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IDENTIFICATION OF CHESTNUT TREES

Introduction

Chestnuts have been cultivated for nuts and wood for thousands of years. The name Castanea is believed to come from Kastanea, a city in Pontus, Turkey. European chestnuts (*Castanea sativa*) probably survived the ice age in Southern Russia in the Caucasus Mountains, between the Black and the Caspian Seas. They were planted throughout the Roman Empire, and now grow wild in Italy, France, Spain, and Greece. Chestnuts are also important in Asia, where there are four native species (*Castanea mollissima*, *C. henryi*, *C. seguinii*, and *C. crenata*).

In North America, pollen records from the last interglacial period show that American chestnut trees, *Castanea dentata*, were present on Long Island 30,000 to 50,000 years ago. After the ice had permanently receded (about 13,000 years ago), measurable chestnut pollen was first deposited in the Blue Ridge area of North Carolina. American chestnut trees then spread their range all along the Appalachian mountain range, from Portland, Maine to northern Georgia. Within this area, chestnuts grew in mixed, hardwood forests, usually on high, sandy land, gravel ridges, or mountain slopes that were wholly, or nearly free from limestone. In the last 150 years chestnuts have been planted outside the native range in favorable spots (Michigan, Wisconsin) where they have become dominant forest trees, protected from chestnut blight disease by geography until only recently. Allegheny chinquapins, *Castanea pumila*, share the southern part of the range with American chestnut from Pennsylvania south. Ozark chinquapins are found on the Ozark Plateau, and Florida and trailing chinquapins are found in northern Florida.

Even though the *Castanea* are divided into separate species, all of the species will cross with each other and produce viable offspring. These "mules" are often male-sterile and fail to produce pollen, but the female flowers are capable of receiving pollen and will produce viable nuts. The genetics of this male sterility is not understood; sometimes fertility is restored in subsequent generations and sometimes it is not.

Descriptions

Chestnuts are deciduous trees with alternate, short-stemmed, prominently veined, oblong leaves that have course to fine pointed marginal teeth or bristles. Male (staminate) flowers are formed in the axils of successive or alternate leaves in early June, in groups of cylindrical catkins (aments) as long as or longer than the leaves. Female (pistillate) flowers form later and on younger wood, at the base of

short catkins. The nuts develop in prickly husks called burs (with one r), which open when the nuts are mature (usually mid-September to mid-October).

There are seven to ten species identified by taxonomists (depending on whether they are "splitters" or "lumpers").

Leaves to be examined should be fully expanded, from parts of the tree exposed to full sun and not from within 6 inches of flowers.

Quick key

Leaves to be examined should be fully expanded, from parts of the tree exposed to full sun and not from within 6 inches of flowers.

Group I Three nuts per bur

A. Leaves hairless and deeply indented, or with only a few short hairs on the mid-vein on the lower surface.

1. **Twigs smooth**, red-brown, leaves thin, 5 to 10 inches long, lower surface of leaves with few glands.
   Castanea dentata = American chestnut

2. **Twigs with short simple hairs**, leaves 2 to 4 inches long lower surface of leaves densely covered with **glands**.
   Castanea seguinii = Dwarf Chinese chestnut

A. Leaves hairy on the lower surface

3. Twigs thick and coarse, brown and downy at first and then becoming smooth: leaves 5 to 10 inches long with **long hairs on the veins of both the lower and upper surfaces**.
   Castanea sativa = European chestnut

4. **Twigs greenish-brown to buff-yellow and downy**; leaves coarsely serrate and usually thick and leathery with dense or sparse stellate hairs on the lower surface,
   Castanea mollissima = Chinese chestnut

5. Twigs delicate, dark reddish-brown and downy, becoming smooth as they mature; leaves with dense or sparse stellate hairs and **gland**s on the lower surface, leaf margins with **bristle-like projections instead of deeply-cut teeth**.
   Castanea crenata = Japanese chestnut

Group II One nut per bur

A. Leaves densely hairy on the lower surface, margins deeply indented, 3 to 10 inches long

Castanea pumila = Allegheny chinquapin
Castanea ozarkensis = Ozark chinquapin
Castanea floridana = Florida chinquapin
Castanea alnifolia = trailing chinquapin

B. leaves hairless, margins with bristle-like teeth, leaves shaped like willow leaves and 3 to 6 inches long.

Castanea henryi = Chinese chinquapin

Details

Group I Nuts 3 per bur

Female flowers form near the ends of the branches (except for *C. seguinii*) and little branch growth occurs on those branches after flowering. Hence the burs are at the ends of the branches. Nuts germinate in the spring after a cold treatment of about three months.

