Aesculus glabra Willd. Ohio Buckeye

Hippocastanaceae Horsechestnut family

Robert D. Williams

Ohio buckeye *(Aesculus glabra)*, also known as American buckeye, fetid buckeye, and stinking buckeye, derives its unflattering common names from the disagreeable odor that emanates when the leaves are crushed. The tree is an attractive ornamental, but it has limited commercial use as sawtimber because of the soft, light wood. The bark and seeds contain a narcotic glucoside considered poisonous to livestock, leading many landowners to eradicate it.

Habitat

Native Range

Ohio buckeye (fig. 1) grows mostly on mesophytic sites in western Pennsylvania, Ohio, and southern Michigan west to Illinois and central Iowa. Its range extends south to eastern Kansas, southwestern Oklahoma, and central Texas; east to western Arkansas,

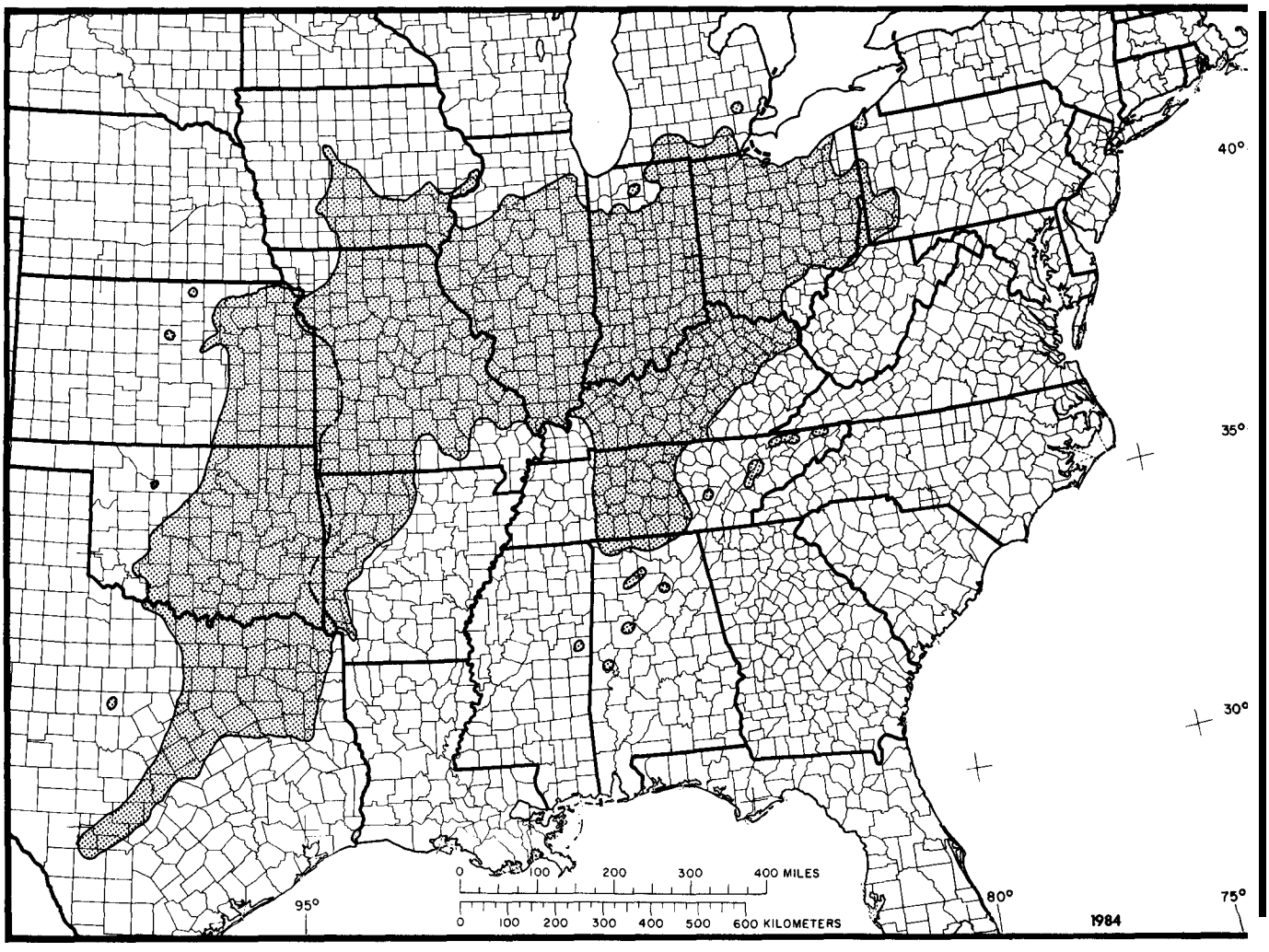

Figure *1-The native range of Ohio buckeye. The broken line separates eastward the typical variety and westward the variety* arguta, *Texas buckeye.*

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Tennessee, and central Alabama with one location in eastern Mississippi (9). It has been planted in Europe and the eastern United States; in eastern Massachusetts, Minnesota, and western Kansas *(11)*.

Climate

The average annual temperature in the growing area of Ohio buckeye ranges from about 4" to 10° C (40" to 50" F) (6). Average minimum temperatures are not below -29" C (-20° F) within its range, but -40" C (-40" F) temperatures have been recorded where it grows in Missouri and Iowa. Maximum temperatures as high as 46" C (115° F) have occurred in the western part of its range. Average annual precipitation ranges from 760 mm (30 in) in Kansas and Oklahoma to 1020 mm (40 in) in Ohio and western Pennsylvania, and up to 1400 mm (55 in) in Mississippi and Alabama. Growing-season precipitation averages 510 to 640 mm (20 to 25 in). Snowfall ranges from 5 cm (2 in) in the southern part of the geographic distribution to 102 cm (40 in) in the northern part. About 160 days are frost-free in the northern part of the range and as many as 220 days in the southern part.

