Upright weak stem – Twiners and Climbers

Twiners

Stem is long, flexible and sensitive. It can coil around an upright support like a rope.

Ex: Dolichols lab-lab, Ipomoea, Convolvulus

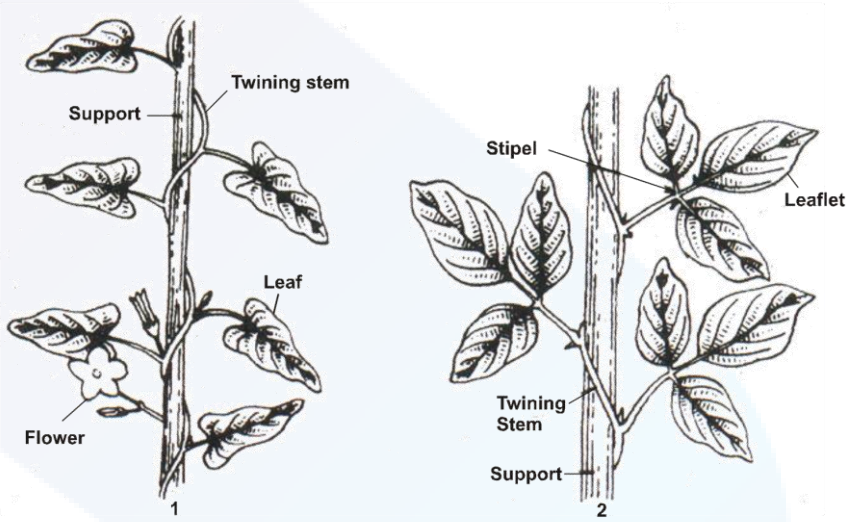


Fig:- Twiners. 1, Sinistrorse twiner – Convolvulus arvensis (Hiran khuri) 2, dextrorse twiner – Lablab (sem).

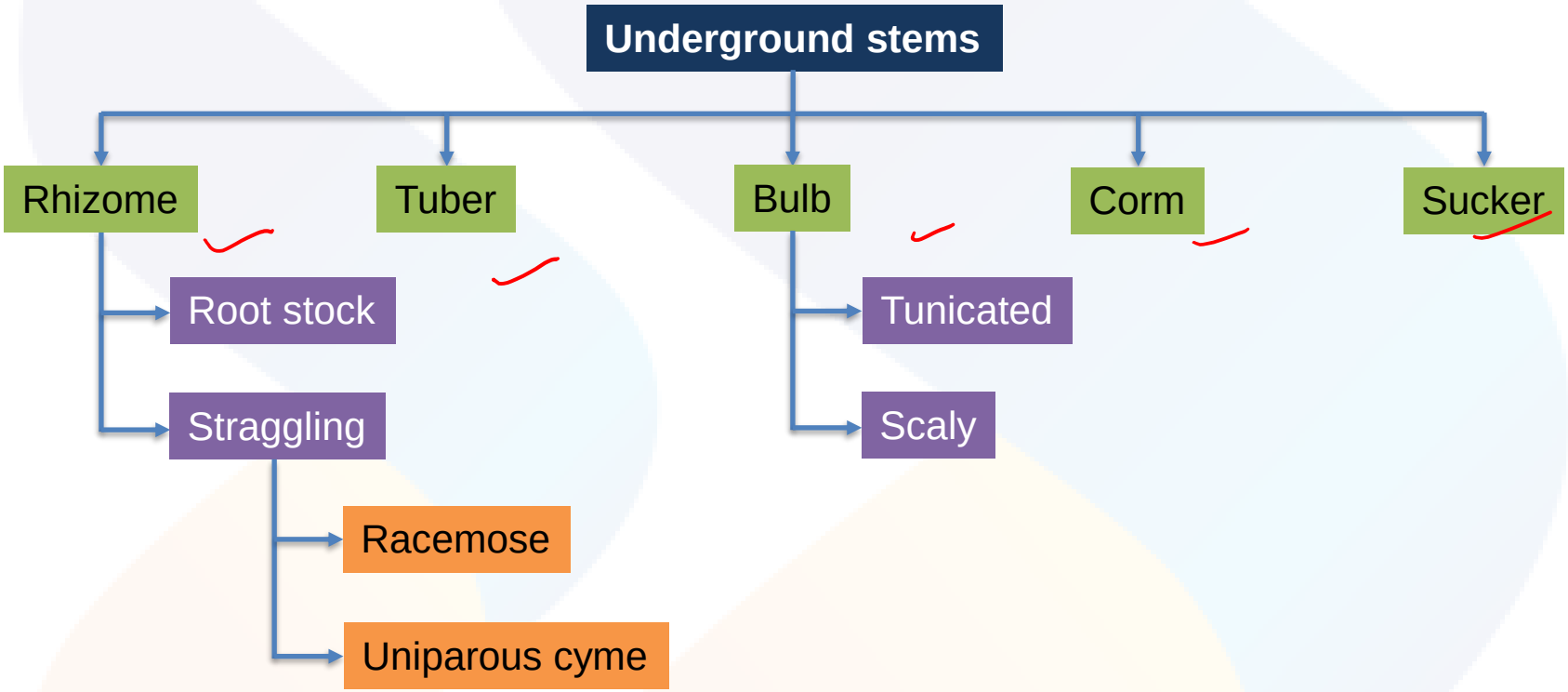
Climbers

It bears clinging structures for climbing like adventitious roots, tendrils Ex: Smilax, Ivy, Pea

- **Root climbers** → Adventitious roots provide support to clings the stem. Ex: Ivy, Betel
- **Tendril climbers** → Green-coiled structures coils around a support. Ex: Passiflora, pea
- **Lianas** → They are woody twiners or climbers Ex: Aristolochia
- **Scramblers** → Stems rises up a support by clinging to it. Ex: Bougainvillea, Rose

Underground stems

They lie below the surface of the soil, store food and take part in perennation.



Rhizome

Horizontal underground stem bears nodes and internodes.

