Basic Terminology

admedial - toward the midline of the lamina (Fig. 4).

apex - usually the upper ~25% of the lamina (see Character 24).

apical (distal) - toward the apex (Fig. 4).

basal (proximal) - toward the base (Fig. 4).

base - usually the lower ~25% of the lamina (see Character 23).

concave - curving toward the center of the lamina or tooth (Fig. 3).

convex - curving away from the center of the lamina or tooth (Fig. 3).

costal vein - primary and secondary veins that extend from the base of the leaf or from a primary toward the leaf margin.

exmedial - away from the midline of the lamina (Fig. 4).

intercostal area - the region bounded by two costal veins.

lamina (blade) - the expanded, flat part of a leaf or leaflet (Fig. 1).

margin - the edge of the lamina (Fig. 1).

midvein - medial primary, in pinnate leaves this is the only primary.

node - the place where a leaf is (or was) attached to the axis (stem) (Figs. 1, 2).

petiole - the stalk of the leaf (Figs. 1, 2).

petiolule - the stalk of a leaflet in a compound leaf (Fig. 2).

primary vein - the widest vein of the leaf and any others of like width and/or course. Primaries usually originate at or just above the petiole. Symbolized 1° (Fig. 1, see Section III).

rachis - the prolongation of the petiole of a pinnately compound leaf upon which leaflets are attached (Fig. 2).

secondary - the next narrower class of veins after the primary, originating from the primary or primaries. Symbolized 2° (Fig. 1, see Section III).

sessile - a leaf or leaflet that is lacking a petiole or petiolule (Fig. 15.2a).

tertiary vein - the next narrower class of veins after the secondaries, originating from the secondaries or primaries. Symbolized 3° (see Section III).

vein course - the path of the vein.

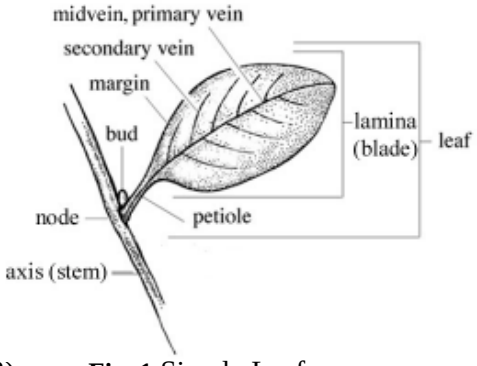


Fig. 1 Simple Leaf

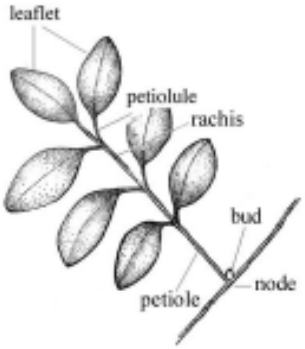


Fig. 2 Pinnately Compound Leaf

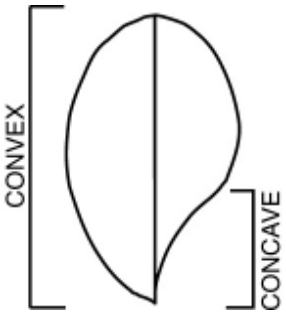


Fig. 3

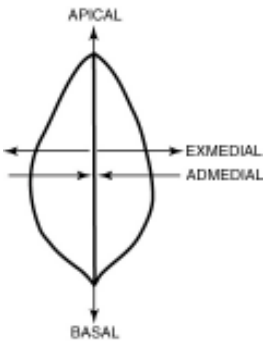


Fig. 4

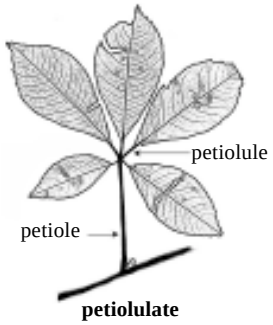
15. LEAF ORGANIZATION

Fig. 15.1

simple - consisting of a single lamina.

sessile

Fig. 15.2a



petiolulate
***Chorisia insignis* (Bombacaceae)**

Fig. 15.2b

palmately compound - a leaf with separate subunits (leaflets) attached at the apex of a petiole.

Fig. 15.3

ternate (trifoliate) - a compound leaf with three leaflets.

