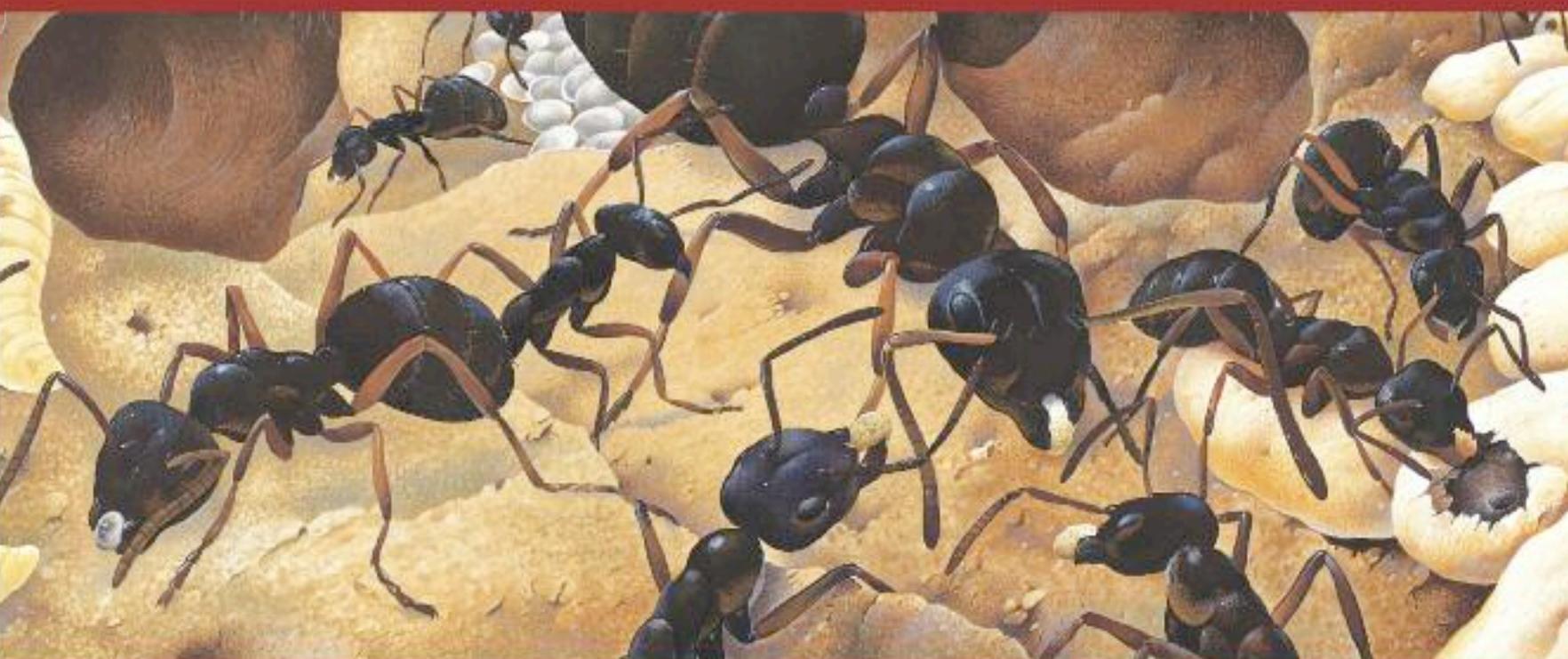


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MINI-BEASTS



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MINI-BEASTS

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Created and produced by Nicholas Harris, Sarah Hartley,
Katie Sexton, Ruth Symons and Erica Williams, Orpheus Books Ltd.

Text Ruth Symons

Illustrated by Susanna Addario, Tom Connell, Fiammetta Dogi, Elisabetta Ferrero,
Giuliano Fornari, Andrea Ricciardi di Gaudesi, Sauro Giampaio, Ray Grinaway,
Ian Jackson, Nicki Palin, Alessandro Rabatti, Claudia Saraceni,
Studio Inklinc, Colin Woolf and David Wright

Consultant Chris Jarvis, Oxford University Museum of Natural History

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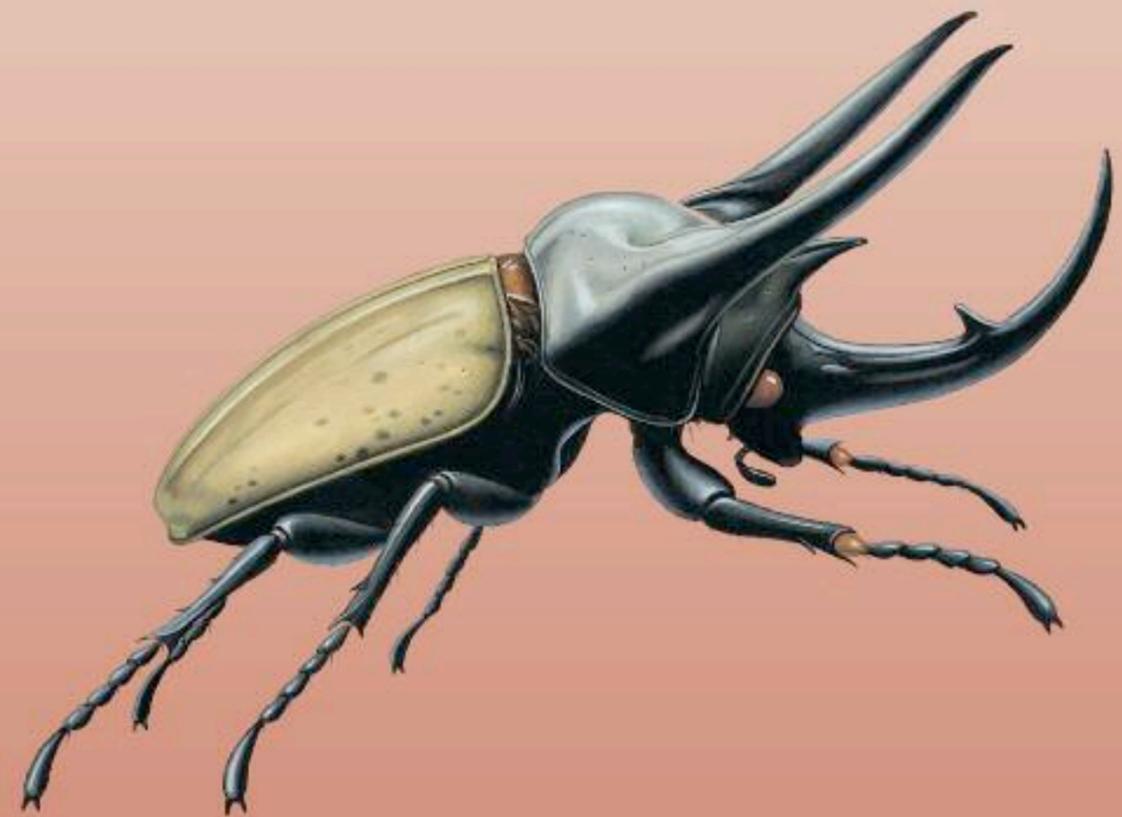
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ABOUT THIS BOOK

Each double page contains a brief introduction, explaining the general subject, followed by key words arranged in alphabetical order. To look up a specific word, turn to the index at the back of this book: this will tell you which page to go to. If you want to learn more about a subject, take a look at the factfile, or follow the arrows to read related entries.



INTRODUCTION
This explains the general subject and provides some basic knowledge.

KEY WORDS AND ENTRIES
Key words are arranged alphabetically across each double page. Each entry provides a short explanation of what the key word means.

FACTFILE
The factfile provides extra information on the subject. Facts are presented in easy to read bullet points.

SPIDERS

Spiders are an order of arachnids. They have two body segments, eight legs and many pairs of eyes. All spiders are carnivores, feeding mostly on insects. Their saliva turns body tissues into liquid which they then suck up. All spiders can produce silk. Some spin silk webs which they use to catch their prey. Others hunt or ambush prey. Most spiders have a venomous bite (1), with which they paralyze or kill their prey. A few species are so venomous that they can kill humans.

Bird-eating spider A South American tarantula. It is the largest known spider, with a body 7.5 cm long and a leg span of up to 30 cm. It chases its prey across the rainforest floor. It feeds mainly on insects or lizards and frogs, but rarely on birds.

Black widow spider A tiny, black spider with red markings. It spins a web to catch flying insects. After mating, the female eats the male, a practice for which the spider is named. Black widows only bite if provoked, but their venom can easily kill humans.

Bolas spider A small spider that hunts moths using a lasso-like thread of silk with a sticky "bola" at one end. It attracts male moths by making a similar smell to that given off by female moths.

Fishing spider A spider that skates across water in search of tadpoles and fish. It lures its prey by dangling a leg in the water. When a creature investigates, it snatches it up and drags it on to land to feed.

Funnel-web spider A spider that builds funnel-shaped webs at the entrance to its burrow. The spider lurks at the narrow end of the web, waiting for an insect to stumble into its trap. Funnel web spiders live in Australia and Asia. They are aggressive and their bite can be fatal.

Crab spider A spider that holds up its front legs in a similar way to a crab wielding its pincers. It hides in flowers or under bark to ambush its prey. Some species change colour to blend in with their background.

Jumping spider A small spider that jumps from spot to spot in pursuit of its prey. It has large eyes for spotting prey and judging distances. It eats mostly moths and flies, but may attack larger creatures. Males may be brightly coloured in order to attract a mate.

Nursery web spider A small spider that builds a protective, tent-like web in which to raise its young.

Ogre-faced spider A slim spider with stick-like legs. One pair of its eyes are very large, giving it an ogre-like appearance. It spins a small web, which it throws over insects like a net to trap them.

Orb-weaver A small spider that spins spiral-shaped webs between branches. It may eat its web at the end of the day, recycling nutrients in order to build a new one.

Pedipalps Feelers near a spider's mouth, used to grab prey and pull it to the mouth.

A Mexican red-kneed tarantula feeding on a gecko.

HOW A SPIDER SPINS ITS WEB:
The spider joins two branches with a line of silk and walks along it, spinning a second thread as it goes (1). It pulls the second thread down and anchors it (2). Lines are linked together at the central hub (3). The spider lays down sticky spiral strands (4) and waits for its prey (5).

Pirate spider A small spider that raids the webs of other spiders. It may steal prey caught in the web, but more often feeds on the web-owner, feigning insect movements in order to lure it out.

Tarantula A large, hairy spider. It feeds mostly on insects, but larger species can kill lizards or rodents. Tarantulas use their hairs to detect vibrations. They can also flick them at attackers to cause itching.

Trapdoor spider A spider that ambushes its prey from a burrow. The entrance to the burrow is sealed by a lid, with a hinge made from spider silk. The spider rushes out when it detects vibrations made by its prey.

Water spider The only spider that lives underwater. Tiny hairs on its body trap bubbles, which the spider arranges into an air-filled underwater web. It darts out of its web to snatch prey, such as aquatic insects.

Sheet weaver spider A small spider, also known as the **money spider**, that builds horizontal webs. It spends most of its time hanging upside down under the web, waiting to catch tiny insects.

Silk A strong thread, made from liquid produced in a spider's abdomen. As it is drawn out through the **spinneret**, it becomes solid. Spiders use silk to build webs, contain their eggs, wrap up prey or form a safety line when jumping.

Splitting spider A small spider that catches its prey by squirting poisoned silk at it. Its aim is deadly accurate. As soon as an insect is entangled, the spider moves forward to paralyze it with its bite.

Wolf spider A small spider, also known as the **wandering spider**. It stalks its prey on the ground. It has large eyes for spotting its prey, which it may ambush or even chase over a short distance.

FACTFILE

- ★ A length of spider silk is stronger than a piece of steel wire the same length and thickness. It is also more stretchable.
- ★ Some spiders, such as tarantulas, can live for up to 30 years.
- ★ Only a few species of spider are venomous enough to be dangerous to humans. These include the black widow, the funnel web spider, the Brazilian wandering spider and the brown recluse spider. The venom of most other spiders, including the widely feared tarantulas, will only cause mild pain in most instances.
- ★ The smallest spider in the world is the Patu Diga spider, which is 0.37 mm long.
- ★ The first spiders are thought to have appeared around 200 million years ago.
- ★ There are about 40,000 species of spider.

ARROWS
These arrows show you where to look up other words mentioned in the entry. For example, (→ 26) tells you to go forward to page 26 and (← 6) tells you to turn back to page 6.

BOLD WORDS
These highlight useful words that do not have their own entry.

PAGE NUMBER
Page numbers are easy to find at the side of the page.

WORLD OF MINI-BEASTS

In every house, garden, field or forest on Earth, there is a world of activity which we hardly even notice. On the ground, in the soil, in the air and in the water live many small creatures such as insects, spiders, millipedes, worms and snails. They are all invertebrates—animals without backbones. Some are large predatory creatures, big enough to feed on rodents and small lizards. Others are far too tiny for us to see without a microscope.

Camouflage The means by which an animal can escape the notice of other animals by using the colours or patterns of its body to blend into its surroundings.

Cocoon A silk case spun by some arthropods, used to hold eggs or to encase insect larvae while they pupate.

Colony A group of one species of animal living together.

Exoskeleton An external skeleton, made of a strong material called **chitin**, that protects the inner parts of the animal.

Imago An adult insect.

Larva A young animal that looks different from its adult form. Many insects hatch as larvae and go through metamorphosis.

