waterfleas).

Some bristletails live under stones and tree bark or among moss and leaf litter. They are omnivorous, and are good recyclers, eating rotting vegetation and dead invertebrates. Most are found outdoors in Britain although they are generally thought of as household pests; the silverfish and firebrats (*Thermobia domestica*) are associated with human habitation.



FACT FILE

- The term Thysanura is derived from the Greek thysanos meaning fringed and ura meaning tail.
- When bristletails mate, the male has to dance for the female. He then leaves a spermatophore on a silk thread for her to pick up.
- Bristletails are surprisingly long-lived and can reach the grand old age of seven.
- Thysanurans have inhabited the planet for over 300 million years.
- Some bristletail species are parthenogenetic, which means that the females can reproduce without mating with males.

SPECIES PROFILE

Silverfish *Lepisma saccharina*

Silverfish (up to 10mm) are common insects and in the UK are nearly always associated with human habitation. They generally live in dark, damp corners and used to be very common in kitchens. They get their name from the tiny fish-like silvery scales that cover the body. These help them to escape from predators by making them slippery.

Silverfish feed on carbohydrates (starchy food) and can be a pest, eating away at wallpaper, flour and sugar. They also have cannibalistic tendencies, eating dead and injured silverfish. They can sometimes be found in outhouses such as garden sheds and garages.

Order : Collembola

SPRINGTAILS

The springtails, or Collembola, are tiny animals named for their ability to jump. There are around 250 species in Britain, representing an ancient group of primitive insects, examples of which have been found as fossils 400 million years old. There is some debate among scientists as to whether or not they are true insects. Springtails are one of the most widespread and abundant groups of insects living in terrestrial ecosystems. Their scientific name is derived from the Greek *colle* (glue) and *embolon* (piston), referring to a ventral tube on their underside. This is filled with fluid which helps the springtail to stick to surfaces and in righting themselves after jumping. The jumping organ is known as the furca, which is normally folded under the body, held in place by a catch. Springtails jump by releasing this catch to drive the furca into the ground. They can spring into the air in a fraction of a second when disturbed.



FACT FILE

- In 1996, fire fighters in Austria were called out to clean up a chemical spill on a road to discover that the patch was in fact several million springtails.
- The male of the springtail *Deuteromithurus pallipes*, common in gardens in the south of England, entices his mate to pick up his packet of sperm by dancing and head-butting the female.
- The smallest springtail is less than 0.2mm in length.

SPECIES PROFILE

Tomocerus longicornis

Tomocerus longicornis does not have a common name. Luckily it is easy to identify by its habit of rolling its long antennae into spirals when blown on. It is one of the largest springtails in Britain, growing up to 6mm in length. It is very common in gardens and can be found by looking under stones or turning over the compost heap. *Tomocerus longicornis* springs by contracting internal muscles around the springing organ and increasing local blood pressure. The force of the jump makes it do several somersaults before landing. Like most springtails, it feeds on either decaying plants or fungi and therefore plays a role in nutrient recycling in the garden.

Order : Ephemeroptera
MAYFLIES

Mayflies and dragonflies are the oldest surviving forms of flying insects. The ancestors of mayflies first appeared in the Carboniferous period. Mayflies are typically found near freshwater streams and rivers, into which they lay their eggs. Adults do not feed, and their role is restricted to mating and laying eggs. This results in a brief adult life-span and is reflected by their formal scientific name, Ephemeroptera. Indeed, one species of mayfly has an adult life so short that the males survive for less than an hour. Mayflies can be seen in gardens near lotic (moving) freshwaters, so people living near canals, streams and rivers may see large numbers. A few species do colonise garden ponds, such as *Cloeon dipterum*, the pond olive. Mayfly nymphs are more hidden, foraging for small particles of organic matter, such as algae, either filtered from the water or collected from plants and rocks.



FACT FILE

- There are approximately 2,000 species of Ephemeroptera, and they inhabit all continents, with the exception of Antarctica. There are 46 species found in the UK.
- Acid rain resulted in the loss of many mayfly populations across northern Europe and North America.
- As with all insects, mayflies develop through a series of moults. During the penultimate moult, their midgut is sealed at both ends, and this fills with air, causing the nymphs to float to the surface. When this occurs in large numbers, the effect is similar to seeing rain falling on the water.

SPECIES PROFILE

Mayfly *Ephemera danica*

Ephemera danica is the most common species of mayfly seen in the UK, where large mating swarms can be seen on warm summer evenings near unpolluted slow-moving water bodies. Mating takes place in the air. After mating, the female releases her eggs, which may number up to 8,000, into the water. Both sexes die soon after reproducing. The eggs hatch and the life cycle generally takes two years to complete, although in the warmer south of England the cycle may be completed in a year. Species such as *Ephemera danica* are ecologically important as a food resource for many bird and fish species. This important role as fish prey is recognised by fly-fishers, who have developed many ingenious imitations of mayflies.

Order : Odonata

DRAGONFLIES AND DAMSELFLIES

Dragonflies are an extremely old group of insects; they are found as fossils over 300 million years old. Fossils of enormous dragonflies with wingspans of at least 70cm have been found. The closely related dragonflies (Anisoptera) and damselflies (Zygoptera) can be distinguished from each other by observing them at rest. The damselflies are generally smaller and at rest hold their wings vertically above their body, or partly open. The dragonfly will always rest with its wings spread horizontally.

Both the water-dwelling juveniles and adult Odonata are predatory, eating other insects and small vertebrates. They have an interesting sex life; females mate with a number of males and store their sperm in specialised organs. She will tend to use sperm from the most recent mating to fertilise her eggs and this leads to great competition between the males. The penis contains structures that allow the male to scrape out or reposition the sperm of rival males. The male will also hold the female in the copulatory position for long periods of time to prevent other males from mating with her.



FACT FILE

- In some countries, dragonfly nymphs are used to control mosquitoes; dropping a nymph into a water container can remove up to 90% of the larvae.
- Some damselfly males will demonstrate the flow rate of water in his territory by floating downstream for a few seconds. This is a risky thing to do since he might be eaten by fish. This may show his intended mate that he is strong enough to escape.
- Dragonflies are strong fliers and can reach speeds of up to 20 miles an hour.

SPECIES PROFILE

Azure Damselfly *Coenagrion puella*

Also known as the pond damselfly, this is possibly the commonest damselfly in gardens across Britain. It likes to breed in small bodies of standing water and is therefore likely to find your pond appealing. It can be seen from the end of April until the middle of September, skimming the pond and searching for insect prey. It gets its name from the male colouration of bright blue and black, although the female is often black with some green on the thorax and blue at the tip. The male can be distinguished from similar species by the U-shaped mark at the beginning of the abdomen. This marking does not touch the black markings on the segment below. The female azure damselfly lays her eggs into the tissues of plants floating on the surface of the water. If you want to encourage them into your pond, plant marginal plants and keep your pond fish-free.

Order : Odonata

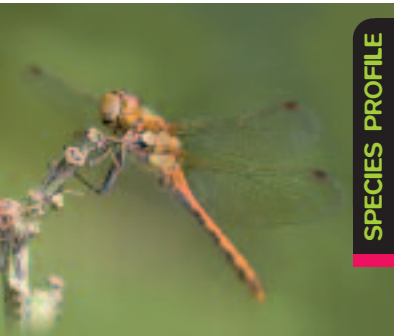
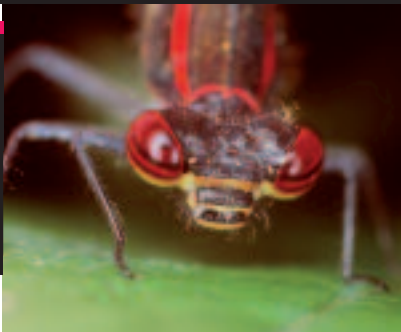
DRAGONFLIES AND DAMSELFLIES

Large red damselfly

Pyrhosoma nymphula

The large red damselfly is widespread throughout much of the UK. This is a very conspicuous species inhabiting a range of freshwater habitats, including garden ponds, where their bright colouration is unmistakable. They are one of the earliest odonates on the wing, often seen in late spring. In a study of large red damselflies in Durham, it was found that in some years fewer than 1 in 200 nymphs made it through to the adult stage.

SPECIES PROFILE



SPECIES PROFILE

Common darter

Sympetrum striolatum

Dragonflies fall into a number of subgroups, of which the hawkers and the darters are most common in the UK. Darters are generally more robust and make ambush forays from vegetation, feeding on other flying insects. The common darter is the most common species of British dragonfly, and is regularly seen in gardens, as they forage some distance from water. Common darters will often allow close approach, provided care is taken to avoid sudden movements, and this will be rewarded by views of a truly spectacular aerial predator.

