MORPHOLOGY OF FLOWERING PLANTS

THE STEM

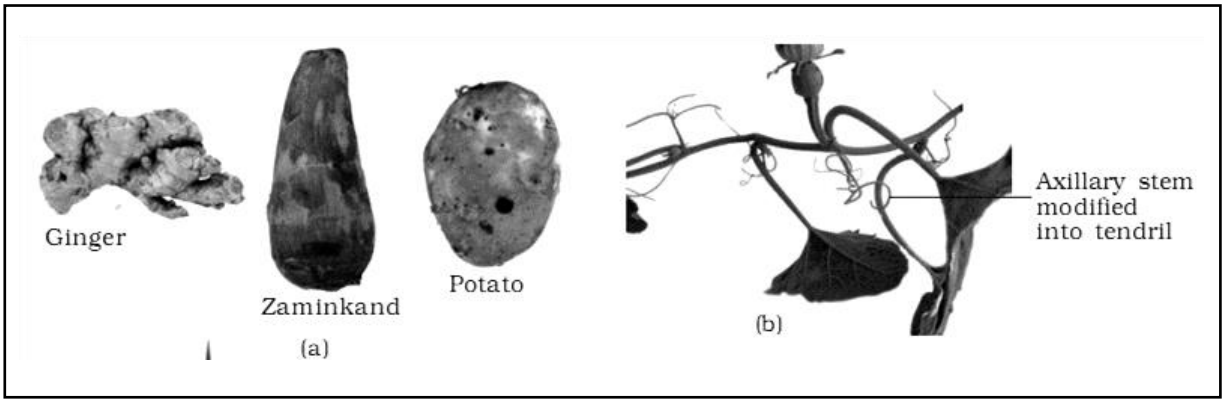
STEM

Introduction

Stem is an erect, ascending part of plant which develops from plumule of embryo.

Main characters of stem:

1. Stem bears Nodes and internodes.
2. It is positive phototropic and negative geotropic.
3. Stem bears leaves, flowers and fruits.
4. It has buds.
5. It bears lateral branches, which arise exogenously from cortex.
6. Hairs if present, they are multicellular.
7. Terminal bud of stem is responsible for the elongation of plant.



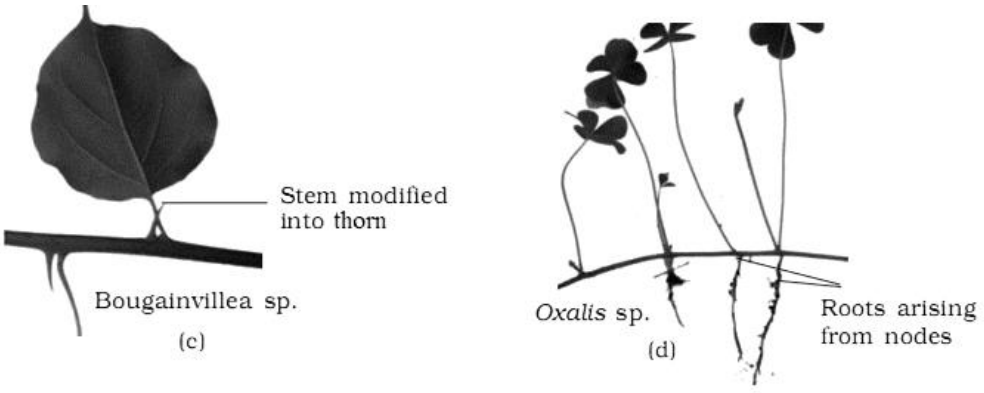


Fig.: Modifications of stem for: (a) storage (b) support (c) protection (d) spread and vegetative propagation

Forms of stem :-

(i) **Caudex/Columnar :-** It is unbranched, erect, cylindrical stem and marked with scars of fallen leaves.

eg :- Palm.

(ii) **Culm :-** Jointed stem with solid nodes & hollow internodes. eg :-Bamboo (Gramineae).

Forms of stem:

Stem is of three forms on the basis of position in the ground.

(I) **Reduced stem:**

- Stem present as small disc on which nodes and internodes are not differentiated, Leaves are crowded together on these stems.
- The leaves are called **radical leaves.**

  e.g. Radish, Turnip.
- In some aquatic plants, the reduced discoid stem is green and flattened to float on the surface of water **e.g. Wolffia, Lemna.**

(II) **Erect stems:**

- It is strong and remains erect or upright with out any external support.

  e.g. Mango, wheat.

