

Leaf



- Flat lateral outgrowths
- From stem nodes
- Functions- Photosynthesis, transpiration, gas exchange
- arise from leaf primordium
- exogenous origin
- possess axillary bud in the axil\
- heterophylly (two types of leaf in the same plant) – *Limnophila heterophylla*, Coriander
- Scale leaves to very large size
- circular, oval, linear, intermediate shapes seen

Dissected under water leaf

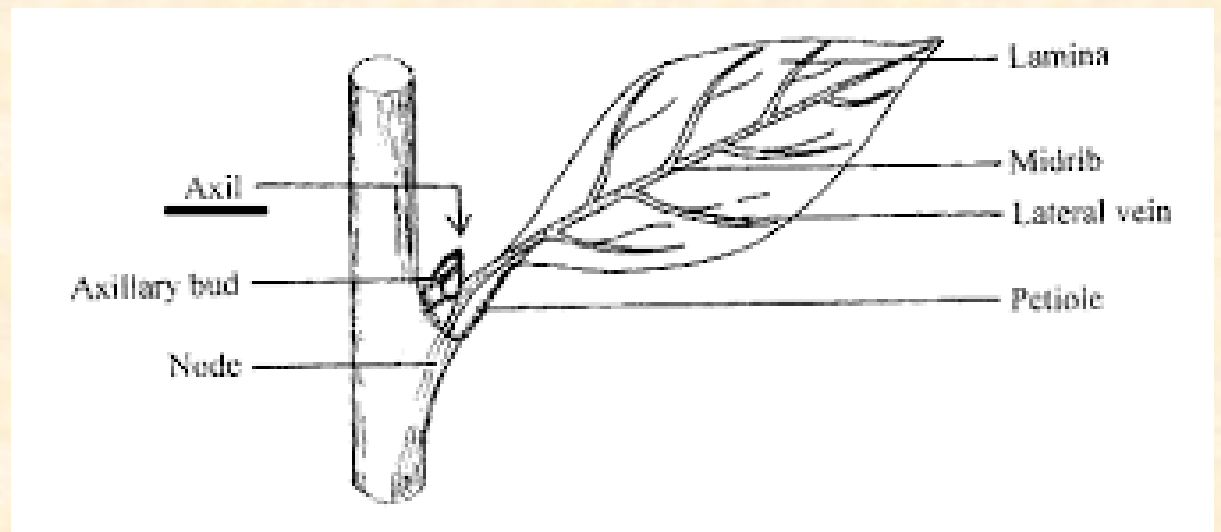
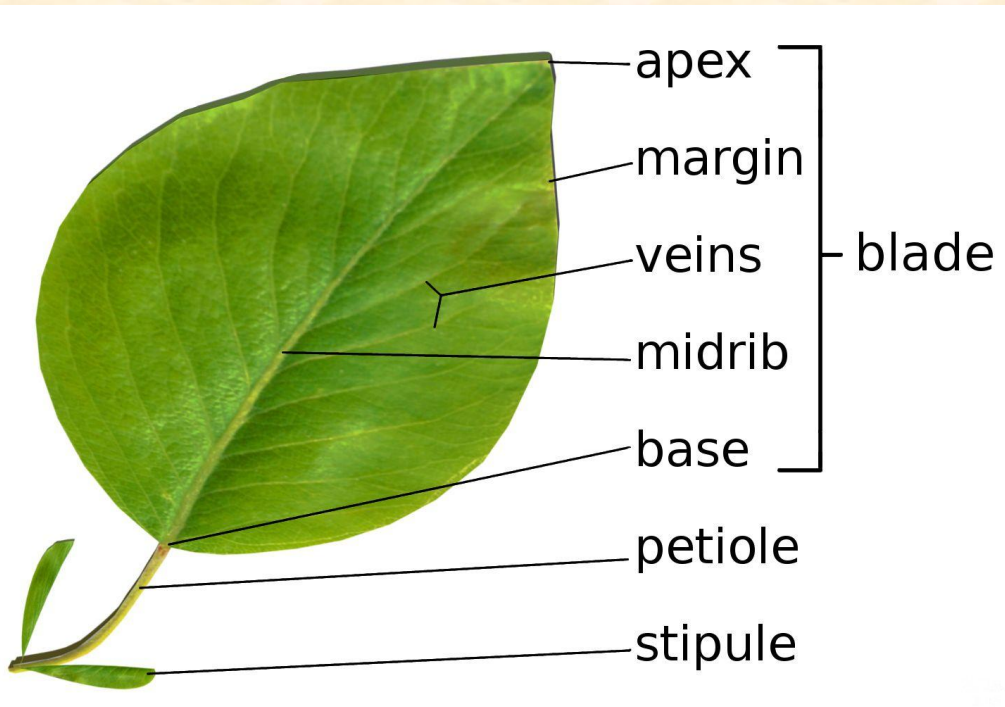


