



Department of Horticulture

Purdue University Cooperative Extension Service West Lafayette, IN

A Guide to Flowering and Why Plants Fail to Bloom

*Michael N. Dana and B. Rosie Lerner**

Pollination is the initial step in the transformation of flowers into fruits. Pollen is physically transferred from the “male” to the “female” flower structures. Honeybees take most of the credit for transferring pollen for vegetable, tree fruit and berry crops. But the wind also transfers pollen in crops such as corn, nuts, and some landscape plants. Other natural pollen carriers are moths, butterflies, birds, and water.

Flower Structure

A flower is usually composed of many parts. It has sepals, which enclose the flower bud; petals, which are frequently attractive and colorful; and stamens, the male flower parts, which hold pollen. A filament and anther make up each stamen. Flowers also have a female part called the pistil. It is composed of a stigma, style, and ovary. Seeds develop inside the ovary. The entire flower rests on the flower’s stem called the pedicel (Figure 1).

Pollination is the transfer of male pollen grains by some means from stamens to pistils. When pollen from the anther sticks to the stigma of the pistil, pollination has occurred (Figure 2). When a grain of pollen sticks to the stigma of the pistil, it grows down the style of the pistil until it reaches an ovule (immature seed) within the ovary. Cells are discharged from the pollen grain inside the ovule where they unite with female sex cells. When this occurs, the process is called fertilization (Figure 3). After fertilization has been completed, the ovule matures into a seed and the ovary enlarges to form a fruit or seed-holding vessel. Both pollination and fertilization must occur for a seed to develop.

Some plants develop fleshy pulp around the seeds. We commonly call these fruits. Examples of these are apples, oranges, tomatoes, grapes, etc. Plants that do not develop fleshy pulp around the seeds usually have other types of seed-holding vessels. For example, beans are enclosed within a pod and milkweed seeds are found within a dry capsule or follicle.

Flower Types

Some plants bear perfect flowers. These have both sexual parts—stamens and pistils in each flower. However, other plants bear imperfect flowers which have at least one sex absent. If stamens are missing, then the pistil must receive pollen from another flower (Figure 4).

Some plants have evolved so that separate male (bearing stamens) and female (bearing pistils) flowers are on the same plant such as birches, cucumbers, and begonias. These are called monoecious plants. Dioecious plants have separate male and female flowers, but they are borne on separate plants. Holly, willow, and poplar are examples (Figure 5) of dioecious plants. Therefore, for fruits to develop on a holly plant you must have a cultivar bearing female flowers and a nearby source of pollen from a holly cultivar of the same type bearing male flowers.

Female flowers can usually be distinguished from male flowers. Female flowers have an ovary directly behind or within the bloom which usually looks like a tiny, immature fruit (Figure 6).

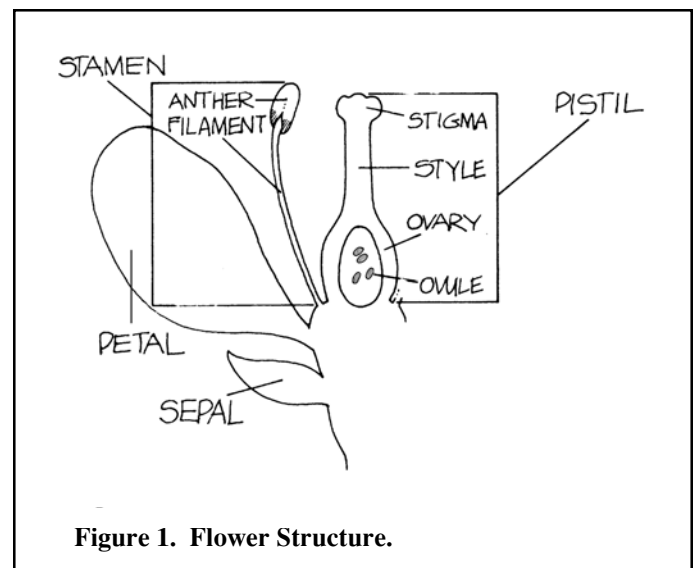


Figure 1. Flower Structure.