(III) Weak stems:

- It can be Upright and prostrate.
- In this type, stem is soft and weak.
- It requires a support for spreading.

(A) Upright weak stems:

- It is of two types-

(i) Twiners:

- Stem is long, flexible and sensitive.
- It can coil around an upright support like a rope.

  e.g. Dolichos lab-lab, Ipomoea, Convolvulus.

(ii) Climbers:

- Stem is flexible and weak.
- It bears clinging structures for climbing like **a**dventitious roots, **t**endrils

  e.g. Smilax, Ivy, Pea, Bougainvillea.

(B) Prostrate or Sub aerial weak stem: It is of following types

(i) Trailers:

- The shoots trail or spread horizontally along the ground without rooting at intervals. **e.g. Euphorbia prostrata.**

(ii) Stolon:

- **A slender lateral branch arises from the base of the main axis and after growing aerially for some time arch downwards to touch the ground.**
- It produces a new plant at its tip.

  e.g. Dracaena, Paper mint, Jasmine.

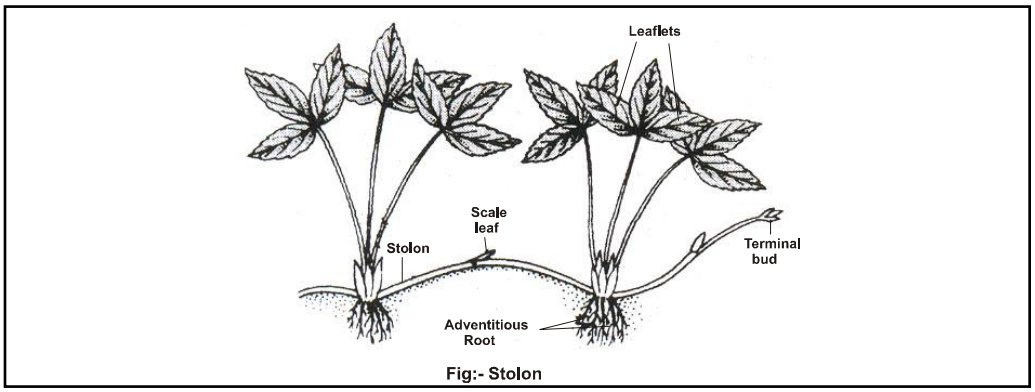


Fig:- Stolon

(iii)Offset:

A lateral branch with short internodes and each node bearing a rosette of leaves and a tuft of roots is found in aquatic plants E.g. Pistia and Eichhornia.

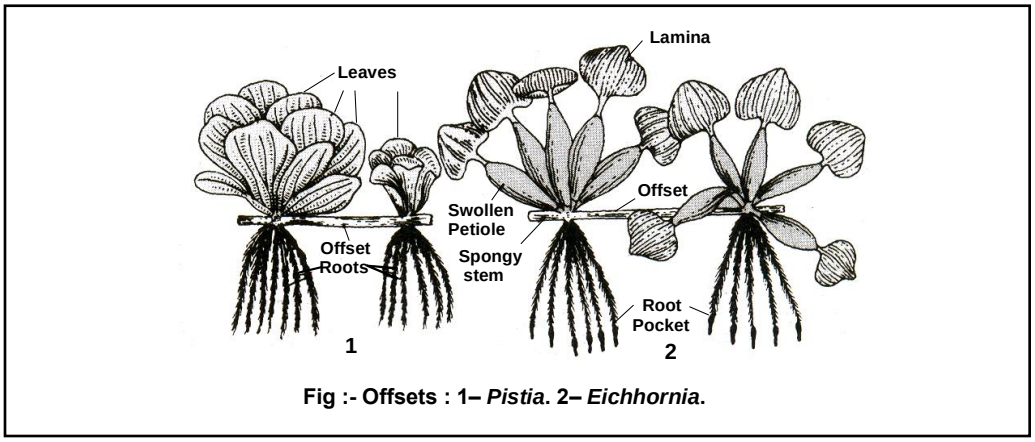


Fig :- Offsets : 1– *Pistia*. 2– *Eichhornia*.

