

# FOREST PHASE III: BIOLOGY OF THE AMERICAN CHESTNUT



INTRODUCTION TO MORPHOLOGY AND  
CHESTNUT SPECIES IDENTIFICATION

**Richard  
King  
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Foundation**



# INTRODUCTION TO MORPHOLOGY



## TERMINOLOGY AND CHESTNUT SPECIES ID



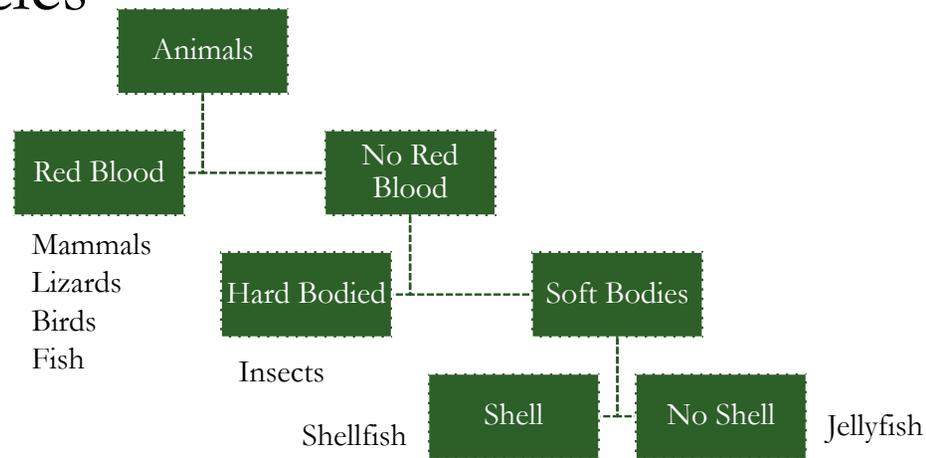
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# Morphological ID



- 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



Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA NRCS. 1995. *Northeast wetland flora: Field office guide to plant species*. Northeast National Technical Center, Chester.

# Leaves



## Simple

## Compound



Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA SCS. 1991. *Southern wetland flora: Field office guide to plant species*. South National Technical Center, Fort Worth.



Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA SCS. 1989. *Midwest wetland flora: Field office illustrated guide to plant species*. Midwest National Technical Center, Lincoln.

