



THE OAKS OF ILLINOIS.

BY FREDERICK BRENDEL, of Peoria, Illinois.

It was my intention to present in this essay a complete description of all our forest trees, with illustrations, so that every body could identify each species at once. But as I had not the necessary leisure to do so, I will, for the time, begin with the oaks, one of the most important genera that compose our forests.

The oaks in Illinois are mostly large trees, partly of a very irregular growth. This irregularity is not founded in nature, but the effect of different external causes. Any tree, if not disturbed by external influences, would grow up as regular as a crystal is. A certain mode of growth is innate to each species, but as the conditions, under which the individual plant grows up, are different, a variety of irregular shapes are produced. For instance, the seed of a tree is planted and germinates. For the first time the young plant will produce regularly distributed leaves, buds and twigs. Making a horizontal cut through the young stem we remark in different species different forms of the pith and the surrounding woody layer. In the oaks it forms a five rayed star. One of these rays is prolonged at a certain place and produces a leaf and in the axil of the same a bud, to be developed the next year. One ray, considered the first one, upward, to a certain interval, the third ray produces its leaf and bud, then the fifth, then the second, then the fourth—all in a spiral line, to a certain point—where the sixth corresponds to the first one. This spiral line runs either from the right to the left, or from the left to the right. Often are both directions found in the same tree. In the oaks the spiral line of leaves makes two turns, before one is to come immediately above another, and this is the sixth one counted from the first one. This arrangement is called phyllotaxis, and is indicated for the oaks by 2-5, 2 indicating the number of turns and 5 the number of the leaves which make both turns. Suppose now that each bud would develop undisturbed and receive the same quantity of nourishment, and each branch arising from the bud protected against external influences would keep its original direction, we

would see in winter, when the leaves are fallen, the single trees of one species one just alike the other—mathematical regular figures. But the trees, exposed to various influences, present quite another aspect. Storms break and bend the branches; animals destroy single buds. Often we see the branches on one side of a tree stronger than on the other, and when we examine the root, we find the branches of the root stouter on the same side; and by further examination certainly we can find out the reason of it; either the soil on that side contains more alimentary matter or more humidity, or the branches of the root are destroyed more or less on one side, and so on. Single standing young laurel oaks show often a great regularity of growth, the leafy crown forming a short cone. The most irregular forms have exposed old white oaks, post oaks and the black jack oak.

The flowers of all our species appearing in May are monœcious, *i. e.*, sterile and fertile ones separated, but on the same tree—the former below, the latter above, on the young twig. The sterile flowers are clustered loosely at the base, densely towards the point of a slender drooping catkin, which has a very small rudiment of a bract at its base, and is covered in the bud by two large lateral stipules which by botanists have been mistaken for scales. The flower consists of a membranaceous, often hairy, perianth; which is more or less parted in several lobes and bears inside at the base a variable number of stamens. I have observed 4 in the black oak, 4 to 5 in the laurel or single oak, 5 in red oak, 5 to 6 in white oak, 6 to 7 in the overcup white oak, 7 to 8 in chestnut oak. The stamens are longer than the anthers in the black and the red oak. The perianth is mostly sessile or very short pediceled, but has a very conspicuous pedicel in red oak; it is cup-shaped and short-lobed in red oak and shingle oak; cup-shaped and deeper cut in black oak; more flat and short-lobed in chestnut oak; deeply lacerated in white oak and overcup oak. The lobes of the perianth correspond generally with the number of stamens. The fertile aments are solitary in the axils of the leaves, few flowered, the terminal flower mostly abortive. The involucre consists of minute scales, afterwards forming a cup around the base of the one-seeded nut. The ovary has three united styles, with three distinct stigmas, and is three-celled, each cell with two ovules, but all, except one, abortive.

The fruits, in general, consist of foliaceous expansions of the fibro-vascular bundles in the stem, from which they originate, like the true leaves, the sepals, the petals, the stamens. Dissecting the acorn of the oak we observe on the tomentose endocarp three distinct (often projecting) lines, formed by the connection of three leaves. The summits of the same penetrate the apex of the fruit as three styles. Only one of the six ovules ripens and takes afterwards possession of the whole cavity. The seed is enveloped in a proper membranaceous tender leaf, the margins of which are inflexed in a longitudinal rim between the cotyledons. This envelop-

ment of the seed in leafy expansions reminds us of the involute frutiferous fronds of some ferns, and is indeed analogous.