B - Underground modification of stem

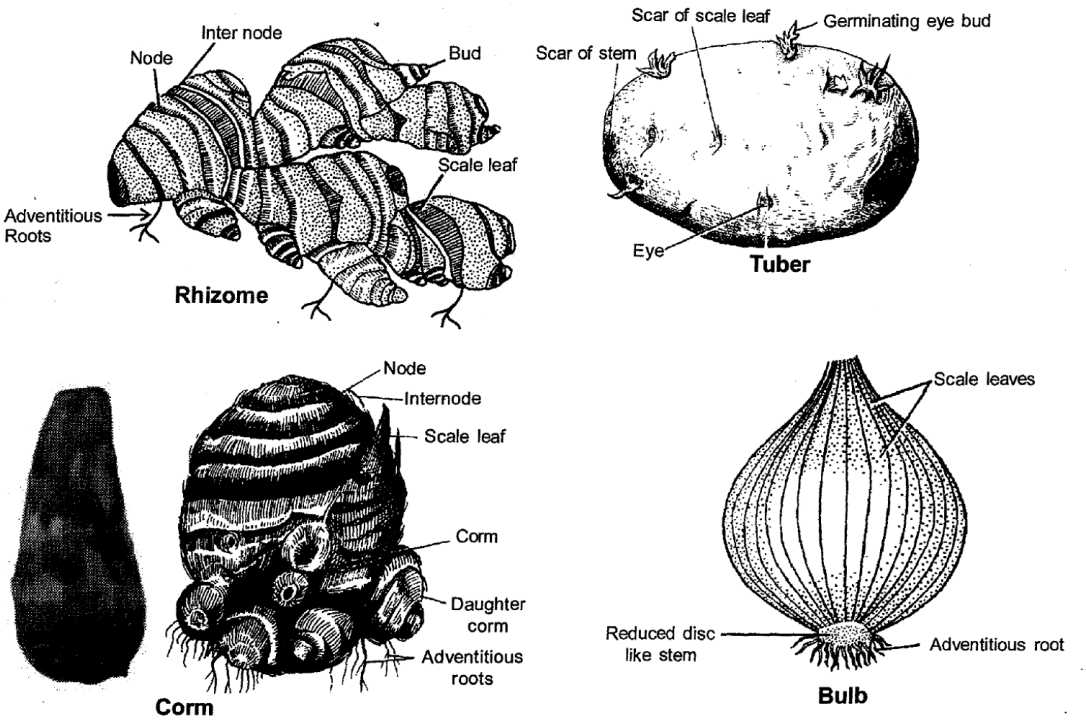
This type of modification occurs generally for food storage and vegetative propagation.

(1) **Tuber -** The tips of branches become swollen in the soil. Eyes are found on tuber which are axillary buds and axillary buds are covered with scaly leaves. Eg. Potato.

(2) **Rhizome -** It is fleshy stem which grows horizontally in the soil. Nodes and small internodes are found which are covered by scaly leaves. Eg. Ginger, turmeric, canna, water lily, banana.

(3) **Corm-** It is condensed structure which grows vertically under the soil surface. Eg. Colocasia, Alocasia, zaminkand, saffron, Colchicum.

- Organ of perennation- Underground stems of potato, ginger, turmeric, Colocasia, zaminka, are modified to store food in them. They also act as organ of perennation to tide over conditions unfavourable for growth.



(4) **Bulb -** Stem is highly reduced and disc like and surrounded by numerous fleshy leaves. Many roots arise from its base. Eg. Onion, garlic. The fleshy leaves of onion and garlic store food.

Note: Type of stem in banana is rhizome and modification is sucker. Banana propagates through rhizome. Aerial part of banana plant which looks like stem is pseudostem (leaf bases).

