SPECIALIZED INFLORESCENCE

(A) **Verticillaster:** The Sage (*Salvia*) and *Ocimum* (Tulsi) plants provide excellent examples of verticillaster. In the sage plant at each node there are in addition to whorls of flowers, pair of opposite leaves. Each leaf of the pair has really an inflorescence in its axil. The inflorescence of sage really consists of a pair of dichasia, but the flowers are either sessile or subsessile, and hence, they appear to be crowded together. The succeeding daughter axes of each diachasium form scorpioid cymes. This kind of inflorescence is found in several members of the family Labiateae like *Coleus, Mint* (Podina) *etc.*

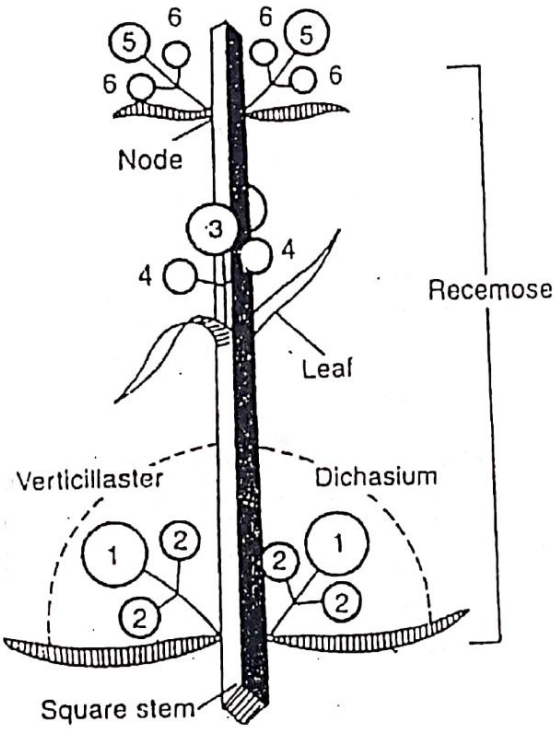


Fig. 6.9. Verticillaster.

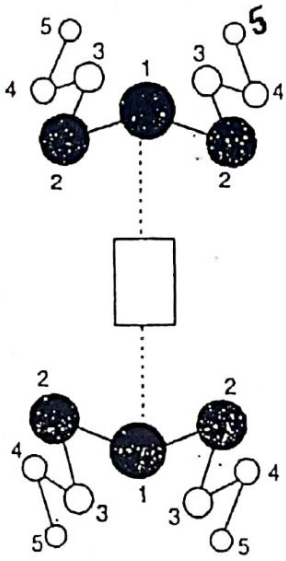


Fig. 6.10. Transverse section of a verticillaster showing the relation of flower.

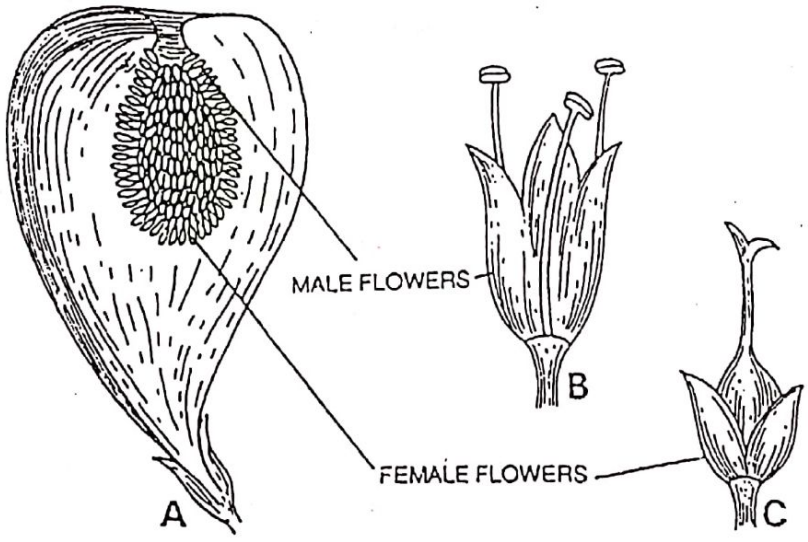


Fig. 6.11. Hypanthodium, fig in longitudinal section

(B) **Hypanthodium:** It is really a highly specialized type of racemose inflorescence. It may be considered to be a modification of the capitulum. In the capitulum, the receptacle is flat, and the sessile flowers are always crowded on its surface. But in hypanthodium the receptacle forms a fleshy cup-shaped structure with a minute opening at the apex which is guarded by small scales. The flowers are borne by the inner margin of the hollowed out receptacle. The flowers are small, greatly reduced and unisexual, the female flowers are borne towards the

bottom and male flowers are borne towards the top of the cavity. Familiar examples are the Banyan (bargad), Fig (anjeer), Goolar, *etc.* (Fig. 6.11).