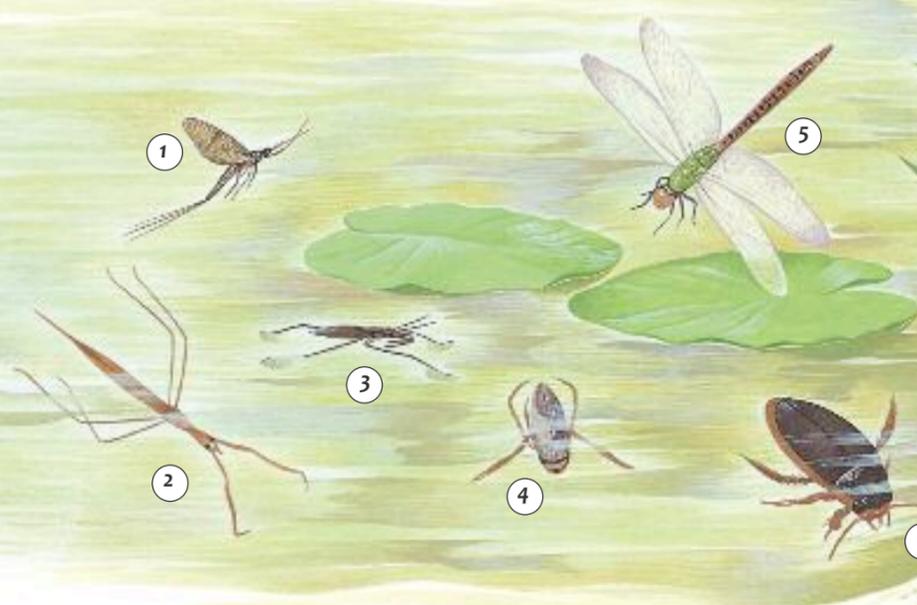
Parasite An animal that takes its food or shelter from another, called the **host**. A parasite does not usually kill its host.

Pupa A living thing at an inactive, or resting stage of its development. In some insects, this is the stage at which the larvae changes into its adult form, or pupates.

Venom A poisonous substance found in the bodies of certain animals, including some spiders, scorpions and insects. It can be used for hunting or defence, and is usually injected with a sharp sting or bite.

Vertebrate An animal with a backbone. Mammals, birds, reptiles, amphibians and fish are all vertebrates.

6



Arachnids A class of arthropods that have eight legs. Arachnids include spiders (▶26) and scorpions (▶28). They feed by piercing their prey with their sharp fangs, paralyzing or killing them with their venom. Their saliva turns the body tissues into liquid that can then be sucked up.

Arthropod An animal with a hard external skeleton, or exoskeleton, and jointed legs. As arthropods grow, they moult their outer skeleton and grow a new one.

Nymph The young of an insect that looks like its adult form but does not have wings. To grow, nymphs shed their exoskeleton and grow a new one. Some species shed their skin up to 20 times before they finally become adults.

Metamorphosis The process whereby an animal changes its body structure and behaviour between the larval stages and the adult stages of its life. In some animals, this involves a period of pupation.

KEY

- | | |
|-----------------------|---------------|
| 1 Mayfly | 11 Centipede |
| 2 Water stick insect | 12 Spider |
| 3 Pond skater | 13 Fly |
| 4 Water boatman | 14 Woodlouse |
| 5 Dragonfly | 15 Slug |
| 6 Great diving beetle | 16 Ants |
| 7 Bee | 17 Millipede |
| 8 Caterpillar | 18 Worm |
| 9 Butterfly | 19 Ants' nest |
| 10 Moth | 20 Beetle |



7

CLASSIFICATION

Living things are organized into groups of increasing size, which show how closely related they are to each other. Here we see how they apply to the monarch butterfly:

SPECIES: The smallest grouping of animals. All monarch butterflies have the same body structure and can breed together.

GENUS: A group of very similar species. The genus *Danaus* contains the monarch, queen and tiger butterflies.

FAMILY: The genus *Danaus* belongs to the brushfooted butterfly family. They all have short, hairy front legs, but vary in size, habitat and behaviour.

ORDER: All butterflies and moths belong to the order Lepidoptera. They all have four wings and scaled bodies.

CLASS: The order Lepidoptera belongs to the insect class. All insects have six legs.

PHYLUM: Insects belong to a larger group called the arthropods, which all have external skeletons.

KINGDOM: The arthropod phylum is one of over 30 phyla in the animal kingdom.

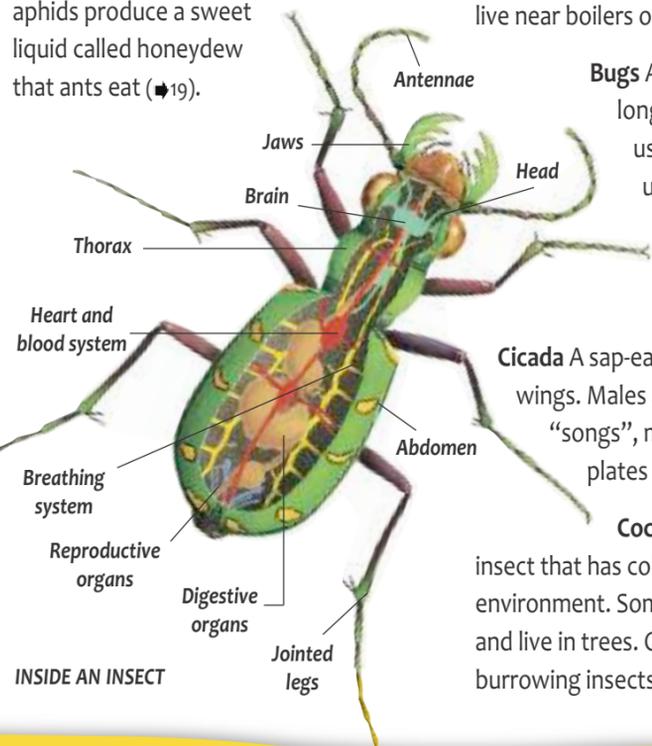
INSECTS

Insects are a class of arthropods (➤ 6). They have six legs and hard external skeletons. The body of an insect is divided into three sections: the head, thorax and abdomen. The hard covering of the legs is jointed to enable the insect to move. Insects have a pair of antennae on their heads and most insects have one or two pairs of wings. The mouth shape of an insect depends on its diet. Some have tube-like mouths for sucking up fluids; others have jaws for chewing up their food. After mating, a female lays her eggs. Some species hatch as nymphs (➤ 6). Others hatch as larvae (➤ 6).

Abdomen The rearmost body section of an insect, usually containing its digestive, waste-disposal and reproductive parts.

Antennae A pair of long sense receptors on the head of an insect. They are very sensitive to smells, flavours and touch.

Aphid A small bug that feeds on plant sap. Most species are green. When they feed, aphids produce a sweet liquid called honeydew that ants eat (➤ 19).



Stick insect

Assassin bug A long-legged, carnivorous bug. Most species ambush other insects, sucking out their bodily fluids, but some species suck the blood of larger animals.

Bed bug A wingless bug that feeds on the blood of mammals and birds. Bed bugs often live in clothing or mattresses.

Bristletail A small, wingless insect. Bristletails include **silverfish** which live in dark, damp places, and **firebrats**, which live near boilers or ovens.

Bugs An order of insects with long, beak-like mouthparts, used to pierce food to suck up its liquid contents. Most bugs feed on plant juices, but some are carnivorous.

Cicada A sap-eating bug with transparent wings. Males are known for their loud “songs”, made by clicking drum-like plates on their abdomens.

Cockroach A nocturnal insect that has colonized almost every environment. Some species have wings and live in trees. Others are wingless, burrowing insects, often found in houses.

Compound eye An eye made up of thousands of tiny lenses. Many insects have compound eyes. This means they have a wide field of vision, and are able to sense movements and judge distances very accurately.

Earwig An insect with a slim, dark body, long antennae and a pair of pincers at the rear of its body. Most species have wings, although they rarely fly. Earwigs come out at night to feed on plants and other insects.

Flea A small, flightless insect that lives on, or near, the bodies of other animals, feeding on their blood. Fleas have a “trigger” in their hind legs that enables them to jump 100 times their own length.



The compound eyes of a fly

Hopper A small, plant-eating bug that hops from plant to plant. Some species are camouflaged to look like thorns.

Leaf insect An insect shaped like a leaf in order to disguise itself from predators. It lives in trees, eating leaves. It may even sway in a breeze like the other leaves around it.

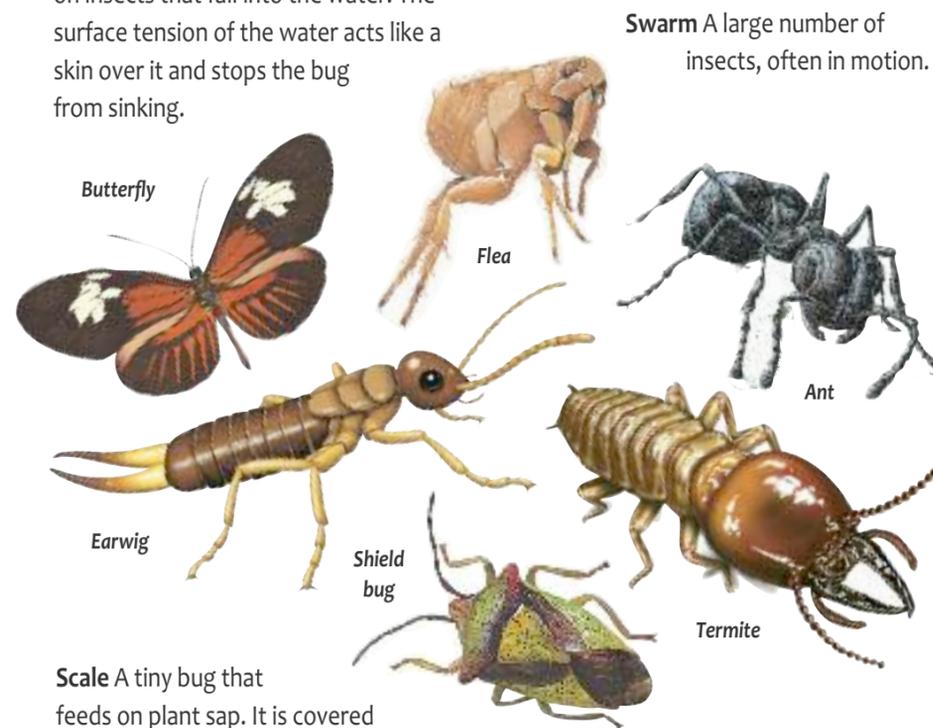
Louse A wingless insect that feeds on the blood, skin, feathers or hair of animals. The **headlouse** feeds on human blood. Its claws grasp tightly to human hair.

Mandibles A pair of hard, external biting mouthparts, belonging to insects and other arthropods, such as millipedes (➤ 28). They are used to grasp and slice food.



Claws and sticky hairs help some insects such as flies to walk on walls and ceilings.

Pond skater A long-legged bug that slides over the surface of ponds or rivers feeding on insects that fall into the water. The surface tension of the water acts like a skin over it and stops the bug from sinking.



Scale A tiny bug that feeds on plant sap. It is covered in a waxy substance that gives it a scale-like appearance.

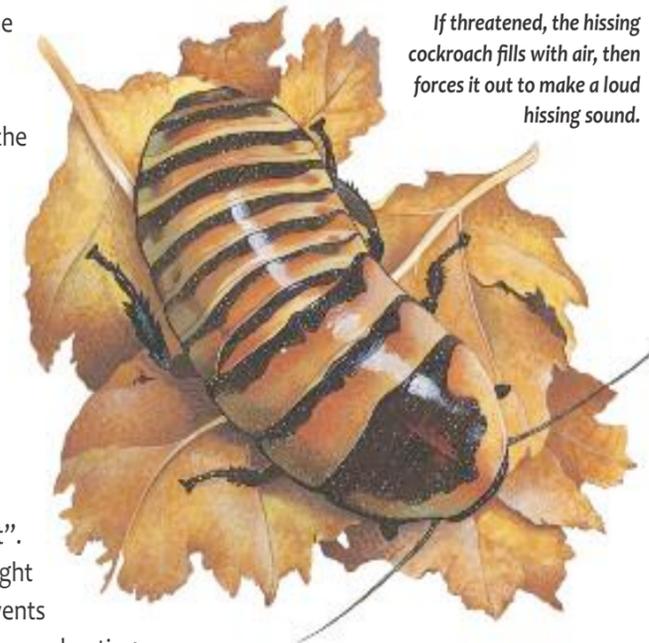
Shield bug A shield-shaped bug that secretes a foul-smelling liquid if attacked. Species come in many different colours and patterns.

Spiracle An opening in the thorax or abdomen of an insect, through which air enters its body allowing the insect to breathe. Some water insects breathe through gills or through tubes that project out of the water like a snorkel.

Spittlebug A sap-feeding bug, whose young produce a frothy, bitter-tasting substance known as spittle, or “cuckoo spit”. This keeps them out of sight from predators, and prevents them from getting cold or overheating.

Stick insect An insect with a long body and long, thin legs. It is camouflaged to look like a stick or plant stem. Stick insects live in trees, feeding on leaves.

Swarm A large number of insects, often in motion.



If threatened, the hissing cockroach fills with air, then forces it out to make a loud hissing sound.

FACTFILE

★ There are more kinds of insects in the world than all other animals put together. Over 1 million species are already known to us, but scientists estimate there are between 5 and 10 million insect species yet to be discovered.

★ Insects live on every land environment in the world, including the frozen continent of Antarctica. There are even five species of pond skater that can survive in the open oceans, the only insects known to do so.

★ A species of stick insect from Borneo, known as Chan's megastick, can grow up to 56.7 cm long, the longest insect of all.

★ A cockroach can live for over a week without its head.

★ The loudest insect in the world is the African cicada.

Water bug An aquatic bug that lives in, or above, a lake or river. Most water bugs are carnivorous. They include **water scorpions**, **back-swimmers**, **water toads** and the **water boatmen**.

Webspinner A small brown or black insect that spins silk and feeds on dead plants. It has a long, thin body and lives in large colonies inside tunnels made of silk.

BEETLES

Beetles are the largest order of insects. They all have two pairs of wings, but only the back pair are used for flying. The front wings form a hard, protective case that folds over the flying wings. Some beetles do not fly, so their front wings are fused together. Beetles hatch as larvae, then pupate, emerging as fully-formed adults (➤6). Plant-eating larvae are legless grubs. Predatory larvae have legs and large jaws for catching prey. Adult beetles have varied diets: some feed on plants, some scavenge and some are predators.

