Practice in Pharmaceutical Botany

Week 1 – Leaf Examination

Leaf*

Leaves are essential organs of photosynthesis, transpiration and respiration in plants

LEAF

Structure that grow out of the nodes on the trunk and side branches and have limited growth.

It is generally a broad, flat and green organ attached to the trunk and branch. Leaves are found on the branches attached to the nods.

Leaf-shape and **leaf arrangement** on the stem is **characteristic for each plant.**
For this reason, the **leaf character** plays a big role in the **identification of a plant.**

*Folia (L.)

A typical leaf is a thin flat (lamina) supported by vascular bundles, a leaf stalk (petiole) that carry lamina and connects the lamina to stem, and the base is the basis of the leaf joined to the stem (basis).

It can be a stalked (= petiolate) or a stalkless (= sessile).

Petiolate: With a petiole.

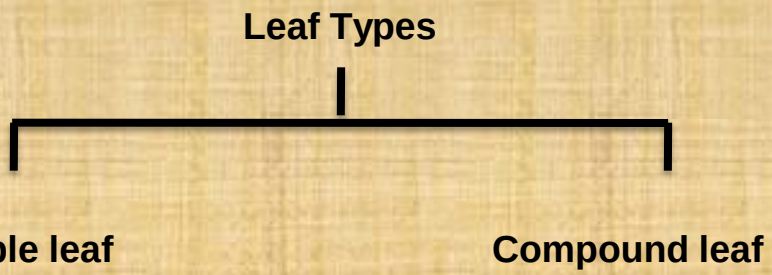
Sessile: Attached directly, without a supporting stalk, as a leaf without a petiole.

AMPLEXICAUL LEAF:
A leaf with the margins entirely surrounding the stem, so that the stem appears to be passing through the leaf.

LEAF DESCRIPTION

Leaf: The usually expanded, photosynthetic organs of a vascular plant.

Leaf Types: Two basic forms of leaves can be described considering the way the (lamina) blade is divided:



LEAF DESCRIPTION

Simple leaf:

Has an undivided lamina (blade). However, the leaf shape may be formed of lobes, but the gaps between lobes do not reach to the main vein. Undivided, as a leaf blade (lamina) which is not separated into leaflets.

Compound leaf:

Has a fully subdivided lamina (blade), each leaflet of the lamina seperated along a main or secondary vein. Because each leaflet can appear to be a simple leaf, it is important to recognise where the petiole occurs to identify a compound leaf. Compound leaves are a characteristic of a some families of higher plants, such as Fabaceae and Rosaceae. The middle vein of a compound leaf, when it is present, is called a rachis. A leaf blade (lamina) separated into two or more distinct leaflets.

PARTS OF A SIMPLE LEAF:

Apex: The tip; the point farthest from the point of attachment.

Base: The end of the leaf blade nearest to the point of attachment.

Blade: The broad, usullay flat part of a leaf.

Margin: The edge of a leaf blade.

Midrib (=Midvein): The central vein of a leaf.

Petiole: A leaf stalk

Stipula: One or a pair of leaf-like appandages found at the base of the petiole in some leaves.

PARTS OF A COMPOUND LEAF:

- **Foliol (Leaf-let):** A division of a compound leaf.
- **Petiole:** The stalk of a leaflet of a compound leaf.
- **Rachis:** The main axis of a compound leaf
- **Stipula:** One or a pair of leaf-like appandages found at the base of the petiole in some leaves.

A- TERMS OF LEAF SHAPES:

Cordate: Heart-shaped, with the notch at the base.

Deltoid: With the shape of the Greek letter delta; shaped like an equilateral triangle.

Elliptic: In the shape of an ellipse or a narrow oval, broadest at he middle and narrower at the two equal ends.

Ensiform: Swort-shaped, as an *Iris* leaf.

Falcate: Sickle-shaped; hooked, shaped like the beak of a falcon.

Flabellate: Fan-shaped.

Hastate: Arrowhead-shaped, but with the basal lobes turned outward rather than downward; halber-shaped (compared to sagittate).

Lanceolate: Lance-shaped; much longer than wide, with the widest point below the middle.
Linear: Resembling a line; long and narrow with the more or less parallel sides.