Rhizome

- **Root stock** → Vertical rhizome is Root Stock Ex: Dryopteris (Fern), Banana
- **Straggling** → It is horizontal and branched
  - **Racemose** → When axis is monopodial Ex: Lotus, Sugarcane
  - **Uniparous cyme** → When axis is sympodial. Ex: Ginger, Turmeric

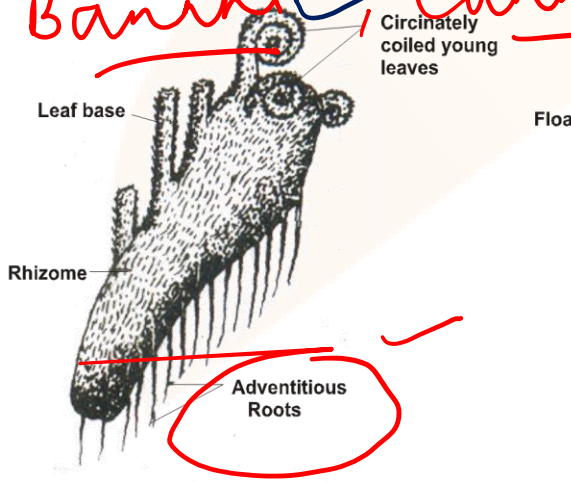


Fig:- Dryopteris (=Aspidium): Rootstock rhizome

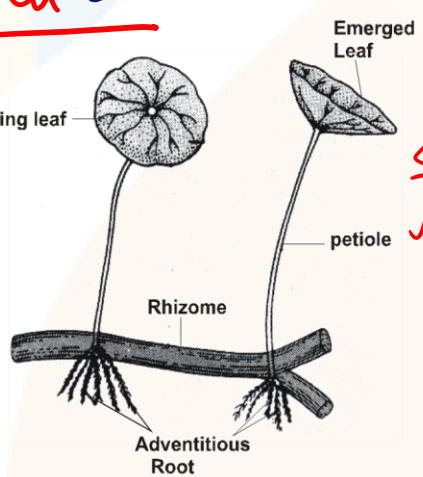


Fig:- Lotus (Nelumbo nucifera) : A monopodial rhizome

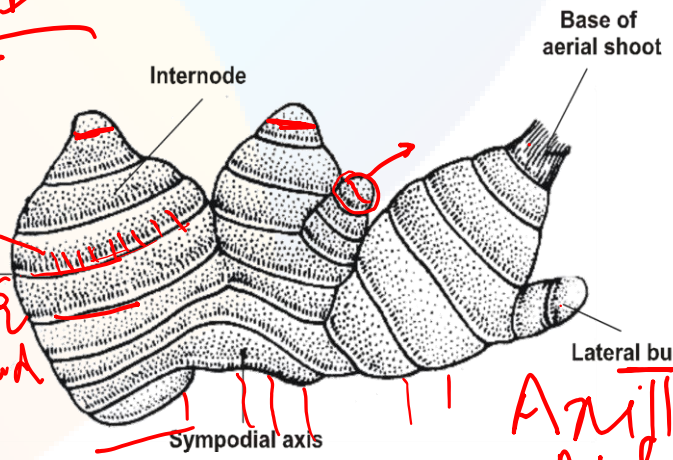


Fig:- Ginger : Sympodial rhizome

Bulb

- Stem is disc shaped and reduced.
- The bud is surrounded by many concentric leaves.
- The leaf bases are fleshy and edible.
- Disc bears adventitious roots at its base

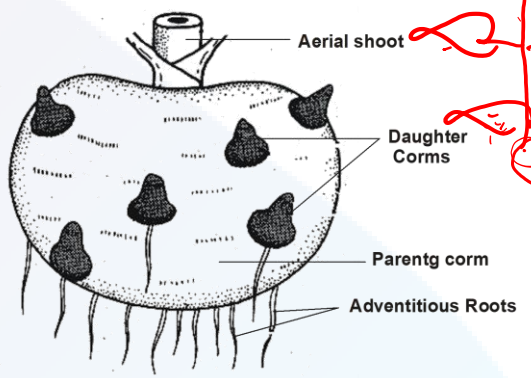


Fig:- Amorphophallus campanulatus : Corm

Bulb

- **Tunicated** → A sheath of dry membranous scale on the bulb.
  Ex: onion (simple tunic), garlic (compound tunic)
- **Scaly** → A tunic or covering sheath is absent. Ex: Lily. Ex: Lily

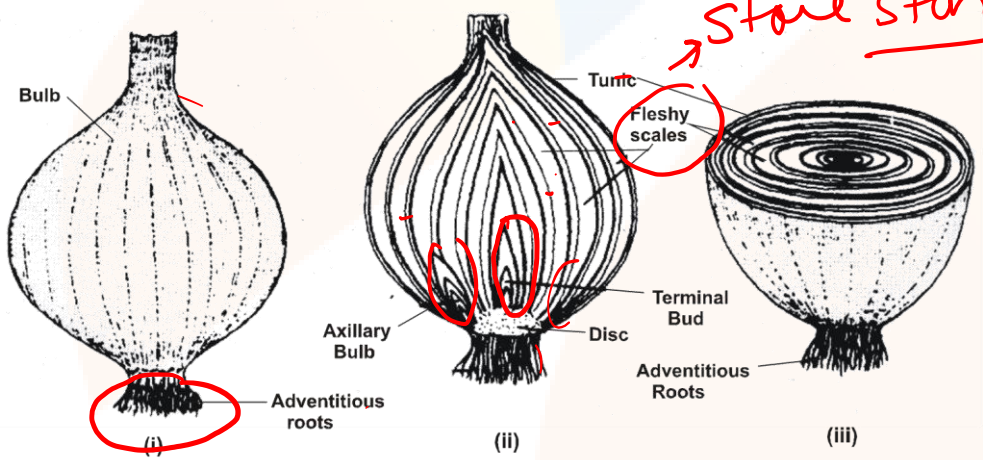


Fig:- Tunicated bulb of Onion. (i) external view. (ii) V.S. bulb. (iii), T.S. Bulb.

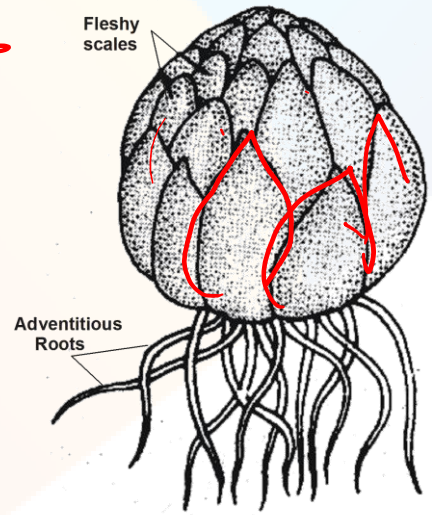
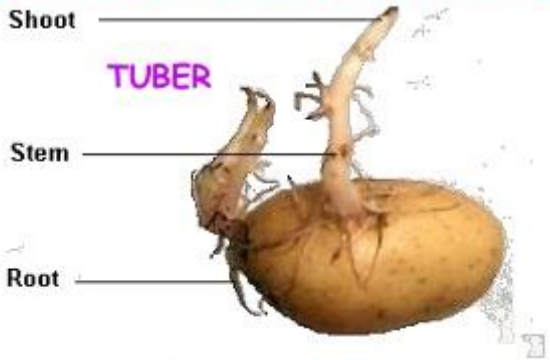


