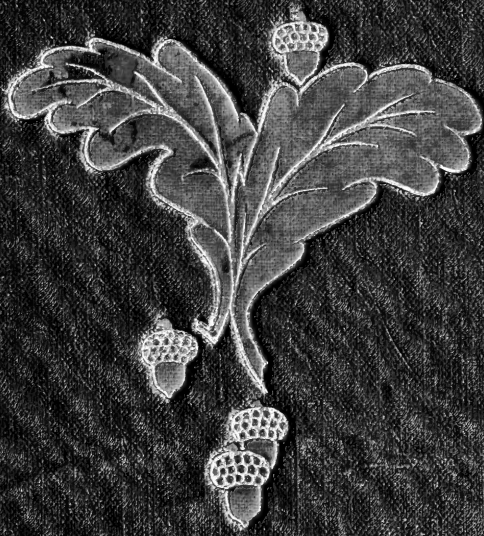


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TREES

AND HOW TO KNOW THEM



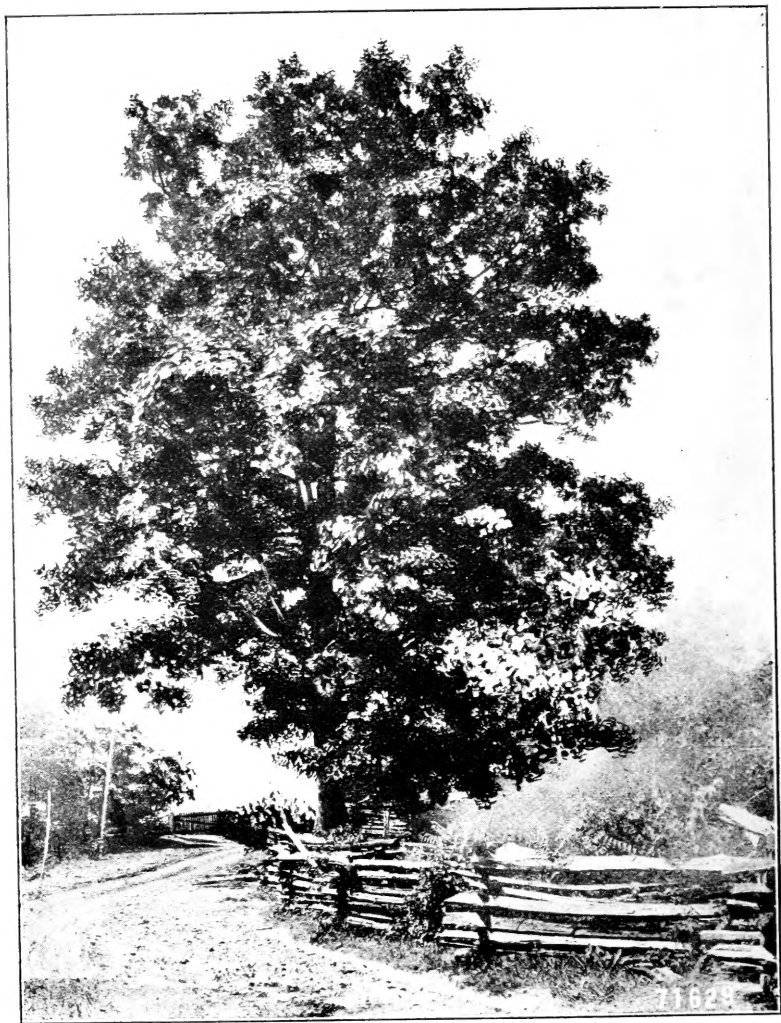
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TREES
AND HOW TO KNOW THEM



WHITE OAK

Botany
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TREES

AND HOW TO KNOW THEM



A MANUAL

WITH

Analytical and Dichotomous Keys of the Principal Forest
Trees of the South



By

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and

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PREFACE

The practical study of trees for many years, together with an effort to instruct others, has led me to prepare the keys offered in this book; they have grown from a few pencil notes relative to the trees in the University grounds and vicinity to a more comprehensive tabulation of the principal forest trees of the Southern States. All the trees of this territory are not included, because an exhaustive list would make the keys so cumbersome as to threaten their practical use. On the other hand they include many trees that are not indigenous to the territory. It was thought well to do this because the importation of foreign varieties for ornamental uses has made desirable a knowledge of their relationship.

Both keys place the emphasis upon the leaves rather than upon the flowers. This method has been followed because of the fact that leaf characters are more easily mastered by the beginner; their distinguishing features are complex, to be sure, but such complexity does not approach the many difficulties which are offered by a method based upon the flowers. Moreover, many of the public schools are not yet equipped with laboratories, without which it would be impractical to depend upon a flower key. Another, and the paramount reason, is that each key is intended for practical use in the field where the observations, when made, are of the character that produces real knowledge, stimulates the young mind, and gives encouragement and confi-

dence to those who would undertake further the study of nature. While the keys avowedly direct the enquirer to the name of the tree, the questions to be decided are so arranged that the student at each step is forced to observe for himself the important characteristics of trees, so that in the end he cannot help but see relationships that enable him to form useful and comprehensive conclusions.

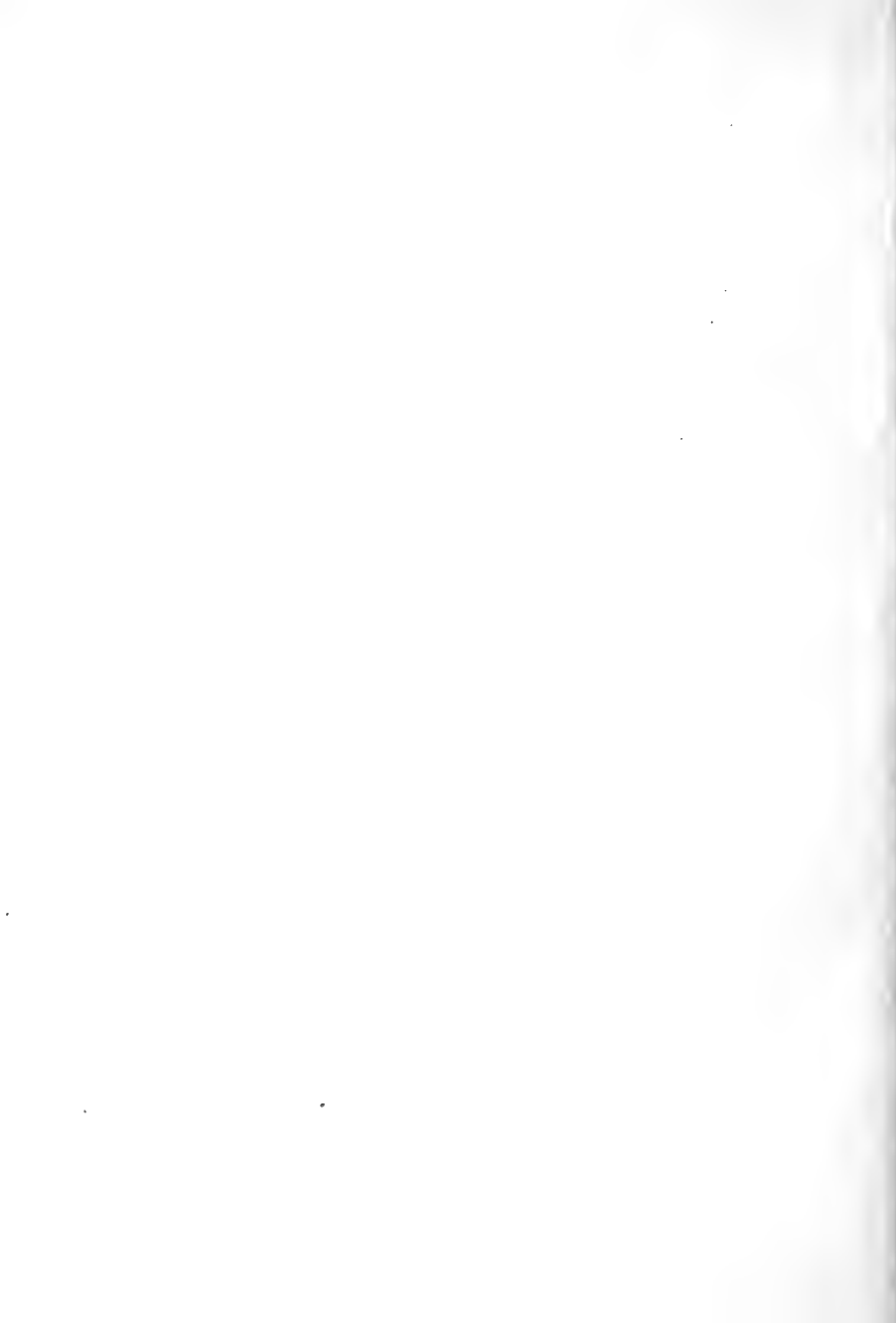
It is believed that a class exercise in the woods for a few hours each week, especially during the spring months, supplemented by leaf study in the school, will give to our youth a comfortable and practical knowledge of their most useful and majestic plant neighbors.

W. A. LAMBETH.

UNIVERSITY OF VIRGINIA, *June, 1911.*

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TREES

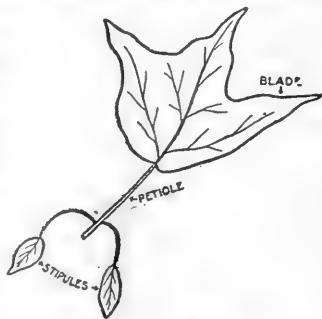
AND HOW TO KNOW THEM

LEAVES

The classification of the principal forest trees of the Southern States, as given in this book, is an arbitrary one based mainly upon the leaves; such a classification, confining itself primarily to one organ, can be of great use only when the detail of that organ and its parts have been closely and accurately studied.