C- Aerial modification of stem

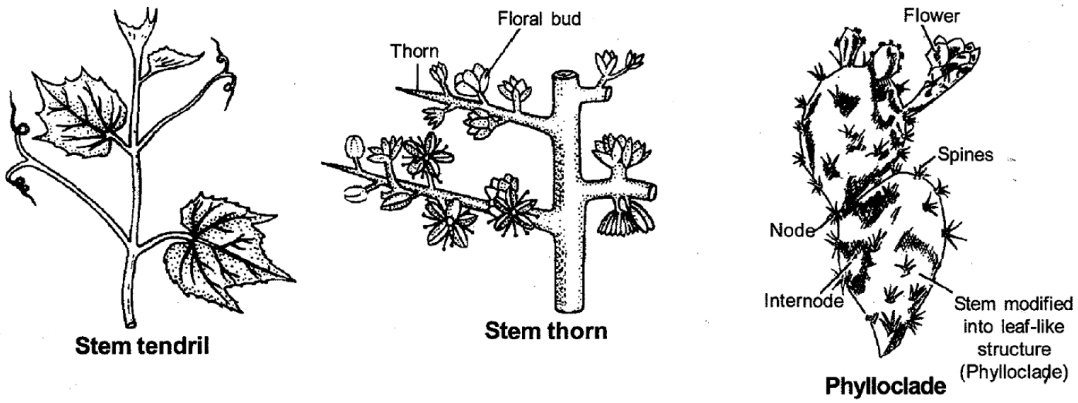
(1) **Stem tendril-** In this type of modification axillary bud forms tendril in place of branches and helps in climbing of those plants which have weak stem. Eg. Grapes/Grapevines, Passiflora, gourds (cucumber, pumpkins, watermelon)

(2) **Stem thorn -** Thorn develops from axillary bud of the stem. It may bear leaves, flowers.

Eg. Carissa (karonda), Bougainvillea, pomegranate, Citrus

- Thorn protects plant from browsing animals. It is a woody pointed structure.

(3) **Phylloclade -** Stem is modified into a fleshy flat (Opuntia) or fleshy cylindrical (Euphorbia) and green leaf like structure and carries out photosynthesis like leaf. The leaves are modified into spines E.g. Opuntia, Euphorbia, cactus, Casuarina (cylindrical).



Some important points

1. **Thorns, Spines and Prickles:**

- These are sharp, straight or curved, pointed and hard structures that perform same function.
- Thorns are modified stem part. Spines are formed by modification of leaves or leaf part.
- Both thorns & spines have vascular supply.
- Prickles represent epidermal outgrowth that do not bear vascular supply

e.g. Rose and Plum.

Function of stem:

1. The main function of stem is to bear branches, leaves, flowers and fruits.
2. It is helpful to translocate water and mineral salts
3. It translocates the prepared food from leaves to all plant parts.
4. Some stem perform the function of storage of food, support, protection and in vegetative propagation.

Important point

1. **Shape of stem:**

a. **Cylindrical:** It is circular or cylindrical in shape. **e.g. Lemon, shoe flower.**

b. **Quadrangular:** In cross section the stem appears four angled forming a square. **e.g. Tulsi (Ocimum).**

c. **Triangular:** It shows three angles. **e.g. Cyprus rotundus.**

d. **Flat:** Stem is flat and leaf like. **e.g. Opuntia.**

e. **Ribbed:** Stem bears ridges and furrows. Therefore stem show wavy appearance. **e.g. Casuarina,** Cucurbita.

f. **Ribbon shaped:** Stem is either filamentous or ribbon like. **e.g. Podostemone.**

2. **Climbers are of four types**

a. **Root climbers:** Adventitious roots provide support to cling the stem. **e.g. Ivy, Betel.**

b. **Tendril climbers:** These are green-coiled structures, which may coil around a support and the weak stem to climb up. **e.g. Passiflora, pea, cucumber, pumpkins, watermelon.**

c. **Lianas:** They are woody twiners or climbers **e.g. Aristolochia.**

d. **Scramblers:** The stems are able to rise up a support by clinging to it with the help of curved thorns **e.g. Bougainvillea, Rose, Citrus.**

3. **Rhizome is of two types-**

a. **Root stock:**

- Vertical rhizome is known as Root stock **e.g. Dryopteris (Fern), Banana.**

b. **Straggling:** It is horizontal and branched, branching is of two types-

(i) **Racemose:** When axis is monopodial **e.g. Lotus, Sugarcane.**

(ii) **Uniparous cyme:** When the axis is sympodial. **e.g. Ginger, Turmeric, Canna**

