

5. External Plant Structure and Common Terms Employed

PLANTS DEVELOP from seeds, or from overwintering stems or roots as described below. The seed is a structure containing an inactive embryonic plant and stored food used by the plant in initiating growth. Under favorable conditions the seed germinates and the young plant sends out a root, stem, and leaves. The first leaflike structures present above ground on the seedlings of most broad-leaved plants are cotyledons. The root, stem, and leaves make up the vegetative structures of the plant. After a period of growth (a month to several years) the plant develops reproductive structures. These include the flower, fruit, and seed.

VEGETATIVE STRUCTURES

The Root

Roots may be annual or perennial. They may have one main axis, a taproot, with much smaller secondary branches, or they may be much branched, e.g. fibrous roots of grasses. Taproots or root crowns are frequently thickened and serve as food storage organs or as overwintering perennial structures which will send out new shoots the following year. Horizontally developing perennial underground roots are possessed by many noxious weeds. These roots send out stem buds at intervals. Small fragments of such roots are frequently capable of developing new plants.

The Stem

Stems may be subterranean or aerial. Underground stems are usually, at least in part, perennial. They frequently form overwintering crowns or special storage organs (tubers, bulbs). Certain noxious weeds (e.g. quackgrass) possess horizontally elongated underground stems known as rootstocks or rhizomes. These structures function in much the same way as creeping underground roots, are perennial, and are capable of producing aerial stems and root systems.

Above ground stems may be perennial or annual. Those of trees and shrubs are perennial and soon become woody. Those of most weeds and crop plants are annual; that is, they die back to the ground every year even if underground stems or roots are perennial in nature. Annual stems ordinarily do not become woody but are soft or herbaceous. Stems may be erect, twining, or prostrate; they, and other plant parts, may be hairy, pubescent, or free from hairs (glabrous).

Stems usually bear leaves spaced at more or less regular intervals. The specialized regions on the stem from which leaves arise are known as the nodes. The angle between the stem and leaf, from which secondary branches arise, is the axil. The portions of the stem between the nodes are the internodes.

The Leaf

Leaves are more diverse in form and arrangement than any of the other vegetative organs of plants. Most weeds can be recognized from their leaves alone.

Arrangement of leaves. Leaves may be borne on the aerial stem or may arise in a basal cluster from a stem crown. A basal cluster of leaves is a leaf rosette. Dandelions and plantains produce only rosette leaves; there is no leafy aerial stem. Other weeds, particularly winter annuals and biennials, first form a basal rosette and subsequently send up a leaf-bearing stem, e.g. wild carrot (*Daucus*), bull thistle (*Cirsium*), wild parsnip (*Pastinaca*). Leaves borne on the aerial stem may be alternate, opposite, or whorled. Alternate leaves are produced singly at stem nodes and appear to alternate on the stem; opposite or paired leaves are borne two at each node; if three or more leaves are produced at each node, they are said to be whorled.

Parts of the leaf. A complete leaf consists of a stalk, the petiole, and a blade. Some leaves do not possess a petiole; i.e. the blade is attached directly to the stem. Such leaves are said to be sessile. The edge of the blade is the margin.

The stem nodes of many plants bear a pair of appendages (stipules), one on each side of the leaf. These structures may be bristle- or blade-like in form; they are sometimes fused and form a sheath about the node and lower portion of the leaf.

Form of the leaf blade. The leaf blade may consist of a single piece in which case it is said to be simple, or it may be divided into several secondary leaflets in which circumstance it is compound. If the leaflets are arranged along a main axis in feather-like fashion, the leaf is pinnately compound; if the leaflets arise from one point in finger-like fashion, it is palmately compound.

Leaf blades may be deeply cut or incised even though not divided into separate leaflets. Lobed leaves possess broad divisions; dissected leaves are cut into numerous, narrow lobes. Leaves may be pinnately lobed or dissected. Many leaves possess pinnately lobed leaves which are said to be pinnatifid.

Shape of the leaf blade. The following are among the more common leaf shapes: rounded, circular in outline; elliptical, shaped like an ellipse; ovate, similar to elliptical but broader towards the basal end, egg-shaped; lanceolate, narrow, broadest at the base and gradually tapering towards the upper end; linear, very narrow with parallel sides, e.g. leaves of grasses; cordate, heart-shaped; obovate and oblanceolate, similar to ovate and lanceolate respectively but with the broad end uppermost.