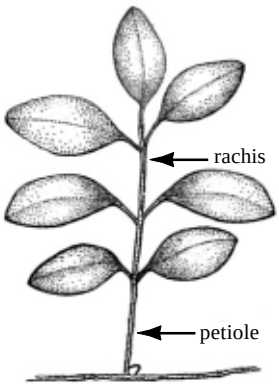


Fig. 15.4
odd-pinnate

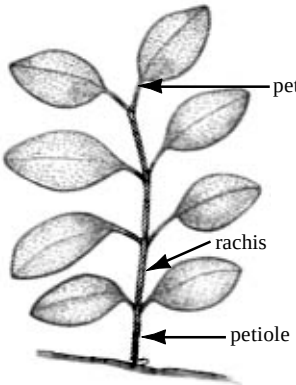


Fig. 15.5
even-pinnate

pinnately compound - a leaf with leaflets arranged along a rachis.

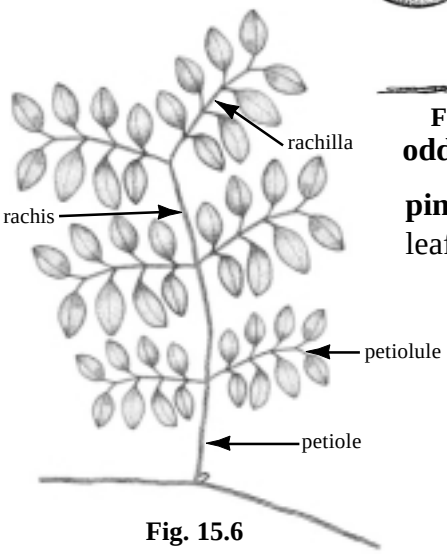


Fig. 15.6

bipinnate (twice pinnately compound) - compound leaf dissected twice with leaflets arranged along rachillae that are attched to the rachis.

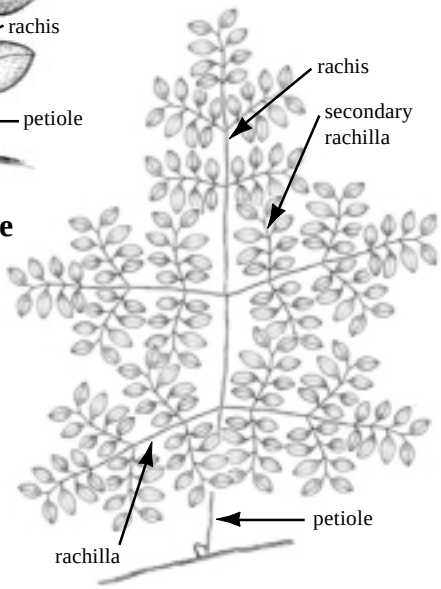
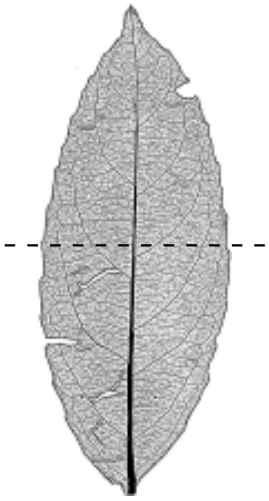


Fig. 15.7

tripinnate (thrice pinnately compound) - a compound leaf with leaflets attached to secondary rachillae that are in turn attached to rachillae, which are borne on the rachis.

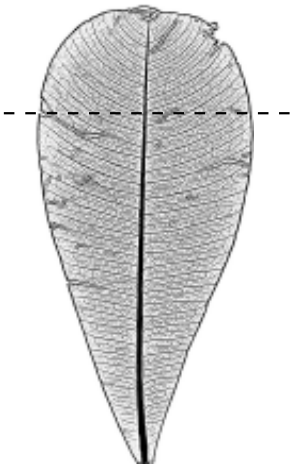
18. LAMINAR SHAPE

The simplest way to describe the overall shape of the lamina is to locate the axis or, in some cases, the zone of greatest width that lies perpendicular to the axis of greatest length (long axis):



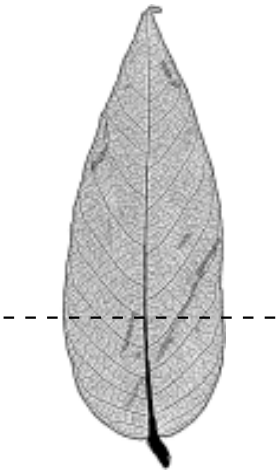
Cheiloclinium anomolum **(Celastraceae)**
Fig. 18.1

elliptic - the widest part of the leaf is on an axis in the middle fifth of the long axis of the leaf.