Blister beetle A slender beetle that is often brightly-coloured to warn predators it is toxic. To defend itself, it secretes a fluid that can blister human skin.

Carrion beetle A flat-bodied beetle that feeds on carrion. It also lays its eggs beneath carrion so its larvae can feed on it.

Click beetle A beetle that can flip itself into the air to escape predators. It does this by arching its back in such a way that a spine catches on its abdomen, catapulting it into the air and making a loud clicking sound.

Cockchafer A large beetle that spreads its feathery antennae as it flies. This helps it to detect the scent of food or a mate.

Darkling beetle A dark beetle that feeds mostly on dead plant or animal matter. The larvae of darkling beetles are known as **mealworms**.

Dermestid beetle A small scavenging beetle. Its hairy larvae feed on carpets and other fibrous material.



Diving beetle

Dung beetle A scarab beetle that moulds animal dung into balls, in which it lays its eggs. When the larvae hatch they will be protected inside the ball and feed on the dung and the bacteria growing inside it.

Elytra The hard front wings of a beetle, which form a case over its back wings. In some species the elytra are fused together.

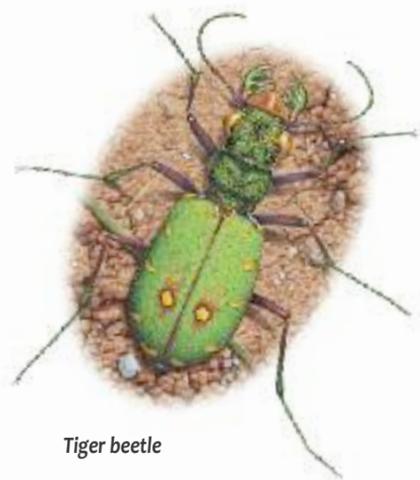
Feather-winged beetle The smallest beetle in the world, growing to between 0.5 and 2 mm long. It has feather-tipped wings, which help it to float on water, where it feeds on moulds and fungi.



Male stag beetles fighting

Firefly A beetle that can produce light, generated by chemical reactions inside its abdomen. Flashes of light are used to attract a mate. Most species live in warm, wet regions. Wingless females and larvae are sometimes called **glow-worms**.

Goliath beetle A scarab beetle that grows up to 11 cm long and can weigh as much as a rat. It lives in the tropical forests of Africa, flying through the treetops in search of fruit to eat. At night, it crawls under leaves to hide from predators.



Tiger beetle

Ground beetle A beetle with long, thin legs and a shiny body. Ground beetles are mostly carnivorous, running quickly after their prey. The ground beetle family includes **tiger beetles, nest beetles** and **bombardier beetles**.

Hercules beetle A huge rhinoceros beetle, that grows up to 17 cm long. About half its length is made up of its huge horns, which are used to fight other males over mates. The fight ends when one beetle throws the other on to its back.

Ladybird A small, round beetle with a red or yellow body and black spots. When threatened, it oozes a smelly substance from its leg-joints. Ladybirds feed on plant-eating insects such as aphids or scales (➤9).

Leaf beetle A small, brightly coloured, beetle that feeds on plant leaves. Its antennae are half the length of its body.

Longhorn beetle A brightly coloured wood-boring beetle with antennae as long as its body. These help it to locate plants as well as mates.

Rhinoceros beetle A large, tropical scarab beetle. Males have a horn-like structure at the front of their heads, used to fight off rivals. They only eat plants.



Wood-boring beetle

Rove beetle A carnivorous or scavenging beetle with a small, slim body and short elytra. When threatened, it can raise the back of its abdomen to look like a stinger.

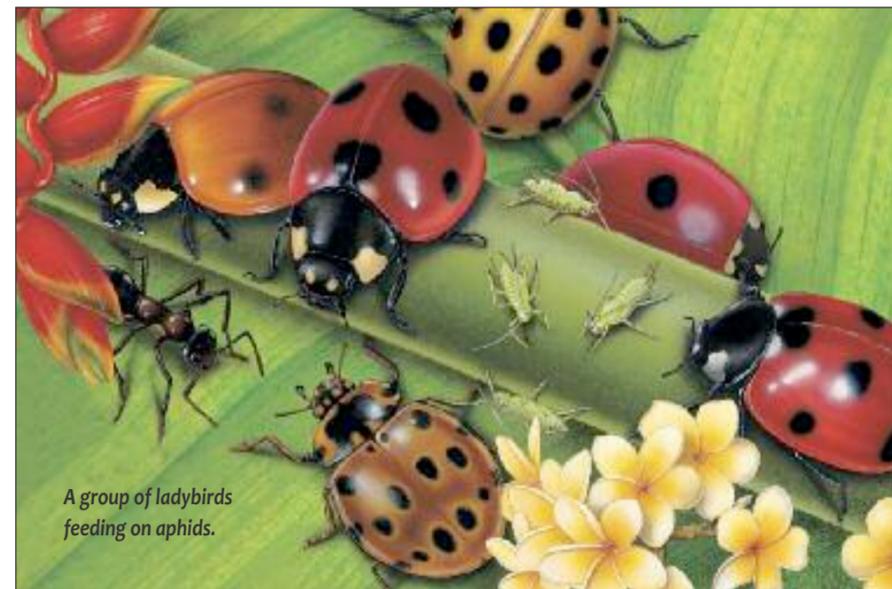
Scarab beetle A broad, oval beetle with clubbed antennae and thick legs. Many species have bright, metallic colouring. Scarab beetles include the rhinoceros, dung, goliath and chafer beetles.

Soldier beetle A slim beetle that lives near flowers, feeding on other insects as well as some pollen. Some species have colourful markings.

Stag beetle A large, dark beetle. Males have massive, horn-like jaws, used to fight over territory or mates. Some species grow up to 12 cm long.



A tiny feather-winged beetle. It can only be seen clearly through a microscope.



A group of ladybirds feeding on aphids.

Tiger beetle A fierce, brightly coloured ground beetle. Its larvae hide in burrows, seizing passing insects to eat. Adults chase and catch their prey in the open. They have powerful jaws and are among the fastest insects, both running and in flight.



Dung beetle

Water beetle A freshwater beetle with an oval body and powerful back legs. When it dives, it carries a bubble of air under its elytra to breathe underwater. Water beetles feed on insects, tadpoles and small fish. Species include the **water scavengers** and **diving beetles**. Their fierce, predatory larvae are known as water tigers.

Weevil A small, plant-eating beetle with a long snout. Most weevils are wingless and lay their eggs inside plants. Species such as the **rive, boll** and **grain weevil** are very destructive to crops.

Whirligig beetle An oval-shaped beetle that lives on the surface of ponds or rivers, feeding on insects that fall into the water. Its eyes are divided, enabling it to see above and below the water's surface at the same time.

Wood-boring beetle A beetle that eats wood, damaging living trees or furniture. Its larvae are called woodworms. Wood-boring beetles include the **death watch beetle, bark beetle** and **longhorn beetle**.

FACTFILE

★ Nearly half of all insects and one quarter of all life-forms are beetles. There are at least 350,000 species of beetle in the world.

★ The rhinoceros beetle is the strongest animal in the world. It can lift 850 times its own weight.

★ The fastest insect on land is Hudson's tiger beetle, which can run at 9 km/h.

★ The longest beetle is the Titan longhorn beetle, which reaches lengths of up to 16.5 cm.



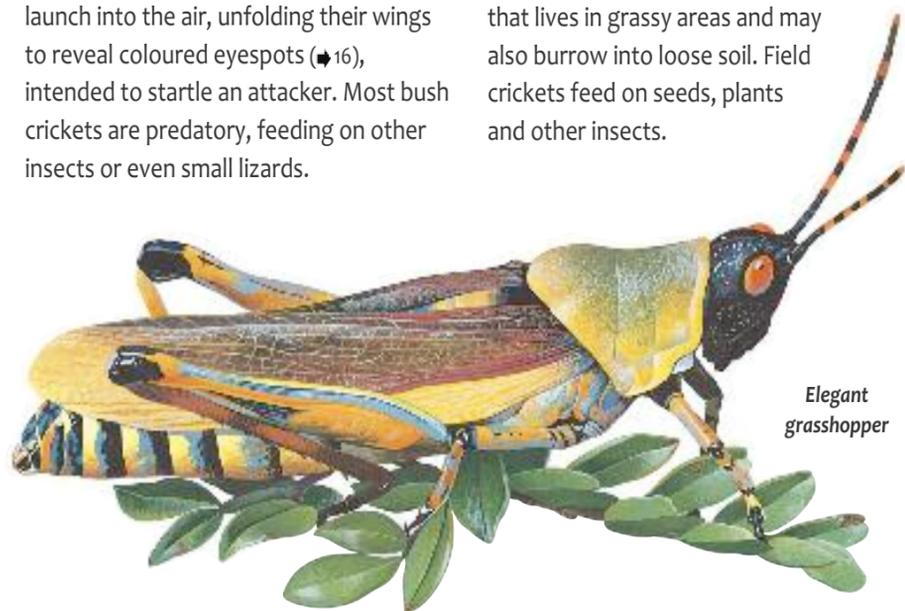
Firefly

GRASSHOPPERS & CRICKETS

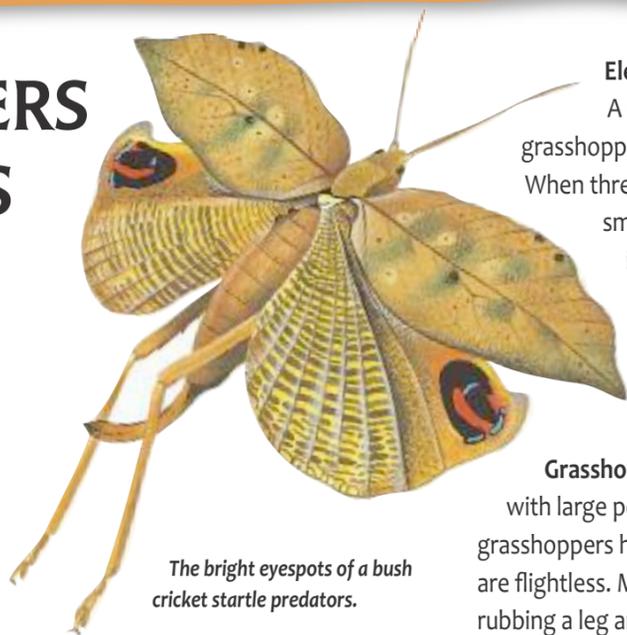
Grasshoppers and crickets are insects with long, powerful back legs and loud, chirping “songs”. They use their muscular legs to spring to safety if attacked but can also deliver a powerful kick if seized by a predator. Most male crickets and grasshoppers make loud chirps to attract females. These are produced by rubbing both wings together (cricket), or a leg and a wing together (grasshopper). Most grasshoppers and crickets are plant-eating insects that live above ground. Their young are nymphs (♣ 6).

Ant-loving cricket A small, yellow, wingless cricket that lives in ant nests, feeding on an oily substance given off by ants. Up to 50 crickets may be found in one ant nest at a time.

Bush cricket A large, flightless cricket with long antennae. Bush crickets are also known as **long-horned grasshoppers** or **katydids**. They live in trees, camouflaged as dead leaves. When disturbed, they launch into the air, unfolding their wings to reveal coloured eyespots (♣ 16), intended to startle an attacker. Most bush crickets are predatory, feeding on other insects or even small lizards.



Elegant grasshopper



The bright eyespots of a bush cricket startle predators.

Cave cricket A flightless cricket with a humped back, long legs and long antennae. Cave crickets, also known as **camel crickets**, live in dark places such as caves. They are usually brown in colour and they do not chirp.

Cricket A nocturnal insect with long legs for jumping and long, thin antennae, used to find its way in the dark. Most crickets are non-fliers. They feed on both leaves and other insects. Male crickets make chirping calls by rubbing their wings together. Females hear the calls through their ears—actually slits in their front legs.

Field cricket A common, black cricket that lives in grassy areas and may also burrow into loose soil. Field crickets feed on seeds, plants and other insects.



A swarm of locusts descending on the crops of an African village.

Ground cricket A flat-bodied cricket that lives in fields or woodlands and has a soft call. The striped ground cricket has dark markings on its back.

Groundhopper A small insect, related to grasshoppers and crickets. Groundhoppers have tiny, scale-like front wings but can fly well using their strong hind wings. Groundhoppers often live near streams or rivers and some species can even swim. Groundhoppers include the **pygmy grasshoppers** and **pygmy locusts**.

Elegant grasshopper

A brightly coloured grasshopper from South Africa. When threatened, it secretes a foul-smelling fluid from between its joints. This green frothing substance deters predators from attacking the grasshopper.

Grasshopper

A herbivorous insect with large powerful legs. Most grasshoppers have wings although some are flightless. Males make chirping calls by rubbing a leg and a wing together. Females hear the calls through hearing organs on their abdomens. Most species are camouflaged, but some are brightly coloured to show that they are poisonous.



A brightly coloured swarming locust.

Jerusalem cricket A large, North American insect, also known as the **potato bug**. It has a translucent brown body and no wings. It may have dark stripes on its abdomen. Jerusalem crickets burrow underground to feed on roots and tubers.

Locust A large grasshopper. Locusts are usually solitary, but if wet weather causes plant growth, their population may increase massively. Crowded together, their legs rub against each other, triggering the behaviour that makes them swarm. Solitary locusts are camouflaged, but swarming locusts, protected by their vast numbers, moult to reveal bright colours. When swarms descend on an area of vegetation, they strip it bare in minutes.

Mole cricket A cricket that digs tunnels underground. It feeds on plant roots or insect larvae. It can shape its tunnels in such a way that its calls to other crickets are amplified. Mole crickets have wings and may leave their burrows to fly above ground at night.



The locust rests on the ground with its legs folded (1). It uses its hind legs to push it into the air (2) with its front legs held back. Once in the air it opens its wings to fly (3).

Orthoptera An order of insects to which grasshoppers and crickets belong. Their name means “straight-winged”. All insects in this family have two pairs of wings. The transparent rear wings fold up behind the hardened, leathery front wings. Most orthopterans can produce loud chirping sounds to communicate with one another.

