FOREST Phase III: Biology of the American Chestnut

Introduction to Morphology and Chestnut Species Identification

Richard King Mellon Foundation

THE AMERICAN CHESTNUT FOUNDATION®
INTRODUCTION TO
MORPHOLOGY

Terminology and Chestnut Species ID
A dichotomous key uses yes/no questions to hone in on a particular species.

Morphological traits are used for most plant species identification.

Need to know morphology vocabulary to work through a key.

Use morphological ID to distinguish chestnut species.
Leaves

Broad Leaves

Needles or Scales

Leaves

Simple

Compound


Leaves

Palmately Compound

- Fan

Pinnately Compound

- Feather

W.D. Brush @ USDA-NRCS PLANTS Database

W.D. Brush @ USDA-NRCS PLANTS Database
# Leaves

## Alternate

- Most common for tree species

## Opposite

- MADCAP HORSE
- Whorled also an option

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http://geo.cbs.umn.edu/treecgy/navkey.html (c) 2003 George Weiblen & Nick Deacon
Leaf Shapes

Chinese Chestnut

- linear
- oval
- oblong
- ovate
- obovate

American Chestnut

- deltoid
- cordate
- elliptical
- lanceolate

http://www.clemson.edu/extension/natural_resources/landowner/youth_environ_education/terminology.html#leaf_arrangement
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Leaf Tips

American Chestnut

- acute
- acuminate
- bristle-tipped

Chinese Chestnut

- truncate
- obtuse

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Leaf Bases

American Chestnut

Chinese Chestnut

cuneate
obtuse
cordate truncate oblique
Leaf Margins

- **American chestnut:**
  - Coarsely and sharply serrate with hooked or incurved teeth

- **Chinese chestnut:**
  - Coarsely serrate with wedge or bristle-like teeth

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Leaf Margins
• Chestnut buds:
  ○ Color
    ▪ American – yellow to red
    ▪ Chinese – pea green
    ▪ Japanese – glossy brown
    ▪ European – dark red, large
  ○ Angle
    ▪ American – 45% angle to stem
    ▪ Chinese – parallel to stem
  ○ Pubescence
    ▪ American, Japanese and European – not hairy
    ▪ Chinese - hairy

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Lenticels

- Function like a pore
  - **American**
    - Small, white
  - **Chinese**
    - Large, yellow
  - **Japanese**
    - Large, bright white
  - **European**
    - Small, white

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Stipules

• Outgrowth from either side of the petiole – part of the leaf’s anatomy
  ○ American
    ✷ Slender
    ✷ Sharp angle from stem
    ✷ Fall off in June
  ○ Chinese
    ✷ Broad, flared
    ✷ Close to stem, cover buds
    ✷ Persistent throughout growing season
Trichomes

- Epidermal outgrowths or surface hairs
- Chestnut trichomes are **glandular hairs**
  - **American**
    - 4 celled “hot cross bun”
  - **Chinese**
    - Stalked with prominent heads
  - **Japanese**
    - 9-celled – similar to American but much larger
  - **European**
    - Stalked, club-shaped
Using a Key

• Yes/No questions to narrow options and find correct species

• Helps to know morphological vocabulary
  ○ Most good keys will have a glossary to help you
  ○ Read the instructions for the key – not all use the same set-up or terminology

• Usually helpful to have leaves present
  ○ May be able to use bud, bud scars, twig, growth form and other characteristics if leaves are not present
ACTIVITY:

Use Peterson’s Field Guides: Eastern Trees to key out a species
What Am I?

- Broad-leaved tree, alternate simple leaves
- True end buds are pointed and clustered with more than three bundle scars per leaf scar
- Leaves have toothed margins, no bristle tips
  - Teeth are somewhat rounded
- Leaves are glossy and may be leathery
- Bark dark and deeply ridged

Answer: Chestnut oak (*Quercus montana* or *Q. prinus*)
CHESTNUT ID
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CHESTNUT SPECIES IDENTIFICATION

[Image of chestnut leaves]
American Chestnut (*Castanea dentata*)

- **Member of the Fagaceae family**
  - Beech (*Fagus*), chestnut (*Castanea*) and oak (*Quercus*)
- **Species of *Castanea* native to north America**
  - *Castanea dentata* – American chestnut
  - *Castanea pumila* – Chinquapin or Allegheny Chinquapin
  - *Castanea ozarkensis* (*Castanea pumila* var. *ozarkensis*) – Ozark Chinquapin
- **Non-native *Castanea* species**
  - *Castanea mollissima* – Chinese chestnut
  - *Castanea crenata* – Japanese chestnut
  - *Castanea sativa* – European chestnut
  - *Castanea henryi* – Henry’s chinquapin (China)
  - *Castanea seguinii* – Seguin chestnut (China)
Chestnut Species