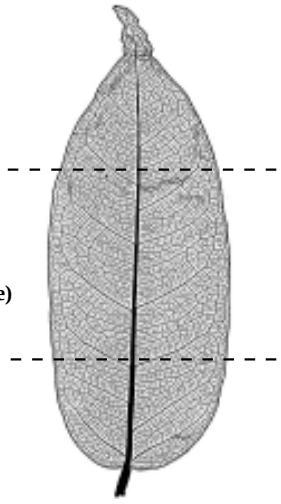
Alstonia congensis **(Apocynaceae)**
Fig. 18.2

obovate - widest part of the leaf is on an axis in the apical 2/5 of the leaf.



Parinari insularium **(Chrysobalanaceae)**
Fig. 18.3

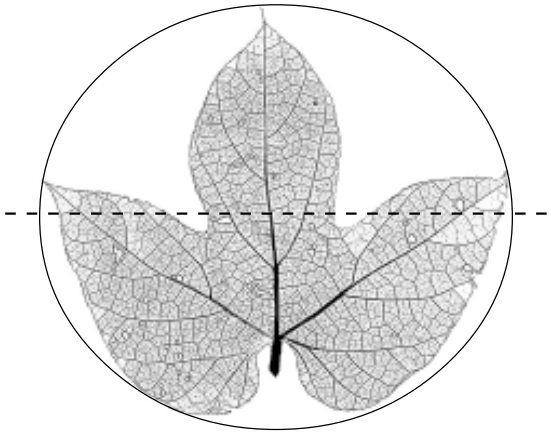
ovate - widest part of the leaf is on an axis in the basal 2/5 of the leaf.



Ficus citrifolia **(Moraceae)**
Fig. 18.4

oblong - widest part of the leaf is a zone in the middle 1/3 of the long axis where the opposite margins are roughly parallel.

In lobed leaves the blade shape is determined from an ellipse drawn around the apices of the lobes. The widest part of the ellipse is then considered as in unlobed leaves (Fig. 18.5).



Dioscoreophyllum strigosum **(Menispermaceae)**
Fig. 18.5
elliptic

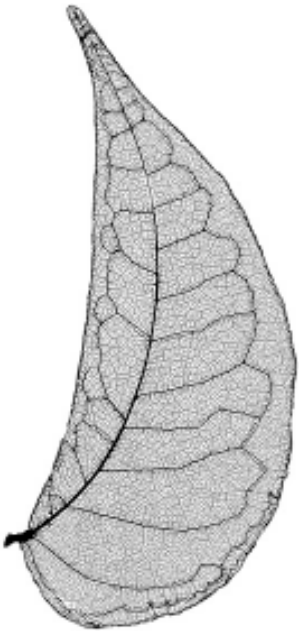
special - leaf is not described by any of the shapes illustrated here (such as a needle or awl).

19. LAMINAR SYMMETRY

Maytenus aquifolium **(Celastraceae)**

Fig. 19.1

symmetrical - lamina approximately the same shape on either side of the midvein.



Daniellia ogea **(Leguminosae)**

whole lamina

Fig. 19.2

asymmetrical - lamina different size or shape on either side of the midvein.

Fraxinus floribunda **(Oleaceae)**

base only

Fig. 19.3

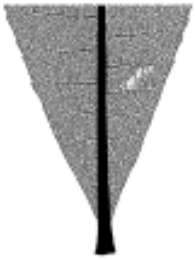
base asymmetrical - base of the lamina of markedly different shape on either side of the midline.

20. LAMINAR L:W RATIO

Measure the length of the lamina (L - see Fig. 7) and divide this number by the width of the lamina. Report the full range of ratios (e.g., 3:1 - 6:1).

23. BASE SHAPE

These states apply to the basal 25% of the lamina (0 - 0.25L as in Fig. 7).



Carya leiodermis **(Juglandaceae)**

Fig. 23.1

cuneate (straight) - the margin between the base and 0.25L has no significant curvature (l_b = 0).

