STEM

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.

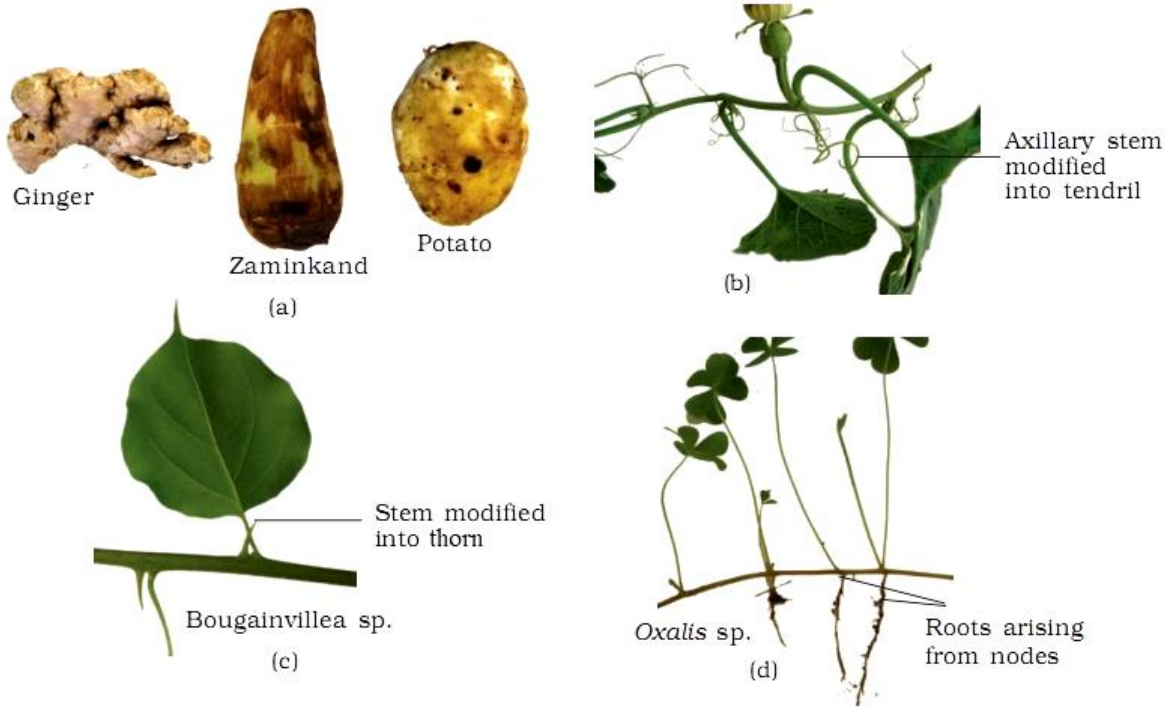

Fig.: Modifications of stem for : (a) storage (b) support (c) protection (d) spread and vegetative propagation

Forms of stem:

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:

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

(A) Upright weak stems:

- It is of two types-

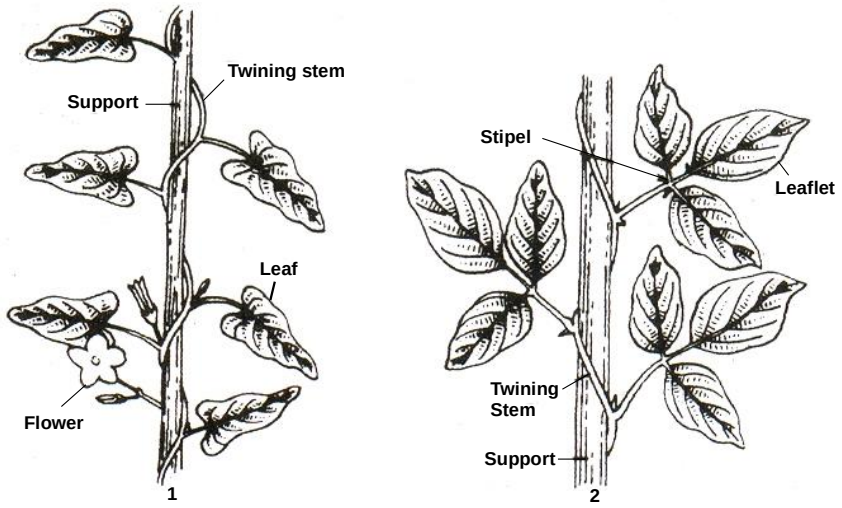

Fig:- Twiners. 1, Sinistrorse twiner – *Convolvulus arvensis* (Hiran khuri)
2, dextrorse twiner – *Lablab* (sem).

