Classification "What is a locust?"

When we classify animals we need to put them into groups. First of all we need to see if they are vertebrates, which mean that they have a backbone like us, or invertebrates which means that they don't have a backbone.

Is your locust **an invertebrate** or **a vertebrate**?

Locusts are also **Arthropods**. These are all of the small invertebrates with jointed legs and a hard skin called a cuticle. Arthropod actually means "Jointed Legs" in Latin.

Arthropods include insects, spiders, millipedes, centipedes and crustacea (like crabs).

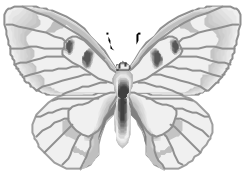
Insects have three main body parts, the head, thorax and abdomen. All insects have three pairs of legs and they have joints where the legs bend. Most insects also have one pair of antennae, compound eyes and one or two pairs of wings.

Do you think that locusts are **insects**, **spiders**, **millipedes**, **centipedes** or **crustacea**?

We can classify our locust still further!

There are lots of different groups of insects. We call these Orders. You may have heard of some of them:

Type of insect	**Order**
True bugs	Hemiptera
Beetles	Coleoptera
Fleas	Siphonaptera
True flies	Diptera
Butterflies and moths	Lepidoptera
Bees, wasps and ants	Hymenoptera
Grasshoppers and crickets	Orthoptera



Locusts are in the order **Orthoptera**. This includes grasshoppers and crickets. Locusts are large grasshoppers. There are lots of different types of locusts. We can also put them in more groups, but the smallest group is called a species. This only has one type of animal in it that is able to interbreed. All breeds of dogs, for example, belong to the same species because they can all breed with each other.

When scientists first started to classify plants and animals in the 17th and 18th centuries they wrote in Latin or Greek, which we still use today. If you could understand these languages then the words may help to describe the insect. Orthoptera actually means "straight wing".

Our classification is: **Common name:** The desert locust
Scientific name: *Shistocerca gregaria*

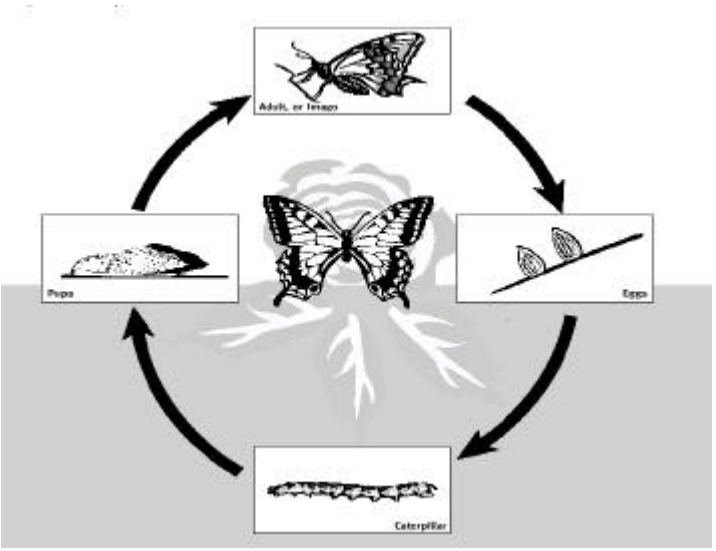
Kingdom: Animal
Phylum: Arthropoda
Class: Insecta
Order: Orthoptera
Suborder: Caelifera
Family: Acrididae
Genus: *Shistocerca*
Species: *gregaria*

Life-cycles : The life-cycle of the locust

Insects can have different types of life-cycles, with either **complete** or **incomplete metamorphosis**.

COMPLETE METAMORPHOSIS

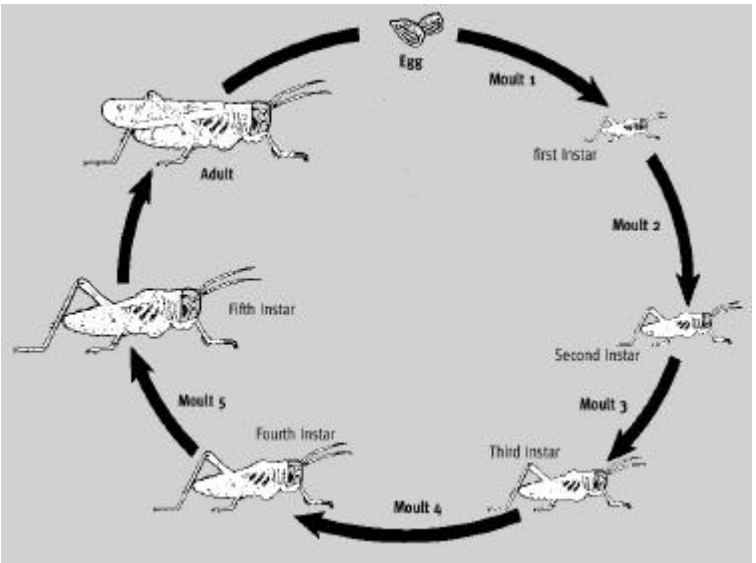
Insects like butterflies have four stages in their life-cycle. They lay an **egg** on a leaf and the egg hatches into a **larva** (or **caterpillar**) which does not look like the adult butterfly. The caterpillar grows and turns into a **pupa** (which is sometimes called a **chrysalis**). The body of the butterfly develops inside the pupa and the **adult butterfly** emerges. It then finds a mate and the cycle will start again. This is called **complete metamorphosis** because the young are different to the adult.



