Structure and Function of leaves

Leaves are the main photosynthetic organ in plants. In general, they are flattened dorsoventrally and thin for maximum photosynthesis but vary considerably in appearance.



[See appendix for further details on the process of photosynthesis]

Leaf blade and Petiole

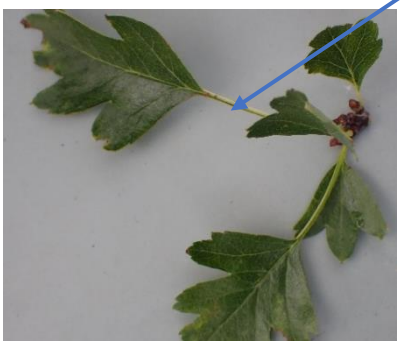
The leaf blade [lamina] is adapted for maximum photosynthesis.

The large surface area of the leaf blade enables maximum light absorption.

The thin, flattened blade ensures effective exchange of carbon dioxide and oxygen

The petiole Stalk which connects the leaf blade to the stem. If a species does not have a petiole, it is described as **sessile**

Leaf with stalk or petiole




Sessile leaf without stalk/petiole

Axillary buds are found at the junction between the base of petiole and the main stem

Axillary bud

Stipules Structures which grow at the base of the petioles, in some cases the stipules protect the developing leaf bud. Only present in some species and can be diagnostic. Stipules are usually present in pairs, only one of the pair visible in the photographs below.

Stipules

Leaf Arrangement

The leaves can be **opposite, whorled or alternate/spiral**

Opposite Each node gives rise to two leaves, one on each side placed oppositely. Here the pairs of leaves may alternate

One pair of opposite leaves

A second pair of opposite leaves alternate to the first pair

Whorled Several leaves are present at the same level around the stem giving it a whorled appearance. This feature is found in the bedstraws for example.

Alternate /Spiral Each leaf grows from a separate node on the stem at different levels.

The leaves are attached to the stem in a spiral arrangement

The leaf buds show the position of this year's leaves and next year's shoots

Leaves can be simple or compound

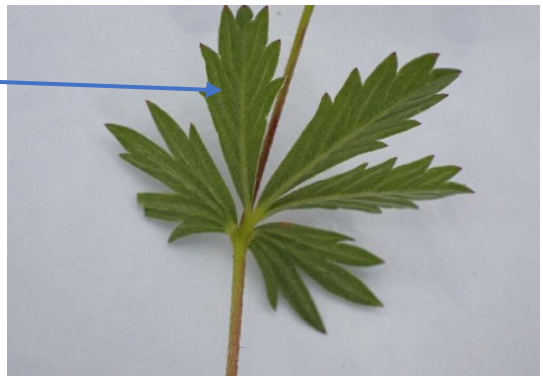
Simple leaves The leaf blade is not divided into leaflets although it can be lobed or divided in some way. There will always be an **axillary bud** at the base of the petiole.

Simple leaf

Compound leaves The Leaf blade is divided into **leaflets.** There will **not** be an axillary bud at the base of each leaflet although there will be an axillary bud at the base of the petiole.

The arrangement of the leaflets may be **palmate** where the leaflets originate from a central point.

Leaflets fan out from a central point



The arrangement of the leaflets may be **pinnate** where leaflets grow out in opposite pairs from the leaf stalk.

Pairs of leaflets grow out from the central leaf stalk

Part of a rose leaf to show the axillary bud always present at the base of a compound leaf

Basal and Cauline Leaves

Basal leaves grow out from the base of the plant, often forming a **basal rosette**.

Cauline leaves are found on the stem. The basal leaves are generally larger and more complex in shape and diagnostic, sometimes dying off before flowering. Cauline leaves often become smaller and simpler towards the inflorescence

Basal Leaves

Basal leaves arranged in rosette

Cauline leaves which grow up the stem

Shape of the Blade

There are many leaf shapes including ***cordate, lanceolate, linear, ovate [egg shaped], obovate [inverted egg shape]***

Cordate leaves in the Marsh marigold

Edge of the leaf blade

The edge/margin of the leaf blade can be **entire, dentate, serrate, lobed, pinnatifid.**

Entire Leaf margin is smooth with **no divisions** of any kind.

Serrate leaf margin has **saw teeth.**

Lobed Leaf blade is divided into **rounded lobes**, the division does not reach the midrib.

Pinnatifid Leaf blade divided into **pinnately arranged lobes**.

Arrangement of veins

The xylem and phloem vessels which transport the nutrients around the plant are visible as veins on the leaf surface

Parallel venation

The **vein**s run **parallel** to each other along the leaf blade.

Palmate venation The veins **fan** out **from one central point**

Pinnate venation The **lateral veins** branch out from a **central vein** which runs own the middle of the leaf

Hairs on the leaves

In some species the leaves may be be **glabrous** [without hairs]. Other species may have hairs on some or all of the leaf surfaces. The hairs can be glandular or simple.

The type of hair and distribution on the leaf is often diagnostic. This is a very interesting topic which you may wish to research further, along with shape of leaf base and tip.

Prepared by Lizzie Maddison November 2022, amended for printing NP

Appendix

Adaptations for photosynthesis

Green plants fix carbon dioxide from the atmosphere and convert it into sugar using sunlight energy and hydrogen ions from water. They are adapted for this process in a number of ways, the most common of which are listed below

- Large surface area to absorb light.
- Large numbers of stomata [openings in the leaf surface]. These tiny pores enable carbon dioxide to diffuse in from the air; excess oxygen produced during photosynthesis passes out in the opposite direction.
- Chloroplasts contain chlorophyll. This important molecule absorbs the light energy from the sun and converts it into chemical energy during photosynthesis. Energy rich molecules such as sugar and starch are two of the molecules which are produced by plants during this process.
- Air spaces within the leaf store gases
- The surface of the leaf may have extra layers to reduce water loss such as a waxy cuticle.
- Transport vessels are needed to carry the sugars through the plants and bring the water and minerals up from the roots. They are visible on the surface of the leaf as raised veins.
- The veins on the surface of the leaf form characteristic patterns

Main parts of the Flowering plant