CORDATE LEAF

Etimology: cor, cordis (L.): heart

FALCATE LEAF

Falcate leaf: Sickle-shaped; hooked, shaped like the beak of a falcon.

Etymology;
Falx (L.): sickle + -ate (similar)

FLABELLATE LEAF

Flabellate leaf: Fan-shaped.

Etymology:
Flabellum (L.) (= Fan) + -ate (=similar)

Obcordate: inversely cordate, with the attachment at the narrower end, sometimes refers to any leaf with a deeply notched apex.

Obdeltoid: Deltoid, with the attachment at the pointed end.

Oblanceolate:I nversely lanceolate, with the attachment at the narrower end.

Oblong: Two to four times longer than the width with nearly paralel sides.

Obovate: Inversely ovate, with the attachment at the narrower end.

Orbicular: Approximately circular in outline.

Oval: Broadly elliptic, the width over one-half the length.

Ovate: Egg-shaped in outline and attached at the broad end (applied to plane surface).

Pandurate: Fiddle-shaped.

Peltate: Shield-shaped ; borne in a stalk attached to the lower surface rather than to the base of margin.

Perfoliate: A leaf with the margin entirely surrounding the stem, so that the stem appear to pass through the leaf.

PELTATE LEAF

Peltate leaf: Shield-shaped; borne in a stalk attached to the lower surface rather than to the base of margin.

Etymology;
***Pelta* (L.):** a shield, from Ancient Greek

Quadrate: Square; rectangular.
Reniform: Kidney-shaped.

Rhombic: Diamond-shaped.
Rotund (Rotundate): Round or rounded in outline.

Sagittate: Arrowhead-shaped, with the basal lobes directed downwart (compare hastate).
Spatulate: Like a spatula in shape, with a rounded blade above gradually tapering to the base.

Subulate: Awl-shaped.

LAMINA BASE

B-TERMS OF LEAF BASES:

Acute:Tapering to a pointed base with more or less straight sides.

Aequilateral: Equal sided, as opposed to oblique.

Attenuate: Tapering gradually to a narrow base.

Auriculate: With ear-shaped appendages.

Cordate: Heart-shaped, with the notch at the base.

Cuneate: Wed-ge shaped, trangular and tapering to pint of the base.

Hastate: Arrowhead-shaped, but with the lateral lobes turned outward rather than downward; Halbert-shaped.

oblique: With unequal sides; slanting.

Rounded: With a rounded base.

Sagittate: Arrowhead-shaped, with the basal lobes directed downward.

Truncate: With the base squared at the end as if cut off.

C-TERMS OF LEAF APEX:

Acuminate: Gradually tapering to a sharp point and forming concave sides along the tip.

Acute: Tapering to a pointed apex with more or less straight sides.

Apiculate: Ending abruptly in a small, slender point.

Aristate: Bearing an awn or bristle at the tip.
Aristulate: Bearing a minute awn or bristle at the tip.
Caudate: With a tail-like appendage.

Cirrose: With a cirrus (tendril).
Cuspidate: Tipped with a short, sharp, abrupt point (cusp).
Emarginate: With a notch at the apex.

LAMINA APEX

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Cirrose: With a cirrus (tendril).

Cuspidate: Tipped with a short, sharp, abrupt point (cusp).

Emarginate: With a notch at the apex.

Mucronate: Tipped with a short, sharp, abrupt point (mucro).

Obcordate: With a deeply nothched apex.

Obtuse: Blunt or rounded at the apex;
with the sides coming together at the apex
at an angle greater than 90 degrees.

Retuse: With a shallow notch in around or blund apex.

Rounded: With a rounded apex.

Subacute: Slightly acute.

Truncate: With the apex squared at the end.

D-TERMS OF LEAF DIVISION:

Bipinnate: Twice pinnate; with the division again pinnately divided.

Biternate: Doubly ternate with the ternate division again ternately divided.

Palmate: Lobed, veined or divided from a common point, like the finger of a hand.

Paripinnate(= even pinnate): Equally pinnate.

Imparipinnate (= Odd-pinnate): Unequally pinnate.

Simple: Undivided, as a leaf blade which is not separated into leaflets (though the blade may be deeply lobed or cleft).