The acorns of the oaks ripen either the same season, (and we find them in the axils of the leaves—so in *Qu. alba*, *macrocarpa*, *obtusiloba*, *Prinos*, *castanea*,) or not before fall of the next year; and then we find them below the leafy shoot of the season, in *Qu. imbricaria*, *nigra*, *tinctoria*, *rubra* and *palustris*.

It is not difficult to recognize the different species of *Quercus* by the fruit. The cup covers only one fourth or third part of the acorn in *Qu. alba*, *rubra* and *palustris*; nearly one half is covered by the cup in *Qu. obtusiloba*, *castanea*, *Prinos*, *imbricaria*, *nigra* *tinctoria*, and nearly inclosed is the acorn in *Qu. macrocarpa*. The upper scales of the cup in the last species, and often in *Prinus* var. *discolor* are subulate and give to the margin a fringed appearance. The scales, which generally are arranged in 10 to 12 rows, are tuberculate in *Qu. alba*; very smooth and appressed in *Qu. rubra*, *palustris* and *imbricaria*; very small and tuberculate in *Qu. castanea*; large and tomentose in *Qu. tinctoria*. The acorn is large in *Qu. macrocarpa*, *Prinus* var. *discolor*, *alba*, and *rubra*, sometimes more than an inch long, and the cup in the two former one inch in diameter; it is middle sized in *Qu. tinctoria*; *obtusiloba*, *nigra*, small in *Qu. imbricaria*, *castanea* and *palustris*; it is oblong in *Qu. alba*, *Prinus* *discolor*; *rubra*, cvoid or globose in *Qu. imbricaria*, *castanea*, *palustris*, *tinctoria*, *nigra*, *macrocarpa* and *obtusiloba*; very smooth in *Qu. alba* and *imbricaria*—in the latter often with dark longitudinal stripes; partly covered with a farinaceous pubescence in *Qu. macrocarpa*, *Prinos* *discolor*, and *tinctoria*. The fruit is long peduncled in *Qu. alba*, *Qu. macrocarpa* and *Qu. prinus* *discolor*; shorter in *Qu. obtusiloba* and *castanea*; very short peduncled or sessile in *Qu. imbricaria*, *nigra*, *tinctoria*, *rubra* and *palustris*.

The leaves are very variable, often on the same tree; and if we would distinguish oaks merely by the leaves, we could create innumerable new species. The margin of the leaf is entire and in veneration revolute in *Qu. imbricaria*, coarsely serrate with callous points and in veneration plicate in *Qu. Prinos* *discolor* and *Qu. castanea*; it has a few blunt lobes in *Qu. nigra*, more or less deeply lobed is it in *Qu. macrocarpa*, *alba*, *obtusiloba*, *tinctoria*, *rubra* and *palustris*. The three latter and *Qu. nigra* have the lobes setaceous mucronate. All are tomentose, when young, and some, at least, below, even when old; for instance, *Qu. macrocarpa*, *obtusiloba*, *imbricaria*, *Prinus* *discolor*, and *castanea*; the latter has the older leaves, while below, with smooth yellowish brown ribs; some are shining above when old, *fide Qu. obtusiloba*, *imbricaria*, *castanea*; some on both sides, *fide Qu. palustris* and *rubra*. Three species have long petioled leaves: *Qu. tinctoria*, *Qu. rubra* and *Qu. palustris*, but sometimes short petioled on young shoots. The stipules, which are membranaceous, linear or spathulate and ciliate, are falling away very early.

In winter some species can easily be recognized by the buds. *Qu. tinctoria* has the buds tomentose, elongated, regularly imbricated, five ridged; *Qu. rubra* nearly globose, smooth and shining; *Qu. macrocarpa* oblong, tomentose and often irregularly imbricated; *Qu. obtusiloba* globose and tomentose; *Qu. alba* oblong, regularly imbricated and smooth; *Qu. castanea* oblong, acute, smooth and whitish; *Qu. imbricaria* oblong, acute and rather hairy.

The buds do not open before middle of May. The most tardy are those of *Qu. imbricaria*; but this decolorates its leaves the last, and keeps them, though dry, like the white oak, all the winter. All the rest generally shed the dry leaves in October and November.

The bark of the young white oak is very smooth and whitish; on the older parts it separates, like *Qu. castanea*, in plates. The bark of the branches of the overcup is rather corky, thick and lacerated; that of the red oak smooth and reddish brown; that of the pin oak very smooth, even on older trees; that of *Qu. Prinos* discolor separates in flat recurving plates, even on the smaller branches; that of black oak is on old trees very rough, rimmy and blackish—the inner bark, which is used for dying, is thick and yellow. The bark of all the oaks, but especially of the latter, is used for tanning.

