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SILVICAL CHARACTERISTICS *of* CHINKAPIN OAK

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This is the tenth of a series of 17 papers dealing with the silvical characteristics of forest trees important in the Central States region. The following species are included in this series. (Those marked with an asterisk have already been published.)

- *Ohio buckeye
- Yellow buckeye
- *Northern red oak
- *Black oak
- *Chinkapin oak
- *Pin oak
- *White oak
- Swamp white oak
- Bur oak
- Butternut
- *Black walnut
- *Shellbark hickory
- Sycamore
- *Honeylocust
- Hackberry
- Black locust
- *Eastern redcedar

Papers covering additional important American species will be issued by other Forest Experiment Stations of the U. S. Forest Service.

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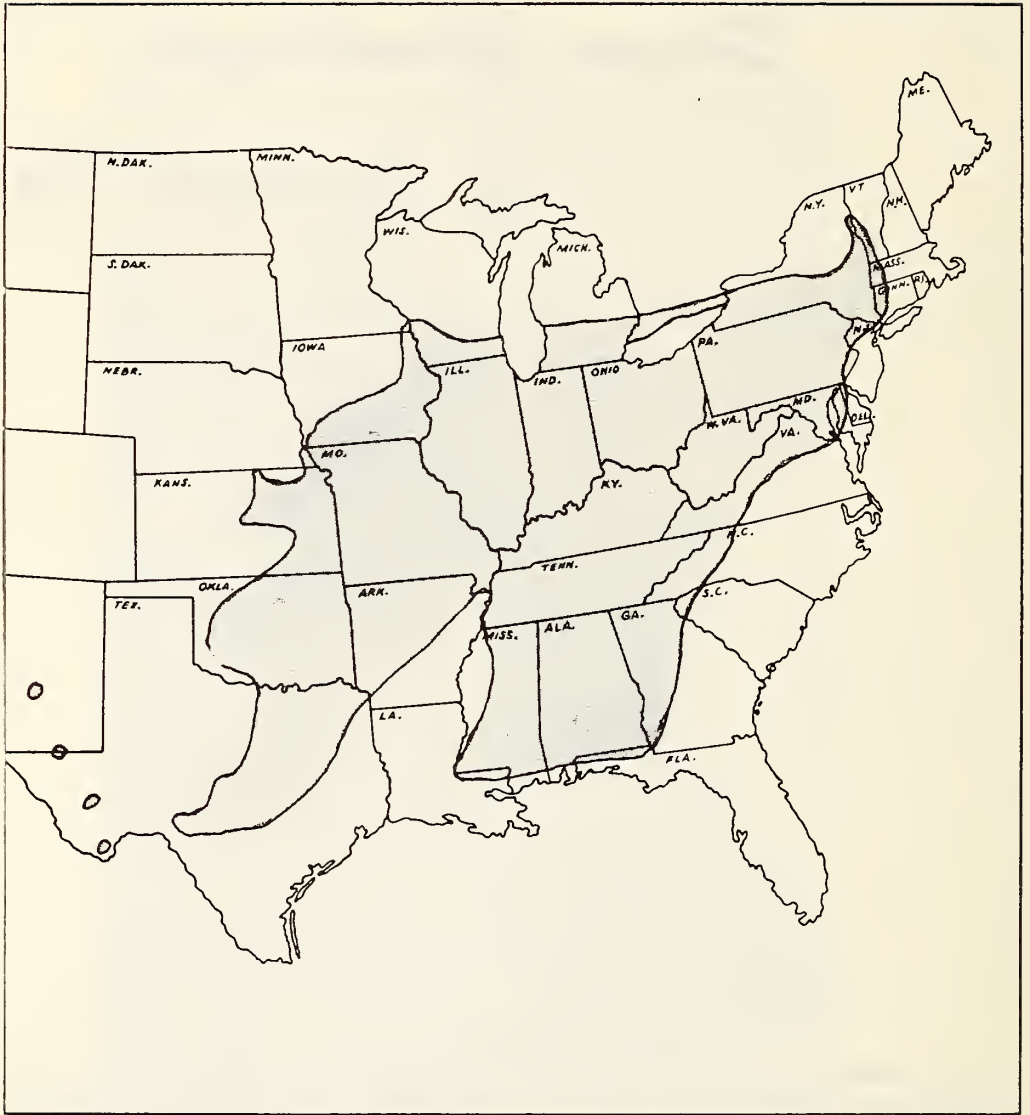
Silvical Characteristics *of Chinkapin Oak*

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Chinkapin oak is a rather uncommon tree throughout its rather wide range in North America. It resembles white oak in general appearance, and is sold as such in the lumber and tight-cooperage markets. It is reported to have attained heights of 160 feet and diameters of 4 feet in the virgin forests of the lower Ohio and Wabash River Valleys (24)^{1/}

^{1/} Numbers in parentheses refer to Literature Cited, p. 9.