Normal aerial leaf



Limnophila: Heterophylly





PARTS OF DICOT LEAF

1. Leaf Base(Hypopodium) – attachment part

- leaf base swollen – pulvinate (nyctinasty)
- pair of leafy lateral outgrowths from leaf base – stipule
- Leaf with stipule- stipulate (Ixora)
- leaf without stipule – exstipulate (Mangifera)
- Stipules protect young leaf

2. Leaf Stalk – connection of lamina with base

- * simple leaf stalk – petiole
- * compound leaf stalk – rachis
- * leaf without stalk – sessile (Calotropis)
- * leaf with petiole – petiolate (Hibiscus)
- * leaf with winged petiole - Citrus

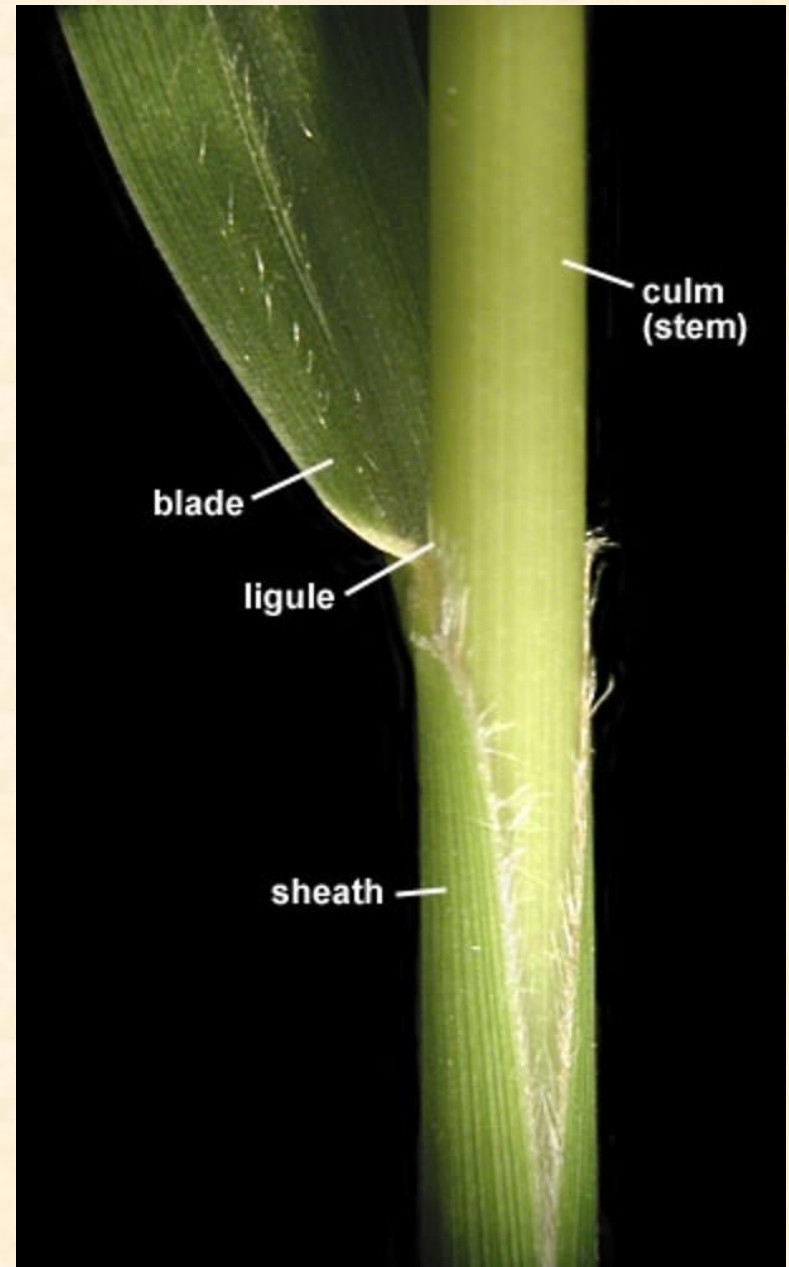




3. Leaf Lamina (leaf blade) – green, thin expanded part
- * photosynthesis, transpiration & respiration
 - * Tip of leaf – leaf apex
 - * border of leaf – margin
 - * petiole extension thru' lamina – midrib
 - * branches from midrib – veins branch to veinlets
 - * midrib, vein, veinlets- structural framework, supply of food, water, minerals
 - * Leaf lamina dorsiventral