INCOMPLETE METAMORPHOSIS

When insects change their body shape gradually, without any sudden change, it is called incomplete metamorphosis.

This is the life-cycle of a locust, it is an example of incomplete metamorphosis.



The female locust lays her eggs in a hole in damp, warm soil or sand called a pod. She produces a frothy liquid that hardens and protects the eggs from the sun and enemies.

After about 10 days young locusts, called nymphs, emerge. They look like a smaller version of the adult but without wings, just wing buds.

As the nymphs grow they shed their skin or moult. After the fifth moult they are mature adults with fully formed wings and sexual organs.

LIFE-CYCLE FACTS !

Locust nymphs are also called hoppers, why do you think this is?

Locusts are adapted to live in hot and dry countries, their eggs are sometimes able to dry out and still hatch out when it is wet again!

When locusts moult, they hang by their legs from the branches of trees or bushes. When locusts are moulting they cannot escape if their enemies try to attack them.

Where do locusts live? Why do locusts swarm?

Unlike most grasshoppers, locusts can form large groups or **swarms**. Desert locusts normally live in an area in a band across Africa south of the Sahara and into India. When a locust plague occurs, the swarms move into Africa, Asia, Europe and beyond. Swarms can migrate over huge distances.

When locusts are on their own (i.e. not in swarms) they are called **solitarious** and they normally try to avoid each other, flying at night. The solitarious adults are coloured **green**. When there are lots of locusts crowding together, **often to find food**, swarms can develop.

When locusts are about to swarm they not only change their behaviour, but if they are still nymphs, they will even grow up to look different as adults. These adults are **multi-coloured**, e.g. with black, pink and yellow areas. They are called **gregarious** forms. A gregarious mother can also decide whether her offspring will be solitarious or gregarious. Scientists have found that there is something in the protective foam around the eggs that may cause them to hatch into gregarious nymphs.

A green solitarious nymph

A multi-coloured gregarious nymph

What the scientists say……

Scientists have found that if solitarious locusts are crowded together they change to have gregarious behaviour after only a few hours.

Experiments at the University of Oxford have tried to find out whether it is the sight, smell or contact with others, or a combination of these, that causes the change in behaviour.

Scientists have found that touch is the major stimulus, the locusts don't even have to touch another locust. Touching the locusts with small balls of papier mâché is enough to trigger a change in behaviour. Locusts have touch receptors all over their bodies, but the receptors on their legs are especially important.

Although sight and smell alone are not enough to trigger a change in behaviour, sight and smell together may be important. Smell helps to keep the locusts together, scientists think that it is the smell of the faecal pellets that is important in maintaining swarms.

When the researchers do their experiments they always have to make sure that it is a *fair test*. For example if they are testing sight, they can put the locusts in transparent perspex chambers so that they can't smell or touch the other locusts. They also have to make sure that the temperature and the length of time are the same. The locusts that are used in the experiments are bred and reared under carefully controlled conditions to keep them healthy.

Locust feeding, crop damage and control

Insect mouthparts

The ancestors of insects had three sets of mouthparts. Locusts have similar mouthparts to those of ancient insects. The first set of mouthparts is used to bite or saw-off pieces of vegetation. These jaws move from side to side. The other mouthparts are used to manipulate the food.

Mouthparts have become specialised in some other types of insects: butterflies have long sucking tubes (called a probosis), flies have sponge-like mouthparts, mosquitos have piercing and sucking mouthparts.

The mouthparts of a locust

What do locusts eat?

Artwork: Dr Damon Crook

Locusts eat plant material. They are a problem because swarming locusts will strip an area of its vegetation including the crops.