Common hawker

Aeshna juncea

Hawkers are more likely to be seen in gardens near larger water bodies, where they constantly move over their territories in search of prey, mates and challengers. This species is more common in parts of the UK where acidic habitats are found, such as near the heathlands of southern England, and the heather-dominated moors of the northern UK.

SPECIES PROFILE



There are eleven species of grasshopper in the UK. Most grasshoppers have a series of pegs on their hind legs, which they draw across toughened veins in the forewing. This produces the classic stridulatory call of warm summer days. Grasshoppers are herbivores, although they will also eat insect cadavers and even grasshopper faeces. Crickets are similar to grasshoppers, but tend to have longer antennae. Several large crickets are often found in gardens, such as the dark (*Pholidoptera griseoaptera*) and the oak bush crickets (*Meconema thalassinum*). The only cricket found inside our homes is the house cricket, *Acheta domesticus*. This species was accidentally introduced from North America in the 17th century, and may be one of our earliest insect invaders from the New World. The house cricket cannot survive the British winter outdoors, although they are sometimes found in rotting rubbish and compost, where heat generated by fermentation provides suitable conditions for their survival.

FACT FILE

- The very rare mole cricket (*Gryllotalpa gryllotalpa*) has powerful forelegs which are used to dig tunnels.
- The wartbiter cricket (*Decticus verrucivorus*) is the subject of an intense conservation programme in the UK. Some of the best places to see wartbiters are nature reserves on the South Downs, where sunny hillsides with short sward provide suitable habitat.
- The locust, *Schistocerca gregaria*, is one of the world's most important agricultural pests. Locusts infected with fungal pathogens choose to sit in the noon sunshine, which heats them beyond their normal body temperature. The heat kills the fungus before the locust is seriously harmed, allowing it to recover.



SPECIES PROFILE

Common field grasshopper *Chorthippus brunneus*

The common field grasshopper (18-24mm in length) is widely distributed through the UK, but prefers dry sunny areas where the grass sward is of intermediate height. They show great variation in colour, which mainly ranges from green to brown. They often have a small patch of orange on the tip of their abdomen. The common field grasshopper is most often noticed at the end of June or early July, when their calls can be heard on sunny days. Males use these calls to attract females; once a female is near, the call changes to entice her into mating. The female grasshopper lays eggs in the soil in batches of around a dozen; each batch is coated with a spongy secretion. This helps prevent fungal infection and predator attack, as well as ensuring that the eggs do not dry out. The nymphs emerge in the following May, looking like miniature wingless adults.

Order : Orthoptera

GRASSHOPPERS AND CRICKETS

Oak bush cricket

Meconema thalassinum

The oak bush cricket is found in gardens near deciduous trees, and also on large shrubs. The females are particularly impressive, with their long ovipositors, used for egg laying under the bark of a suitable tree. The 'song' of the oak bush cricket involves drumming on leaves with its hind legs, and so is difficult to hear unless you are very close. This species is an active predator, feeding on a range of small insects.

SPECIES PROFILE



Speckled bush cricket

Leptophyes punctatissima

This is perhaps the easiest of the UK's crickets to identify, as no other species has a similar pattern of dark markings, which help conceal it from predators in dappled vegetation. It is common in southern and central England, but not frequently seen in the north. This species is flightless, with wings reduced to small protuberances on the male. As with most orthopterans, the speckled bush cricket 'sings', but the song of this species is made at a frequency too high for most people to hear.

SPECIES PROFILE



Meadow grasshopper

Chorthippus parallelus

Another common grasshopper species, found throughout Britain. Often seen in gardens where the grass is allowed to grow. The wings of this species are generally not fully developed, meaning that this species is incapable of flight, although occasional long winged forms are found when summers are hot. The meadow grasshopper is a behavioural thermoregulator, meaning that it chooses habitat patches which help it maintain its preferred temperature range of 32-35°C.

SPECIES PROFILE



Order : Dermaptera

EARWIGS

Earwigs are common residents of gardens throughout the year, and are also occasionally found in houses. They are in the insect order Dermaptera, named after their skin-like wings, which are rarely seen. Earwigs can be pests of garden flowers, such as dahlias, clematis and chrysanthemums, eating young leaves and petals in summer, leaving them pock-marked with unsightly holes. They also attack some fruit trees, where they cause damage to the fruit, allowing the entry of fungal diseases. However, while they can be a minor garden problem, earwigs also play a beneficial role in the garden by attacking pests, such as aphids. To remove earwigs, provide shelter in the form of inverted pots. Pack these loosely with dried grass and place the pots on the top of canes situated among the plants. The earwigs can be disposed of once caught, making the use of insecticides unnecessary.



FACT FILE

- A common myth suggests that earwigs can crawl through the ear and lay eggs on the sleeping victim's brain. This is untrue, but while earwigs are creatures of damp, moist places, it is unlikely that they creep into ears.
- While the majority of earwig species are omnivorous, some species (the Hemimerina) feed on the shed skin of the giant rat and others (the Arixenina) feed on the skin gland secretions of bats.
- The oldest fossil Dermaptera is over 200 million years old and their likely ancestors were alive about 290 million years ago.

SPECIES PROFILE

The common earwig *Forficula auricularia*

Forficula auricularia is commonly found in houses, where they are a nuisance, rather than a health risk. Outdoors, they survive the winter by hibernating in nests. The female mates with a male in this nest and lays a batch of about 50 eggs. The female guards the eggs and the emerged young (known as nymphs). Females use their formidable cerci (pincers) to defend their eggs and young against attack. The shape of the cerci can be used to sex male and female *Forficula auricularia*. Females have cerci which are close together, whereas males have strongly curved cerci. There are two forms of male common earwig. The rarer form has much larger cerci. Females prefer to mate with these males, and males with larger cerci are also more likely to win skirmishes with other males. However, large cerci are not common since males require both the right genes and a food-rich environment before they can grow them.

Order : Hemiptera

BUGS

The term bug refers to an order of insects which all share one common feature – they have piercing and sucking mouthparts (the rostrum), which in many species looks like a mobile hypodermic needle. The rostrum contains four elements (the stylets) in two pairs. The outer pair have serrated edges, to allow the mouthparts to pierce its host, while the inner pair form two canals, for the passage of food and saliva in opposite directions. At the tip of the rostrum are specialised receptor cells which allow the insect to determine the suitability of its food source.

Many hemipterans pierce plant tissues to feed on sap, while others use the same organ to suck the juices of other animals. Most predatory hemipterans feed on other insects, although some do suck the blood of humans and other warm-blooded animals



FACT FILE

- The vine phylloxera, *Daktulosphaira vitifoliae*, almost completely destroyed the European wine industry when it was accidentally introduced from North America at the end of the 1800s. It was only by grafting European shoots to American root stock that the damage was reversed.
- Several 'kissing bugs', found in the Americas, are of huge health concern. By feeding on the blood of sleeping people and excreting near the wound, they transmit a protozoan blood parasite, *Trypanosoma cruzi*. This is the cause of Chaga's disease, which kills around 50,000 people per year.

SPECIES PROFILE

Common froghopper *Philaenus spumarius*

This species is commonly known as the spittlebug, due to the frothy mass produced by their nymphs. This froth protects them from drying out, and more importantly, helps prevent natural enemies such as parasitic wasps from attacking. This species exhibits considerable colour polymorphism, with populations often showing discrete variation in colour and pattern. For example, in the UK, darker colour morphs are more common in urban settings. Nymphal spittlebugs form their frothy defences using a combination of anal fluid, a surfactant produced by epidermal glands, and air from specialized caudal appendages. Nymphs feed head-down, and gravity helps the 'spittle' to quickly cover their body.

Order : Hemiptera
APHIDS

There are about 4,000 species of aphids worldwide, of which about 250 are serious pests. Aphids are garden pests as they feed on plant sap by inserting their stylets (mouthparts) into the plant's phloem. As well as damaging the plant, they can transmit plant viruses. Plant sap is high in sugars, but low in proteins, so aphids have to ingest large volumes of sap to get a balanced diet. This is why aphids produce honeydew, a sugary excretion, which can provide a substrate for sooty moulds. These moulds can grow anywhere where there is a high concentration of honeydew, such as on cars parked under lime trees in the late summer. If you must control aphids, remember all the beneficial insects that rely on them. Remove them manually or apply detergent-based sprays. If you must use pesticides, apply systemic ones such as pirimicarb, which should have a minimal effect on beneficial insects.