PARTS OF MONOCOT LEAF

- 3 parts- leaf base, petiole, lamina
- Leaf base sheathing
- petiole absent (grasses)
- Petiole as Rachis (palms)
- Pair of outgrowths b/w leaf base & petiole – ligule (grass)
- leaf lamina – Isobilateral
- Leaf venation - Parallel



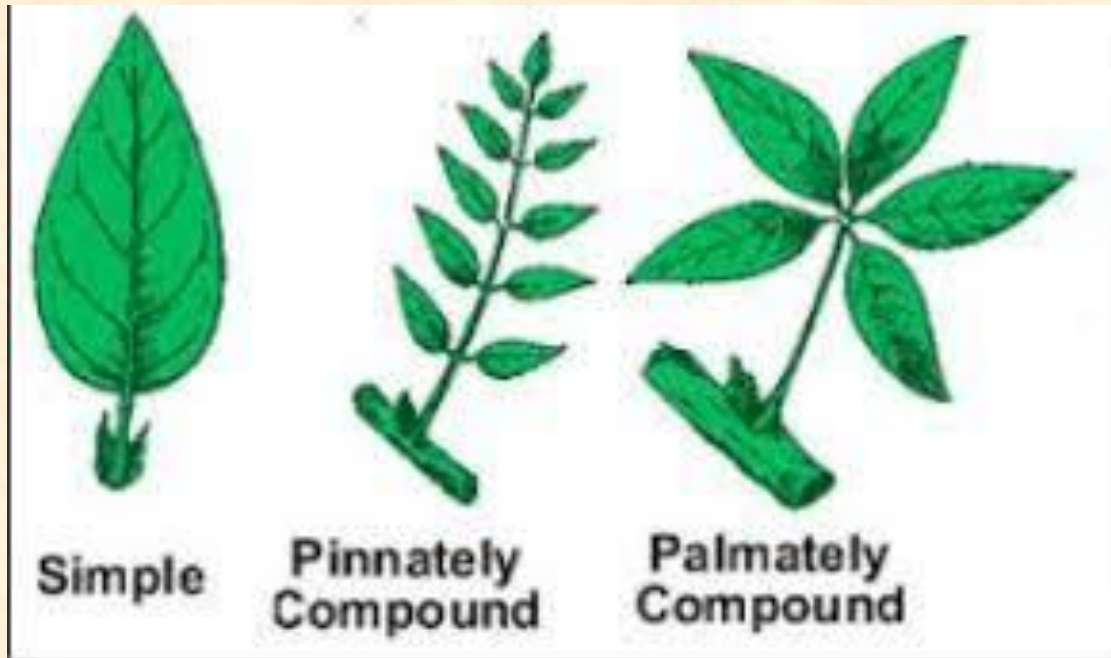
VENATION

- Pattern of arrangement of veins in the leaf blade
- Dicots – Reticulate (anastomosing network of veins & veinlets)
- Monocots – Parallel (Horizontal/ longitudinal) veins
- Exceptions – Calophyllum, Alstonia, Eryngium (dicots) – Parallel
- Aroids, Dioscorea (Monocots) – reticulate



