Chapter - 1
Reproduction in Angiospermic Plants

Alternation of generations is not distinct in angiosperms. Their plant body is a diploid sporophyte, which is long-lived, autotrophic, differentiated into root, stem and leaves. This represents the dominant generation. Haploid gametophyte is another generation which is short-lived, very much reduced and develops on the diploid generation. It is not free-living.

There are two methods of reproductions in Angiosperms :-

(1) Asexual reproduction

(2) Sexual reproduction

(I) Asexual Reproduction

In this method of reproduction, the essential events of sexual reproduction i.e. meiosis and syngamy do not occur. Due to this reason, this type of reproduction is known as asexual reproduction or apomixis. In this method of reproduction, the offsprings are genetically similar to the parent plants. There are two types of asexual reproduction in angiosperms -

(1) Agamospermy (A = not or without; gamous = fertilization; sperma = seed): - In this method of asexual reproduction, the development of plants is through seeds but meiosis and gametic fusion do not take place in these seeds.

(2) Vegetative Reproduction or Vegetative propagation: - In this method of reproduction the regeneration of plants takes place from any vegetative part of the plant except its seeds. The plant organ used for vegetative reproduction is known as Propagule. Vegetative reproduction may be either (A) Natural vegetative propagation or (B) Artificial vegetative propagation.

(A) Natural Vegetative Propagation

This may take place from the following organs of the plants –

(i) Vegetative propagation by stems – Modified stems; like – Rhizome - example Ginger; Tuber – example Potato; Bulb – example Onion, Garlic; Corm – example *Colocasia*; Runner – example Lawn grass; Sucker – example Mint; Stolon – example strawberry etc, under favourable conditions help in multiplication of plants.

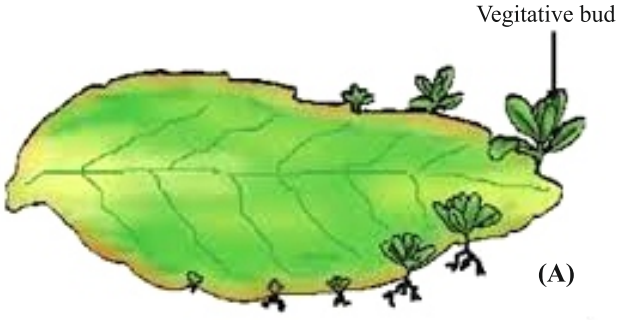
(ii) Vegetative propagation by roots :- In some woody plants, roots give rise to shoots, which grow into new plants like the mother plant, example neem, jasmine, Indian red wood , sisoo etc. There are tuberous roots in some plants which produce **adventitious buds**. These adventitious buds give rise to plants similar to the mother plant, examples Sweet potato, *Asparagus, Dahlia* etc.

Fig. 1.1 : Vegitative propagation by potato tuberous

Fig. 1.2 : Vegitative propagation by potato tuberous root in sweet potato

Fig. 1.3 : Vegitative propagation by potato tuberous root in Dahlia

(iii) Vegetative propagation by leaves : - In *Bryophyllum*, buds develop from the margins of leaves and in *Bigonia*, buds are produced from the petiole and leaf surfaces of along the veins, which upon separation from the mother plants, give rise to new plants like the plant on which they are produced.



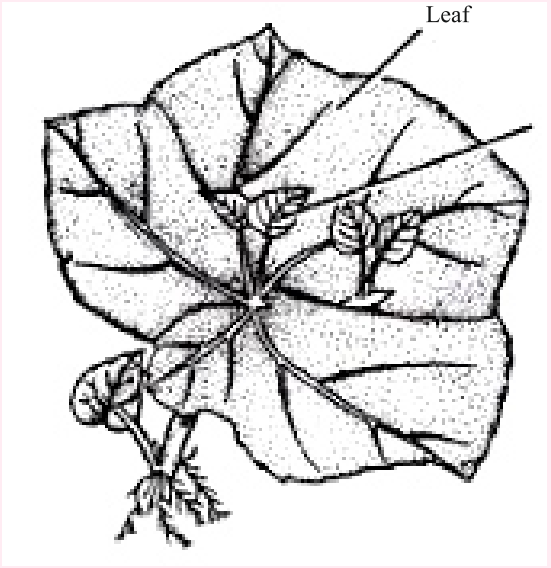


Fig. 1.4 : Vegitative propagation by leaf (A) Bryophyllum (B) Begonia

(iv) Vegetative propagation by reproductive organs :- In certain plants multicellular **bulbils** are formed in place of flower buds. When they fall on the ground, give rise to news plants, examples *–Agave, Dioscorea*.

