TERMINOLOGY USED IN PLANT DESCRIPTIONS

This is a review of terms used in these keys for identifying plants. Terms are also defined in the Glossary; some specialized terms are defined within the family descriptions at the beginning of each family.

Flowers

The foundation of plant taxonomy is the classification of plants according to their floral structure. Plants are most easily identified in this or any other key if they are in flower or fruit. A description of the typical floral structure is included in each family description.

Flowers may include the following parts, from the inside out: pistil (or pistils), stamens, petals, and sepals (Fig. 2). These are attached to the receptacle. The stalk which supports the flower is the pedicel. When both stamens (containing male gametes) and pistil (containing female gametes) are in the same flower, the flower is perfect; when only one of these organs is present, the flower is imperfect. If flowers are imperfect but flowers of both sexes (both staminate and pistillate flowers) are present on one plant, the plant is monoecious. When a single sex is present on one plant (i.e., two plants of different sexes are necessary for pollination), the plant is dioecious.

A pistil consists of an ovary containing one or more ovules (which develop into seeds), the (often) slender style, and the stigma or receptive surface at the tip of the style. The pistil is formed from one or more ovule-bearing units known as carpels. The number of carpels included in a pistil often can be determined by counting the number of styles and/or stigmas arising from the ovary. The interior of the ovary is often divided into chambers or “cells” known as locules. These are noted in family descriptions as, for example, “2-celled”. The number of locules is related to the number of carpels, although the loss of internal partitions between adjacent carpels may reduce the number of locules. A flower may have more than one pistil; in such flowers, each pistil consists of a single carpel and each style can be traced to a different ovary.

The position of the ovary with respect to the receptacle is also an important character. The ovary may be above the receptacle, so that the petals and sepals are attached beneath the ovary (Fig. 12); this is a superior ovary. When the ovary is enclosed by the floral tissue, so
that the petals and sepals are attached at the top of the ovary, it is an **inferior ovary** (Fig. 39).

These keys have been designed to require a minimum of dissection. However, to determine whether the ovary of a flower is superior or inferior, it may be helpful to use a knife to make a longitudinal cut through the center of the flower. Use a hand lens if necessary.

**Figure 2: Floral structure**

A **fertile stamen** consists of a slender **filament** and the **anther**, which contains pollen. Some stamens may be **sterile**, meaning that a stamen-like structure exists without a pollen-producing anther. This sterile stamen (or **staminode**) may also be petal-like (**petaloid**) in appearance, *i.e.*, expanded and colored. The fusion of stamen filaments with each other (so that they are **connate**) or the other floral parts can be significant in identification.

The **sepals** and **petals** together are the **perianth** of the flower. The number of sepals (together called the **calyx**) and petals (the **corolla**) is often an important character; a plant description might indicate
“parts in 4s” or that the “calyx and corolla are 4-merous”. While the sepals of most plants are green, they may sometimes be petaloid. In some flowers, it is difficult to distinguish sepals from petals, thus the plant description may simply refer to tepals. The sepals and petal may be separate (free) or more or less fused to one another (united). Fusion of parts is noted in family descriptions; if no mention is made, it should be assumed that the individual sepals and petals are separate.

The flower may be subtended by specialized leaves known as bracts. In some families, such as the Euphorbiaceae, the bracts may be colored or otherwise prominent and resemble petals (Fig. 26). A tightly organized arrangement of bracts called the involucre forms the base of the head of the Compositae and is also present in flowers of some other families. Flowers may be regular with all parts of a whorl being the same size and shape. Regular flowers (Figs. 13, 19, 34) are usually radially symmetrical; a cut through more than one direction will produce two similar halves. Irregular flowers are most often bilaterally symmetrical, where floral parts are grouped or fused so that a cut through only one plane will produce two equal halves (Figs. 23, 36, 39), or they may be entirely asymmetrical.

**Inflorescences**

Flowers occur in arrangements which are often characteristic of the plant species. The entire flowering portion of the plant, including flowers, “stems” (pedicels), and bracts, is referred to as the inflorescence (Fig. 3). When the flower or inflorescence is at the top or end of the stem, it is terminal. When the inflorescence or flower is located in an axil (usually subtended by leaves), it is axillary (or lateral). Solitary flowers are often terminal, sometimes on a scape arising from a rosette of leaves. Flowers on pedicels along a single unbranched axis, erect or drooping, form a raceme (Fig. 23). When pedicels are not present, the flowers are sessile and the inflorescence is a spike. The basic branched inflorescence is the panicle, in which pedicels are located along several branches arising from a central axis. In an umbel, all pedicels arise from a central point, with the flowers arranged in a flat plane or a convex rounded cluster (Fig. 14). A corymb has a similar appearance, but the pedicels arise at different points along the stem. Both the umbel and corymb may be compound, with different tiers of pedicels within the inflorescence.
Terminology Used in Plant Descriptions