(C) **Cyathium:** This special type of cymose inflorescence looks like a single flower and is commonly found in the members of the family *Euphorbiaceae.* The familiar examples are *Poinsettia* and *Euphorbia.*

Each apparent flower-like structure consists of a cup-shaped **involucre,** which is formed by the union of large number of bracts of the flowers of the inflorescence. The cup shaped involucre is usually brightly coloured and may have on its rim many crescentic **extra-floral nectaries.** The individual flowers of the inflorescence, which are enclosed by the invloucre, are always unisexual and greatly reduced. The central part of the cup is occupied by a single pedicellate naked pistillate (female) flower, surrounding which are found numerous pedicellate male flowers arranged in scorpioid cymes. Each male flower is so much reduced that it is represented by single stamen. The stamen is always distinctly joined to a long pedicel which may be of a different colour. The presence of a distinct joint between the pedicel and the filament of stamen is a clear proof of the fact that it is a reduced flower. In certain cases each of these reduced flowers may arise in the axil of fine filament-like bracteoles. The order of developmenty of these male flowers is always **centrifugal,** that is the oldest flowers are found near the centre, while younger flowers lie near the periphery (Fig. 6.12).

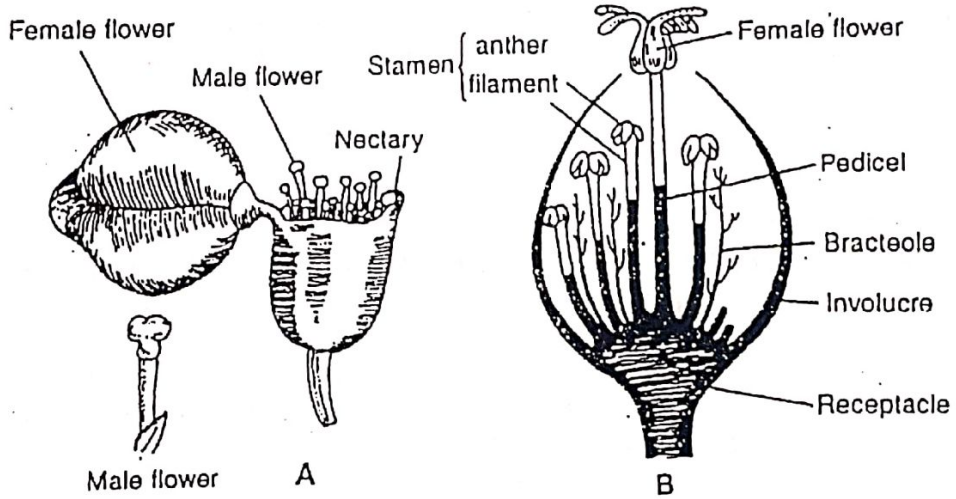


Fig. 6.12. Cyathium of *Euphorbia* — A, outer view ; B, longitudinal section.

Table 6.4 : Differences between hypanthodium and capitulum.

Hypanthodium	Capitulum
1. It is a specialised type of cymose inflorescence.	1. It is a racemose inflorescence.
2. The receptacle is fleshy and flask shaped.	2. The receptacle is usually flattened and never fleshy.
3. The flowers are unisexual.	3. The florets may be unisexual, bisexual or neuter.
4. The flowers can be pollinated only through a pore present on the upper surface of the swollen receptacle.	4. Flowers are exposed hence can easily be pollinated.
5. It is characteristically found in *Fig.*	5. It is characteristic inflorescence of the family Compositae.
6. Pollination dependent upon the wasp *Blastophaga.*	6. Can be pollinated by butterflies or bees.

POLLINATION

The transference of pollen grains from the anther to the stigma is termed as **pollination.** It may be of two types:

(*a*) Cross-pollination, and

(*b*) Self-pollination.