Prunus manshurica **(Rosaceae)**

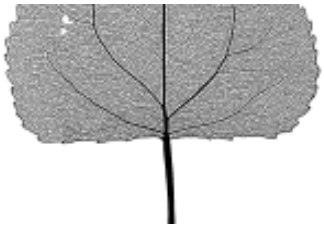
Fig. 23.2

convex - the margin between the base and 0.25L curves away from the center of the leaf (l_b = 0).

Carissa opaca **(Apocynaceae)**

Fig. 23.3

rounded - subtype of convex in which the margin forms a smooth arc across the base (l_b = 0).



Populus dimorpha **(Salicaceae)**

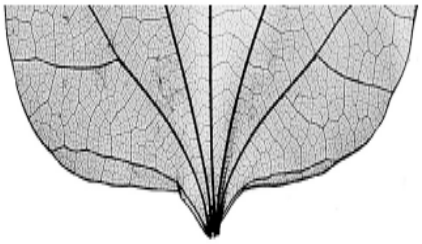
Fig. 23.4

truncate - subtype of convex in which the base terminates abruptly as if cut, with margin perpendicular to the midvein or nearly so (l_b = 0).

Sassafras variifolium **(Lauraceae)**

Fig. 23.5

concave - the margin between the base and 0.25L curves toward the center of the leaf (l_b = 0).



Diploclisia chinensis **(Menispermaceae)**

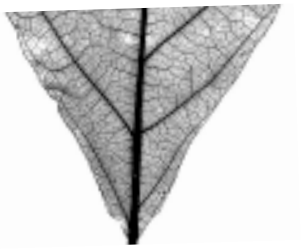
Fig. 23.6

concavo-convex - the margin between the base and 0.25L is concave basally and convex apically (l_b = 0).

Alstonia plumosa **(Apocynaceae)**

Fig. 23.7

decurrent - subtype of either concave or concavo-convex in which the laminar tissue extends basally along the petiole at a gradually decreasing angle (l_b = 0).

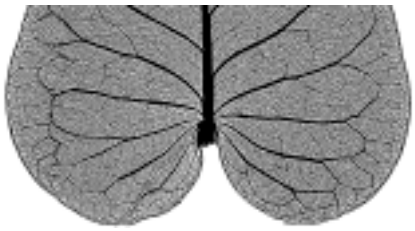


Adelia triloba **(Euphorbiaceae)**

Fig. 23.8

complex - there are more than two inflection points in the curve of the margin between the base and 0.25L (l_b = 0).

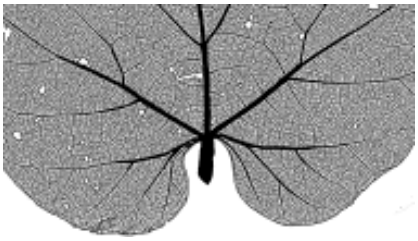
23. BASE SHAPE CONTINUED



Phyllanthus poumensis **(Euphorbiaceae)**

Fig. 23.9

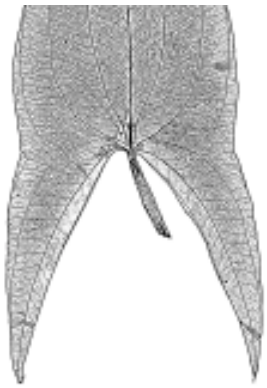
cordate - the leaf base is embayed in a sinus with straight or convex sides ($l_b > 0$).



Dioscoreophyllum strigosum **(Menispermaceae)**

Fig. 23.10

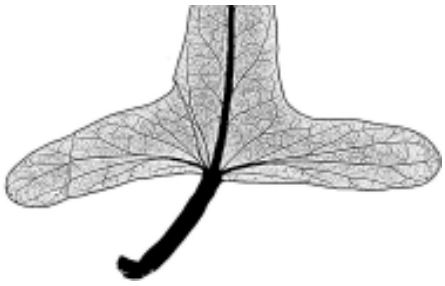
lobate - rounded projections with inner margins (those towards the petiole) concave in part ($l_b > 0$).



Sagittaria sp. **(Alismataceae)**

Fig. 23.11

sagittate - narrow pointed lobes with apices directed basally, i.e. at an angle 125° or greater from the leaf axis ($l_b > 0$).