Types of leaves

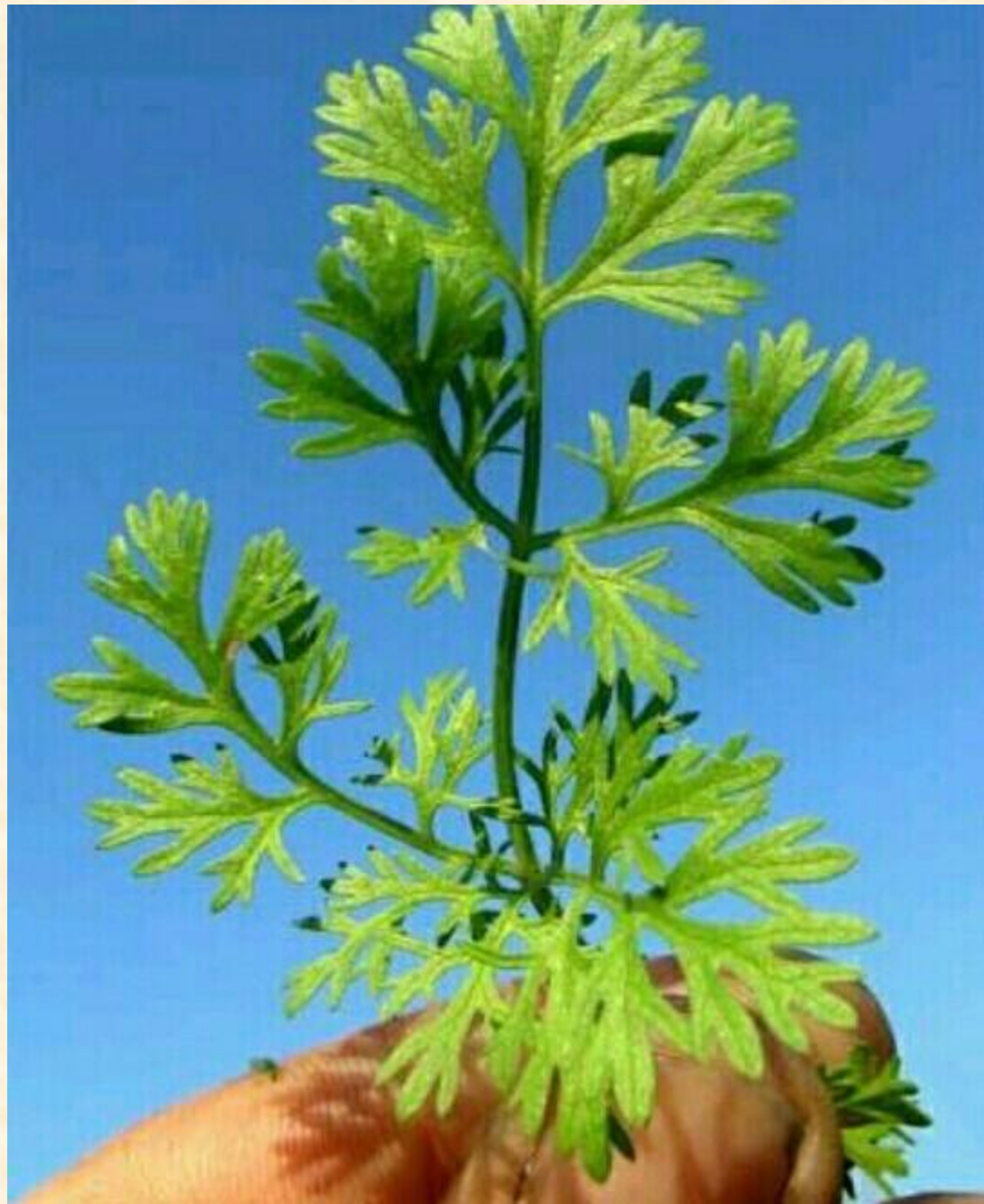
- Based on number of lamina, or incision of lamina two types
- 1. Simple leaves – single lamina, entire or incised (not reaching the petiole)



2. Compound Leaves: 2 types – Pinnately compound, Palmately Compound

- * Pinnately compound – leaflets arranged on both sides of rachis
- ❖ Unipinnate/ simple pinnate – single rachis present
 - * paripinnate – leaflets paired at tip (Tamarindus)
 - * leaflets unpaired at tip (Rosa)
- ❖ Bipinnate – primary rachis divided to sec. rachis/ rachilla with leaflets (Mimosa)
- ❖ Tripinnate – primary rachis- sec. rachis- tertiary rachis bearing leaflets (Moringa)
- ❖ Decompound – tertiary rachi divide further (coriander)