Function.—The leaf is the organ by which a tree or shrub is brought into useful contact with the carbonic acid of the air; when exposed to sunlight, the leaf unites this carbonic acid with the nitrogen brought up to it in the sap from the roots below.

Three Parts of a Leaf.—A complete leaf is said to consist of three parts: the *blade* or expanded portion, the stem or *petiole*, by which it is attached to the shoot, and a pair of appendages, leaf-like in character, which are called *stipules*. The blade is constant; but the stipules are not often observed by the beginner, for in most plants they fall away before the leaf is expanded. They can usually be found on willows and the black sugar maple. The petiole, or stem, is constant though frequently obscured by the extension downward of the blade on the side of



1. BLACK SUGAR MAPLE LEAF
SHOWING THREE PARTS

the midrib to its point of attachment on the shoot. When this condition exists, the leaf is said to be *sessile* or without petiole.

Simple and Compound Leaves.—As a general rule, leaves have only one blade, as the oak, sugar maple, and elm; such leaves are called *simple leaves*. But the leaves on many plants have each three or more blades, each sub-blade being called a *leaflet*. These refinements in definition make it troublesome for beginners to determine in some cases just what a leaf is. This difficulty is avoided to some extent by regarding as one leaf all the expanded part or parts, with the stem or stems attached, extending from the axillary bud to the tip. That the axil of



2. COMPOUND LEAF



3. SIMPLE LEAF

every leaf contains a bud is a biological rule without exception, but in nature it is frequently very much obscured; for, although there is a potential axillary bud, many of these never develop, so that frequently leaves without the axillary bud are found. The question can always be settled, however, by the examination of several leaves on the plant under observation. Very few of the narrow linear leaves of conifers have axillary buds, but most trees with expanded leaves have such buds well developed.

When the part of the plant thus defined as a leaf has more than one expanded portion, or is made up of leaflets, the leaf is said to be a *compound* leaf. (Fig. 2.) When only one blade is present, it is said to be a *simple* leaf. (Fig. 3).

Position of Leaves on the Stem.—The order of the attachment of leaves to the stem, or shoot, is made use of for purposes of classification. When the leaves are close together, yet separate from one another, and in their attachment are arranged all around the shoot, they are said to be *scattered*. Such is the case with the leaves of spruces and firs. When they are attached in pairs, one leaf attached on the shoot opposite another, as in a maple, they are said to be *opposite*. (Fig. 4).



4. OPPOSITE

5. ALTERNATE

6. WHORLED

When the leaves are attached singly and not opposite, they are called *alternate*. (Fig. 5.)

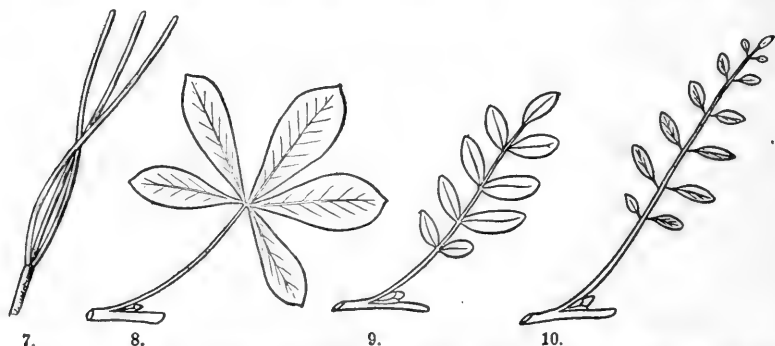
When three or more leaves are attached at the same level on the shoot, the arrangement is said to be *whorled*. (Fig. 6.)

When, as in the case of the pine family, two or more leaves are bundled together in the same attachment, they are said to be *fasciculated*. (Fig. 7.)

It is not always easy in the examination of the leaves on dwarfed lateral twigs to determine which of the methods of

attachment prevails; therefore examination of extended, thrifty terminal shoots is essential.

Frequently scattered leaves, as seen in the hemlock, and alternate leaves, as seen in the elm, have an arrangement of the leaf blades in one plane to the right and left of the shoot; when such is the case, the leaves are said to be *two-ranked*, regardless of what the real attachment may be. Thus the term 'two-



7, FASCICULATED; 8, PALMATELY COMPOUND; 9, PINNATELY COMPOUND (leaflets sessile); 10, PINNATELY COMPOUND (leaflets petiolate).

ranked' does not apply to attachment in any case, but only to the *position* taken by the blade in relation to the stem.

A compound leaf in which all the leaflets are attached at one place on the petiole is said to be *palmately compound*. (Fig. 8.)

If the leaflets are scattered in their attachment along the midrib of the leaf, it is said to be *pinnately compound*. The pinnae or leaflets may be attached to the midrib without a stem, in which case they are said to be *sessile* (Fig. 9); but, if attached by means of a stem, they are said to be *petiolate*. (Fig. 10.)

Termination of Compound Leaves.—Pinnately-compound leaves may terminate with an odd pinna at the tip, and are then

called *odd pinnate* (Fig. 11); or they may end with a pair of lateral pinnae, in which case they are called *abrupt pinnate*. (Fig. 12.)

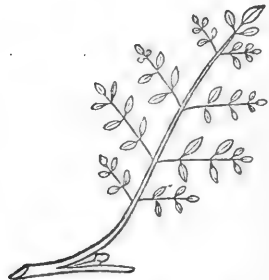
Pinnately-compound leaves are further modified by having their leaflets or pinnae sub-divided into pinnules; in which case they are said to be *twice pinnately-compound*. (Fig. 13.)



11. ODD PINNATE



12. ABRUPT PINNATE



13. TWICE PINNATELY-COMPOUND



14. PINNATELY OR FEATHER VEINED



15. PALMATELY VEINED, OR THREE-RIBBED

Twice-pinnately-compound leaves may be either twice-odd-pinnately compound or twice abrupt-pinnately compound, and the pinnules may be either petiolated or sessile.

Framework or Veining of Leaves.—For classification great use is made of the veining of leaves. If the larger veins of the blade take origin separately along the side of the midrib, the leaf is said to be *feather veined* or *pinnately veined*. (Fig. 14.)

If, however, the larger veins arise from the midrib nearly together at the base of the blade, the leaf is said to be *palmately veined*, as seen in the maple and sycamore. (Fig. 15.)



16. ORBICULAR



17. OVAL



18. ELLIPTICAL



19



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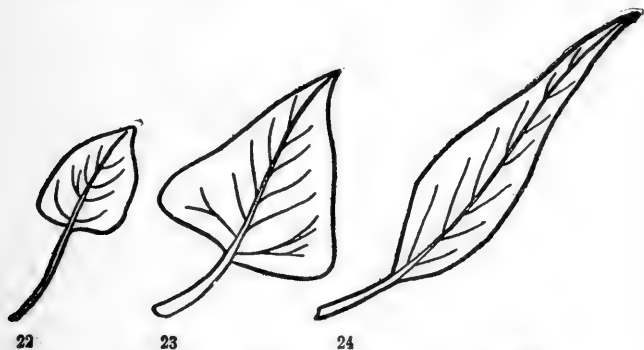
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19, LINEAR; 20, OBLONG; 21, NEEDLE-SHAPED

Leaf Shapes.—For further distinction, use is made of the shape or outline of leaves disregarding the petiole. They are usually placed in three great classes:

FIRST. Those whose transverse diameter at or near the middle is as great as, or greater than, any other transverse diameter:

(1) *Orbicular*—when about as broad as long (Fig. 16); (2) *oval*—longer than broad (Fig. 17); (3) *elliptical*—twice, or more, as long as broad, the two sides partially parallel (Fig. 18); (4) *linear*—six or more times as long as broad (Fig. 20); (5) *oblong*—three times as long as broad, the two sides nowhere parallel (Fig. 20); (6) *needle-shaped*—without obvious expansion, like a fir, spruce, or pine leaf (Fig. 21).



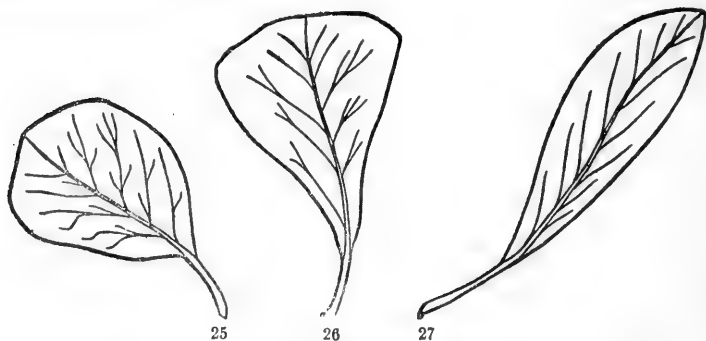
22, OVATE; 23, DELTOID (Triangular); 24, LANCEOLATE

SECOND. Leaves with their greatest transverse dimension near the base or petiole:

(1) *Ovate* (Fig. 22); (2) *Deltoid* (Fig. 23); (3) *lanceolate* (Fig. 24); (4) *awl-shaped*, curving like an awl and with a sharp point, as seen in the leaves of juniper or Virginia red cedar; (5) *scale-shaped*, as seen in the flattened, scaly, appressed leaves of the common arbor-vitae.

THIRD. Leaves with their greatest transverse measurement near the tip or free end:

(1) *Obovate*—reversed ovate (Fig. 25); (2) *obdeltoid*—reversed wedge-shaped—reversed deltoid (Fig. 26); (3) *oblanceolate*—reversed lanceolate (Fig. 27).