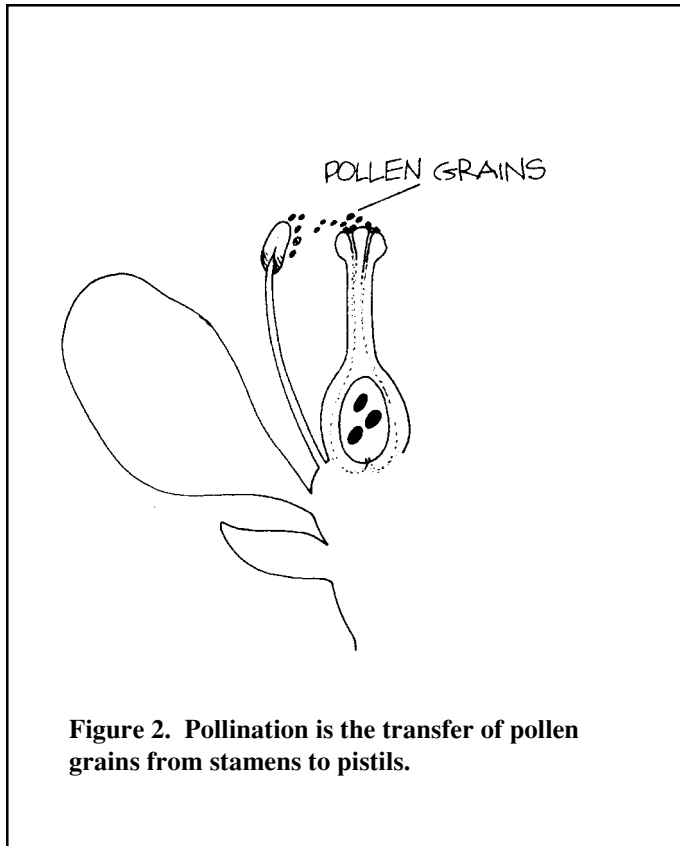


Figure 2. Pollination is the transfer of pollen grains from stamens to pistils.

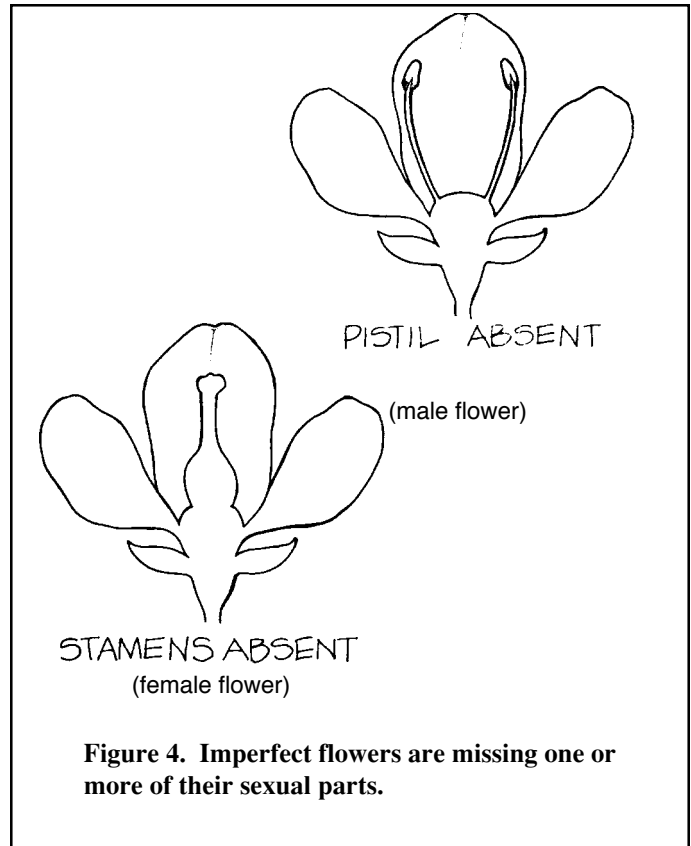


Figure 4. Imperfect flowers are missing one or more of their sexual parts.

