Colorado Master Gardener

G A R D E N I N G S E R I E S

Colorado
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Plant Structures: Leaves

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Line drawings by S. Johnson.

Outline. . .

Thought question:

- Last spring my tulips were magnificent. As blooms faded, I removed the blossoms and foliage so it wouldn't detract from other spring flowers coming into bloom. This year, most of the tulips didn't come back. Why?

Leaves are the principle structure, produced on stems, where photosynthesis takes place. Cacti are an exception. The leaves are reduced to spines, and the thick green, fleshy stem is where photosynthesis takes place.

Functions

- To compete for light for photosynthesis, i.e., the manufacture of sugars.
- Evapotranspiration from the leaves is what moves water and nutrients up from the roots.
- Small openings on the leaf, known as **stomata,** regulate moisture and gas exchange (water and carbon dioxide) and temperature (cooling effect as water vapor and escapes through stomata).
- Horticultural uses including:
  - aesthetic qualities,
  - feed and food,
  - mulch and compost,
  - plant identification,
  - propagation from cuttings,
  - summer cooling (The evaporative cooling accounts for 70 to 80 percent of the shading impact of a tree.),
  - wildlife habitat, and
  - wind, dust and noise reduction.

Structure

Internal Features

The leaf blade is composed of several layers as follows:

Epidermis – outer layer of tissues

Cuticle – waxy protective outer layer of epidermis that prevents water loss on leaves, green stems and fruits. The amount of cutin or wax increases with light intensity.

Leaf hairs – part of the epidermis.

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Putting Knowledge to Work

Palisade layer – a tightly packed layer of parenchyma tissues filled with chloroplasts for photosynthesis.

Chloroplasts – a subcellular, photosynthetic structure in leaves and other green tissues. Chloroplasts contain chlorophyll, a green plant pigment that captures the energy in light and begins the transformation of that energy into sugars.

Vascular bundle – xylem and phloem tissues, commonly known as leaf veins.

Spongy mesophyll – layer of parenchyma tissues loosely arranged to facilitate movement of oxygen, carbon dioxide, and water vapor. They also may contain some chloroplasts.

Stomata – natural openings in leaves and herbaceous stems that allow for gas exchange (water vapor, carbon dioxide and oxygen).

Guard cells – specialized kidney-shaped cells that open and close the stomata.

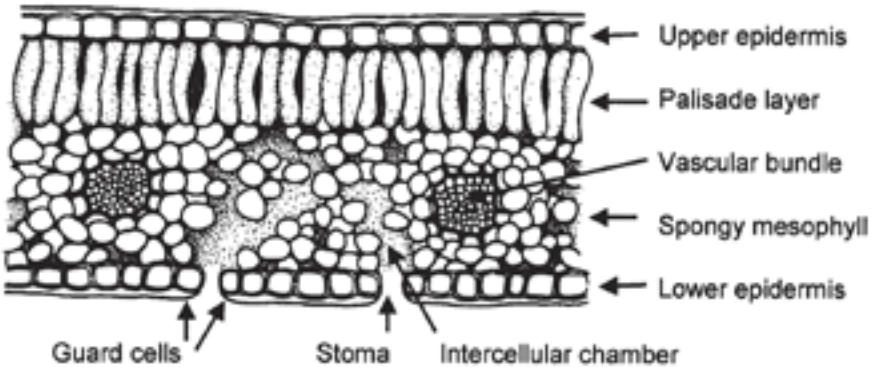

Figure 1. Internal structure of a leaf.

External Features

Leaf blade – flattened part of the leaf.

Petiole – leaf stalk.

Stipules – leaf-like appendages at the base of the leaf.

For plant identification purposes, the shapes of the leaf margin, leaf tip and leaf base are key features to note. Remember, a leaf begins at the lateral or auxiliary bud.

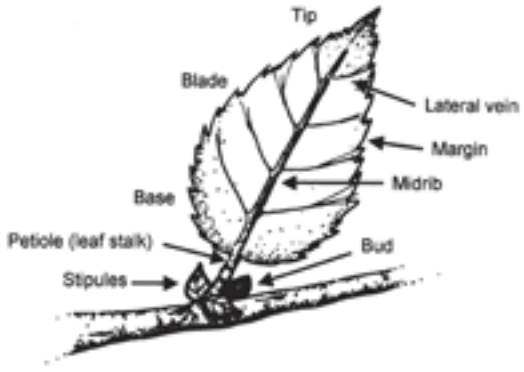

Figure 2. External features of a leaf.

