7-LEAF STRUCTURE

(SIMPLE AND COMPOUND LEAVES, LEAF BLADE, APEX, BASE AND MARGIN SHAPES)

SUB-TOPICS

1. Leaf arrangement
2. Leaf venation
3. Leaf blade shapes
4. Leaf apex shapes
5. Leaf base shapes
6. Leaf margin shapes
7. Leaf metamorphosis

1. LEAF STRUCTURE

A leaf is an organ of a vascular plant and is the principal lateral appendage of the stem. The leaves and stem together form the shoot. Leaves are collectively referred to as **foliage.**

Leaves are flattened structure of a higher plant and typically green. They are the main organs of photosynthesis and transpiration.

Most leaves have three main parts: **(1)** the blade **(2)** the petiole (leafstalk), and **(3)** basis.

1. LEAF ARRANGEMENT

1. Alternate or spirally: Alternately arranged leaves produce one leaf per node and are rotated slightly from the nodes below and above it. If the spiral is to the right, it is referred to as "**dextrorse**"; if to the left, it is referred to as "**sinistrorse**".

2. Opposite: When two leaves occur at one node, the arrangement is called "**opposite**" or the leaves are paired at a node and borne opposite to each other.

For example; member of ***Apocynaceae*** family can be given.

3. Decussate: An opposite pattern of leaves which has successive pairs at right angles to each other (i.e. rotated 90 degrees along the stem when viewed from above)

For example; member of ***Lamiaceae*** family can be given.

4. Verticillate or whorled : When three or more leaves occur at one node, a whorled or verticillate arrangement is produced.

For example; member of ***Rubiaceae*** family can be given.

5. İmbricate: The leaves are arranged like fish scale or tiles on a roof.

For example; member of ***Cupressaceae*** family can be given.

6. Rosette: A leaf rosette is a plant growth habit in which a plant grows a cluster of leaves in a circular pattern. Usually these plants have a prostate growing habit that is close to the ground.

2. LEAF VENATION

Venation is the pattern of **veins** in the blade of a leaf.

The sporophytic leaves of vascular plants contain vascular bundles, known as "**veins**", which conduct water, minerals, and sugars between the leaf and the stem.

The leaves of some vascular plants have only a single vein, but in most the veins are branched.

The major vein of a leaf is called the "**primary vein**" and If a simple leaf has a single primary vein, that vein is called the "**midrib**". From the primary vein(s), smaller, lateral veins may branch off, these known as "**secondary veins**", from secondary veins, even smaller "**tertiary veins**" may.

Four, very general venation classes are as follows;

1. **Uninervous:** There is a central midrib with no lateral veins.

For example, Lycophytes, Psilophytes, and Equisetophytes, and many conifers have an **uninervous** veins.

2. Reticulate: There is a prominent vein called the mid rib from which arise many small veins which finally form a net like structure in the lamina.

For example, most leaves of **dicotyledonous** flowering plants have reticulate venation.

3. Parallel: The primary and secondary veins are essentially parallel to one another, the ultimate veinlets being transverse (at right angles),

For example, most of the monocots have parallel venation.

4. Dichotomous: The veins successively branch distally into a pair of veins of equal size and orientation,

For example, *Ginkgo biloba* leaves have typically dichotomous venation.

Sometimes, reticulate leaves can be **pinnately veined** (pinnate-netted), with secondary veins arising along length of a single primary vein; **palmately veined** (palmate-netted), with four or more primary veins arising from a common basal point.

3. LEAF BLADE SHAPES

The pattern of division of a leaf into discrete components or segments is called "**leaf type**".

A simple leaf is one bearing a single, continuous blade.

A compound leaf is one divided into two or more, discrete leaflets.

A- Simple Leaves Types

1. Ovate: Oval, hen's egg like, with a tapering point and the widest portion near the petiole.

2. Obovate: Reversed ovate or teardrop-shaped, stem attaches to the tapering end.

3. Pandurate: Fiddle-shaped; obovate with a constriction near the middle. **For example, *Rumex scutatus*** leaves

4. Reniforme: Shaped like a kidney: an oval with an inward curve on one side

Foe example, member of ***Geranium*** and ***Pelargonium*** genus

5. Spatulate: Spoon-shaped; having a broad flat end which tapers to the base. **For example,** some ***Berberis species***

6. Sagittate: Arrowhead-shaped with the lower lobes folded, or curled downward. **For example**, ***Sagittaria sagittifolius*** leaves

7. Hastate: Spear-shaped: pointed, with barbs, shaped like a spear point, with flaring pointed lobes at the base.

8. Cordate: Heart-shaped, with the petiole or stem attached to the notch. For example, *Tilia sp.* leaves

9. Lanceolate: Long, wider in the middle, shaped like a lance tip.

10. Orbicular: Circular shaped, ıt have a more or less circular leaf shape in which the width and length of the lamina are equal, or nearly so.