25, OBOVATE; 26, OBDELTOID; 27, OBLANCEOLATE



28. OVATE LANCEOLATE



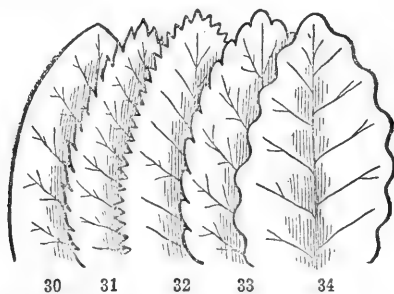
29. OBOVATE

These shapes are based upon the outline of all the parts of a *blade* disregarding any irregularities produced by notches, lobes, pinnae, or leaflets. For instance, a compound leaf, as shown in Figure 28, is called *ovate lanceolate* because the dotted line enclos-

ing all the parts of the blade takes the shape indicated. The two names combined indicate that the outlines of the leaves have the characters of both ovate- and lanceolate-shaped leaves, and as it is nearer lanceolate than ovate the term lanceolate is placed last.

The same method is applied to simple leaves. Figure 29 represents a leaf of the red oak, which is described as *obovate* because the circumscribing line gives such a figure. Of course on the same tree would be found leaves oval in outline; but, as most of them are found obovate, it is so described.

Margins, Tips, and Bases of Leaves.—Besides the general shape of leaves, the margins, the tips, and the bases have special and peculiar features which are made use of for descriptive purposes.



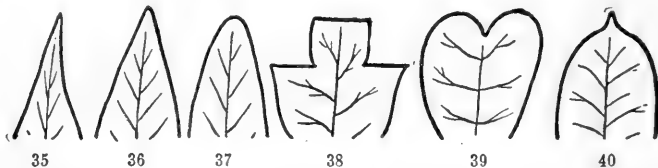
30, ENTIRE; 31, SERRATE; 32, DENTATE; 33, CRENATE; 34, SINUATE

1. MARGINS. The margin may be uncut by notches or sinuses, and when so unmarked, it is said to be *entire* (Fig. 30); when notched like the edge of a saw, with teeth pointing to the tip of the leaf, it is called *serrate* (Fig. 31); when both margins of the teeth of a serrate leaf are of nearly equal length, it is said to be *dentate* (Fig. 32); when the points of a serrate leaf are rounded it is said to be *crenate* (Fig. 33); when the notches and teeth are

bounded by curving lines, it is said to be *sinuate* or *undulate* (Fig. 34).

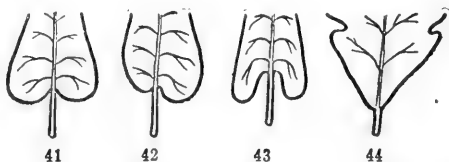
If the larger teeth on the margins are themselves toothed or notched, the leaf is said to be *twice serrate-dentate*, etc.

2. TIPS. The terms used for designating the peculiarities of leaf tips are indicated below.



35, ACCUMINATE; 36, ACUTE; 37, OBTUSE; 38, TRUNCATE; 39, CORDATE; 40, CUSPIDATE

3. BASES. Descriptive terms applied to leaf bases are indicated below.



41, CORDATE; 42, OBLIQUE; 43, AURICULATE; 44, WEDGE-SHAPED

General Terms and Explanations.—The character of the surface of leaves is also useful in designating plants. When the surface is slick or smooth, it is called *glabrous*; when covered with fine soft hairs, *pubescent*.

A leaf is said to be *succulent* when thick, herbaceous, and fleshy; *membranous* when thin, soft, and translucent.

Leaves are *evergreen* when they remain green through two or more seasons. When not more than one year old, they are

lighter in color than the older ones. Leaves are *deciduous* when they fall off at the end of their first season.

The twigs and branches of forest trees extend their length by annual growths from the terminal bud of the preceding year; between these growths there is an annular mark or ring around the shoot, called a *node*. This node marks the position of a previous terminal bud, and the length of shoot between any two nodes measures the extent of growth during the season following the opening of the bud. The part of the shoot between two nodes is called the *internode*, and while it increases in diameter from year to year it never increases in length after the first year. A nail driven into a tree three feet above ground will remain at that distance regardless of the tree's continued growth in height.

By examination, beginning at the present terminal bud, we can determine at any time, even when the plant is in summer foliage, whether or not the tree is an evergreen. If we observe that there are leaves attached behind the last node or that they are on wood which was made the previous year or years, the tree is an evergreen. So likewise we can determine a deciduous tree in summer by observing that no leaves can be found on any wood more than one year old.

We can determine further how long the tree retains its leaves, for, although the tree may remain in green foliage throughout the year, the foliage is always changing. By counting backward the number of nodes which have attached to them green leaves, we can determine the number of years required to change the foliage completely. Thus by counting backward on the fir or spruce, we find leaves on nine or ten consecutive nodes and conclude that each leaf remains on the tree nine or ten years.

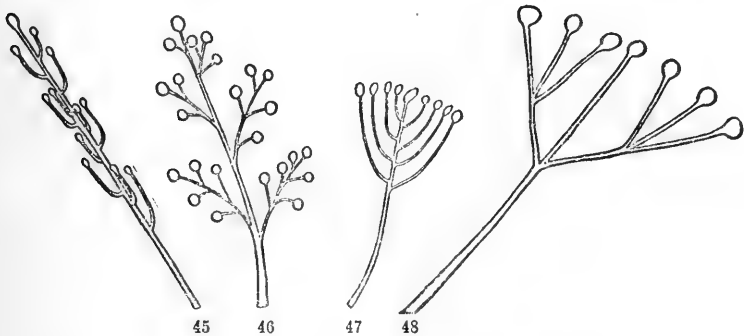
We can also determine by the position of leaf scars in winter whether or not, in a deciduous tree, the leaves are alternate or opposite.

In firs, cedars, and spruces it is frequently possible to determine the age of the tree because of their habit of developing a ring of axillary buds around the terminal bud of each season. This gives a trunk with whorls of branches at the end of each year's growth.

FLOWER CLUSTERS AND FRUITS

In the arrangement of these keys some use has been made of the difference in the arrangement of the flowers and in the character of the fruits.

Flowers.—A *raceme* of flowers or fruits is an arrangement of individual flowers on the main axis each with a separate pedicel, all about equal in length. (Fig. 45).



45, RACEME; 46, PANICLE; 47, CORYMB; 48, CYME

A *panicle* is a cluster twice compound and spreading. (Fig. 46).

A *corymb* is an arrangement by which the pedicels arising at different points on the peduncle terminate near the same level. (Fig. 47).

A *cyme*—in this case the flowers terminate at the same level, but the pedicels are compound, dividing into pedicellets. (Fig. 48).

Fruits.—An *acorn* is a nut partially covered by a dry scaly involucre, called the cup; *e. g.*, the fruit of the oak.

A *nut* is the inner hard parts of such fruits, as the fruit of the beech, chestnut, hickory, and walnut.

An *apple* is a fleshy fruit, with the seeds in a specialized hard covering, buried in the pulp with the remains of the old calyx or flower at the free end of the fruit; *e. g.*, the fruit of crabs and haws.

A *berry* is a pulpy fruit in which the hard seed are embedded without a special covering, and the calyx or flower, if any, is at the attached end.

A *drupe* is a fruit with one large, hard seed embedded in a pulpy or fleshy mass, as a cherry.

A *legume* is a pea-like pod splitting at both edges without a dividing partition, as in the fruit of the red bud.

A *samara* or *key* is a dry fruit with winged margins, as in the fruit of elms, ashes, maples, and hop trees.

A *cone* is a mass of scales enclosing the seed. Sometimes the scales are thin and overlapping, as in the spruce; they may, however, be thick and meet edge to edge without overlapping, as in the white cedar and cypress. They are usually dry, though they may be soft and pulpy, as in the juniper and yew. When the scales of a cone overlap, it is said to be *imbricated*; when the edges only meet, they are said to be *valvate*.

ANALYTICAL LEAF KEY

How to Use the Key.—Suppose that while standing before a tree in July we make the following observations:

(1) That the leaves are narrow, linear, flattened, with an upper and lower surface and two lateral edges (hence not four-sided or needle-shaped); (2) that when we pull a leaf off, instead of leaving a stump or part of it attached to the stem, there remains a round dot perfectly smooth as if the leaf had been glued on; (3) that we see green leaves on wood several years old; (4) that, although the leaf is narrowed at its attachment, it is sessile and has no petiole; (5) that the leaves are irregularly scattered around the shoot; (6) that in the top of the tree there are some cones standing erect, not hanging down.

Turning to the key, we find that the facts in regard to a leaf of this tree can be included under the class of leaves numbered 1 under First Division; then reading a^1 we find that it is still included; but when we read b^1 under a^1 we find it excluded, for we have observed that it is strongly *evergreen*. So we go to b^2 and find it again included; but c^1 excludes it as the leaf is *linear*; going at once to c^2 , we find it again included. Examining d^1 under c^2 , we find it again excluded, for our leaf is *sessile*, not petiolated. We then try d^2 and find that it is again included. But we cannot fit the observations to the statement under e^1 as our leaf is not whorled; reading e^2 , we find it included. We also find it under f^1 , for our leaf is *flat*; under g^1 we find that the description of the leaf and cones agree with the observations. Hence the tree is a fir (*abies*).

FIRST DIVISION

1. Leaves scale-shaped or awl-shaped, narrow or needle-shaped; many species, but not all of them, evergreen.

a¹ Leaves irregularly and separately scattered on the twig, but never in clusters or bundles.

b¹ Leaves feebly evergreen in very slender, delicate, feather-like sprays

c¹ Leaves broadened at base, somewhat clasping, narrowing to an acutely pointed tip, not spreading from the stem filament or twig; clusters of pink, spike-like flowers. *Tamarix.*

c² Leaves slender, longer, diverging from twig, feather-like, not clasping, deciduous (carrying young twig when falling); fruit, rounded, rough-sculptured, valvate cones which begin falling in December. *Taxodium* (Bald Cypress).

b² Leaves completely evergreen.

c¹ Leaves awl-shaped, scale-shaped, not diverging from the stem but closely appressed.

d¹ Leaves markedly 2-ranked.

e¹ Cones elongated, of 6-10 overlapping scales.

Thuja (Arbor Vitae).

e² Cones rounded, of valvate scales.