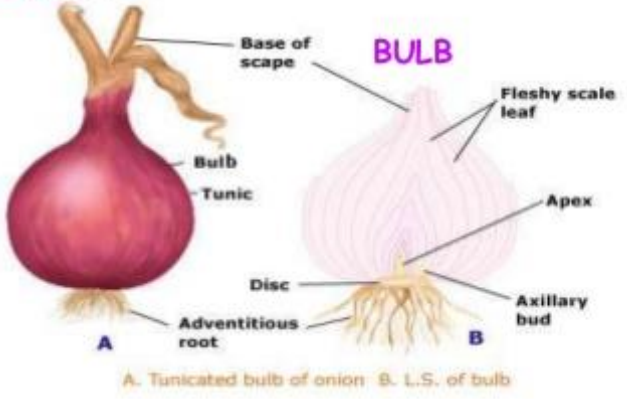
Fig :- Lily : Scaly bulb

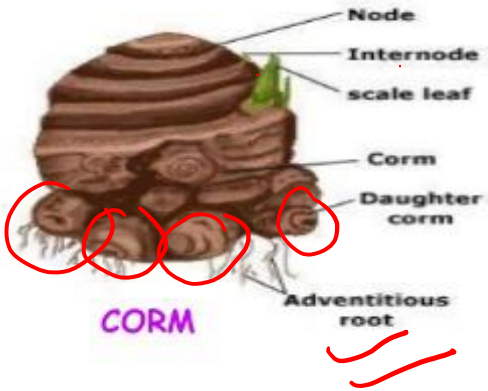
Stem Modifications

MODIFICATION OF STEMS :

I) UNDERGROUND MODIFICATIONS :







Tuber, Corm, Sucker

Tuber

Potato, Dahlia

- Terminal portion of underground stem branch, which is swollen on account of accumulation of food.

Adventitious roots absent.

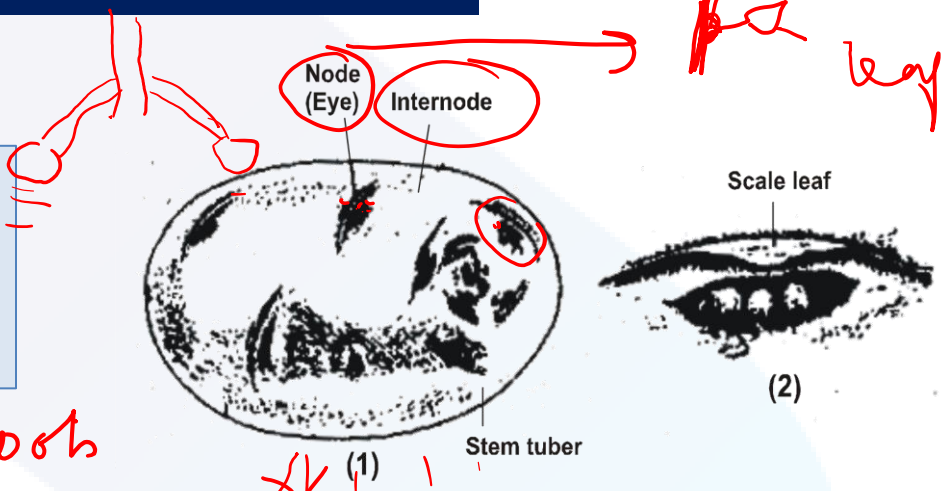


Fig:- 1– stem tuber of potato 2– an enlarged eye

Corm

- Short, thick, unbranched underground stem with stored food material.
- Grows vertically and covered by thin sheathing leaf bases of dead leaves called scales.

Ex: Amorphophallus, Colocasia, Crocus, Colchicum. Gladiolus

**

Longest flower / Inflorescence

Sucker

- Develops by axillary bud of underground part of stem.
- The branch creeps below soil surface & grows obliquely upward and produce new shoot.

Ex: Chrysanthemum, pineapple, Rose, Mentha

Modification of aerial stem – Phylloclade and Stem tendrils

Phylloclade

- Green flattened or rounded fleshy stem with leaves either modified into spines or feebly developed. Ex: Opuntia, Cocoloba

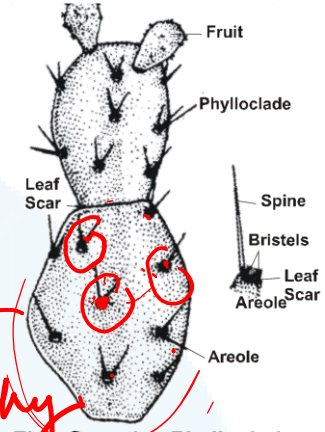


Fig:- Opuntia : Phylloclades

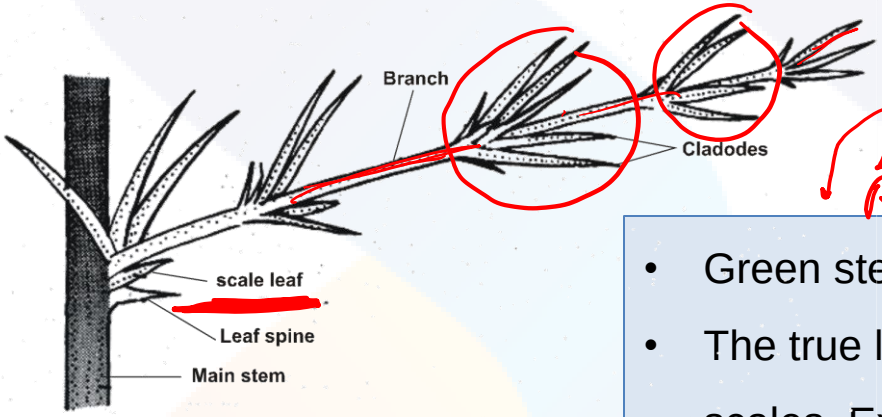


Fig:- Asparagus : Cladodes

Cladode

- Green stems with one long internode.
- The true leaves are reduced to spines or scales. Ex: Asparagus, Ruscus

Stem tendrils

Thread like sensitive structures coils around a support & help plant to climb.

- Axillary → Ex: Passiflora
- Extra axillary → Ex: Lagenaria, Luffa, Cucurbita
- Leaf opposed → Ex: Vitis vinifera
- Floral buds → Ex: Antigonon

Modification of aerial stem – Hooks, Stem thorns

Hooks

- Pedicels are modified into stiff curved hooks for helping in climbing called stragglar.

