

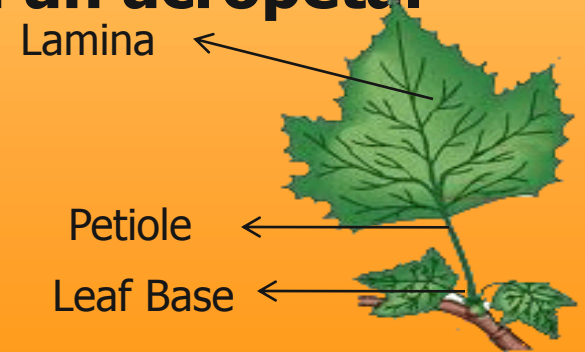


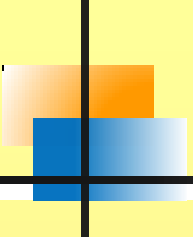
MORPHOLOGY OF FLOWERING PLANTS (LEAF)



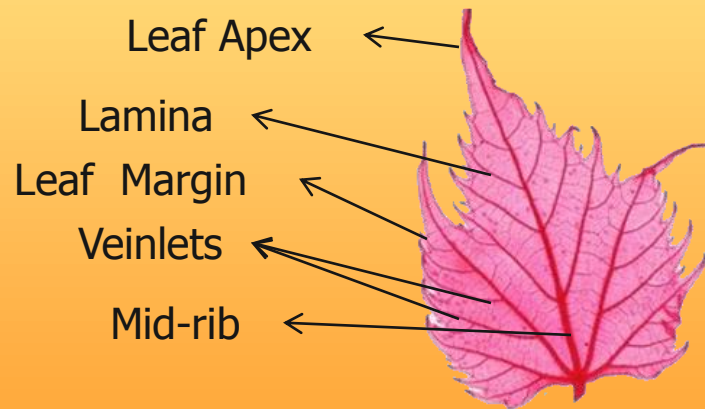
THE LEAF

- “The leaf is lateral, flattened structure borne on a node of the stem.”
- The leaves are the food manufacturing organs of the plant.
- The leaf bears a bud in its axil. The axillary bud later develops into a branch.
- The leaves originate from the shoot apical meristems which are small, isodiametric and thin walled and are arranged in an acropetal order.
- Leaf consists of three main parts -
 - Leaf Base
 - Petiole
 - Lamina



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- **Leaf Base is the lower most part of leaf by which leaf is attached to the node. Leaf base bear two lateral small leaf like structures called 'stipules'.**
 - **In some plants leaf base is swollen to form 'pulvinus', which is responsible for sleep movements. Example *Mimosa pudica* (touch-me-not).**
 - **The petiole exposes the lamina to the sunlight.**
 - **The lamina is a flat, thin , broad and expanded part of the leaf with veins and veinlets.**
 - **The middle prominent vein is called 'midrib'. The sides of lamina forms the margin and tip forms the leaf apex.**

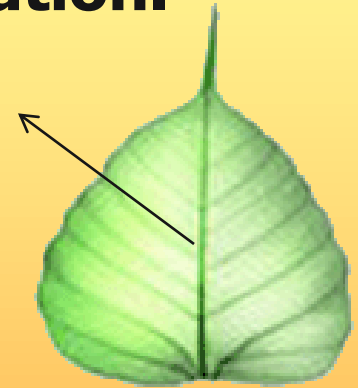
- **The sides of lamina forms the margin and tip forms the leaf apex.**
- **Veins contain the vascular tissue and act as channel for the transport of food, water and minerals. Veins also act as the skeleton of lamina.**



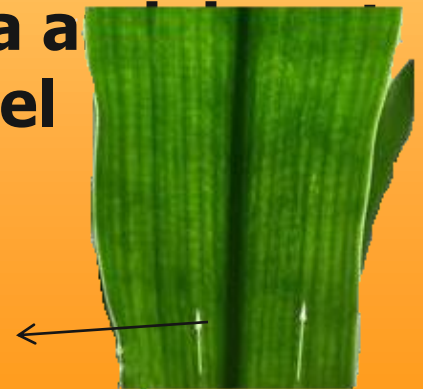
VENATION

- “ The arrangement and distribution of veins and veinlets in the leaf lamina is called venation.”
- The two main types of venation are-
 - Reticulate -“When the veins are irregularly distributed to form a network, it is known as reticulate venation.”
 - Parallel -“When the veins are parallel to each other within a lamina and do not form a network, it is known as parallel venation.”