Chamaecyparis (White Cedar).

d² Leaves not 2-ranked, spray branching irregularly.

e¹ Fruit, a purple berry; bark shreddy. *Juniperus* (Red Cedar).

c² Leaves needle-shaped, diverging from the stem.

d¹ Leaves narrowing to a short but well-defined petiole.

e¹ Leaves 4-sided with brown petiole attached to rough and somewhat ridged stem; fruit, a 2-4 in. valvate cone.

Picea (Spruce).

e² Leaves 2-sided (flattened), with greenish petiole.

f¹ Leaves rounded or pointed at tip, striped underneath; 2-ranked, less than 1 in. long; oval cones 1 in. long with overlapping scales. *Tsuga* (Hemlock).

f² Leaves acutely pointed; fruit dioecious, drupe-like with single hard seed.

g¹ Leaves not 2-ranked, more than 2 in. long. *Podocarpus.*

- a¹b²c²d¹e²f²g²** Leaves 2-ranked.
- h¹** Leaves with 2 longitudinal lobes, with disagreeable odor when burned or bruised; ornamental, yew-like evergreen. *Torreya* (American Yew).
 - h²** Leaves with midrib in a sharp ridge, odor not disagreeable.
 - i¹** Leaves less than 1 in. long. *Taxus* (Yew).
 - i²** Leaves much longer than 1 in. *Cephalotaxus*.
- d²** Leaves without petiole, sessile.
- e¹** Leaves whorled or opposite.
- f¹** Leaves not decurrent, sharp pointed, usually in whorls of 3 around stem; fruit rounded, blue, $\frac{3}{16}$ in. in diameter and berry-like. *Juniperus* (Red Cedar).
 - f²** Leaves decurrent but less than $\frac{1}{2}$ in. long.
 - g¹** Fruit, a small, rounded, cone; scales not overlapping. *Chamaecyparis* (White Cedar).
 - g²** Fruit, cones, of 6-8 overlapping scales. *Thuja* (Arbor Vitae).
- e²** Leaves spirally arranged or scattered around stem, not opposite.
- f¹** Leaves linear, flattened, spreading at right angle from stem.
 - g¹** Leaves linear with disk-like attachments to stem; cones, erect, very resinous; scales overlapping. *Abies* (Fir).
 - g²** Leaves 2 in. long, widening from pointed tip to a broad $\frac{1}{2}$ in. base, which is decurrent; ornamental, not indigenous. *Cunninghamia*.
 - f²** Leaves 4-sided, not flattened, curved, enlarging from tip to base, completely covering young twigs; cones rounded; scales not overlapping. *Cryptomeria* (Japanese Cedar).
- a²** Leaves in vari-numbered clusters or bundles.
- b¹** Clusters in umbrella-like whorls around the stem; not indigenous. *Sciadopitys* (Umbrella Pine).
 - b²** Leaves in bundles of 2-5. *Pinus* (Pine) (See family).
 - b³** Leaves in bundles of 6 or more.
 - c¹** Leaves flexible, soft, deciduous, clustered around the lateral twigs. *Larix* (Larch).
 - c²** Leaves rigid, prickly, evergreen. *Cedrus* (Cedar).

SECOND DIVISION

1. Leaves broadly expanded; most of the species deciduous, but a few of them, like the magnolia and holly, evergreen.

a¹ Leaves simple and alternate.

b¹ Leaves with netted veins and midrib.

c¹ Leaves with pronounced feather veining.

d¹ Leaves with margin entire or nearly so.

e¹ Leaves thick, 2-3 in. long, revolute margin, evergreen; fruit an acorn. *Quercus* (Oak) (See family).

e² Leaves evergreen, oval, or lanceolate; small trees or shrubs.

f¹ Leaves aromatic; berries dark blue on red stalks.

Persea (Bay).

f² Leaves not aromatic, 1 ft. long; flowers large, solitary.

Magnolia.

f³ Leaves not aromatic, 1-4 in. long; flowers very small; fruit, dark berries. *Rhamnus* (Buckthorn).

f⁴ Leaves not aromatic; flowers large and in clusters; leaves 6 in. long; fruit, a nut-like capsule. *Rhododendron*.

f⁵ Leaves not aromatic, 3-4 in. long. *Kalmia* (Laurel).

e³ Leaves deciduous.

f¹ Plant somewhat spiny

g¹ Fruit, a 2-4 seeded berry; juice not milky.

Rhamnus (Buckthorn).

g² Fruit, large, orange color when ripe; juice milky.

Maclura (Osage Orange).

g³ Fruit small, cherry-like, black when ripe; juice milky.

Bumelia (Buckthorn).

f² Plant not at all spiny.

g¹ Leaves thin, long pointed, with curving, parallel veins or ribs. *Cornus* (Dogwood).

g² Leaves thin, oval, or circular in outline, with blunt, rounded apex; veins not parallel; fruit, a red berry in terminal panicles. *Rhus* (Sumac).

g³ Leaves elongated, 5 times as long as wide.

h¹ Wood soft; both sexes of flowers in catkins; leaves with stipules; seed with cotton in capsules. *Salix* (Willow).

h² Wood hard, leaves thick; fruit, an acorn. *Quercus* (Oak).

a¹b¹c¹d¹e³f²g⁴ Leaves unlike **g¹**, **g²**, or **g³**.

h¹ Deciduous bud scales or stipules, leaving a ring scar all around stem at base of leaves; fruit, cone-like body.

Magnolia.

h² Without ring scars or scales on leaves.

i¹ Leaves distinctly straight veined and thin.

Fagus (Beech).

i² Leaves thick, obtuse; fruit, an acorn. *Quercus* (Oak).

i³ Leaves 6 in. or longer; fetid odor when bruised; fruit, a banana-like pulpy mass. *Asimina* (Papaw).

i⁴ Leaves 3-5 in. long; twigs and leaves spicy; a shrub; yellow flowers; fruit, a drupe. *Lindera* (Spicebush).

i⁵ Leaves 2 in. long, oval; twigs with ridges running down from the leaf stalk. *Lagerstroemia* (Crepe Myrtle).

i⁶ Leaves unlike **i¹**, **i²**, **i³**, **i⁴**, or **i⁵**.

j¹ Fruit, a $\frac{1}{2}$ - $1\frac{1}{2}$ in. long, pulpy berry with thickened calyx. *Diospyros* (Persimmon).

j² Fruit small, $\frac{1}{4}$ in. long; fleshy drupe, striate stone; lower branches drooping. *Nyssa* (Black Gum).

j³ Fruit, a black, juicy berry, $\frac{1}{3}$ - $\frac{1}{2}$ in. long, 3 seeds.

Rhamnus (Buckthorn).

j⁴ Fruit, an ovoid dry drupe, $\frac{1}{2}$ in. long; leaves sweet to the taste. *Symplocos* (Sweetleaf).

j⁵ Fruit, an apple-like pome. *Pyrus* (Quince).

d² Margins once or twice serrate, crenate, wavy-edged but not lobed.

e¹ Leaves straight veined.

f¹ Leaves harsh, oblique at base, distinctly 2-ranked; tree; fruit, a circular samara. *Ulmus* (Elm).

f² Leaves oblique at base, margin wavy; shrub or bush; fruit, a dry nutlet or capsule. *Hamamelis* (Witch Hazel).

f³ Plant thorny; fruit berry-like with a spreading calyx.

Crataegus (Hawthorn).

f⁴ Leaves not oblique; plant not thorny.

g¹ Leaves thin, soft or smooth; bark smooth.

h¹ Leaves generally aromatic; bark peeling in papery layers.

Betula (Birch).

h² Bark not peeling.

i¹ Leaf buds long and slender; fruit, a prickly burr with 2 seeds. *Fagus* (Beech).

- a¹b¹c¹d²e¹f⁴g¹h²i²** Fruit, an elongated catkin with large leaf-like bracts.
Carpinus (Blue Beech).
- i²** Fruit, a leaf-like catkin with large leaf bracts; bark close; trunk grooved. *Ostrya* (Ironwood).
- g²** Leaves thick, edge wavy, almost lobed; fruit, an acorn.
Quercus (Oak).
- g³** Leaves broad, wavy and serrate or doubly serrate; shrubs, rarely trees.
- h¹** Fruit an open woody cone remaining until after new cones mature. *Alnus* (Alder).
- h²** Fruit, a rounded filbert-like nut in hairy, green, fluted-edge, leaf-like bracts. *Corylus* (Hazelnut).
- g⁴** Unlike **g¹**, **g²**, or **g³**.
- h¹** Leaves more than 3 times as long as wide; widest near center; fruit, a round, prickly burr, 2-3 horny-coated nuts. *Castanea* (Chestnut).
- h²** Leaves widest near the sharply serrated tip, narrow and entire near the base; fruit, small pods in terminal racemes; hardly a tree, shrubby.
Clethra (Pepperbush).
- h³** Leaves widest near base; usually small; bark scaling like the sycamore; fruit, $\frac{1}{4}$ in. round drupe, axillary and solitary. *Planera* (Planer Tree).
- e²** Leaves not straight veined.
- f¹** Leaves evergreen, margin revolute or spiny. *Ilex* (Holly).
- f²** Leaves evergreen, lanceolate-oblong, minutely serrate; sessile; flowers white, 4 inches. *Gordonia* (Loblolly Bay).
- f³** Leaves deciduous.
- g¹** Fruit edible and fleshy.
- h¹** A drupe with single stone. *Prunus* (Plum, etc).
- h²** A berry; plant, thorny. *Crataegus* (Hawthorn).
- h³** A black berry without calyx; 3 cartilaginous seeds. *Rhamnus* (Buckthorn).
- h⁴** A red berry, without calyx; 4-6 hard, grooved nuts. *Ilex* (Holly).
- h⁵** Fruit, apple-like with seeds in horny cells.
- i¹** Fruit sweet, $\frac{1}{2}$ in. in diameter; in drooping racemes. *Amelanchier* (Juneberry).
- i²** Fruit sour and much larger. *Pyrus* (Quince).

