

Castanea pumila (L.) Mill.: An Underused Native Nut Tree

Introduction

Chinkapins, also spelled “chinquapins” and sometimes called dwarf or bush chestnuts, are shrubs and small trees commonly found throughout the eastern, southern, and southeastern United States. The plants usually bear one nut per bur and have burs (involucres) that open into two halves, such as a clam shell. Some taxonomists and geneticists have separated the chinkapins into eight or more poorly defined taxa based on growth form, leaf morphology, bur characteristics, habitat, and blight susceptibility (Ashe, 1923, 1924; Graves, 1950, 1961; Jaynes, 1975). Species include *Castanea pumila* (L.) Mill., *C. ozarkensis* Ashe, *C. ashei* (Sudw.) Ashe, *C. alnifolia* Nutt., *C. floridana* (Sarg.) Ashe, *C. paucispina* Ashe, *C. arkansana* Ashe, and *C. alabamensis* Ashe. Other taxonomists (Johnson, 1987, 1988; Tucker, 1975) have reduced most of these taxa to synonymy within *C. pumila* var. *pumila* and indicate that the chinkapin is but a single species, *C. pumila*, comprising two botanical varieties: vars. *ozarkensis* (Ashe) Tucker and *pumila*. Only the Allegheny chinkapin, *C. pumila* var. *pumila* (Terrell, 1977) is treated in this report.

The Allegheny chinkapin, also called the American, common, or tree chinkapin, may well be our most mistreated and misrepresented native North American nut tree. It has been widely hailed as a sweet and edible nut; wood source for fuel, charcoal, fence posts, and railroad ties; coffee and chocolate substitute; food for wildlife (birds and mammals); dwarfing rootstock for other *Castanea* spp.; and a blight-resistant taxon for hybridizing with other chestnut species; in addition, the root has been used as an astringent, a tonic, and to treat fevers (Gillespie, 1959; Halls, 1977; Krochmal and Krochmal, 1982; Percher, 1970; Taylor, 1960).

Description and distribution

Castanea pumila var. *pumila* is a large, spreading, smooth-barked, multistemmed shrub that is 2 to 4 m tall. Occasionally, there

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is but a single stem and the plant may reach 5 to 8 m. Large trees are sometimes found, especially where humans have intervened and removed competing trees. According to Rehder (1960), *C. pumila* attains a height of 15.2 m; however, the *National Register of Big Trees* (Pardo, 1978) lists its two *C. pumila* specimens at 12.5 and 12.8 m. Johnson (1988) recorded a 15-m-tall tree with a diameter at breast height of 1.1 m in Liberty County, Fla.

The Allegheny chinkapin is found in dry sandy woods and thickets from southern New Jersey and Pennsylvania, west to Indiana and Missouri, and south to Florida and Texas (Fig. 1). According to Hooker (1967), *C. pumila* is rare in Oklahoma and, when found, is widely scattered in the extreme eastern counties on dry, rocky, or gravelly ridges, or siliceous uplands.

Botany and horticulture

In Georgia, budbreak normally occurs during the last week of March or the first week of April. The leaves are borne alternately along the slender pubescent to glabrescent reddish-brown twigs. The simple leaves are acute, elliptic to obovate, 4.1 to 21.7 cm long, 1.5 to 8.3 cm wide, bright yellowish green to light green and glabrous above, and whitish and

densely tomentose beneath. The leaf margins are coarsely serrate and bristle-tipped, and the petiole is stout and glabrous, but can be pubescent. There is much variation in leaf shape, size, color, and pubescence even when growing on the same tree (shrub).

Flowering occurs after the first leaves have expanded. The flowers are borne on erect, horizontal, or pendant axillary spikes on shoots of the current-season's growth. There is only one inflorescence per leaf axil, and it may be staminate, androgynous, or, rarely, pistillate. Unisexual male catkins appear near the bases of the shoots; bisexual catkins containing male and female flowers are found nearer the terminal ends of the shoots. The female or pistillate flowers occur near the bases of these bisexual catkins and the male or staminate flowers near the tips. Occasionally, female catkins (catkins bearing only pistillate flowers) are present instead of bisexual ones.