Leaf Arrangement on Stems

Alternate – arranged in staggered fashion along stem (willow).

Opposite – pair of leaves arranged across from each other (maple).

Whorled – arranged in a ring (catalpa).

Rosette – spiral cluster of leaves arranged at the base (or crown) (dandelion).

Figure 3. Types of leaf arrangements.

Note: Sometimes the terms leaf or leaflet can be confusing. Look at the petiole attachment. A leaf petiole attaches to the stem at a bud node. There is no bud node where leaflets attach to the petiole.

Leaflet Arrangement on Petiole

Simple – leaf blade is one continuous unit (cherry, maple, and elm).

Compound – several leaflets arise from the same petiole.

- **Palmately compound** – leaflets radiate from one central point (Ohio buckeye and horse chestnut).
- **Pinnately compound** – leaflets arranged on both sides of a common rachis (leaf stalk), like a feather (mountain ash).
- **Double pinnately compound** – double set of compound leaflets.

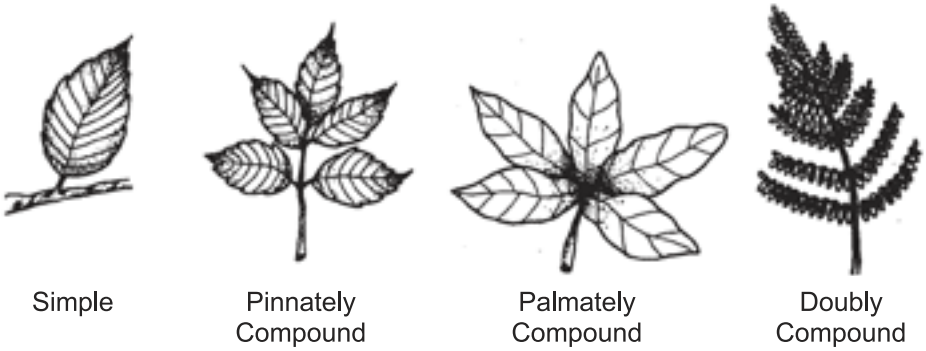

Figure 4. Types of leaflet arrangements.

Overall Leaf Shape

Leaf shape is a primary tool in plant identification. Descriptions often go into minute detail about general leaf shape, and the shape of the leaf apex and base. Figure 5 shows common leaf shapes as used in the *Manual of Woody Landscape Plants.*

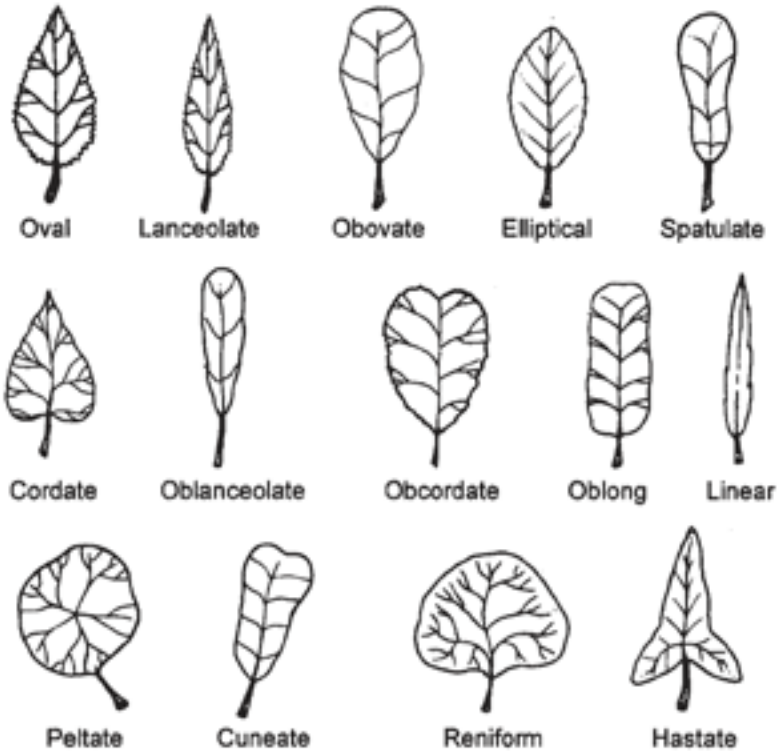

Figure 5. Types of leaf shapes.