A- Compound Leaves Types

The compound leaves are divided into two; *pinnate* and *palmate* leaves

1. Pinnate Leaves shapes

1. **Pinnately lobed:** Leaves have partly the lobes spreading radially from a point. **For example,** some species of ***Quercus*** genus

2. **Pinnatifid:** Leaves have lobes with incisions that extend less than half-way toward the midrib.

For example, some species of ***Quercus*** genus.

3. **Pinnatipartite:** Leaves have lobes with incisions that extend more than half-way toward the midrib.

For example, some species of ***Quercus*** genus.

4. Pinnatisect: Leaves have lobes with incisions that extend almost, or up to midrib. **For example,** some species of ***Pteris*** genus.

5. Imparipinnate (odd-pinnate): With an odd number of leaflets, pinnate with a terminal leaflet. **For example,** ***Ailanthus altissima***

6. Paripinnate (even-pinnate): Pinnate with an even number of leaflets, lacking a terminal leaflet.

2. Palmate Leaves shapes

1. Palmately lobed: Lobes spread radially from a point. **For example,** some ***Vitis*** species.

2. Palmatifid: Palm-shaped, having lobes with incisions that extend less than half-way toward the petiole. **For example,** ***Hibiscus diversifolius***

3. Palmatipartit: Leaves have lobes with incisions that extend over half-way toward the petiole. **For example,** some ***Bryonia*** species

4. Palmatisect: Leaves have lobes with incisions that extend almost up, but not quite to the petiole.

4. LEAF APEX SHAPES

1. **Acute:** Pointed, having a short sharp apex angled less than 90°

2. **Acuminate:** Tapering and ending in a short, slender point.

3. **Emarginate:** Slightly indented at the tip.

4. **Mucronate:** Ending abruptly in a small sharp point as a continuation of the midrib.

5. **Obtuse:** Blunt, forming an angle greater than 90°

6. **Truncate:** The leaf apex or base is cut, flat.

4. LEAF BASE SHAPES

1. **Amplexicaule:** If a leaf is sessile and clasps the stem most, but not all, of its circumference, the attachment is called amplexicaul.

2. Cuneate: A wedge-shaped leaf having the acute angle at the base.

3. Perfoliate: The leaf blade surrounding the stem such that the stem appears to pass through the leaf.

4. Connate: A leaf shaped as though the bases of two opposite leaves had fused around the stem

5. Cordate: The leaf base is the heart shape.

6. Hastate: The lobe of the leaf base develops transversely.

7. Sagittate: The lobes on the leaf base develop downward.

8. Truncate: The leaf base is cut.

4. LEAF MARGIN SHAPES

1. Entire: Even; with a smooth margin; without toothing.

2. Crenate: Wavy-toothed; dentate with rounded teeth.

For example, ***Cercidiphyllum magnificum***

3. Dentate: Toothed. May be coarsely dentate, having large teeth. **For example;** ***Urtica dioica*** (nettle)

4. Serrate: Saw-toothed; with asymmetrical teeth pointing forward

5. Undulate: With a wavy edge, shallower than sinuate.

6. Ciliate: Fringed with hairs. Hair structures on the edges of the leaves develop.

7. Revolute: Leaf edges are curled backwards. **For example,** ***Dryas integrifolia***

7. LEAF METAMORPHOSİS

In many plants, leaves get modified to perform some special functions other than the normal ones, such as photosynthesis and transpiration. Sometimes these modifications are in response to certain environmental conditions.

Some of the important modifications are given below:

1. Storage Leaves
2. Leaf-spines
3. Leaf Tendrils
4. Scale-leaves
5. Insect Catching Leaves
6. Reproductive leaves

1. Storage Leaves

Some plants of xerophytic habitats have highly thickened and succulent leaves with water storage tissue. These leaves have large parenchymatous cells with big central vacuole filled with hydrophilic colloid. This kind of adaptation helps plants to conserve very limited supply of water and resist desiccation. For example, members of *Crassulaceae* family

2. Leaf-spines:

Leaves of certain plants become wholly or partially modified for defensive purpose into sharp, pointed structures known as spines. For example; member of *Cactaceae* and *Berberidaceae* family

3. Leaves Tendril

In weak-stemmed plants, leaf or a part of leaf gets modified into green threadlike structures called tendrils which help in climbing around the support. For example, member of *Lathyrus*, *Pisum*, *Clematis*, and *Smilax* genus

4. Scale-leaves

Typically these are thin, dry, stalkless, membranous structures, usually brownish in colour or sometimes colourless or different. Their function is to protect the axillary bud that they bear in their axil. For example, *Acer sp.*, *Aesculus sp.*

5. Insect Catching Leaves:

In insectivorous plants, the leaves are especially adapted to catch and digest insects to fulfil their nitrogen requirement.

6. Reproductive leaves

Produce adventitious plantlets which fall of the leaf and take root in the soil

Leaves modified for reproduction-form tiny plants at the edges of their leaves. These plants become new individuals when they are shed from parent leaves.

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