Stridulation The act of making noises by rubbing together body parts. Male grasshoppers and crickets both stridulate by rubbing together their legs or wings. Stridulation is used to attract a mate, impress her or to ward off rival males. Other insects, such as weevils and scarab beetles (♣ 10), also stridulate.

A LOCUST TAKING FLIGHT

FACTFILE

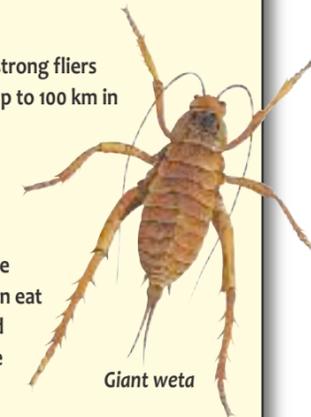
★ Many grasshoppers can jump more than 20 times their own body length.

★ Locusts are strong fliers and can travel up to 100 km in one day.

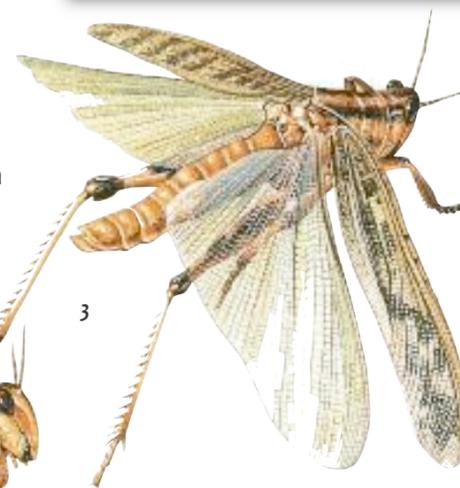
★ Locusts can eat their own weight in food every day. In one day, a swarm can eat food that would feed 500 people for a year.

★ Young grasshoppers or crickets are called “hoppers” and have no wings.

★ The fastest flying insect is the African desert locust, which can reach speeds of up to 34 km/h.



Giant weta



3

Tree cricket A white or green cricket that lives in trees or shrubs. It has one of the longest and loudest calls of all crickets. There are about 80 species of tree cricket across the world.

Weta A cricket with long, spiny back legs, which it waves at enemies to warn them off. Some species will also bite attackers. Weta are nocturnal, coming out at night to feed on plants and fungi. There are about 100 species of weta, all of which are native to New Zealand.

MANTIDS & DRAGONFLIES

Mantids are a group of camouflaged predatory insects. They have triangular heads, large eyes and strong, spiny legs for grabbing prey. They stay completely still, waiting to ambush passing insects. Dragonflies are fast-flying insects that live near rivers or ponds. They have long abdomens, large eyes and transparent wings. Dragonflies feed on other insects, catching them with their legs. The young of both dragonflies and mantids are predatory nymphs (6). Some net-winged insects, such as mantidflies and antlions, are often mistaken for mantids.

Antlion A winged insect with a dull coloured body and net-like wings. Antlion larvae feed on ants, which they trap in conical pits, dug into sandy ground.

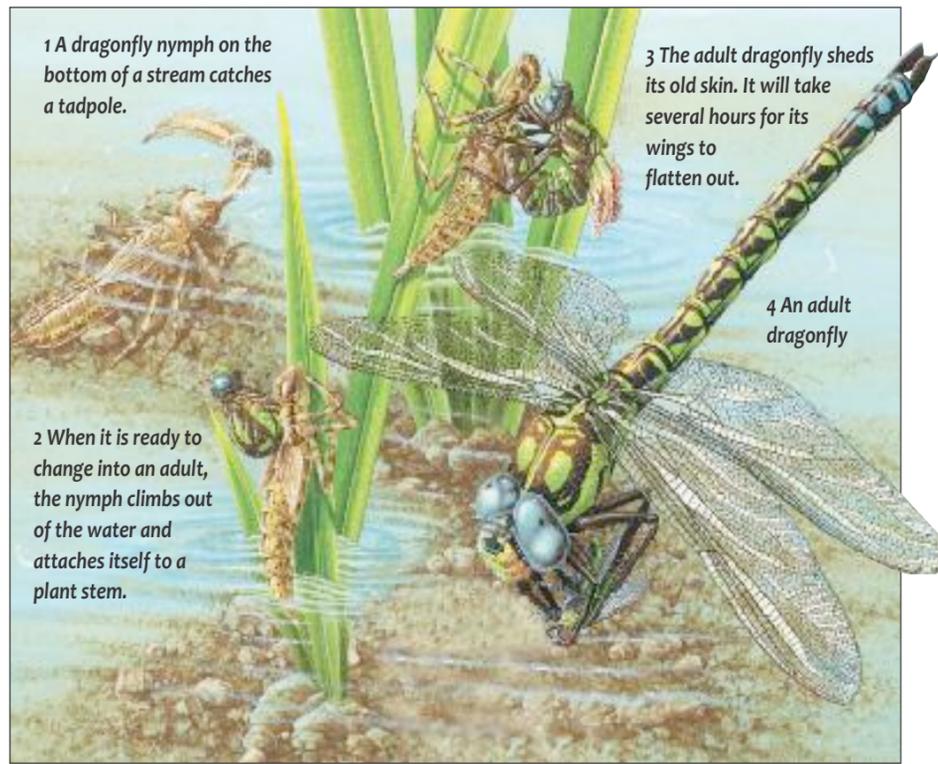
Clubtail dragonfly A dragonfly with a club-shaped body and wide-set eyes. Its nymphs burrow into mud on stream beds.

Cruiser dragonfly A dragonfly with short, stiff wings that enable it to “cruise” for long periods, searching for prey. It may have yellow markings on its dark abdomen.

Damselfly A carnivorous insect related to dragonflies but smaller, and weaker in flight. Damselflies lay their eggs in slits cut into the stems of water plants.



Pink orchid mantis



1 A dragonfly nymph on the bottom of a stream catches a tadpole.

2 When it is ready to change into an adult, the nymph climbs out of the water and attaches itself to a plant stem.

3 The adult dragonfly sheds its old skin. It will take several hours for its wings to flatten out.

4 An adult dragonfly

Dead leaf mantis A brown mantis camouflaged to look like a dead leaf. It may move like a leaf swaying in the wind as it stalks its prey.

Dragonfly A fast-flying, predatory insect that lives near freshwater. It has two pairs of transparent wings, of which the hind wings are broader. They cannot fold behind its back. All dragonflies lay their eggs in or near water.

Dragonfly nymph A young dragonfly that lives underwater for up to five years, feeding on insects, tadpoles and fish. Dragonfly nymphs have a clawed “mask” on their faces, which they use to catch prey and pull it into their mouths.

Emerald dragonfly A dragonfly with a dark body and metallic green eyes. Emerald dragonflies include the **sundragon**, **shadowdragon** and **baskettails**.

Flower mantis A petal-shaped mantis, camouflaged to sit among flowers, waiting for prey. Species such as the **orchid mantis**, are adapted to blend in with specific flowers, for example the pink orchid.

Giant Asian mantis A large praying mantis from Southeast Asia. It grows up to 9 cm long and can tackle prey as large as itself.



Lacewing

Hawker dragonfly A large, fast dragonfly. Most species are blue or green. Hawkers, also known as **darners**, spend most of their time in flight and are among the fastest of fliers. They are also the largest dragonflies.

Lacewing A flying insect with a network of veins in its delicate wings. It has sensitive hearing organs in its wings that enable it to hear the calls of bats and so avoid them.

Mantidfly A tropical flying insect with delicate, net-like wings. Like a mantis, it has large, spiny forelimbs used to snatch its prey and is a fierce predator.

Mayfly A delicate, plant-eating relative of the dragonflies. Mayflies may spend a year or more as nymphs, but their adult life only lasts a day or two. As adults, they cannot feed and merely mate, lay their eggs and then die.

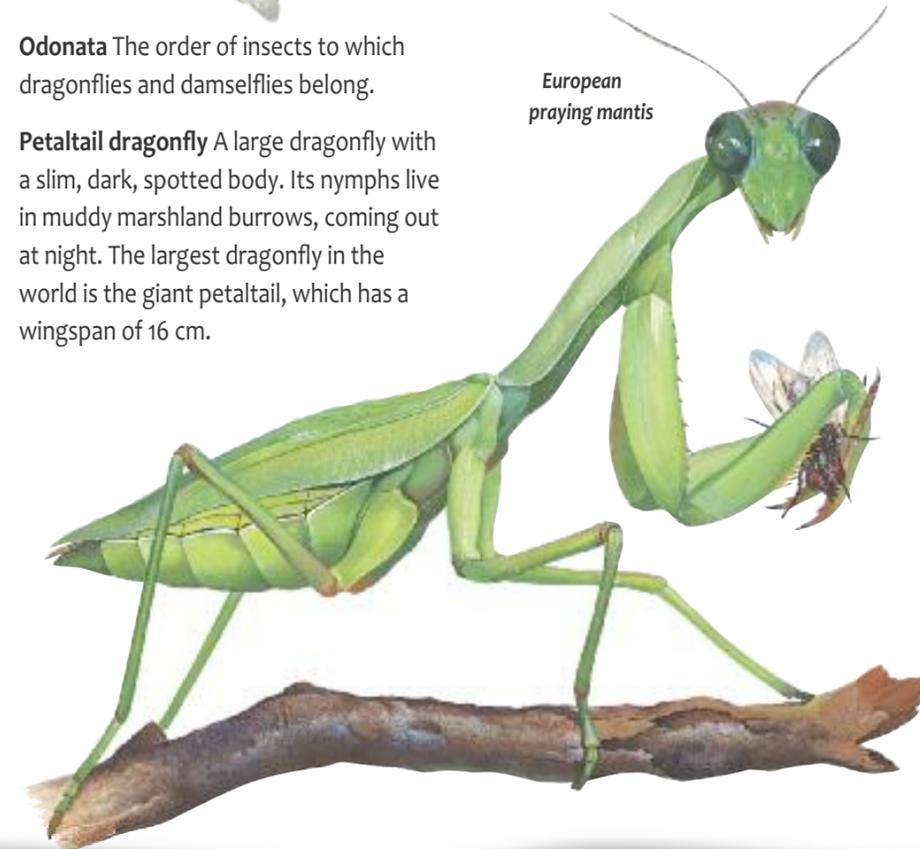
Neuroptera The order of insects to which lacewings, mantidflies and antlions belong. They are known as the **net-winged insects**.

If threatened, a mantis may flutter away or spread its wings and strike out with its front legs.



Odonata The order of insects to which dragonflies and damselflies belong.

Petaltail dragonfly A large dragonfly with a slim, dark, spotted body. Its nymphs live in muddy marshland burrows, coming out at night. The largest dragonfly in the world is the giant petaltail, which has a wingspan of 16 cm.



European praying mantis

Mantis laying eggs

Praying mantis An insect that preys on other insects or small frogs and lizards. The praying mantis is so-called because it holds its forelimbs as if it is praying while it waits to ambush its victims. Females lay eggs in a frothy mass that hardens into a cocoon. The young emerge as nymphs.

Skimmer dragonfly A large dragonfly with a thick body. It often flies low, skimming the surface of the water. Many species have brightly-coloured wings.



Mantids hatch from a mass of eggs as tiny replica adults called nymphs.

Spiketail dragonfly A large dragonfly with a dark abdomen striped with yellow. It spends most of its day flying. Most species have a long, pointed body.

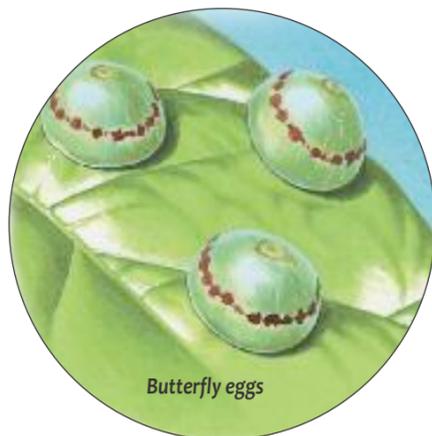
Stonefly A dull coloured insect with transparent wings, thick legs and two tails. It is a weak flyer, and mostly runs on the ground or hides under stones. It is often mistaken for a mayfly.

FACTFILE

- ★ The largest praying mantis is the Chinese mantis, which grows up to 10 cm long.
- ★ The largest member of the odonata family is a species of damselfly from South America, which has a wingspan of 19 cm.
- ★ Hawkers are the fastest dragonflies, usually cruising at speeds of about 16 km/h, but capable of much faster bursts of speed.
- ★ The largest ever dragonfly lived over 250 million years ago (before the dinosaurs) and had a wingspan of around 75 cm.
- ★ Mantids can turn their heads up to 180° when searching for prey. They are the only insects that can do this.

BUTTERFLIES & MOTHS

Butterflies and moths are flying insects covered with tiny scales. These give them colours and markings used for camouflage or to attract a mate. Most butterflies fly in the day and have clubbed antennae, whereas most moths are night-flyers with feathery antennae. Both have a long, hollow tongue, called a proboscis, used to feed on nectar. A butterfly or moth starts life as a caterpillar, hatched from an egg. It grows, then changes into a hard-cased pupa (➔ 6), inside which its adult form takes shape.



Butterfly eggs

Birdwing butterfly A large butterfly from the rainforests of Southeast Asia. Males are brightly coloured but females are darker. The **Queen Alexandra birdwing** is the largest known butterfly, with a wingspan of 31 cm.

Brushfooted butterfly A butterfly with shortened, hairy front legs. It has bright markings on the upper side of its wings and camouflaged colours on the underside. Brushfooted butterflies include admirals, monarchs, emperors, morphos and snouts.

Burnet moth A small red and black moth. Its colours warn predators it is poisonous.

1 The caterpillar attaches to a twig.



2 It spins a cocoon (➔ 6) around itself.



PUPATION OF A CATERPILLAR

3 Inside the cocoon, the caterpillar starts to change.



4 After two weeks the change is complete. The adult butterfly emerges from the cocoon.



Carpenter moth A large moth with speckled brown wings that camouflage it against bark. Its caterpillars bore into trees.