Shape of Leaf Apex and Base

Shape of the leaf apex (tip) and base is another tool in plant identification. See Figure 6 for common tip and base styles as used in the *Manual of Woody Landscape Plants.*

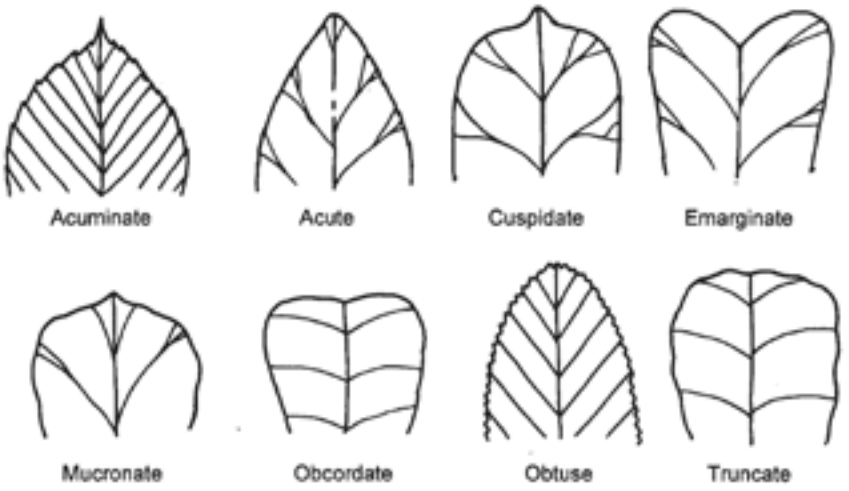

Figure 6a. Types of leaf tips.

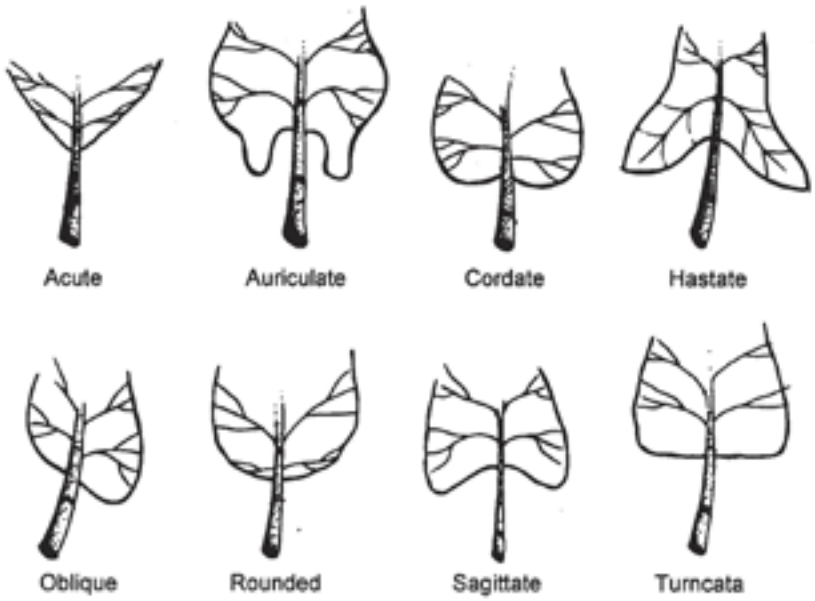

Figure 6b. Types of leaf bases.

Leaf Margin

The leaf margin is another tool in plant identification. See Figure 7 for common margin types as used in the *Manual of Woody Landscape Plants.*