Figure 3: Inflorescence types

(Fig. 28, compound umbel). Combinations of two inflorescence types may occur, such as a panicle of racemes (Fig. 15). The *cyme* may take many forms, but is always characterized by a single central flower which matures before the rest of the inflorescence (Figs. 22,
The head is composed of flowers tightly arranged on a flat or discoid axis (Fig. 41). The typical inflorescence of the Araceae is the spadix, a fleshy spike, subtended by a large bract, the spathe. Catkins are typical of many woody species; they are spikes or racemes of unisexual flowers.

**Fruits**

The type of fruit produced is often a key character in plant identification; an ideal specimen includes both flowers and fruits. Fruits are the ripened ovaries of flowers, contain the seeds, and may include accessory structures. Some types of fruit are dry at maturity, while others have a fleshy fruit wall.

**Indehiscent** dry fruits do not open to release seeds at maturity. The fruit wall and the seed coat are fused together in the grain, the characteristic fruit of the Gramineae. The achene is also a small single-seeded fruit, with a dry thin fruit wall closely appressed to the seed coat. Wings or other appendages may be attached to the achene (Fig. 15); a samara is a winged achene typical of some woody plants. A utricle is a small single-seeded fruit resembling an achene, but with the fruit wall loose from the seed coat. Nuts and nutlets are dry indehiscent fruits with hard fruit walls. Sometimes there is an involucre attached to the nut, as in the acorn (the characteristic fruit of Quercus spp., Oaks).

**Dehiscent** dry fruits open to release seeds. The capsule develops from an ovary with more than one carpel, so that internal partitions between locules (“cells”) are often visible. Seeds are released when the capsule opens at the top or sides. A follicle forms from one carpel and splits along one seam (Fig. 32). A legume is also formed from one carpel but splits along two seams; it is the typical fruit of the Leguminosae. The silicle and silique each split along both sides, leaving a membranous partition in the middle; they are typical of the Cruciferae (Figs. 19, 20). Pieces of the dry fruit wall which separate from one another during dehiscence are called valves. A schizocarp arises from an ovary where the mature carpels split away from one another, so that each unit (a mericarp) resembles an entire indehiscent fruit.

Fleshy fruits are all indehiscent. The berry is several-celled (though partitions may not be visible at maturity) and many-seeded. A drupe
has a single, usually large seed. A *pome* is typical of some Rosaceae (such as *Malus*, apple), in which the swollen, fleshy receptacle encloses the papery fruit wall. Some plants have multiple fruits which develop from the entire inflorescence.

**Leaves**

The leaf consists of a *petiole* (usually stalk-like) and an expanded *blade* (Fig. 4). The leaf is attached to the stem at the *node*, while the length of the stem between leaf attachments is the *internode*. Either the petiole or the blade may be modified or missing; the leaves of some plants lack blades and consist only of petioles, flattened or not. *Sessile* leaves only have a blade. In other leaves, the petiole may be flattened to form a

![Figure 4: Leaf structure](image-url)
sheath, which encircles the stem; a ligule, a ridge of tissue at the top of the sheath, may be present. Small (usually) leaflike structures, the stipules, are often present at each side of the point of leaf attachment. The space described by the angle between the upper side of the leaf attachment and the stem is referred to as the axil. The axillary bud may eventually expand to produce a branch or a flower.

Venation is an important character for identification (Fig. 4). The central vein (the midrib) is usually the most prominent. When other especially prominent veins are visible, they are called nerves. In leaves with net venation, two patterns of venation are possible. Secondary veins arise in two rows along the midrib in a leaf with pinnaate venation, while secondary veins arise from a central point near the petiole in palmate venation. In leaves with parallel venation, all major veins are parallel to the midrib.

Leaf arrangement (Fig. 5) may be alternate, in which one leaf is attached at a node, opposite, with a pair of leaves at a node, or whorled, with three or more leaves at a node.

Leaves may have an undivided blade (a simple leaf), or may be divided into leaflets (a compound leaf). Pinnately compound leaves are based on pinnate venation, with parts of the midrib exposed between individual leaflets (Fig. 5). Palmately compound leaves are based on palmate venation, with leaflets meeting at a central point. A ternately compound leaf has three leaflets, based on palmate venation. A trifoliolate leaf has three leaflets, based on pinnate venation. Leaves may also show two or even three levels of compoundness; a twice-pinnately-compound leaf is referred to as bipinnate. A simple rule to distinguish leaflets from leaves is to look for an axillary bud; leaves have them, leaflets do not.