  Ex: *Artabotrys*

Stem thorns

- These are modification of axillary buds and are modified in to stiff and sharp structure, called thorns. Ex: Citrus, Bougainvillea, Duranta, Carissa, Pomegranate

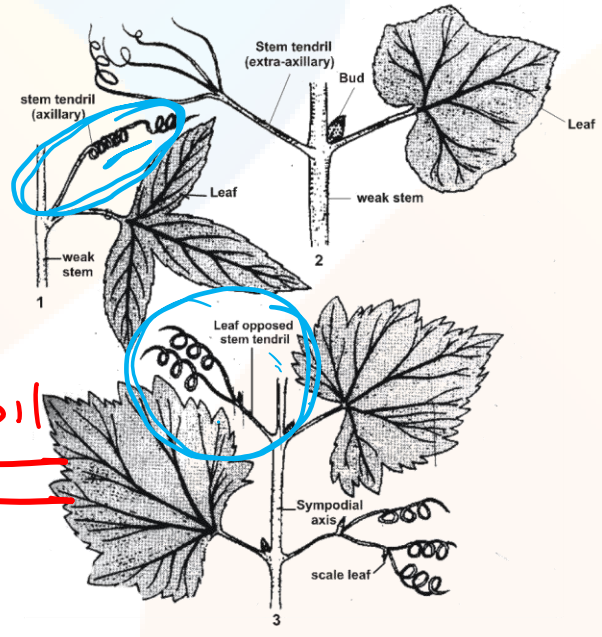


Fig:- Stem tendrils (1) Axillary – Passiflora
(2) Extra - Axillary – Luffa
(3) Leaf Opposed– Grape Vine.

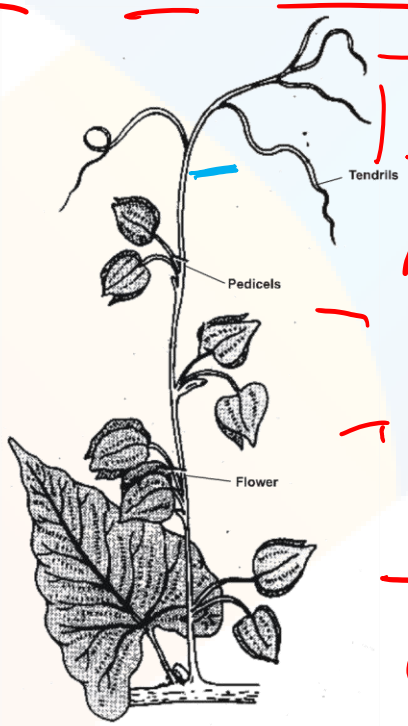
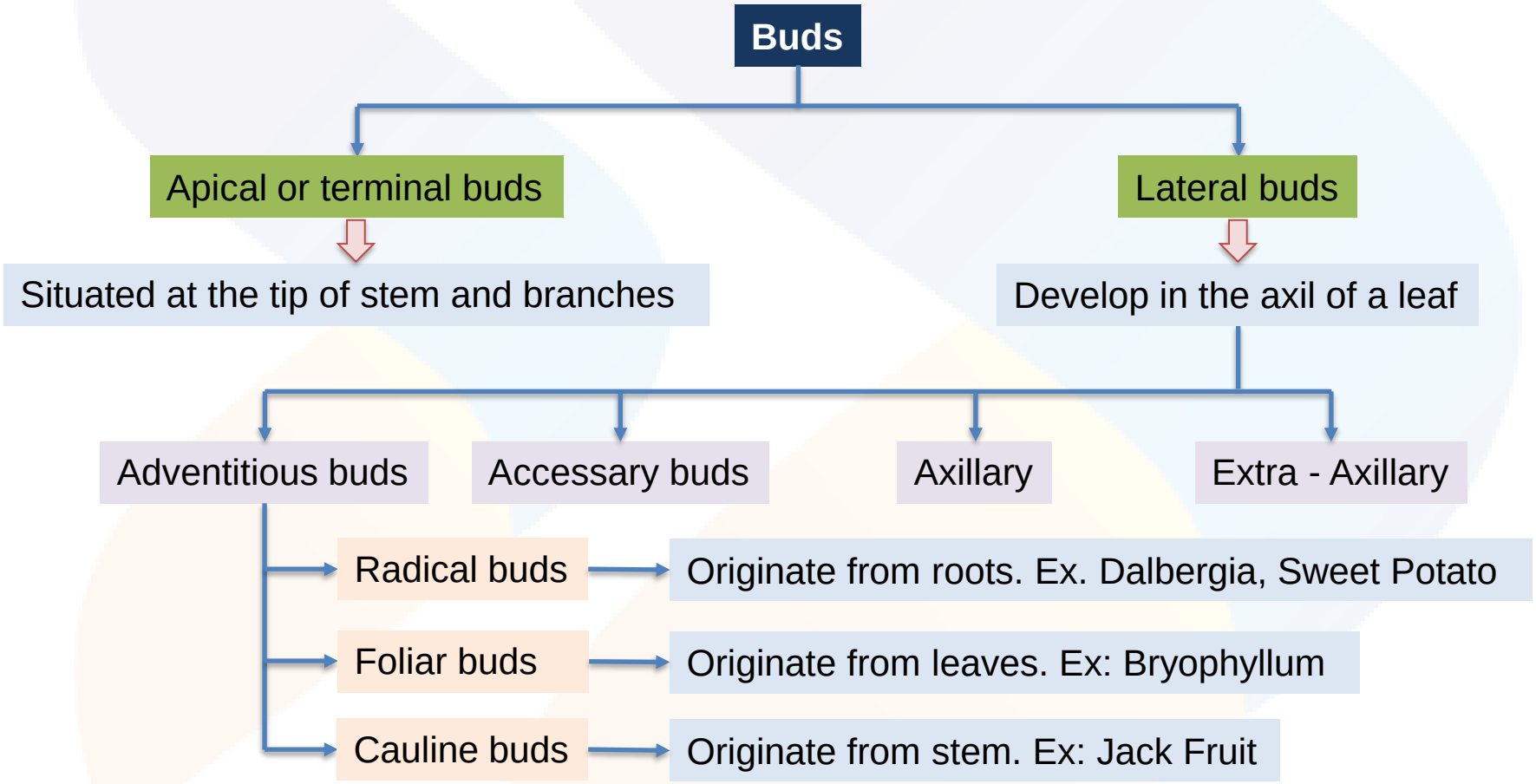