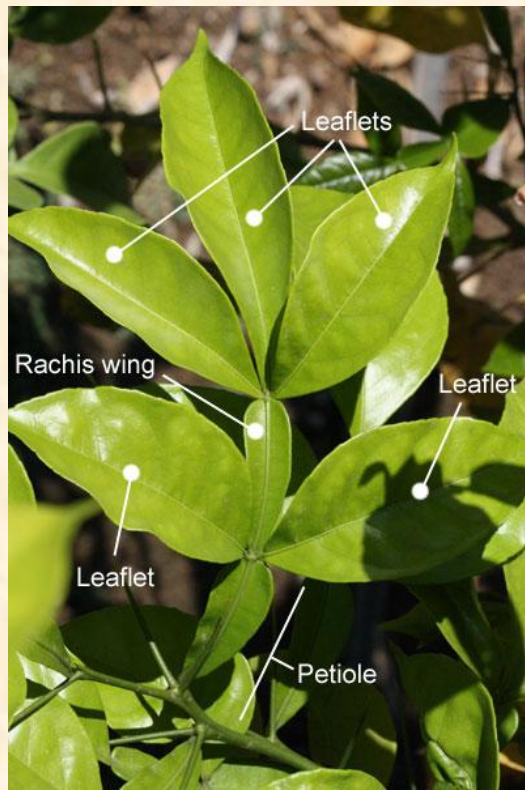




* Palmately Compound:

leaflets radiate from tip of rachis

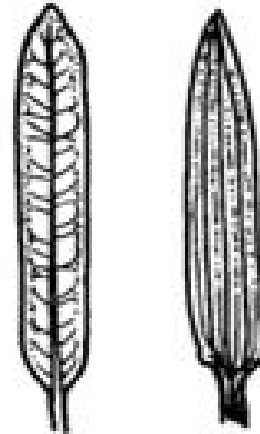
- ❖ Unifoliate – palmately compound with only one leaflet (Citrus)
- ❖ Bifoliate – Two terminal leaflets (Bignonia)
- ❖ Trifoliate – three terminal leaflets (Trigonella)
- ❖ Quadrifoliate – Four terminal leaflets (marsilea)
- ❖ Multifoliate – more than four (Tapioca)



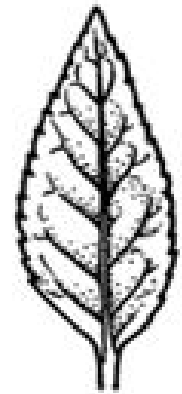


SHAPE OF LEAF LAMINA

- Linear – Long (grasses)
- Lanceolate - broad near stalk, long & tapering at ends (Bamboosa)
- Oblanceolate – lamina lanceolate, but broad part near apex (Calamus)
- Elliptical – lamina tapering at ends, broad in middle (Vinca)
- Oblong – lamina 2 Or 3 times long as broad, ends rounded (plantain)



LINEAR



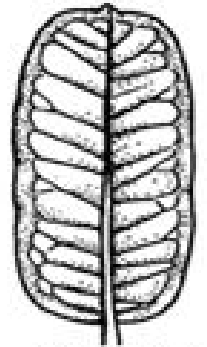
LANCEOLATE



OBLANCEOLATE



ELLIPTIC

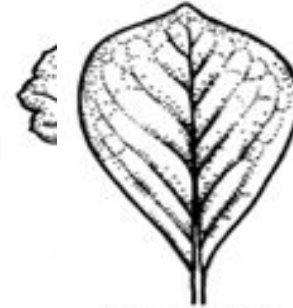


OBLONG

- Ovate – Lamina egg shaped (banyan)
- Obovate – lamina inversely ovate (Tectona)
- Orbicular/ rotund – lamina circular (Lotus)
- Cordate – lamina heart shaped (thespesia)
- obcordate – leaflets inversely heart shaped (Oxalis)
- Reniform – Lamina is kidney shaped (Centella)
- Cuneate – leaf blade broadest beyond the middle & tapering down (Oxalis)
- deltoid- lamina inversely cuneate (abutilon)
- Sagittate- Arrow shaped (Arum)
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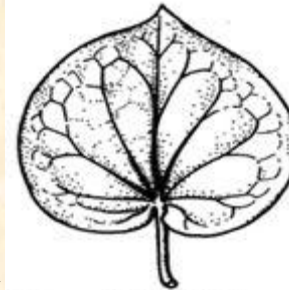
OVATE