Tendril-pinnate: Pinnately compound, but ending in a tendril., as in the sweet pea (*Lathyrus odoratus*).

Ternate: In threes, as a leaf which is divided into three leaflets.
Trifoliate: With three leaves or three leaflets.

Tripinnate: Pinnately compound three times, with pinnate pinnules.

Triternate: Triply ternate.

LAMINA VENATIONS

E-TERMS OF LEAF VENETION:

The pattern of veining on a leaf.

Net-veined: In the form of a network; reticulate.

Paralel-veined: With the main veins paralel to the leaf axis or to each other.

Pinnate: Resembling a feather.

Pinnipalmate: Intermediate between pinnate and palmate, as in a leaf with the first pair of veins larger or most distinctive than the others**.**

Leaf veins = Vascular bundles

The vein, which progresses in the same direction of the petiol and is stronger than the others, is called the midvein (midrib).

Midvein divides the lamina two equal parts.

PINNATE VENATION

The lamina has a midvein and it branches.
Resembling a feather.

Veins seperate from the midvein are named as lateral veins.

Etymology:
Pinna (L.): feather

PALMATE VENATION

Palmate leaf: Lobed, veined or divided from a common point, like the finger of a hand.

Etymology:
Palmatus (L.): Hand shaped

PELTATE VENATION

Peltate leaf: Shield-shaped; borne in a stalk attached to the lower surface rather than to the base of margin.

DICHOTOMIC VENATION

The laminar veins are always bifurcated.

PARALLEL VENATION

Laminar veins are parallel to each other.

LEAF TYPES

Simple leaf

SIMPLE LEAF:
Lamina is a single unit, **it is not divided**.

Semi-compound (lobed) leaf

SEMI-COMPOUND LEAF: Lamina margins are lobed.

Pinnatilobate
Pinnatifid
Pinnatipartid
Pinnatisect

Compound leaf

Compound leaf: Has a fully subdivided lamina (blade), each leaflet of the lamina seperated along a main or secondary vein. Because each leaflet can appear to be a simple leaf, it is important to recognise where the petiole occurs to identify a compound leaf. Compound leaves are a characteristic of a some families of higher plants, such as Fabaceae and Rosaceae. The middle vein of a compound leaf, when it is present, is called a rachis. A leaf blade (lamina) separeted into two or more distinc leaflets.

LAMINA MARGIN

F-TERMS OF LEAF MARGIN:

Bidentate: with two teeth.

Bifid: Deeply two-cleft or two lobed, usually from the tip.

Crenate: With rounded teeth along the margin.

Crenulate: With very small rounded teeth along the margin.

Crisped: Curled, wavy or crinkled.

Dentate: Toothed along the margin, the teeth directed outward rather than forward.
Denticulate: Finely tooted.

Digitate: Lobed, veined or diveded from a common point, like the fingers of a hand (same as **palmate).**
Dissected: Deeply diveded into many narrow segments.

Entire: No teeth, notched or divided, as the continuous margins of some leaves.

Incised: Cut sharply,deeply and usually irregularly.

Involute: With the margins rolled inward toward the upper side.

Lacerate: Cut or cleft irregularly, as if torn.

Laciniate: Cut into narrow, irregular lobe or segment.

Lobed: Bearing lobes which are cut less than half-way to the base or midvein.

Lobulate: With lobules.

Palmate: Lobed, veined or divided from a common point, like the finger of a hand

Palmatifid: Palmately cleft or lobed.

Palmatisect: Palmately divided.

Parted: Deeply cleft, usually more than half the distance to the base or midvein.

Pedate: Palmately divided, with the lateral lobes 2-cleft.

Pinnatifid: Pinnately cleft or lobed half the distance or more to the midrib, but notreaching the midrib.

Pinnatilobate: With pinnately arranged lobes.

Pinnatisect: Pinnately cleft to the midrib.

Repand: With a slightly wavy or veakly sinuate margin. Some as **undulate.**

Revolute: With the margins rolled backward toward the underside.(compare **involute).**

Runcinate: Sharply pinnatifid or cleft, the segments directed downward.

Serrate: Toothed along the margin, the sharp teeth pointing forward.