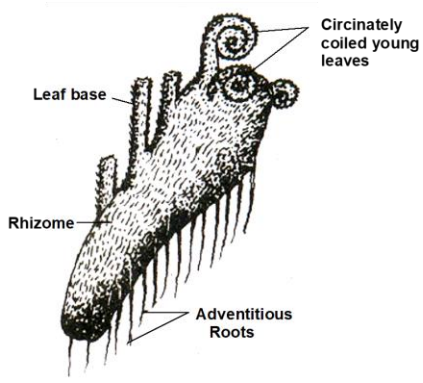


Fig:- *Dryopteris* (=*Aspidium*): Rootstock rhizome

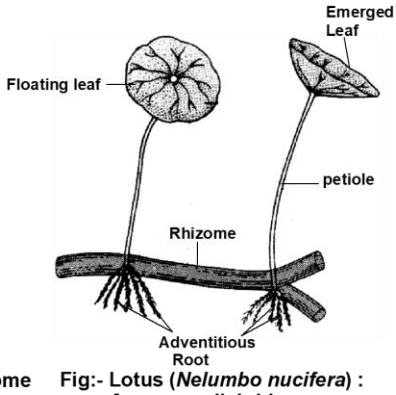
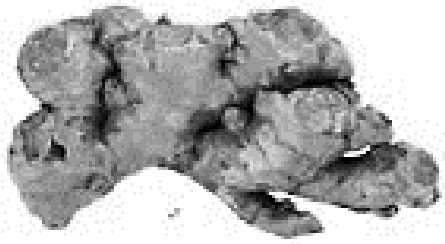


Fig:- Lotus (*Nelumbo nucifera*) : A monopodial rhizome



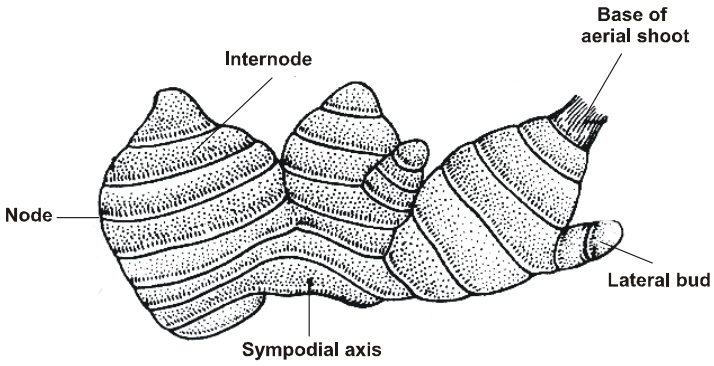


Fig:- Ginger : Sympodial rhizome

4. **Bulbs are of two types-**

a. **Tunicated:**

- Bulb is surrounded by a sheath of dry membranous scale called tunic.
- **e.g. onion (simple tunic), garlic (compound tunic).**

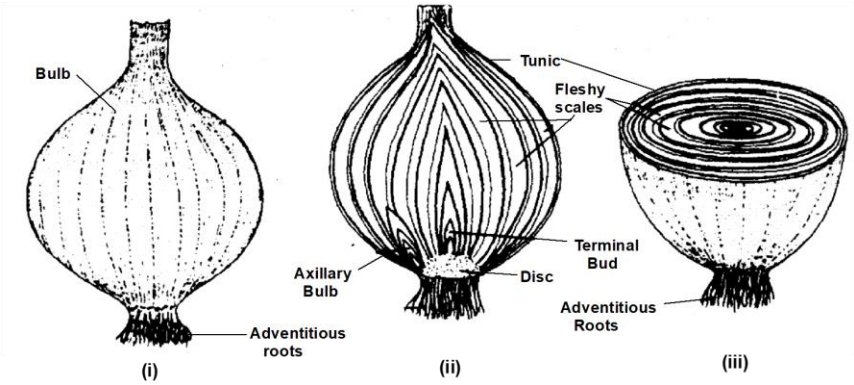


Fig:- Tunicated bulb of Onion. (i) external view. (ii) V.S. bulb. (iii), T.S. Bulb.

b. Scaly: A tunic or covering sheath is absent. **e.g. Lily.**

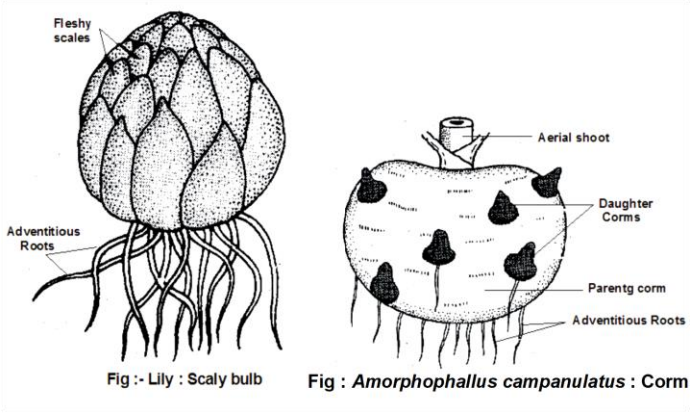


Fig :- Lily : Scaly bulb

Fig : *Amorphophallus campanulatus* : Corm

5. Types of Stem tendrils

They are of four types

a. Axillary - e.g. Passiflora.

