Dynamic Plant
An examination of leaves

Common Leaf Forms

Adapted for Photosynthesis
• Leaves are usually thin
  – High surface area-to-volume ratio
  – Promotes diffusion of carbon dioxide in, oxygen out
• Leaves are arranged to capture sunlight
  – Are held perpendicular to rays of sun
  – Arranged so they don’t shade one another

Leaf Shape
Simple leaves - With a single blade
Compound leaves - Blade divided into leaflets
• Pinnately compound leaves - Leaflets in pairs along rachis (petiole)
  – Bipinnately compound leaf - Leaflets subdivided
• Palmately compound leaves - All leaflets attached at same point at end of petiole.
Leaf Arrangement

(a) Alternate  b) Opposite  c) Whorled

Leaf Vein
- One vascular bundle

Internal Anatomy of Leaves

Cuticle
Epidermis
Veins
- Surround by bundle sheath
Mesophyll
Stomata

Mesophyll
Most photosynthesis takes place in the mesophyll between the two epidermal layers.

I. Palisade Mesophyll
- Compactly stacked, barrel-shaped parenchyma cells, commonly in two rows
- Contains most of leaf’s chloroplasts

II. Spongy Mesophyll
- Loosely arranged parenchyma cells with abundant air spaces

Venation
Arrangement of veins in a leaf or leaflet blade

Pinnately veined leaves - Main midvein included within enlarged midrib.

Palmately veined leaves - Several primary veins fan out from base of blade.
Leaf Veins: Vascular Bundles

- Xylem and phloem; often strengthened with fibers
- In dicots, veins are netlike
- In monocots, they are parallel

Stomata

Site of gas exchange.
CO₂ comes into the leaf
Water and oxygen exit the leaf.
Open when water is abundant.
Close when water is scarce.

Transport of Sugars

Sugars flow from:
Source (leaf) → Sink
Sink = any structure that uses up sugars or stores them e.g. fruits, roots, stems.
Pressure-flow theory relies on differential hydrostatic pressure to move fluid through the phloem cells.

Specialized Leaves

Sundews
- Have round to oval leaves covered with glandular hairs that have a sticky fluid of digestive enzymes at tip

Venus’s Flytraps
- Only in North Carolina and South Carolina
- Blade halves trap insects.
Specialized Leaves

• Leaves of Arid Regions
  – Arid regions have limited availability of water, wide temperature ranges, and high light intensities.
  – Leaves reduce loss of water by:
    • Thick, leathery leaves
    • Fewer stomata or sunken stomata
    • Succulent, water-retaining leaves, or no leaves
    • Dense, hairy coverings

• Leaves of Aquatic Areas
  – Less xylem and phloem
  – Mesophyll not differentiated into palisade and spongy layers.
  – Large air spaces

Abscission

Seasonal leaf drop
Process by which leaves are shed
Occurs as a result of changes in abscission zone near base of petiole
  – Protective layer
    • Cells coated and impregnated with suberin.
  – Separation layer
    • Pectins in middle lamella of cells are broken down by enzymes.

Specialized Leaves

Tendrils
Spines
Thorns - Modified stems arising in the axils of leaves of woody plants

Trichomes on an Arabidopsis leaf. Trichomes are extensions from the plant's epidermis and they occur in numerous shapes and sizes in various plants. Trichomes may provide defense against insects and the trichomes of the stinging nettle (Urtica) irritate human skin. SEM.