CONCEPT MAP

MORPHOLOGY OF STEM

Stem is the ascending part of the plant axis which develops from the plumule of the embryo. It grows by means of a terminal bud and shows distinction into nodes and internodes. Leaves and stem branches develop exogenously from it.

Branching of stem

Branching of the stem is of two types: 1. Dichotomous branching and 2. Lateral branching.

1. Dichotomous branching : The growing point gets divided into two in the region of branching, *e.g., Asclepia syriaca, Pandanus.*

2. Lateral branching : Branching occurs by exogenous growth of lateral buds. It is further divided into two main types: (i) Racemose branching and (ii) Cymose branching.

(i) **Racemose or monopodial branching :** Terminal bud continues its activity indefinitely and the lateral branches are borne in an acropetal succession, *e.g., Eucalyptus, Casuarina.*

(ii) **Cymose or sympodial branching :** The terminal bud, after forming a small portion of the axis, either stops its activity or gets modified into a flower, tendril, thorn etc. Lateral branches are borne in basipetal succession. Further growth of the axis is continued by one or more axillary branches. Accordingly, it is of three types: (a) **Uniparous or monochasial** – Further growth is continued by a single axillary branch. The successive branches may develop either on both the sides *i.e.,* scorpioid (*e.g.* grapevine) or on one side only *i.e.,* helicoid (*e.g., Saraca*). (b) **Biparous or dichasial –** Further growth is continued by two axillary branches, *e.g., Viscum, Mirabilis etc.*

(c) **Multiparous or polychasial :** Growth is continued by whorl of three or more axillary branches, *e.g., Euphorbia, Croton* etc.

Unbranched stem is called caudex, *e.g.,* palm, sugarcane.

Buds and their classification

A bud represents a condensed immature or embryonic shoot possessing a growing point enveloped by closely placed immature leaves.

Classification of buds :

(I)On the basis of nature/ structure : (i) **Vegetative buds**(give rise to leafy shoots only), (ii) **Floral buds** (give rise to flowers), (iii) **Mixed buds** (give rise to both vegetative and floral branches).

(II) On the basis of position: (i) **Normal buds -** These are borne on stem either terminally or laterally. Accordingly these may be **apical/terminal buds, e.g.,** cabbage; **lateral buds** which may be axillary (*e.g.,* rose), accessory (*e.g. Cucurbita*), extra -axillary (*e.g., Solanum nigrum*), (ii) **Adventitious buds -** When a bud grows from a position other than normal, it is called adventitious bud. These may be **epiphyllous/foliar** buds *e.g. Bryophyllum*; **cauline buds** *e.g., Duranta* and **radical buds** *e.g. Ipomoea.*

(III) On the basis of activity - (i) **Active buds** (These become active as soon as they are formed), (ii) **Dormant buds** (These remain inactive for short or long periods and are commonly covered by protective scales, *e.g. Ficus*), (iii) **Modified buds -** *e.g.,* bulbils in *Dioscorea,* turions in *Potamogeton,* tendrils in *Passiflora* and thorns in *Duranta,* etc.

Diverse forms of stem

Stems of flowering plants attain diverse forms to perform various functions. They are grouped into three broad categories: reduced stems, erect stems and weak stems.

1. Reduced stems – Stem is reduced to a small disc and nodes and internodes are not distinguishable, *e.g.,* in raddish, carrot, *Lemna, etc.*

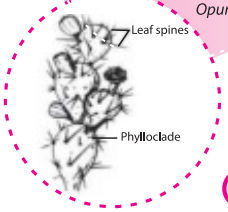
2. Erect stems – Stems are sufficiently strong to remain erect or upright without any external support. Erect stems with swollen nodes or jointed stems (**Culms** *e.g.,* bamboo), unbranched erect stems (**caudex or columnar** *e.g. Cocos nucifera*), branched erect stems (**Excurrent** *e.g., Eucalyptus,* **Deliquescent** *e.g. Dalbergia*).