Fig:- Antigonon : Floral bud tendrils

Buds

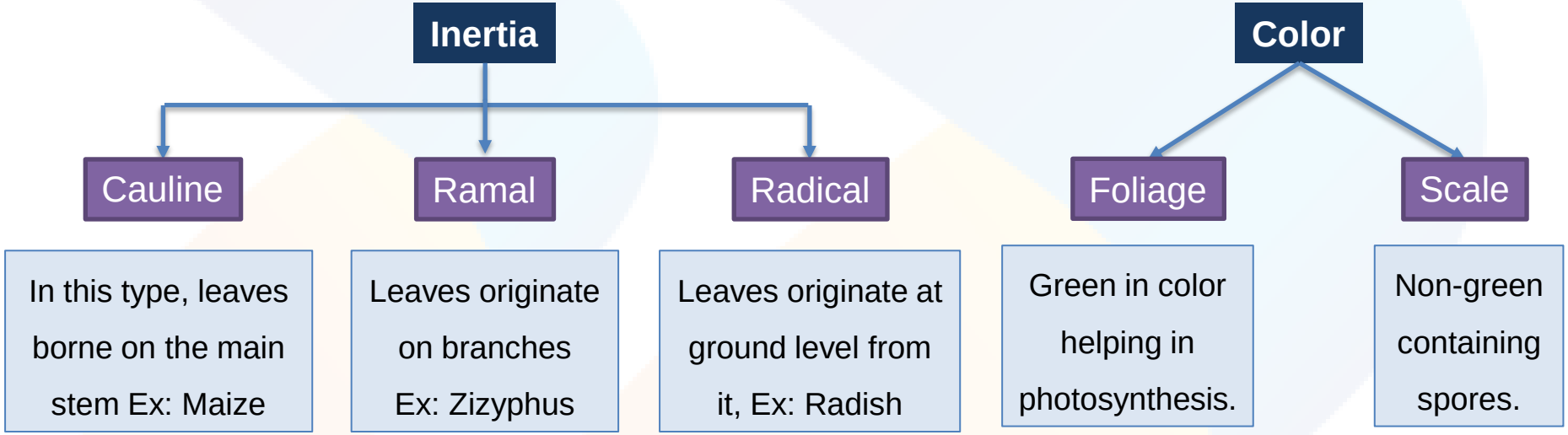
- It is a condensed immature or embryonic shoot having a growing point surrounded by closely placed immature leaves



Leaf and Its types

- Dissimilar exogenous lateral out growth.
- Borne on the node of stem.

Functions → Photosynthesis and transpiration



Part of a leaf (Phyllopodium)

Leaf

- **Leaf blade (Epipodium)**
  - Thin and expanded part of the leaf.
  - Bears network of Veins and Vein.
- **Petiole (Mesopodium)**
  - It is a cylindrical part which bears the Lamina.
  - May be
    - **Petiolate**
    - **Sessile**
      - Petiole absent
- **Leaf base (Hypopodium)**
  - Lowest part of leaf.
  - May be swollen.
  - Ex. Cassia fistula, Mimosa pudica (Leguminous plants)

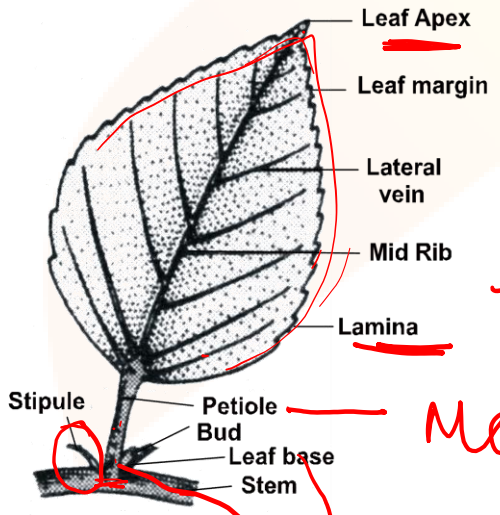


Fig:- Structure of a typical leaf.

Epipodium

Petiole-stalked leaf

Mesopodium

Hypopodium.

Stipule and its types

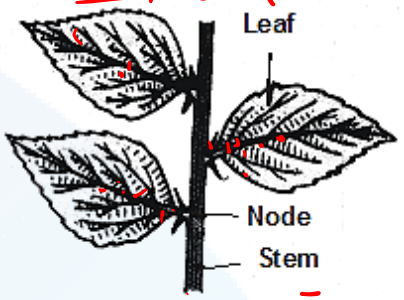
- Leaf base contains two small lateral outgrowths called stipule. Leaf with stipules is known as stipulate while the leaf without stipules is termed as exstipulate.

Free lateral	Two small stipules which develop on both side of leaf base.
Adnate	Stipules fused with petals
Interpetiolar	Adj. stipules of opp. leaves are fused to appear in between petioles
Intrapetiolar	These are situated between petiole and axis
Scaly	Very small dry membranous stipules.
Foliaceous	Two large green leaf like structures
Tendrilar	Stipules are modified in to tendrils.
Spinous	Stipules are converted into spines
Ochreate	Stipules fuse to form a sheath around the stem
Convoluted	They are located towards axial side of petiole

Phyllotaxy – Alternate and Opposite

Alternate or spiral

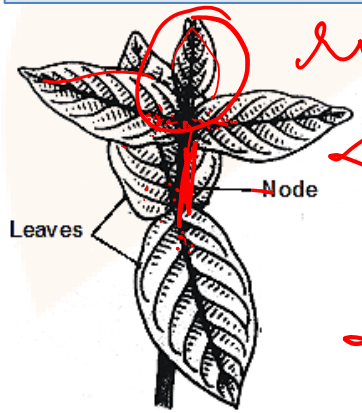
- Only one leaf at a node and the leaves of the adjacent nodes roughly lie towards the opposite sides and form two or more alternate rows.
- Ex: Ipomoea, china rose, mustard, sunflower



Opposite

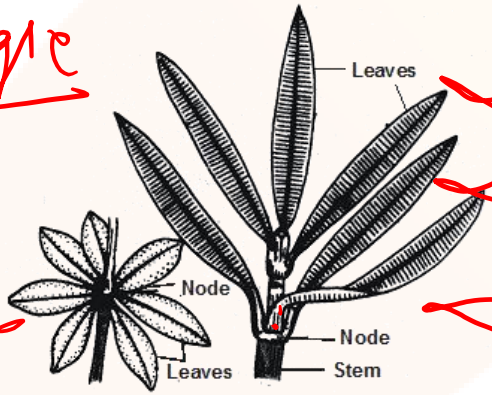
Decussate

Leaf pair formed at successive nodes.



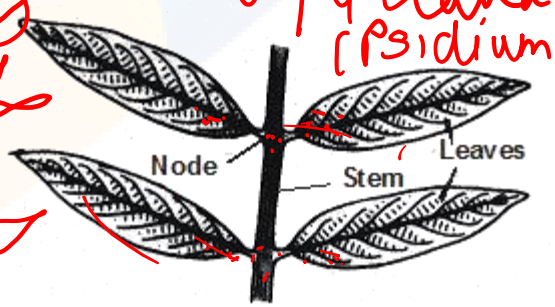
Whorled

More than two leaves from a single node.