Margin of the leaf blade. If the leaf margin is untoothed it is said to be entire; if toothed with outwardly directed teeth it is dentate; if toothed with upwardly pointed teeth it is serrate. The teeth may be rounded or pointed.

The Flower

Flower arrangement. Ordinarily, flowers are borne in clusters or inflorescences. The more common types of inflorescences include: the spike, flowers sessile on an unbranched, elongate stem axis, e.g. a spike of wheat; the raceme, similar to a spike, but the flowers borne on stalks or pedicels; the panicle, similar to a raceme but branching, the flowers produced on the secondary or tertiary branches; the umbel, flowers borne on pedicels all of which arise from the same place at the apex of the stem, e.g. onion, carrot; the head, flowers sessile in a dense cluster at the apex of the stem, e.g. thistle; axillary cluster, flowers borne in the leaf axils and not segregated into a distinct inflorescence.

Flower structure. A complete flower contains calyx, corolla, stamens, and pistils or pistil.

The calyx is the outer envelope of the flower, composed of separate or fused lobes, the sepals.

The corolla makes up the conspicuous, commonly colored whorl of flower parts. The segments or lobes of the corolla are the petals. The corolla lies within the calyx, and its lobes usually alternate in position with those of the calyx. If the petals are partially or completely fused, the flower is said to be gamopetalous. In the majority of flowers the petals are of the same size and the flower is symmetrical in appearance; such flowers are said to be regular. Many flowers, however, possess petals of different forms or sizes; such flowers are not symmetrical (radially) and are said to be irregular.

The stamens are the male, or pollen-producing organs of the flower. The stamens lie immediately within the corolla. Each stamen possesses a stalk, the filament, which bears at its apex the pollen-producing anther.

The female portion of the flower located within the stamens is the pistil. It consists of a basal bulbous portion, the ovary, above which arises a stalk, the style, bearing at its apex one or several pollen-receptive stigmas. Inside the ovary are the ovules (one to many) which ultimately develop into seeds.

Some of the above parts are missing from many kinds of flowers. Such flowers are incomplete flowers. Sepals and petals may both be absent, e.g. grasses, or sepals present but petals absent, e.g. pigweeds. Unisexual or imperfect flowers, in which either the stamens or pistils are absent, are common in many kinds of plants. In Canadian thistle some plants produce staminate flowers (contain only stamens) and other plants produce pistillate flowers (contain only pistils).

Fertilization consists of the fusion of an egg and sperm cell (from which the new embryo plant ultimately develops), as well as fusion of another sperm with the so-called polar nuclei, this resulting in endosperm, a food storage tissue. Fertilization normally initiates the development of the fruit and seeds. In some plants modifications in the reproductive process allow development of the fruit and seed without fertilization; for example, fertilization does not usually take place in Kentucky bluegrass.

The Fruit

After fertilization, the calyx, corolla, and stamens usually wither or are variously modified. The ovary (sometimes surrounded by additional accessory structures) develops into the fruit, and the ovules into the seeds. The fruit may be dry or fleshy; it may contain one or many seeds; it may split open at maturity (dehiscent) releasing the seeds; or it may remain intact and fail to split open (indehiscent). Common types of fruits include:

Achene. A dry indehiscent fruit containing only a single seed. The fruit wall of the achene is closely associated with the seed coat but is usually distinct from it. The achene functions as a single seed. Examples: buckwheat (*Fagopyrum*), sunflower (*Helianthus*) and thistle (*Cirsium*).

Grain (caryopsis). The fruit of grasses. The grain is similar to the achene in that it contains only a single seed and is dry and indehiscent. It differs in that the embryo (germ) is usually visible at one end of the fruit and that the seed and fruit coat cannot be separated.

Capsule. A several-seeded, dry, dehiscent fruit usually containing several internal chambers. Examples: butterprint (*Abutilon*), poppy (*Papaver*).

Pod or legume. A dry, dehiscent or indehiscent fruit containing one to several seeds. If several seeds are present, they are lined up in one row within a single chamber. The pod is produced by members of the bean family. Examples: beans (*Phaseolus*) or peas (*Pisum*).

Berry. A fleshy, indehiscent fruit containing several seeds. Examples: tomato (*Lycopersicon*), grape (*Vitis*).