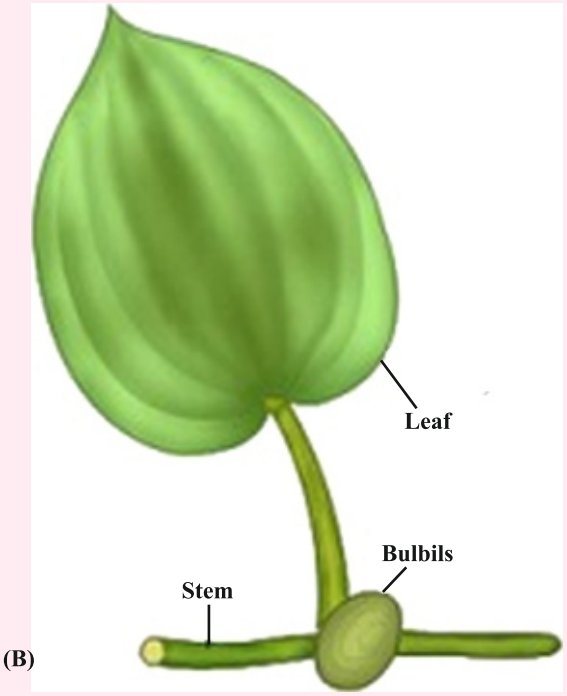


Fig. 1.5 : Vegitative propagation by reproductive organs (A) Agave (B) Dioscorea

(B) Artificial Vegetative Propagation

These methods are man-made and are used for the commercial production. Important methods of artificial vegetative propagation are as follows :

(i) Cutting : (a) Stems cutting (b) Root cuttings

(ii) Layering : (a) Mound layering (b) Air layering or Gootee

(iii) Grafting : (a) Tongue grafting (b) Wedge grafting (c) Crown grafting (d) Bud grafting.

(i) Cutting

(a) Stem cutting: In this method, stem of the plant is cut into small pieces and these pieces are planted in the soil. The vegetative propagation by stem cutting is affected by many factors such as length of propagule, age of the mother plant, environment of the area where cuttings are being grown etc. Examples of vegetative propagation by stems cutting are sugarcane, grapes, roses, *bougainvillea* etc.

(b) Root cutting: Lemon, guava, apple, cherry etc. are the examples of vegetative propagation by root cuttings. In root cutting method, the pieces of roots or cuttings are planted in vertical (erect) position so that the adventitious buds present on the top may sprout.

(ii) Layering

In this method, the stem or branch of the plant is induced to produce adventitious buds without separating it from the mother plant, which give rise to new shoots. There are two methods of layering:-

(a) Mound layering – In this method a drooping stems branch of a plant is buried in the soil. Care is taken during burring that at least two nodes of the branch are buried in the soil and the top of the branch remains above the soil level. After some time, adventitious roots from the nodes of buried portion of the stem start developing. After suitable time, this branch is cut from the mother plant and along with the soil mass, it is planted at the desired place, where it grows as an independent plant, example Sambac, Jasminum.

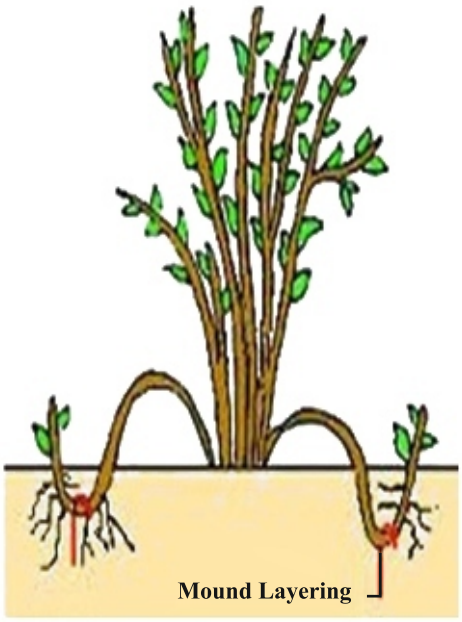


Fig. 1.6 : Mound Layering

(b) Air layering or Gootee – This method is used for the trees which have thick branches. In this method, the bark or outer layer of a normal, thick, healthy part of a branch is removed in the form of a ring. This bark- less part of branch is covered with moss, wet soil or wet cotton, which keeps this part moist. This covered part of branch is known as

gootee. As shown in the diagram, the gootee is provided with water drop by drop. After 4-8 weeks roots are seen in the gootee. This rooted gootee is removed from the mother plant and potted in the soil.