Superposed

Leaves lie in the same plane so that only two rows are formed on the stem



Venation – Reticulate

- The arrangement of veins and veinlets in the lamina of a leaf is called venation.

Reticulate → Veinlets are irregularly distributed in lamina

- **Unicostate**: The lamina contains single mid rid. Ex: Peepal
- **Multicostate**: Number of veins arise from tip of petiole & reach either the apex or margins of lamina.
  - **Convergent**: The principal veins converge towards the apex of the lamina. Ex: Zizyphus, Tajpat
  - **Divergent**: The principal veins diverge towards the margins. Ex: Lagenaria, pumpkin, Luffa

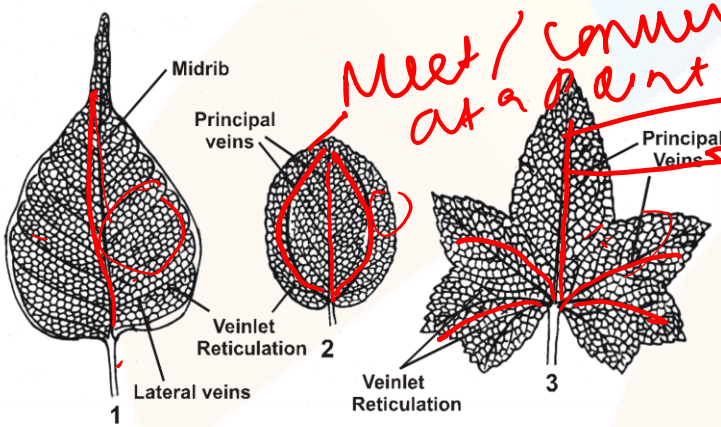


Fig:- Reticulate venation :
1 – Unicostate Reticulate -Peepal
2– multicostate convergent - Zizyphus (ber)
3– multicostate divergent - Luffa.

Venation – Parallel

- The veins run parallel to one another and reticulations are absent. Ex: Monocot plants.

↳ NO net like structure

Parallel

Unicostate

Single principal vein or mid rib that runs from base to the apex of the lamina.

Ex: Banana (Musa paradisiaca).

Multicostate

Several principal veins arise from the base of the lamina

Convergent

The principal veins converge towards the apex of the lamina. Ex: Bamboo, Grass

Divergent

The principal veins diverge towards the margins. Ex: Livistonia

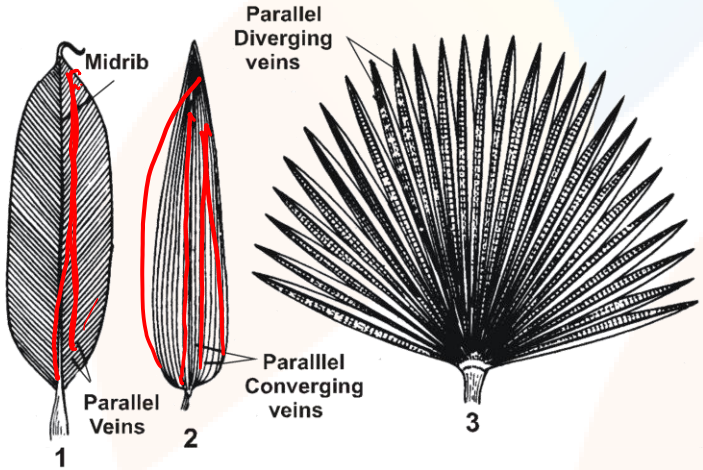
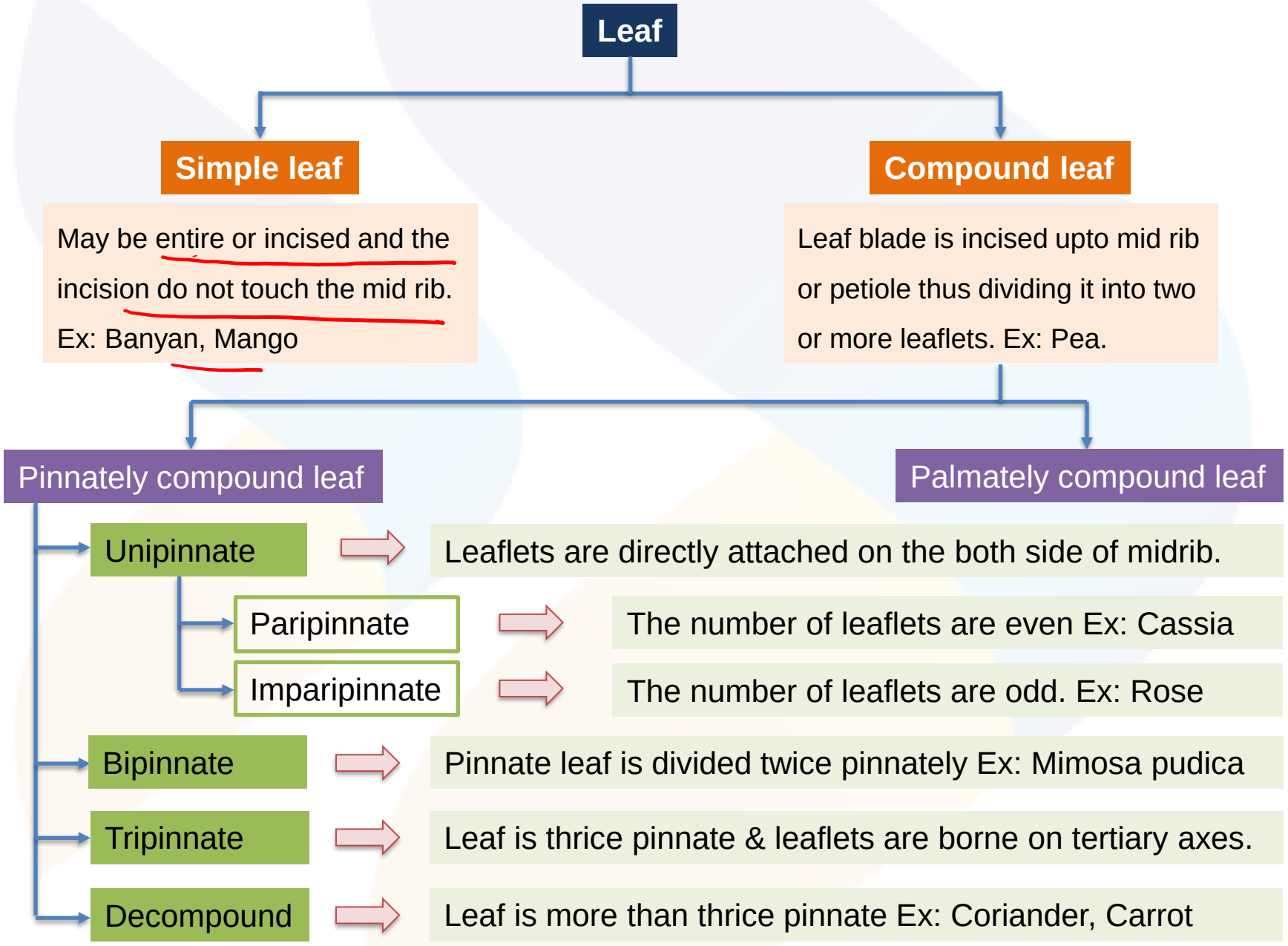


Fig:- Types of parallel venation.
1 – Unicostate parallel of Banana
2 – Multicostate convergent of Bamboo
3 – Multicostate divergent of Fan Plam (Livistonia).

