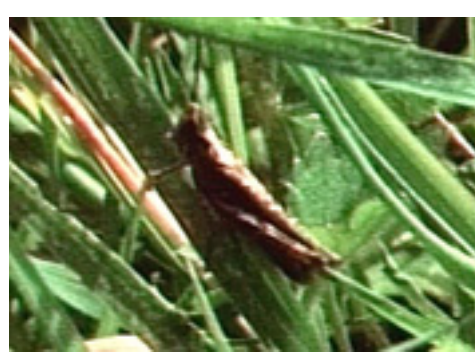


INSECTS



Insects are defined by three main identifying features. If it has wings it is an insect, if it has three pairs of legs it is an insect and if it has three body parts, head, thorax and abdomen it is an insect.

A spider with only two body parts and four pairs of legs is not defined as an insect, although in the same group as insects, defined as arthropods. Insects are the most successful group of animals on the planet, a million known species. They have hard protective skins, reproduce in huge numbers, are able to fly, go through different life cycles exploiting different feeding niches, can live in water and in the air, and will eat any kind of plant and animal food.

Insects were on the planet long before humans, 400 million years ago, while humans have been on the planet for 7 million years.

Insects represent over two thirds of the worlds 1.8 million named species, 1.05 million compared with 73,000 vertebrates (animals with a backbone), with many more insect species still undiscovered. There are many more insect species than all the other species put together. Their physical size makes them undervalued, understudied by scientists. Nevertheless they play a vital role in maintaining the world we all inhabit.

At the bottom of the food chain they feed the small animals, that feed the larger animals, that feed many of us. They pollinate the crops that feed us. They recycle nutrients as they feed underground nourishing the trees and plants. They maintain the balance that allows us to survive.

Insects are divided into 8 groups, dragonflies, mantis, grasshoppers, beetles, wasps and bees, flies, bugs, butterflies and moths. They have two different courses of development, those that develop in stages, from egg to caterpillar to pupae to their adult form, like butterflies, beetles, ants, bees and wasps, and those that grow in stages, shedding their outer skin as they grow, like cockroaches and dragonflies.

Insects have extraordinary sensibilities. They do not have lungs but absorb oxygen directly into their cells, Ants can see into the ultraviolet spectrum, beetles and butterflies can sense infrared. Hawkmoths can see color in complete darkness. Moths antenna can smell a female from miles away. Jumping spiders have four pairs of eyes, allowing it to see in front and behind at the same time. Crickets can sense the airflow produced by a wasps wingbeat. Bees can detect electric fields, sensing the negative grounding of flowers inviting pollination. Flies have ultrafast vision reacting to stimuli 7 times faster than a human.

Insects have extraordinary life patterns. Butterflies are on the wing during the summer months, but may go through three to four generations in that time. Some overwinter as adults in a near dormant state, others as pupae or a caterpillar waiting to hatch in the spring. Bees build intricate mud structures under the eaves of houses, or tunnel onto the barks of trees, to lay their eggs.

Cockroaches deposit their dark brown egg capsules at the back of kitchen drawers, their nymphs taking one year to mature through several moults.

The decline in their populations has gone almost unnoticed.

An estimated 2 million insect species are at risk of extinction with the insect population declining by 2% each year. This is in the context of an average 70% decrease in wildlife populations over the last 50 years.

24% of invertebrates are at risk. Insects that pollinate crops, fruits, vegetables as well as flowers. Without insect pollination 75% of food crops will wither. Already up to 5% of food crops are lost due to lack of pollination because of insect decline.

More than half of all species live in the soil. Healthy soil depends on insects that live in the soil recycling nutrients. A hotter climate and dryer soil reduces the soil populations, reducing the soils capacity to feed growing plants. Overproduction and lack of recycling nutrients has led to 40% of land now classed as degraded.

Clean water depends on healthy plant ecosystems. Fewer pollinators reduce plant growth which increases pollutants entering the water systems. Only 40% of the waters in Europe are considered to be in a healthy state

Insects in the garden pollinate flowers, encourage birds to visit, give nutrients to the trees, from tiny mosquitoes that bite people in their sleep to four inch long stick insects, noisy crickets and secretive cockroaches. Some fly, others crawl. Most can be found in a town garden.