FACT FILE

- Aphids can reproduce parthenogenetically (asexually) for much of the time, with each female producing a series of genetically identical offspring.
- Aphids are like Russian dolls. Inside every female is a developing nymph, which in turn contains a developing aphid embryo. Each female therefore carries her own granddaughters.
- Most aphids have symbiotic microorganisms, called *Buchnera*, which help produce essential amino acids the aphid can not live without.
- Many aphid species are tended by ants. In return for protecting the aphids from predators, the ants are rewarded with honeydew.

SPECIES PROFILE

The pea aphid *Acyrtosiphon pisum*

The pea aphid is a common pest of legumes throughout the world, and is often found on garden broad beans. Pea aphids are either green or pink in colour, with the green form being more common. As with all aphids, *Acyrtosiphon pisum* numbers can increase rapidly. Nevertheless, they do not do so well in very hot summers as they stop developing at temperatures above 28°C. Temperatures above this kill their symbiotic bacteria and without the essential nutrients the symbionts produce, the aphids eventually die. Pea aphids are attacked by a range of natural enemies, including fungal pathogens, predators and parasitoids. However, they are not defenceless. A female pea aphid can produce winged offspring when there are ladybirds around, which disperse from the plant to a new host. Recent advances in entomology suggest that symbiotic bacteria help defend the aphid against parasitoids.

Order : Hemiptera

SHIELD BUGS

Adult shield bugs are attractive insects, easily characterised by their flatish oval or five-sided shield shape (the pentatomids). They are often called stink bugs because when threatened, some species produce a pungent liquid from special glands near their hind legs (poke one and then sniff your hand). Most shield bugs feed on plant sap and some are pests of economically important crops such as coffee and cotton. Few gardeners would consider them to be pests, although the noxious liquid they produce can taint the taste of some fruit. Most shield bugs need symbiotic bacteria for the digestion of the sap. They acquire this aid-to-digestion at an early age; their mother smears her eggs with the bacteria so that the young nymphs ingest them as they feed on the egg case. Unlike many insects, shield bugs often show parental care, guarding their young from predators. The parent bug (*Elasmucha grisea*) is so named because the female will actually sit on the eggs until they hatch. This reduces levels of attack from parasitic wasps.



FACT FILE

- In Mexico stink bugs are eaten both live and cooked (for instance in paté or salsa) since their pungent odour gives a dish an aromatic flavour.
- Some stink bugs species have switched from feeding on plant juices to feeding on "insect juices" including caterpillars.
- Bean plants damaged by stink bug feeding and egg laying emit an odour attractive to parasitoid wasps, which then attack the bugs.

SPECIES PROFILE

Green shield bug *Palomena prasina*

These common bright green bugs are unmistakable with their shield-shaped bodies. Although they feed on tree sap, they are not pests in the garden. Adults are between 10-13mm in length and in the spring and summer their bright green backs are stippled with tiny black dots. During the winter, the adult turns brown and hibernates in piles of dead leaves or other vegetation, emerging in May. The female lays clusters of small barrel-shaped eggs on the underside of leaves, which hatch into nymphs, undergoing five moults through this wingless stage to reach adulthood in September. In common with other pentatomid bugs, *Palomena prasina* adults can communicate by singing, using vibrations that tell other bugs when to approach, when to stay away and when the female wants to mate.

Order : Hemiptera
SHIELD BUGS

Hawthorn shield bug

Acanthosoma haemorrhoidale

Adults (13-15mm in length) are an attractive green/brown, with some red on their "shoulders". They overwinter as adults and larvae are present from May-October, feeding mostly on haws and leaf sap. It will also feed on oak and birch, but is generally harmless in the garden and can be found easily if you search your hedges.

SPECIES PROFILE



Sloe bug

Dolycoris baccarum

This is one of the easiest shield bugs to identify. Its covering of fine hairs (which is why it is also known as the 'hairy shield bug') and distinctive ringed antennae are diagnostic. The sloe bug is frequently seen in English and Welsh gardens, but is less common further north. This species can be a minor annoyance as it feeds on small berries, and can reduce yields, and it is also one of the more potent 'stink' bugs.

SPECIES PROFILE

Spiny shield bug

Picromerus bidens

Easily recognised because the edges of the adult thorax or "shoulders" are pulled out to sharp spines. It is a rich brown colour with red legs and antennae. Adults can be found from July-October on tall herbaceous plants and low shrubs. *Picromerus bidens* is predatory, feeding on the juices of caterpillars that might be attacking your plants.

SPECIES PROFILE



Order : Hemiptera

BUGS

Dock leaf bug

Coreus marginatus

Also known as the squash bug, this is one of the most common bugs found in British gardens. It is readily identified by the presence of two small 'horns' between its antennae. This species is often found on dock, but will also feed on the flowers and fruit of a wide range of garden plants. When handled, this species can produce a nasty smelling liquid, which can also stain if in prolonged contact with material.

SPECIES PROFILE



Pond skater

Gerris lacustris

This predatory hemipteran is a common sight on garden ponds. Pond skaters have specialised tiny hairs (microsetae, some only a few hundred nanometers in diameter) on their legs which allow them to stand on the surface of the water by trapping minuscule volumes of air. This prevents their feet from breaking the water's surface tension. They sense the struggles of insects which have fallen into the water, and quickly subdue their prey before piercing it with their rostrum. They can then suck the body fluids from their prey at leisure.

SPECIES PROFILE



Common backswimmer

Notonecta glauca

This bug is a strong flyer and quick to colonise garden ponds. Common backswimmers swim underwater, touching the surface with their elongated hind legs. They are active predators, attacking small fish and tadpoles, as well as other insects. They can give a painful bite and so should be handled with care. Sensitive hairs allow them to respond to the presence of prey in the water, and their large eyes help make them superb predators.

SPECIES PROFILE



Order : Neuroptera
LACEWINGS

Lacewings are common insects in British gardens and are easy to recognise by their transparent lace-like wings, which are nearly twice as long as the abdomen. Lacewing larvae are voracious consumers of aphids and insect eggs. There are several British lacewing species, which are often divided by colour, into green (14 species) or brown (29 species) forms. The giant lacewing (*Osmylus fulvicephalus*), with a wingspan of up to 5cm, is often found near streams and rivers. They are fairly slow moving and would make a ready meal for a foraging bird, so are rarely seen flying during the day. Instead of feeding on aphids, the larvae of the giant lacewing are semi-aquatic, and feed on the larvae of midges and other small species. Lacewings can be encouraged to remain in your garden by providing homes for their winter hibernation, which can be bought from some garden centres. They will be ready to lay eggs and help to control your aphids when they emerge from hibernation in the spring.



FACT FILE

- Lacewings court by 'tremulation', a low-frequency sound produced by vibrating their abdomens, which in turn causes the substrate they are standing on to vibrate. The males and females will take turns tremulating; this duet is an essential prerequisite for mating.
- The common green lacewing was thought to be one species, but recent research has shown that they are several closely-related species, which can only be distinguished by their courtship songs.

SPECIES PROFILE

Green lacewing *Chrysoperla carnea*

The green lacewing is a pale green insect of around 10mm in length, with long fine antennae. The female lacewing lays eggs, which hang on individual stalks from leaves. This reduces the chances of cannibalism among the larvae, which are often known as aphid lions. The larvae forage for aphids and other soft-bodied insect prey on the leaves of plants, and there are records of individual larvae eating up to 60 small aphids in an hour. The larvae will feed for several weeks before pupating in small silken cocoons, although the time taken depends on the ambient temperature. The adults will also eat aphids in addition to feeding on nectar and pollen. There are usually two generations a year. In some countries, such as the US and Egypt, green lacewings are available commercially for the control of pests in cotton crops.

Order : Coleoptera

BETLES

Coleoptera are the largest and most diverse insect order, with almost 400,000 known species (4,000 UK species). Beetles are armour-plated, with hardened forewings (elytra) that cover and protect the membranous hind wings, although in some species the hind wings are absent. If the forewings overlap and are membranous at the tip, then the insect is probably a bug. Their hard cuticle makes them fairly resistant to desiccation and they can live in water, using the space between their wing cases and bodies as an air tank. All beetles have biting mouthparts, whereas bugs have a long sucking tube on the insect's underside. Many beetles are important predators of garden pests and should be encouraged into the garden. Some eat plants and can be serious pests. Often it is the larvae that do the damage and there are four beetle species in the Royal Horticultural Society's top ten garden pests; vine weevil, viburnum beetle, rosemary beetle and lily beetle.