The Seed

The seed, a matured ovule, represents the sexually produced reproductive unit of flowering plants. The "seed" of popular usage may be a true seed (beans, clover), or it may consist of a seed or group of seeds enclosed by various accessory structures. The commonest of such seed-like bodies are the one-seeded indehiscent fruits in which the seed is permanently enclosed within the fruit wall, such as the grain of grasses, the achene of smartweeds, or composites.

Seeds contain an embryo plant (or germ), a protective covering, and stored food which is used by the embryo in starting growth. The embryo consists of a partially developed root, stem, leaves, and one or two cotyledons or seed leaves. In the grasses and grass-like plants (monocotyledons) only one cotyledon is present; it is not leaf-like in appearance. In the broad-leaved plants (dicotyledons) two cotyledons are present, and they are usually leaf-like in appearance.

The seed coat is the protective covering of the seed. In many seed-like structures, particularly one-seeded fruits, the true seed coat is usually reduced, the protective functions having been assumed by the fruit coat, the pericarp.

The stored food may be incorporated within the embryo proper, usually in the cotyledons (beans). In other cases it makes up a special storage tissue, the endosperm.

The most valuable characters for identifying seeds are (1) the shape, (2) the nature and arrangement of markings (lines, ridges, pits, projections) on the seed surface, (3) the position and nature of the attachment scar (the hilum of true seeds), (4) the internal structure, position, and size of the embryo, presence or absence of endosperm.

GLOSSARY OF COMMON DESCRIPTIVE BOTANICAL TERMS

Accrescent - Closely pressed against or folded around.

Alternate - Leaf arrangement, one leaf at each node of the stem.

Annual - A plant whose life duration is a year or less.

Anther - The terminal, pollen-producing portion of a stamen.

Apetalous - A flower without petals.

Auricle - A lateral projection, one on each side, at juncture of sheath and blade of certain grass leaves.

Awn - A bristle-like tip; most frequently used with respect to bristle- or hair-like projections from glumes, lemmas, or paleas of grass spikelets.

Axil - The angle between a leaf and a stem in which branches or flowers may arise.

Axillary cluster - Referring to flowers or flower clusters borne in leaf axils rather than distinct inflorescences.

Berry - A fleshy, several-seeded fruit.

Biennial - A plant whose life duration is two years.

Bract - A modified, reduced leaf which subtends a flower or portion of an inflorescence.

Bulb - An underground, perennial, storage organ consisting of a stem axis and numerous, overlapping leaf scales.

Callus - Thickened tissue contiguous to the basal scar of a grass lemma.

Calyx - The outer whorl of flower parts; the sepals. The calyx is usually greenish and covers the other flower parts in bud.

Capillary - Thread-like.

Capsule - A dehiscent, dry several-seeded fruit.

Caryopsis - The grass fruit; one-seeded, indehiscent; seed coat scarcely distinguishable from fruit coat. Also called a grain.

Clasping - Descriptive of leaves, those which, usually sessile, possess a pair of basal lobes which tend to clasp about the stem.

Complete flower - A flower possessing all four whorls of flower parts: sepals, petals, stamens, and pistil.

Compound (leaf) - A leaf whose blade is divided into two or more distinct leaflets.

Cordate - Heart-shaped; usually used with reference to leaves with a pair of rounded basal lobes.

Corolla - The whorl of flower parts immediately inside of the calyx; composed of petals, usually colored.

Cotyledon - Seed leaf; the first leaf-like structures, usually paired, appearing above ground in most dicotyledonous plants. The cotyledons are often thick and fleshy and serve as food storage organs of the embryo plant. The so-called cotyledon (scutellum) of monocotyledons does not emerge from the seed.

Culm - The stem of a grass.

Dehiscent - Referring to a dry fruit which splits open at maturity releasing the seeds.

Dentate - Toothed, with the teeth directed at right angles to the edge. Usually employed with reference to leaf margins.

Digitate - With several parts or branches arising at or near the same point; finger-like.

Dioecious - A plant with unisexual flowers, the pistillate and staminate flowers being borne by different individuals.

Disk - Referring to the central portion of flower heads of members of the sunflower family and composed of tubular flowers in distinction to the marginal ligulate ones. The term is also employed with respect to individual tubular flowers, i.e. disk flowers.