Self pollination always involves only one parent plant. It is carried out in two different ways. *viz*-

(*i*) Pollination taking place within a flower **(autogamy)**, or,

(*ii*) Pollination involving two different flowers situated on the same parent plant **(geitonogamy).**

Similarly, **cross pollination** may involve (i) transfer of pollens of a flower to the stigma of another flower situated on a different plant of the same species **(xenogamy)**, or,

(*ii*) Transfer of pollens of a flower of one species to stigma of a flower of a different species **(hybridisation).**

CROSS-POLLINATION OR ALLOGAMY

Cross-pollination is much more common in plants than self-pollination because of certain advantages. These advantages are:

(*i*) Experimental evidence shows that cross-pollination leads more often to the production of stronger and healthier seeds than self-pollination.

(*ii*) It provides for the blending of the characters of the two parents. Thus, it provides a great opportunity for the production of individuals with new and useful characters. Since it is the strongest, and thus most fitted for life in the particular situations, it is most likely to survive and produce well-developed plants.

(*iii*) As a result of cross-pollination new characters are introduced. Self-pollination cannot give the ovum any new character or new ability of any kind, but pollen from some other plant may bring with it new factors. This is important, because as environments are continually changing, so it becomes important that new characters should be developed, which make it possible for plants to thrive under the changed conditions.

(*iv*) It has been utilized by man to improve his crops and offer greater variety. The many different kinds of apples, pears, plums, potatoes, roses, carnations, sweet-peas and so on, are primarily due to cross-pollination. In recent times, wheat has been tremendously improved in the same way from several points of view. A strong, healthy, disease-resisting crop is desired, and one which

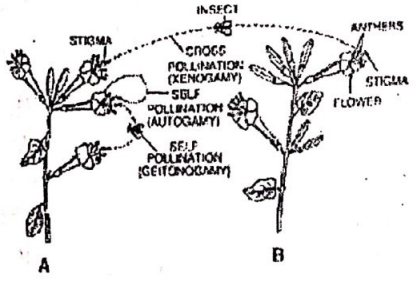
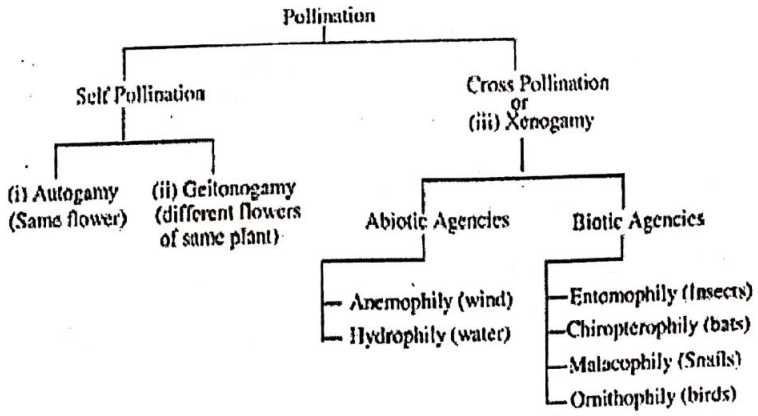


Fig. 2.16. Self and Cross pollination.



will produce good wheat grains for milling and making bread. All these and many other characters have been modified as a result of cross-pollination.

TYPES OF CROSS-POLLINATION

Cross-pollination needs the assistance of some external agent to transfer the pollen from one flower to another. The following main types are found:

(*i*) Anemophily (Wind-pollination)

(*ii*) Entomophily (Insect-pollination)

(*iii*) Hydrophily (Water-pollination)

(*iv*) Ornithophily (Bird-pollination)

(*v*) Malacophily (Snail-pollination)

(*iv*) and (*v*) are together also known as Zoophily.

Anemophily or wind-pollination

Some flowers are adapted to use the wind instead of insects to convey their pollen from the anthers to the stigmas. Such flowers are known as wind-pollinated or anemophilous flowers, and they show the following special features:

(*i*) They do not need bright colour and are small and unisexual.

(*ii*) The flowers are generally small and petals and sepals are absent or poorly developed.

(*iii*) No nectar is secreted as a rule.

(*iv*) The flowers have no scent.

(*v*) Wind-pollinated species produce large quantities of pollen just for ensuring pollination. One plant of *Rumex* produces about 39 crores of pollen grains.

(*vi*) When flowers are unisexual, the staminate flowers are very much more numerous than the pistillate ones.

(*vii*) The stigmas of wind-pollinated flowers are usually broad and feathery (Fig. 8.1) and sticky, and so afford a larger surface for catching pollen grains. The filaments of stamens are long and anthers are versatile.