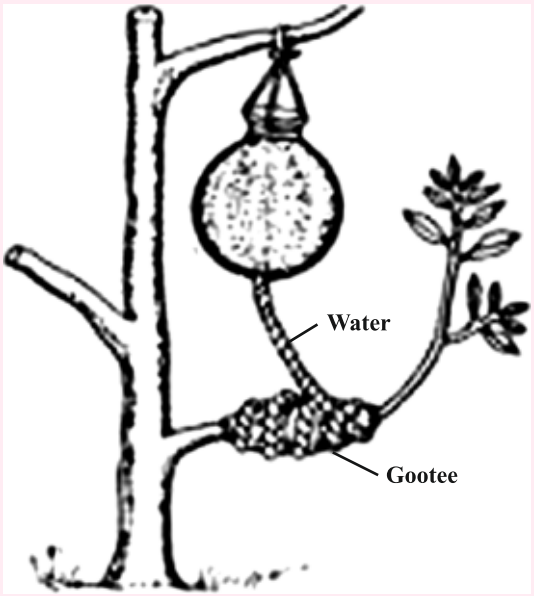


Fig. 1.7 : Gootee Layering

(c) Grafting – In this method, parts of two separate plants are joined in such a say that after combining they may grow in the form of a new plant. The part of good quality plant which is grafting is known as **scion**. The other local plant with inferior quality on which scion is fitted and which will form the base of the new plant is termed as **stock**. Scion and stock are tightly tied together so that their cambium remains in contact. After sometime both the cambium get attached and their cells start dividing. Now the vascular tissues of both scion and stock make contact with each other. This method is used in the economically important plants like roses, mango, apple, lemon etc.

Following are the main methods of grafting –

(a) Whip or Tongue grafting – In this type of grafting, both the stock and scion should be of same thickness. About 5-8 cm long 'V' shaped cut is made in the stock like wise the scion is cut in such a way that it gets fitted in the cut portion stock. After fitting the scion on the stock, it is tightly tied. After some days buds of the scion start growing.

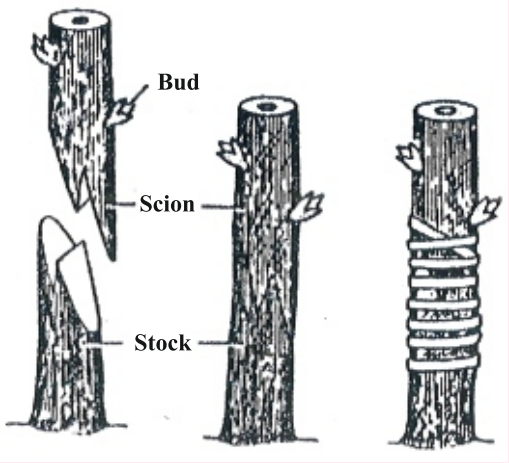


Fig. 1.8 : Whip or Tongue grafting

(b) Wedge grafting – In this method also the stock as well as the scion are of the same thickness. The stock is cut in the shape of 'V' while the scion is cut in wedge shape. After fitting the scion on the stock they are tightly tied together.

(c) Crown grafting – In this method, the stock is many times in thickness in comparison to the scion. Therefore a large number of scions may be grafted on the stock.

(d) Bud grafting – In this method, a bud is grafted on the stock. A 'T' shaped cut is made in the bark of stock plant and a bud is grafted in this cut. After grafting the bud on the stock, it is tightly tied. The grafted bud starts growing after few days.

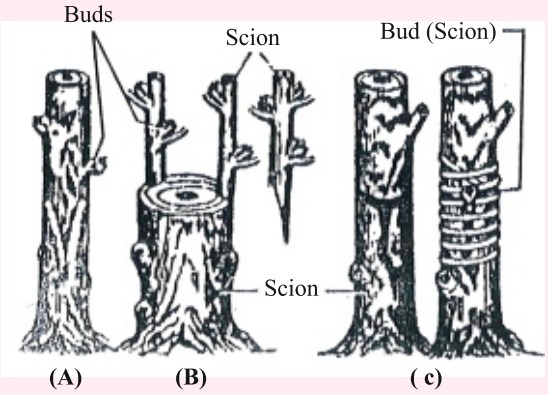


Fig. 1.9 : (A) Wedge Grafting (B) Crown Grafting (c) Bud Grafting

II Sexual Reproduction

In angiosperms, sexual reproduction takes place through flowers. A flower is a modified shoot with limited growth.