Dissected (leaf) - A leaf whose blade is cut up into numerous, narrow lobes.

Drupe - A berry-like fruit with a hard endocarp and containing a single seed.

Drupelet - A small drupe.

Ellipsoidal - Elliptic in three dimensions, roughly football-shaped.

Elliptic - Shaped like an ellipse and essentially symmetrical.

Endosperm - A food storage tissue in seeds formed by the fusion of a sperm with the polar nuclei.

Entire - The margin of a leaf which is untoothed.

Fertilization - The fusion of the egg and sperm nuclei within the ovule of the pistil resulting in the initiation of the new embryo plant, and fusion of another sperm nucleus with the polar nuclei to produce endosperm.

Fibrous roots - A root system, as in grasses, composed of numerous, separate roots rather than one main root.

Filiform - Thread-like, very slender.

Filament - The stalk-like basal portion of a stamen.

Floret - A grass flower surrounded by lemma and palea.

Gamopetalous - Petals partially or completely fused.

Glabrous - Without hairs.

Glume - One of the two sterile bracts at the base of a grass spikelet.

Grain - The grass fruit; characterized by being one-seeded, indehiscent, with the seed coat scarcely distinguishable from fruit coat. Also called a caryopsis.

Hastate - Spear-head shaped; used especially with reference to leaves with a pair of basal lobes, these lobes directed outwards.

Head - An inflorescence in which the sessile flowers arise essentially from more or less the same level from a common, compound receptacle.

Herbaceous - Soft; lacking woody tissue. Used with respect to plants without woody tissue or with reference to the above-ground parts which do not live over winter.

Hilum - The attachment scar on a seed; the point of separation from its connection to the fruit.

Imperfect flower - A flower lacking either stamens or pistils; unisexual.

Indehiscent - Referring to a fruit which does not split open and release the seed or seeds at maturity.

Inferior - Referring to a flower, or its ovary, in which the other flower parts arise from the apex of the ovary rather than from below it.

Inflorescence - A cluster of flowers, or the flower-bearing portion or portions of a plant.

Internode - Portion of a stem between nodes.

Involucral bract - One of the several bracts surrounding or forming the lower part of the flower head in the sunflower family.

Irregular - A flower with petals which differ in size. Example: flowers of the legume family.

Lanceolate - Narrow and tapering from the base to the tip.

Leaflet - A secondary division of a compound leaf.

Lemma - The larger of the two bracts surrounding a grass flower.

Ligule - An appendage (a short membrane or row of hairs) on the upper side of the leaf at the juncture of the leaf and blade.

Ligulate (flower) - Strap-shaped, irregular flowers characteristic of the sunflower family. Ligulate flowers may constitute the entire head (dandelion) or make up the marginal petal-like flowers in those head types possessing both ligulate and tubular flowers (daisy).

- Limb - Referring to the expanded or flattened portion of the corolla of many gamopetalous flowers.
- Lobed - Shallowly or deeply divided into usually rounded sections or divisions; ordinarily employed with respect to leaves or leaf margins.
- Margin - Edge of a leaf.
- Mericarp - A seed-like fruit segment of the carrot family. The fruit, at maturity, splits longitudinally into two one-seeded, usually plano-convex segments, the mericarps.
- Monoecious - A plant with unisexual flowers; both pistillate and staminate flowers borne by the same individual.
- Node - That part of the stem from which leaves and branches arise.
- Nutlet - Characteristic seed-like fruit segments of the mints and related families. The fruit splits longitudinally into four sections, each shaped like a quarter section of an orange; these are the nutlets.
- Oblanceolate - Relatively narrow but broadening from the base to the tip.
- Obovoid - Egg-shaped; broadest end uppermost or opposite point of attachment.
- Ochrea - A membranous sheath surrounding the stem immediately above attachment of the leaves in members of the smartweed family.
- One-celled - Referring to a pistil or ovary containing but a single chamber or cell inside.
- Opposite (leaves) - The leaves paired at each node.
- Ovary - The basal portion of the pistil containing the ovules.
- Ovoid - Egg-shaped; broadest at the lower end.
- Palea - The smaller of the two bracts surrounding a grass flower.
- Palmately compound - A compound leaf in which the leaflets all arise from the same point.
- Panicle - A branched inflorescence.
- Pedicel - The stalk of an individual flower.
- Peduncle - The stalk of an inflorescence or a part of an inflorescence, but not of an individual flower.
- Perennial - A plant whose life duration may be several years.
- Perfect (flower) - A flower which contains both stamens and pistils.
- Pericarp - Fruit coat; used especially of the seed-coat-like covering of indehiscent, one-seeded fruits.
- Perigynium - A sac-like structure surrounding the flower and fruit of *Carex*.
- Petal - A single member of the second whorl of usually colored flower parts, collectively the corolla.
- Petiole - The stalk of a leaf.
- Pinnately compound (leaf) - A compound leaf in which the leaflets are arranged feather-fashion along an elongate axis.
- Pinnatifid - A leaf whose blade is lobed in pinnate fashion.
- Pistillate - Possessing only a pistil or pistils. May refer to a flower or to a plant.
- Planoconvex - With one flat side and one concave side; turtle-shaped.