MATING

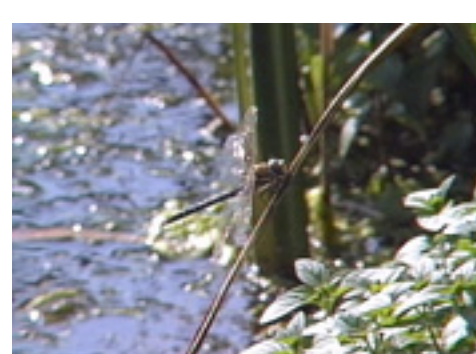


Most insects live solitary lives. They must find and recognise a prospective mate. This is done by sight, sound or smell. The sense most frequently used is scent, emitted by the female and detected by the male. This is a chemical, known as a pheromone, which gives a scent unique to each species. Moths can pick up the females scent over two miles away. The pheromones are produced by the female in minute quantities, the male can sense one tenth of a thousand of a millionth of a gram. Night flying male moths can pick up the odour from pheromones emitted by the female 3 miles away through his sensitive antennae. Butterflies use sight to recognise partners, their bright colours having been developed for recognition through evolution. The male waits on a branch for a passing female, who will emit a pheromone to encourage him to fly up to invite her to his branch to mate. Dragonflies have acute eyesight. The male will intercept a female flying over his territory and mate on the wing. Grasshoppers and crickets communicate by sound. Grasshoppers stroke the pegs on their hind legs against their wings. Each species has a different arrangement of these pegs, making a sound unique to the species. The male does most of the singing, recognised by the female who will sing back. Male crickets announce their presence by brushing one wing against the other, one wing has a ridge the other a row of pegs. Cicada males sing by vibrating a membrane at the base of its abdomen. Their song can be loud and penetrating.

INSECT METAMORPHOSIS

There are three types of insect metamorphosis. Primitive insects like the silverfish are a smaller version of an adult when they are born. They may shed their skin as many as 50 times as they grow to become a full adult. Dragonflies and grasshoppers have a truncated growth cycle, egg, nymph and adult. Butterflies, moths, flies, bees and wasps have a complete growth cycle, egg, larvae(caterpillar), pupa(chrysalis), and adult. Grasshoppers develop in stages, growing larger with each moult, their wing appearing as buds on then second moult, and increasing in size with each moult, fully developed after the last moult. Its legs appear much earlier allowing it to hop around as it develops. There is no considerable change in their feeding habits and way of life as they grow and in adulthood. The dragonfly and damselfly has a complete change of lifestyle. Most of its life is spent underwater As a nymph. To mate it needs to leave the water. It will then crawl up a reed where its skin splits and the mature insect crawls out. It's fully formed wings are folded and crumpled, slowing drying and unfurling under the sun. It flies around the pond advertising itself and mating, the eggs dropping back into the water. Butterflies start life as larvae, a caterpillar, which eats voraciously, growing and shedding its skin. It then turns into a pupa(chrysalis). The pupa hangs on the underside of a twig, while all the organs not required by the adult butterfly are liquified, producing the material and energy to build the adults organs. When the butterfly emerges it is a completely different organism. The larva and nymph stages are entirely used for feeding and growth, the adult stage is for reproduction, to find a mate and restart the cycle.

INSECT EYES



Insects have two kinds of eye. The simpler sort of eye has a single lens and is called an ocellus, a convex lens with a transparent layer underneath beneath which are light sensitive cells. The second kind of eye, a compound eye, there are numerous lenses, sometimes many thousands. The eye has a cornea divided into thousands of hexagonal cones. The simple eyes are situated on the side of the insect's head and are used only to detect movement and light intensity. Most insects have compound eyes as well, situated on the top of their heads, which help the insect to react more quickly to light. Night flying insects lack the dark pigment which surround the eyes cone and retina. As this pigment absorbs light, the night flyers are better able to see without it.

The larger the eye, the more cones and the better the eyesight. Dragonflies have the largest and most developed eyes, enabling them to spy prey while flying at speed. Underground insects on the other hand will have simple compound eyes as they do not need to see clearly. Bees and wasps have colour vision which extends into the ultra violet, although cannot detect red at the other end of the colour spectrum. They see the ultraviolet patterns in flowers which direct them to the pollen at the flowers centre.