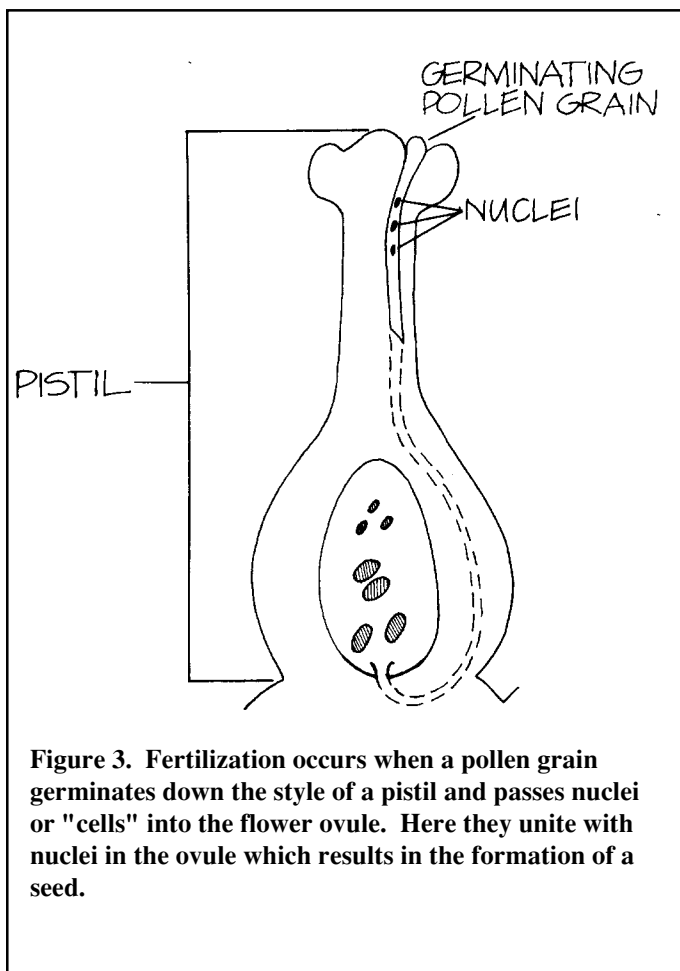


Figure 3. Fertilization occurs when a pollen grain germinates down the style of a pistil and passes nuclei or "cells" into the flower ovule. Here they unite with nuclei in the ovule which results in the formation of a seed.