Caterpillar The larva of a butterfly or moth. Caterpillars feed mostly on leaves but some eat other insect larvae. Many are poisonous or are covered in spines and stinging hairs to deter predators.

Chrysalis The pupal stage (➔ 6) of a moth or butterfly's life, when it changes into its adult form.

Clearwing moth A moth with a dark body and transparent wings. It may have red or yellow marks to make it look like a wasp.



Caterpillar

Clothes moth A small brown or yellow moth, whose tiny caterpillars feed on the fibres in human clothing, especially wool.

Emperor moth A large moth with brown or white wings and large eyespot markings. It lives in cool habitats, often in forests.



Morpho butterfly

Eyespot A marking that looks like the eye of a large, predatory bird or mammal. Some butterflies and moths have eyespots to scare potential predators.

Geometer moth A slim moth with broad wings. Its young are called **inchworms**.

Giant silk moth A large moth from Asia. Its caterpillars, called **silk worms**, produce silk to make their cocoons. This is used by people to make silk cloth.

Gossamer-winged butterfly A small, bright butterfly. Gossamers include **hairstreaks**, **coppers** and **blues**. The caterpillars of some species emit smells that attract ants, or mimic the squeaking calls of ant larvae. Ants look after the caterpillars in exchange for the honeydew (➔ 19) they produce.

Hawkmoth A large, fast moth that hovers over flowers to feed on nectar. Hawkmoths have the longest tongues of any insect.



A butterfly's proboscis rolls up when it is not feeding.

Leafroller moth A stocky moth whose caterpillars construct cocoons out of leaves rolled around their body.

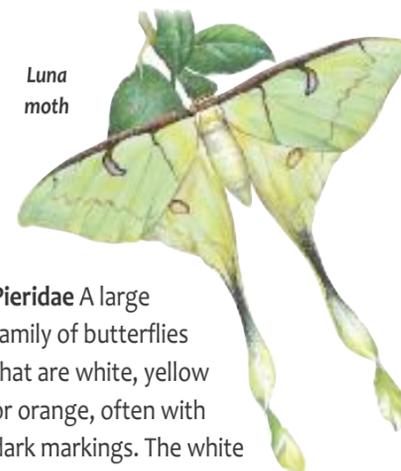
Lepidoptera The order of insects to which all butterflies and moths belong. They all have scaled bodies and four large wings.

Luna moth A large, pale green moth with long wing tails patterned with crescent-shaped markings. The luna moth's wingspan can measure more than 12 cm.

Monarch butterfly A black and orange butterfly that migrates more than 3000 km from Canada or North America to Mexico. Here, thousands of monarchs cluster on trees for the winter.

Morpho butterfly A large blue or green butterfly from the tropical forests of South America. Its wingspan can reach 17 cm across. Adults feed on rotting fallen fruit.

Owl butterfly A large, dark butterfly with orange eyespots that look like owl eyes.



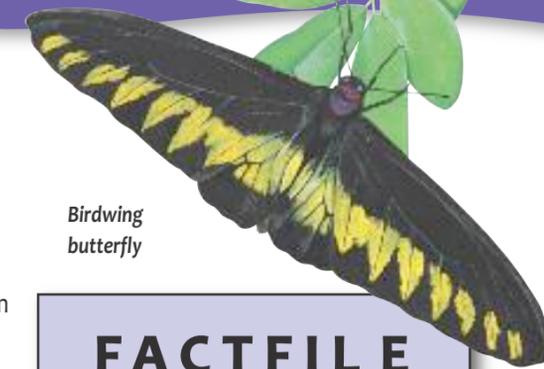
Luna moth

Pieridae A large family of butterflies that are white, yellow or orange, often with dark markings. The white **cabbage butterfly** is a common member of the family, known for the damage it does to crops and gardens.

Skipper A small insect that moves with a skipping motion from flower to flower. Skippers have moth-like bodies but upright wings like butterflies. Most species have club-like antennae that end in small hooks.

Snout moth A large, hairy moth with elongated mouthparts. Its young are called tent caterpillars because they live together in tent-like nests made from silk.

Swallowtail A large, colourful butterfly with tail-like extensions to its hind wings. Swallowtails beat their wings slowly, just five times a second. Their caterpillars are camouflaged to look like bird droppings.



Birdwing butterfly

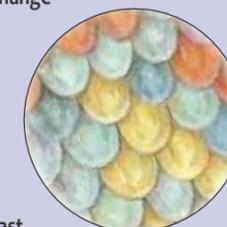
FACTFILE

★ There are around 160,000 species of moth but only 18,000 species of butterfly.

★ Butterflies and moths have tiny taste receptors in their feet. Before laying their eggs on a leaf, they taste it to see if it is edible for their caterpillars.

★ Some butterflies and moths have scales that reflect light to give an impression of colour. Looked at from a different angle, they seem to change colour.

★ Between hatching and pupating, a caterpillar must increase its size by at least 300 times. To do this, it must eat constantly.



Close-up of scales

Tiger moth A large, dark moth, patterned with colourful stripes or spots. Its furry caterpillars are often called "woolly bears".

Tussock moth A dull coloured moth, whose caterpillars are covered in fur. Tussock moths includes the **gypsy moth**, **satin moth** and **nun moth**.

Morgan's sphinx hawkmoth



ANTS

Ants are insects with thin waists and long antennae. They are closely related to bees and wasps and, like them, live in large colonies. These are made up of a winged queen, winged males, wingless workers and, in some species, soldiers. Ants nest in a maze of tunnels and chambers under the ground, with separate chambers for eggs, larvae and food stores. Ants have varied diets that include seeds, fruit, honeydew and other insects. Their young hatch from eggs as larvae, then pupate (➤6).

Amazon ant A small, red ant with dagger-like jaws. Amazon ants invade the nests of other ants and kidnap their young. These are then raised as slaves to look after the Amazon colony. Amazon ants are so dependent on slaves that they cannot feed themselves or care for their young.

Ant hill A pile of soil or leaves at the entrance to an ant nest. It soaks up warmth from the sun to heat the nest.

A dairy ant milking a scale insect (➤9) for honeydew.



INSIDE AN ANTS' NEST

Argentine ant A small, dark ant without a soldier caste. Argentine ants feed on honeydew, plant sap and other insects.

Army ant A tropical ant that marches in vast numbers from place to place, eating any insect that cannot get out of its way. When the colony needs to rest or lay eggs, the ants group inside a hollow log. They then carry their larvae with them.

Bulldog ant A large, Australian ant with long, sharp jaws and a strong sting like that of a bee. Adults feed on fruit, nectar or honeydew but also catch other insects to feed to their larvae.

Bullet ant A large black ant from the tropical forests of America. It has the most painful sting of any insect, said to hurt as much as a bullet wound.

Carpenter ant A large ant that nests in damp wood and feeds on plants or insects. Some species explode if threatened, showering toxic fluid over their attacker.

Dairy ant An ant known for "farming" aphids (➤8) for the honeydew they make. The ants protect the aphids and stroke them in encouragement. In return, the aphids let the ants take their honeydew.

Driver ant An army ant that nests for part of the year. Driver ants have strong, shearing jaws. When they march, they eat anything they come across, including mammals, birds and even people who cannot escape.



The strong jaws of an Australian bulldog ant

Drone ant A winged male ant. A drone's only task is to mate with the queen ant.

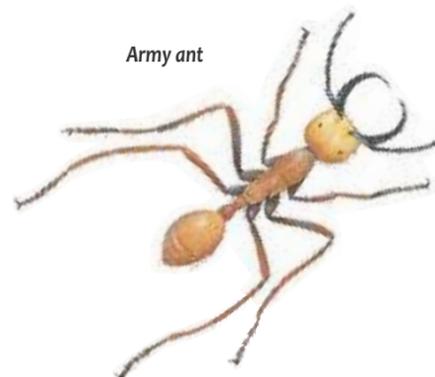
Field ant An ant that lives in forests or meadows, feeding on honeydew or insects. Some species, such as wood ants, pile pine needles above their nest to keep it warm.

Fire ant A red-black ant with a powerful sting on its abdomen. Fire ants live inside large earth mounds.

Ghost ant A tiny tropical ant with a dark head and transparent body. Ghost ants eat sweet or greasy foods.

Gliding ant An ant that lives in treetops. If it falls, or jumps to escape danger, it uses its flat head and legs to control its direction and land further down on the same tree.

Harvester ant An ant that feeds on seeds and grass, which it hoards and stores underground. It has a strong sting.



Army ant

Honeydew A sweet liquid, made by aphids (➤8) and other insects when they eat plant sap. It is a favoured food of many ants.

Honeypot ant A small ant from dry regions. During the rainy season, workers store nectar and water in their abdomens. In the dry season, other ants can feed from it.



Weaver ants building a nest. One ant squeezes larvae to make it produce silk.

Soldier ant A large, wingless, female ant that protect its colony from invasion. Soldier ants have large heads and jaws and cannot mate.

Thief ant A small yellow or brown ant that invades other ant colonies to feed on their food or eggs.

Weaver ant A tropical, tree-dwelling ant that builds its nest out of leaves, stitched together with silk produced by its larvae. Weaver ants have a painful bite, as they squirt acid into the bite wound.

Worker ant A wingless female ant that cannot reproduce. Workers build and repair the nest, provide food, rear the young and look after the queen.

Leafcutter ant An ant that carries bits of leaf to its nest, where it chews them into a pulp on which fungus grows. The ants then feed on the fungus.

Queen ant A large female ant, whose main task is to lay eggs. A young queen takes flight, mates with a male and lands to lay her eggs. Once she has mated, her wings break off and she gives birth to workers.

Slave-maker ant An ant that is cared for by workers of another colony. Some species, such as the Amazon ant, kidnap larvae to raise them as slaves. Others lay their eggs in other ants' nests so the young are brought up by the slaves.

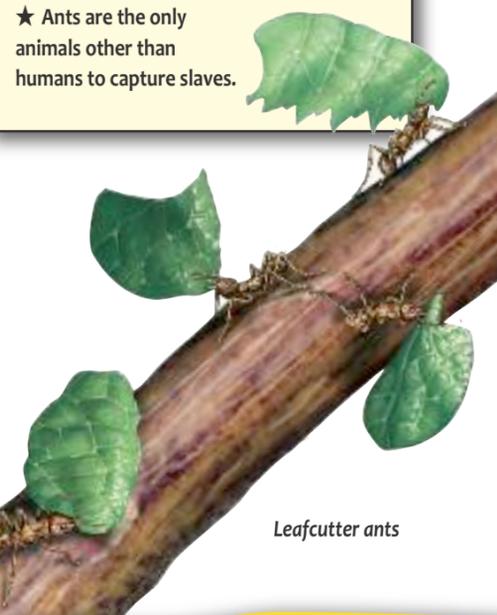
A honeypot ant hanging from the roof of its nest.



FACTFILE

- ★ There may be up to 6 million individuals in a large ant colony.
- ★ Ants evolved from wasps. This is why some species still have a sting.
- ★ Ants can lift approximately 20 times their own body weight. They carry objects not with their feet but with their mouths.
- ★ Ants have two stomachs. One has food for themselves and one contains food to regurgitate and share with the colony.
- ★ In some tropical regions, native people use army ants as natural stitches. Once the ant bites the skin together, its body is broken off. Its jaws can keep a wound sealed for several days.
- ★ Ants are the only animals other than humans to capture slaves.

Leafcutter ants



TERMITES

Termites are pale, soft-bodied insects that feed on wood and other dead plant material. They live in colonies, mostly in tropical regions. Termites build large nests underground, in trees or in large mounds above the ground. Their nests keep them moist and regulate their temperature. Inside the nest lie at least one royal couple: a large king and even larger queen. Soldier termites protect the colony from attack by enemy ants. Worker termites find food, feed the others and look after the young. Termite young are nymphs (♣6).

Alate A winged, reproductive termite, destined to become a king or a queen. Alates leave the nest in swarms at least once a year. When they land, they shed their wings, mate and start a new colony.

Arboreal termite A termite that lives in treetop nests built from wood and faeces. Tunnels lead from the nest down to the forest floor, enabling termites to safely leave the nest in search of food.

Dampwood termite A large termite that nests in, and feeds on, damp or rotten wood. Dampwood termites have no workers. Instead, the king, queen and soldiers are fed by their young.

Darwin termite A large termite from Northern Australia. Darwin termites live underground or in tree stumps. They eat anything, from wood to leather, plastic and rubber.



The enormous queen surrounded by workers

Drywood termite A termite that lives inside dry wood, conserving water in its body so it does not depend on soil or rotten wood for moisture. Drywood termites may live in furniture or the timbers of houses, making them a pest to humans.

Formosan termite A subterranean termite from China and Japan. Formosan colonies are very large and can seriously damage wooden buildings.

Ventilation shaft

Nurseries

Chimney

Fungus stores

Fungus garden

Fungus-growing termite A termite that grows fungus inside its nest, on “combs” made from termite faeces. The fungi break down the faeces into substances that the termites can digest.

Harvester termite A large termite from grassland areas of Africa and Asia. It feeds on grass and twigs, which it collects and hoards in its underground nests.

King termite A large male termite that has mated with the queen. He lives by her side and continues to mate with her for life.

Magnetic termite An Australian termite that builds wedge-shaped mounds pointing north to south. In the morning and evening, the sun warms the large east and west facing surfaces. The hot midday sun only hits the narrow ridge of the wedge, so the mound does not overheat.

Queen termite A huge female termite that spends her life laying eggs. She has a huge abdomen, up to 15 cm long, full of eggs.

Sawtooth termite A Brazilian termite that nests in the walls of other termite’s mounds. It has strong jaws and can bite off whole chunks of wood at a time.



Male and female alates

Snouted termite A subterranean termite with a large, prominent snout.

Soil-feeding termite A termite that feeds on soil. Most species live in rainforests.



A termite mound in the Australian outback

Soldier termite A termite that protects the colony from attack. Most soldiers have heads and jaws so large that they cannot feed themselves. Some can paint poison on their enemies, squirt toxic glue at them or explode their toxic innards over them.