- a¹b¹c¹d²e²f³g²** Fruit a dry, more or less rounded pod.
- h¹** Flowers conspicuous, 1 in. broad, white.
- i¹** Flowers bell-shaped; leaves widest below; fruit with longitudinal wings. *Halesia* (Snowdrop tree).
- i²** Flowers white, spreading, 2 in. broad; leaves thrice as long as broad; fruit, a 5-angled pod. *Stuartia* (Tea).
- i³** Flowers spreading 3 in.; leaves 3 times as long as broad. *Gordonia* (Bay).
- h²** Flowers inconspicuous, small.
- i¹** Flowers and fruit in large panicles; resembling the lily of the valley; leaves sour and peach-leaf-like in shape. *Oxydendron* (Sorrel Tree).
- i²** Flowers in erect, terminal racemes; fruit small, a 3-celled pod; leaves oval; shrubby. *Clothra* (Pepperbush).
- i³** Fruit, a rounded, dry drupe with calyx, one-seeded; clusters, 3-many; leaves 1-3 in. long. *Styrax* (American Storax).
- g³** Fruit and flowers in dry catkins; leaves 3 times as long as broad, finely serrate to entire; stipules; wood soft; seeds with cotton hairs. *Salix* (Willow).
- d³** Margin distinctly lobed.
- c¹** Plant more or less thorny; fruit, a round berry ending in persistent calyx; shrub or small tree. *Crataegus* (Hawthorn).
- e²** Plant not thorny.
- f¹** Leaf deeply pinnatifid; basal lobes completely separated; cultivated. *Pyrus* (Mountain Ash).
- f²** End of leaf as if cut off; sides with one large lobe; margins entire; fruit, a cone-like body. *Liriodendron* (Tulip tree).
- f³** Lower leaves 3-lobed, heart-shaped at base; margin entire; small tree or shrub; fruit, with a juicy pulp, 4-seeded. *Clerodendron* (Flat tree).
- f⁴** Not as in f¹, f², or f³.
- g¹** Leaves thin; bark of trunk peeling. *Betula* (Birch).
- g²** Leaves thin; leaf buds long and pointed; bark not peeling. fruit, a 3-angle nut in a burr. *Fagus* (Beech).
- g³** Leaves thick; bark rough; fruit oval, woody cone remaining one year. *Alnus* (Alder).
- g⁴** Leaves thick; fruit, an acorn. *Quercus* (Oak).

- a¹b¹c²** Leaves with radiating veins, including those which have the lower ribs much larger than the upper ones.
- d¹** Leaves aromatic and mucilaginous; somewhat irregularly lobed; margins entire; flowers yellow; fruit drupe-like, $\frac{1}{2}$ in. long.
Sassafras.
- d²** Leaves deltoid or heart-shaped with serrate margins, sometimes lobed; varnished buds.
Populus (Poplar).
- d³** Leaves broadly heart-shaped, margin entire; shrubs with showy, red, pea-like flowers; fruit in pea-like pods. *Cercis* (Redbud).
- d⁴** Leaves not as in **d¹**, **d²**, or **d³**.
- e¹** Leaves heart-shaped, young ones much lobed, base not oblique, margin serrate; milky juice.
- f¹** Fruit not edible; leaves rough above, hairy below; twigs opposite.
Broussonetia (Paper Mulberry).
- f²** Fruit edible; leaves not hairy, never opposite.
Morus (Mulberry).
- e²** Leaves broadly heart-shaped, oblique base, regularly serrate; juice not milky; fruit, a nutlet attached to a leaf-like bract or slender pedicel.
Tilia (Linden).
- e³** Leaves only slightly heart-shaped, generally oblique at base, without lobes or milky juice.
- f¹** Fruit, a small 3-seeded berry in axils of leaves which are markedly 3-nerved.
Hovenia (Buckthorn).
- f²** Fruit a small drupe, one seeded, solitary or in pairs in axils of leaves.
- g¹** Plant prickly; leaves narrow 3-nerved, 2-ranked on green twigs.
Zizyphus (Jujube tree).
- g²** Plant without prickles; leaves very oblique at base; fruit, berry-like and sweet.
Celtis (Hackberry).
- e⁴** Leaves decidedly and regularly lobed.
- f¹** Leaves with 5 large lobes, margins entire, slightly angulated; not indigenous.
Sterculia.
- f²** Leaves star-shaped, 5-9 pointed lobes; serrate margin.
Liquidambar (Sweet Gum).
- f³** Leaves large, base of petiole with top-shaped socket enclosing the bud.
Platanus (Sycamore).
- f⁴** Plant thorny; fruit, apple-like berry ending in an enlarged calyx.
Crataegus (Hawthorn).
- f⁵** Leaves with a tapered base, shrubby or a small tree; flowers like the hollyhock.
Hibiscus (Rose Mallow).

- a^{1b}** Leaves with parallel veins, fan-shaped, without midrib; fruit, a 1 in. drupe. *Ginkgo* (Maiden-hair tree).
- a²** Leaves opposite or whorled.
- b¹** Leaves palmately compound.
- c¹** Leaflets slender; lanceolate, almost entire; shrub. *Vitex* (Chaste tree).
- c²** Leaflets broader, serrate; usually trees. *Aesculus* (Horse Chestnut).
- b²** Leaves pinnately compound.
- c¹** Leaves 18 in. long; serrate leaflets 11 or more. *Phellodendron* (Cork tree).
- c²** Leaves smaller; leaflets entire, more than 5. *Fraxinus* (Ash).
- c³** Leaflets 3-7, coarsely and irregularly toothed. *Negundo* (Box Elder).
- b³** Leaves simple, opposite, evergreen, entire, 2 inches long. *Osmanthus* (Devilwood).
- b⁴** Leaves simple, entire, evergreen, less than 1 in. long. *Buxus* (Boxwood).
- b⁵** Leaves simple, deciduous.
- c¹** Branches ending in thorns; small trees or shrubs.
- d¹** Leaves ovate, small, minutely serrate. *Rhamnus* (Buckthorn).
- c²** Branches not thorny.
- d¹** Leaves palmately lobed with more than three lobes, or with notches and serrations; fruit dry-winged. *Acer* (Maple).
- d²** Lower leaves palmately 3-lobed and heart-shaped at base, upper leaves ovate, entire; 4-seeded drupe-like fruit with juicy pulp. *Clerodendron* (Flat tree).
- d³** Leaves palmately lobed; fruit, a one-seeded, berry-like drupe in clusters with flattened stones; shrubby. *Viburnum* (Black Haw).
- d⁴** Leaves heart-shaped entire, angulated but not lobed.
- e¹** Leaves with radiating ribs.
- f¹** Leaves large, 6 in. or more; 2 buds, one above the other in the axil of the leaves of rapid-growing shoots; flowers large, purple; fruit, a rounded pod. *Paulownia*.
- f²** Leaves large; flowers large, white in June; fruit, a long, bean-like pod. *Catalpa*.
- e²** Leaves with feather veining.
- f¹** Leaves 2-6 in. long; flowers small in large, dense, terminal clusters; ornamental shrub. *Syringa* (Lilac).
- f²** Flowers in pairs; leaves 1-4 in. long. *Lonicera* (Honeysuckle).

- a²b⁵c²d⁵** Leaves neither heart-shaped nor lobed; shrubby.
- c¹** Leaves entire.
- f¹** Leaves lanceolate, entire, small; flowers crimson; fruit yellow, large and showy. *Punica* (Pomegranate).
- f²** Leaves broad, oval, thin with curving parallel veins. *Cornus* (Dogwood).
- f³** Leaves large, broad, oval without either curving or straight parallel veins; fruit, $\frac{1}{2}$ in. drupe. *Chionanthus* (Fringe tree).
- d⁶** Leaves serrate or dentate, ovate or oval.
- e¹** Fruit, rounded drupes in clusters. *Viburnum* (Black Haw).
- e²** Fruit, lobed pods bursting in fall, with a red aril; square shoots. *Euonymus* (Burning Bush).
- a³** Leaves compound and alternate.
- b¹** Leaves of 3 entire leaflets; fruit, a pea-like pod. *Laburnum* (Trefoil tree).
- b²** Leaves of 3 serrate, transparent, dotted leaflets. *Ptelea* (Hop tree).
- b³** Leaves once or twice pinnate; leaflets entire.
- c¹** Leaves 2 feet or more, twice abruptly pinnate; branches blunt at end but not thorny. *Gymnocladus* (Coffee tree).
- c²** Leaves and leaflets smaller, once or twice abruptly pinnate; branches slender-tipped; tree thorny; fruit, a legume with sugary pulp. *Gleditsia* (Honey Locust).
- c³** Leaves regularly once pinnate, not over 2 feet long.
- d¹** Leaves odd pinnate; shrub with few heavy-tipped branches; no spines; milky juice; fruit, a red berry in terminal panicles. *Rhus* (Sumac).
- d²** Leaves odd pinnate, 9-11; round-top tree; fruit, a bead-like beam. *Cladrastis* (Yellow wood).
- d³** Leaves odd pinnate, leaflets 3 in. long, 11-21, with stipular spines at base of leaves; fruit, a dry bean-like pod. *Robinia* (Locust).
- b⁴** Leaves once or twice pinnate; margins serrate or notched.
- c¹** Leaves irregularly once, twice, or thrice pinnate.
- d¹** Leaves regularly twice odd-pinnate; leaflets 1 in. long; juice not milky; fruit, clusters of rounded berries on plants not prickly; branchlets not heavily tipped. *Melia* (China tree).
- d²** Leaves 1-2 odd pinnate, leaflets irregularly and coarsely toothed; fruit, a bladder pod. *Koelreuteria*.