In central Georgia, unisexual male catkins normally shed pollen during the first week of May. The distillate flowers of the bisexual catkins are normally receptive \approx 1 week later, several days before the staminate flowers of these bisexual catkins shed pollen. This type of blooming sequence or flower maturation has been called duodichogamy and heteroduodichogamy (Stout, 1928; Vilkomerson, 1940). Chinkapins are rarely self-fruitful and cross-pollination is necessary to ensure a good nut crop. However, Morris (1914) reported that plants of *C. pumila* may set viable seeds without pollination. McKay (1942) reported

(continued on p. 130)

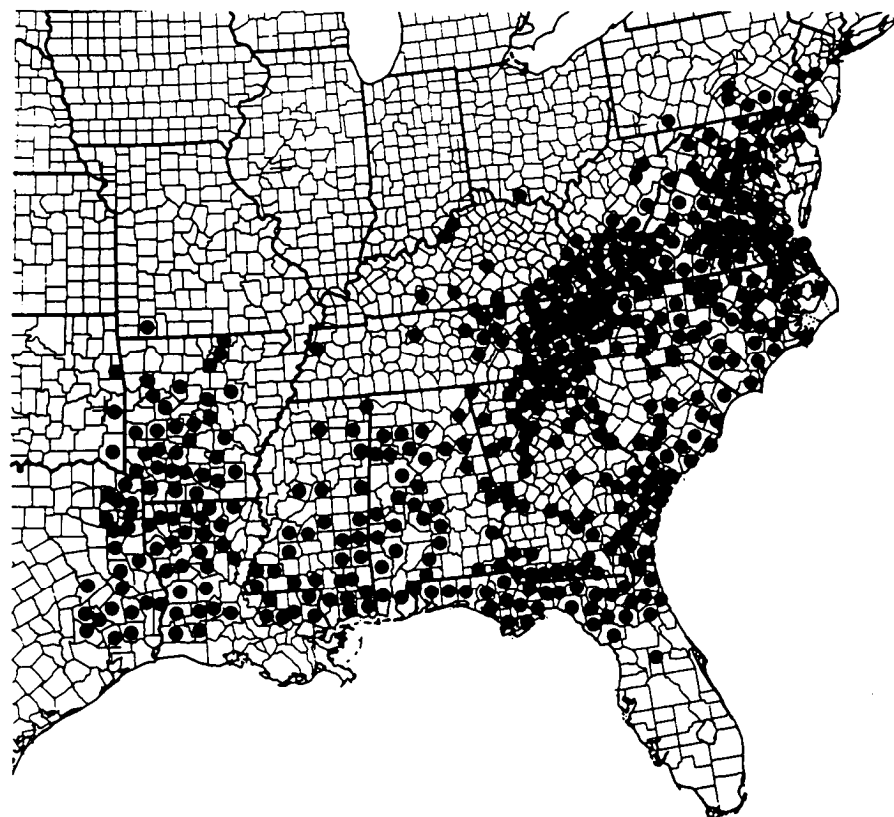


Fig. 1. Distribution of *Castanea pumila* var. *pumila*, based on herbarium specimens (source: Johnson, 1988).

(continued from inside front cover)

this apomictic behavior in Chinese chestnuts (*C. molissima* Bl.).

The Allegheny chinkapin normally is ready for harvest in early September. Harvest must be prompt to gather nuts before wildlife (birds and small mammals) remove the entire crop. One single brown, lustrous, round nut is contained in each spiny green involucre. The burs of chinkapin are normally no more than 1.4 to 4.6 cm in diameter and split into two valves at nut maturity. In contrast to other chestnut species, chinkapins usually remain attached to the bur at the hilum for several days after the bur has opened. Also, the burs and catkins do not abscise at harvest time, but remain attached until later in the fall or even until the following season. On each catkin, the more basal burs usually ripen before the more distal ones. These characteristics make chinkapins very difficult to harvest; the burs cannot be shaken or easily picked from the trees. After the burs open, but before the nuts fall, the exposed nuts are tempting morsels for birds or climbing mammals. Even at the peak of harvest, shaking a chinkapin branch will bring down only a small percentage of its crop, because half of the nuts are already gone and the other half have not opened yet. If the unopened burs are cut or tom from the branches, very few of them will subsequently open. Most will then require a tedious threshing. Complicating harvest and subsequent use is the fact that chinkapins germinate in the fall. Often the radicle emerges while the nuts are still on the tree. Some of the chinkapin clones from isolated sites in Georgia bear nuts averaging 480 per kilogram (fresh weight); however, the normal range is 800 to 1320 per kilogram. According to Taylor (1960), *C. pumila* has been marketed in considerable quantities and for more than two centuries (Woodroof, 1979); however, we seldom see mention of chinkapins for sale in any recent state market bulletins.