Worker

Subterranean termite A termite that lives underground and relies on the surrounding soil to keep it damp. Subterranean termites build tunnels from their nests up to the wood on which they feed.

Termite nest A shelter in which termites raise their young and store food. Nests may be built underground, above ground, in dead trees or in living tree branches. They can be made of mud, wood or faeces mixed with saliva.

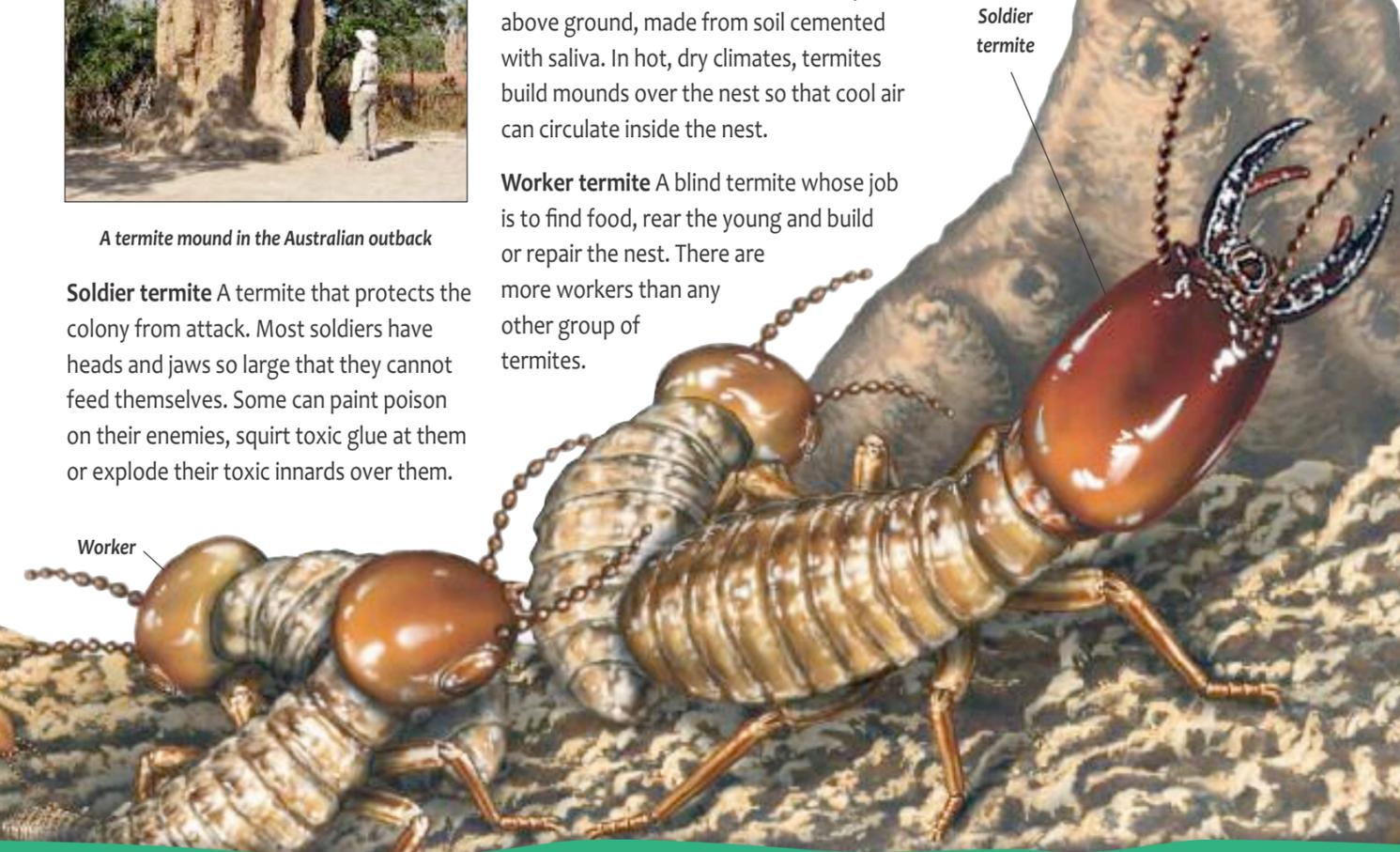
Termite mound A nest that reaches up above ground, made from soil cemented with saliva. In hot, dry climates, termites build mounds over the nest so that cool air can circulate inside the nest.

Worker termite A blind termite whose job is to find food, rear the young and build or repair the nest. There are more workers than any other group of termites.

FACTFILE

- ★ There are about 2600 species of termites known to us, but there may be many hundreds as yet undiscovered.
- ★ Termites are closely related to cockroaches, from whom they evolved.
- ★ A queen termite can lay up to 36,000 eggs in one day.
- ★ The tallest termite mound on record was 12.5 m tall.
- ★ A termite nest may be inhabited by a colony for more than 50 years.
- ★ Abandoned nests may become homes to other animals, such as snakes, lizards and small mammals or birds.

Soldier termite



BEES & WASPS

Bees and wasps are flying insects with narrow waists. Many protect themselves by using a sting on their abdomen, which injects painful venom. These species usually have black and yellow stripes to warn that they are dangerous. Bees have round, furry bodies, and feed on pollen and nectar, which they collect from flowers using their tongues. Wasps have smooth, slender bodies, and most species prey on other insects. Some bees and wasps live in colonies, while others are solitary.

Beeswax A substance produced by glands in the abdomens of honeybees and used to construct cells in the nest.

Bumblebee A fluffy black and yellow bee. The movement of its flight muscles makes a loud buzzing sound. Bumblebees form small colonies in burrows or piles of grass.

Carpenter bee A large, solitary bee that tunnels into dead wood to build its nest.

Cell A hexagonal compartment inside the nest of a bee or wasp, where eggs, honey or pollen are stored. A cluster of cells is called a **comb**.

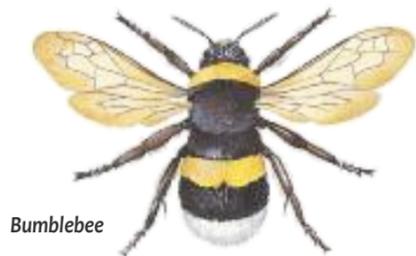
LIFE CYCLE OF A HONEYBEE: 1 The queen bee lays eggs in cells built by her workers.



Cuckoo bee A bee that lays its eggs inside the nest of other species. Once hatched, the larvae kills the queen and all other eggs, and takes over the colony.

Drone A male bee or wasp whose task is to mate with the queen. Drones cannot sting.

Gall wasp A small, solitary wasp that lays its eggs inside plants. Once the eggs are laid a bump, or gall, rises on the plant. The larvae hatch and feed inside this.



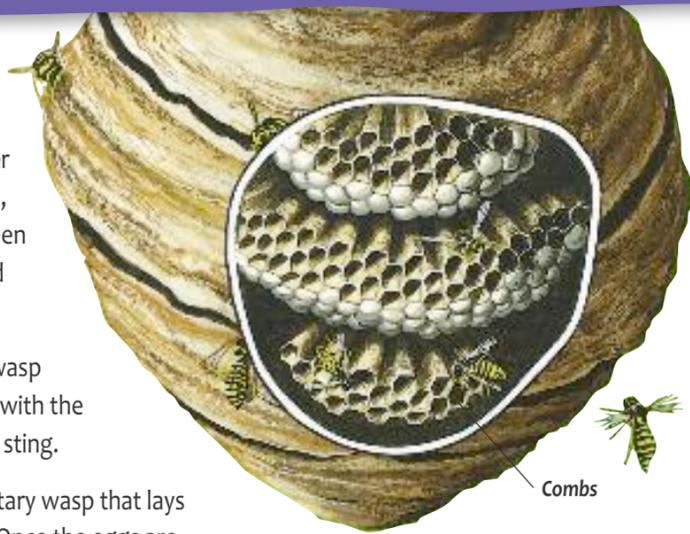
Bumblebee

Honey A sweet-tasting liquid made when nectar mixes with enzymes in a bee's stomach. The mixture is regurgitated into cells, where it is stored as food for winter.

Honeybee A bee that builds its nests in crevices or hanging from a tree. It is often kept by humans for its honey. If it uses its sting, it is ripped from its body, killing it.

Hornet A large striped wasp with a strong sting. Hornet colonies live in paper nests made from chewed wood.

2 After three days, the eggs hatch. The larvae are fed honey, pollen and a small amount of royal jelly.



Paper wasps' nest

Hymenoptera The order of insects to which all bees, wasps and ants (18) belong.

Leafcutter bee A large bee that builds its nests inside hollow plants, cutting circles from leaves and using them to make cells.

Mason bee A solitary bee, also known as the **mortar bee**, that builds nests in hollow plants, constructing its cells out of mud.

Mason wasp A wasp, also known as the **potter wasp**, that builds pot-shaped nests out of sand and soil, glued by its saliva. It fills the nest with paralyzed spiders and insect larvae, on which its young will feed.

Mining bee A solitary bee that builds its nest in a vertical underground tunnel.

Mud-dauber wasp A long, thin, wasp that moulds nests out of mud. It hunts spiders, which it paralyzes with its sting, and carries to its nest to feed to its young.

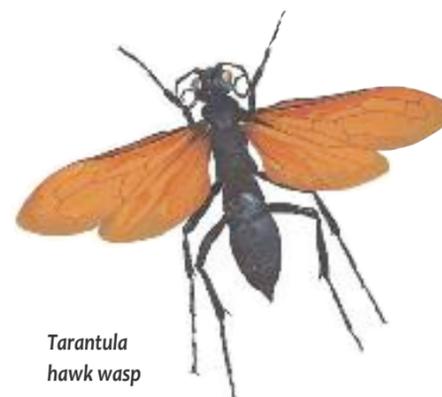
3 After nine days, workers cap the cells with wax to protect the developing larvae.



Paper wasp A wasp that builds its nest out of paper made from chewed-up wood. Nests are attached to branches by a stalk.

Parasitic wasp A solitary wasp that lays its eggs in the nests of other bees or wasps, or inside plants or animals, such as caterpillars or spiders.

Pollinator An insect, such as a bee, that carries pollen from the male part of a flower to a female part, enabling it to reproduce. When insects drink nectar from a flower, some pollen sticks to them. At the next flower they visit, the pollen brushes off.



Tarantula hawk wasp

Queen bee A large, female bee that has mated with a male and lays eggs. Queens develop from normal larvae that are fed exclusively on royal jelly.

Queen wasp An adult female wasp that has mated with a male and lays eggs. She builds the foundations of her nest. Once she has raised workers, they take over nest-building and other tasks.

4 After 20 days, the young workers hatch. Once their bodies have hardened, they leave their cells.



When the colony grows too big, a group of workers go to another site to start a new colony.

Royal jelly A nutritious, milky substance made by young worker bees and fed to young larvae and the queen bee.

Spider wasp A large, long-legged wasp that lays its eggs in the stomachs of spiders, having first paralyzed them with its sting. When the larvae hatch, they feed on the still-living spider. The black **tarantula hawk wasp** has a wingspan of 12 cm and hunts tarantulas (26).



Hornet

Stingless bee A tropical bee that nests in large colonies. It does not sting its attackers, but gives them painful bites. Stingless bees are sometimes kept by humans for the honey they produce.

Sweat bee A small bee that is attracted to the salt in human sweat. Sweat bees usually build their nests underground or inside trees, but some are parasitic.

Waggle dance A figure-of-eight "dance" performed by honeybees to show other bees where flowers are located. The movements communicate how far away the flowers are and in what direction.

Worker bees A female bee that cannot lay eggs. Young workers repair and build new cells. After this, they act as guards at the entrance to the nest. Older workers find food, feed the larvae and produce honey.

FACTFILE

★ Most bees have an average flying speed of about 30 km/h.

★ A single bee may visit as many as 1000 flowers in one day.

★ Only female wasps and bees have stings. This is because their stings are modified ovipositors (egg-laying organs).

★ The largest bee in the world is a leafcutter called Wallace's giant bee, which can grow up to 4 cm long and has a wingspan of over 6 cm.

★ The largest wasp in the world is the Asian giant hornet, which can grow over 5 cm long and has a wingspan of over 7 cm. It has a venom so powerful it can dissolve human tissue.

FLIES & MOSQUITOES

Flies are insects with only one pair of wings. They are able to fly at high speed and with great agility. Instead of biting jaws, flies have mouthparts that suck up liquid food. Many help to pollinate flowers by feeding on nectar and pollen, while others are scavengers. Some females feed on blood in order to gain proteins needed for laying eggs. Although some species spread diseases, many flies help to keep our environment clean, by feeding on dung or rotting material such as dead plants and animals.

