LEAF

Leaf is a thin, flat, green exogenous appendage of stem.

The order of arrangement of leaves is acropetal succession.

Leaves grow normally on the stem (cauline eg : Cocos) or on the branches (ramal)

In few plants, the stem is reduced and the leaves appear as if they are on the top of the root system. Such leaves are called as radical leaves. (Allium)

The leaf performs 3 main functions.

i) Photosynthesis

ii)Transpiration

iii) Respiration

Parts of a leaf:- Leaf has four parts, they are

(i) Leaf base (ii) Stipule

(iii) Petiole and (iv) Lamina.

Leaf base:- The basal part of the petiole which attaches the leaf with the stem at the node is called leaf base.

Stipule:- The small, green, lateral appendages present on either side of the leaf base are called stipules.

Stipules protect the leaf in bud condition.

Deciduous stipules:- Stipules drop off as soon as leaf develops. Ex: Michelia.

Persistent stipules:- Stipules remain for long time. Ex: Pisum, Rosa.

Branched stipules:- Ex. Ipomoe aquamoclit.

Petiole:-The leaf stalk.

Petiolate:- When leaf has a petiole.

Sessile:- When leaf does not bear petiole.

Function:- It arranges the leaves in a definite distance from the stem to expose their lamina properly to sunlight and air.

It conducts water and food materials.

Lamina:- The flattened part of a leaf.

Lamina is the most important part of a leaf, photosynthetic in function.

VENATION:

The mode of arrangement of veins on the lamina is called venation.

Venation is of 2 types, (i) Reticulate (ii) Parallel

Reticulate venation:- Irregular net work of veins.

Dicotyledons show reticulate venation.

Rarely it is also found in monocot plants like Smilax and Dioscorea.

Pinnately Reticulate:- This is also called unicostate reticulate venation.

The lamina contains single midrib extending from the base to the apex.

It gives off many lateral veins and veinlets forming a network in the lamina.

Ex: Hibiscus, Mangifera.

Palmately reticulate:- This is also called multicostate reticulate venation. Lamina shows many midveins and smaller veins. This is of 2 types.

a) Palmately reticulate convergent:- Three or more prominentveins meet at the apex. .

Ex: Z-iziphus, Cinnamomum.

b) Palmately reticulate divergent:- The prominent veins do not meet at leaf apex but run in different directions.

Ex: Ricinus, Cucurbita

Parallel venation:-

The veins run parallel to each other.

Monocots show parallel venation.

Rarely it is also found in dicot plants like Caulophyllum and Eryngium.

Pinnately parallel:- Lamina has a single prominent vein giving off lateral veins which run parallel to each .other to the margin of leaf. Eg: Musa. paradisiaca

Palmately parallel:- From the base of the lamina many prominent veins run towards the margin parallel. This is of 2 types.

Palmately parallel convergent:- The prominent vein meet of the apex of leaf. Ex. Oryza sativa.

Palmately parallel divergent:- Veins arising at the base at lamina seperate into the lobes of the leaf. Borassus.

TYPES OF LEAVES:

Based on external form, the leaves are of 2 kinds, i) Simple ii) Compound

Simple leaves:-

The petiole bears one lamina at its apex.

The lamina is either lobed or unlobed. Ex. Annona, Psidium

If the lamina is lobed, the lobes are arranged either in pinnate manner (Brassica) or in palmate manner

(Ex. Passiflora, Gossypium)

Compound leaves:-

The lamina of the leaf is cut into independent leaflets called pinnules.

i) compound leaves contain axillary buds.

ii) The leaflets do not contain axillary buds. Compound leaves are of 2 types.

iii) Thestalkofthecompoundleaf is called Racltis. a) Pinriately compound b) Palmatelycompound.

Pinnately compound:- The leaflets are on both the sides of rachis.

Pinnately compound leaves are of 4 types.

Unipinnately compound:- Leaflets are arranged on the primary rachis.

a) Paripinnate:- Leaflets are even in number on the rachis. Eg: Tamarindus.

b) Imparipinnatc:- Leaflets are odd in number. Rachis ends in a leaflet. Ex: Azadirachta

Bipinnately compound:- The leaflets are arranged on secondary rachis. Ex: Delonixregia, Acacia arabica.

Tripinnately compound:- The leaflets are arranged on the tertiary rachis. Eg:Moringa, ■Millingtonia.

Decompound:- The primary rachis is repeatedly divided. The leaflets arise on the ultimate rachis. Ex: Coriandrum.

Palmately compound leaves:- Leaflets are arranged on the top of the petiole like the fingers of a palm.

According to the number of leaflets present, palmately compound leaves are of several types.

a) Unifoliate compound:- Petiole bears single leaf let. Ex: Citrus."

b) Bifoliate:- Two leaf lets are on the petiole. Ex: Hardwickia.

c) Trifoliate:- Three leaflets are on the petiole. Ex; Dolichos.

d) Tetrafoliate:- Petiole bears 4 leaf lets. Ex: Marsilea.

e) Pentafoliate:- Petiole bears five leaflets. Ex: Gynandropsis.

f) Multifoliate:- Petiole bears many leaflets. Ex: Ceiba.