Flower is borne on a stalk known as **pedicel**. The terminal part of the pedicel gets swollen, which forms **thalamus**. A typical flower has four parts. If all these four parts are present, the flower is known as **complete**, but if any of these four parts is absent, the flower is termed as **incomplete**. Examples of complete flower are Mustard, Pea, etc. and those of incomplete flower are bottle gourd, papaya etc.

A flower consists of the following four parts or whorls:-

(i) Calyx : This is the outermost whorl of the flower and formed by **sepals**, the individual parts of Calyx.

(ii) Corolla : This is the second whorl of the flower and is formed by individual members known as **petals**.

(iii) Androecium : This whorl lies inner to the corolla and is the male reproductive part of the flower. Individual unit or member of androecium is termed as **stamen**. A stamen is formed by **filament, anther** and **connective.**

(iv) Gynoecium : The inner most whorl of a flower is known as gynoecium which is the female reproductive part of the flower. A gynoecium is formed by **carpels**. A carpel is composed of **ovary, style** and **stigma**. Carpel is also known as **pistil**.

Calyx and corolla are sterile parts and these are known as **accessory** whorls, while androecium and gynoecium directly take part is reproduction. Therefore, these are known as **essential** or **reproductive whorls.**

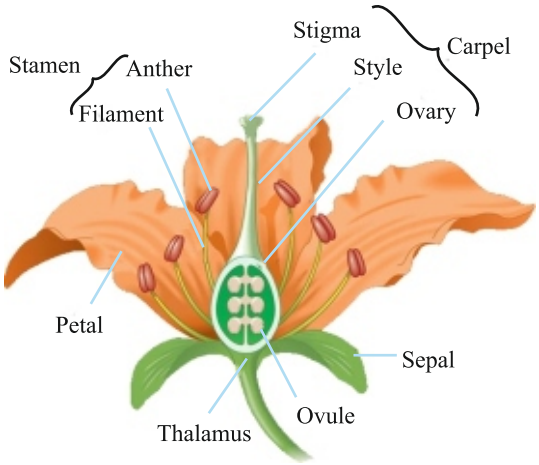


Fig. 1.10 : Various parts of flower (longitudinal section)

Important Points

1. There are two types of reproduction in angiosperms – asexual and sexual reproduction.
2. Asexual reproduction is further of two types – Agamospermy and vegetative reproduction or vegetative propagation.
3. In Angiosperms, sexual reproduction takes place through flowers.
4. A flower is a modified shoot with limited growth.
5. A flower has mainly four parts or whorls – calyx, corolla, androecium and gynoccium.

Practice Questions

Multiple Choice Questions –

1. The plant body of angiosperms is
   (a) Diploid sporophyte
   (b) Haploid sporophyte
   (c) Diploid gametophyte
   (d) Haploid gametophyte
2. The plant organ used for vegetative propagation is known as –
   (a) Calyx (b) Corolla
   (c) Gynoecium (d) Propagule
3. Vegetative propagation by tuber is found in –
   (a) *Murraya* (b) Potato
   (c) *Bryophyllum* (d) Onion
4. Vegetative propagation by cutting is found in –
   (a) Sugarcane (b) Jasmine
   (c) Sambac (d) All of these
5. Flower is a modified –
   (a) Root (b) Shoot
   (c) Leaf (d) Root tip

Very Short Answer Questions –

1. Write names of different parts or whorls of flower.

2. What is vegetative reproduction?
3. How does vegetative propagation take place is rose and sambac?
4. Explain cutting grafting and layering methods.

Short Answer Questions –

1. What is agamospermy?
2. Describe different methods of grafting?
3. Describe briefly the methods of vegetative propagation by stems.

Essay type Questions –

1. Describe in details, the asexual method of reproduction in angiosperms.
2. Describe various organs of flower of angiosperms.

Answer Key-

1. (a) 2. (d) 3. (b) 4.(d) 5. (b)