Serrulate: Toothed along the margin with minute, sharp, forward pointing teeth.

Sinuate: With a strongly wavy margin

Tridentate: Three-toothed.

Trifid: Three-cleft.

Tripartite: Three-parted.

Tripinnatifid: Thrice pinnately cleft.

Undulate: Wavy, but not so deeply or as pronounced as sinuate. (See illustration for **repand.)**

G-TERMS OF LEAF ATTACHMENT:

Amplexicaul (= clasping) : Clasping the stem, as the base or stipules of some leaves.

Auriculate-clasping: Earlike lobes at the base of aleaf, encircling the stem.

Connate-perfoliate: With the base of opposite leaves fused around the stem.

Decurrent: Extending downward from the point of insertion, as aleaf base that extends down along the stem.

Ocreate: With sheating stipules.

Perfoliate: A leaf with the margins entirely surrounding the stem, so that the stem appears to pass throught the leaf.

Petiolate: With a petiole.

Petiolulate: With a petiolule.

Sessile: Attached directly, without a supporting stalk, as a leaf without a petiole.

Sheathing: Forming a sheath, as the leaf base of a grass forms a sheath as it surrounds the stem.

H-TERMS OF LEAF ARRANGEMENT:

Alternate: Borne singly at each node, as leaves on a stem.(compare **opposite).**

Basal: Positioned at or arising from the base, as leaves arising from the base of the stem

Decussate: Arranged along the stem in pairs, with each pair at right angles to the pair above or below.

Dextrorse: Turned to the right or spirally arranged to the right, as in the leaves on some stems.

Equitant: Overlapping or stranddling in two ranks, as the leaves of *Iris.*

Opposite: Borne across from one another at the same node, as in a stem with two leaves per node. (compare **altenate).**

Rosette: A dense radiating cluster of leaves usually at or near ground level. Leaves form a rosette.

Rosulate: With the leavse arranged in basal rosettes, the stem very short or lacking.

Verticillate (= Whorled): Arranged in verticils, whorled.

I-TERMS OF SURFACE OF LEAF:

Arachnoid: Bearing long, cobwebby, entangled hairs.

Barbellate: With short, stiff hairs or barbs.

Barberlulate: With very thiny short , stiff hairs or barbs.

Bullate: With rounded, blistery projectins covering the surface.

Canaliculate: With longitudinal channels or grooves.

Canescent: Gray or white in color due to a covering of short , fine gray or white hairs.

Ciliate: With a marginal fringe of hairs.

Coriaceous: With leathery texture.(like skin,leather).

Crinite: With tufts of long, soft hairs.

Echinate: With prickles or spines.

Echinulate: With very small prickles or spines.

Floccose: Bearing tufts of long, soft, tangled hairs.

Glabrous: Smooth, hairles.

Glandular: Bearing gland.

Glaucous: Covered with a whitish or bluish waxy coating (bloom).

Hirsute: Pubescent with coarse; stiff hairs.

Hirsutulous: Pubescent with very small, coarse, stiff hairs.

Hispid: Rough with firm, stiff hairs.

Hispidulous: Minutely hispid

Holosericeous: Covered with fine, silky hairs.
Lanate: Woolly; densely covered with long tangled hairs.

Lanuginous: Downy or woolly; with soft downy hairs.
Lanulose: Dimininutive of lanate; minutely woolly.

Lepidote: Covered with small, scurfy scales.
Mammillate: With nipplelike protuberances .

Manicate: With a thick, interwoven pubescsnce.

Mealy: With the consistency of meal; powdery, dry, and crumbly.

Muricate: Rough with small, sharp projections or points
Paleaceous: Chaffy; with chaffy scales.

Pannose: Covered with a short, dense, felt-like).
Papillate: Having papillae.

Papillose-hispid:With stiff hairs borne on swollen, nipple-like bases.

Perforate: With hole sor perforations.

Pilose: Bearing long, soft, straight hairs

Puberulent: Minutely pubescent; with fine, short hairs.

Pubescent: Covered with short, soft hairs; bearing any kind of hairs.

Pustulose: With small blisters or pustules, often at the base of a hair.

Rugose: Wrinkled.

Sericeous: Silky, with long, soft, slender, somewhat appresssed hairs.