PHYLLOTAXY:

The mode of arrangement of leaves on the stem and branches is called phyllotaxy.

The.uses of phyllotaxy is to see that all leaves'receive uniform sunlight.

There are 3 types of phyllotaxy

(a) Alternate (b) Opposite (c) Whorled.

Alternate phyllotaxy:- Only one leaf is.,present at each node. Ex: Hibiscus, Ficus, Annona.

Orthostichy:- The leaves are arranged in vertical rows called orfhostiches.

Leaf Mosaic:

This is a special type of alternate phyllotaxy.

The lower leaves with longer petioles and upper ones with shorter petioles.

The jeaf blades appear to form a continuous appearance. Ex: Acalypha indica, Carica papaya.

Opposite:- Two leaves are present at each node but opposite to each other.

Opposite decussate:- When one pair of leaves is at right angles to another pair present at the lower or upper node.

Ex: Calotropis.

Opposite superposed: The leaves of all nodes are in the same plane. Eg: Quisqualis.

Whorled: More than two leaves are present at each node. Eg: Nerium odorum.

HETEROPHYLLY:

Having two or more types of leaves on the same plant is called heterophylly.

It is of 3 types.

A. Ecological / Environmental:

(a) Depends on Environment.

(b) Found commonly in hydrophytes.

(c.) Root like leaves to normal leaves are seen on the same plant.

Ex: Limnophila heterophylla, Ranunculus.

B. Developmental:

In Dolichos lablab simple leaves are formed during seedling stage and trifoliate compound leaves in the developed plant.

In Acacia melanoxylon bipinnate compound leaves are developed in the beginning which are modified into phyllodes at maturity.

C. Habitual heterophylly:

(a) Different types of leaves are seen at different nodes.

(b) From normal simple leaves to different lobed leaves are seen.

Ex. Artocarpus, Selaginella (Pteridophyte)

LEAF MODIFICATIONS:

Tendrils:

(a) Complete leaf except stipules modified-into tendrils- Lathyrus.

(b) Terminal leaflets of compound leaf modified into tendrils -Pisum.

(c) Leaf tip modified into tendrils - Gloriosa superba.

(d) Stipules modified into tendrils - Smilax.

(e) Petiole modified into tendrils - Clematis.

(f) Part of petiole modified into tendrils-Nepenthes.

Spines:

(a) In some plants leaves are modified into sharp, pointed spines.

(b) They help in reducing the rate of transpiration in xerophytic plants and also protect the plants from herbivorus animals.

(c) Entire leaf is modified into spines. Ex: Euphorbia, Asparagus.

(d) Leaf apex is modified into spine. Ex: Agave, Yucca, Phoenix.

(e) Stipules are modified into spines. Ex: Acacia, Ziziphus.

(f) Leaf margin is modified fnto spines. Ex: Argemone

(g) First leaf of axillary bud is modified into spine. Ex: Citrus.

Scale leaves:

(a) In some xerophytic plants and underground stems, scale leaves are present

(b) In desert plants, scale leaves reduce transpiration. Ex. Casuarina.

(c) In underground stems they protect the axillary and terminal buds. Ex: Zingiber, Allium.

(d) In Allium, the scale leaves store food material.

Phyllode:

(a) This is a xerophytic adapatation.

(b) In Acacia melanoxylon the petiole is modified into phyllode.

(c) In parkinsonia, the secondary rachis is modified into phyllode.

Reproductive leaves:

(a) Vegetative buds develop on some leaves helping the plant in vegetative propagation.

(b) In Bryophyllum, the buds lie in the notches present in the crenate margins of the leaf.

(c) In Scilla indicathe buds arise from the tip of the leaf.

(d) In Begonia, the epiphyllous buds arise from the injured part of leaf.

Trap leaves:

(a) Modified leaves to capture insects for obtaining nitrogen requirements of plants are known as Trap leaves.

(b) Insectivorus plants contains trap leaves.

(c) Insectivorus plants inhabit in nitrogen deficient soils.

(d) Plants capture insects to obtain their required nitrogen as insect body is rich in proteins.

(e) In insectivorous plants, a part of leaf or whole leaf is modified into a trap leaf.

(f) Trap leaves contain digestive glands.

(g) Trap leaves secrete acidic juices to paralyse and kill the insect.

(h) Trap leaves secrete proteolytic enzymes to digest proteins insect body and absorb digested nitrogen.

(i) Trap leaves carry on extra cellular digestion.

Ex: Nepenthes, Drosera, Dionaea, Utricularia.

Nepenthes:

It is an insectivorus plant occuring in Assam forest.

(a) It is commonly called pitcher plant.

(b) The lower part of the petiole is modified into a wing like structure, and the upper part of the petiole is modified into a tendril. The leaf lamina is modified into pitcher.

(c) The lid is attractive, colourful and immovable.

(d) The bending hairs of the pitcher donot allow the insect to crawl in an upward direction.

(e) The insect is killed and digested by the action of proteolytic enzymes and the digested nitrogen substances are then absorbed and transported to the plants.