- a³ b⁴ c¹ d³** Leaves irregularly, twice pinnate without prickles; heavily tipped branches. *Rhus* (Sumac).
- d⁴** Leaves large, 3 feet long, 1-3 odd pinnate; stem and trunk with prickles; small tree or shrub. *Aralia* (Hercules Club).
- d⁵** Leaves once or twice abruptly pinnate; large tree with slender branches, usually thorny; fruit, a pod containing sweet pulp. *Gleditsia* (Honey Locust).
- c²** Leaves regularly once pinnate.
- d¹** Leaves less than 1 foot long; leaflets 3 in.; fruit, bright-colored, berry-like pomes in clusters persistent into winter; not thorny nor heavily tipped. *Pyrus* (Mountain Ash).
- d²** Leaves usually large on a small tree or shrub; juice milky, branches heavily tipped. *Rhus* (Sumac).
- d³** Leaves 1-2 ft. long; leaflets 3 in. long; fruit, a nut with green, pulpy covering.
- e¹** Coat of fruit dehiscent, 4 valves, leaflets 7-11, usually, 5-7. *Carya* (Hickory).
- e²** Coat not dehiscent; nut rough. *Juglans* (Walnut).
- d⁴** Leaves very large, 2-4 ft.; heavily tipped branches; odor of bruised leaves offensive; juice not milky.
- e¹** Leaflets with 2 glandular notches at base; fruit, a samara. *Ailanthus* (Tree of Heaven)
- e²** Leaflets entire or serrate near the tip. *Cedrela*.

DICHOTOMOUS KEY

How to Use the Key.—Standing before a tree with one of its leaves in hand, read the two statements at the beginning of each division; one of these statements will more completely describe the leaf than the other. At the end of the statement which harmonizes with the facts will be found a number. Further down this number will be found and it will be repeated at least twice. Then read the two statements under these numbers, selecting that statement which again most nearly agrees with the characteristics of both tree and leaf. Continue this process until a statement is followed by a name instead of a number; if no mistake has been made in the observations, that name will be the name of the tree. Suppose, for example, that standing in June before a tree we make the following observations:

(1) That the tree has fruit with wings; (2) that since there are no leaves on last year's growth of the twig, it is not evergreen but deciduous; (3) that the leaves are simple—only one blade; (4) that its veining is palmate, the large veins coming from near one point in the midrib; (5) that the leaves are attached opposite to each other on the stem.

With these facts, commence by reading the two lines numbered 1 in the key; we find that our facts agree with the second line, because the fruit is not a cone. Line number 1 refers us to number 3. Turning to number 3 we again read the two lines and discover that as our specimen is not evergreen it must be under the second of the two lines, which refers us to number 9. As our leaf has only one blade, we are referred to 11, and in 11, since our leaf is palmately veined, we are referred to 23. Reading the first line, we find that it corresponds with our winged samara or fruit. Hence the tree is a *maple*.

The student, after having traced a tree through the analytical key, should then trace it through the dichotomous key in order to verify his conclusions and emphasize his observations.

-
1. Trees having fruit in cones, including the juniper and the yew. 2.
 1. Trees without coniferous fruit, excluding the juniper and the yew. 3.
 2. Leaves in bundles or fascicles. 4.
 2. Leaves single and scattered on the shoot. 5.
 4. Leaves linear and in clusters of 2-5. *Pine.*
 4. Leaves linear, more than 5 in a cluster, deciduous. *Larch.*
 5. Leaves deciduous. *Cyprus.*
 5. Leaves evergreen. 6.
 6. Leaves scale-like or awl-shaped. 7.
 6. Leaves linear, arranged right and left in one plane. 8.
 7. Cones of few irregular-shaped dry scales, spreading when ripe. *Arbor Vitae.*
 7. Cones or fruit more like a berry than a cone, blue or purple in color. *Juniper (Red Cedar).*
 8. Cones about 1 in. long, pendulous, woody. *Hemlock.*
 8. Cones red and fleshy without scale. *Yew.*
 3. Leaves evergreen, margin with prickles. *Holly.*
 3. Leaves not evergreen. 9.
 9. Leaves made of more than one blade, compound. 10.
 9. Leaves with only one blade. 11.
 10. Leaves palmately compound. 12.
 10. Leaves pinnately compound. 13.
 12. Leaves composed of 5-7 leaflets; fruit, a round dehiscent pod. *Buckeye.*
 12. Leaves with only 3 leaflets; fruit, a circular samara. *Hop tree.*
 13. Leaves with leaflets subdivided or twice pinnately compound. 14.
 13. Leaves with leaflets undivided but pinnately compound. 15.
 14. Trunk and branches with compound thorns; fruit, a pod with honey around the seed. *Honeyshuck or Honey locust.*
 14. Trunk and branches thornless, twigs large, leaves abruptly pinnate and very large; fruit, a pea-like pod without honey. *Kentucky Coffee tree.*

15. Trees very thorny. 16.
 15. Trees without thorns. 17.
16. Small trees, bark pungent, prickled, and tuberculate; fruit, a capsule.
Prickly Ash.
16. Large trees without pungent bark. 18.
 18. With large compound thorns, twice odd-pinnately compound leaves, succulent; fruit, a pod 8-12 in. *Honeyshuck* or *Honey locust.*
 18. Short stipular prickles at the bases of the leaves; leaves once odd-pinnately compound; fruit, an inedible dry pod 3-4 in. long.
Yellow Locust.
17. Leaves with 3-7 leaflets, twigs ashy-green; fruit, a double winged key.
Box Elder.
17. Leaves with many leaflets, always more than five, without winged fruit. 19.
 19. Leaves once odd-pinnately compound, 2-4 ft., with leaflets 21-41; fruit, a single-winged key in clusters. *Ailanthus.*
 19. Leaves less than 2 ft. long. 20.
20. Pith in twigs made up of jointed plates; leaflets 11-23 and sessile; fruit, an indehiscent nut. *Walnut.*
20. Pith not in jointed plates as above. 21.
 21. Small tree, a shrub; fruit in terminal panicles or clusters of red berries; juice milky. *Sumac.*
 21. Large trees; fruit not in panicles. 22.
22. Leaves once odd-pinnately compound, alternately attached to shoot; fruit, a dehiscent nut. *Hickory.* (See family).
22. Leaves once odd-pinnately compound, but oppositely attached; fruit, a single-winged samara. *Ash.*
11. Leaves palmately veined, as in maples. 23.
 11. Leaves pinnately veined, as in elms. 24.
23. Leaves opposite on shoot; fruit, double-winged. *Maple.*
23. Leaves alternately attached. 25.
 25. Leaves with margins entire, heart-shaped at the base; fruit, a dry legume without pulp. *Red Bud.*
 25. Leaves cut into lobes. 26.
26. Leaves broad, with pointed lobes, petiole drilled out to fit over the top-shaped bud; bark shedding in thin plates as the sap rises; fruit, a rounded head, hanging through winter. *Sycamore.*
26. Leaves star-shaped, 5-7 sharp-pointed lobes; young twigs with winged bark; fruit, a rounded, many celled, prickly capsule. *Sweet Gum.*

24. Leaves with uncut margins, entire. 27.
24. Leaves strongly lobed. 28.
24. Leaves with toothed margins. 29.
27. Leaves whorled on stem, or opposite each other. 30.
27. Leaves, one at each node, alternate. 31.
30. Leaves large, heart-shaped, acute or acuminate pointed, sometimes feebly lobed; flowers in large panicles, showy; fruit, a long bean-like capsule with winged seeds. *Catalpa.*
30. Leaves small, ovate to oval; flowers, greenish-yellow in dense heads surrounded by four large white bracts, petal-like; fruit, scarlet berries in heads. *Dogwood.*
28. Small spreading trees or shrubs. 38.
28. Large trees. 39.
38. Leaves serrate, acute angled at base, on vigorous shoots, lobed; flowers, white in terminal corymbs; fruit, a small apple. Most varieties of this genus are thorned. *Haw.*
38. Leaves with rounded base. 40.
40. Leaves and twigs mucilaginous; bark aromatic; flowers yellow; fruit, a drupe. *Sassafras.*
40. Leaves variously and irregularly lobed and cut; bark not aromatic; fruit, a berry. *Mulberry.*
39. Leaves truncate at the tip, 4-6 lobes with entire margins; flowers large and tulip-shaped; fruit, a dry cone-like body. *Yellow Poplar.*
39. Leaves not truncate at tip; fruit not a cone. 41.
41. Leaves variously lobed or entire, pinnately veined; flowers in aments; fruit, an acorn. *Oak.*
41. Leaves triangular in shape, serrate or dentate margin, feebly lobed; flowers in catkin-like bodies, buds frequently varnished; fruit, a four-valved capsule. *Poplar.*
29. Leaves in pairs at the nodes, opposite. 42.
29. Leaves, one at each node, alternate. 43.
42. Leaves entire, oval, or elliptical; flowers white and fragrant; fruit, a blue berry. A shrub used for hedges. *Privet.*
42. Leaves ovate to oval, finely serrate; flowers, white in cymes; fruit, an oval drupe, ripe in October. *Black Haw.*
31. Leaves 5-10 in. long. 32.
31. Leaves much smaller, never more than 5 in. long. 33.
32. Leaves broadly-ovate, large trees, petioles at least 1 in. long; fruit, a large cone-like body. *Magnolia.*