(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*.**

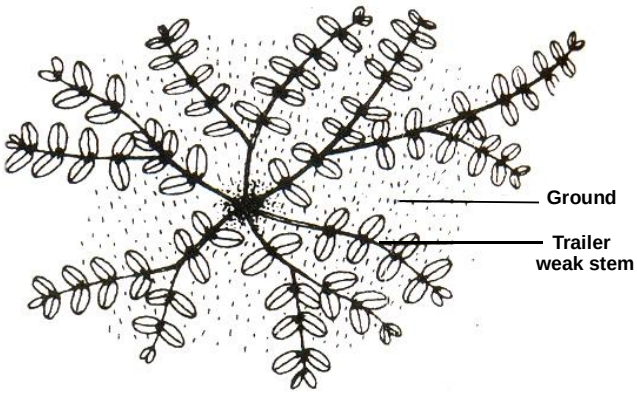

Fig:- *Euphorbia prostrata*: Diffused trailer

(ii) Runner:

- It is elongated prostrate aerial branch with long internodes and roots at nodes,
  e.g. *Oxalis*, *Centella asiatica* (Brahmi), grass, Strawberry.

Note: According to NCERT grasses and straberry are example of underground stem.

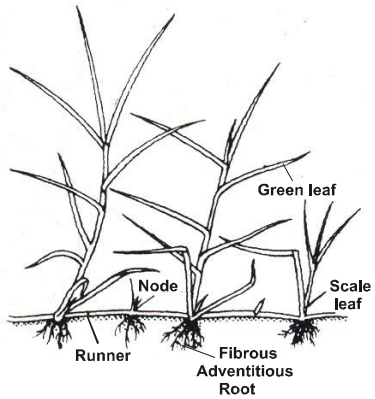

Fig :- Runners of Grass.

(iii) Stolon:

- It is elongated horizontal branch, which arise from base of the stem and after growing aerially for some time arch downwards to touch the ground.
- It produces a new plant at its tip.
  e.g. *Dracaena*, Mint (*Mentha arvensis*), Jasmine.

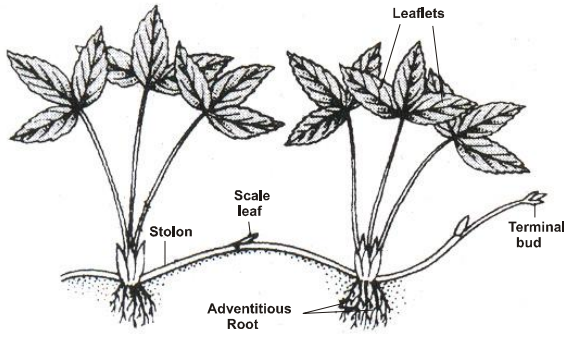

Fig:- Stolon

(iv) Offset:

- It is short horizontal branch producing a cluster of leaves above and cluster of roots below.

e.g. *Pistia, Eichhornia*.

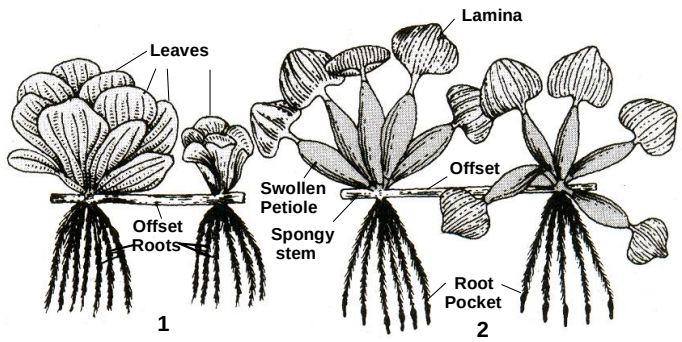

Fig :- Offsets : 1– *Pistia*. 2– *Eichhornia*.