Reticulate Venation



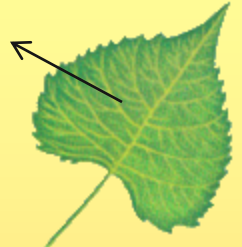
Parallel Venation



TYPES OF LEAVES

- On the basis of incision or indentation leaves are of two types-
 - **Simple** – A leaf is said to be simple when its lamina is entire or is incised but the incision do not reach the mid-rib in pinnate leaf or do not reach upto the tip of petiole in palmate leaf.
 - **Compound** – A leaf is said to be compound when its lamina goes down to the mid-rib (rachis) or to the petiole so the leaf is broken up into number of segments called leaflets.

Simple Leaf



Palmately Compound



Paripinnately Compound



Bipinnately Compound





DIFFERENCES BETWEEN SIMPLE AND COMPOUND LEAF

SIMPLE LEAF

- The lamina is not divided into distinct lobes or leaflets i.e. it has single lamina.
- An axillary bud is present in the axil of simple leaf.
- Simple leaves appear in acropetal succession on stem.
- The base of leaf may bear stipules.

COMPOUND LEAF

- The lamina is incised into two or more distinct leaflets. The leaflets are borne either at the tip of petioles or on the sides of rachis.
- Individual leaflets do not bear any axillary bud. However, bud is present in the axil of whole leaf.
- Leaflets of a compound leaf do not appear in acropetal succession on rachis.
- Stipules may be present at the base of compound leaf however such structures are never present at the base of leaflets.



DIFFERENCES BETWEEN

PINNATELY COMPOUND LEAF

- These are feather like in shape.
- Leaflets appear on elongated axis and in two rows.
- There is no joint between leaflet and its axis.
- Axis bearing leaflets is continuation of branch of mid-rib.

PALMATE COMPOUND LEAF

- As the name says these are like palm of hand.
- Leaflets appear from common point and are clustered together.
- Stem is negatively geotropic and hydrotropic.
- Tip of petiole represents the leaflet bearing point.

PHYLLOTAXY

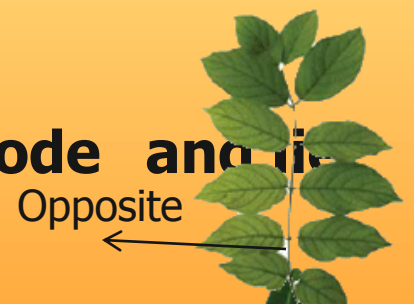
- The arrangement of leaves on a stem or branch is called phyllotaxy. It results in the orientation of leaves in such a way that they receive maximum sunlight to perform the photosynthesis. It is of three main types-



- **Alternate or Spiral** – A single leaf arises at each node alternately.

Example – *Hibiscus rosa sinensis*

- **Opposite** – A pair of leaves arise at each node and are opposite to each other.



Example- *Calotropis procera*.

- **Whorled** – When three or more leaves arise at each node and are in whorl or circle.

Example- *Nerium , Oleander*.



MODIFICATION OF LEAVES

- Leaves are modified to perform functions other than photosynthesis. It is of following types-
- **Tendrils** –Tendrils are thread like green structures, which are sensitive to touch and are capable of coiling around the support. Examples- *Pisum sativum* , *Smilax*, *Gloriosa*, etc.
- **Spines** –Spines protect plant from grazing animals and also reduce the area for transpiration. Examples - *Opuntia*, *Aloe*, *Argemone*, etc.
- **Food Storage** – Food is stored in the leaves of *Alium cepa*. The leaves become fleshy and juicy due to storage of water, mucilage and food material. *Aloe* and *Portulaca*.