FACT FILE

- Beetles represent 25% of all known species in the world.
- The largest beetles (Cerambycidae from Fiji and the Amazon) have larvae that can grow up to 20cm in length.
- Fireflies and glowworms (Lampyridae family) are beetles that use light to attract mates. In some cultures, these have been used as hair decoration for night time ceremonies.
- Ancient Egyptians venerated the dung beetles (Scarabaeinae), associating their dung-rolling with their sun-God, who rolled the sun across the skies.

SPECIES PROFILE

Harlequin ladybird *Harmonia axyridis*

The harlequin ladybird is a native of Asia but has been introduced to many countries to control aphids on crops. It arrived in Britain from continental Europe in 2004 and has since spread rapidly throughout the country. This is of concern since it is a top predator and competes with native ladybirds as well as other aphid predators. The harlequin ladybird has a variety of colour patterns of the elytra. These vary from all one colour (orange or red) to up to 21 black or red spots. The most common patterns found in the UK are orange with 15-21 black spots or black with two or four orange or red spots. Adults are relatively large at 7-8mm. Ladybirds less than 5mm long are definitely not harlequins.

Order : Coleoptera

GROUND BEETLES

Ground beetles are members of the Carabidae family, which contains around 350 species in Britain. Most ground beetles are voracious predators. As the name suggests, many ground beetles spend their time on the ground and few can fly. The fusion of their wing cases (elytra) acts as protecting armour. Both larvae and adults are carnivorous and often specialise in eating slugs and snails, as well as eating a range of carrion. Depending on the ground beetle species, they will also attack aphids and other pest insects. By encouraging them into your garden you can start on the road to a natural method of pest control. Many ground beetles are nocturnal and need some form of shade during the day. Provide them with shelter such as a log pile, leaf litter or just some large stones. Ground beetles can be found throughout the year, although they hibernate during the coldest winter months, sometimes in garden sheds.



FACT FILE

- When threatened, ground beetles can discharge a noxious, highly irritant fluid (harmless to humans) from the tip of their abdomen. Females also use this as their own can of 'pepper spray' to deter over-amorous males.
- Many ground beetles eat by vomiting on their prey and waiting for their digestive enzymes to make the food more fluid and easier to eat.
- While most carabid beetles only live for a year or two, species adapted to live in low nutrient environments such as caves can live for up to six years.

SPECIES PROFILE

Violet ground beetle *Carabus violaceus*

Carabus violaceus is a relatively large (20 – 30 mm) ground beetle, common in gardens and hedgerows. Its name comes from the bright violet sheen around the edges of the wing cases and thorax. The violet ground beetle is difficult to separate from the species *Carabus problematicus*; they look almost identical. The small rounded bumps found on the wing case always form longitudinal rows in *Carabus problematicus*, whereas they are more often irregular in *Carabus violaceus*. *Carabus violaceus* is an extremely useful predator of slugs. Slugs defend themselves by producing copious amounts of sticky mucus. The violet ground beetle is able to prevent this response by effectively paralysing them with a blow to the mantle, the saddle-like structure on their back through which they breathe. Recent research shows that they also eat the vine weevil and could be deployed to naturally control these pests.

Order : Coleoptera
WEEVILS

There are over 50,000 weevil species worldwide, many of which are pests. Weevils are a highly successful group of beetles (the Curculionidae) characterised by their prominent snout (called a rostrum) with jaws at the tip. This family is represented by more than 400 species in Britain. They are easily identified by their elbowed antennae located half way down the rostrum. Weevils are herbivores and often lay their eggs inside the host plant, where the larvae develop. Some species (e.g. *Sitophilus* species) are major pests of grain and other seeds worldwide. The female will drill a hole in the grain and lay an egg inside. The larva develops to the adult stage inside the seed, eating it from the inside out. The economic loss resulting from weevil infestation is enormous, especially in developing countries. Attempts to control these pests with insecticides have often failed because the beetles, like other pest insects (e.g. mosquitoes, aphids), have evolved resistance to the toxic effects of the chemicals.



FACT FILE

- Boll weevils almost devastated the US cotton industry, which has only been saved by the use of huge amounts of insecticides.
- The large larvae of the palm weevil *Rhynchophorus phoenicis* are a traditional food item in Angola.
- The tiny weevil *Cyrtobagous salviniae* is responsible for saving communities in Papua New Guinea. It was introduced as a means of controlling the aquatic fern *Salvinia*, which can completely block waterways.

SPECIES PROFILE

Vine weevil *Otiorhynchus sulcatus*

Adult vine weevils are a dull black colour with small patches of yellow on the wing case. They are flightless, 7 – 10 mm in length, and have a fairly short rostrum. As their name suggests, they are major pests of vines, but are also serious pests of many other plants. Vine weevils attack on two fronts. The larvae eat roots and other parts of the plant below the soil, whereas the adults eat the leaves. Plants grow slowly, wilt and eventually die. Their biology is unusual in that like aphids, they can reproduce without sex. One female is able to lay hundreds of eggs throughout the summer. These are normally laid on the soil to allow the larvae to burrow down and eat the plant from below ground. To control vine weevils, encourage predatory ground beetles into the garden by providing them with shelter. Nematodes are also commercially available to target the larvae.

Order : Coleoptera
LADYBIRDS

There can be few insects more readily identifiable than ladybird beetles, yet they do not all have the common red and black colour pattern. For example, some are yellow with black spots. There are about 42 species found in the UK, and they are in the family Coccinellidae, which means 'little sphere' - a good description. Many are excellent predators of pest insects in the garden. Over-ambitious two-spot ladybirds (*Adalia bipunctata*) can succumb to a fungal sexually transmitted disease. Surprisingly, ladybirds from central London have higher rates of the disease than those outside the capital. It appears that the increased promiscuity of the urban ladybirds is a result of the centre of the capital being warmer than the outskirts. As a consequence, city ladybirds are active (in all senses) for longer than those in the suburbs. Ladybirds can generally be found in gardens from March to October.



FACT FILE

- Numbers of some ladybird species have been rapidly declining since the late 1990s, which may be due to an increase in numbers of a parasitic wasp, *Dinocampus coccinellae*, which attacks adult ladybirds.
- One of the biggest threats to a young ladybird is another young ladybird – cannibalism is common, even though larvae may try to avoid eating their siblings.
- The bright patterns on many ladybirds are an example of aposematic (warning) colouration – ladybirds taste vile!

SPECIES PROFILE

Seven-spot ladybird *Coccinella septempunctata*

The largest and most common ladybird in the UK is the seven-spot ladybird, *Coccinella septempunctata*. Each adult is 6 - 8mm long and is easily identified by the seven black spots on the elytra (wing cases) and the white patches on the sides of its head. The eggs are laid in batches of 10 - 50 in aphid colonies and the larvae can eat scores of aphids each day. *Coccinella septempunctata* is one of several ladybird species that has been introduced into other countries to help control crop pests. However, there are fears in the USA that the introduced ladybirds are displacing native species, reducing biodiversity and having a detrimental impact on ecological communities. *Coccinella septempunctata* hibernate during the winter in colonies of up to several thousand adults, often in houses and garden sheds, where they should be left undisturbed, if possible.

Order : Coleoptera

BETLES

Soldier beetle

Rhagonycha fulva

Soldier beetles (Family Cantharidae) are named after 17th-19th century British soldiers who wore bright red coats. Adults, a familiar sight in July/August, are 7-10mm in length and have orange elytra (wing cases) with black tips. *Rhagonycha fulva* feeds on nectar, preferring open-structured flower heads such as umbellifers. Both adults and their caterpillar-like young eat other insects, making them excellent 'pest controllers'.

SPECIES PROFILE

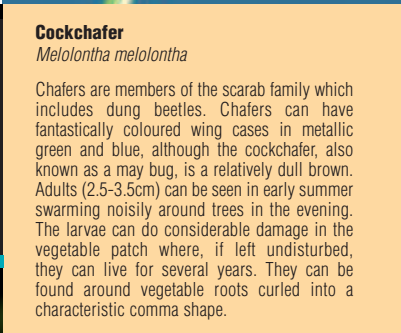


Cockchafer

Melolontha melolontha

Chafers are members of the scarab family which includes dung beetles. Chafers can have fantastically coloured wing cases in metallic green and blue, although the cockchafer, also known as a may bug, is a relatively dull brown. Adults (2.5-3.5cm) can be seen in early summer swarming noisily around trees in the evening. The larvae can do considerable damage in the vegetable patch where, if left undisturbed, they can live for several years. They can be found around vegetable roots curled into a characteristic comma shape.