# Leaves



## Palmately Compound

- Fan



W.D. Brush @ USDA-NRCS PLANTS Database

## Pinnately Compound

- Feather



W.D. Brush @ USDA-NRCS PLANTS Database

# Leaves

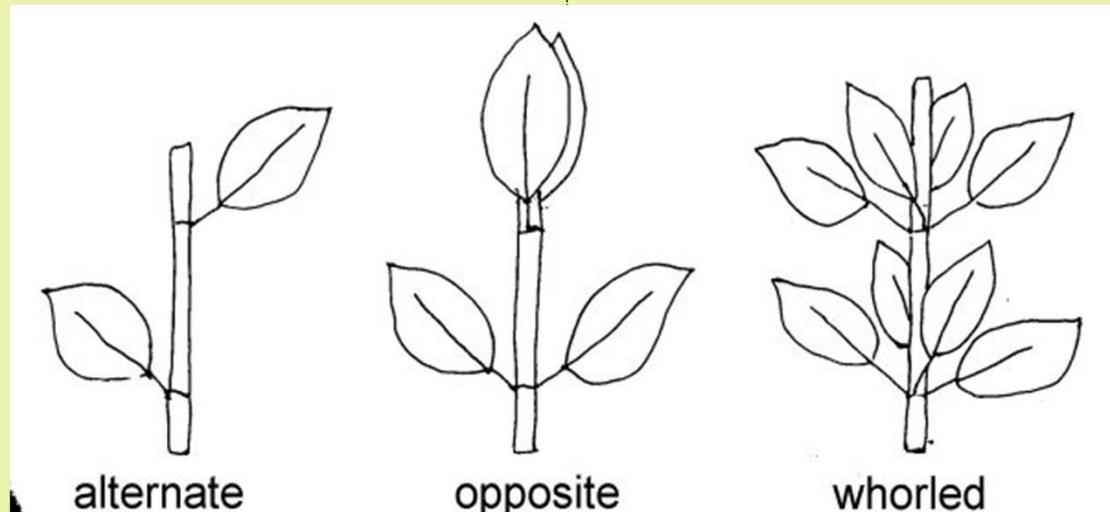


## Alternate

- Most common for tree species

## Opposite

- MADCAP HORSE
- Whorled also an option



# Leaf Shapes



## Chinese Chestnut



linear



oval



oblong



ovate



obovate



deltoid



cordate



elliptical



lanceolate

## American Chestnut

# Leaf Tips



American Chestnut



acute



acuminate



bristle-tipped

Chinese Chestnut



truncate

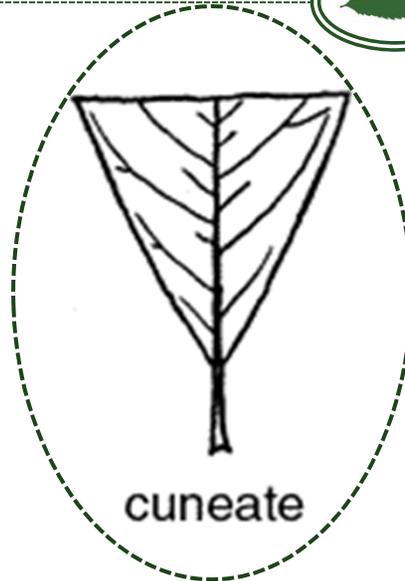


obtuse

# Leaf Bases

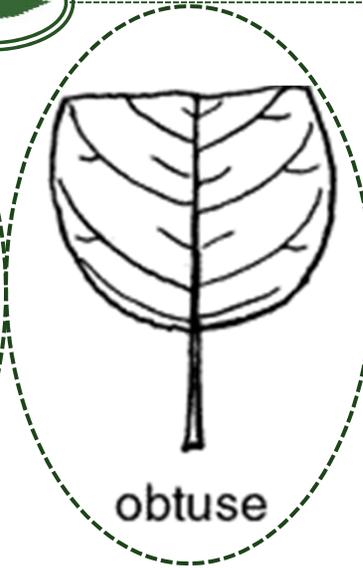


American Chestnut



cuneate

Chinese Chestnut



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

Chestnut



entire



undulate



finely  
serrate



coarsely  
serrate



doubly  
serrate



crenate



lobed

# Leaf Margins

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# Buds



- Chestnut buds:

- Color

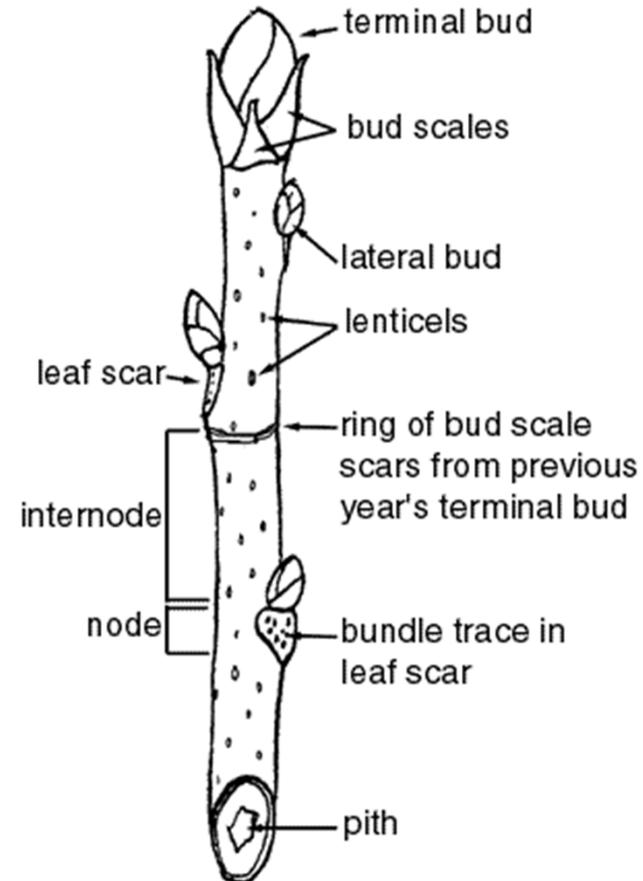
- ✦ American – yellow to red
- ✦ Chinese – pea green
- ✦ Japanese – glossy brown
- ✦ European – dark red, large