Learn examples

Types of leaf – Pinnately compound leaf



Types of leaf – Palmately compound leaf

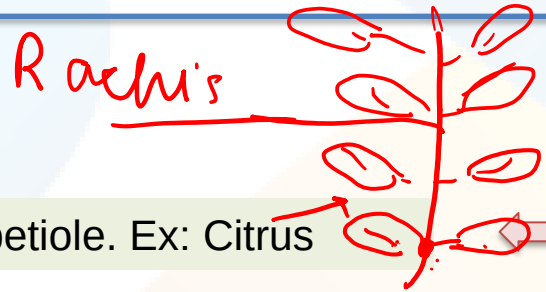
Leaf

Simple leaf

May be entire or incised and the incision do not touch the mid rib. Ex: Banyan, Mango

Compound leaf

Leaf blade is incised upto mid rib or petiole thus dividing it into two or more leaflets. Ex: Pea.



Pinnately compound leaf

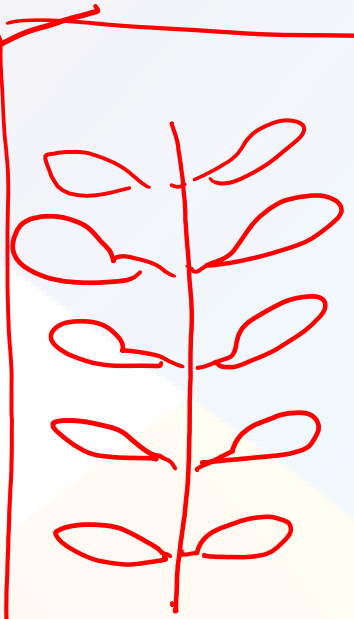
Palmately compound leaf

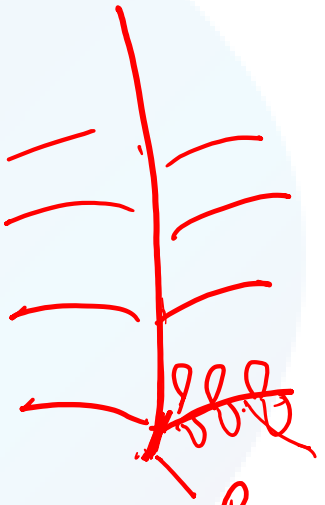
Only one leaflet attached to the petiole. Ex: Citrus	Unifoliolate
2 leaflets attached to petiole. Ex: Princepia, Balanites	Bifoliolate
3 leaflets at the tip of petiole. Ex: Trifolium, Oxalis	Trifoliolate
4 leaflets are attached to the petiole. Ex: Marsilea.	Quadrifoliolate
5 or more leaflets at the tip of petiole. Ex: Bombax	Multifoliate

Modifications of leaves – Leaf tendrils

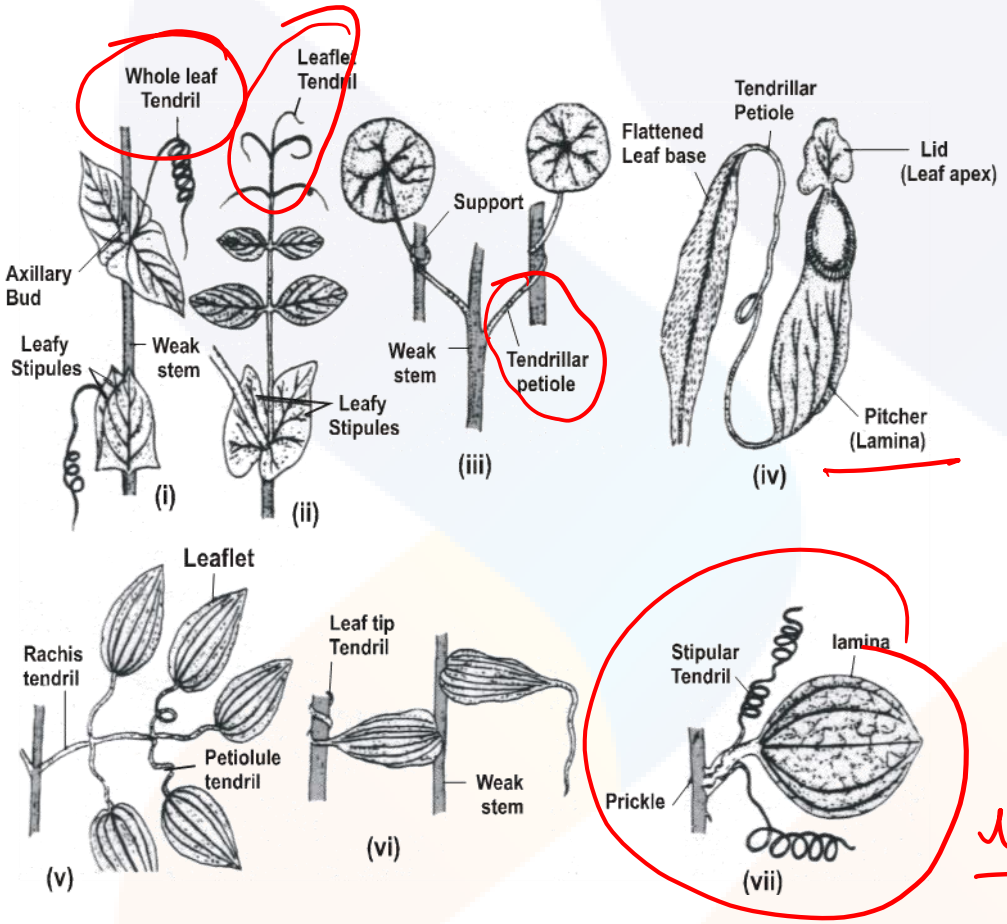
Leaf tendrils — These are thread like sensitive structures, which can coil around a support to help the plant in climbing. Leaf tendril is of following types.