OBOVATE



ORBICULAR



CORDATE



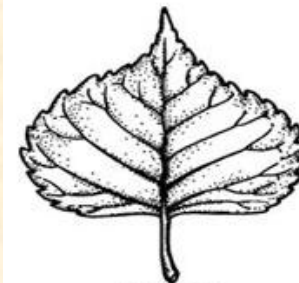
OBCORDATE



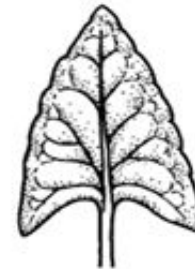
RENIFORM



Cuneate



DELTOID



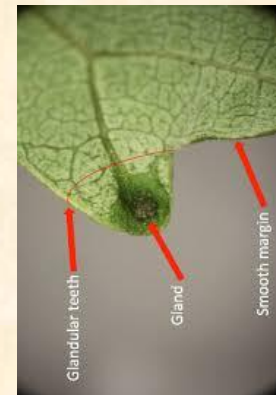
SAGITTATE

- Falcate- sickle shaped (Acacia)
- Oblique- Right and left halves not symmetrical
- Pinnatifid - Lamina cut half way to midrib to pinnate lobes (Sphaeranthes)
- Lyrate – Lyre shaped with terminal large & small lateral lobes (Mustard)
- Acicular – Needle shaped (Allium)
- Lorate – strap shaped (Vallisnaria)



LEAF MARGIN

- Entire – Margin smooth (Mangifera)
- Serrate – toothed (Balsam)
- Dentate – toothed, sharp (Hibiscus)
- Crenate – rounded forward pointing teeth (bryophyllum)
- Undulate/Sinuate – wavy (polyalthia)
- Spiny – margin with spines (aloe)
- Glandular – margin with sticky gland hair (Jatropha)
- Ciliate – Margin with cilia like hairs (Cleome)



•Fid/ Fidus – lamina divided to lobes

* Pinnately fid – radish

* Palmately fid – Papaya



• Sectile- margin extend to midrib

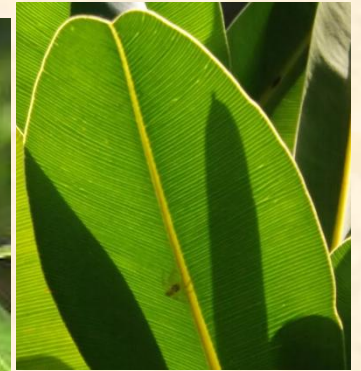
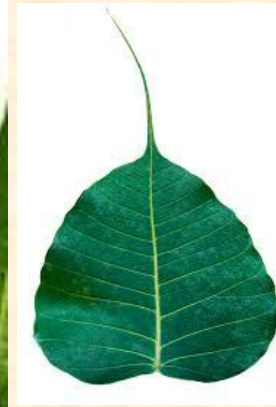
* Pinnatisect-ipomoea

* Palmatisect - Tapioca



LEAF APEX

- Acute – tip pointed (Mangifera)
- Acuminate (Caudate) – pointing with very long tail (Ficus)
- Obtuse - Blunt tip (Jackfruit tree)
- Cuspidate - leaf tip spine (pineapple)
- Mucronate – round apex, with pointed tip (Caesalpinia)
- Retuse – Blunted with shallow notch (Calophyllum)
- Emarginate – leaf tip with deep notch (Bauhinia)



Leaf surface with hairs - Indumentum

LEAF SURFACE

* Glabrous – smooth & shiny
(Ficus)

• Pubescent – surface with short & soft hairs (Hibiscus)

• Villous – covered by soft & long hairs (F. villosa)

• Hispid – stiff hairs covered (Spermacoce)

• Scabrous – rough surface, stiff hairs (Lantana)

• tomentose – matted hairs (Gauzema)



- Glandular – Surface with sticky, glandular hairs (Jatropha)

- Gland dotted – translucent dots (Citrus)

- Strigose – sharp, stiff swollen hairs cover (Mertensia)

- Sericeous – silky sheen, silky hairs (Gingelly)



PHYLLOTAXY

- Pattern of leaf arrangement on stem
- Provide sufficient light to leaves
- foliage leaf arranged in bud – prefoliation
- leaf folding in bud – Ptyxis
- leaf within bud – vernation
- 2 types of phyllotaxy – 1) RADICAL 2) CAULINE
- RADICAL – Leaves in cluster at top of root on stem – Radish
- CAULINE – Leaves on stem with nodes & internodes – Hibiscus



CAULINE

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graph TD; CAULINE --> Alternate; CAULINE --> Opposite; CAULINE --> Whorled;
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Alternate

(Leaves on alternate rows, 1 at each node)

1. distichous (Anona)
2. pentastichous (spiral) (Hibiscus)

Opposite

((leaf pairs arranged oppositely on each node)

1. Opposite decussate (Ixora)
2. Opposite superposed (Calotropis)

Whorled

(3 or more leaves arise at a node as a whorl.