DISTRIBUTION



SITE

Climate

In general the climate in that part of the United States and Canada where this species occurs is humid, changing to moist subhumid and dry subhumid only in the southwestern fringe of the natural range (27). The average length of frost-free periods ranges from 120 days in Vermont to 240 days in Texas. Warm season precipitation (April 1 to September 30) varies from an average of 10 inches in southwest Texas to 80 inches in the southern Appalachians. In southern Indiana and southern Ohio, where chinkapin oak is most abundant, the average warm season precipitation is 20 to 25 inches (29).

Soils

The occurrence and abundance of chinkapin oak appear to be related more to soil reaction and texture than to other soil properties. The influence of soil reaction is reflected in the rather limited pH range for the species' establishment and growth, whereas the effects of soil texture are evident in its drainage and aeration requirements. Deam and Shaw (11) state that it is usually restricted to well-drained uplands in Indiana; throughout the Atlantic states it usually occurs on limestone outcrops (13). Read (19) noted the presence of chinkapin oak only on limestone geologic formations in the Arkansas Ozarks. In western Florida it is found along streams in limestone regions (31), and in Kansas, Gates (12) has noted its occurrence mainly on limestone soils, rocky river banks, and usually on higher ground than bur oak. In the upper Mississippi Valley it grows on dry, calcareous bluffs and slopes (21). In Ontario it appears to be limited to limestone outcrops (8).

Reynolds and Potzger (20) made an intensive study of the occurrence of chinkapin oak in relation to soil reaction in Indiana. On four slopes with limestone outcrops they noted that the species "thrives best on medium acid to highly alkaline" soils. They found it on soils with pH values less than 7.0 in only one place, a slope where pH varied from 6.7 to 6.85; on the crest of this slope, where chinkapin oak was not found, pH ranged from 6.05 to 6.15.

In a study of plant succession in the "Swamp Forests" of northern Ohio, Sampson (22) noted that soil types per se did not influence the occurrence or abundance of tree species. He observed that chinkapin oak did not occur until the better drained phase of the transition from swamp forest to the mesophytic forest had developed.

Physiography

In general, chinkapin oak is associated with certain physiographic features that affect soil drainage, aeration, and leaching. In the area studied by Reynolds and Potzger (20), the mantle of glacial till is generally acid through long years of leaching of its soluble calcium. Here, on the relatively level, undissected terrain, chinkapin oak is absent in all stands. However, on the hilly, dissected terrain where an uplift (the Cincinnati Arch) has resulted in continuous leaching of limestone outcrops, the soil is alkaline and supports hardwood stands with chinkapin oak on both north and south exposures. Read (19) also found chinkapin oak on north and south slopes in parts of the Arkansas Ozarks, but only on shallow silty clays derived from the St. Joe limestone.

In the Mississippi Delta region Putnam and Bull (17) observed the species only in the better drained rises in the second or higher bottoms. Although the Appalachians are located within the geographic range of chinkapin oak, the species is apparently absent or rare in the higher elevations. Braun (5) does not mention it as an associate of forest types in the oak-chestnut forest region, a region embracing the higher parts of this mountain chain.

Associated Species

Because chinkapin oak is rarely predominant in any timber stand, it is listed as a component of only one forest cover type--post oak-black oak--by the Society of American Foresters (25). However, it is associated with many other species depending upon location. Braun (5) lists several examples:

Near Lewisburg, West Virginia chinkapin oak was found in stands dominated by white oak but also containing black oak, sugar maple, hickory, black cherry, cucumbertree, ash, basswood, black walnut, and yellow-poplar. Farther west, in Arkansas, chinkapin oak occurs in mixed oak stands along with butternut, black walnut, shortleaf pine, sugar maple, and Ozark chinkapin. In the South it is found, along with holly and various oaks, in stands dominated by beech and magnolia.

Although chinkapin oak "is found in limited numbers in all parts of the state" (11), it has been reported as common in only four counties in southern Indiana. In limited locations, marked by outcrops of Ordovician and Silurian limestones, it occupies a codominant position in the crown canopy, forming a Quercus muehlenbergii-Q. rubra association (20).

In the Ozarks it is frequently found with eastern redcedar. Beilmann and Brenner (4) described a redcedar-chinkapin oak association in Missouri; it was closely correlated with a certain type of underlying rock strata--pure dolomite, known locally as "cotton rock."

Little specific information on the role of animals in the reproduction and development of chinkapin oak has been published. Like other species of white oaks the acorns are a food highly prized by wildlife. According to Smith (24), the acorns of chinkapin oak are usually sweet, and the most edible of all acorns, a characteristic that may account for the scarcity of this species on many sites. The bark is known to be eaten by beavers (2).

LIFE HISTORY

Seeding Habits

Chinkapin oak is monoecious, bearing staminate flowers on the twigs of the preceding season and pistillate flowers in the axils of new leaves (7). Over most of its range, flowering begins in late May or early June when the leaves are about one-fourth grown. The fruit is an acorn, maturing in one growing season, borne solitary or in pairs, and ripens in September or October. There are about 520 seeds per pound (30).