- Angle

- ✦ American – 45° angle to stem
- ✦ Chinese – parallel to stem

- Pubescence

- ✦ American, Japanese and European – not hairy
- ✦ Chinese - hairy



# Lenticels



- Function like a pore

- American

- ✦ Small, white

- Chinese

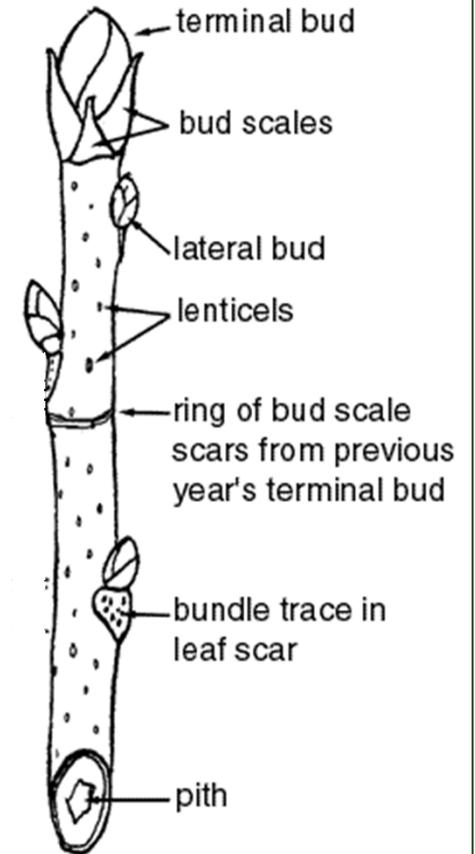
- ✦ Large, yellow

- Japanese

- ✦ Large, bright white

- European

- ✦ Small, white



# 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

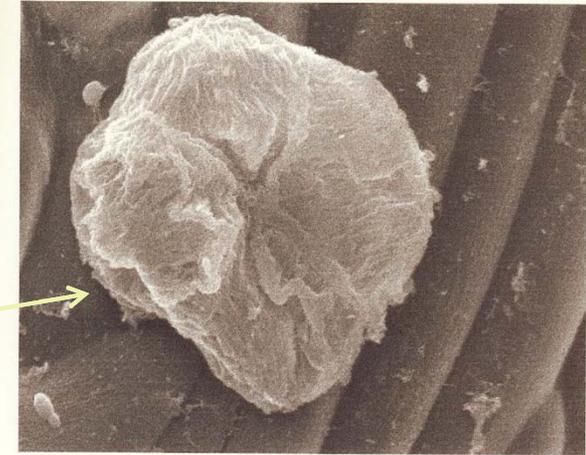
- ✦ Broad, flared
- ✦ Close to stem, cover buds
- ✦ Persistent throughout growing season



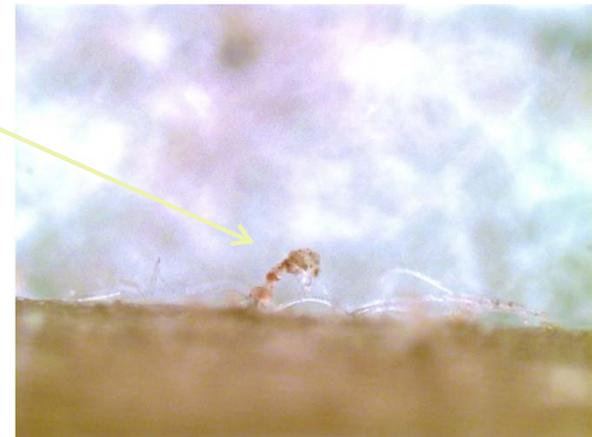
# Trichomes



- 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



American chestnut 2000x



# 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

# USING A KEY



**ACTIVITY:**  
**USE PETERSON'S FIELD GUIDES: EASTERN  
TREES TO KEY OUT A SPECIES**

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# 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

## 101



### CHESTNUT SPECIES IDENTIFICATION



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# American Chestnut (*Castanea dentata*)

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- 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