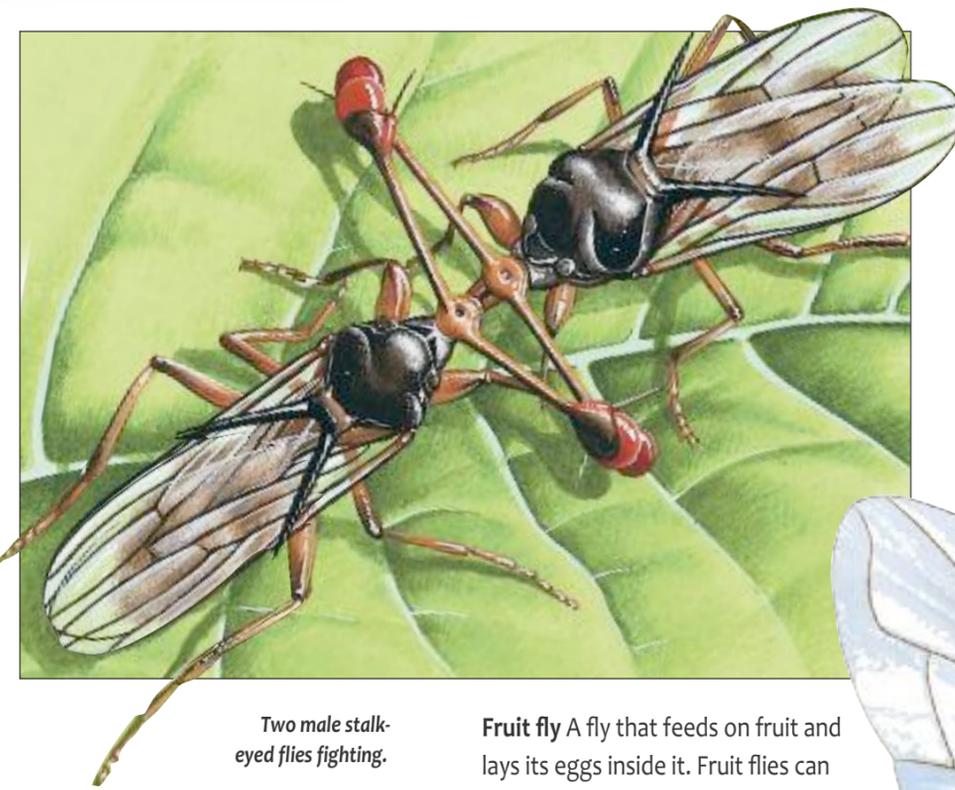
Bee fly



Bee fly A yellow-striped, furry fly that looks like a bee to deter predators. It feeds on nectar from flowers.

Blowfly A large, scavenging fly with metallic blue or green colouring. Blowflies include **bluebottles**, **cluster flies** and **screwworms**. They lay their larvae in rotting meat, open wounds or dung.

Botfly A hairy fly whose larvae live as parasites (♣6) inside mammals. It catches smaller flies and lays its eggs on their bodies. When the smaller, less noticeable flies land on a mammal, the animal's body heat causes the eggs to hatch, drop on to the skin and burrow into the flesh.



Two male stalk-eyed flies fighting.

Crane fly A fly with a slim body and long legs and wings. Crane flies live near water and feed on nectar. Their larvae, known as **leather jackets**, feed on rotten plant material or other insect larvae.

Diptera The order of insects to which all flies, mosquitoes and gnats belong.

Flesh fly A fly that feeds and breeds on rotting meat or open wounds. Flesh flies usually have red eyes and dark stripes on their bodies. Some give birth to live larvae instead of laying eggs.



Eggs and maggots inside a wound

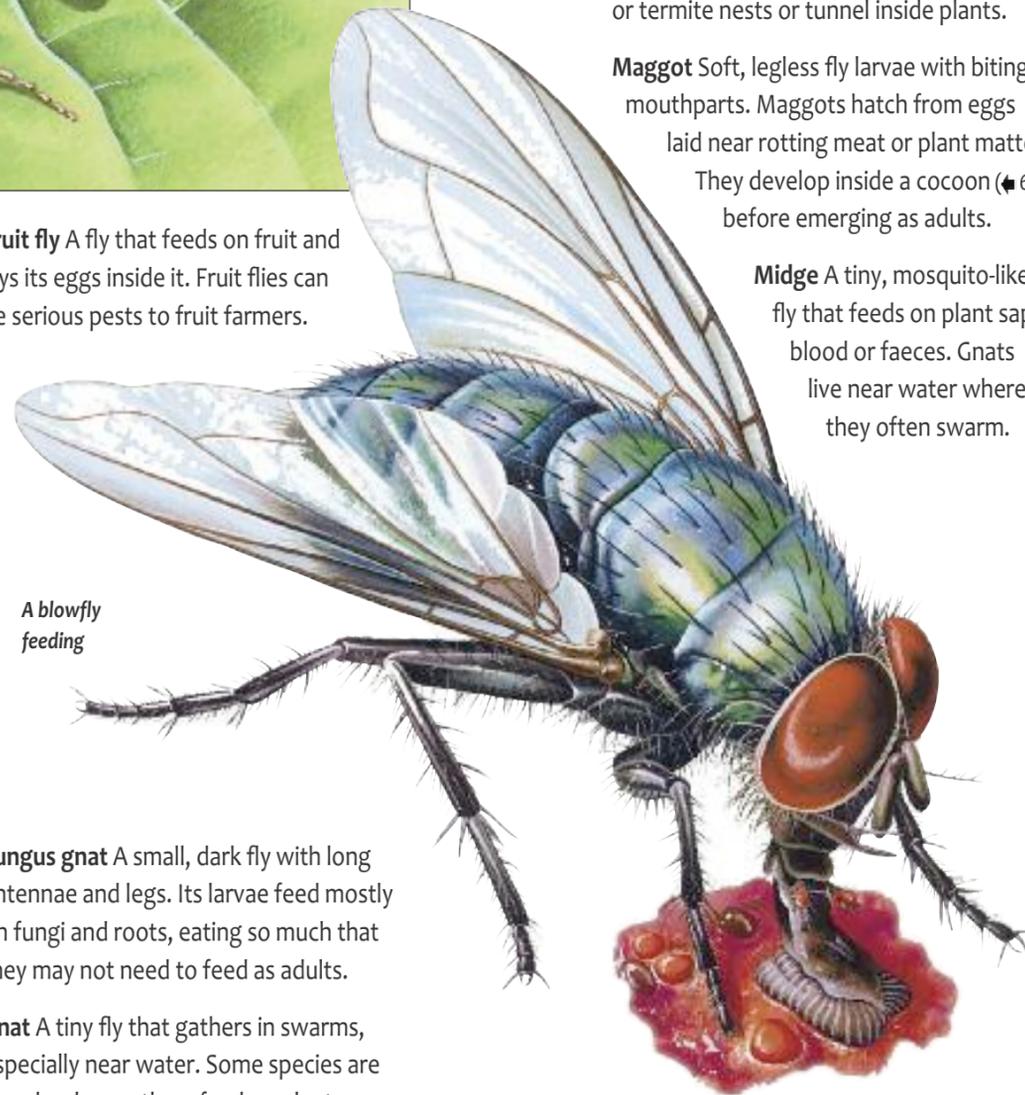
Fruit fly A fly that feeds on fruit and lays its eggs inside it. Fruit flies can be serious pests to fruit farmers.

A blowfly feeding

Fungus gnat A small, dark fly with long antennae and legs. Its larvae feed mostly on fungi and roots, eating so much that they may not need to feed as adults.

Gnat A tiny fly that gathers in swarms, especially near water. Some species are bloodsuckers; others feed on plant material. Many gnat larvae are aquatic.

Haltere The modified back wings of a fly. Halteres are short protrusions with small dumbbell shapes at the end. They flap back and forth during flight and help to keep the insect stable.



Horsefly A large fly that lays its eggs near water. Females suck the blood of large mammals, such as horses.

Housefly A large bristly fly that often lives in houses and lays its eggs in rubbish or faeces. It transmits diseases by moving on to human food.

Hoverfly A fly with bee-like markings. Hoverflies move their wings in figure-of-eight movements to hover over flowers as they feed. Some hoverfly larvae live in ant or termite nests or tunnel inside plants.

Maggot Soft, legless fly larvae with biting mouthparts. Maggots hatch from eggs laid near rotting meat or plant matter. They develop inside a cocoon (♣6) before emerging as adults.

Midge A tiny, mosquito-like fly that feeds on plant sap, blood or faeces. Gnats live near water where they often swarm.

Mosquito A fly whose females suck blood. Mosquitoes pierce the skin with their sharp mouthparts and inject a chemical that stops blood from clotting. In some parts of the world, mosquitoes carry the germs that cause malaria.

Moth fly A small fly with a hairy body. Most species feed on decaying plants but some are bloodsuckers.

Robber fly A predatory fly with a broad body and long legs. It catches its prey in mid-air and sucks the juices out of them.



Like many flies, crane flies can walk on ceilings.

Scuttle fly A fly that often runs instead of flying. It feeds on nectar or wounds. One species is known as the **coffin fly**, because it breeds in dead bodies after burial.

Snipe fly A small fly that often lives near water. Adults and larvae feed on insects and females also suck blood. Some larvae catch their prey in sandy pits.

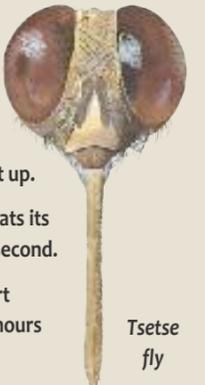
Soldier fly A brightly coloured fly that lives near flowers and feeds on nectar. Most species have yellow, green or black stripes.

A female mosquito drinking blood.



FACTFILE

- ★ There are more than 120,000 species of fly in the world.
- ★ The absence of a second pair of wings enables flies to carry out faster, tighter manoeuvres in mid-air than other insects.
- ★ Flies have over 4000 lenses in each compound eye (♣12).
- ★ To eat foods that are not already liquids, flies vomit over them. This liquefies the food so that the fly can suck it up.
- ★ The average fly beats its wings 200 times per second.
- ★ Some flies can start mating as soon as 12 hours after hatching.



Tsetse fly

Stalk-eyed fly A fungus-eating fly with its eyes on the end of long horizontal stalks. During mating season, males compete over females, judging their opponent's strength by the length of his eye stalks.

Tsetse fly A small African fly that can pass on a fatal disease called sleeping sickness by biting humans or cattle. Females give birth to larvae instead of laying eggs.

SPIDERS

Spiders are an order of arachnids (♣ 6). They have two body segments, eight legs and many pairs of eyes. All spiders are carnivores, feeding mostly on insects. Their saliva turns body tissues into liquid which they then suck up. All spiders can produce silk. Some spin silk webs which they use to catch their prey. Others hunt or ambush prey. Most spiders have a venomous bite (♣ 6), with which they paralyze or kill their prey. A few species are so venomous that they can kill humans.

Bird-eating spider A South American tarantula. It is the largest known spider, with a body 7.5 cm long and a leg span of up to 30 cm. It chases its prey across the rainforest floor. It feeds mainly on insects or lizards and frogs, but rarely on birds.

Black widow spider A tiny, black spider with red markings. It spins a web to catch flying insects. After mating, the female eats the male, a practice for which the spider is named. Black widows only bite if provoked, but their venom can easily kill humans.

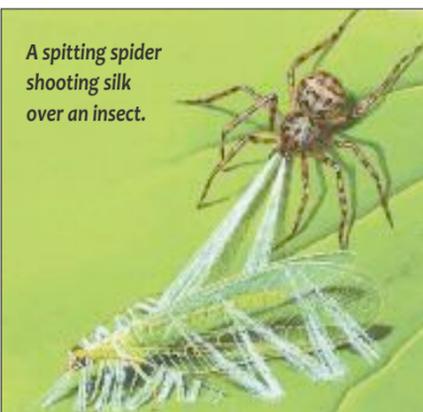
Bolas spider A small spider that hunts moths using a lasso-like thread of silk with a sticky "bola" at one end. It attracts male moths by making a similar smell to that given off by female moths.



Ogre-faced spider

Fishing spider A spider that skates across water in search of tadpoles and fish. It lures prey by dangling a leg in the water. When a creature investigates, it snatches it up and drags it on to land to feed.

Funnel-web spider A spider that builds funnel-shaped webs at the entrance to its burrow. The spider lurks at the narrow end of the web, waiting for an insect to stumble into its trap. Funnel web spiders live in Australia and Asia. They are aggressive and their bite can be fatal.



A spitting spider shooting silk over an insect.



A Mexican red-kneed tarantula feeding on a gecko.

Crab spider A spider that holds up its front legs in a similar way to a crab wielding its pincers. It hides in flowers or under bark to ambush its prey. Some species change colour to blend in with their background.

Jumping spider A small spider that jumps from spot to spot in pursuit of its prey. It has large eyes for spotting prey and judging distances. It eats mostly moths and flies, but may attack larger creatures. Males may be brightly coloured in order to attract a mate.

Nursery web spider A small spider that builds a protective, tent-like web in which to raise its young.

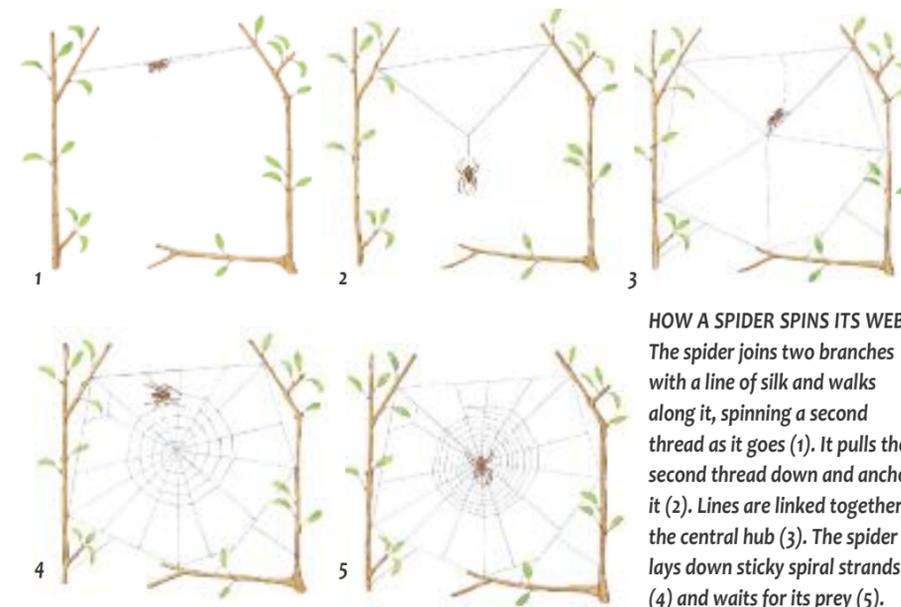
Ogre-faced spider A slim spider with stick-like legs. One pair of its eyes are very large, giving it an ogre-like appearance. It spins a small web, which it throws over insects like a net to trap them.



Black widow

Orb-weaver A small spider that spins spiral-shaped webs between branches. It may eat its web at the end of the day, recycling nutrients in order to build a new one.

Pedipalps Feelers near a spider's mouth, used to grab prey and pull it to the mouth.