32. Leaves obovate but acute-pointed, rank odor when bruised; petiole short, $\frac{1}{4}$ in. long; fruit, a pulpy banana-like mass. *Papaw.*
33. Large forest trees. 34.
33. Shrubs or small trees. 35.
34. Flowers in catkins or aments; fruit, an acorn. *Oak.*
34. Flowers small, bell-shaped; fruit, a large berry 1 in. long. *Persimmon.*
34. Flowers in clusters; fruit, a small blue drupe or a small pea-like pod; a legume. 36.
36. Leaves ovate falcate, coarsely serrate, base oblique or cordate; fruit, globose and sweet, $\frac{1}{4}$ in. in diameter; bark of trunk tuberculated, twigs almost spiny. *Hackberry.*
36. Leaves ovate-obovate, entire, dark green, shiny; fruit, a small drupe with grooved stone, ripe in Oct., Nov. *Sour Gum.*
35. Leaves broad, ovate, entire, rounded base, pinnately veined, acuminate pointed; fruit, a large, orange yellow globe; some leaves with axillary spines. *Osage Orange.*
35. Leaves irregular, and unequally lobed or not lobed, mucilaginous, scented when bruised; flowers yellow; fruit, a small drupe-like berry; bark and roots aromatic. *Sassafras.*
37. Leaves and twigs mucilaginous; bark and roots aromatic; flowers yellow; fruit, a drupe-like berry. *Sassafras.*
37. Leaves with curving parallel veins, ovate or oval; bark not aromatic but bitter; fruit, a cluster or head of many drupe-like berries. *Dogwood.*
43. Leaves with oblique base. 44.
43. Leaves not oblique at base. 45.
44. Leaves finely serrate, pinnately veined; base, cordate, oblique; point, acute or acuminate; flowers yellow, fragrant in axillary cymes attached to a membranous leaf-like bract; fruit, a dry, small, nut-like body, attached to a leaf-like bract by slender pedicel. *Linden.*
44. Leaves without heart-shaped base, slenderer. 46.
46. Leaves inequilateral, straight, pinnately veined, simply or doubly serrate, harsh, tough; fruit, a circular samara. *Elm.*
46. Leaves equilateral, oblique at base, serrate margin, acuminate point; fruit, a globose, sweet-tasted drupe with a rugose stone; bark of trunk rough and tuberculated. *Hackberry.*
45. Branches, and frequently trunk, thorny. 47.

45. Neither trunk nor branches thorny. 48.
47. Thorns conspicuous and sharp pointed; leaves roundish or wedge-shaped at base, coarsely toothed, serrate and sometimes lobed; flowers, white in corymbs; fruit, an apple-like body with calyx at end. *Haw.*
47. Thorns, if any, inconspicuous, not sharp pointed; twigs stunted and thornlike. 49.
49. Leaves ovate, triangular, truncate to sub-cordate base, acute pointed, notched, and serrate; flowers fragrant; fruit, a 1 in. apple. *Wild Crab Apple.*
49. Leaves ovate-obovate, 3 in. long, round or pointed base, acute pointed, once or twice serrate; fruit, a large, one-seeded, cherry-like body. *Wild Plum.*
48. Leaves regularly and finely serrate. 50.
48. Leaves irregularly toothed and notched or doubly toothed. 51.
50. Leaves bright green, lanceolate or nearly linear; cotton on seed. *Willow.*
50. Leaves dark green, slender, not long. 52.
52. Leaves deltoid to ovate, petioles frequently flattened from side to side permitting leaves to quiver; seed with cotton. *Poplar.* (See family).
52. Leaves oval to obovate. 53.
53. Fruit pulpy, or fleshy. 54.
53. Fruit dry, not fleshy. 55
54. Fruit, a drupe or plum. *Wild Plum.*
54. Fruit, a small apple-like body; leaves oval, finely serrate, acute pointed, rounded base, pinnately veined; dry calyx at tip of fruit. *Juneberry or Serviceberry.*
55. Fruit with four longitudinal wings and one seed; leaves oval, very finely serrate, pinnately veined; flowers white. *Snowdrop tree.*
55. Fruit, a small nutlet in axils of scales of a cone-like body; leaves oval, ovate, or obovate, straight pinnate-veined; a shrub on creek banks. *Alder.*
51. Leaves palmately veined or 3-nerved at base. *Mulberry.*
51. Leaves not palmately veined. 56.
56. Leaves pinnately-straight veined. 57.
56. Leaves not straight veined. 58.
57. Large forest trees. 59.

58. Shrubs or small trees. 60.
 59. Leaves thin, glossy; buds fusiform; bark smooth and gray; fruit,
 a 3-angle nut. *Beech.*
59. Bark rough; leaves thick. 61.
 61. Leaves thick; bark rough; fruit, an acorn. *Oak.*
61. Leaves thinner; bark rough; fruit, a spiny-covered nut. *Chestnut.*
60. Bark smooth gray; fruit in axils of 3-lobed, clustered bracts.
 Water Beech.
60. Bark rough; fruit in hop-like strobiles. *Ironwood.*
58. Shrubs or small trees; leaves nearly, but not quite, straight veined,
 oval to obovate, unequal base; flowers yellow; fruit, a capsule.
 Witchhazel.
58. Always trees. 62.
 62. Leaves broadly wedge-shaped, oval, or triangular. 63.
 62. Leaves oblong or only oval. 64.
63. Petioles slender and flattened from side to side. *Poplar or Aspen.*
63. Petioles stout and short, not flattened. *Birch.*
64. Fruit, an acorn. *Oak.*
64. Fruit, a small drupe, ripening in October. *Black Gum.*

TREE FAMILIES

PINE—(*Pinus*).

Leaves needle-shaped, long and rounded, or semilunar, in sections, in clusters surrounded at the base with a sheath; flowers in catkins; fruit, a persistent, woody cone of overlapping scales.

1. Bundles containing five leaves; cones, 5 in. long, pendant; scales without prickles. WHITE PINE (*Pinus Strobus*).

2. Bundles containing 2 or 3 leaves.

a Leaves in bundles of 3's, six in. long; cones 3½ in. long; scales with prickles. (Eastern Virginia.)

OLD FIELD PINE (*Pinus Taeda*).

b Leaves in bundles of 3's, 3-5 in. long; cones with recurved and prickled scales. PITCH PINE (*Pinus Rigida*).

c Leaves in bundles of 2's, 4 in. long; cones 2 in. long; scales with weak prickles. YELLOW PINE (*Pinus Echinata*).

d Leaves in bundles of 2's, 2 in. long; cones 2½ in. long; scales with sharp prickles. SCRUB PINE (*Pinus Virginiana*).

WALNUT—(*Juglans*).

1. Leaves 18 in. long, with 11-12 leaflets; fruit, a round rugose nut.

BLACK WALNUT (*Juglans Nigra*).

2. Leaves 14 in. long, with 9-17 leaflets; fruit, a four-ribbed nut.

WHITE WALNUT (*Juglans Cinera*).

HICKORY-NUT—(*Hicoria*).

1. Leaves 10 in. long, 9-11 leaflets 5 in. long, sessile and serrate; fruit, 1 in. with 4 sutures or ridges, winged at apex.

BITTER NUT (*H. Minima*).

2. Leaves 10-20 in. long, with 5 (sometimes 7) leaflets; bark scaly; fruit, in clusters of nuts 1½ in. SHAG-BARK HICKORY (*H. Ovata*).

3. Leaves 9-15 in. long, fragrant, 7-9, lanceolate leaflets; fruit oblong, 1½ in., 4 ribbed or sutured.

WHITE HICKORY or MOCKER NUT (*H. Alba*).

4. Leaves 6-10 in. long, 7-9 leaflets; fruit globose, 1½ in.

PALE LEAF HICKORY (*H. Villosa*).

POPLAR—ASPEN—COTTONWOOD (*Populus*).

1. Leaves broadly deltoid, finely toothed, cordate base; flowers in catkins in May. CAROLINA POPLAR (*P. Deltoides*).
2. Leaves orbicular, 3-6 in. long, coarsely notched; flowers in ament in May. LARGE-TOOTHED POPLAR OR ASPEN (*P. Grandidentata*).

BIRCH (*Betula*).

1. Leaves ovate, 3 in. long, serrate margins, pinnately veined; fruit, a strobile, 1 in. long. RIVER OR RED BIRCH (*B. Nigra*).
2. Leaves ovate, 5 in. long, acute, serrate, pinnately veined; fruit, a strobile, 1½ in. long. SWEET OR BLACK BIRCH (*B. Lenta*).
3. Leaves cut square at base, acutely pointed, serrate, 3 in. long. POPLAR BIRCH (*B. Populifolia*).

OAK—(*Quercus*).

1. Leaves with veins projecting beyond the margin of leaf; bark, dark colored; acorn cup with very short stem and the acorn hull (not cup) lined with hair-like felt; all acorns found on last year's wood.
 - a Leaves oval, rounded at base, lobes cut halfway to midrib; lobes 1-3 toothed; fruit, an acorn ¼ in. long; acorn cup shallow and made of closely imbricated scales. RED OAK (*Q. Rubra*).
 - b Leaves obovate, broad, rounded sinuses, 5-7 lobes, acorn round, ½ in., saucer-shaped cup of thin scales. PIN OAK (*Q. Palustris*).
 - c Leaves ovate, truncate at base, 5-9 narrow, spreading lobes, repand dentate; acorns half buried in a deep top-shaped cup. SCARLET OAK (*Q. Coccinea*).
 - d Leaves 10 in. long, obtuse base, pinnately lobed to about halfway to midrib, 7 lobes; acorn ½ in. long, in coarsely scaled top-shaped cup. BLACK OAK (*Q. Velutina*).
 - e Leaves often falcate with 3-7 lobes, rounded base; acorn, ½ in. long, in flat turbinated cup. SPANISH OAK (*Q. Falcata*).
 - f Leaves obovate, entire or three lobed, thick, brittle; acorn, ½ in. long, covered in a turbinated cup with thin scales. BLACK JACK (*Q. Marylandica*).
 - g Leaves variable, but narrow and obovate, tapering from apex to base; some leaves with margins entire; acorn round; cup, saucer-shaped. (Eastern Shore, Va.) WATER OAK (*Q. Nigra*).

h Leaves lanceolate, 5 in. long, margin entire; acorn round; cup, saucer-shaped and thin. WILLOW OAK (*Q. Phellos*).

i Leaves narrow, oblong, entire, 3 in. long; acorn round; cup, saucer-shaped. (Eastern Shore, Va.)

LAUREL OAK (*Q. Laurifolia*).