Whole leaf tendrils	Ex: Lathyrus aphaca
Leaflet tendrils	Upper leaflets are modified into tendrils. Ex: Pisum sativum
Leaftip tendrils	Ex: Gloriosa superba
Petiolar tendrils	Ex: Nepenthes, Nasturtium, Clematis
Stipular tendrils	Ex: Smilax





Leaf tendril



ring

Stipule modified into tendril

- Leaf Tendrils . (i) whole leaf tendrils – Lathyrus aphaca (Jungli matter). (ii) leaflet tendrils – Pisum sativum (Edible Pea or mattar). (iii) petiolar tendrils – Garden nasturtium. (iv) petiolar tendril – Nepenthes. (v) rachis and petiolule tendrils – Clematis. (vi) leaf tip tendrils – Gloriosa. (vii) stipular tendrils – Smilax.

Modifications of leaves – Leaflet hook and Phyllode

Leaflet hook

- The terminal leaflets of the compound leaves become transformed into three stiff claw like and curved hooks.

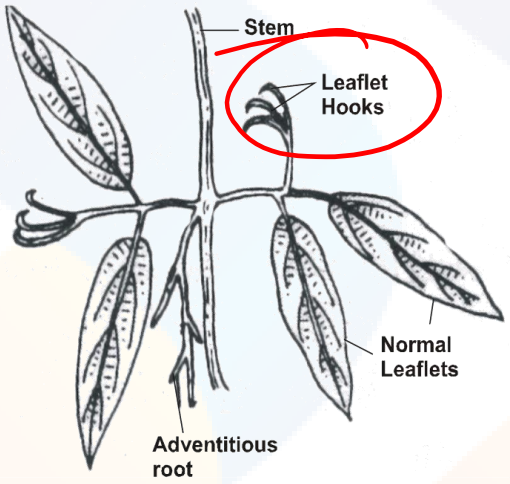


Fig :- Bignonia unguiscati : Leaflet hooks

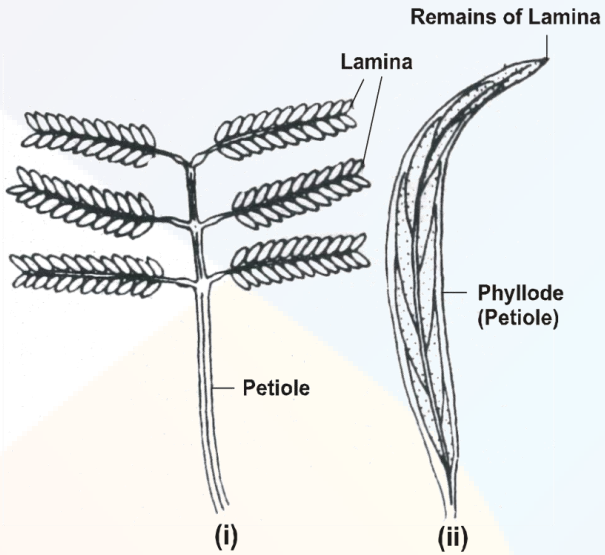


Fig:- Acacia melanoxylon.(i) Normal leaf (ii) Phyllode

Phyllode

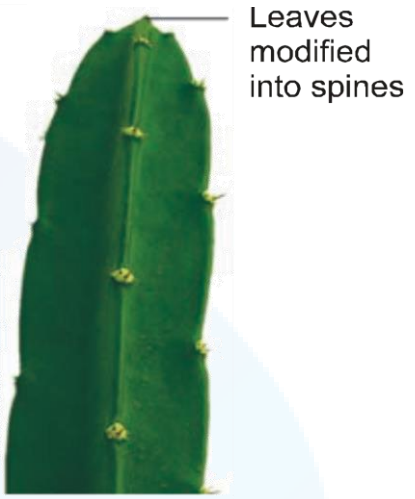
- It is a flattened, green petiole, which performs the function of food synthesis instead of lamina because the latter is absent.

  Ex: Australian acacia, Parkinsonia

Modifications of leaves –spines, bladders and pitcher

Leaf spines

- The leaf parts become changed into spines in order to protect the plant from grazing animals and excessive transpiration.
  Ex: Aloe vera, Solanum xanthocarpum, Opuntia, Asparagus



Protection spines

Leaf bladders

- Some parts of leaf are modified into sac like bladder, which is useful for trapping and digesting animals.
  Ex: Utricularia (Insectivorous plant).

Leaf pitcher

- The lamina is modified to form a large pitcher which is useful for catching and digesting insects. Ex: Nepenthes

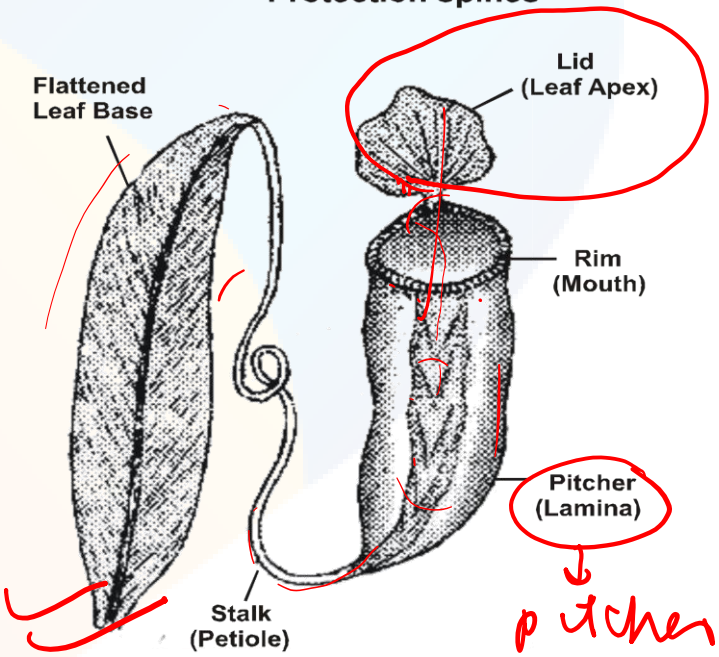


Fig :- Leaf Pitchers : Nepenthes

Modifications – Succulent, Scaly, Colored and Fleshy leaves

Succulent leaves

- Leaves are fleshy and swollen. They store water or mucilage or food substances. Ex: Xerophytic plants like Bryophyllum, Aloe vera, Portulaca

Scaly leaves

- These are small, dry whitish or brownish membranous leaves, which do not take part in photosynthesis. Ex: Casuarina, Ruscus

Colored leaves

- In Euphorbia pulcherima, the leaves borne near the Cyathium are brightly colored to attract insects for pollination

Fleshy leaves

- Found in Onion, and garlic