Pollen - The male, sex-cell-carrying units which, produced by the stamens, serve to carry out pollination.

Pollination - Transfer of pollen from the anther to the stigma. Note that pollination is not synonymous with fertilization, the latter referring to nuclear fusions within the ovule.

Pubescent - Possessing hairs; hairy.

Raceme - An unbranched inflorescence in which the flowers are stalked.

Rachilla - A short stalk, usually appressed against the lower portion of the palea of certain grass "seeds" (florets). Rachilla-possessing florets originate from several-flowered spikelets. The rachilla represents that portion of the spikelet axis lying between the two contiguous florets.

Ray (flower) - Strap-shaped irregular (ligulate) flowers characteristic of the heads of certain members of the Compositae. Such flowers may make up the entire head or form the outer petal-like whorl.

Regular - Referring to flowers in which petals are equal, or approximately so, in size, the flower thus being radially symmetrical.

Rosette - A basal cluster of leaves not separated by evident internodal stem elongation.

Sagittate - Arrowhead shaped; used especially with reference to leaves possessing a pair of basal lobes, these lobes usually directed downwards.

Scapose - The inflorescence arising directly from the ground and not leaf-bearing.

Sepal - The outer whorl of flower parts, collectively the calyx. Usually the sepals are greenish and cover the other flower parts in bud.

Serrate - Toothed, the teeth slanting somewhat forward; usually employed with reference to leaf margins.

Sessile - A leaf or flower which is attached directly to the axis; without a petiole or pedicel.

Sheath - The tubular lower portion of a grass leaf surrounding the stem.

Siliqua - The fruit of the mustard family; typically two-chambered, dry, usually dehiscent.

Sinuate - Wavy; used especially with respect to leaf margins.

Spatulate - Spoon-shaped.

Spike - An unbranched inflorescence in which the flowers or flowering units are sessile.

Spikelet - The basic flowering unit within a grass inflorescence; consisting of a condensed stem axis bearing a pair of sterile bracts (glumes) at base and one or more florets above. The term spikelet is sometimes also employed with reference to similar flowering units in the sedge family.

Stamen - One of the male, pollen-producing organs of the flower. Consisting of a stalk, the filament, and the apical pollen-bearing anther.

Staminate - Possessing only stamens; may refer to a flower or to a plant.

Stigma - The terminal pollen-receptive portion of the pistil.

Stipules - Appendages, usually paired, arising from the stem at either side of petiole attachment; particularly characteristic of the legume family.

Stolon - A prostrate stem which roots at the nodes.

Style - The stalk-like part of the ovary which bears the stigma.

Subtend - To bear above; used especially with reference to a bract or a leaf which bears a flower in its axil.

Taproot - A root in which the main vertical axis predominates over the lateral branches, e.g. dandelion, carrot.

Tube - Referring to the basal tubular portion of many gamopetalous flowers.

Tuber - A swollen underground storage stem, e.g. a potato.

Tubular (flower) - Regular flowers characteristic of many members of the sunflower family. Such flowers may constitute the entire head or form the center portion of the head in those kinds which possess both tubular and ligulate flowers.

Umbel - An inflorescence in which the pediceled flowers arise essentially from the same point.

Whorled - A leaf arrangement; three or more leaves borne at each stem node.

Winter annual - An annual plant which usually initiates growth in the fall, lives over winter, and produces seed the following spring.