A. Leaves hairless and deeply indented at the margins

1. *Castanea dentata* (Marshall) Borkhausen American chestnut

Before ink disease (caused by *Phytophthora cinnamomi*) and chestnut blight disease (caused by *Cryphonectria parasitica*) were brought into the US, this was a tree 60 to 80 (occasionally 100) feet tall. Now mature trees are uncommon within the native range, and the species is usually found as a shrubby cluster of sprouts three to 15 feet tall, or as a slender, understory tree 15 to 60 feet tall. The twigs are chestnut brown; the buds are smooth and brown and asymmetrically bullet-shaped, usually askew on the twig. Leaves are oblong, pointed at the tip, and acute at the base where they join the petioles (canoe shaped), with coarsely dentate (toothed) margins. Mature leaves are light green and paper-thin, and droop down from the twigs.

The most striking difference between American chestnut trees and the other species is their slender, upright growth, and their thinner, smoother leaves. The nuts are generally smaller than all other chestnuts, except chinquapins, and taste sweeter.

2. *Castanea seguinii* Dode Dwarf Chinese chestnut

This species is a shrub to a small tree in China, but is not very winter-hardy in Connecticut. It seems to have some resistance to chestnut blight disease. Flowers form early in the spring and continue to form through the growing

season, until killed by the first frost. Hybrids are valuable for use as dwarfing rootstocks, and for their ever-flowering characteristic.

B. Leaves hairy on the lower surface

1. *Castanea sativa* Miller European chestnut

These trees were extensively planted in North America, starting in 1773 (Thomas Jefferson). The commercial nuts of France and Italy are cultivars called 'Marrone' that are probably European X Asian hybrids. 'Marrone' have stellate hairs on the lower surface of the leaves, and are male sterile (produce no viable pollen). They were selected in the 1100's by Monks in what is now southern Turkey. 'Marrone' are orchard trees, and are often grafted onto European chestnut rootstocks. Their nuts are large, and only one develops in each bur.

Trees of the pure species are tall and straight like American chestnut trees. Leaves are usually straight across where they join the petiole, and have no stellate hairs. They usually stand out nearly straight from the twigs. Nuts of the pure species are about the size of American chestnuts. Both types of trees are susceptible to chestnut blight disease, and are usually not very winter-hardy. Hence, many of the commercial cultivars grown in Europe today are hybrids of European X Japanese chestnuts with resistance to blight and to ink disease (*Phytophthora cactorum* or *cinnamomi*). There were many hybrids of *C. sativa* X *C. dentata* planted in the US in the last century, including the popular cultivar 'Paragon.'

2. *Castanea mollissima* Blume Chinese chestnut

Both orchard and timber trees have been planted in eastern North America since about 1915. Nuts are small to large, and often quite sweet. They are easy to peel and the pell (tomentum) covering the nut inside the shell is easily removed. Chinese chestnut trees range in resistance to chestnut blight from very susceptible (as susceptible as American chestnut trees) to very resistant. Many cultivars are very cold tolerant. They can usually be recognized by their thick, leathery leaves that are densely hairy on the lower surface.

3. *Castanea crenata* Siebold and Zuccarini
Japanese chestnut

The Japanese chestnut trees that were extensively planted in eastern North America (after 1876) were predominately orchard trees. They are usually very resistant to chestnut blight and ink disease, and some cultivars have been selected for their resistance to Oriental Chestnut Gall Wasp. The leaves have dense or sparse stellate hairs on the lower surface and with many glands, and leaf margins usually have bristle-like projections instead of deeply cut teeth. The nuts are medium to large and the pell covering the nut inside the shell is hard to remove and often bitter when the nuts are fresh.