Setose: Covered with bristles.

Setulose: Covered with minute bristles.

Silky: Silk-like in appearance or texture; sericeous.

Smooth: With an even surface; not rough to the touch.

Stellate: Star-shaped, as in hair with several to many branches radiating from the base.

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Strigillose: Minutely strigose.

Strigose: Bearing straight, stiff, sharp, appressed hairs.

Strumose: With a covering of cushion-like swellings; bullate.

Tomentose: With a covering of short, matted or tangled, soft, wooly hairs;with tomentum.

Tomentulose: Slightly tomentose.

Verrucose: Warty; covered with wart-like elevations.

Villose: Same as **Villous.**

Villous: Bearing long, soft, shaggy, bu unarmed hairs.

Villosulous: Diminutive if **villous.**

Wooly: With long, soft, entangled hairs; lanate.

LABORATORY STUDIES

MORPHOLOGICAL STUDY:
LEAF EXAMINATION

Simple Leaf

Plant Name (P. N.)= *Atropa belladonna* (deadly nightshade)

Drug Name (D. A.)= Folia Belladonnae

Simple Leaf

Plant Name (P. N.)= *Eucalyptus globulus* (Eucalyptus, Gum tree)

Drug Name (D. N.)= Folia Eucalypti

Simple Leaf

Plant Name (P. N.)= *Melissa officinalis* (Lemon balm)

Drug Name (D. N.)= Folia Melissae

Simple Leaf

Plant Name (P. N.)= *Ginkgo biloba* (maidenhair tree)

Drug Name (D. N.)= Folia Ginkgoae

PARTS OF SIMPLE LEAF:

Apex: The tip; the point farthest from the point of attachment.

Base: The end of the leaf blade nearest to the point attachment.

Blade: The broad part of a leaf.

Margin: The edge of a leaf blade.

Midrib (= Midnerve): The central vein of a leaf.

Petiole: A leaf stalk

Stipula: One of a pair of leaf-like appandages found at the base of the petiole in some leaves.

EXAMPLE FOR SIMPLE LEAF DESCRIPTION:

1. Leaf type: simple

2. Lamina shape: elliptic

3. Lamina apex: acute

4. Lamina base: acute

5. Lamina margin: smooth

6. Lamina structure: leathery

6. Lamina venation: pinnate

7. Lamina surface: glabrous

8. Leaf petiole: petiolate

9. Leaf base: estipulate

PARTIAL LEAF

Plant Name (P. N.)= *Malva sylvestris* (common mallow)

Drug Name (D. N.)= Folia Malvae

PARTIAL LEAF

Plant Name (P. N.)= *Ricinus communis* (Castor-oil-plant)

Drug Name (D. N.)= -

EXAMPLE FOR PARTIAL LEAF DESCRIPTION:

1. Leaf type:……..
2. Lamina shape: ……..
3. Lob apex:……..
4. Lob margin:……..
5. Lamina venation:……..
6. Lamina structure: ……..
7. Lamina surface: ……..
8. Lamina base:……..
9. Leaf stalk: ……..
10. Leaf base: ……..

Compound Leaf

Plant Name (P. N.)= *Aesculus hippocastanum* (Horse chestnut)
Drug Name (D. N.)= -

Compound Leaf

Plant Name (P. N.)= *Rosa sp.* (Rose)
Drug Name (D. N.)= -

PARTS OF A COMPOUND LEAF:

- **Foliol (Leaf-let): A division of a compound leaf.**
- **Petiole: The stalk of a leaflet of a compound leaf.**
- **Rachis: The main axis of a compound leaf**
- **Stipula: One or a pair of leaf-like appandages found at the base of the petiole in some leaves.**

EXAMPLE FOR COMPOUND LEAF DESCRIPTION:

1. **Leaf type: ……..**

2. **Foliol type: ……..**

3. **Foliol margin: ……..**

4. **Foliol apex: ……..**

5. **Foliol base: ……..**

6. **Foliol venation: ……..**

7. **Foliol stalk: ……..**

8. **Foliol structure: ……..**

9. **Foliol surface: ……..**

10. **Leaf venation: ……..**

11. **Leaf stalk: ……..**

12. **Leaf base: ……..**