The wood of nearly all these species is valuable as timber and as fuel. It is generally very tough and more coarse-grained than many other kinds of timber, and therefore used more by wagon-makers and coopers than by cabinet-makers. The black oak is much used for staves; the young white oak for hoops; the laurel oak, which splits very easy, for shingles; the post oak, the most durable of all, and the white oak, for ship building. Valuable for fuel are the black jack, the black, the laurel, the white, and the post oak; not so the red and the pin oak. The heaviest is the post oak, which, when dried, has a specific weight of 100 (100=water.) By drying the oaks lose generally 30 per cent. of their absolute weight. The specific weight varies in different parts of the same tree and in different trees of the same species; as the weight of the timber will depend upon the quality of the soil and the rapidity or slowness of growth. I have made only a few calculations on each species, and it will be necessary to repeat the same, to obtain a reliable average. I have found for *Qu. macrocarpa* and *Q. tinctoria* 92—*Qu. imbricaria* 86—*Qu. castanea* and *Prinos discolor* 84—*Qu. alba* 80—*Qu. rubra* 76.

For comparison, I will enumerate some other wood I have examined: Persimon 93, honey locust 91, flowering dogwood 82, mockernut 80, box elder 80, bitternut and hazelnut 79, crab apple and shellbark hickory 78, hornbeam 77, sugar maple 76, hop hornbeam, scarlet fruited thorn and panicled cornel 75, white ash, plumbtree and sycamore 74, hackberry 73, slippery elm 72, Kentucky coffee tree 71, red cedar and blue ash 65, white elm, buckthorn and large-toothed aspen 64, red bud and sassafras 62,

mulberry and shrubby trefoil 60, red maple 59, pecan nut 58, prickly ash 56, burning bush 53, blatter nut 52, arbor vitæ 50, black willow 48, basswood 47, cottonwood 46, papaw 46, buckeye 42, smooth sumac 40.

In concluding this essay, I have only to say that it is very incomplete yet. The determination of the per cent. of charcoal and the examination of the Ashes is yet to be made, and will be presented to the public, perhaps, in the next volume.

ILLUSTRATIONS.

EXPLANATION OF THE PLATES.

PLATE I.

- 1—*Quercus alba*, L. White Oak.
- 2-3—different shaped leaves.
- 4—stipula, falling very early.
- 5—bud.
- 6—sterile catkin.
- 7—perianth of the sterile flower.
- 8—stamen.