Underground stems:

They lie below the surface of the soil and they store food and take part in perennation. They are of Following types –

(i) Rhizome:

- The underground stem bears nodes and internodes. **e.g. Banana, Ginger and Turmeric.**

(ii) Tuber:

- It is terminal portion of underground stem branch, which is swollen on account of accumulation of food.
- It does not bear adventitious roots initially but at the time of germination eye buds develop in to small shoots.
- The latter bear adventitious roots at its base.

e.g. Potato, Artichoke (*Helianthus tuberosus*)

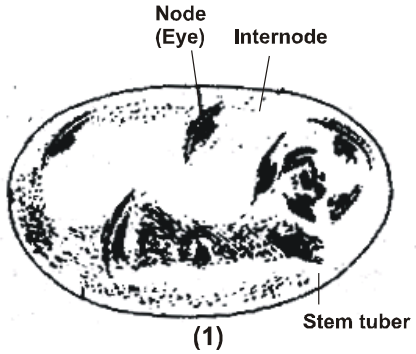

Fig. Stem tuber of potato

(iii) Bulb:

- Stem is disc shaped and reduced.
- On the upper side the bud is surrounded by many concentric leaves.
- The leaf bases are fleshy and edible. Disc bears adventitious roots at its base e.g. Onion (Simple tunic), Garlic (Compound tunic) and lily (no tunic).

(iv) Corm:

- ❖ It is short, thick, unbranched underground stem with stored food material.
- ❖ It grows vertically and covered by thin sheathing leaf bases of dead leaves called scales.

e.g. *Amorphophallus* (Zaminkand), *Colocasia, Crocus, Colchicum*.

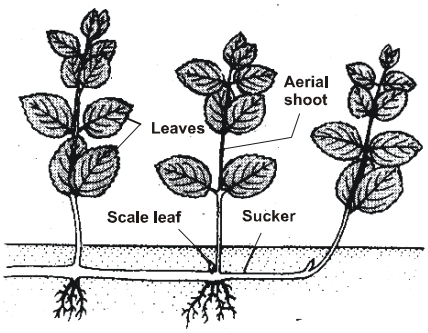

Fig : Mint (Podina) : Sucker

(v) Sucker:

- ❖ It develops by axillary bud of underground part of stem.
- ❖ The branch creeps below the soil surface and grows obliquely upward and produce new shoot.

e.g. *Chrysanthemum*, Pineapple, Rose, *Mentha*, Banana(ncert).

Modification of aerial stem:

(1) Phylloclade:

- ❖ It is green flattened or rounded fleshy stem with leaves either modified into spines or feebly developed. **e.g. *Opuntia* (Flattened), *Coccoloba, Euphorbia* (Cylindrical).**

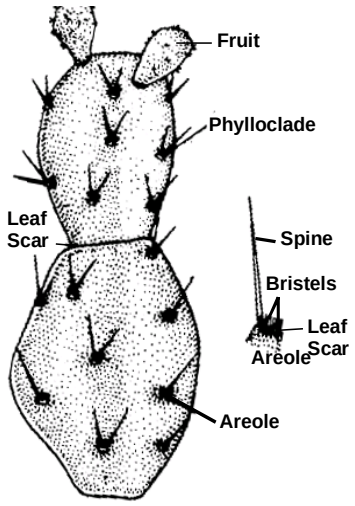

Fig:- *Opuntia* : Phylloclades

(2) Cladode:

- ❖ They are green stems with one long internode. Which take part in photosynthesis.
- ❖ The true leaves are reduced to spines or scales.

e.g. *Asparagus, Ruscus*.

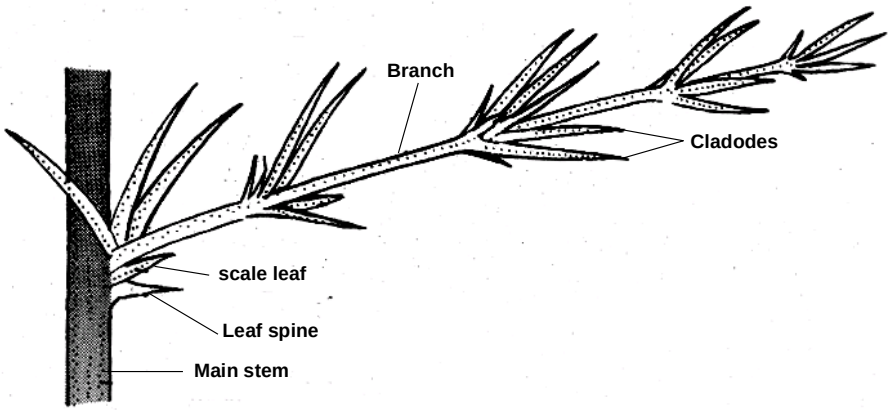

Fig:- *Asparagus* : Cladodes

(3) Stem tendrils:

- Tendrils are thread like sensitive structures, which can coil around a support and help the plant in climbing. e.g. Gourds (Cucumber, pumpkins and watermelon) and Grape wine.

