

(Fig. 20: Diagram)

- (1) Culms are jointed stems with solid nodes and hollow internodes. This can be found in the bamboos e.g. *Bambusa vulgaris*.
- (2) Scape is an underground stem which produces an erect unbranched aerial shoot bearing either a single or a cluster of flowers, such flowering shoot is called scape. Examples can be found in onion (*Allium cepa*), garlic (*Allium sativum*) etc.
- (3) Pseudostem is a stem formed by the joining together of the leaf bases of several leaves of the plant e.g. Banana and plantains (*Musa sp.*), *Ensete gilletii* etc.

Weak stems

Plants with weak stems could be either trailers, creepers, climbers, twinners, lianas, stranglers or scramblers.

- (1) Trailers these are plants with thin and long or short branches that trail on the ground without rooting at the nodes. They could be procumbent or prostrate (when the stem lies flat or run parallel to the ground) e.g. *Indigofera sp.*, *Oxalis sp.* etc. or Decumbent (when the tip of the stem is raised) as in *Tridax procumbens* or Diffuse (when the stem branches spread out in all directions) as in *Boerhaavia sp.*

(Diagram)

- (2) Creepers are plants with long or short branches that creep on the ground and rooting at the nodes. Creeping stems could be runners, stolons or offsets. Each of the rooted node with shoot can become independent plants if the linking stems (internodes) are cut. Creeping plants could be runners, stolons or offsets.
- (3) Runners are creeping stems with long and slender stems that run parallel to the ground surface e.g. *Cucurbita sp.*, *Lagenaria sp.*, *Telfaria occidentalis* etc.

- (4) Stolons are creepers with the portion of the stem between two adjacent nodes raised from the ground surface i.e. the internode does not lie flat on the ground e.g. *Fragaria indica*, wild strawberry etc.

(Fig. 21: diagram)

Offsets are similar to runners, but the internodes in offset are shorter and stouter than those in runners e.g. water lettuce (*Pistia sp.*) water hyacinth (*Eichhornia sp.*).

Climbers are plants that attach themselves to any neighbouring plant or object, often by means of some special devices and climb the support to a long or short distance. Different kinds of climber are known, depending on their devices or means of climbing. Examples are:

- (1) Hook climbers e.g. *Bougainvillea sp.*, Rose (*Rosa sp*)
- (2) Stem tendril climbers e.g. *Passiflora edulis*, *Telfaris occidentalis*
- (3) Leaf tendril climbers e.g. *Gloriosa superb*  
Root climbers e.g. *Piper betle*, *Piper guinensis* etc.
- (4) Twinners/stem climbers are herbaceous plants with weak stems that climb other plants or objects without any device or means of climbing. They twine round their supports, e.g. Yams (*Dioscorea sp*) *Ipomoea*.
- (5) Lianes/Lianas are perennial plants with woody climbing stems e.g. *Entada gigas*, *Alafia barteri*

(Fig. 22: Diagram)

Other forms of plants with weak stems are scramblers and stranglers.

Scrambling plants do not attach themselves to their supports, but they simply lean against nearby plants or any other support and spread over them e.g. *Combretum sp.*

Strangling plants usually start their life from seeds which grow on the host or near the host. They produce short and root systems which grow round the host or support and may later kill the host or support by strangulation e.g. *Ficus sp.*

(Fig. 23: diagram)

## Underground stems

These are modified stems which are developed underground for the purpose of storage, propagation and perennation. They are usually dormant during unfavourable season but give off aerial shoots annually under favourable conditions. They are always thick and fleshy, having deposit of reserve food materials in them.

### Types of underground stem

- (1) Rhizome is a prostrate, thickened stem, creeping horizontally under the surface of the soil. It has distinct nodes and internodes. Roots and scaly leaves are produced as their nodes. Rhizomes bear terminal and axillary buds which give rise to new aerial shoots during favourable periods.

(Fig. 24: Diagram)

Some rhizomes may be swollen with stored food substance as in the alligator pepper (*Aframomum canna*), ginger (*Zingiber officinarum*) or slender as in grasses such as the spear grass (*Imperata cylindrical*).

- (2) Tubers are swollen ends of special underground branches or stems which bear adventitious roots. They have on their surface a number of "eyes" or buds which grow up into new plants. Tubers are often very much swollen, becoming almost spherical and they usually occur singly. Examples of tubers are sweet potato (*Ipomoea batata*), yams (*Dioscorea* sp.), Irish potato (*Solanum tuberosum*), Tiger nut (*Cyperus esculentum*) etc.

(fig. 25: diagram)

- (3) Bulb is an underground modified shoot consisting of a shortened stem with a single, often large terminal bud and numerous scale leaves. The scale leaves grow from the upper surface of the stem or around it while a cluster of fibrous roots grow from the base of the stem. The fleshy scale leaves store food while the dry outer scale leaves give protection. The bulb grows in vertical direction.

(Fig. 26: diagram)

The terminal bud gives rise to the aerial shoot. Some axillary buds may also be produced in the axils of the fleshy scale leaves. These may develop into aerial shoots and finally form daughter bulbs. Examples are the common onion (*Allium cepa*), garlic (*Allium sativum*).