Group II One nut per bur

A. Leaves hairy on the lower surface and deeply indented at the margins.

The taxonomy of American chinquapins is still controversial, and opinions on the group vary. Johnson's publication lumped all chinquapins into a single species with sub-species. Nuts germinate in the fall soon after ripening.

1. *Castanea pumila* Miller Allegheny chinquapin

Widely distributed and highly variable, these small multi-branched shrubs are important sources of food for wildlife, and for people with a great deal of patience. Leaves are small, and quite variable in size and shape even on the same plant. Flowers form on long spurs, and the resulting burs are in clusters of 5 to 15, each with a single nut. The branches continue to grow after the spurs are formed so that they are some distance from the end of the branch when the nuts are ripe. The nuts are about the size of a pea, but their pleasant flavor makes pealing them worth it. They have some resistance to chestnut blight disease, but are very susceptible to ink disease. Payne has reported that they are resistant to infestation by Oriental Chestnut Gall Wasp.

2. *Castanea ozarkensis Ashe* Ozark chinquapin

These are usually large trees to 60 feet tall, often with sprouts at base. Leaves are much larger than those of Allegheny chinquapins. The burs are in pairs or small clusters on short side spurs, and the branches continue to grow after flowering has occurred, and so the spurs with burs are finally several feet from the ends of the branch. Our Ozark chinquapins from eastern Oklahoma usually mature only two burs per spur, but those from further east (central Arkansas) usually mature three to 5 per spur. Ozark chinquapins are severely threatened in their natural habitat by drought, fires, and chestnut blight disease. A foundation to call attention to their plight can be found at: www.ozarkchinquapin.com

3. *Castanea floridana* (Sargent) Ashe Florida chinquapin

Small shrubs found in coastal areas of Northern Florida. The leaves have few leaf hairs and are about the size of those of Allegheny chinquapins. The two plants growing in Connecticut are usually killed back severely each year. Flowers on our two form much later than those on other *Castanea* species here. I have never seen nuts mature before frost kills them, but both Graves and Jaynes reported that they have, and Jaynes succeeded in using them as females in his species crosses.

4. *Castanea alnifolia* Nuttall Trailing chinquapin

Confusing reports of the ability of chinquapins to form underground stolons that sprout to form new colonies make it hard to define this species. Ashe placed this plant "from South Carolina near the coast to southeastern Louisiana and south to Gainesville, Florida." The one specimen still surviving in

Connecticut flowers much later than other Castanea species here, but Jaynes succeeded in using this species as a female parent in his species crosses.

B. Leaves hairless, and leaf margins with bristle-like teeth,

1. *Castanea henryi* (Skan) Rehder and Wilson
Chinese chinquapin

There are few mature Chinese chinquapins in Connecticut, as this species is not reliably winter-hardy. Trees in western Georgia (U.S.A.) have little blight and appear to resist Oriental Gall Wasp. Reports from China describe *C. henryi* as a major timber tree.

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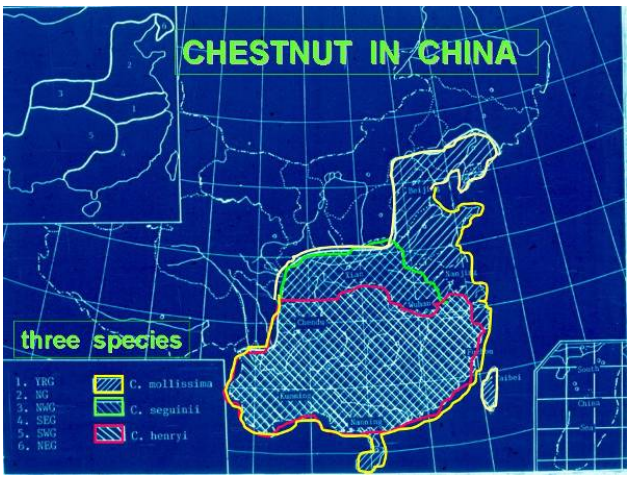
Additional Range Map