3. Weak stems : The stems are thin, soft and weak. These may be upright or prostrate. (i) **Upright weak stems :** These are further of two types **–** Twiners and climbers. **Twiners :** The stems are long, stender, flexible and sensitive. They twin or coil around an upright support on coming in its contact, *e.g., Convolvulus, Lablab.* **Climbers :** The stems are weak and climb up the support with the help of some clasping or clinging structures. Accordingly, these may be (a) **Root climbers** *e.g.,* Ivy (b) **Tendril climbers** *e.g., Passiflora, Gloriosa.* (c) **Scramblers** *e.g., Bougainvillea* (d) **Lianas** *e.g., Bauhinia.* (ii) **Prostrate or sub-aerial weak stems:** These spread over the ground for proper exposure of leaves. These are of two types **–** Trailers and creepers. Trailers do not root at intervals, *e.g., Euphorbia prostrata.* Creepers root at intervals and take part in vegetative propagation. These may be runners, stolons and offsets. (a) **Runners :** They are special narrow, green, above ground horizontal or prostrate branches which develop at the bases of erect shoots called crowns. The nodes bear scale leaves and axillary buds, which grow to form new crowns *e.g., Cynodon dactylon, Centella* etc. (b) **Stolons :** These are arched runners which can cross over small obstacles, *e.g.,* strawberry, jasmine etc. (c)**Offsets :** These are one internode long runners usually found in rosette plants at the ground or water level, *e.g., Eichhornia, Pistia* etc.

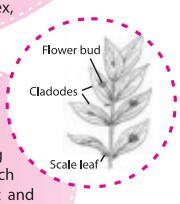
Modifications of stem

Aerial stem modifications

Phylloclades
These are the green, photosynthetic stems of unlimited growth, in which true leaves are caducous. These help the plants to grow in xerophytic conditions, *e.g., Opuntia.*



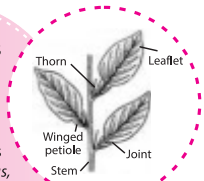
Cladodes
These are one to two internode long stem branches which are photosynthetic and have limited growth, *e.g., Ruscus aculeatus.*



Stem tendrils
These may be axillary (*e.g. Passiflora*), extra-axillary (*e.g. Cucurbita*), leaf opposed (*e.g.* grapevine), inflorescence tendrils (*e.g., Antigonon*) etc.

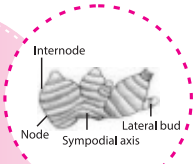
Thalamus
It forms the broadened tip of the pedical or floral stalk. It bears sepals, petals, stamens and carpels.

Stem thorns
A thorn represents an axillary branch of limited growth. Thorns are deep seated having vascular connections with stem , *e.g., Citrus, Duranta* etc.



Underground stem modifications

Rhizome
It is a perennial, fleshy underground stem which grows indefinitely producing new leaves or aerial shoots during favourable season. It may be **rootstock rhizome** (*e.g., Dryopteris*) or **Straggling rhizome** (*e.g., Zingiber*).

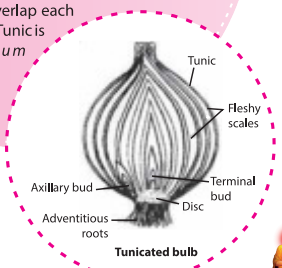


Tuber
It represents the swollen end of a specialised underground stem branch. Each tuber bears nodes called eyes, *e.g., Solanum tuberosum*

Bulb
It consists of a highly reduced discoid stem and several fleshy scales enclosing a terminal bud. Bulbs are of two types **–** Tunicated and scaly.

(i)Tunicated bulb : In *Allium cepa* (onion), the scale leaves occur in a concentric manner forming a series of rings and the rings are surrounded by a common tunic (**Simple tunicated bulb**). In *Allium sativum* (garlic), the fleshy scales represent buds and are called **bulblets** or **cloves**, which occur in irregular concentric rings. Each ring is surrounded by a white tunic and each bulblet has its own thick white tunic (**Compound tunicated bulb**).

(ii) Scaly bulb : Fleshy scales are narrow, small, separated, loosely arranged and overlap each other at their margins. Tunic is absent, *e.g., Lilium bulbifera.*



Corm
It is short, thick, fleshy, usually unbranched, spherical or subspherical specialised underground stem produced **annually** and growing **vertically** in soil. Circular nodes bear scale leaves and one or more axillary buds, *e.g., Amorphophallus, Colocasia* etc.

Sucker
It is an under-ground, non-green slender branch of the stem which arises from the axillary bud of the underground part of aerial stem,*e.g., Chrysanthemum.*