Araujia angustifolia **(Asclepiadaceae)**

Fig. 23.12

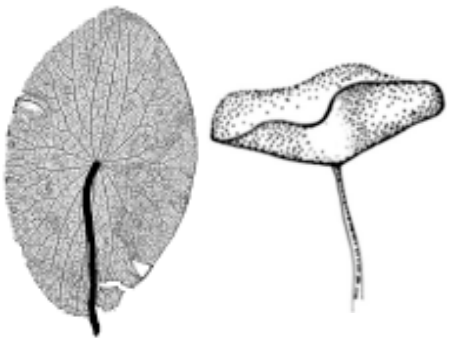
hastate - two narow pointed lobes that have apices directed exmedially, i.e. at 90°-125° from the leaf axis ($l_b \sim 0$).

24. POSITION OF PETIOLAR ATTACHMENT

Luniana piperoides **(Flacourtiaceaee)**

Fig. 24.1

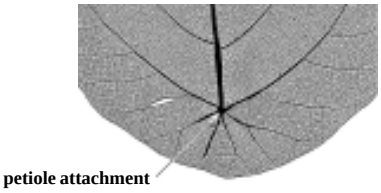
marginal - petiolar insertion at the margin of the leaf.



Brasenia schreiberi **(Cabombaceae)**

Fig. 24.2

peltate central - petiole attached within the boundaries of the leaf margin and near the center of the leaf (l_b>0).



Macaranga bicolor **(Euphorbiaceae)**

Fig. 24.3

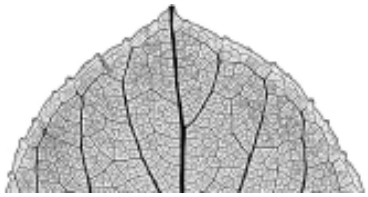
peltate eccentric - petiole attached near the edge but inside the boundaries of the leaf margin (l_b>0).

25. APEX SHAPE

These states apply to the apical 25% of the lamina (0.75L - 1L as in Fig. 7).

Agonis flexuosa **(Myrtaceae)**
Fig. 25.1

straight – the margin between the apex and 0.75L has no significant curvature ($l_a = 0$).



Saurauia calyptrata **(Actinidiaceae)**
Fig. 25.2

convex – the margin between the apex and 0.75L curves away from the center of the leaf ($l_a = 0$).

Ozora obovata **(Anacardiaceae)**
Fig. 25.3

rounded – a subtype of convex in which the margin forms a smooth arc across the apex ($l_a = 0$).

Oxalis sp. **(Oxalidaceae)**
Fig. 25.4

truncate – the apex terminates abruptly as if cut, with margin perpendicular to midvein or nearly so ($l_a = 0$).

Neouvaria acuminatissima **(Annonaceae)**
Fig. 25.5

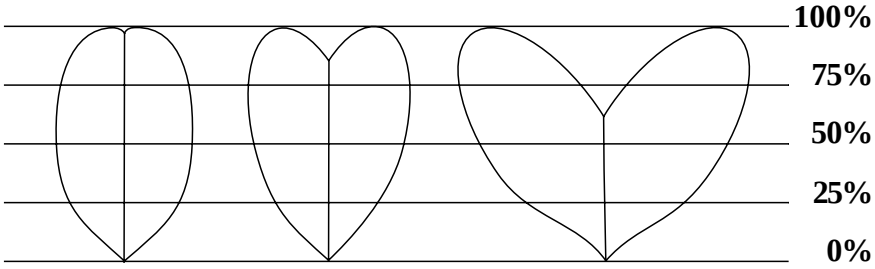
acuminate – the margin between the apex and 0.75L is concave, curving toward the center of the leaf, or is convex basally and concave apically ($l_a = 0$). This category includes most drip tips.

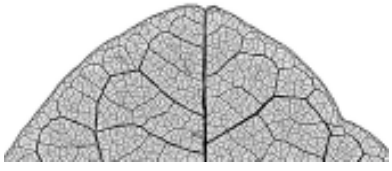
Banksia verticillata **(Proteaceae)**
Fig. 25.6

complex – there are more than two inflection points in the curve of the margin between the apex and 0.75L ($l_a = 0$).

If $l_a > 0$, then the leaf is retuse, emarginate, or lobed.

