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Further information for teachers (on Pollination PowerPoint presentation)

This short illustrated presentation describes the process of pollination and explains its importance in flowering plants. It includes examples of the way in which flowers are adapted to both wind and insect pollination. The examples chosen are mainly plants that are commonly found in the wild in Britain or can be readily grown in the garden. It is ideal if children can see the living plants as well as the pictures.

The presentation can be used directly as a teaching resource for a whole class or for smaller groups of children. A version without text is provided for those teachers who wish to use some or all the pictures, while providing their own explanation. Some more advanced children may be able to use the text version on their own. Teachers may wish to use the presentation as an introduction to the pollination game, see booklet (Part 2), page 8 or to out of classroom activities described elsewhere on the SAPS website.

The presentation is also intended for primary teachers who have only a limited background in science and may wish to know more about the subject of pollination.

Useful information is given in the text version of the presentation. The notes provided here give some more details about plants shown in the slides and this extra information may be of interest to some teachers.

Introduction

In flowering plants sexual reproduction involves the joining of male genetic material inside the pollen grain with female genetic material inside the ovule. This then forms the seed. This mixing of genetic material results in the offspring having a slightly different genetic make-up from each other and from the parents. This variability makes it more likely that, in a changing environment, at least some offspring in each generation are well enough adapted to survive.

Slide 1

The title page shows Germander Speedwell (*Veronica chamaedrys*). You can see the 2 stamens and stigma and style. Dark blue nectar guides on the petals direct the visiting insects towards the nectar.

Slide 2

The crocus shows the 3 stamens, which produce the pollen grains, and form the male part of the flower. Each stamen consists of a stalk (filament) and 2 pollen sacs (the anthers). The female part of the flower consists of the ovary, style and stigma. In the crocus the ovary lies below ground at the time of flowering. The style is divided into 3 branches each of which bears a fringed stigma.

In Britain, the crocus is often grown in gardens and several different species are represented. The styles of the saffron crocus (*Crocus sativus*) provide the spice known as saffron.

Slide 3

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Pollination is the transfer of pollen (often by insects and other animals, but sometimes by wind or water) from the stamens to the stigma.

When they land on a stigma, only pollen grains from the same species of plant or genetically very similar species are able to produce pollen tubes. Most species of plants have pollen grains that are unique and differences in size and shape are often clearly visible at high magnification. Self pollination occurs when pollen lands on the stigma of its own flower or another flower on the same plant. Cross pollination occurs when pollen is transferred to the stigma of a flower on another plant. Since some genetic mixing takes place in the production of the male and female cells, even self pollination will result in some variation, but maximum variation occurs as a result of cross pollination, which is therefore preferable. The structure of many plants is designed to promote cross pollination.

A method that can be used to demonstrate the growth of pollen tubes is given on SAPS Student Sheet 4 on the SAPS website.

Slide 4

The amazing variety of size, shape, colour and even smell of flowers is linked to their pollination mechanisms. After watching the presentation children can be encouraged to think about how some of the wild flowers they see around them might be pollinated. Are they wind-pollinated or insect-pollinated? How big might the insect be and so on? Be careful if using cultivated flowers as these often come from abroad where other agents, such as birds and mammals, may be involved. Useful information about the way in which flowers are pollinated in some of the more common families of flowering plants is given in Hickey and King (1997) and Holm (1979) – see references at end of these notes.

Slide 5

The Hazel (*Corylus avellana*) shown here is typical of many wind-pollinated trees. The male and female parts are borne in separate flowers to help ensure at least some cross pollination takes place. Numerous male flowers dangle in tassel-like catkins readily releasing pollen as they are blown about by the wind. The female flowers are grouped in special buds. The styles are crimson and can be seen protruding from the bud, catching pollen being carried in the air. The flowers of wind-pollinated trees are often produced in early spring before the trees come into leaf, allowing the wind more access to the catkins. Look for Hazel in flower during January and February.

Slide 6

This male Hazel catkin shows the large amount of pollen which is produced as the catkin moves. The pollen grains of wind-pollinated plants are usually very small and light so that they can be carried long distances. In Timothy grass (*Phleum pratense*), 210 million pollen grains weigh just one gram!

Slide 7

In the grasses, it is the stamens that have long dangling stalks. Even gentle movement of grass stems in a light breeze can release large amounts of pollen. The stigmas, which develop later, are long and feathery helping them to sweep pollen from the air. It is often the grasses that flower in June and July which cause problems for hay fever sufferers.

Slide 8

Nectar is mainly a solution of various sugars in water and is a very important food source for many adult insects. Social bees, like the honey bee, store much of the nectar they collect as honey. The Butterfly-orchid (*Platanthera chlorantha*) is a rare plant but nectar can be found in the long spurs of the common and easily grown garden plant, the Nasturtium (*Tropaeolum majus*).

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Orchids, like the Butterfly-Orchid, have complicated pollination mechanisms. The flowers are mainly pollinated by long-tongued moths, which can reach the nectar in the long spur. In order to present the flower parts in the right position for pollination, many orchids, like this one, move the flower through 180° as it opens. The result of this twisting can be seen in the flower on the left of the picture.

Slide 9

Pollen is rich in protein and is important particularly to bees, which feed their larvae on pollen as well as nectar.

Slide 10

In insect-pollinated plants the pollen grains often have a sculptured outer pollen coat, which helps them to stick to the hairs of the insect. These pollen grains are generally larger and heavier than those of wind-pollinated plants as they do not need to be carried in the air.