Soils and Topography

The buckeye is a moist-site tree and is most frequently found along river bottoms and in streambank soils. It is often found on the moist soils of the Early Wisconsin Drift Plain in Indiana (4). Ohio buckeye is most commonly found growing on soils of the order Alfisols. In the early 1800's buckeye and sugar maple *(Acer saccharum)* were prominent on the slope phase of the Miami silty clay loam in Ohio (9). Buckeye made up about 5 percent of the forest stand on this soil type. Since then its abundance has diminished.

Although Ohio buckeye is sometimes found on drier sites such as those supporting oak-hickory stands, and on clayey soils, it usually grows slowly in these situations and seldom becomes dominant. It is a shrub, only 1.2 to 1.5 m (4 to 5 ft) tall, on dry habitats in the oak-hickory association of eastern Oklahoma *(9)*. Ohio buckeye also is found in hardwood stands on moist sites in the limestone-sink-and-cave section of the Bluegrass region of Kentucky and is infrequently found on the well developed flood plains along the Missouri River in southeastern Nebraska (9).

Associated Forest Cover

Ohio buckeye grows in mixed stands with bur oak *(Quercus macrocarpa),* chinkapin oak *(Q. muehlenbergii),* white ash *(Fraxinus americana),* hackberry *(Celtis occidentalis)*, sugar maple, black walnut *(Juglans nigra),* black cherry *(Prunus serotina)*, honeylocust *(Gleditsia triancanthos)*, Kentucky coffeetree *(Gymnocladus dioicus)*, shagbark hickory *(Carya ovata),* American elm *(Ulmus americana),* and red mulberry *(Morus rubra)* in the Bluegrass region of Kentucky (9). In Indiana, 6 percent of the trees in a mixed hardwood stand were buckeyes; 39, 11, 16, and 28 percent were sugar maple, American elm, black walnut, and miscellaneous species, respectively. In another stand in which more than 50 percent of the trees were beech *(Fagus grandifolia)*, sugar maple, hackberry, and black walnut, buckeye constituted a little more than 10 percent.