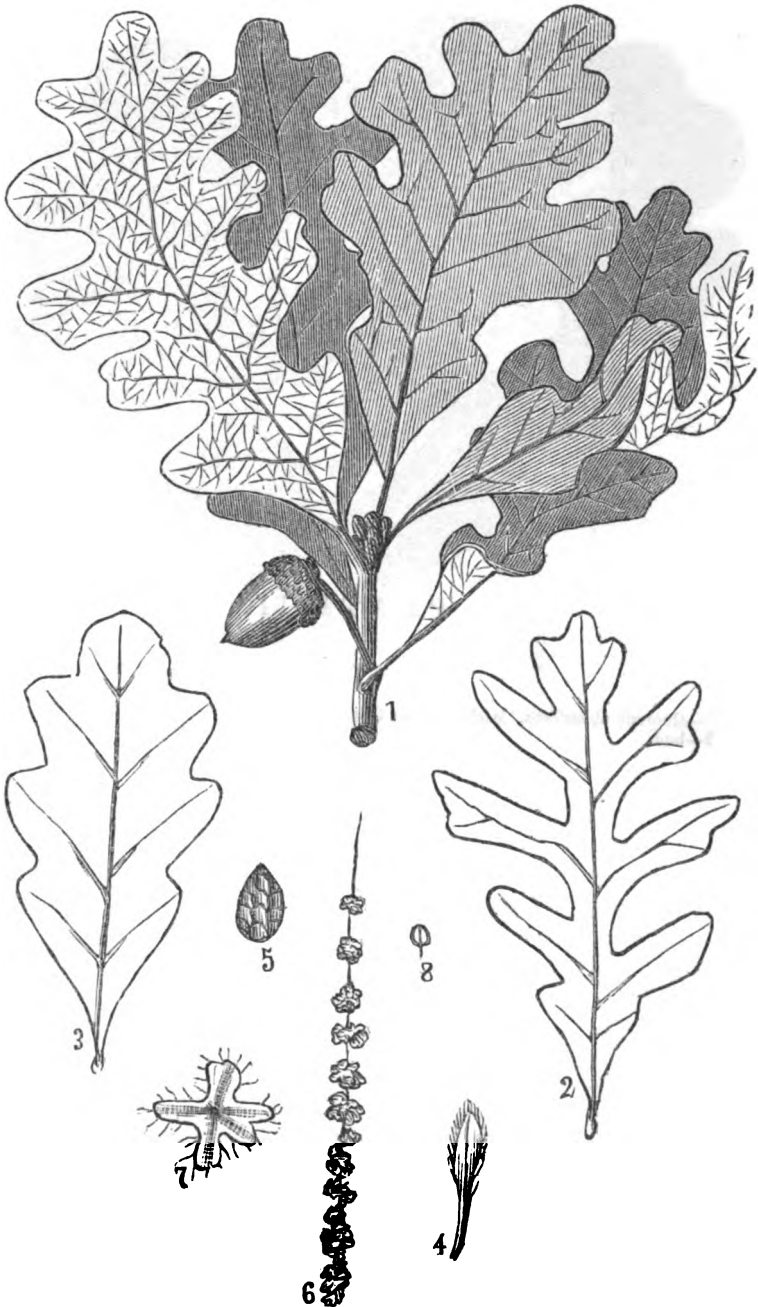


PLATE I.—*QUERCUS ALBA*, L.

PLATE II.

- 1—*Quercus obtusiloba*, Michx. Post Oak.
2—bud.



PLATE II.—QUERCUS OBTUSILOBA, *Michx.*

PLATE III.

1—*Quercus Prinos*, var. *discolor*, Michx. (*Quercus bicolor*, Willd.) Swamp White Oak.

2-3—different shaped leaves.

4—bud.



PLATE III.—*QUERCUS PRINUS*, VAR. *DISCOLOR*, *Muhl.*

PLATE IV.

- 1—*Quercus castanea*, Willd. (*Quercus prinus*, var. *acuminata*, Michx.) Yellow Chest-nut Oak.
- 2—different shaped leaf.
- 3—leaf in vernation.
- 4—stipule.
- 5—bud.
- 6—scale of the bud.
- 7—sterile catkin.
- 8—perianth of a sterile flower.
- 9—stamen.



PLATE IV.—*QUERCUS CASTANEA*, Willd.

PLATE V.

- 1—*Quercus macrocarpa*, Michx. Bur Oak or Over-cup-White Oak.
- 2-3—different shaped leaves.
- 4—stipule.
- 5—leafless twig, with buds.
- 6—sterile catkin.
- 7—perianth of a sterile flower.
- 8—stamen.



PLATE V.—*QUERCUS MACROCARPA*, Michx.

PLATE VI.

- 1—*Quercus imbricaria*, Michx. Laurel or Shingle Oak—showing the fruits of two seasons.
- 2—leaf in vernation, with revolute margins.
- 3—flowering twig, with the sterile catkins at the base of the new shoot and the fruits of the precedent year on the older shoot.
- 4—buds.
- 5—perianth of a sterile flower.
- 6—stamen.
- 7—fertile flower, vertically cut.



PLATE VI.—*QUERCUS IMBRICARIA*, Michx.

PLATE VII.

- 1—*Quercus nigra*, L. Black Oak or Barren Oak.
2—different shaped leaf.

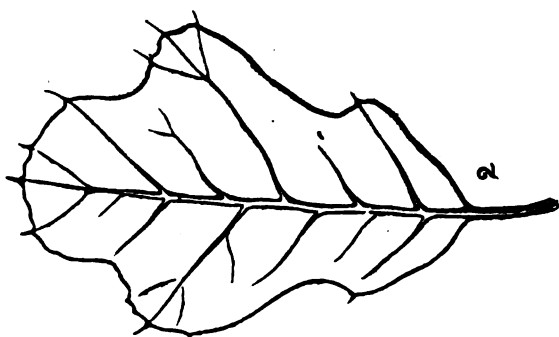


PLATE VII.—*QUERCUS NIGRA*, L.

PLATE VIII.