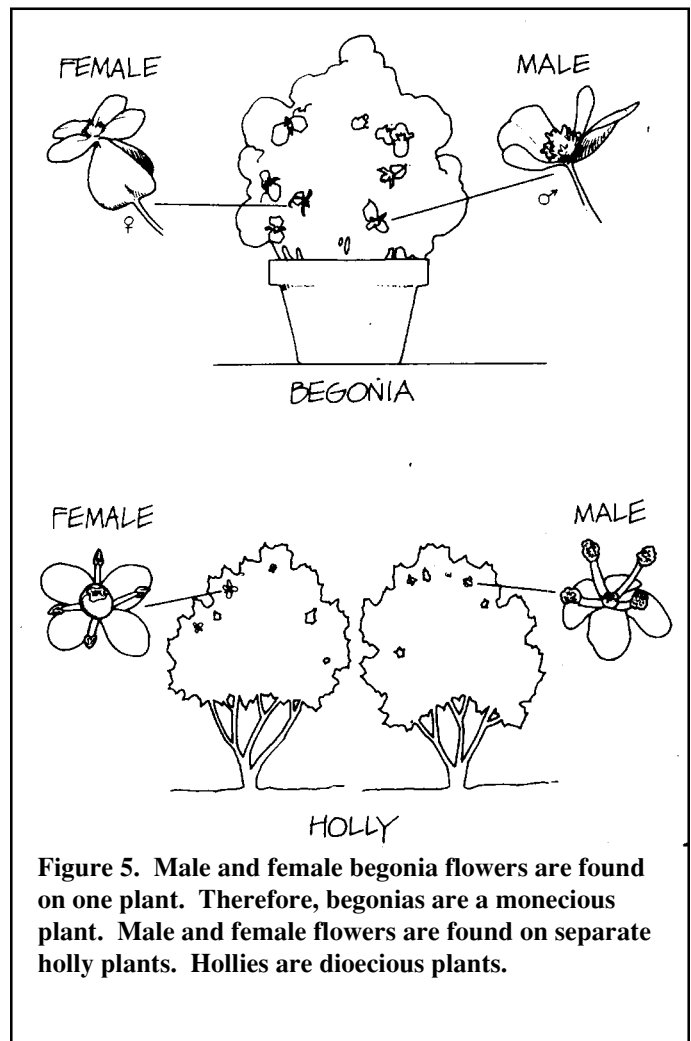
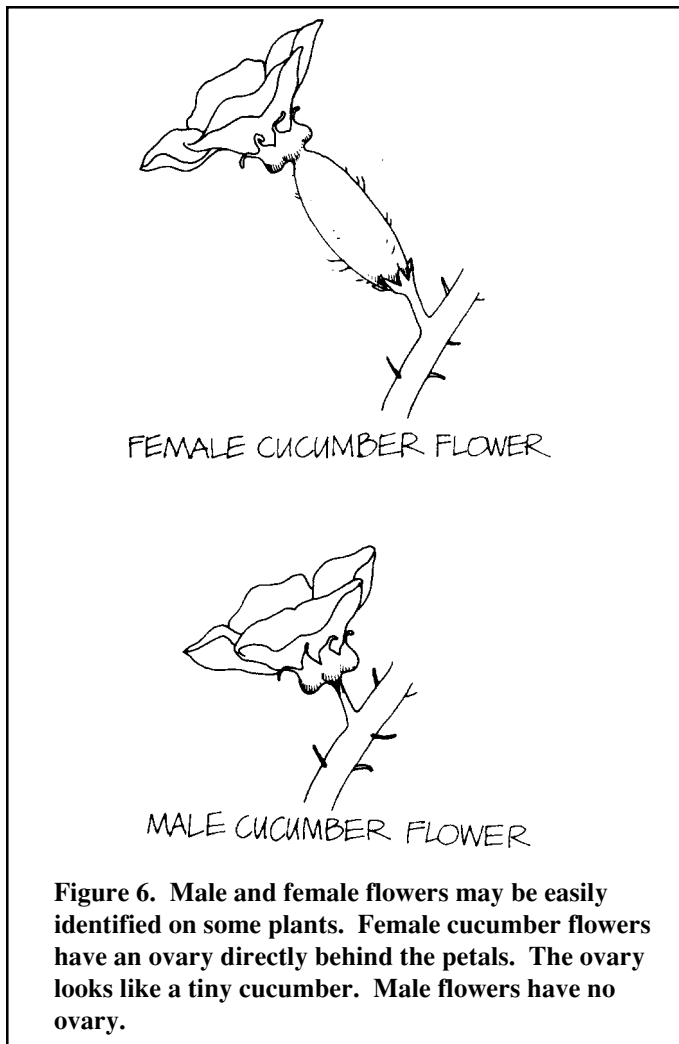


Figure 5. Male and female begonia flowers are found on one plant. Therefore, begonias are a monoecious plant. Male and female flowers are found on separate holly plants. Hollies are dioecious plants.



is generally related to one or more of the following: plant age, temperature, light, and other environmental and cultural factors.