In the mixed mesophytic climax forests of Marion and Johnston Counties, IN, in 1819, Ohio buckeye made up 6 and 2 percent, respectively, of the total number of stems *(9)*, and less than 2 percent of these trees were more than 46 cm (18 in) in d.b.h. In a few stands, however, it made up as much as 17 percent of the total stems, ranking second in importance only to beech.

Buckeye is a frequent or even a common tree in association with beech, sugar maple, and American basswood *(Tilia americana)* in the Wabash River Basin in southern Illinois and Indiana (9).

Ohio buckeye is not listed by the Society of American Foresters as a major or minor component of any of the North American forest cover types *(5)*, probably because of its relatively minor commercial importance and its increasing rarity. It is not a pioneer tree and thus is seldom found on old fields or spoil-bank sites.

Life History

Reproduction and Early Growth

Flowering and Fruiting-Ohio buckeye is polygamo-monoecious, bearing both bisexual and male flowers. The pale greenish-yellow flowers appear after the leaves in the spring from March to May and are borne in upright branched clusters. Only those near the base of the branches of a cluster are perfect and fertile; the others are staminate *(4,11)*. The fruit is a leathery capsule containing one, two, or three seeds. The ripe seed is dark chocolate to chestnut brown, smooth and shiny, with a large, light-colored hilum so that it resembles an eye. The cotyledons are very thick and fleshy and contain no endosperm.

Seed Production and Dissemination-Seeds are dispersed from early September to late October by gravity, by animal activity, and sometimes by

water. The number of hulled seeds per kilogram ranges from 105 to 150 (48 to 67/lb), and most seeds are sound *(11)*. The seeds have a high moisture content and should be kept moist to avoid loss of viability.

Ohio buckeye begins bearing seeds at 8 years but no data are available on frequency and amount of seed produced ***(11).***

Seedling Development-The seeds ordinarily germinate in the spring after wintering on the ground. Germination is hypogeal. If seeds are to be sown in a nursery, they should be sown in the fall or stratified about 120 days before spring sowing (11). No germination has been observed on dry surface soil, even with an ample seed supply.

Seedlings can grow under some shade, but the species seems to develop best as isolated individuals in openings along streambanks and on other moist sites. No data are available on early growth rates.

Vegetative Reproduction-No information available.

Sapling and Pole Stages to Maturity

Growth and Yield-Ohio buckeye generally develops a strong taproot the first year. Most of the shoot growth occurs early in the growing season. As a sapling it grows faster than most of the oaks but slower than yellow-poplar ***(Liriodendron tulipifera).*** In the open, it is characteristically branchy with a short, knotty trunk.

Fifty Ohio buckeyes measured in Jefferson County, IN, averaged 20.7 m (68 ft) in height and 84 cm (33 in) in d.b.h., 91 cm (36 in) above the ground (9). Apparently these trees were larger in diameter than average for buckeye, even though the diameter was measured lower on the bole than the standard breast height of 1.37 m (4.5 ft). This species generally does not grow taller than 9.1 m (30 ft) and seldom exceeds 21.3 m (70 ft) (9). In 1978, the largest living tree registered was 116 cm (45.5 in) in d.b.h., 44.5 m (146 ft) tall, and had a crown spread of 16.5 m (54 ft) *(1)*. Trees larger than 61 cm (24 in) in diameter are rare. On good sites, the tree will reach usable sawtimber size at 60 to 80 years of age. On poor sites, it seldom has the form or size to produce saw logs.

Rooting Habit-No information available.