- 1—*Quercus tinctoria*, Bartram. Black Oak or Quercitron.
- 2-3—different shaped leaves.
- 4—stipule.
- 5—bud.
- 6—sterile flower.
- 7—stamen.
- 8—horizontal cut of the twig of the season.
- 9—the same, at the point where a leaf and bud is produced.



PLATE VIII.—QUERCUS TINCTORIA, *Bartram.*

PLATE IX.

- 1—*Quercus rubra*, L. Red Oak.
- 2-3—different shaped leaves.
- 4—stipule.
- 5—bud.
- 6—sterile catkin.
- 7—perianth of sterile flower.
- 8—stamen.
- 9—acorn and cup, vertically cut.
- 10—seed, vertically cut. On one side is to be seen the inflexed margin of the enveloping membranaceous leaf.



PLATE IX.—*QUERCUS RUBRA*, L.

PLATE X.

Quercus palustris, Du Roi. Swamp Spanish or Pin Oak. •



PLATE X.—QUERCUS PALUSTRIS, Du Roi.

ABSTRACT OF METEOROLOGICAL OBSERVATIONS AT PEORIA, ILLINOIS, DECEMBER, 1856—NOVEMBER, 1858.

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—COMPARATIVE TABLE OF TEMPERATURE—1856-1857.

| | Dec. | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Year. |
|---|--------|------|------|--------|--------|------|-------|-------|------|--------|------|------|-------|
| Mean temperature..... | 23 | 13.4 | 35.1 | 38.6 | 40.6 | 58.9 | 70.9 | 78.4 | 74.3 | 68.8 | 62.2 | 35.2 | 48.75 |
| M. T. at 7 A. M..... | 18.8 | 7.4 | 30.1 | 26.8 | 34.6 | 52.2 | 64.7 | 71.2 | 68.1 | 62.8 | 45.9 | 29.3 | 42.6 |
| M. T. at 2 P. M..... | 28.1 | 20.4 | 41.3 | 41.7 | 49.1 | 69.2 | 79.4 | 89.2 | 83.2 | 76.8 | 60.4 | 40.9 | 56.7 |
| M. T. at 9 P. M..... | 22.2 | 12.5 | 33.8 | 32.2 | 38 | 55.2 | 68.6 | 74.7 | 71.5 | 66.9 | 50.2 | 35.3 | 46.8 |
| M. T. of the coldest day... | 2 | 6.5 | 5.6 | 10 | 23.7 | 44.7 | 59 | 65 | 63.9 | 53.7 | 34.6 | 5.4 | 6.6 |
| M. T. of the warmest day... | 42.9 | 36.1 | 51.2 | 55.2 | 59.8 | 75.6 | 81.5 | 89.4 | 85.6 | 80.7 | 66.1 | 58 | 89.4 |
| Minimum..... | .6 | .16 | .2 | .1 | 16 | 32 | 43 | 53.5 | 50 | 41 | 23 | .2 | .16 |
| Maximum..... | 49 | 43 | 59 | 66 | 73.5 | 90.5 | 91.5 | 100.5 | 97 | 91.5 | 78 | 63.5 | 100.5 |
| Range..... | 55 | 59 | 61 | 67 | 57.5 | 58.5 | 48.5 | 47 | 47 | 50.5 | 55 | 65.5 | 116.5 |
| Greatest change in 24 hours | | | | | | | | | | | | | |
| ↑ rising, ↓ falling..... | f 40.5 | f 37 | f 39 | f 31.5 | f 42 | ↑ 43 | ↑ 29 | f 35 | ↑ 29 | ↑ 31.5 | f 28 | f 29 | ↑ 43 |
| M. T. above freezing p't | 8 | 1 | 20 | 18 | 25 | 31 | 30 | 31 | 31 | 30 | 31 | 19 | 275 |
| M. T. below freezing p't | | | | | | | | | | | | 1 | 1 |
| M. T. freezing point... | 23 | 30 | 8 | 13 | 5 | | | | | | | 10 | 89 |
| Daily minimum, not below freezing point... | | | | | | | | | | | | | |
| Daily maximum, not above freezing point | 4 | | 14 | 10 | 14 | 31 | 30 | 31 | 31 | 30 | 29 | 15 | 239 |
| Mean subterranean temp. 4 | | | | | | | | | | | | | |
| inches below surface, exposed to sunshine 3 P. M. | 19 | 27 | 4 | 10 | 2 | | | | | | | 6 | 68 |
| | | | | | | 68 | 74 | 82.8 | 80.6 | 73.4 | | | |