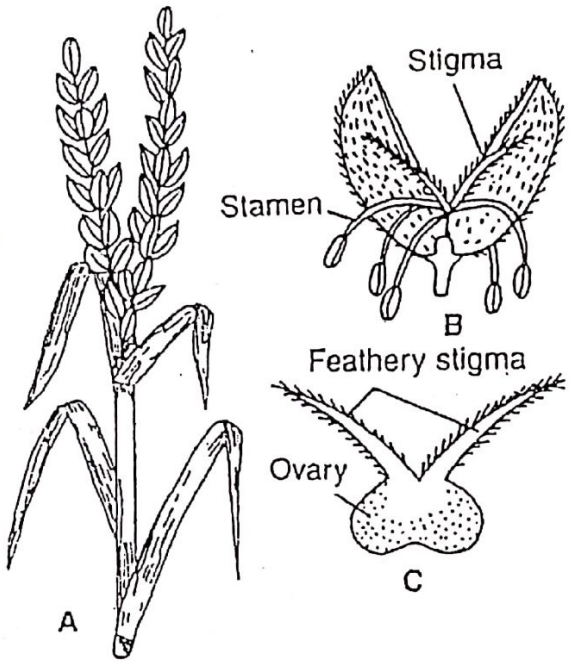


Fig. 8.1. Wind-pollinated flowers of a corn plant A, one complete inflorescence; B, a simple spikelet; C, ovary with feathery stigma.

(*viii*) Many wind-pollinated species produce their flowers above the green leaves, as is found in wheat, barley, corn, plantains, or they do so at a time when they do not have leaves. In the silk-cotton tree (Semal) the flowers appear early in the spring before the leaves have appeared. Both of these arrangements increase the chances of pollen grains to reach the stigma.

(*ix*) In such flowers no attracting or feeding materials are needed, and thus, some of the energy and material is saved which is used to produce more and often larger anthers well-exposed from the protective bracts. The stamens are usually pendulous and exserted.

(*x*) The pollen is quite dry and dusty.

(*xi*) The pollen is light and smooth and can thus be easily blown away by wind. In some cases, as in *Pinus* (Fig. 8.2), the pollen grains may be winged.

Wind-pollination is exhibited by a relatively small number of species of flowering plants. It commonly takes place in those species which grow together in large numbers rather than in those which grow scattered. Since Wheat, Barley, Paddy, Maize, *etc.*, often cover quite extensive areas they are very well adapted to this method of pollination.

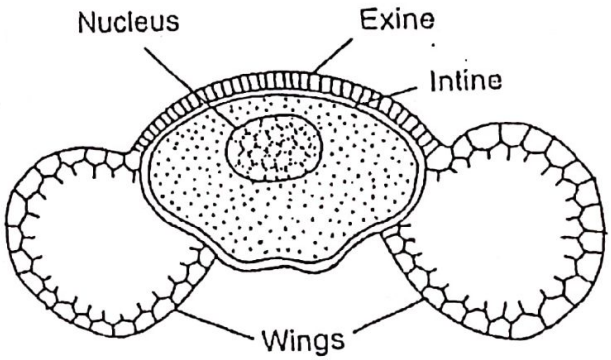


Fig. 8.2. Winged pollen grain of *Pinus*.

Indian corn (*Bhutta*) is a good example of a wind-pollinated plant (Fig. 8.3). The male flowers occur at the top of the plant in what is commonly known as the tassel (terminal panicle or compound raceme). The female flowers are produced lower down in compound spadices. Each spadix is protected by large greenish and membranous spathe. Large number of long silky hairs project from the spadix or ear and these are the styles and stigmas. When the anthers of the male flowers on top burst, a cloud of dust-like pollen-grains is formed. Each group of staminate flowers (*tassel*) may produce from 20,000,000 to 50,000,000 pollen grains. The female flowers, which are situated lower down, are thus in a favourable position to have pollens blown to them.