The small market size for chinkapins and their accessibility for general consumption has not encouraged research into the nutritive quality and chemical composition of the nuts. Woodroof (1979) stated that chinkapins contain 5% fat, 5% protein, 40% starch, and 50% water, while Payne et al. (1982) found the caloric content of chinkapins was $\approx 20 \times 10^3$ J·g⁻¹ and the ash content was 4.0%* 0.4%. In a more recent study, Senter et al. (1994) compared the total lipids, fatty acids, sugars, and nonvolatile organic acids of nuts from *Castanea* species and found that chinkapins compared more favorably with the American chestnut [*C. dentata* (Marsh.) Borkh.] in the quantities of these constituents than did the European chestnut (*C. sativa* Mill.) or the Chinese chestnut. Average lipid content (dry-weight basis) of the chinkapins over selections was 4.01% and was comprised primarily of triglycerides containing palmitic, stearic, oleic, linoleic, and linolenic fatty acids. The fatty acids constituted > 90% of the lipids present and were predominantly oleic and linoleic acids (46% and 34%, respectively). Very low percentages

of the saturated fatty acids were present, which confirms the nutritional quality of the chinkapin. Sugars in chinkapins were glucose, fructose, and sucrose and the sugar alcohol, inositol. Sucrose, a normal constituent of fruiting bodies, averaged 8.3% of the dry weight and did not differ quantitatively from the American chestnut. The remaining sugars and the organic acids, malic and citric, constituted $\approx 0.1\%$ of the dry weight and were considered normal metabolic products. Based on the preceding analyses, the legendary superior flavor of the chinkapin may be due to its sucrose content, which would contribute sweetness, and to its relatively high lipid content, which is one of the primary factors contributing to food acceptance (Pilgram and Kamen, 1963).

Yields

There is very little information regarding expected yields from chinkapins because commercial plantings are practically nonexistent. However, some values can be extracted from nurseries that have been established as a source for seed and for breeding research. Yield extrapolations from a southeastern Kentucky 6-row planting of 30 *C. pumila* trees with a 3-m between-tree spacing and a 6-m between-row spacing would give 1.2 t·ha⁻¹ in the twelfth year and 3.1 t·ha⁻¹ in the fourteenth year. These yields are lower than expected due to fall germination and adherence of nuts in the bur. Yield also was measured from a 7-year-old, closely spaced (1 x 2 m) planting of seedlings in east-central Ohio. The planting had reached crown closure but had not yet suffered much branch loss due to shading. Individual tree yields varied considerably from 0 to 21 kg. Average yield from trees in the middle of the planting was 5.0 \pm 1.5 t·ha⁻¹. This yield equals or exceeds the level expected for other chestnuts. Thus, the prolific production of chinkapins compensates for their small size.

Pest problems

There is limited information on pest management for chinkapins; however, they are susceptible to many of the insects, mites, and diseases that attack other native and introduced *Castanea* species (Payne and Johnson, 1979; U.S. Dept. of Agriculture Crops Research Division, 1960; U.S. Dept. of Agriculture Forest Service, 1985). Several insects, including two chestnut weevils [*Curculio caryatrypes* (Boheman) and *C. sayi* (Gyllenhal)], a nut curculio (*Conotrachelus*

carinifer Casey), Asiatic oak weevil [*Cyrtopistomus castaneus* (Roelofs)], Japanese beetle (*Popillia japonica* Newman), yellownecked caterpillar [*Datana ministra* (Drury)], and pinkstriped oakworm [*Anisota virginiana* (Drury)], feed on the flowers, fruit, and foliage of chinkapin. The Oriental chestnut gall wasp (*Dryocosmus kuriphilus* Yasumatsu) has recently been found on chinkapins near Americus, Ga. It is a serious pest of Chinese chestnut and Japanese chestnut (*Castanea crenata* Sieb. and Zucc.) in Georgia, Japan, China, and Korea; no control is known presently (Payne et al., 1983).