- (4) Corm is a condensed form of rhizome consisting of a stout, solid, fleshy underground stem growing in the vertical direction. The corm bears buds in the axils of the scale leaves and some of these buds give rise to daughter corms. Adventitious roots develop from the base and sometimes also from the sides e.g. cocoyam (*Xanthosoma sagittifolia*), taro (*Colocasia esculentum*).

(Fig. 27: diagram)

- (5) Sucker is a lateral branch developing from the underground part of the stem node. It grows horizontally outwards under the ground and later upwards and directly gives rise to a leafy shoot or a new plant. The sucker may be short and stout as in banana (*Musa sp.*), pineapple (*Ananas sp.*), bamboo (*Bambusa vulgaris*) etc.

#### Further modifications of stem for special functions

The stem or the vegetative and floral buds or other appendages on the stem can be modified to perform specialized functions e.g. stem and floral tendrils for climbing, thorns, hooks and prickles for protection, phylloclade for food manufacture (photosynthesis) and bulbs for vegetative propagation.

- (1) Stem tendril is a thin, wiry, leafless, spirally-curved branch usually developing on the stem at the leaf axils, by which climbing plants attach themselves to neighbouring plants or objects and climb them e.g. Passion plant (*Passiflora edulis*), 'Ugwu' (*Telfaria occidentalis*).
- (2) Floral tendril is similar to stem tendril in structure, but it has its own origin from the floral bud, usually occurring as an extension of the inflorescence axis e.g. *Corculum sp.*

(fig. 28: diagram)

- (3) Thorn is a hard, often straight and pointed structure. It arises endogeneously at the axil of a leaf or at the apex of a branch which is normal position of a bud. Thorns sometimes bear leaves, flowers and fruits e.g. *Citrus sp.*, *Duranta sp.*

(Fig. 29: Diagram)

Thorns are however different from (4) prickles and (5) hooks which are superficial (exogeneous) and occurring as irregular outgrowths on the surface of stem or leaves and never bear leaves, flowers or fruits e.g. *Bougainvillea sp.*, *Hura crepitans*.

- (6) Phylloclade is a green flattened or cylindrical stem or branch of unlimited growth, consisting of a succession of nodes and internodes at long or short intervals. It is common in xeromorphic plants growing in the dry regions such as sahel savanna and deserts. The leaves in such plants are usually not well developed or all off early or are modified into spines as a strategy to reduce evaporating surface. The phylloclade therefore performs the duties of the leaves, particularly photosynthesis. The strong cuticle of the stem prevents evaporation and the roots are often scanty.

(Fig. 20: diagram)

They also store water for the plant e.g. Cactus plants (*Opuntia sp.*), Christmas cactus (*Epiphyllum truncatum*) and members of the family Euphorbiaceae e.g. (*Euphorbia cameroonica*).

- (7) Cladodes are short, green cylindrical or flattened profusely branching stems with branches of unlimited growth developing from the nodes of the stem in the axils of the scale leaves. The branches have distinct nodes from which they produce further branches of limited growth which are often mistaken for leaves. Leaves in the cladodes are usually reduced to spines e.g. *Casuarina equisetifolia*, *Asparagus racemosus*.

(Fig. 31: diagram)

- (8) Bulbis are special vegetative organs, bulb-like in structure and is essentially meant for the vegetative reproduction of the plant. It may be a modified vegetative or floral bud. At maturity, it detaches itself from the mother plant and grows up into a new independent plant e.g. *Dioscorea bulbifera*, *Globba bulbifera* etc.

(Fig. 32: diagram)

### Shape of stem

The shape of the stem can be clearly seen when the transverse section is made. The following shapes are commonly encountered in different plant species.

Cylindrical or circular stem e.g. *Elaeis guinensis*, *Cocos nucifera*

Square stem This is common in the Labitae specie e.g. *Coleus sp.*

Triangular stem e.g. *Pinnata*

Polygonal stem Common in species of the family Polygonaceae

Terete these are stems that are spherical in shape

### SHAPES OF STEM

(diagrams)

Aplanate stems are stems that are compressed in the middle

Fluted or fissured stem these are stems with vertical grooves e.g. *Chrysophyllum albidum* (star apple)

### Stem branching:

This is the mode of arrangement of the branches on the stem. There are two basic types

(1) Lateral branching

(2) Dichotomous branching

Lateral branching This is when the branches are produced laterally i.e. from the sides of the main stem. The lateral branching may be racemose or cymose.

Racemose type The growth of the main stem of the plant is indefinite while producing branches laterally in acropetal succession i.e. the lower branches are older and longer than the upper ones. This type of branching is also termed Monopodial because there is a single continuous or indefinite axis e.g. *Casuarina*, *Pinus*. This type of branching gives a conical or pyramidal shape to the plant.

(Fig. 34: diagram)

Cymose type In cymose lateral branching the growth of the main stem is definite i.e. terminated after a while and lateral branches are produced below the terminal bud. This process may be repeated over and over again.