Fig. 25.7



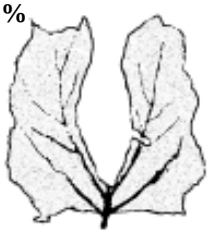


Fitzlania heteropetala **(Annonaceae)**
Fig. 25.8

retuse – the length of l_m is 95-99% of $l_m + l_a$ ($l_a > 0$).

Lundia spruceana **(Bignoniaceae)**
Fig. 25.9

emarginate – the length of l_m is 75-95% of $l_m + l_a$ ($l_a > 0$).



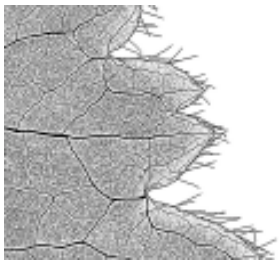
Liriodendrites bradacii
Fig. 25.10

lobed – the length of l_m is <75% of $l_m + l_a$ ($l_a > 0$).

26. MARGIN TYPE

DEFINITIONS

TEETH are marginal projections with sinuses indented less than 1/4 of the distance to the midvein or long axis of the leaf. Teeth can be either dentate, serrate or crenate.
Note: If there is a single tooth of any size, the leaf is considered to be toothed.



Waldsteinia idahoensis **(Rosaceae)**
Fig. 26.1

dentate - teeth pointed with their axes perpendicular to the trend of the leaf margin.

Fagus grandifolia **(Fagaceae)**
Fig. 26.2

serrate - teeth pointed with their axes inclined to the trend of the leaf margin.

Tripterygium wilfordi **(Celastraceae)**
Fig. 26.3

crenate - teeth smoothly rounded without a pointed apex.

Rhododendron amagianum **(Ericaceae)**
Fig. 26.4

entire - margin is smooth, without teeth.

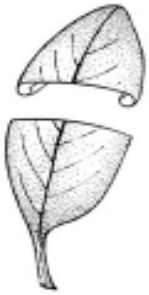


Fig. 26.5

revolute - margins are turned under or rolled up like a scroll.

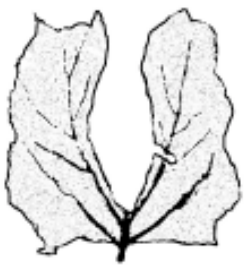
Cornus coreana **(Cornaceae)**
Fig. 26.6

erose - margins are irregular as if chewed.

27. LOBATION

LOBES are marginal indentations that reach 1/4 or more of the distance to the midvein, measured parallel to the axis of symmetry of the lobe.

Gouania longispicata **(Rhamnaceae)**
Fig. 27.1
unlobed



Liriodendrites bradacii
Fig. 27.2
bilobed

Dioscoreophyllum strigosum **(Menispermaceae)**
Fig. 27.3
palmately lobed

Stenocarpus sinuatus **(Proteaceae)**
Fig. 27.4
pinnately lobed

Section 4: Teeth

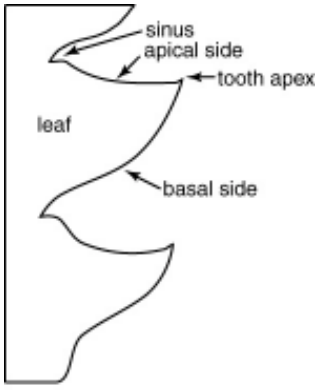
DEFINITIONS

Sinus - an incision between marginal projections of any sort (lobes, dentations, serrations, crenations). May be angular or rounded.

Tooth apex - the tip of a tooth.

Apical side - the side of the tooth that is toward the apex of the lamina.

Basal side - the side of the tooth that is toward the base of the lamina.

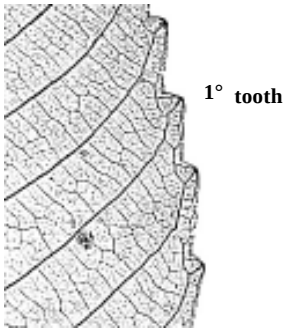


Parts of a tooth

Fig. 10

47. # OF ORDERS (OF TEETH)

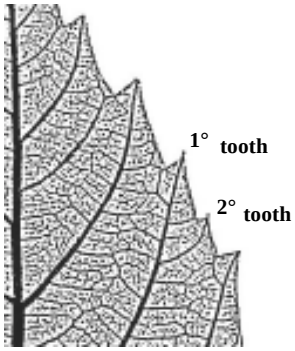
(**1°**, **2°** or **3°**) If the teeth can be separated into different size groups, they are called *compound*.