Reaction to Competition-Because Ohio buckeye is often found in beech-sugar maple stands, it must be classed as shade tolerant. It only attains good form as a timber tree when it grows in reasonably dense stands. Side competition and shade foster straight boles and encourage natural pruning of this tree, which tends to have a large, branchy crown,

Damaging Agents-Ohio buckeye is relatively free of insect pests but the sapwood timber-worm ***(Hylecoetus lugubris)***, the lacebug *(Corythucha aesculi)*, the chrysomelid ***(Derocrepis aesculi),*** and the walnut scale ***(Quadraspidiotus juglansregiae)*** feed on buckeye (2).

Ohio buckeye also has relatively few diseases (6). It is susceptible to a leaf blotch ***(Guignardia aesculi),*** which begins as brown spots or blotches on the leaves and may eventually involve all the leaves, giving the tree a scorched appearance. This disease may slow the growth rate but does no permanent damage to the tree and can be controlled on ornamentals. One of the powdery mildews, ***Uncincula flexuosa***, also attacks the leaves of buckeye.

A leaf rust of the Ohio buckeye that occurs in the western part of the species range was long known as ***Aecidium aesculi*** but has now been established by Baxter as *Puccinia* ***andropogonis (3).***

Leaf blotch and leaf scorch, the latter involving a physiogenic response to heat and drought along urban streets, may be the most serious diseases (7). Air pollution may be more responsible for the leaf blighting than heat or drought.

Because Ohio buckeye leafs out early in the spring, the young leaves are sometimes killed by frost. This species is capable of withstanding severe winters, however, and has been successfully introduced in Minnesota and Massachusetts. Moreover, the bole of the tree is not commonly damaged by frost, and the heavy branches of the crown are seldom severely damaged by heavy loads of sleet or snow. Apparently buckeye is not susceptible to sunscald either.

The common eastern leafy mistletoe, ***Phoradendron serotinum,*** occurs on Ohio buckeye, but damage is negligible (7).

Fungi capable of causing either rot of the central stem or rot at wounds of living trees include ***Ganoderma applanatum, Oxyporus populinus,*** *Phellinus johnsonianus,* and ***Polyporus squamosus (7).*** Buckeye growing in forest stands is usually free of defect caused by decay unless the bole has been damaged by fire.

Special Uses

The seeds as well as the bark of Ohio buckeye are reported to be poisonous, and the ***Aesculus*** native to Illinois is known to contain a poisonous narcotic glucoside (9). The young shoots of buckeye are poisonous to cattle, and landowners in Indiana have

exterminated buckeye in many areas because the seed is considered poisonous to livestock *(9)*. On the other hand, some buckeye seed are apparently eaten by squirrels. In Ohio, it constitutes from 2 to 5 percent of the food of eastern fox squirrels during the fall, winter, and spring seasons. Other studies in Ohio list buckeye as an auxiliary food that was sampled by squirrels in September but not eaten in quantity (9). Thus, it seems probable that the use of buckeye seed for food by animals is not a limiting factor in its reproduction.

Fox squirrels in Illinois were observed eating the pith from terminal twigs *(6)*. Buckeye pith contains 66 percent raffinose, a sweet-tasting M-carbon sugar that is much sweeter and contains potentially more energy than sucrose.

The wood is light and soft and is used for pulpwood, woodenware, and occasionally for lumber *(10)*.

Genetics

Texas buckeye (***Aesculus glabra*** var. ***arguta*** (Buckl.) Robins.), a shrub or small tree, ranges from southeastern Nebraska southwest to central Texas *(8)*.

Hybrids of ***Aesculus glabra*** with ***Ae. octandra*** (*Ae. x marylandica* Booth ex Dippel), ***Ae. pavia*** (***Ae. x bushii*** Schneid.), and ***Ae. octandra x pavia*** (***Ae. x arnoldiana*** Sarg.) have been recorded (8). Intermediate hybrids exhibiting the characteristics of both species occur as hybrid swarms, or most often, individual plants of one species have one or more characteristics of the other species from introgression (4).

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