Locusts very often live singly or in small groups, sometimes the numbers build up and they can do a great deal of damage to the crops. Although the young hoppers can't fly, they still march in bands, eating the crops in their path. They march during the day, moving about a km a day, and rest at night in plants and shrubs. They moult and grow until they become adults. Then they start to fly and move in a vast swarm. A single swarm may contain ten thousand million locusts and cover an area larger than greater London. Swarming adult locusts can fly 80km a day and they may travel several 1,000km before they settle to breed.

The swarming locusts will devastate an area. A large swarm may eat 160,000 tonnes of food each day. This amount of corn would feed 800,000 people for a whole year.

Who or what eats locusts?

Locusts can be eaten by spiders, birds, lizards and desert foxes. The birds can eat so many that they become too heavy to fly off. In some parts of Africa people even eat locusts with honey!

How can we stop the locusts eating our crops?

Farmers used to try to drive away the locusts by lighting fires. They also dug up the eggs. Now crops can be sprayed with insecticides from vehicles or aeroplanes. Scientists are trying to improve the control of locusts, by preventing or dispersing swarms. Farmers and scientists also link to try to predict when a swarm will appear, so that controls can be introduced earlier.

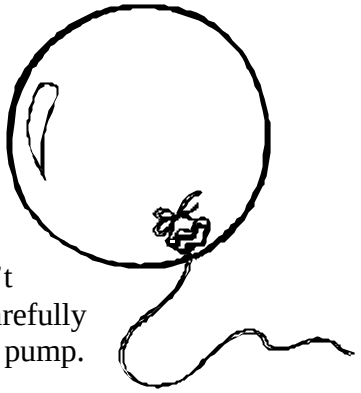
We can also use fungal pathogens to control grasshoppers and locusts, this is called biological control. The fungal pathogens can be sprayed onto the locusts. Locusts can also be attacked by parasites that develop inside the locusts or their eggs.

Growth and movement

Question: If the locust skeleton (called a cuticle) is on the outside, how does the locust grow?

Answer: The locust grows in stages. When the nymphs need to get bigger they shed their old skin (called moulting) and a new skin forms underneath this which is bigger.

Balloon models



We can demonstrate how a locust moults by using a balloon and papier mâché.

First blow up the balloon to half its size using a balloon pump. Then cover the balloon with strips of papier mâché around the middle. Don't cover up the tied end of the balloon. When the papier mâché is dry, carefully untie the end of the balloon and inflate it to full size using the balloon pump.

Does the layer of papier mâché split? The papier mâché is like the old skeleton that has been shed. The balloon is like the new skeleton.

How do locusts move?

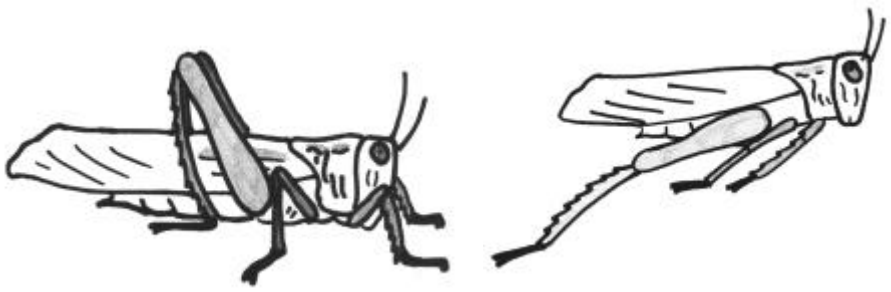
We are able to move because our skeleton has muscles attached to it. They surround the skeleton. Muscles come in pairs; when one muscle contracts and shortens, the other relaxes and lengthens back to its original shape.

Remember When muscles work they get shorter. This makes the animal move.

The locust has an exoskeleton which is on the outside of the body, so the muscles of the locust are attached to the inside of the skeleton rather than outside.

The back leg muscles of the locust are well developed. The back leg is about twice as long as the front and middle legs. When the locust jumps, the back legs work like a 'catapult'. The locust pulls the back legs in slowly, like an archer pulling an arrow back, then the locust releases the spring quickly, like releasing the arrow.

When it is preparing to jump, the locust pulls the bottom part of its back legs (called the tibia) underneath the top part of its legs (called the femur). When the muscles get shorter the leg is pulled straight and the insect is thrown into the air.



Locusts can also fly. When they have jumped as high as they can, they open both pairs of wings and flap the back wings. This propels them forward. If they are flying in the same direction as the wind they can fly up to 19km per hour.

How are locusts adapted? Fact sheet

"How are locusts adapted ? What do you think?" can be used to stimulate class discussion. The fact sheet is an aid for teachers to guide the discussion.

When the locust is on its own (called the solitarious phase) it is green. This is the colour of the vegetation. Why do you think that the locust is green?