Leea macropus **(Vitaceae)**

Fig. 47.1

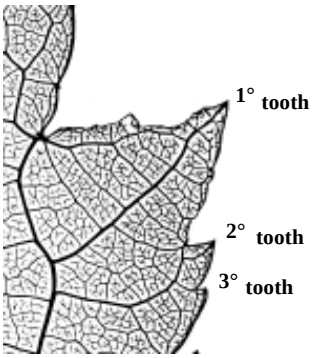
1 order



Celtis davidiana **(Ulmaceae)**

Fig. 47.2

2 orders



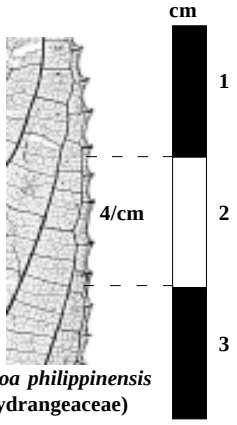
Physocarpus capitalus **(Rosaceae)**

Fig. 47.3

3 orders

48. TEETH/CM

The number of teeth/cm in the middle 50% of the leaf.



Dichroa philippinensis
(Hydrangeaceae)

Fig. 48.1

49. (TOOTH) SPACING

This refers to the interval between corresponding points on the teeth or crenations.


Fig. 49.1

Dichroa philippinensis **(Hydrangeaceae)**

regular - the interval varies less than 25%.


Fig. 49.2

Beauaertia mucronata **(Celastraceae)**

irregular - the interval varies more than 25%.

50. (TOOTH) SHAPE

Tooth shape is described in terms of the shape of the apical side and the basal side. The possible combinations are shown in the chart below. In the database, the following abbreviations are used:

cv (convex) **st** (straight) **cc** (concave) **fl** (flexuous) basally convex and apically concave **rt** (retroflexed) apically convex and basally concave

The apical shape is listed first. For example, cc/fl would be concave on the apical side and flexuous on the basal side of the tooth. Note that a given leaf can exhibit more than one tooth shape.