Chinkapins are quite susceptible to *Phytophthora cinnamomi* root rot (Crandall et al., 1945). The Allegheny chinkapin is reported to be slightly resistant to the chestnut blight fungus caused by *Cryphonectria (Endothia) parasitica* (Murr.) Barr (Chandler, 1957); however, diseased and heavily cankered trees have been found in Georgia and Louisiana (Wallace and Peacher, 1970). Chinkapins blight to some degree, but they continue to sucker and send up shoots from the root collar and, despite cankering, produce fruit. *Castaneapumila* has been widely used in the breeding programs for blight resistance (Graves, 1950; Jaynes, 1975). 'Alamoore' (*C. crenata* x *C. pumila*) was introduced in 1952 by the Alabama Agricultural Experiment Station because it was blight resistant, prolific, and early bearing (Brooks and Olmo, 1972). According to a blight researcher (S. Anagnostakis, New Haven, Conn., personal communication), the chinkapin hybrids areas susceptible to chestnut blight as American chestnuts based on inoculation tests with two strains of *Cryphonectria parasitica*.

Prospects

According to Taylor (1960), two named varieties of *C. pumila*, 'Fuller' and 'Rush', have been published and propagated to a limited extent; however, neither is listed in Brooks and Olmo's (1952, 1972) *Register of New Fruit and Nut Varieties*. The U.S. Soil Conservation Service, Univ. of Kentucky Agricultural Experiment Station, and Kentucky Dept. of Fish and Wildlife jointly released 'Golden' for commercial production in 1983; however, we know of no commercial orchards.

Our native Allegheny chinkapins are prolific producers of sweet, nutty-flavored, small chestnuts (Table 1). They have attractive foliage and flowers, although some consider the odor at blossoming time unpleasant. Incorporo

Table 1. Advantages and problems associated with development of Allegheny chinkapin as a crop.

Advantages	Problems
Precocious—Produce nuts in 2–3 years	Excessive bird and mammal feeding
Prolific—Many female flowers per catkin	Difficult to harvest
Many female catkins per shoot	Fall germination
Distinct flavor and aroma—Sweet and edible	Small nut size
Attractive foliage, flowers, and burs	Nuts adhere in the bur and germination occurs in the bur
Attracts wildlife—Food and cover	Susceptible to blight
Dry-site plant—Reclamation	Multistemmed suckering
Dwarfing rootstock possibility	Pesticide registrations

rating the sweetness, texture, and flavor of the chinkapin into the Japanese chestnut or the Chinese chestnut would enhance demand for uncooked chestnuts (Jaynes, 1979). If suckering could be eliminated, chinkapins have promise as a dwarfing rootstock, especially because the Allegheny chinkapin occurs across a wide geographic range. The great drawback of the American chestnut was its small nut size and the added disadvantage that many nuts adhere in the bur at harvest and have to be removed by force (Smith, 1950); the same can certainly be stated for the Allegheny chinkapin (Table 1). Since the nuts are small, difficult to harvest, and because they germinate at harvest, chinkapins have limited potential as a commercial crop. However, their small tree size, precocity, and heavy production may be useful characteristics to breed into the commercial chestnut species. These chinkapin characteristics will facilitate the development of high-density chestnut production systems to be used with cultivars having earlier and higher yields than existing chestnut cultivars.

Since the chinkapin is adapted to a wide range of soils and site conditions, it should be considered for its wildlife value. The nuts are eaten by various small mammals, such as squirrels (*Sciurus* spp.), rabbits (*Sylvilagus* spp.), deer mice (*Peromyscus* spp.), eastern chipmunks [*Tamias striatus* (L.)], and eastern woodrats [*Neotoma floridana* (Oral)]. By cutting the stem at the ground surface, dense thickets can be established within a few years to provide food and cover for wild game, especially white-tailed deer [*Odocoileus virginianus* (Zimmerman)], ruffed grouse [*Bonasa umbellus* (L.)], northern bobwhite [*Colinus virginianus* (L.)], and wild turkey [*Meleagris gallopavo* (L.)].

A renowned horticulturist once remarked, "To hear about the attributes of the Allegheny chinkapin makes your mouth water but to see it makes your eyes water." According to Fuller (1896), "From present indications this tree will be well worthy of cultivation as an ornamental shade tree, even if we leave out of the account its rapid growth, productiveness, and delicious little nuts, which will be very acceptable for home use, if not possessing any great commercial value." We believe that after 98 years, the economic potential of this nut crop remains uncertain, although the plant has potential in landscaping and as a wildlife food source and shelter.

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