(Nerium, Alstonia)



Alternate distichous & Pentastichous



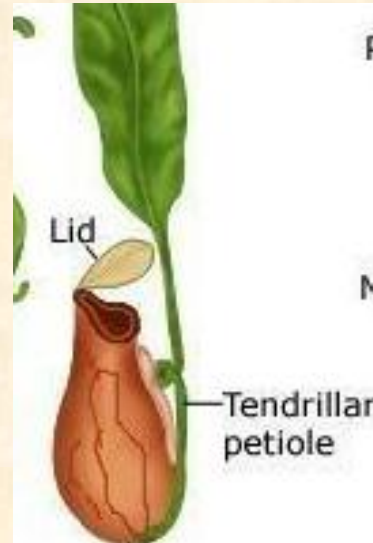
Opposite decussate Opp. Superposed



Whorled

LEAF MODIFICATIONS

- **Leaf tendrils** – long, spirally coiled, help weak stemmed plants to climb
- *Pisum* terminal leaflets modified
- *Gloriosa* leaf tips
- *Lathyrus* entire leaves
- *Nepenthes* petioles
- *Clematis* modified rachillae.



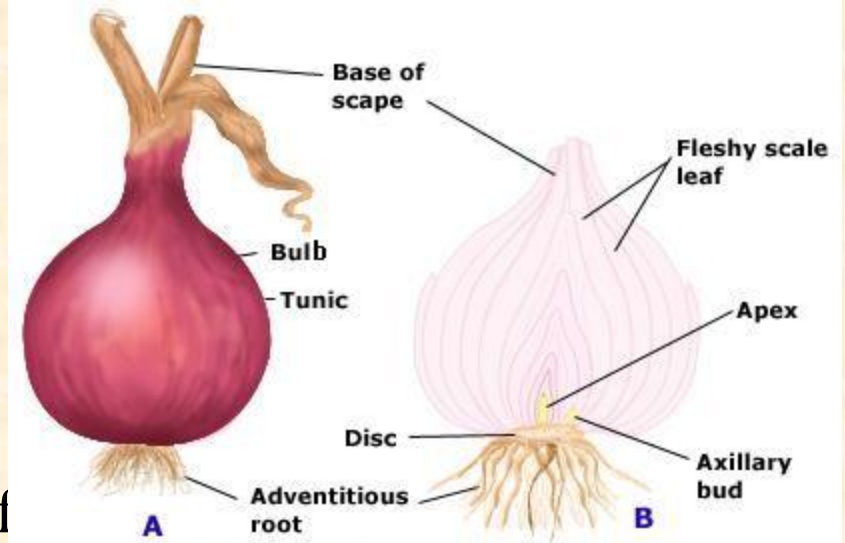
- **Leaf hooks** – hook like modifications
- for clinging
- in weakstemmed plants
- *Bignonia unguis-cati*, 3 terminal leaflets as cat-claw like hooks.



- **Leaf spines** – pointed structures
- xerophytic plants
- *Opuntia* minute leaves of axillary bud modified (original leaves as scale leaves)
- *Ananas*, *Agave* leaf margins
- defence, protection & control transpiration.



- **Leaf Scales** – thin, stalkless, membranous
- protects axillary buds in axils
- *Allium*, fleshy & dry scale leaves
- fleshy store water, mucilage & food



- **Pitcher** – flask shaped modification of leaf lamina

- insectivorous plants
- mouth covered – operculum (leaf tip)
- basal part of petiole – green, photosynthetic
- upper petiole – coiled, tendril like
- sugary secretion at mouth rim – slippery
- insects fall in
- gets digested by enzymes
- enzyme secretion & absorption of digested food by pitcher wall



- **Phyllode** – flat, leaflike, green, photosynthetic

- petiole or rachis modification
- xerophytic adaptation
- reduce transpiration
- *Acacia*, *Parkinsonia*
- normal leaf falls off early
- petiole /rachis develops as phyllode



FUNCTIONS OF LEAF

- Photosynthesis - chloroplast
- Gas exchange - stomata
- Transpiration - stomata
- storage of food & water- fleshy leaves
- Veg. propagation- adv. buds
- defence & protection - spines
- support for climbing – tendrils & hooks
- food capture - Pitcher