SPECIES PROFILE



Rosemary beetle

Chrysolina americana

There are more than 25,000 species of leaf beetle worldwide. Many are serious pests of garden plants and crops and include the asparagus beetle, the lily beetle and the notorious colorado beetle. Despite this, many leaf beetles are living jewels. The rosemary beetle (6-8mm long) is a stunning example of this, with metallic purple and green stripes on their wing cases and thorax. Initially found at Wisley, Surrey in 1994, it is rapidly spreading throughout England and Wales.

SPECIES PROFILE



Order : Diptera

FLIES

True flies are from the order Diptera meaning two wings. Their hind wings have been reduced down to small club-shaped structures called halteres that help balance the insect in flight. This is an enormous and diverse group of insects, with more than 5,200 species recorded in Britain, many of which can be seen in the garden.

Many important disease carrying insects are flies because they either suck blood or lay their eggs in flesh or food. All flies imbibe liquid food and lack the ability to gnaw or slice food. Fly lifestyles vary enormously between species and also, between life stages. Some flies, including mosquitoes and midges, live in the water when young and in the air when adult and it is common for the immature and mature stages to eat completely different foods.



FACT FILE

- Your doctor can prescribe you greenbottle (*Lucilia*) maggots on the NHS (LarvE) to clean septic wounds and encourage healing.
- Cluster flies *Pollenia rudis* are often found in dense aggregations in houses and out-houses in the autumn. Their larvae eat earthworms; adults lay their eggs on the soil and the larvae burrow down until they find a worm to feed on.
- Flies are generally considered poor flower pollinators because of the small amount of pollen they carry and lack of flower specificity.

SPECIES PROFILE

Bee fly *Bombylius major*

Although these furry insects look like delicate bumblebees, they are in fact flies (bees have four wings). They mimic bees but are easy to recognise with their long, rigid proboscis and long spindly legs. Adults are 12-18 mm long and are often seen in spring hovering over flowers such as primroses and *Aubretia* (much like a humming bird). They can also be seen hovering low over the lawn, in which case they are looking for the nests of solitary bees. Bee fly larvae are all parasitic on other insects. *Bombylius major* lays its eggs near the opening to the nest and its larvae go on to eat both the bee's food and its young. There are 10 bee fly species in Britain.

Order : Diptera
HOVERFLIES

Many hoverfly species mimic wasp colouration to avoid attack by birds and other predators. This is an example of Batesian mimicry, where harmless species mimic dangerous species, gaining protection from visually searching natural enemies. Over 250 species have been recorded in the UK, and more than 85 species have been found in a single garden. Hoverfly adults are generally seen on the wing between March and early November. While the adult hoverfly mainly feeds on nectar and pollen, the larvae of many species are voracious predators of aphids and other garden pests. As a result, hoverflies should be welcome in any garden, acting both as efficient pollinators and pest controllers. The female hoverfly requires pollen and nectar to mature her eggs, and then uses aphid honeydew as a cue to locate aphid colonies.

FACT FILE

- Hoverflies can fly in bursts of up to 40km per hour.
- The rat-tailed maggot is the larva of a hoverfly species, the drone fly *Eristalis tenax*. It lives in foetid habitats such as stagnant water, sewage and farmyard manure. To compensate for the low oxygen levels in these environments it breathes through its tail, using it like a snorkel.
- Hoverfly sexes can be separated by looking at their eyes – the male's eyes meet at the top of the head, whereas the female's eyes are separated by a gap.

The marmalade hoverfly *Episyrphus balteatus*

Episyrphus balteatus is one of the most common species of hoverfly in the UK. Like all hoverflies, *Episyrphus balteatus* is easy to identify by its ability to hover and change direction at seemingly impossible speeds. The black and yellow stripes change through the year. Individuals emerging earlier in the year tend to have wider dark stripes, as this helps them to warm up more quickly on chilly mornings. As the days get warmer, emerging individuals will have narrower stripes. This relationship between temperature and colour is known as thermal melanism. The population size of *Episyrphus balteatus* varies greatly from year to year. In part this is because the species is largely migratory. Numbers arriving and the timing of their appearance in the UK in the spring are influenced by weather conditions on the continent.

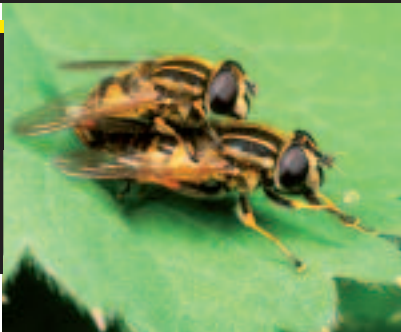
Order : Diptera
HOVERFLIES

Sun fly

Helophilus pendulus

The sun fly gains its common name from the suggestion that you will only observe them when the sun is shining. In contrast to many garden hoverfly species, the larvae of *Helophilus pendulus* are not predators of aphids. Instead, the larvae develop in stagnant bodies of water, and even occasionally in very wet manure or cow dung, where they feed on bacteria. The larvae use their elongated 'tails' as snorkels to breathe.

SPECIES PROFILE



Drone fly

Eristalis tenax

The drone fly is named after its resemblance to a male honey bee, although it is easy to tell them apart – hoverflies have only one pair of wings and lack the bee's 'waist'. Males are often seen hovering in gardens, waiting to pounce on a passing female. Indeed, if you carefully toss a small hoverfly-sized item past a hovering male, they will chase after it. Drone flies have been accidentally introduced into North America where they are now widespread and abundant, but are not thought to have resulted in any ecological problems.

SPECIES PROFILE



Rhingia campestris

Rhingia campestris

Rhingia campestris is instantly recognisable, with its peculiar 'beak'. Male and female *Rhingia* require different nutrients, reflecting the costs of developing eggs. While both sexes feed on flowers, adult males tend to feed more on the carbohydrate rich nectar, whereas females consume more of the protein rich pollen. *Rhingia campestris* larvae develop in dung and are more likely to be seen in rural and semi-rural gardens.

SPECIES PROFILE



Order : Diptera
MOSQUITOES

Although you probably associate mosquitoes with warm climates, 32 species have been recorded in Britain. These include species that transmit diseases elsewhere in the world. Although you may not consider them to be garden insects, there is a high chance that some species are breeding in water-filled containers in your garden from May onwards. They will happily live in water butts and any other reasonable sized container that has standing water; they have even been known to lay eggs in water dishes put out for pets. Mosquitoes lay their eggs in still water and begin life as aquatic larvae and pupae, breathing oxygen from the surface. Adults emerge from the pupal stage and most female mosquitoes need to feed on blood to produce eggs. Most British species will bite humans, but they usually feed on frogs, birds, mammals and reptiles. The male mosquito only feeds on nectar and honeydew.



FACT FILE

- The biggest mosquito is *Toxorhynchites*, with a wingspan of up to 2.5cm. It doesn't bite and the larvae eat larvae of other mosquito species.
- Larvae of the mosquito *Coquillettidia richiardii* breathe oxygen by penetrating the vascular system of submerged aquatic plants.
- Adult mosquitoes of the human-biting form of *Culex pipiens* are spreading worldwide from Africa by stowing away on airplanes. They have been caught on planes landing at Heathrow. Larvae also travel across oceans on boats transporting old tyres filled with water.

SPECIES PROFILE

Common house mosquito *Culex pipiens*

This is the most common mosquito in Britain, breeding in water butts and other artificial containers from late April onwards. Eggs are laid in black boat-shaped rafts of up to 5mm in length, which sit on the water surface. These hatch into tiny larvae which hang from the surface and undergo four moults before turning into comma-shaped pupae. The typical form of this species in Britain rarely bites people, preferring amphibian and reptile blood. Females emerging after August will use blood to survive hibernation, which is usually in an unheated building or cave. If you go into old-fashioned unheated toilets in public houses, they can be found sitting quietly high up on cubicle walls during the winter. *Culex pipiens* is part of a complex of species that can breed with each other that includes human-biting forms that can transmit diseases such as encephalitis and filariasis (elephantiasis).

Order : Lepidoptera

BUTTERFLIES AND MOTHS

There are more than 150,000 species of Lepidoptera (butterflies and moths) worldwide and around 2,500 in Britain. As a rule of thumb butterflies are usually brightly coloured day-flying insects, have clubbed antennae and hold their wings vertically above the body at rest. In contrast, most moths are nocturnal, hold their wings flat at rest and have either hair-like or feathery antennae. Lepidoptera have mostly herbivorous larvae (caterpillars), which, depending on the species, are able to eat almost any part of the plant from the root to the leaves, flowers and seeds. Some Lepidoptera are considered to be pests in the garden. Many leaf miners are moth larvae feeding inside the leaf. Butterfly larvae of the Pieridae family are pests of brassicas and moth larvae of the Tortricidae are pests of trees, including fruit trees (i.e. codlin moth, *Cydia pomonella*). However, the majority of British Lepidoptera are not pests.