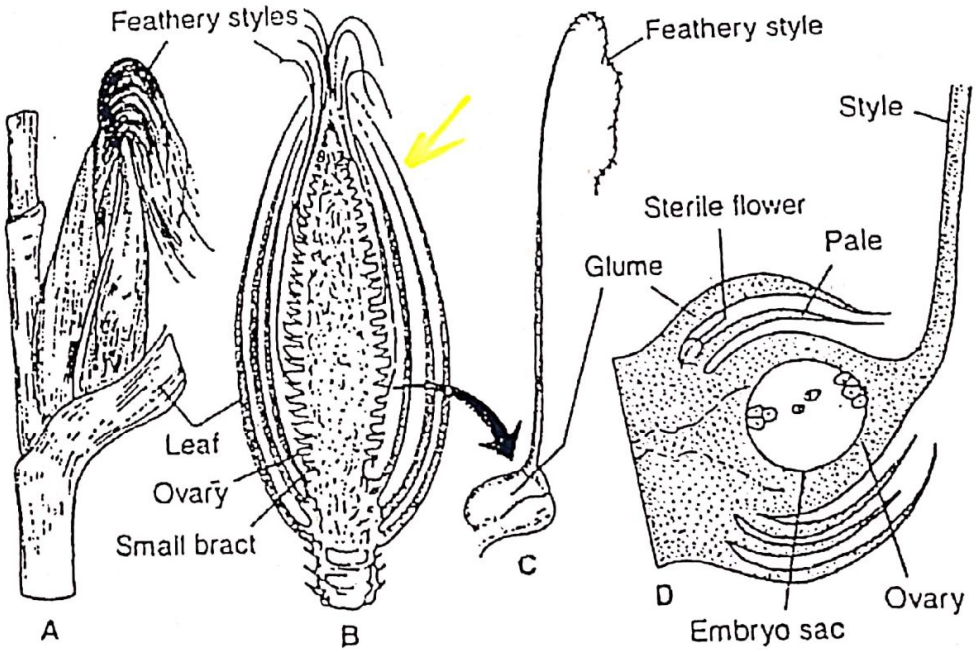


Fig. 8.3. Wind-pollination in the Indian corn.

⇨ Entomophily or insect-pollination

The adaptations of flowers which rely upon insects like Bees, Wasps, Butterflies, Moths, Beetles, *etc.*, for pollination, are almost countless.

(*i*) In general the flowers, or the inflorescence, are large and brightly coloured. The colours are very varied to suit the tastes of different insects. Bees are known to have a preference for blue and violet while moths visit white and pale yellow flowers more particularly, because these are easily seen in the twilight which is the time moths choose to fly abroad.

(*ii*) The sepals and petals are well-developed and showy.

(*iii*) Flowers which attract insects often have a pleasant scent. Large number of inconspicuous flowers are pollinated by insects that are attracted by the odour. Large and brightly coloured flowers in many cases are odourless.

(*iv*) Associated with both colour and scent there is usually nectar to feed the insect, which is placed in different positions to try and ensure the right kind of insect to come in at the front door and effect pollination. The nectar is a sweet liquid that is secreted by glands which may be on the receptacle or on the petals (spurs) or elsewhere. Bees use the nectar in making honey.

(*v*) Even flowers without any nectar, however, may satisfy some insects; bees, for instance, collect the pollen itself, as well as the nectar, and the flower is perfectly willing to let them have some pollen when there is plenty, in return for conveying a little of it to a suitable stigma.

(*vi*) Insect-pollinated flowers are spread out to some extent and are firm enough to provide a platform for the insect to alight.

(*vii*) Pollen grains are rough and sticky and usually are not produced in great abundance. Sometimes the pollen grains collect to form small masses known as *pollinia as in Calotropis* (Madar). The pollinia of *Calotropis* form a rider-like structure which is carried by an insect on its legs, from one flower to another.

(*vii*) Stamens have short filaments and are usually inserted.

(*ix*) The stigmas are short, rough and sticky so that they may easily catch rough or sticky pollen.

(*x*) Sometimes when the individual flowers are small and inconspicuous, other associated parts become enlarged and showy. Thus, in *Euphorbia* the bracts of each cyathium become deep red in colour. In *Bougainvillea* the bracts surrounding the small flowers become brightly coloured (Fig. 8.4). In Poinsettia (*Euphorbia pulcherrima*) the leaves in the floral region become bright red in colour. In *Mussaenda* one of the sepals becomes greatly enlarged and brightly coloured (Fig. 8.5). In some plants the stamens are brightly coloured and form the most conspicuous part; in *Eucalyptus* they are white or crimson, in Guava white or pink in colour; in *Mimosa* and *Acacia arabica*, the sepals and petals are very inconspicuous but a large number of flowers with long and brightly coloured stamens are crowded together into a showy feathery ball. In *Canna* the sepals and petals are inconspicuous and the brightly coloured part of the flower is composed of petal-like stamens. In Aroids and Plantains the spathes surrounding the spadix or spadices are brightly coloured.