Leaf shapes are shown in Fig. 6. Terms for the shape of the leaf apex and leaf base are illustrated in Fig. 7. Peltate leaves are often round, with a centrally attached petiole. Perfoliate leaves are sessile, with the leaf base entirely surrounding the stem. Decurrent leaf bases continue down the stem as ridges of tissue. Leaf margins (Fig. 8) may be entire (lacking teeth or indentations), toothed, or lobed. Leaves may be pinnately lobed (based on pinnate venation) or palmately lobed. Deeply lobed leaves, with sinuses extending three-quarters of the distance from the margin to the midrib or more, are
Figure 5: Leaf arrangement; compound leaves
divided. Leaves divided into many narrow segments, producing a feathery appearance, are dissected (Fig. 8). Note that lobed, divided, and dissected leaves still retain some blade tissue along the midrib, in contrast to compound leaves. Terms for different types of toothed margins are illustrated in Fig. 8.
Surfaces

Stems, leaves, and floral parts may have distinctive surface structures or appearance which are useful in identification. A magnifying glass or hand lens is sometimes useful to distinguish them. A surface without hairs is *glabrous*. A hairy surface is *pubescent* and is covered by *pubescence*, which can be quite variable in length, shape, and texture. For example, a *pilose* surface is covered with fine, thin hairs, while a *tomentose* surface is densely hairy. Hairs may have special shapes, such as hooked or *stellate* (star-shaped). Hairs which point down towards the base of the plant are *retrorse*. A *glaucous* surface is noticeably waxy, with a bluish or whitish bloom; a *glan-*
dular surface has visible, often darker, gland cells. Surfaces may be punctate, with tiny depressions, or tuberculate, with small protrusions. Prickles are sharp pointed extrusions and may be found on any surface, while thorns are hard, sharp modified branches found at axils and stem tips.

Figure 8: Leaf margins
Plant form

Terrestrial plants fall into two obvious categories. Woody plants include trees, shrubs, and woody vines. They typically persist over many growing seasons as above-ground woody structures. Herbe- ceous plants (sometimes called herbs) consist of succulent green tissue which does not persist through an entire year (typically dying back in winter) in Michigan. Plants which form rosettes of leaves close to the ground are an exception. Subshrubs are mostly herba- ceous plants with a small amount of persistent woody tissue; the upper parts die back as with herbs.

Aquatic plants may be submerged entirely, floating, emergent (lifted somewhat above the water), or merely growing in very wet soil at water’s edge.

The stem growth habit of a species may be distinctive. Plants are upright (erect) or prostrate, growing completely flat on or along the ground. They may also be decumbent (stems trail along the ground, but tips are erect), spreading (stems are held more or less horizontal), or ascending (stems angle upward). Plants dependent on other plants or objects for support are usually considered to be vines. These may climb (lean on trees or shrubs, anchored with thorns, tendrils, or branches) or twine (wrap around stems of the other plant).

The pattern of maturation and flowering is a useful character in identification. Woody species and many herbs are perennial, in that the plant lives for more than two growing seasons and (usually) flowers each season. Herbaceous perennials in Michigan die back to a root system, crown (a thickened stem with buds), or a flat rosette of leaves. Plants which are not perennial exhibit several possible flowering patterns. Annuals germinate from seed, mature, flower, fruit, and die in one growing season; most often this is during spring, summer, and fall. However, winter annuals germinate in the fall, form a rosette, and bolt (send up a flower stalk) with the onset of warm weather and the correct daylength, often completing their entire life cycle by late spring. Biennials germinate in the spring or summer of one growing season, overwinter (usually as a rosette) and then flower and fruit in the second growing season.
Reading a family description

The description of each plant family contains information in a compact format. This representative, though fictional, family description has been annotated to assist in interpretation of the format. Note that the numbers of floral parts are sometimes shown in ranges; in these cases, the number of that part varies, with numbers in parentheses representing unusual conditions. The flowering season is indicated at the end of the description when all Michigan representatives of the family flower in the same season.

Small, monoecious (look for two sexes of flowers on one plant), aquatic herbs with opposite, entire leaves. Flowers regular, unisexual (staminate or pistillate), small, 1 or 2 per leaf axil (either condition is likely); sepals 0; petals 0 (sepals and petals are absent); stamens 1–3(5) (usually 1 to 3 stamens, but can have up to 5); pistil 1, styles 2 (a single ovary with two styles); ovary superior (a long-section will show that the ovary sits on top of the receptacle), 4-celled (a cross-section of the ovary will show 4 compartments). Fruit splitting into 4 nutlets. Summer.