Tendrils

Spines



Food Storage



DIFFERENCES BETWEEN STEM AND LEAF TENDRILS

STEM TENDRILS

- **Stem tendrils are usually branched.**
- **Scale leaves are present in the region of forking.**
- **The buds may be present in axis of scaly leaves.**
- **They may appear from stem, bud or flower.**

LEAF TENDRILS

- **Leaf tendrils are usually unbranched.**
- **Scale leaves are not found on the tendrils.**
- **The buds are not present on leaf tendrils.**
- **They appear from leaf or its parts.**



DIFFERENCES BETWEEN PHYLLOCLADE & PHYLLODE

Phylloclade

- **The phylloclade is the stem modification into leaf-like structure.**
- **It arises in the axil of a leaf which can fall off and leaves a scar.**
- **Phylloclade does not bear any axillary bud.**
- **Phylloclade can develop leaves and flowers etc.**
- **Phylloclade helps in vegetative propagation.**
- **Nodes and internodes are borne on phylloclade.**

Phyllode

- **Phyllode is the petiole modification into leafy structure.**
- **Phyllode does not arise in the axil of a leaf because it is itself a leafy structure.**
- **A bud is present in the axil of a Phyllode .**
- **No such structures are found on phyllode.**
- **Phyllode does not help in any type of reproduction.**
- **A phyllode does not bear nodes and internodes.**



FUNCTIONS OF LEAVES

- **Leaves have following types of functions –**
 - **Primary or Main Functions-**
 - **Photosynthesis – The principal function of the leaves is to manufacture organic food. The seat of photosynthesis are the green cells of leaf having chlorophyll.**
 - **Transpiration – The loss of water from the leaf surface is known as transpiration. It is necessary to create force or tension in water column and thus cause ascent of sap.**
 - **Gaseous Exchange – It takes place in leaves through stomata during the process of photosynthesis and respiration.**

FUNCTIONS OF LEAVES

▪ Secondary or Accessory Functions –

- Storage of Food in leaf bases. Example – Onion. Storage of water in the leaves of succulent nature. Examples- *Bryophyllum*, *Aloe*.

Protection against browsing- By modifying into spines leaves protect plants from grazing. Examples- *Opuntia* and *Barberry*.

- It reduces rate of transpiration when modified into phyllode. Examples- *Acacia*.
- They help in climbing the plants having weak stem, when modified into tendrils and hooks. Examples- *Smilax*.

BRYOPHYLLUM



ALOE



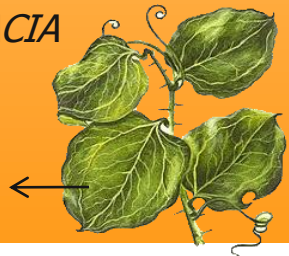
OPUNTIA



ACACIA



SMILAX



FUNCTIONS OF LEAVES Contd....

- **Secondary or Accessory Functions –**
 - Leaves help the plants in vegetative multiplication. *Example – Bryophyllum.*
 - Leaves act as balances for floating when modified into roots. *Example – Salvinia.*
 - The leaves are modified into sepals , petals, stamens and carpels to take part in sexual reproduction.



BRYOPHYLLUM

SALVINIA





Points to Remember

- **Leaf is a lateral outgrowth of stem developed exogenously at the node.**
- **Leaves are green in colour to perform the function of photosynthesis.**
- **Leaves exhibit marked variations in their shape, size, margin, apex and extent of incisions of leaf blade.**
- **Like other parts of a plant leaves also get modified into other structures such as tendrils, spines for climbing and protection respectively.**
- **One internode long phylloclade is called cladode.**
- **The modification of petiole into leaf like structure is called cladode. Example- *Asparagus*.**



Points to Remember

- Reticulate venation in leaves is the characteristic feature of dicot plants. Few monocots like *Smilax*, *Alocasia* and *Dioscorea* also possess reticulate venation.
- *Mangifera indica* has Alternate phyllotaxy.
- *Eugenia* has opposite superimposed phyllotaxy.
- *Calotropis procera* has Opposite decussate phyllotaxy.
- Sugarcane plant has dumb-bell shaped guard cells.
- In *Nepenthes* the lamina forms a pitcher like structure.
- *Utricularia* leaves modify to form bladder like structure.
- *Bryophyllum* leaves help in vegetative propagation.
- Characteristic smell of onion is due to sulphur-allyl sulphide present in fleshy leaves.



Thanks...