2. Leaves without projecting veins; bark light colored; acorns on new wood, covering a hull of acorn not lined with felt or hair.

a Leaves obovate, wedge-shaped at base, 5-7 lobes, not pointed but rounded; acorn maturing first year. WHITE OAK (*Q. Alba*).

b Leaves ovate, 4-8 in. long, rounded at base, lyrate-pinnatifid, 5 divergent lobes; acorn sessile, $\frac{3}{4}$ in. long, cup hemispherical.

POST OAK (*Q. Minor*).

c Leaves obovate, wedge-shaped at base, lyrate-pinnatifid beyond the middle; acorn almost covered by cup. (Southeastern Va.)

OVER CUP OAK (*Q. Lyrata*).

d Leaves 5 in. long, rounded at base, crenately toothed, about ten pairs of pinnate veins—one for each tooth; acorn 1 in. long, tuberculated cup.

BASKET OAK (*Q. Michauxii*).

e Leaves oblong, acuminate, crenately toothed; veins, ten pair, straight; acorn cup long-stalked. CHESTNUT OAK (*Q. Prinus*).

f Leaves evergreen, oblanceolate, rounded at tip, margins entire, acorn and cup slender and long. (Eastern Shore, Va.)

LIVE OAK (*Q. Virginiana*).

SPRUCE—(*Picea*).

1. Leaves $\frac{3}{4}$ in. long, curving inward; cones 2 in. long. (Mountains of Va., N. C., S. C. and Tenn.)

RED SPRUCE (*Picea Rubra*).

2. Leaves $\frac{3}{8}$ in. long; cones recurving, 1 in. long. (Mountains of Va., N. C., S. C. and Tenn.)

BLACK SPRUCE (*Picea Mariana*).

FIR—(*Abies*).

1. Leaves $\frac{1}{2}$ in. to 1 in. long; shorter on fertile branches; cones 5 in. long, standing upright. (Mountains of Va., W. Va. and Tenn.)

BALSAM FIR (*Abies Balsamea*).

2. Leaves 1 in. long; cones 2 in. long.

FRASER FIR (*Abies Fraseri*).

GLOSSARY

[Botanical names have been so loosely used that to a certain extent definiteness has been lost. The following terms found in the keys are used in the sense here defined, which differs in some cases from the meaning given by others.]

- Achene:** a small, dry, hard, one-celled, one-seeded fruit that remains closed at maturity.
- Acuminate:** tapering to a point.
- Acute:** terminating with a sharp or well-defined angle or point.
- Alternate:** not opposite to each other on the axis, but arranged singly at different heights.
- Ament:** a catkin, or scaly spike, as the bloom of an oak or a willow.
- Appressed:** lying close and flat.
- Arcuate:** moderately curved.
- Aril:** an appendage growing at or about the place of attachment of a seed, as shown in the yew.
- Articulate:** jointed; having a node or joint.
- Attenuate:** slenderly tapering, becoming very narrow.
- Auriculate:** furnished with ear-like lobes.
- Awl-shaped:** tapering upward from the base to a slender or rigid point.
- Awn:** a bristle-shaped appendage.
- Axil:** the angle formed by a leaf or branch with the stem.
- Axillary:** situated in an axil.
- Axis:** the central line of any organ or a group of organs; a stem, etc.
- Berry:** a fruit, the whole mass of which is fleshy or pulpy and contains more than one seed.
- Blade:** the expanded portion of a leaf.
- Bract:** a more or less modified leaf subtending a flower or belonging to an inflorescence.
- Bud:** the rudimentary state of a stem or branch on an unexpanded flower.

- Caducous:** falling off very early.
- Calyx:** the outer cup of the flower.
- Capsule:** a dry, dehiscent fruit composed of more than one cavity.
- Carpel:** a small seed-case, or one member of a compound capsule.
- Cartilaginous:** hard but flexible.
- Catkin:** an ament, or bloom, as in the alder.
- Compound:** composed of two or more similar parts united into one whole, as a compound leaf—one divided into separate leaflets.
- Coniferous:** cone-bearing.
- Cordate:** heart-shaped.
- Corymb:** a flat-topped, or convex-topped, open flower-cluster. In a stricter sense a corymb is a contracted raceme progressing in its flowering from the margin inward.
- Crenate:** dentate or serrate, with the teeth much rounded.
- Crenulate:** finely crenate.
- Cuneate:** wedge-shaped; triangular with the acute angle downward.
- Cuspidate:** tipped with a cusp or a sharp rigid point.
- Cyme:** a usually broad and flattish, determinate inflorescence, containing several or many flowers; its central or terminal flowers bloom earliest.
- Cymose:** bearing cymes, or cyme-like.
- Deciduous:** falling at the end of the growing period, as leaves, fruits, etc.
- Decomound:** more than once compound or divided, as in a twice-pinnate leaf.
- Decurrent:** extending downward—said of a leaf whose base extends down below the leaf attachment.
- Deltoid:** triangular.
- Dentate:** toothed, usually with the teeth pointing directly outward.
- Dichotomous:** Forking regularly in pairs.
- Digitate:** compound, with the members arising together at the apex of the support.
- Dioecious:** bearing male and female flowers on the same tree.
- Drupe:** a fleshy or pulpy one-seeded fruit with the inner portion of the seed-covering hard or stony, as the plum.
- Emarginate:** Having a shallow notch at the extremity.
- Entire:** without toothing or division.
- Falcate:** scythe-shaped; curved and flat, tapering gradually.

- Fascicle:** a bundle or cluster.
- Fertile:** capable of producing fruit.
- Fruit:** a plant's seed-bearing products of every form.
- Fusiform:** spindle-shaped.
- Glabrous:** smooth; not rough, pubescent, or hairy.
- Glaucous:** covered or whitened with a bloom.
- Globose:** nearly spherical.
- Head:** a dense cluster of sessile flowers or fruits on a very short axis or receptacle; *e. g.*, fruit of sycamore.
- Imbricate:** overlapping, like shingles, either vertically or spirally, where the lower piece covers the base of the next higher.
- Indehiscent:** remaining closed at maturity.
- Incised:** cut sharply and irregularly, more or less deeply.
- Inflorescence:** the flowering parts of a plant and especially the mode of its arrangement.
- Internode:** the part of a stem between two nodes or joints.
- Leaflet:** a single division of a compound leaf.
- Legume:** a fruit containing several seed in a single cavity, usually splitting by both sutures; *e. g.*, peas and beans.
- Lobe:** any segment of an organ, especially if rounded.
- Lobed:** divided into or bearing lobes.
- Loculicidal:** splitting of seed case.
- Lyrate:** pinnatifid with a large and rounded terminal lobe, the lower lobes being small.
- Midrib:** the central or main rib of a leaf.
- Nerve:** a simple or unbranched vein; a slender rib.
- Node:** the joint of a shoot which normally bears a leaf or whorl of leaves.
- Nut:** a hard, indehiscent, one-celled, and one-seeded fruit.
- Nutlet:** a diminutive nut.
- Obcordate:** inverted heart-shaped.
- Obdeltoid:** reversed deltoid.
- Oblanceolate:** lanceolate with the broadest part toward the apex.
- Oblique:** unequal-sided, or slanting.
- Oblong:** longer than broad and with nearly parallel sides.
- Obovate:** inverted ovate.

Obtuse: blunt or rounded at the ends.

Orbicular: circular.

Palmate: radiately lobed or divided.

Panicle: a loose, irregularly compound inflorescence with pedicellate flowers.

Parted: cleft nearly, but not quite, to the midrib.

Pedice: the support of a single flower.

Peduncle: a primary flower-stalk supporting either a cluster or a solitary flower.

Persistent: remaining attached to the shoot beyond the period of growth.

Pinna: one of the primary divisions of a pinnate or compoundly pinnate leaf.

Pinnate: compound with the leaflets arranged on either side of a common petiole.

Pinnatifid: pinnately cleft.

Pinnule: one of the pinnately disposed divisions of a pinna.

Pod: any dry and splitting fruit.

Pome: a kind of fleshy fruit of which the apple is the type.

Prickle: a small point, more or less slender; sharp outgrowth from the bark or fruit.

Pungent: causing an acrid odor.

Raceme: a simple inflorescence of pediceled flowers upon a common axis more or less elongated.

Repand: with a slightly uneven and somewhat sinuate margin.

Revolute: rolled backward or downward.

Rib: a primary or prominent vein of a leaf.

Rugose: irregularly cut into grooves and ridges; wrinkled.

Samara: an unsplitting, winged fruit.

Scale-shaped: flattened out, as the scales of a fish.

Seed: the ripened ovule, consisting of the embryo and its proper coverings.

Serrate: having sharp teeth pointing forward.

Sessile: without foot-stalk of any kind; attached directly at the base.

Shrub: a woody perennial, smaller than a tree, usually with several stems.

Simple: of one piece; not compound.

Sinus: the cleft or recess between two lobes.

- Spike:** a form of simple inflorescence with the flowers sessile, or nearly so, upon an elongated common axis.
- Spine:** a hard, sharp-pointed growth frequently found on leaf margins.
- Stem:** the main ascending axis of a plant.
- Striate:** showing narrow, structural bands or lines.
- Strobile:** an inflorescence marked by imbricated bracts or scales.
- Suture:** the mark of junction where two elements have united by growth.
- Truncate:** ending abruptly as if cut off transversely.
- Turbinate:** top-shaped; inversely conical.
- Umbel:** an inflorescence in which the peduncles or pedicels of a cluster spring from the same point.
- Valvate:** opening as if by valves; meeting at the edges without overlapping.
- Veins:** threads of fibro-vascular tissue in a leaf or other organ, especially those which branch.
- Whorl:** an arrangement of leaves in a circle at the same point around the stem.
- Wing:** any membranous or thin expansion bordering or surrounding a fruit.

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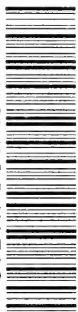
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