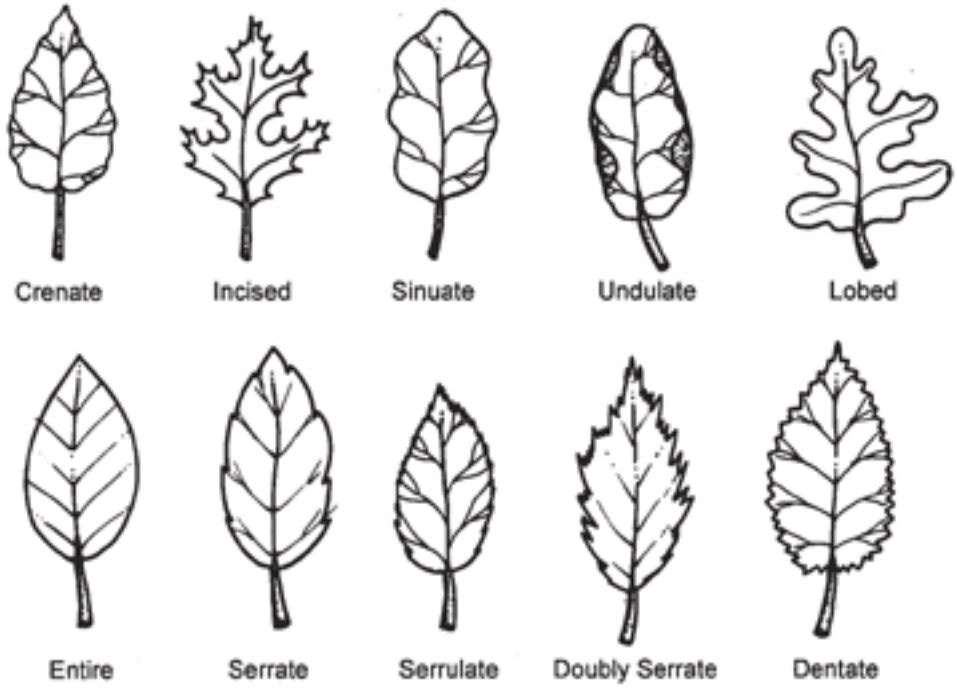

Figure 7. Common leaf margins.

Leaf Types (leaf venation)

Conifer Types

Scale-like – mature leaves common on most junipers and arborvitae.

Awl-shaped – juvenile leaves common on some junipers.

Linear-shape – narrow flat needle of spruce, fir, and yews.

Needle-like – in pine, the single, bundle or cluster of needles makes a rounded shape.

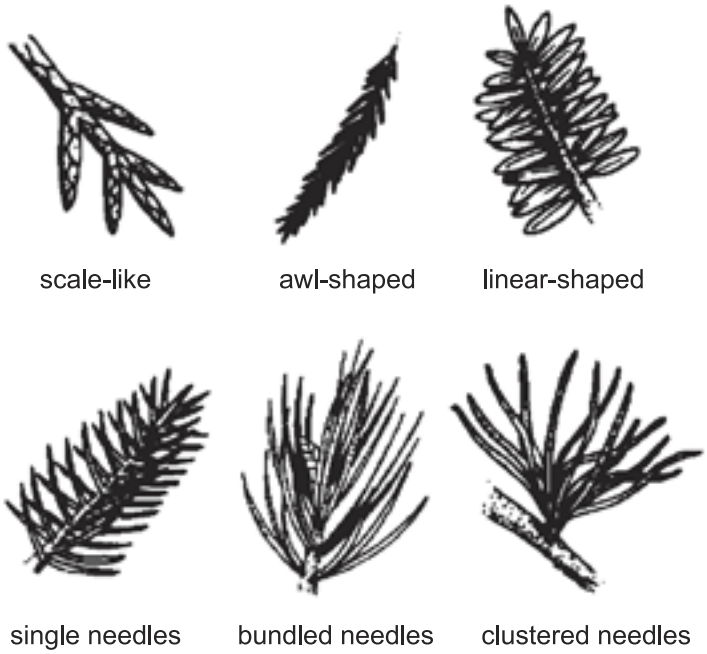

Figure 8. Types of conifer leaves.

Ginkgo Type

Dichotomous venation – somewhat parallel veins sections, forming a 'Y', found in Ginkgo trees.

Dichotomous veined Ginkgo leaf

Monocot Types

Parallel venation – veins run in parallel lines (monocot plants, such as grasses, lilies, tulips).

Parallel veined monocot leaf

Figure 9. Dichotomous and parallel veination.

Dicot Types

Net-veined or reticulate-veined – leaves with veins that branch from the main rib and then subdivide into finer veinlets (dicot plants).

Palmate venation – veins radiate fan-shaped from the petiole (maple, grapes).

Pinnate venation – veins extend from a midrib to the edge (elm, peach, apple, cherry).

Pinnately veined dicot leaf

Palmately veined dicot leaf

Figure 10. Pinnate and palmate veination.

Modified Leaves

Adhesive disc – modified leaf used for attachment mechanism. Sometimes referred to as a holdfast (Boston ivy).

Bract – specialized, often highly colored leaf below flower that often serves to lure pollinators (Poinsettia, dogwood).

Spine or thorn – modified leaf (barberry, pyracantha).

Tendril – modified sinuous leaves used for climbing or as an attachment mechanism (Virginia creeper, peas, grapes).

Figure 11. Type of modified leaf.

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