CONCEPT MAP

MORPHOLOGY OF LEAF

Leaf is an important vegetative organ of plant as it is specialised to perform photosynthesis. It is a green lateral flattened outgrowth borne on the node of a stem or stem branch and bears a bud in its axil.

Parts of a leaf

A typical leaf consists of three parts - leaf base, petiole and lamina. **Leaf base** is the basal part of the leaf by which it is attached to the node of the stem. Different plants have different types of leaf bases *viz.* pulvinus, *e.g.,* pea; sheathing, *e.g., Zea mays*; decurrent, *e.g., Crotolaria* and amplexicaul, *e.g., Polygonum*. Leaves of some plants have lateral appendages on each side of leaf base, known as **stipules** which may be caducous, deciduous or persistent. **Petiole** is the leaf stalk that joins the lamina to the stem or its branch. Sometimes the petiole is absent and then the leaf is said to be **sessile**.

Lamina is the expanded, green and conspicuous part of leaf which is specialised to perform photosynthesis. It is supported by veins and veinlets which contain vascular tissues for conduction of water, mineral salts and prepared food.

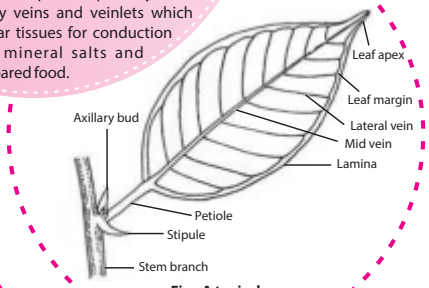


Fig.: A typical dicotyledonous leaf

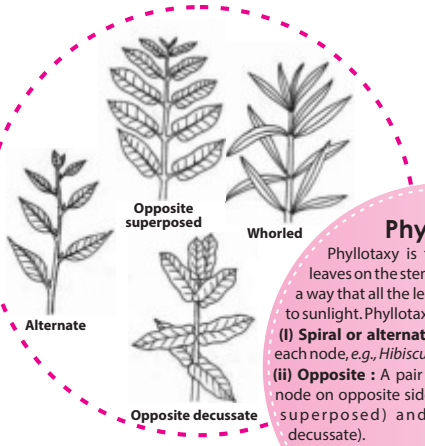
Phyllotaxy

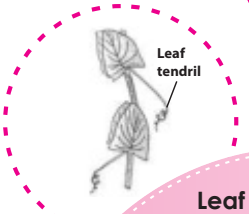
Phyllotaxy is the arrangement of leaves on the stem or its branches in such a way that all the leaves get proper exposure to sunlight. Phyllotaxy is of three main types –

(I) Spiral or alternate : A single leaf is borne at each node, *e.g., Hibiscus*, mango.

(ii) Opposite : A pair of leaves are borne at each node on opposite sides, *e.g., Quisqualis* (opposite superposed) and *Calotropis* (opposite decussate).

(iii) Whorled or verticillate : More than two leaves arise at each node, *e.g., Alstonia*.





Leaf modifications

(i) Leaf tendrils : Leaves are modified into slender, wiry often closely, coiled structures, known as tendrils, which help in climbing. These may be whole leaf tendrils (*e.g., Lathyrus aphaca*), leaflet tendrils (*e.g., Pisum sativum*), petiolar tendrils (*e.g., Nepenthes*), leaf tip tendrils (*e.g., Gloriosa*), Stipular tendrils (*e.g., Smilax*), etc.

(ii) Leaf spines : These protect the plants from grazing animals and excessive transpiration *e.g., Solanum surattense*.

(iii) Leaflet hooks : The terminal leaflets of compound leaves become transformed into stiff claw-like and curved hooks. These help the plant in climbing, *e.g., Doxantha unguis-cati*.

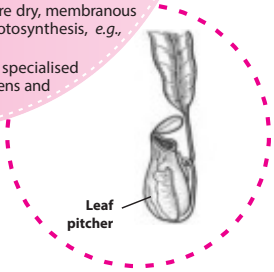
(iv) Phyllodes : These are the flattened petioles or parts of the rachis which perform the function of photosynthesis, *e.g., Acacia* species. These help to reduce transpiration in xerophytic plants.