Distribution of *Castanea pumila* from USGS/Little range map

Distribution of *Castanea alnifolia* (*floridana*) from USGS/Little range map

Distribution of *Castanea ozarkensis* from USGS/Little range map



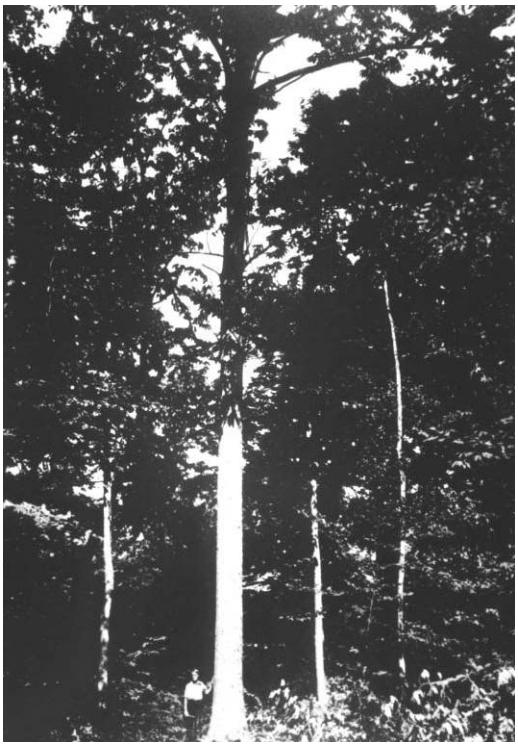
Map courtesy of Dr. Liu Liu, Nanjing Botanical Garden, China

American chestnut

Leaf form


Lower leaf surface

Bur placement


Tree form, Scotland, Ct 1905


Tree form, Rocky Hill, CT 1999

Dwarf Chinese chestnut (ever-flowering)