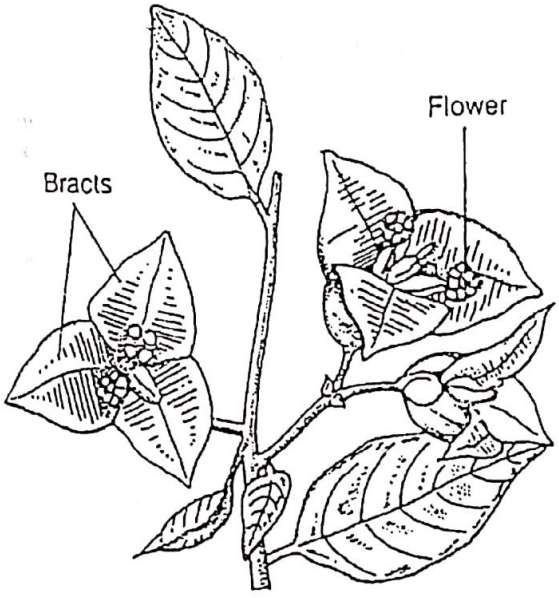


Fig. 8.4. *Bougainvillea* with large coloured showy bracts.

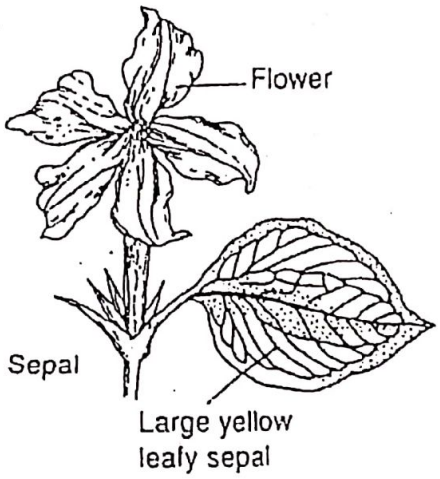


Fig. 8.5. *Mussaenda* flower with a flower modified into a large leaf like advertisement flag.

Reproduction in Flowering Plants

Sporogeesis, Gametogenesis and Fertilization:
It is in herent property of the living organisms to continue their race by mechanism of reproduction. The reproduction is a process by which the living beings propagate or duplicate their own kinds. There are three methods of reproduction.
1) Vegetative reproduction
2) Asexual reproduction and
3) Sexual reproduction

1) Vegetative Reproduction:
The reproduction takes place through vegetative parts such as bulbils, corms, rhizome, bulbs, stem cutting, root cutting, etc.

2) Asexual Reproduction:
In asexual reproduction, special cells or asexual reproduction units are produced by the parent body which grow themselves into new individuals. Therefore, the development of new individuals without fusion of male and female gametes is known as asexual reproduction. The asexual reproduction usually includes mitotic division of the body (somatic) cells, it is therefore, also known as somatogenetic or blastogenic reproduction. The asexual reproduction is common only in lower plants and animals and may be of fission, budding, gemmule formation and regeneration types.

3) Sexual Reproduction:
In sexual reproduction development of new individual take place by the fusion of sex called male and female gametes. It is the most common type of reproduction among plants and animals. There are two types of sexual reproduction.
i) Isogamy ii) Heterogamy

i) Isogamy:
Union of two similar gametes which cannot be distinguished into male and female gametes is called Isogamy. Fusion of such gametes is called conjugation. It is observed in lower plants like mucor and spirogyra.

ii) Heterogamy:
Union of two dissimilar gametes i.e male and female gametes is known as fertilization and the zygote is called Oospores. This type of reproduction is common in flowering plants. And can be divided into:
A) Apomixis B) Amphimixis

A) Apomixis:
It is an abnormal sexual reproduction in which embryo develops from the egg cell, without fertilization and with or without meiosis. It is of various types- a) Parthenogenesis b) Apogamy c) Apospory

a) Parthenogenesis:
In this case embryo develops directly from the egg cell or male gamete without fertilization. It gives haploid (n) plants.

b) Apogamy:
In this case embryo develops directly from haploid nuclei other than egg cells i.e it develops from synergids or antipodal cells of the new embryo sac.

c) Apospory:
In this case embryo develops directly from the somatic cell i.e. it develops from integuments of nucleus.

B) Amphimixis:
This is normal sexual reproduction in which embryo develops from the union of male and female gametes in plants and sperm and egg or ovum in animals.
The process of male gamete formation is known as microsporogenesis and female gamete formation as megasporogenesis in plants.