(v) Insect catching leaves : Leaves are modified to form pitchers (*e.g., Nepenthes*), bladders (*e.g., Utricularia*) etc. to trap and digest insects.

(vi) Succulent leaves : These are fleshy leaves that store food material, *e.g., Aloe, Agave* etc.

(vii) Scale leaves (or **cataphylls**) **:** These are dry, membranous leaves which do not take part in photosynthesis, *e.g., Casuarina*.

(viii) Floral leaves : These are specialised leaves *i.e.,* sepals, petals, stamens and carpels.



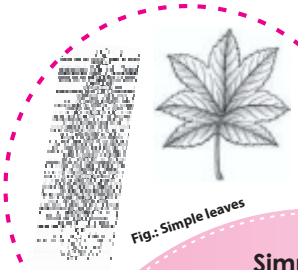


Fig.: Simple leaves

Simple and Compound leaves

A simple leaf is the one in which lamina is undivided or incised to any depth but not upto the midrib. In a compound leaf, lamina is completely broken up into distinct segments called leaflets which are separately articulated at the base. Compound leaves are of 2 types -

(a) Pinnate compound leaves : In these type of leaves, incision of lamina is directed towards the midrib which is known as **rachis.** Leaflets are arranged on both sides on the rachis or on its branches. These are of following types:

(i) Unipinnate : Leaflets are directly attached on the rachis, *e.g., Cassia fistula* (paripinnate), rose (imparipinnate).

(ii) Bipinnate : Rachis divides and gives rise to secondary axis on both sides on which leaflets are arranged, *e.g., Acacia*.

(iii) Tripinnate : Secondary axis too, divides and gives rise to tertiary axis on which leaflets are attached, *e.g., Moringa*.

(iv) Decompound : Rachis divides more than three times and gives rise to small axis on which leaflets are arranged, *e.g.,* carrot.

(b) Palmate compound leaves : In these type of leaves, incision of leaf is directed towards the petiole due to which all leaflets seem to be articulated on the upper end of petiole. It does not have any rachis.

Depending on the number of leaflets present, a palmate compound leaf is called **unifoliate** (*e.g., Citrus*), **bifoliate** (*e.g., Balanites*), **trifoliate** (*e.g., Trifolium*), **quadrifoliate** (*e.g., Paris quadrifoliata*), multifoliate (*e.g., Bombax*).

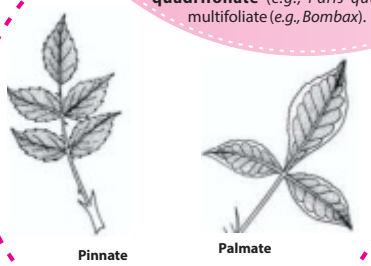


Fig.: Compound leaves

Venation

Venation is the arrangement of veins and veinlets on the lamina of a leaf. Venation is of 3 main types - reticulate (veins form a network), parallel (veins run parallel) and furcate (veins branch dichotomously, *e.g., Circeaster*).

Reticulate venation is found in most dicots. Pinnate (or unicostate) reticulate venation occurs in *Ficus religiosa*. Palmate (or multicostate) reticulate venation occurs in *Zizyphus* (convergent), and *Luffa* (divergent).

Parallel venation occurs in most monocots. Pinnate (or unicostate) parallel venation occurs in banana. Palmate (or multicostate) parallel venation occurs in bamboo (convergent) and *Livistonia* (divergent).

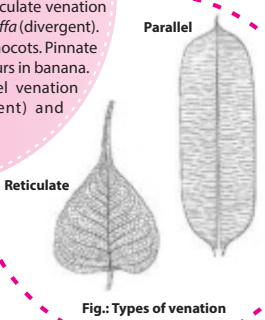


Fig.: Types of venation

Functions of the leaves

Primary functions: Photosynthesis, gaseous exchange, transpiration, protection of buds and conduction through veins.

Secondary functions : Storage *e.g.,* succulent leaves of *Aloe, Agave* etc.; protection *e.g.,* spiny leaves of *Barberry, Opuntia* etc.; support *e.g.,* leaflet hooks in *Doxantha*; nitrogen nutrition *e.g.,* leaf pitchers of *Nepenthes*; reproduction *e.g.,* leaves of *Bryophyllum* help in vegetative propagation; floral leaves help in sexual reproduction.