FACT FILE

- Moth sexes communicate using odours (pheromones). Bolas spiders mimic female moth pheromones to lure male moths to their death.
- Some male butterflies, having mated, will plug the female's genitalia with a sticky secretion to prevent other males from fertilising her eggs.
- Some species of noctuid moth have switched from eating fruit juice to mammalian blood, making them vampire moths.

SPECIES PROFILE

Large white (cabbage white) *Pieris brassicae*

Familiar to most gardeners, adult male large whites are white with black tips to their forewings. Females have additional pronounced black spots. In both sexes the hind wings range from white to yellow on the underside. The large white can be a pest of brassicas. To avoid laying eggs on the wrong plant, the female uses specialised chemical receptors on her feet to test for mustard oils. If the plant is acceptable, she lays the bright yellow eggs in batches of up to 100 on the underside of the leaf. The caterpillars break down the mustard oils in the leaves and use them as a chemical defence against predators. Their green, yellow and black colours are a warning that they are distasteful. The larvae can be controlled using a biological insecticide called *Bacillus thuringiensis*, but consider that you are also killing the beautiful adult.

Order : Lepidoptera

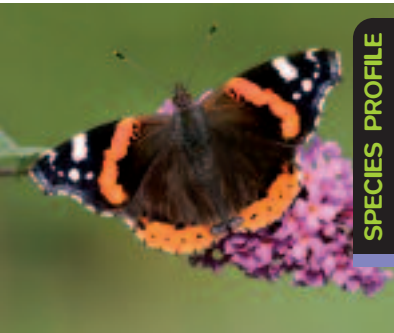
BUTTERFLIES

Small white

Pieris (Artoeja) rapae

The small white is found in gardens all over the UK, where its caterpillars feed on the leaves of brassicas (the cabbage family). In contrast to the caterpillars of the large white, those of the small white are solitary and hard to locate. Adult large and small whites do look similar, although the large whites are up to half as large again as their smaller namesake. Small whites have more angular wings and paler markings, making identification straightforward.

SPECIES PROFILE



SPECIES PROFILE

Red admiral

Vanessa atalanta

This is a familiar visitor to the garden, especially later in the summer and into autumn when the adults feed on nectar from plants such as *Buddleia*, or on the fermenting juice of windfall apples. Few red admirals overwinter in the UK, and our population relies upon the arrival of migrants from the continent in early summer. These arrivals lay their eggs on nettles. The caterpillars fold the nettle leaves and glue the edges together with silk, protecting them from foraging predators and parasitoids.

Large skipper

Ochlodes sylvanus

This butterfly is found throughout England, and its range is expanding northwards. The adults hold their upper and lower wings at oblique angles, making them easy to identify. Males have a dark line on their fore-wings, which marks the presence of scent glands. The caterpillars have a specialised comb-like organ which is used to flick away droppings; this frass acts as an attractant to parasitic wasps, and this adaptation may reduce the likelihood of attack.

SPECIES PROFILE



Order : Lepidoptera
HAWK-MOTHS

Hawk-moths are large, exotic-looking moths which mostly inhabit tropical areas. Of the 17 species of hawk-moth in Britain, only 9 are permanent residents. They are supposedly named after hawks because of their size (the largest in Britain has a wing-span of 10cm) and ability to hover. You can recognise the larvae by their characteristic horn at the rear end. They tend to be larger than the average caterpillar, growing up to 10cm in length. Many hawk-moth species found in Britain migrate hundreds of miles from southern Europe and northern Africa. They are very strong fliers and can reach speeds of up to 15 miles an hour. Many hawk-moths are named after their main food plant, hence the privet, bedstraw, spurge and convolvulus hawk-moths. They mostly feed on trees and various weeds and are unlikely to be a pest in the garden, although some species will feed on fuschia. To attract hawk-moth adults into your garden, plant honeysuckle, jasmine, petunia or sweet tobacco as a source of nectar.



FACT FILE

- 2003 saw an explosion in the number of hummingbird hawk-moths (*Macroglossum stellatarum*) as summer visitors to the UK, prompting a number of sightings of "hummingbirds" by the general public.
- Adult hawk-moths can be lured into your garden by painting molasses or beer onto a post.
- The Death's-head hawk-moth *Acherontia atropos* is so called because of skull-like markings on the thorax. You have probably seen an artistically enhanced version of it on a poster for the film "The Silence of the Lambs".

SPECIES PROFILE

Elephant hawk-moth *Deilephila elpenor*

This night-flying moth is named from the trunk-like snout of the caterpillar. The adult is easy to recognise, with its olive-brown and bright pink coloration. It is one of the smaller of the hawk-moths with a wingspan of around 7-8cm. For those with urban gardens, it is perhaps the easiest to attract, since it will breed on rosebay willow-herb, a common wild flower in towns. The caterpillar is not as beautiful as the adult, and generally sports a drab muddy-brown cuticle although it is sometimes green. It does however have spectacular eye-spots on the segments close to the head. If threatened, it can retract its head and puff up the eye-spots and sway from side-to-side to deter predators.

Order : Lepidoptera

MOTHS

Angle shades moth

Phlogophora meticulosa

The angle shades moth is a common garden visitor between May to July and August to October. It folds its green and brown wings at rest to mimic a crumpled leaf. The caterpillars are green or brown and are found in wildlife gardens feeding on weeds like dock, nettle, chickweed and bramble.

SPECIES PROFILE



SPECIES PROFILE

Peppered moth

Biston betularia

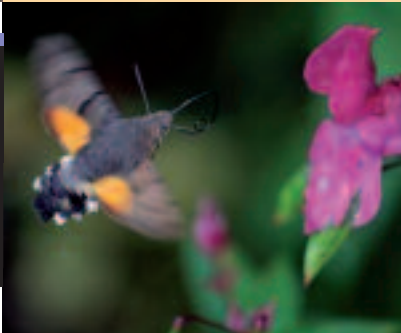
Evolution textbooks give peppered moths as an example of natural selection. The black and peppered forms are selectively eaten by birds depending on whether they rested on polluted (black) or unpolluted trees. Recent data has confirmed this finding. Adults have a 22-23mm wing span and fly at night, but can be spotted resting on tree trunks. Larvae feed on bushes and trees like oak, birch (hence name), plum and bramble.

Hummingbird hawk-moth

Macroglossum stellatarum

These large moths (40 – 50mm wingspan) look just like small hummingbirds as they sip nectar in flight and are unusual in that they fly during the day. It is an immigrant species which sometimes occurs in large numbers. The larvae feed on bedstraw (*Gallium*).

SPECIES PROFILE



Order : Hymenoptera

BEES, ANTS AND WASPS

As a group, we rely on the Hymenoptera more than any other animals for our survival. They are the most important pollinators of our crops; it is estimated that one third of our food production relies on bees. They cycle nutrients in soils, and in some temperate regions ants are as vital as earthworms. Parasitic forms are hugely significant in controlling the numbers of many insect pests, and have prevented the loss of staple crops such as cassava in developing parts of the world. There is thought to be over 250,000 species of bees, ants and wasps, and this biodiversity reflects the many ecological niches they fill. It has been suggested that if you add together the biomass of ants and termites in tropical South America, that it would exceed the combined biomass of all other animals in the same region, including people.



FACT FILE

- In many Hymenopterans the specialised egg-laying organ (the ovipositor) has evolved into the familiar sting.
- The ability to sting is a hugely important adaptation for many species. It allows wasps to attack and subdue prey, and also acts as a potent defence.
- Wasp stings lack barbs, in contrast to bee stings. Wasps also produce much less venom per sting, meaning that a single wasp can attack many times, whereas a bee stings once, and then dies. This reflects the different roles for the sting: bees tend to sting as a last-ditch defence, wasps because they are predators.

SPECIES PROFILE

Honeybee *Apis mellifera*

Honeybees are among the most important of garden insects, acting as pollinators for a wide range of flowering plants. Honeybees have been domesticated for use in crop pollination and for the production of honey and wax. Commercial honeybee hives are under serious threat from a mite called *Varroa destructor*. *Varroa* has recently evolved resistance to pyrethroids, the main chemical used in their control. Some wild honeybees are naturally resistant to the mite. Entomologists are currently trying to crossbreed these strains with domesticated honeybees, so that commercial hives gain a measure of natural resistance to *Varroa*.