b. Extra axillary - e.g. Lagenaria, Luffa, Cucurbita, Cucumber, Watermelon.

c. Leaf opposed - e.g. Vitis vinifera.

d. Floral buds - e.g. Antigonon.

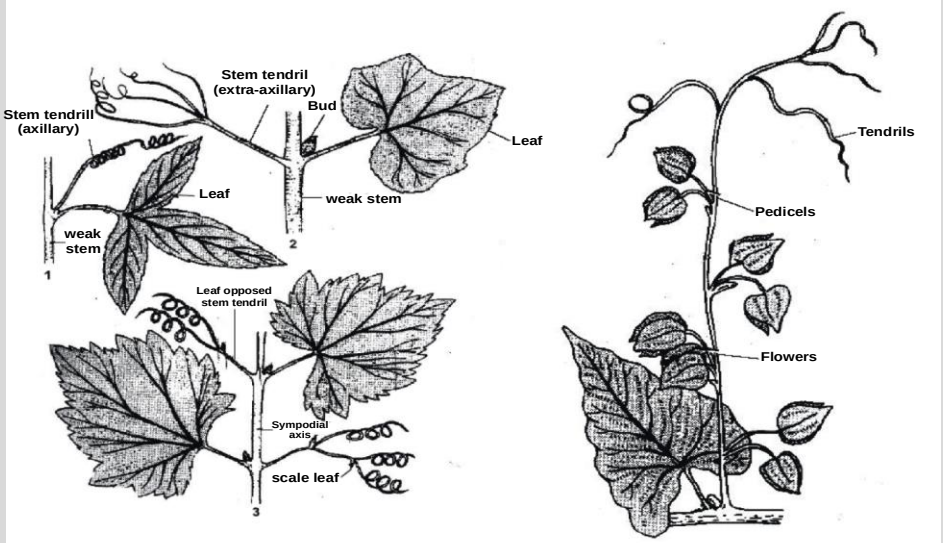


Fig :- Stem tendrils (1) Axillary - *Passiflora*
(2) Extra - Axillary - *Luffa*
(3) Leaf Opposed - Grape Vine.

Fig : - *Antigonon* : Floral bud tendrils

6. In **knol- khol**, whole stem is tuberous due to storage of food. It is also called **Pseudobulb**.
7. **Largest bud** is found in cabbage.
8. Buds, which form on leaf shoot only, are called **vegetative buds.**
9. Condensed fleshy axillary bud is called **Bulbil**. The latter take part in vegetative propagation. e.g. Oxalis, Agave, Dioscorea.
10. Plant in which reduced stem present, is called **Acauliscent**.
11. **Lianas** -These are woody perennial climbers, which coiled around trees and climb up an upward direction for light. These are found in tropical rain forest. e.g. Bouhinia vahlii , Aristolochia.
12. Onion and garlic possess specific odour due to Allyl Sulphide.
13. When Main axis form by the fusion of basis of axillary branches and main stem then it is called **Sympodial axis**.
14. In some aquatic plants fleshy buds function as perennating organ. The latter is called **Turions.** e.g. Utricularia, Potamogeton.
15. **Prickles -** They are superfecial outgrowth of stem without vascular tissues. They can be easily removed. e.g. Rose.
16. **Bristles -** They are stiff hair, which are quite thick due to deposition of Silica or Calcium carbonate.

17. On the basis of habit, woody stem is of following types

(a) **Caudex or columnar** - Unbranched stem e.g. Palm.

(b) **Culm** - Erect stem having solid nodes & hollow internodes e.g. Bamboos.

(c) **Excurrent -** The growth of Apical bud is higher than axillary buds resulting lateral branches of trunk do not compete with the stem and it becomes cone shaped e.g. Eucalyptus, Pinus.

(d) **Deliquescent -** The growth of lateral branches is higher than apical bud hence it becomes dome shaped e.g. Banyan (Ficus bengalensis).