TREES AND BUSHES

WIND POLLINATION

Trees disperse their pollen either on the bodies of visiting insects or blown in the wind. Wind pollinated plants produce much more seeds than insect pollinated as the chances of pollen arriving on the right plant are random. Wind pollinated flowers usually have large dangling anthers, without petals or sepals with the stamens protruding on the outside of the flower for the pollen to be more easily swept by the wind.

Wind pollinated trees do not produce colourful flowers as they do not need to attract insects. Their flowers, or catkins, are small, do not have petals or sepals, which would obstruct the pollen as it is blown on the wind. Catkins are either male or female. Only a few trees like the horse chestnut, have both male and female in the same single catkin. Some trees, like the willows and poplars, have either male or female catkins on separate trees, other trees, the oaks and alders, bear male and female catkins on the same tree. Male catkins have a tasselled, elongated shape while the female catkins are minute and bud shaped. They begin to grow at the end of summer, overwinter as small tight buds, and ripen with the longer days and higher temperatures of early summer, the male catkins rapidly elongating.

The male catkins produce huge amounts of pollen as wind pollination is random and only some pollen will reach the large feathery stigmas of the female pollen. The sweet chestnut is insect pollinated and so its catkins mature later in the years when there are more insects. Willows use both insects and the wind to disperse pollen. Catkins are less common on trees that petalled flowers. The catkin producing trees in Britain are - The beech family, oaks, flowering April-May with both sexes on the same tree, sweet chestnut, whose catkins contain both male and female flowers, pollinated by insects, flowering June-July. The Birch family, the birch with male and female catkins on the same tree, flowering in April-May, alder with male and female catkins on the same tree flowering in Febuary-March. The hazel family, hazel with both sexes on the same tree flowering January-April, hornbeam with both sexes on the same tree, flowering April-May. The willow family, willow with both male and female catkins on separate trees, pollinated by wind and insects, flowering in spring, poplar, male and female catkins on separate trees, flowering February-March. The Walnut family, the walnut flowering in June.

INSECT POLLINATION

Flowers have many shapes, sizes and colours. They are composed of the same four structures, sepals, petals, stamens and pistils. The green sepals make up the outer ring of the flower and their role is to protect the flower while in bud. The petals are the colourful structures designed to attract insects to feed and carry the flowers pollen. Wind pollinated plants have fewer petals. The stamens, the male part of the flower, are made up of anthers borne on the tips of filaments. The anthers produce the pollen holding the male cells. The pistil is the female part of the flower, consists of the stigma, the style and the ovary. The stigma collects the pollen grains and which will lead to germination, producing a pollen tube which grows into the style, transferring the germinated pollen to the ovary. The basis structures are the same for all flowers, although petals can have radically different shapes.

The flowers colour and scent attract the insects. Pollination is the process of carrying pollen from the anther to the stigma. In self pollinating plants pollen grows down from the stigma through the style and fertilises a flower on the same plant. Cross pollination occurs when pollen moves from one plant to another. Cross pollination produces a more robust plant, fusing the genetic characteristics of two plants, than self pollinating plants. Insect pollinated flowers have anthers which hold the pollen deep onside the flower. The insect must enter into the flowers body to to reach the nectar, collecting the pollen on its body as it does so, transferring the pollen from one flower to another. Bees, wasps, butterflies and moths have special structures on their bodies to collect pollen, plover baskets on the legs of bees, and the long coiled tongue of the butterflies.

LEAVES

Leaves on plants provide them with the nutrients in needs. This is done through photosynthesis, the chemical reaction of water and carbon dioxide which combine to produce sugars. Sunlight triggers this process and so these sugars are produced only during the day. To turn the sugars into energy the leaves need to respire, where the sugars are combined with oxygen to provide energy for the plants growth and reproduction. As the plant respires it releases water and carbon dioxide. Respiration takes place day and night. Leaves have four layers. On the skin are the epidermal cells which protect the leaf's inner layers from damage and bind the leaf's structure. Beneath this is the palisade layer, where cells containing chlorophyll, where the sunlight is trapped and which gives the leaf its green colour. Beneath the palisade layer is the spongy mesophyll where loosely packed cells allow gasses to pass in and out.

The lowest layer is perforated with a number of control valves called stomata, which allow gasses to pass between the spongy mesophyll and the outside atmosphere and control the passage of water through the leaf, increasing it in dry weather and reducing it in wet weather. The shape of the leaf maximizes the take in of light with the exchange of gasses. A thin layer covers the top and bottom of the leaf, the cuticle, which prevents unwanted water loss, at the same time protecting the leaf from damage inflicted by insects and fungi. Hairs on the leaf surface disrupt the air flow and cool the leaf and trapping water on the leaf's surface.

PLANT AND ANIMAL CHEMICAL CYCLES

All plants and animals need certain chemicals to have the energy for breathing, movement, growth and reproduction. These chemicals are recycled when the plant or animal dies, broken down by bacteria and fungi, to feed growth. This occurs in a series of natural cycles.

Carbon cycle. Carbon is drawn from the carbon dioxide in the atmosphere. Animals cannot obtain carbon direct from the atmosphere, but plants combine it with other chemicals to form sugars in the process of photosynthesis. Sugars are used by the plants grow, and breathe. As the plants breathe they return the carbon dioxide into the atmosphere. The plant's sugars are held within the plant until it withers and returned to the soil as it is broken down by fungi and bacteria. Or the plant may be be eaten and the sugars used for the herbivores own growth. This carbon dioxide may be returned to the atmosphere, or stored in the soil, as the insect and animals bodies are broken down in turn by bacteria and fungi, stored in peat, coal, oil and gas.

Nitrogen cycle. More complex than the carbon cycle, involving numerous bacteria in a series of chemical changes. 80 percent of the atmosphere is nitrogen, but to be useful to life, nitrogen needs to be converted to a solid state. Nitrogen fixers, the algae and bacteria capable of of converting nitrogen gas into a solid, are found in bacteria in the soil or in the nodules of the roots of leguminous plants like the clover, vetch and gorse. The fixers convert the nitrogen to ammonium compounds, turning into nitrites and nitrates by other bacteria in the soil. Nitrates are taken up by plant roots to produce protein to feed growth. The nitrogen in the plant finds its way back into the soil with the death of the plant, or in the excreta of the animal that feds from the plant, where it is converted by bacteria into ammonium compounds and so the cycle continues.

Phosphorus and sulphur cycles. Phosphorus is taken up in roots of plants as phosphates, sulphur is held in plants as sulphates. Both chemicals return to the soil with the plants death to be taken up by soil bacteria to be released for future growth