(4) Stem thorns:

- These are modification of axillary buds in which growth is stopped and they are modified in to stiff and sharp structure, called thorns.

  e.g. *Citrus, Bougainvillea, Duranta, Carissa,* Pomegranate.

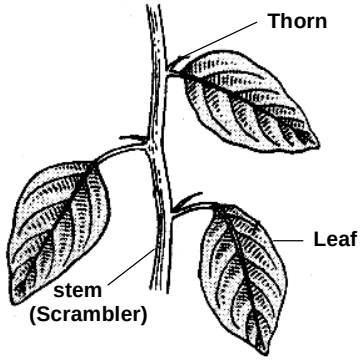

Fig:- Stem thorns : *Bougainvillea*.

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 s**u**pply

  e.g. Rose and Plum.

2. Buds:

- It is a condensed immature or embryonic shoot having a growing point surrounded by closely placed immature leaves.

3. Hooks:

- ❖ Pedicels are modified into stiff curved hooks for helping in climbing.
- ❖ These plants are called straggler.
  e.g. *Artabotrys*.

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.

Resonate the Concept

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***

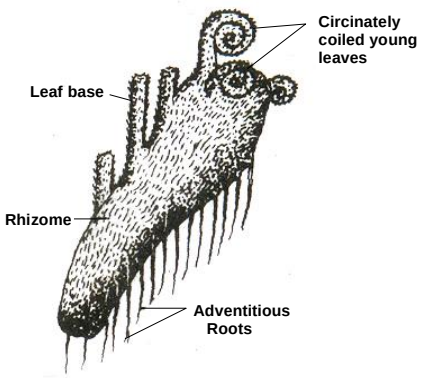

Fig:- *Dryopteris* (=*Aspidium*): Rootstock rhizome

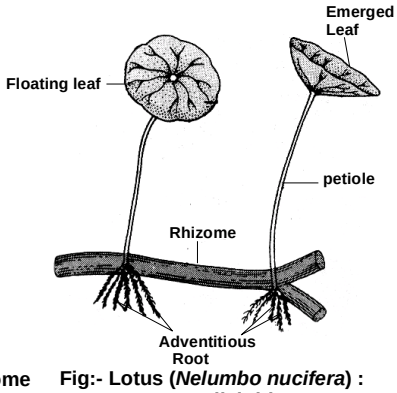

Fig:- Lotus (*Nelumbo nucifera*) : A monopodial rhizome

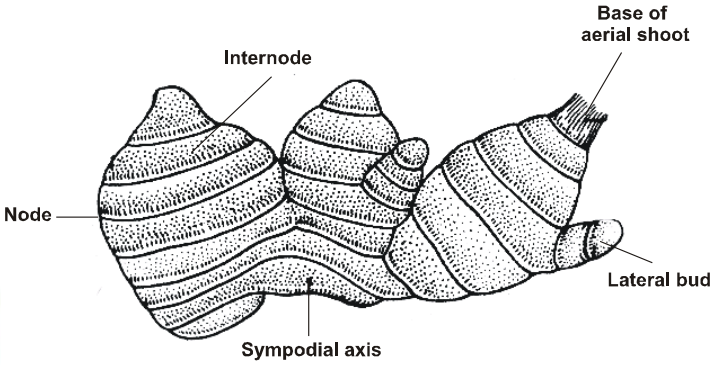

Fig:- Ginger : Sympodial rhizome

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).

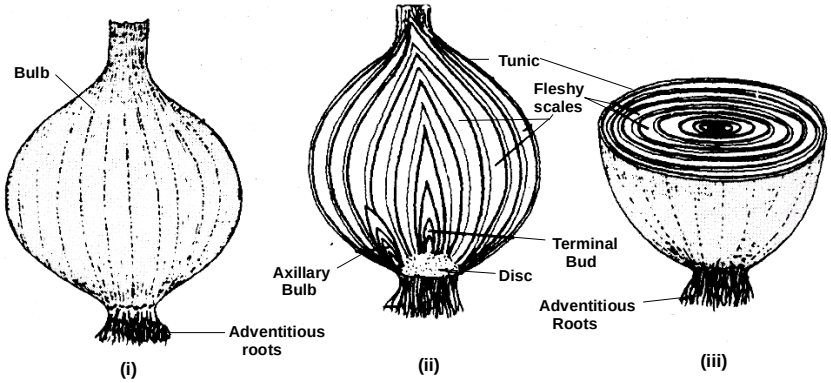

Fig:- Tunicated bulb of Onion. (i) external view. (ii) V.S. bulb. (iii), T.S. Bulb.