Age

Many woody plants have a vegetative phase of growth called the juvenile stage in which the plant does not flower. This stage occurs early in the life of a plant and is sometimes characterized by leaf shapes different than those of other plant parts or leaves clinging to the branches in the fall. While the plant is in its juvenile stage, flowering is prevented by an intricate chemical balance within the plant. This juvenile phase may last 2-3 years on some flowering shrubs or 5-10 years on certain trees. Plants often experiencing a lack of flowering due to juvenility include century plant, crabapple, flowering cherry, Wisteria, and tulip tree.

The flowering of plants produced by budding or grafting may be altered by the type of rootstock on which the plant was grafted. Generally, dwarfing rootstocks produce plants that flower at a younger age than those grown on non-dwarfing rootstocks. For example, standard-sized fruit trees bloom 2-7 years after planting. However, dwarf apple and pear trees bloom 1-2 years earlier.

Some vegetables such as melons, cucumbers, squashes, and pumpkins produce male flowers a week or two prior to the female flowers. When female flowers appear pollination should take place and fruits will begin to develop.

Pollination

Plants have evolved different types of flowers as well as a variety of ways in which pollen is transferred between flowers.

Self-pollination occurs when pollen is transferred within the same flower or between different flowers on the same plant or cultivar. Tomatoes, peppers, and strawberries are examples of self-pollinating plants.

Cross-pollinated flowers must receive pollen from a different plant or cultivar of the same plant-type for fruit to set. For example, most apple flowers need to receive pollen from another apple tree and/or different cultivar for fruit to develop. The pollen may be carried by insects, wind, etc. Examples of cross-pollinated plants are sweet cherries, most apples, and most plums.

Failure to Flower

Successful fruit production requires flowering, pollination, and fertilization. However, some gardeners find that their plants do not bloom. This applies to fruit, landscape, indoor, and garden plants. The cause of failure to bloom

Temperature

Cold temperatures play an important role in flowering for many plants. Although extreme cold is harmful to some plants, a certain amount of cold is needed for many fruit, landscape, indoor, and garden plants to flower. Plants requiring cold temperatures include spring-flowering bulbs, fruit trees, and spring-flowering landscape plants.

Flower buds may be killed by low winter temperatures so few or no blooms appear in spring. This is noticeable with forsythia which may flower only on the portion of the plant protected by snow in extremely cold winters. The two outer bracts (petals) of dogwood flowers may be injured during the winter. The damaged flower will have only one or two bracts instead of the usual four. If your plant fails to flower in spring, examine it to see if flower buds are present. Flower buds usually have a different shape and/or are fatter than leaf buds (Figure 7). If flower buds are present but have not bloomed, they may have been killed by low winter temperatures.

Sometimes flower buds survive winter only to be killed near bloom time by low spring temperatures. Examine the plant for signs of damaged flowers or flower buds.

Cut several flower buds in half. Browning of the interior indicates the buds have been damaged. Also, study the low temperatures of the past several days to determine whether frost or freeze is responsible.