Is it because it eats grass? NO
Although the locust does eat a lot of grass, the exoskeleton is not transparent so you wouldn't be able to see the grass inside the locust's body.

Is it for camouflage? YES
The green colouration of the solitarious form helps to conceal the locust in the vegetation. *The children could also discuss which other animals use camouflage.*

Is it to warn off predators? NO
The green colour of the solitarious form doesn't warn off predators. However, the multi-coloured pattern of the gregarious form makes it difficult for predators to identify individuals in the swarm and probably has a warning role. The gregarious locusts sometimes actually eat poisonous plants so that the predators are deterred from eating them.

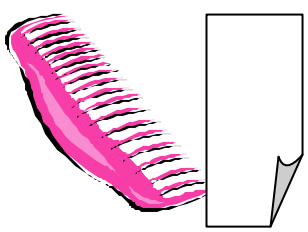
The back legs of a locust are bigger than the back legs of many other kinds of insects. Why do you think that the locust's back legs are so big?

Are they for hopping? YES
Insects like grasshoppers and locusts can hop. The last pair of legs are longer and more powerful and the muscles are bigger. A locust can jump up to 50cm, which is ten times its own body length. Ask the class "*How far would you be able to jump, if you could jump ten times your height*?"

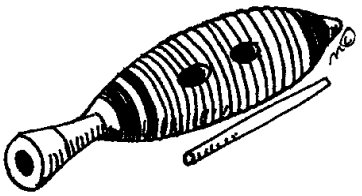
Are they for defence? YES
Some of the large grasshoppers and locusts have spines for defence. Some grasshoppers may also shed a leg if an enemy attacks it. Hopping away is still the locust's main way of escape.

Are they for chirping? YES
Male locusts also use their back legs to produce sounds to attract a mate. They rub their back legs against their hard front wings. Locusts have a row of spines on their back legs. Locusts do not have ears on their heads, instead they hear through their abdomen. Crickets make sounds in a different way to locusts. They "sing" by rubbing their two front wings together. Their ears are in their legs.

Ask the class
Would the spines on a locust's legs make the sound louder or quieter than if they had smooth back legs? Try scraping a comb against a piece of card. Is it louder when you run the teeth or the smooth back edge of the comb against the card?



Can you think of a musical instrument that you use at school that works like this? A guiro (or scraper)!



Extra ideas for class activities

Classification and keys

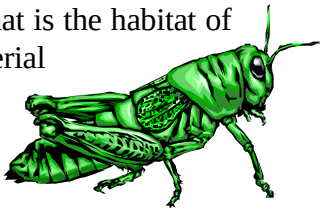
Mini-beasts are usually called bugs or flies. Tell the class that insects actually have different groups (in fact there are 23 different groups) and that two of these groups are called ‘bugs’ and ‘flies’. Some other groups are ‘beetles’, ‘fleas’, ‘butterflies and moths’, ‘bees wasps and ants’ and ‘grasshoppers and crickets’.

You could ask the class to find pictures of insects and put them into their groups. If the insects aren’t in any of these main groups above you could also have a group called ‘others’, this may include insects like dragonflies, stick insects and earwigs. Ask the class to write a key that other classes could use.

Habitats

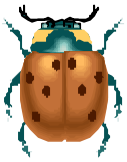
Ask the class “What insect can we find in Britain that is like a locust?”. What is the habitat of this insect. If you were going to collect the insect, what type of habitat material would you give to it?

This links to Discovery Card 2 of the BBSRC Minibeast Discovery Pack “There’s no place like home!”.



Life-cycles

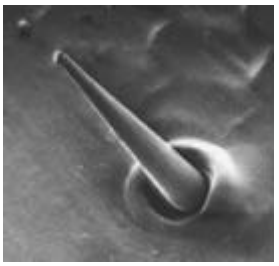
Ask the class to choose another insect. Find out if it has complete or incomplete metamorphosis.



Ladybirds are a good example of complete metamorphosis. They have an egg stage, a larval stage (try to find their larvae, they look very different from the adults and look like black and yellow caterpillars), a pupal stage and an adult stage.

They are also a good example of different types of species because small ladybirds with two spots are a different species from the larger seven spotted ladybirds (they are not just baby ladybirds).

Eating – What should we eat?



A taste receptor

Locusts have special taste receptors that cover the surface of their bodies. There are over 1,000 receptors on each leg and many thousands on the mouthparts. They can tell what tastes good and what tastes bad. They can also tell what sort of nutrients are in the food, and they choose what to eat on the basis of its nutritional status.

Ask the class to find out what foods they should eat.
Then see if they can plan a meal that would be good for them and draw a picture of it.