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

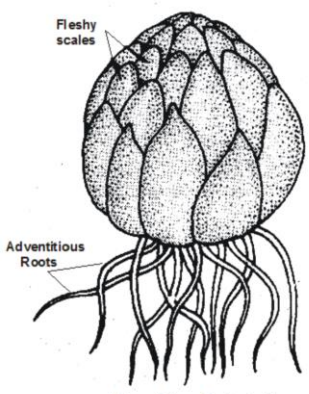

Fig :- Lily : Scaly bulb

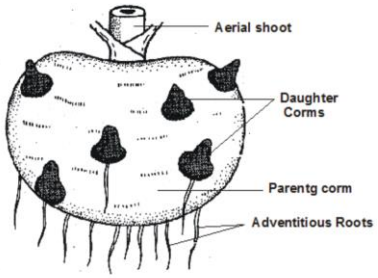

Fig : *Amorphophallus campanulatus* : Corm

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*.

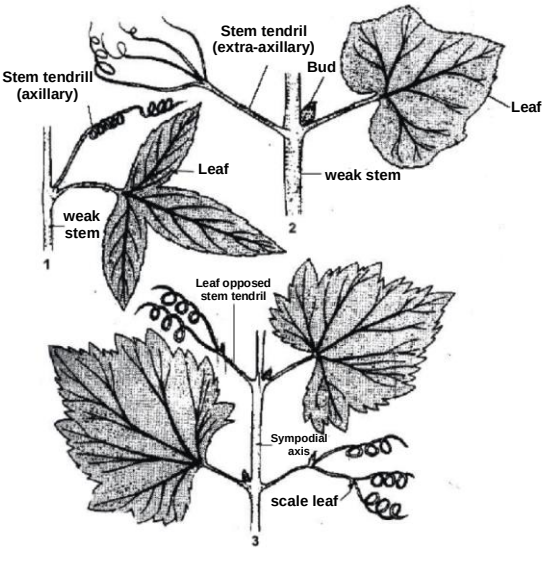

Fig :- Stem tendrils (1) Axillary - *Passiflora*
(2) Extra - Axillary - *Luffa*
(3) Leaf Opposed - Grape Vine.

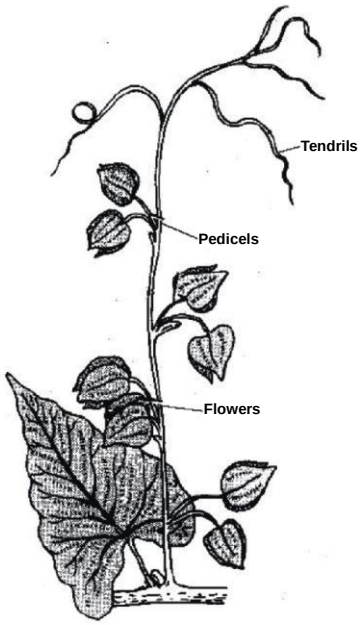

Fig : - *Antigonon* : Floral bud tendrils

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*).

Test your Resonance with concept

1. In which of the following, stem branches are modified into tendrils

(1) *Gloriosa* (2) *Lathyrus* (3) *Passiflora* (4) *Smilax*

2. Offset is a means of vegetative propagation in

(1) *Oxalis* (2) *Antigonon* (3) *Amorphophallus* (4) *Eichhornia*

3. Potato tuber is modified/Edible part of Potato is

(1) Stem (2) Bulb (3) Stolon (4) Root

4. Thorn of *Bougainvillea* is modified

(1) Stem (2) Leaf (3) Floral bud (4) Root

5. Most reduced stem occurs in

(1) Corm (2) Rhizome (3) Stem tuber (4) Bulb

Answers

1. (3) **2.** (4) **3.** (1) **4.** (1) **5.** (4)