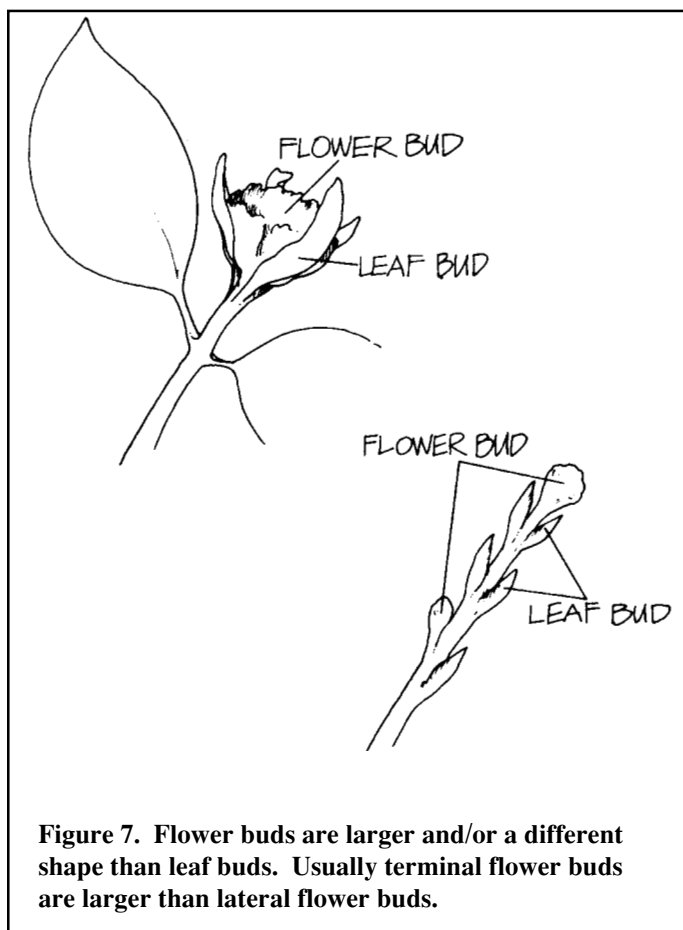


Figure 7. Flower buds are larger and/or a different shape than leaf buds. Usually terminal flower buds are larger than lateral flower buds.

Light

The flowering of some plants is controlled by the number of hours of light and darkness they receive each day. These plants are said to be photoperiodic. Some of these plants flower after they have received prolonged periods of darkness (15-18 hours/24 hour period) for several weeks. These are called “short-day” plants. Poinsettia, chrysanthemum, and gardenia are examples of “shortday” plants. “Long-day” plants must have several weeks of 15 hours of light or more to produce flowers. Examples of shrubs that naturally flower in long days of summer are: rose-of-Sharon, glossy abelia, and weigela

Not all plants are photoperiodic. Most plants need some light to flower. Plants growing in shady areas or darkened rooms may produce lush foliage and appear healthy, but few if any flowers are produced. Moving these plants to sunny locations will help promote flowering.

Nutrition

Vigorously growing plants producing lush foliage may not bloom. Excessive nitrogen fertilizer that promotes an overabundance of leafy growth may be the cause. To obtain blooms on such a plant, the rate of fertilization should be decreased. Water the plant thoroughly once to wash the excess nitrogen from the soil. It may require some time for landscape plants to begin flowering after the nutritional balance has been corrected.

Failure to Fruit

Sometimes plants flower and we assume that they will set fruit. However, weather, lack of bee activity, and an absence of an appropriate pollen source can inhibit fruit formation. Also, some fruit trees flower every other year due to chemical balances within the plant and the previous year’s fruit load. This is called “alternate bearing.” Plants can be encouraged to bear a normal crop every year by proper pruning and crop thinning.

Weather

If frost destroys blossoms, then the fruit will not develop. Apricots, peaches, sweet cherries, dogwood, and other plants all bloom early and are susceptible to frost damage.

Blossoms and/or buds on some beans, pepper, tomato, and other vegetables may drop off during periods of excessively low or high temperatures, high or low humidity, and hot, drying winds. When weather becomes normal, the plants will resume flowering.

Bee Activity

Fruit trees, many vegetables, and other plants are pollinated by bees. Windy, cold, wet weather may prevent bee activity while flowers are in bloom. If they are not pollinated, fruit cannot set.

Pollen Source

Plants that require a second cultivar for a pollen source will not set fruit unless that source is within 50 to 100 feet of the tree. Nut trees sometimes set small fruits which fail to develop and fall from the tree. This is often due to the lack of an adequate pollen source.

** This publication was previously authored by Juliann Chamberlain*

For more information on the subject discussed in this publication, consult your local office of the Purdue University Cooperative Extension Service.