Leaf form and spring flowers

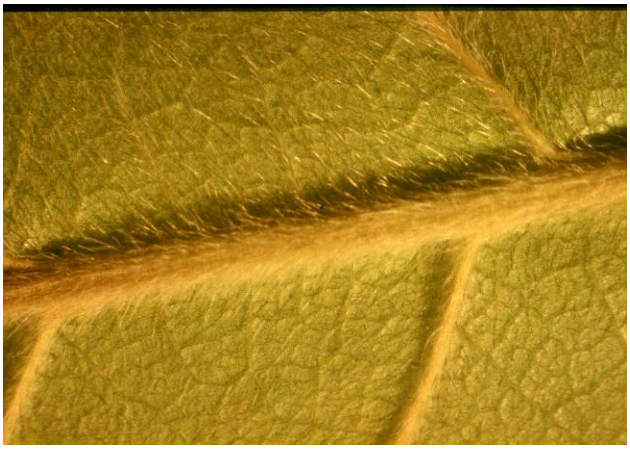
Bur placement

Lower leaf surface

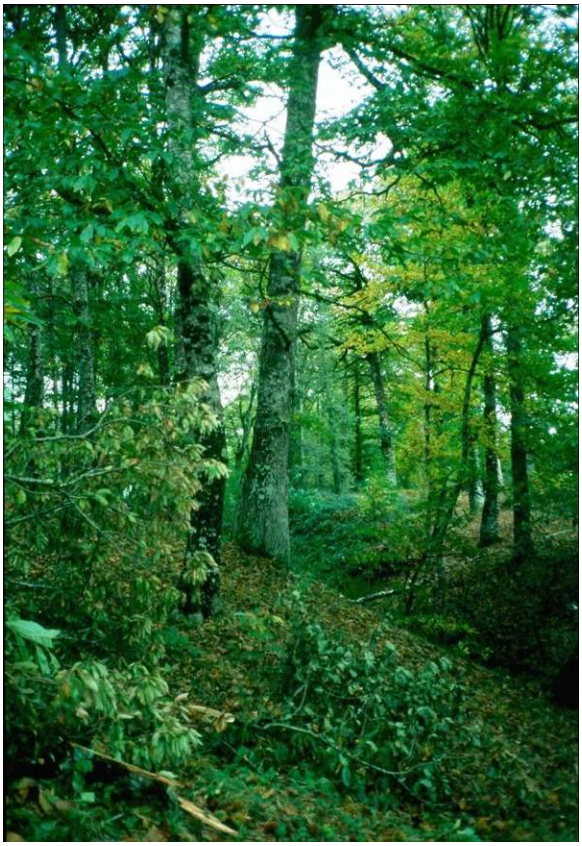
Tree form in Hamden, CT

European chestnut

Leaf form



Lower leaf surface

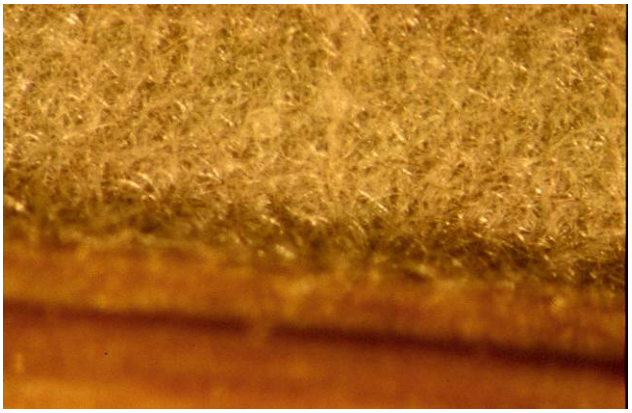


Tree form, northern Spain

Bur placement

Chinese chestnut

Leaf form, showing top and bottom of leaves


Lower leaf surface


Bur placement

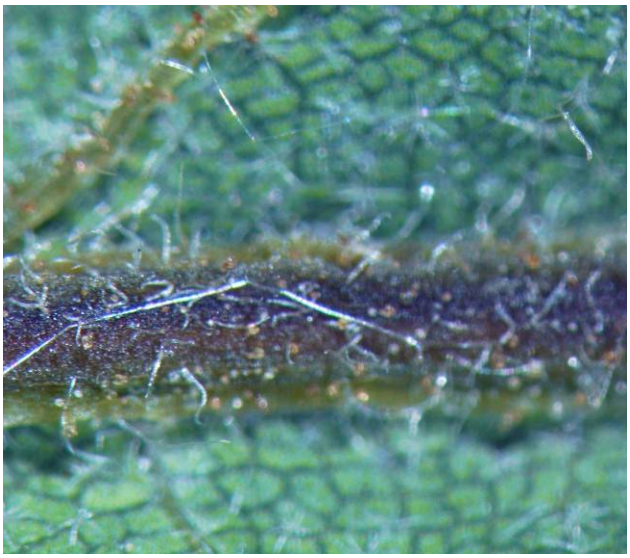

Tree form, timber tree in Hamden, CT


Tree form, orchard tree 'Bartlett' in Hamden, CT

Japanese chestnut

Leaf form


Tree form, timber tree in Hamden, CT


Lower leaf surface

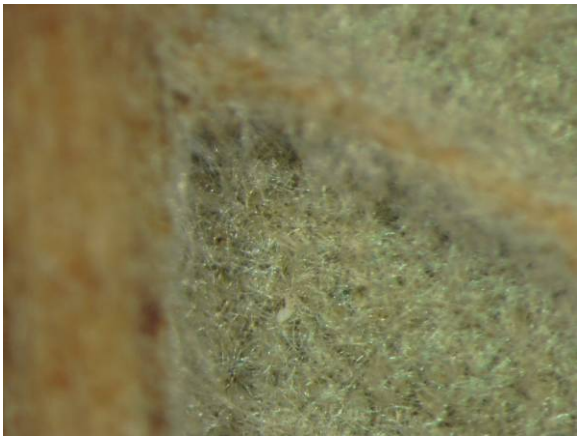
Tree form, orchard tree in Bridgeport, CT


Bur placement

Allegheny chinquapin

Leaf form

Tree form in Hamden, CT


Lower leaf surface


Burs with single nuts


Bur placement

Ozark chinquapin

Leaf form

Tree form in eastern OK

Lower leaf surface

Bur placement

Florida chinquapin

Leaf form

Lower leaf surface

Chinese chinquapin

Leaf form

Lower leaf surface

Bur placement