Vegetative Reproduction

Chinkapin oak reproduces itself well by sprouting from stumps (30). In general, the reproduction of oaks by rooting of stem cuttings and by the usual budding techniques has not been successful. Grafting, on the other hand, has been successful, by both bench and outdoor grafting techniques (23).

Seedling Development

Within its natural range, chinkapin oak germinates and develops most successfully on well-drained, calcareous soils. During the seedling stage it will tolerate a moderate cover of overtopping shrubs and trees. Artificial forestation can be done by direct seeding or by planting of seedling stock. If direct seeding is attempted, some protection from birds and mammals is desirable.

Sapling Stage to Maturity

Because chinkapin oak is rather uncommon over most of its natural range and therefore of little commercial importance, its habits of growth have not been studied extensively. It is a rather fast-growing species, and becomes more intolerant of shade with age (30). When growing in forest stands, chinkapin oak tends to form a straight, columnar trunk, with a dense rounded crown and fairly small branches; growing in the open it usually develops short trunks and broad crowns (24). On better sites, especially in the Ohio Valley, it averages 60 to 80 feet in height and 2 to 3 feet in diameter at maturity (13). The largest tree reported by the American Forestry Association (1) was found near Lattaville, Ohio. Its circumference at breast height was 20 feet, 6 inches; its height 55 feet; and its crown spread 75 feet.

Most of the stands in which chinkapin oak occurs are regarded as edaphic climaxes or subclimax to climatic climaxes. The major associations of which it is a member are the mixed mesophytic, oak-hickory, oak-chestnut, beech-maple, and maple-basswood associations in the deciduous forest formation (5). Potzger and Chandler (16) considered the oak-hickory stands containing chinkapin oak in southern Indiana as subclimax to a climatic climax of beech, ash, and maple. These stands are located in an area that may be regarded as a transition or tension zone between the oak-hickory and beech-maple associations. In the Missouri Ozarks Steyermark (26) placed chinkapin oak in the final successional stage in the development of the flood plain flora to a sugar maple-bitternut hickory association. He also recognizes a chinkapin oak subclimax on south- and west-facing limestone slopes.

ENEMIES AND HAZARDS

Although the species is generally regarded as free from serious diseases or insect attacks (30) it has been found susceptible to oak wilt (6) (Ceratocystis fagacearum) and is often attacked by a disease known as anthracnose (Gnomonia veneta) (18). Common insect pests include various leaf miners (Cameraria spp.), the twig pruner (Hypermallus villosus) and acorn weevils (Curculio spp.) (10). Other pests include the gypsy moth (Porthetria dispar), the oak-bark scarrer (Romaleum cortiphagus), the orange striped oak worm (Anisota senatoria) and various species of trunk borers such as the carpenter worm (Prionoxystus robiniae), the little carpenter worm (P. macmurtrei), the Columbia timber worm (Corthylus columbiacus), the oak timber worm (Arrhenodes minuta), the red oak borer

(Romaleum rufulum), and several species of the genus Goes. The most common twig pruner is Hypermallus villosus.

Young growth is easily damaged by fire (30).

RACES AND HYBRIDS

Deam and Shaw recognize two forms of chinkapin oak: one has wide leaves, an ovoid nut with a deep cup; the other has narrower leaves, more incurved teeth, and a slender nut with shallow cup.

One hybrid is recognized by Little (14): Quercus X deamii is claimed to be a hybrid of Q. macrocarpa and Q. muehlenbergii. There is some controversy over the parentage of this hybrid. Trelease (28) considered it as Q. alba X Q. muehlenbergii, while Bartlett (3) shows that it is probably Q. macrocarpa X Q. muehlenbergii. Palmer (15) called this hybrid Q. X Fallax.

TREE SPECIES MENTIONED

Ash	--	<u>Fraxinus</u> spp.
Basswood	-	<u>Tilia</u> spp.
Beech	-	<u>Fagus</u> spp.
Butternut	-	<u>Juglans cinerea</u> L.
Black cherry	-	<u>Prunus serotina</u> Ehrh.
Chestnut	-	<u>Castanea</u> spp.
Ozark chinkapin	-	<u>Castanea ozarkensis</u> Ashe
Cucumber tree	-	<u>Magnolia acuminata</u> L.
Bitternut hickory	-	<u>Carya cordiformis</u> (Wangenh.) K. Koch
Holly	-	<u>Ilex</u> spp.
Magnolia	-	<u>Magnolia</u> spp.
Sugar maple	-	<u>Acer saccharum</u> Marsh.
Black oak	-	<u>Quercus velutina</u> Lam.
Bur oak	-	<u>Q. macrocarpa</u> Michx.
Chinkapin oak	-	<u>Q. muehlenbergii</u> Engelm.
Post oak	-	<u>Q. stellata</u> Wangenh.
White oak	-	<u>Q. alba</u> L.
Shortleaf pine	-	<u>Pinus echinata</u> Mill.
Eastern redcedar	-	<u>Juniperus virginiana</u> L.
Black walnut	-	<u>Juglans nigra</u> L.
Yellow-poplar	-	<u>Liriodendron tulipifera</u> L.

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