Order : Hymenoptera
BUMBLEBEES

Bumblebees are hairy, rotund insects, familiar to almost everyone. They are excellent pollinators and play an important role in the garden. In the spring the queen will look for a suitable home, such as an old mouse nest, and may fight a rival queen bee to the death for occupancy. Bumblebees have a rigid social structure, which is dominated by the queen. She will lay eggs to produce female workers to serve her, controlling them through aggression and by producing chemical messengers (pheromones) that inhibit their sexual development. Eventually she loses control and both sexes are produced. There are 25 species of bumblebee in the UK. Unfortunately bumblebees are in decline in Europe, probably due to the intensification of farming. Three species have gone extinct in the UK in the past 30 years alone. Encourage them into your garden by planting wild plants, such as honeysuckle, comfrey, knapweed, red clover or flowering currant. These together flower over the bumblebee flying period from March to October.



FACT FILE

- The length of a bumblebee's tongue will determine which flower species it can feed on.
- Long-tongued bumblebees are close to extinction in the UK.
- Bumblebees leave chemical post-it notes on flowers they have just visited to tell others that they have taken all the nectar.
- The cutting of hay meadows during May - August can be disastrous for bumblebees - it destroys nectar-producing flowers and the surface nests of some species.

SPECIES PROFILE

Buff-tailed bumblebee *Bombus terrestris*

Bombus terrestris is extremely common in UK gardens. It is characterised by a brownish-orange or white (as in the picture above) tip to the abdomen and has black and golden yellow/orange stripes on the thorax. It is sometimes confused with *Bombus lucorum*, which always has a white tip and more yellowy stripes. *Bombus terrestris* is one of the larger bumblebees and has a short tongue so it forages on flowers with shallower nectar chambers such as daisies. It is able to feed on flowers with longer chambers by biting a hole further down the flower. In Australia *Bombus terrestris* is thought to be out-competing native bees and is held to be partially responsible for the spread of exotic weeds.

Order : Hymenoptera
SOLITARY BEES

There are more than 200 species of solitary bee in Britain. They are so named because, unlike honeybees and bumblebees, they do not live in colonies. The first solitary bees to appear in the garden, as early as March each year, are the miner bees (*Andrena*). Similar to honeybees in appearance, they lack pollen baskets on their hind tibiae. These hairy bees make nests in the ground, usually in sandy soil and along paths. The female will dig the nest, stock it with nectar and pollen and then seal it, leaving the young to fend for themselves. Also to be seen later on in the season are the leaf-cutter bees such as the *Megachile* species, which cut neat circles out of rose leaves and petals to build nests in dead plant stems or sometimes in stacks of old flowerpots. These bees resemble honeybees but can be distinguished by the bright orange pollen brushes under their abdomens. All solitary bees are excellent pollinators and should be encouraged into your garden.



FACT FILE

- Cuckoo bees lay their eggs in the nests of bumblebees. Having killed the honeybee queen, the female cuckoo bee leaves her offspring to be reared by the bumblebee workers.
- Bees are also parasitized by the Bee Fly *Bombylius major*. This stout and furry fly looks like a bumblebee with long thin legs. It lays eggs close to the entrance to solitary nests and the larvae feed on bee larvae and their stored food.

SPECIES PROFILE

Red mason bee *Osmia rufa*

Osmia rufa is a small bee which often nests in walls and uses mud or sand grains glued together with saliva to construct its nest, a series of cells in a row. Active from late March to July, *Osmia rufa* is a highly efficient pollinator of fruit. They can fly at lower temperatures than honeybees and visit many more flowers. A single female *Osmia rufa* can pollinate as many fruit trees as more than one hundred honeybees! Red mason bees are not aggressive and are very unlikely to sting. They are therefore ideal to encourage an entomological interest in children. Artificial nests can be purchased to encourage *Osmia* into the garden.

Order : Hymenoptera
SOCIAL WASPS

Social wasps, as their name suggests, live in colonies. The make-up of these colonies is similar to that of other social Hymenoptera (ants, honeybees), with a dominant reproductive queen, reproductive males (drones) and non-reproductive worker females. The workers spend much of their time foraging, and wasps are important predators of insect pests such as caterpillars and other small soft-bodied insects. The insects are fed to the wasp larvae, and in return the larvae exude a sweet substance to feed the workers. In autumn, when the queen stops producing eggs, the workers no longer have their food, forcing them to search for replacement sources of sugar. Normally, this would be found on rotting fruit, but the abundance of sweet human foods such as jam encourages them to invite themselves to our tables. This explains why wasps are generally only a nuisance in the autumn.



FACT FILE

- European wasps have been accidentally introduced into Australia and New Zealand, where they have had significant deleterious effects on native biodiversity, feeding on native invertebrates and competing with birds for prey.
- The cuckoo wasp, *Vespa austriaca*, lays her eggs in the nests of a related species, the red wasp, *Vespa rufa*.
- The hornet, *Vespa crabro*, is the largest British wasp. If your garden has old trees, which hornets use to nest, then you may see these rare insects. Be careful, as they can be aggressive.

SPECIES PROFILE

Common wasp *Vespa vulgaris*

The common wasp can be identified by the anchor-like black markings on its face. Queen common wasps hibernate over winter, and on emergence build a nest in a tree hollow, underground crevice or occasionally in cavities in buildings. Early in the summer, wasps are often seen scraping at wooden fencing to collect material for their nests. The wood pulp mixed with wasp saliva produces a paper, which is formed into the cells of the nest. The first eggs (which are fertilised using sperm the queen has stored since the previous autumn) result in workers, which allow the queen to devote herself to egg production. In a short time, the colony will contain around 2,000 wasps. In autumn, the queen produces reproductive females and males (drones). After mating, the new queens hibernate, while the males and workers slowly die through starvation and cold weather.

Order : Hymenoptera

PARASITOID WASPS

Parasitoid wasps lay their eggs on or in other insects. Their life cycle is gruesome - the egg hatches and the parasitoid larva eats the host alive before emerging as an adult. These insects have an important part to play in all terrestrial ecosystems, including your garden habitats. In spite of this critical role, few people are familiar with parasitoids, unaware that they kill enormous numbers of garden pests, such as aphids. They are visible as adults from late spring until early autumn. Parasitoid wasps are produced on an industrial scale by several firms, for release in fields and greenhouses. You can even order smaller numbers for use in your greenhouse from many garden centres. For example, *Aphidius ervi* can be used to control a number of pests, including the pea aphid and the potato aphid.



FACT FILE

- Female parasitoid wasps of many species can choose the sex of their offspring, by controlling whether the egg is fertilised (female) or not (male).
- If a female finds a good quality host, providing lots of food for her offspring, then she will often place a female egg in it. Female parasitoids benefit more than males from having extra food.
- Aphids containing a parasitoid pupa can be recognised by their brown, papery appearance and are often referred to as mummies.

SPECIES PROFILE

The hoverfly parasitoid *Diplazon laetatorius*

Although many parasitoid species play an important role in insect pest management, a few interfere with its success. The larvae of some hoverfly species can eat hundreds of aphids in a few days and should be welcomed in the garden. However, in nature everything has a natural enemy, and hoverflies are no exception. In the field, *Diplazon laetatorius* can attack, and eventually kill, over half of all aphid-eating hoverfly larvae. The hoverfly larvae are not defenceless. If behavioural defences fail, then the second line of resistance is an immune response. The parasitoid egg is surrounded by specialised blood cells which release poisonous compounds that kill the invader. About 20% of *Diplazon laetatorius* attacks on the marmalade hoverfly fail due to host immunity. In contrast to many parasitoid wasps, this species reproduces asexually and only has female offspring.

Ants are among the most abundant organisms on Earth, with some estimates suggesting that there are over 10 quadrillion alive at any one time, mainly in tropical rain forests. There are around 50 ant species in the UK, and some experts suggest that this number will increase as our climate becomes drier as a result of global warming. Gardens are home to several species of ant, many of which 'farm' aphids for their sweet honeydew. In return, they protect the aphid colonies from attack by natural enemies. They will carry individuals to fresh host plants so that new colonies can be founded. Have a look at any large aphid colony and you are likely to be able to see this amazing interaction at work. Some ant species are among a critically important group of organisms ecologists have termed 'ecosystem engineers', as they can have a profound effect on their environment. However, common garden ants are not in this league, although they can cause some minor disturbance around plants as they dig their nests.



FACT FILE

- Ants have complex social structures, with a queen, males and a large number of workers. The queen may live for up to 15 years.
- Red wood ants, *Formica rufa*, are renowned for their defensive behaviour, attacking potential threats with a combination of biting and squirting formic acid from a specialised gland in their abdomen.
- Several bird species will groom by sitting on ant nests (especially wood ants), and allowing the ants to clamber over them. The ants' formic acid may kill some of the birds' lice.