APICAL SIDE

BASAL SIDE

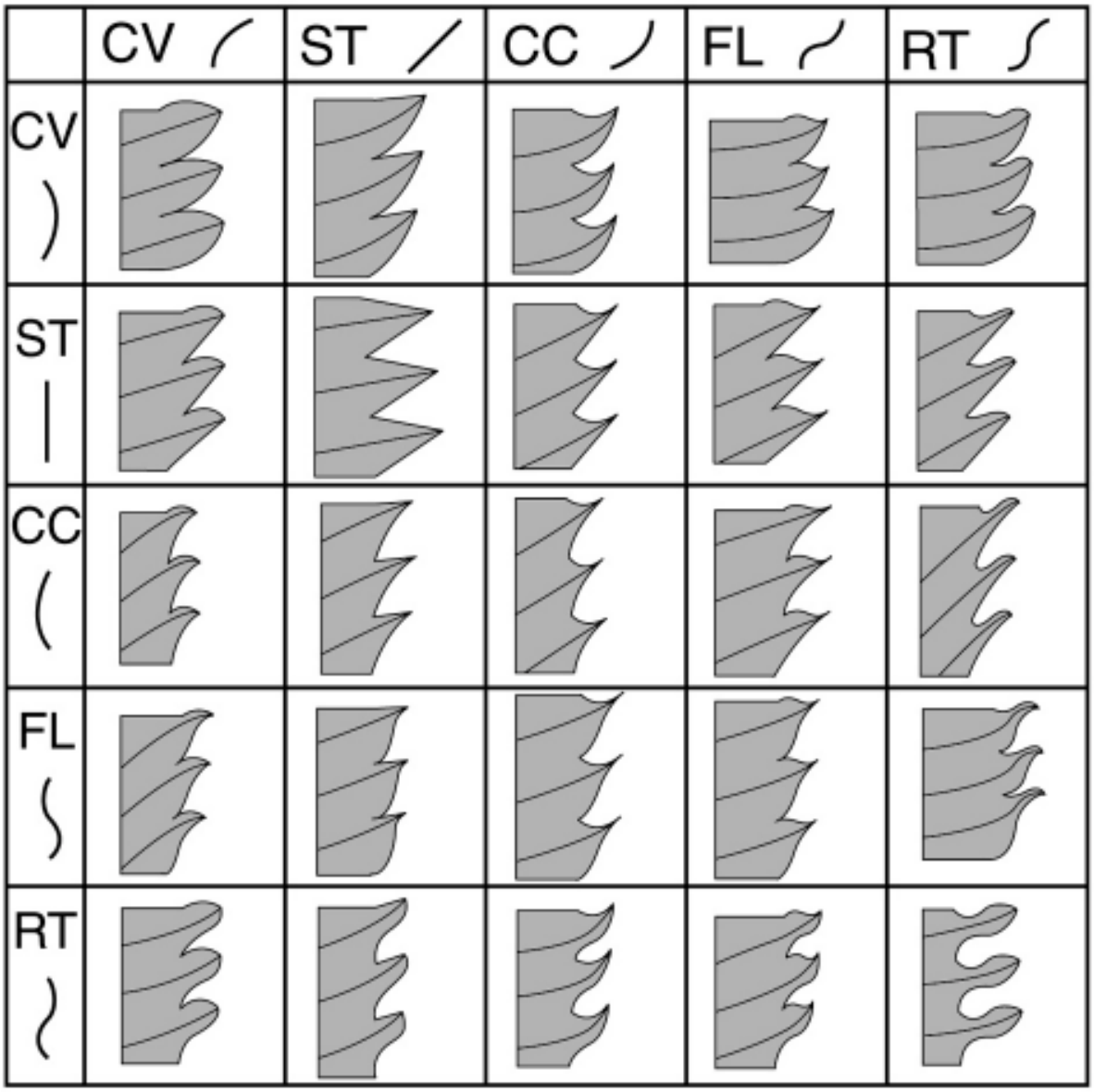


Fig. 50.1

51. SINUS (SHAPE)

The shape of the sinus of the tooth.

Celtis cerasifera **(Ulmaceae)**

Fig. 51.1

angular

Phylloclinium paradoxum **(Flacourtiaceae)**

Fig. 51.2

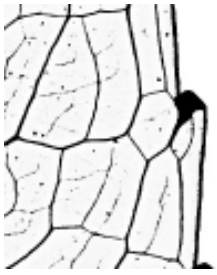
rounded

52. (TOOTH) APEX

There are three major types of tooth apex: simple, spinose, and glandular. In living leaves and some fossils, it may be possible to distinguish the following subsets of glandular: spherulate, papillate, foraminate, mucronate, and setaceous. For situations in which a more specific identification is not possible, use non-specific glandular.

Celtis cerasifera **(Ulmaceae)**
Fig. 52.1

simple - tooth apex formed by the change in direction of the leaf margin without additional elements.



Ascarina lanceolata **(Chloranthaceae)**
Fig. 52.2

non-specific glandular - in fossils, it may be impossible to distinguish between the different subtypes of glandular teeth. This character state is reserved for the description of fossil teeth with a visible concentration of material on the tooth apex.

Ilex dipryena **(Aquifoliaceae)**
Fig. 52.3

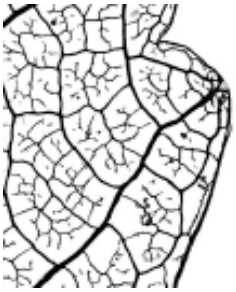
spinose - principal vein of tooth projecting beyond the apex.

Populus jackii **(Salicaceae)**
Fig. 52.4

spherulate - having a spherical callosity fused to the apex.

Haematostemon coriaceous **(Euphorbiaceae)**
Fig. 52.5

papillate - having a clear, nipple-shaped, glandular apical termination.



Leea macropus **(Vitaceae)**
Fig. 52.6

foraminate - with an apical cavity or foramen that broadens from the termination of the principal vein toward the exterior.

Daphandra crypta **(Monimiaceae)**
Fig. 52.7

mucronate - with an opaque or non-deciduous cap or mucro fused to the tooth.

Saurauia calyptrata **(Actinidiaceae)**
Fig. 52.8

setaceous - an opaque, deciduous bristle or cap thickened proximally and not fused firmly with the remaining tooth substance.