• Native:
  - American chestnut (3 nuts/bur)
  - Allegheny chinquapin (1 nut/bur)
  - Ozark chinquapin (1 nut/bur)

• Imported (with recorded dates):
  - European chestnut (1773)
  - Japanese chestnut (1876)
  - Chinese chestnut (1912)

• HYBRID CHESTNUTS
  - Hybridizing efforts have been recorded in the US beginning in 1895
  - The Connecticut Agriculture Experiment Station has been breeding chestnuts since the 1920’s
American chestnut

Leaf hairless, except for sparse hairs on veins

Leaf fairly thin and papery

Leaf canoe-shaped with deeply toothed margins

Twig hairless and red to chestnut-brown

Bud smooth, and brown, pointed and usually askew on the twig

Large, timber-form tree (at maturity)
American chestnut

Underside of the leaf:

No hairs, besides a few on veins

4-celled glandular hairs, called trichomes, on leaf surface

4-celled American trichomes have “hot cross bun” shape
Chinese chestnut

Leaf glossy, usually hairy on underside

Leaf thick, may be leathery in texture

Leaf oval to row-boat shaped with wedge-toothed margins

Twig pea-green to tan, new growth hairy

Bud round, pea-green to tan, hairy and in-line with stem

Spreading, orchard-form tree
Chinese chestnut

Underside of the leaf:

Sun leaf very hairy – both stellate (star-shaped) and simple hairs

Stalked glandular hairs with prominent heads, (trichomes) on leaf veins only
European chestnut

Leaf most similar to American, more triangular leaf margins

Leaf base often rounded, with a long petiole

Leaf underside may be hairy

Twig very thick and coarse, dark brown at maturity

Bud very large, may be reddish

Spreading, orchard-form tree
European chestnut

Underside of the leaf:

Vary between very hairy and not hairy

Stalked, club-shaped glandular hairs (trichomes) present, though often difficult to see

Stalked trichomes on leaf surface and leaf veins
Japanese chestnut

Sun leaf glossy, hairy on underside

Leaf narrow, oval with blunt base

Bristle-toothed margins

Twig pinkish-brown, new growth hairy

Spreading, orchard-form tree
Japanese chestnut

Underside of the leaf:

Sun leaf **hairy** – both stellate (star-shaped) and simple hairs

9-celled glandular hairs (trichomes) on leaf surface

9-celled trichomes **much larger** than American trichomes
Allegheny chinquapin

Leaf usually \textit{hairy} on underside

Leaf margins slightly to deeply toothed

\textbf{One} pointed \textit{nut per bur}, instead of three

Burs form in \textit{clusters}

Burs open in \textbf{two parts}, instead of four

Shrub or small tree
Allegheny chinquapin

Underside of the leaf:

Sun leaf usually very hairy

Both simple and stellate hairs

Bulbous glandular hairs (trichomes) on leaf surface
Species Comparisson

**Top side of leaves:**
- Top row: Allegheny chinquapin
- Bottom row: American, Chinese, European and Japanese chestnuts

**Underside of leaves:**
- Top row: Allegheny chinquapin
- Bottom row: American, Chinese, European and Japanese chestnuts
Top and Side Views of Chestnuts.

From Left: American, Chinese, Japanese, and European

Species Comparison: Nuts
Commonly Confused Species

Horsechestnuts are actually buckeyes, not “true chestnuts”

Palmately compound leaves

Sticky buds

1 “nut” per “husk”
Commonly Confused Species

Also in the Fagaceae family with oaks and chestnuts; exotic

Looks very much like Japanese chestnut

Note three terminal buds

Sawtooth oak – *Quercus acutissima*
Chestnut oak – *Quercus prinus*

Commonly Confused Species

Also in the Fagaceae family with oaks and chestnuts

Lobed dentation

Note three terminal buds

Much blockier bark at all ages.


http://upload.wikimedia.org/wikipedia/commons/6/64/Chestnut_Oak.jpg
Commonly Confused Species

Also in the Fagaceae family with oaks and chestnuts

Long buds

More coarse dentation

Bark stays grey and smooth

American beech – *Fagus grandifolia*