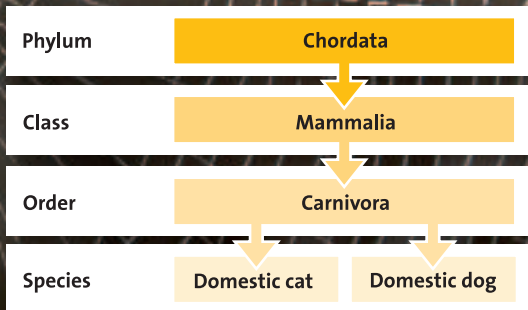
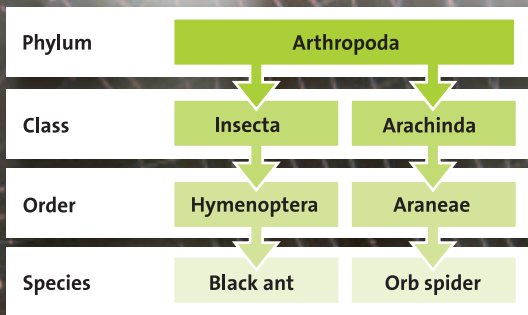
SPECIES PROFILE

Common black ant *Lasius niger*

The common black ant, which is sometimes brown and relatively hairy, is the species most frequently seen in the garden. It is not very adept at building and so needs to find stones or pieces of wood under which to make the nest. It often builds nests under paving slabs and sometimes even invades the nests of other ant species that are better construction workers. In late summer you may come across a swarm, where winged males and queens mate in mid-air. The males die after mating, leaving the queen to found a new colony. First, she bites off her wings and then searches for a suitable crevice. She then lays her first eggs, which become workers. These non-breeding females take on the role of guardians and provisioners of the colony.

Phylum : Arthropoda
NOT AN INSECT

Many people don't understand the term "insect" and use it to describe all terrestrial arthropods and even sometimes worms and snails. Spiders, centipedes, ticks, millipedes, woodlice, and scorpions are all arthropods but not one of them is an insect. Insect adults have six legs, a defined head, thorax and abdomen and most adult insects have wings (see the section on insect classification). They undergo either a complete or partial metamorphosis during development, which means that the young can look very different from the adult. Many arthropods can grow by shedding their skin, but once insects reach adulthood, their main function is reproduction and only primitive insects like silverfish continue to grow. Does it matter that people call spiders, centipedes and millipedes insects? Would you accept it if someone used the term "dog" when referring to a cat? It would be far more accurate than calling a spider an insect, since cats and dogs have the same number of legs, mode of reproduction and in evolutionary terms are closely related:



Order : Various

THREE NON-INSECTS

Woodlice (Order Isopoda)

Woodlice are crustaceans, with seven pairs of legs. They are more closely related to lobsters and shrimps than they are to insects. Many people think that woodlice are pests, but in fact they are essential recyclers in the garden, chewing up dead and decomposing plant tissues, so helping to return nutrients to the soil. They can be found under flowerpots, logs and leaf litter, preferring the damp and dark corners of the garden.

ORDER PROFILE



CLASS PROFILE

Centipedes (Class Chilopoda)


Centipedes such as *Lithobius forficatus* (left) are flattened, elongated arthropods. They are active predators, feeding on insects and earthworms. They kill their prey using modified venomous claws and can give humans a painful sting. They generally have fewer legs than millipedes, but some species have well over 100 pairs. Centipedes are also found in moist and dark habitats. Symphylans, with 12 pairs of legs, are sometimes confused with centipedes. They are small (2-10mm) vegetarians and can be pests in the greenhouse.

Millipedes (Class Diplopoda)


Millipedes are also known as Diplopods, which means double-footed. They don't have a thousand legs, but their numerous abdominal segments (up to 100) each have two pairs of legs. Whereas centipedes are often flattened and very active, the millipede is cylindrical and less active. Millipedes eat decaying plant and animal matter and sometimes living plants. Like woodlice, they like to hide under stones and logs where it is dark and moist.

CLASS PROFILE







Everyone can do something to encourage insects into their garden. Not all of the suggestions given below will be possible in every garden; some are clearly only feasible if you have a larger plot. However, many of these suggestions will be possible, even with the tiniest of gardens. Appropriate food plants in containers will help attract insects into the garden and small piles of broken pots can help provide shelter.




If you have a garden that is large enough for you to have a small patch of "waste ground", allow native wild plants to grow. Nettles in your garden will support a number of butterfly and moth species, but should be in full sun to attract butterflies.




Nettles also support a range of herbivorous insects that are attacked by predators, such as ladybirds and hoverflies. Your nettle patch can be used to provide a reservoir for natural enemies of pests in the rest of your garden.




Allow a section of your lawn to grow into a small meadow. Even a very small section can be effective. Different grass species interspersed with wild flowers such as ox-eye daisies can look beautiful and will attract more insects into the garden. If you buy wild plants or seeds, do make sure that they originate from the UK.




Try to have some form of hedgerow made from native plants such as hawthorn or hazel under-planted with woodland plants such as the bluebell *Endymion nonscriptus* and wood anemone *Anemone nemerosa*.




Make small piles from broken crocks and stones to provide shelter for ground beetles and other nocturnal insects.




Compost your rubbish rather than dispose of it. This will cut down on your garden waste, provide you with free compost and create a habitat for a variety of insects.




Avoid using chemicals if another control method will do. Be aware that you may also be killing the natural predators that feed on the pests, such as ladybirds, ground beetles, hoverflies and parasitoid wasps. If you must control pests, look into buying biological alternatives such as parasitoids, ladybirds, nematodes or microbial pesticides, which can be purchased from garden centres.




Try to live with pest insects and not automatically kill them. As long as they are not totally ruining your plant or crop, their presence may have no real impact.



Encourage pest controllers such as hedgehogs, slow worms, frogs, toads and spiders into your garden by providing suitable habitats. You can purchase toad and hedgehog houses in many garden centres or make your own.



If you don't want to plant wild flowers, traditional cottage garden plants such as lavender, *Buddleia*, wallflowers and cornflowers are ideal for nectar and pollen eating insects such as bees and butterflies.



Dig a fish-free pond! Ponds attract dragonflies and damselflies as well as other aquatic insects. They will also bring in frogs. Try and plant around the pond to provide perching points and have floating vegetation at the sides for the Odonata to lay eggs. Fish will eat the eggs of frogs and many of the larvae of aquatic insects.

GARDEN ENTOMOLOGY

Entomology (the study of insects) can be incredibly rewarding, and each garden can illustrate the fundamentals of insect ecology. Your garden will have keystone species (species fundamental to the community, such as bumble bees), predators (e.g. hoverflies and ladybirds), herbivores (e.g. aphids and caterpillars), parasitoids (similar to a parasite but they kill their host, such as *Diplazon laetatorius*), parasites (e.g. the mite *Varroa*, which attacks honeybees) and detritivores (e.g. stag beetle larvae, helping break down dead wood). These species can interact in a way that benefits one at a cost to the other, such as predators and prey, hosts and parasitoids or plants and herbivores. In addition, there can be beneficial interactions such as mutualisms (an interaction where both species benefit, such as ants protecting aphids from predators in return for honeydew) or symbioses (interactions which are essential for both species, as found with aphids and the microorganism *Buchnera*). Gardeners influence this web of interactions in many ways, such as by choosing which plants to grow, or whether to use chemical means to control pests. So before you reach for the can of insecticide, consider that you will not only be killing pests, but also beneficial insects. Just as one person's weed is another's flower, each gardener decides which insect is a pest. Aphids are a case in point. They are the classic garden pest, yet leaving a few colonies to grow provides an excellent chance to watch their interactions with ladybirds, parasitoids and ants, as well as providing an important food resource for a wide range of insects and birds. Every gardener can play an active role in maintaining biodiversity, and the tips provided in this booklet will help. In addition gardeners can contribute to entomological science by helping to track the distribution of insects. Each county has a network of insect recorders. This is essential if we are to protect our wild heritage, and to understand how environmental problems including climate change may influence the natural world. You don't have to be a professional entomologist to help.



THE ROYAL ENTOMOLOGICAL SOCIETY

The Royal Entomological Society can trace its history back to 1833 when it was founded as the Entomological Society of London. The Society was granted its royal charter by Queen Victoria in 1885, and King George V granted the right to add the word 'Royal' to the title in 1933. Many eminent scientists, including Charles Darwin, have been fellows. The Royal Entomological Society supports insect science through its renowned scientific journals and other publications, scientific meetings and by providing a forum for disseminating research findings. For further details visit www.royensoc.co.uk.

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