Slide 11

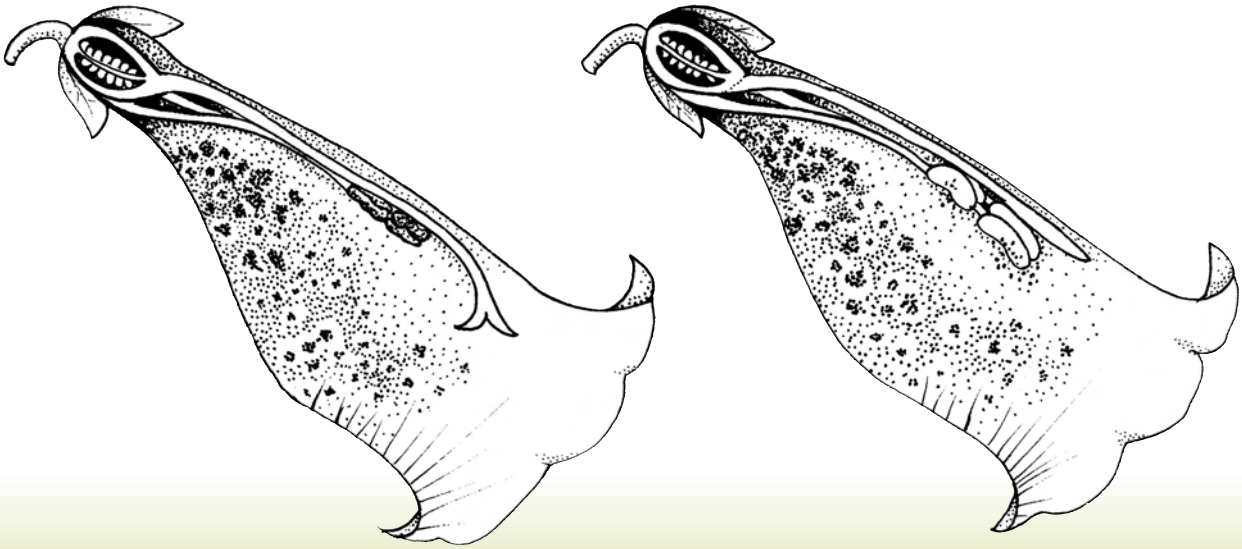
The Foxglove (*Digitalis purpurea*) is a common plant found in both woodland and open ground on acid soils. It should be in flower by June, before the end of the summer term and is a good plant for children to study as the flowers are large. It is also easy to grow from seed. (**Safety note:** *The heart drug digitalin is extracted from this plant and it is very poisonous if eaten.*)

Slide 12

The Bumble bees are attracted to the Foxglove flower by its bright colour. The blotches on the petals, which can be seen here, are nectar guides directing the insect to where the nectar is and at the same time guiding it into the right position to carry out pollination.

Slide 13

In the Foxglove, the male parts of the flower mature before the female parts. In many plants with tall spikes of flowers (like the Foxglove), the flowers at the bottom of the spike are the oldest and will be at the female stage with the stigmatic arms open ready to receive pollen whilst those towards the top will be at the male stage with stamens shedding pollen. Bees normally visit the bottom of the spike first, depositing pollen they have brought with them from other plants, and collecting pollen as they move towards the top of the plant. This makes it less likely that a plant will receive its own pollen and this helps to promote cross pollination. In the flower shown here, the stamens have almost shed all their pollen and the stigmatic arms are beginning to open and bend forward, ready to receive pollen.



Slide 14

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The Large-flowered Evening-primrose (*Oenothera glazioviana*) flowers from June until September and is often seen on waste ground. Like the Foxglove, it grows readily from seed and has large flowers. They are exciting to watch as the sepals and petals rapidly unfold and the flowers pop open in the early evening. The bright luminous yellow colour quickly attracts dusk flying moths, such as the Silver Y moth shown here.

Slide 15

Broom (*Cytisus scoparius*) flowers in May and June. This shrub and its close relatives are often grown as garden plants.

Slide 16

The explosive action, caused by a bee arriving on the flower, can be observed early in the morning. By midday the crop of flowers for that day will mostly have been triggered. The action of the bee can be copied by tapping the keel with a pencil!

Slide 17

The Dandelions (*Taraxacum* spp) have showy heads composed of many small flowers. These mature from outside inwards. If a head is examined closely the outer flowers can be seen with their stigmatic arms just beginning to separate, whilst those towards the centre will have the stigmatic arms curled over backwards looking like a pair of lorgnettes. Dandelions grow nearly everywhere.

Slide 18

The Common Poppy (*Papaver rhoeas*) is a weed of waste and arable places. It flowers from June until August. It is one of the few truly bright red wild flowers found in Britain. It produces no nectar and is pollinated mainly by bees collecting pollen.

Slide 19

Many insects, including bees, can see ultra-violet (UV) light but do not see colours well at the red end of the spectrum. Scarlet flowers are therefore rarely found in the European flora where the most important pollinators are insects, particularly bees. Scarlet flowers are, however, common in North and South America and other geographical areas where birds are important pollinators as birds' eyes are sensitive to red. The Poppy, which appears red to humans, also reflects ultra-violet light so appears ultra-violet to bees. Many flowers when photographed in ultra-violet light using a special filter show patterns that are normally only visible to insects.

Slides 18 and 19 in particular are relevant to the Activity 'The colours of flowers' (see the booklet, *Reproduction and life cycles*, Part 2, page 11).

References

Holm E (1979) *The biology of flowers*. Penguin Nature Guide. Penguin Books.

Hickey M and King C (1997) *Common families of flowering plants*. Cambridge University Press.