HOW A SPIDER SPINS ITS WEB: The spider joins two branches with a line of silk and walks along it, spinning a second thread as it goes (1). It pulls the second thread down and anchors it (2). Lines are linked together at the central hub (3). The spider lays down sticky spiral strands (4) and waits for its prey (5).

Pirate spider A small spider that raids the webs of other spiders. It may steal prey caught in the web, but more often feeds on the web-owner, feigning insect movements in order to lure it out.



Trapdoor spider

Sheet-weaver spider A small spider, also known as the **money spider**, that builds horizontal webs. It spends most of its time hanging upside down under the web, waiting to catch tiny insects.

Silk A strong thread, made from liquid produced in a spider's abdomen. As it is drawn out through the **spinneret**, it becomes solid. Spiders use silk to build webs, contain their eggs, wrap up prey or form a safety line when jumping.

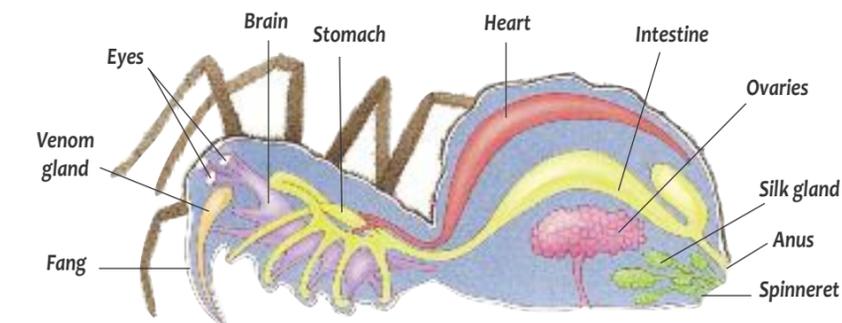
Spitting spider A small spider that catches its prey by squirting poisoned silk at it. Its aim is deadly accurate. As soon as an insect is entangled, the spider moves forward to paralyze it with its bite.

Tarantula A large, hairy spider. It feeds mostly on insects, but larger species can kill lizards or rodents. Tarantulas use their hairs to detect vibrations. They can also flick them at attackers to cause itching.

Trapdoor spider A spider that ambushes its prey from a burrow. The entrance to the burrow is sealed by a lid, with a hinge made from spider silk. The spider rushes out when it detects vibrations made by its prey.

Water spider The only spider that lives underwater. Tiny hairs on its body trap bubbles, which the spider arranges into an air-filled underwater web. It darts out of its web to snatch prey, such as aquatic insects.

Web A net made of spider silk and used to catch prey. Once an insect is caught, a spider can find it by sensing the vibrations it makes. Spiders walk on the claw-like tips of their feet to avoid becoming entangled.



FACTFILE

- ★ A length of spider silk is stronger than a piece of steel wire the same length and thickness. It is also more stretchable.
- ★ Some spiders, such as tarantulas, can live for up to 30 years.
- ★ Only a few species of spider are venomous enough to be dangerous to humans. These include the black widow, the funnel web spider, the Brazilian wandering spider and the brown recluse spider. The venom of most other spiders, including the widely feared tarantulas, will only cause mild pain in most instances.
- ★ The smallest spider in the world is the Patu Digua spider, which is 0.37 mm long.
- ★ The first spiders are thought to have appeared around 200 million years ago.
- ★ There are about 40,000 species of spider.



Jumping spider

Wolf spider A small spider, also known as the **wandering spider**. It stalks its prey on the ground. It has large eyes for spotting its prey, which it may ambush or even chase over a short distance.

SCORPIONS & OTHER MINI-BEASTS

Scorpions are an order of arachnid (6) with a venomous sting at the end of their tails and sharp, grasping pincers either side of their jaws. They are solitary, nocturnal hunters, using their stings to paralyze or kill their prey. Most scorpions eat insects or spiders, using their saliva to turn body tissues into liquid which they then suck up. Larger species can also feed on lizards, snakes and small mammals. Scorpion young are born live. They are carried on their mother's back until they moult for the first time.



Garden snail

Black scorpion A large, black scorpion, also known as the **Asian forest scorpion**. It lives under logs and leaves on the forest floor and grows up to 12 cm long.

Crustaceans Arthropods (6) such as crabs and woodlice with a hard, segmented exoskeleton (6) and two pairs of antennae.

Centipede A carnivorous myriapod with long, fast legs. Centipedes have one pair of legs per body segment and may have between 15 and 300 legs. Large "poison-claws" on their heads are used to capture and paralyse prey before eating it.

Deathstalker scorpion A yellow desert scorpion also known as the **gold scorpion** or **Israeli desert scorpion**. It is about 6 cm long and lives across dry regions of North Africa and the Middle East.



Giant African millipede

Emperor scorpion A large, black scorpion from the forests and savannahs of Africa. It grows up to 20 cm long and feeds mostly on termites.

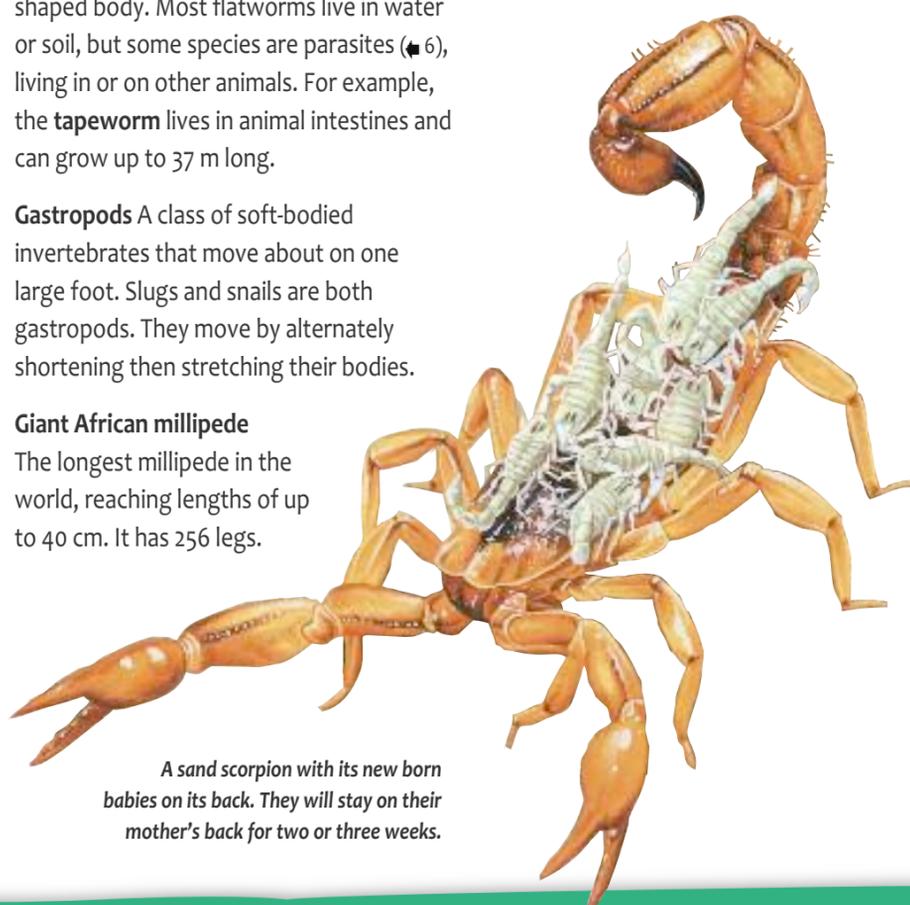
False scorpion A small, scorpion-like arachnid with no tail and two venomous pincers. Like spiders, false scorpions spin silk cocoons for their young. They feed on insect larvae, mites and lice.

Flat rock scorpion A flat, dark scorpion from Africa. Its curved claws give it good grip for walking across rocks and its flattened body enables it to hide in tiny rock crevices. It is the longest recorded scorpion, growing up to 21 cm long.

Flatworm A worm with a flat, ribbon-shaped body. Most flatworms live in water or soil, but some species are parasites (6), living in or on other animals. For example, the **tapeworm** lives in animal intestines and can grow up to 37 m long.

Gastropods A class of soft-bodied invertebrates that move about on one large foot. Slugs and snails are both gastropods. They move by alternately shortening then stretching their bodies.

Giant African millipede The longest millipede in the world, reaching lengths of up to 40 cm. It has 256 legs.



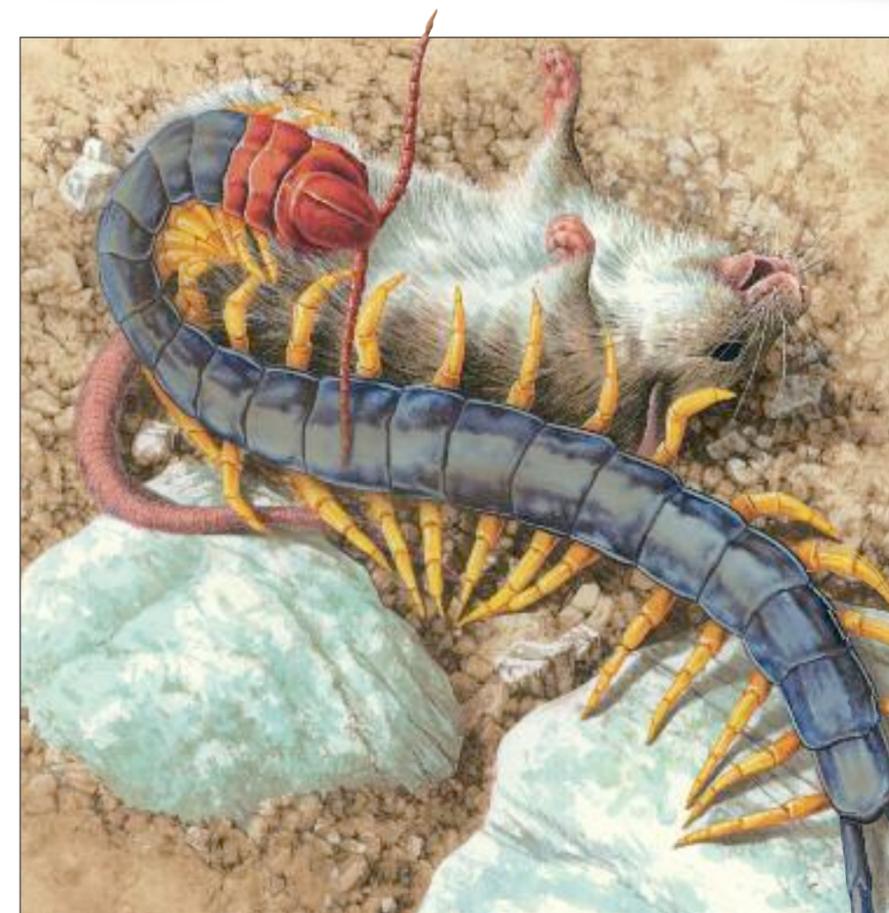
A sand scorpion with its new born babies on its back. They will stay on their mother's back for two or three weeks.

Giant centipede A South American centipede that can reach lengths of 30 cm. It attacks large prey such as snakes, frogs and small rodents. It even hunts bats by hanging over the entrances to their caves and seizing them in mid-air.

Giant desert hairy scorpion A large scorpion from the deserts of America. It is covered in brown hairs, which help it to detect vibrations made by the movements of its prey. It grows up to 15 cm long, and feeds on large prey such as lizards.

Millipede A myriapod with short, strong legs for burrowing through soil or leaves. Most millipedes are herbivorous. They have four legs per body segment and may have between 40 and up to 750 legs.

Mite A tiny arachnid with a single body segment and eight legs. Mites live in soil, water and even inside other animals. Some feed on insects or blood, whilst others feed on plants. Many mites are only visible with the use of a microscope.



A giant centipede (above) feeding on a mouse. The prey is paralyzed but still alive.



Dust mite

Myriapods Arthropods (6) such as millipedes and centipedes that have long, segmented bodies and many pairs of legs. Their bodies dry out easily, so they live in dark, damp places.

Pill millipede A plant-eating millipede with a short, wide body. If threatened, it can curl into a protective ball.

Roundworm A worm with a thin, tapered body. It may live in water, soil or as a parasite (6). Many roundworms can only be seen through a microscope.

Sand scorpion A pale scorpion from sandy desert regions. It has comb-like projections on its legs that stop it sinking into the sand.

Segmented worm A worm with a long body, divided into ring-like segments. Segmented worms include earthworms, leeches and ragworms.

Slug A gastropod with a soft, slimy body and two pairs of feelers, one for seeing and one for smell and touch. Slugs feed mostly on leaves and fungi, but some species eat other slugs, snails and worms.

Snail A gastropod with a hard shell. It can withdraw into its shell if it is attacked. Snails have two pairs of feelers, one pair for seeing and one for smell and touch. Most land species are plant-eaters.

Spider-hunting scorpion An Australian scorpion, also known as the **spiral burrow scorpion**. It grows up to 12 cm long and feeds only on burrowing spiders.

Thick-tailed scorpion A scorpion from Africa and the Middle East with a thick tail and lethal venom. Thick-tailed scorpions grow up to 10 cm long.



Woodlice

Tick A small arachnid that feeds on the blood of other animals. Ticks may carry blood-borne diseases.

Whip scorpion A tropical, scorpion-like arachnid with a thin, whip-like tail and no stinger. Whip scorpions feed mostly on insects and millipedes.

Woodlouse A small crustacean with seven pairs of legs. It lives in damp places and feeds on dead vegetation. They can curl up into a ball when threatened.

Worm A long, thin, soft-bodied invertebrate with no legs. Some worms burrow in the ground, while others live in water or as parasites (6) inside animals or plants.

FACTFILE

★ Out of nearly 2000 species of scorpion, only 25 species have venom strong enough to kill a human. Most scorpions will only sting if provoked.

★ Certain chemicals in the skin of scorpions mean that they become fluorescent under ultraviolet light.

★ The name myriapod means "many legs".

★ Some species of worm have as many as five hearts.

★ Most species of slugs and snails live in the oceans and seas.

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