Cymose branching can be of the following kinds:

- (a) Uniparous cymose branching Here, only one lateral branch is produced at a time. It is also called Monochasial branching. Uniparous cymose branching could be helicoidal i.e. one-sided cyme, when successive lateral branches develop on the same sides as in *Sterculia sp*, *Terminalia catapa*.

(Fig. 35: diagram)

It could also be Scorpioid i.e. alternate-sided cyme, when the successive lateral branches develop on alternative sides of forming a zigzag patten in *Vitis*.

- (b) Biparous Cymose branching: In this, two lateral branches develop at a time below the terminal bud. It is also called Dichasial branching. It is found in plants like Mistletoe, *Plumerias sp.*, *Mirabilis sp.* etc.

(Fig. 36: diagram)

- (c) Multiparous cymose branching More than two lateral branhes develop at a time below the terminal bud. It is also called Polychasial branching. It is common in *Croton sp.*, *Sparsiflorus sp.*, some *Euphorbia sp.* etc.

Dichotomous Branching

In dichotomous branching, the terminal bud bifurcates i.e. divide into two, producing two equal branches in a forked manner. There will be no scar at the point or space between the two branches. This shows that the branching is not due to the termination of the life of the terminal bud. This type of branching is common among the non-flowering plants such *Riccia sp.*, *Lycopodium sp.* and in some flowering plants like *Hyphaene* (a type of palm), *Canscora sp* (a weed).

(Fig. 37: diagram)

## THE LEAF

The leaf is the flattened, lateral outgrowth of the stem or the branch, developing exogeneously from a node and having a bud in its axil. It is normally green in colour, due to the presence of chlorophyll, and acts as the photosynthetic organ of the plant. Some leaves may be coloured yellow or red due to the presence of other pigments apart from chlorophyll.

### Functions of leaves

The primary functions of the leaves are

- (a) Manufacture of food through photosynthesis
- (b) Transpiration to get rid of excess water in the plant
- (c) Gaseous exchange between plant and the atmosphere

Some leaves are modified or equipped to perform some secondary functions such as

- (a) Storage of food and water either for perennation or adaptation to survive dry season e.g. *Cactus sp.*
- (b) Vegetative propagation due to the presence of vegetative buds on the leaves e.g. *Bryophyllum sp.*, *Begonia sp* etc.

### Parts of a leaf

A typical leaf consists of the leaf base, stipules, petiole and the lamina or leaf blade.

(Fig. 38: diagram)



The leaf Base is the part of the leaf that is attached to the stem. In monocotyledons, the leaf base commonly expands to form leaf sheath which partially or wholly clasps the stem. In many dicotyledons, the leaf base bears two lateral leaf-like outgrowths known as the stipules. In some families such as the Leguminosae, the leaf base is swollen to form the Pulvinus.

(Fig. 39: diagram)

Stipules are different from stipels which are also leaf-like outgrowths but are developed at the bases of the leaflets of compound leaves.

Petiole is the stalk of the leaf that connects the leaf blade with stem. It contains a vascular system which is continuous with the vascular system of the stem. Leaves possessing petiole are said to be petiolate or stalked while those without petiole are termed sessile or exstipulate or petiolate. Petioles can be of various shapes such as cylindrical e.g. *Chocorus sp.*, *Amaranthus sp.*, channeled or grooved e.g. Banana (*Musa sp.*), Cocoyam, palms, bulbous, swollen or inflated e.g. water hyacinth (*eichhornia sp.*), winged or flattened as in Citrus sp.

(Fig. 40: diagram)

Stipules are the lateral appendages of the leaf borne at the leaf base. Their function is to protect the young leaves in the bud, and when green, they carry out photosynthesis. Leaves possession stipules are said to be stipulate, while those without stipules are called exstipulate. Stipules occur in many dicotyledonous families, but are absent or very rare in the monocotyledons.

#### Types of stipules

Stipules are described based on their shape, size, position and colour. The following type are identified:

- (1) Free lateral stipules these are two free stipules, usually small and green in colour, borne on the two sides of the leaf base e.g. cotton, sida sp.

- (2) Sally stipules are very small dry scales, usually two in number, borne on the two sides of the leaf base e.g. *Desmodium sp.*
- (3) Follicle-like stipules are two large, green leafy structures that are developed at the leaf base e.g. *Passiflora sp.*, *Aristolochia sp.*, *Cassia auriculata* etc.
- (4) Adnate stipules are two lateral leaf-like outgrowths that develop along the petiole up to a certain height, adhering to the petiole and making it look winged in appearance e.g. Rose (*Rosa sp.*), groundnut (*Arachis hypogea*), strawberry etc.
- (5) Interpetiolar stipules are two stipules that lie between the two petioles of opposite leaves, or alternating with the petioles of whorled leaves e.g. *Ixora*.

(Fig. 41: diagram)

- (6) Orhreate stipules grow around the stem like a hollow tube from the node up to a certain height of the internode in front of the petiole e.g. *Polygonum*