## 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)



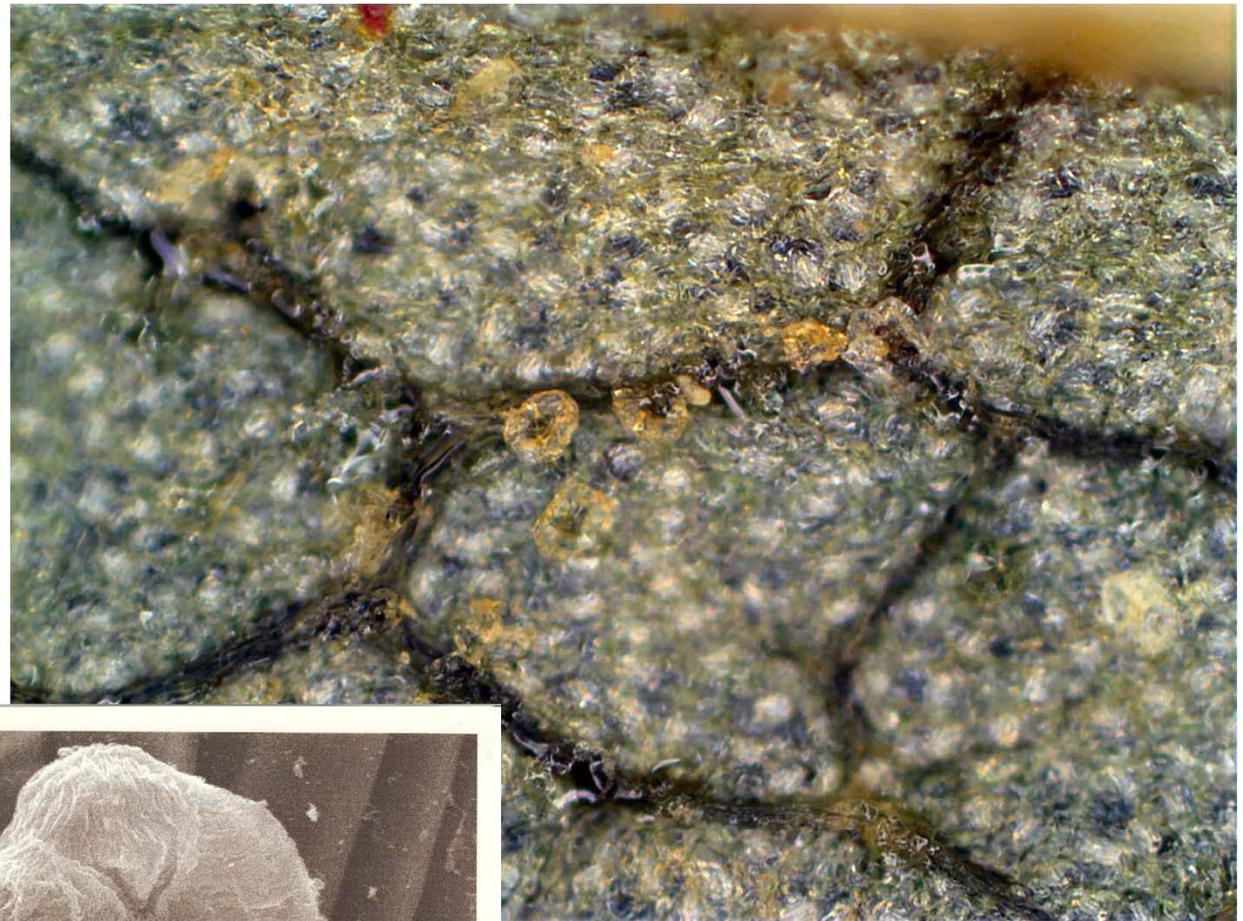
# American chestnut

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



American chestnut 2000x



## 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

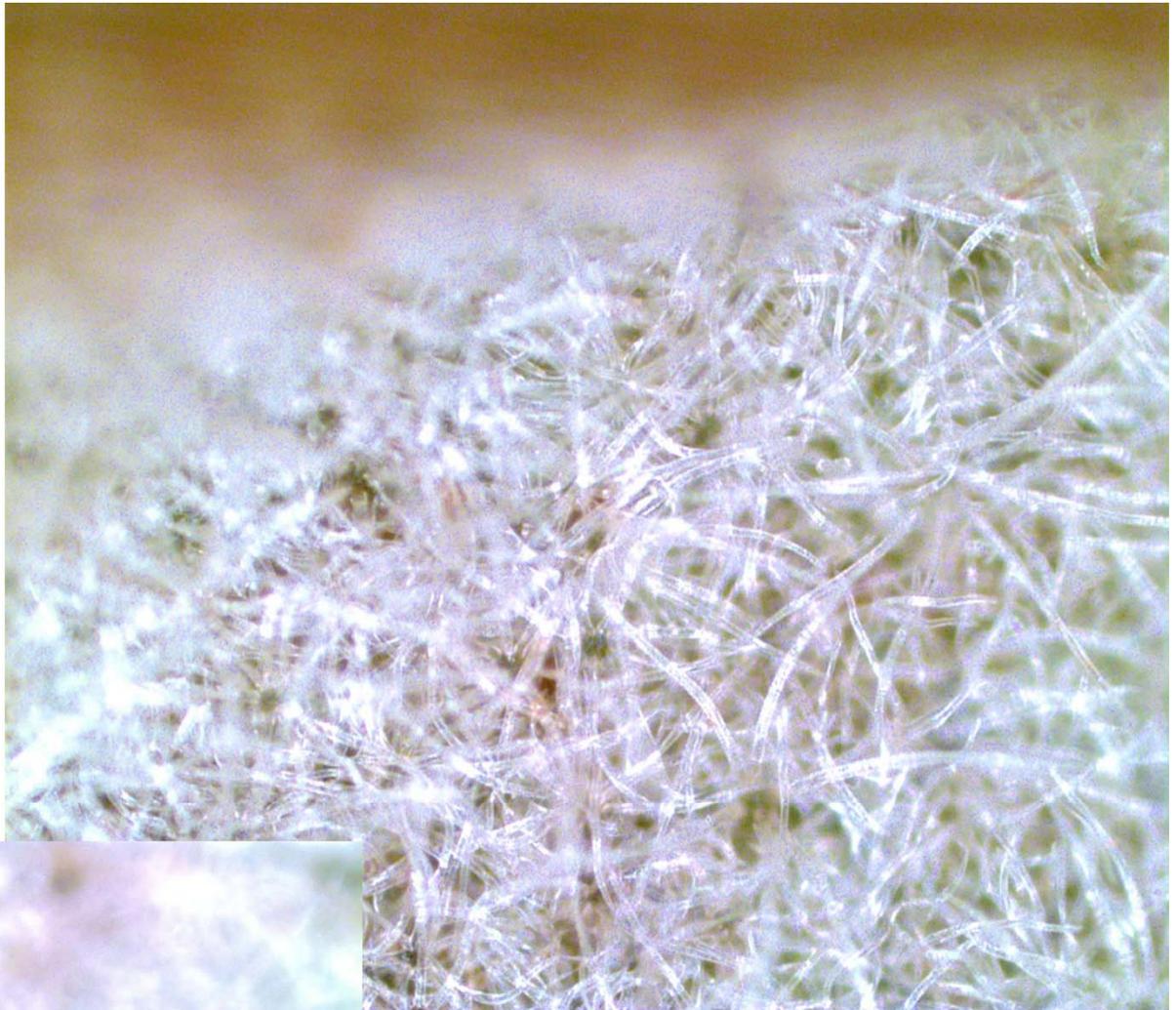


## Chinese chestnut

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**



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## 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



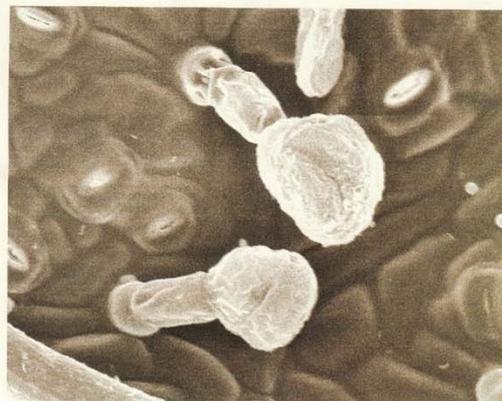
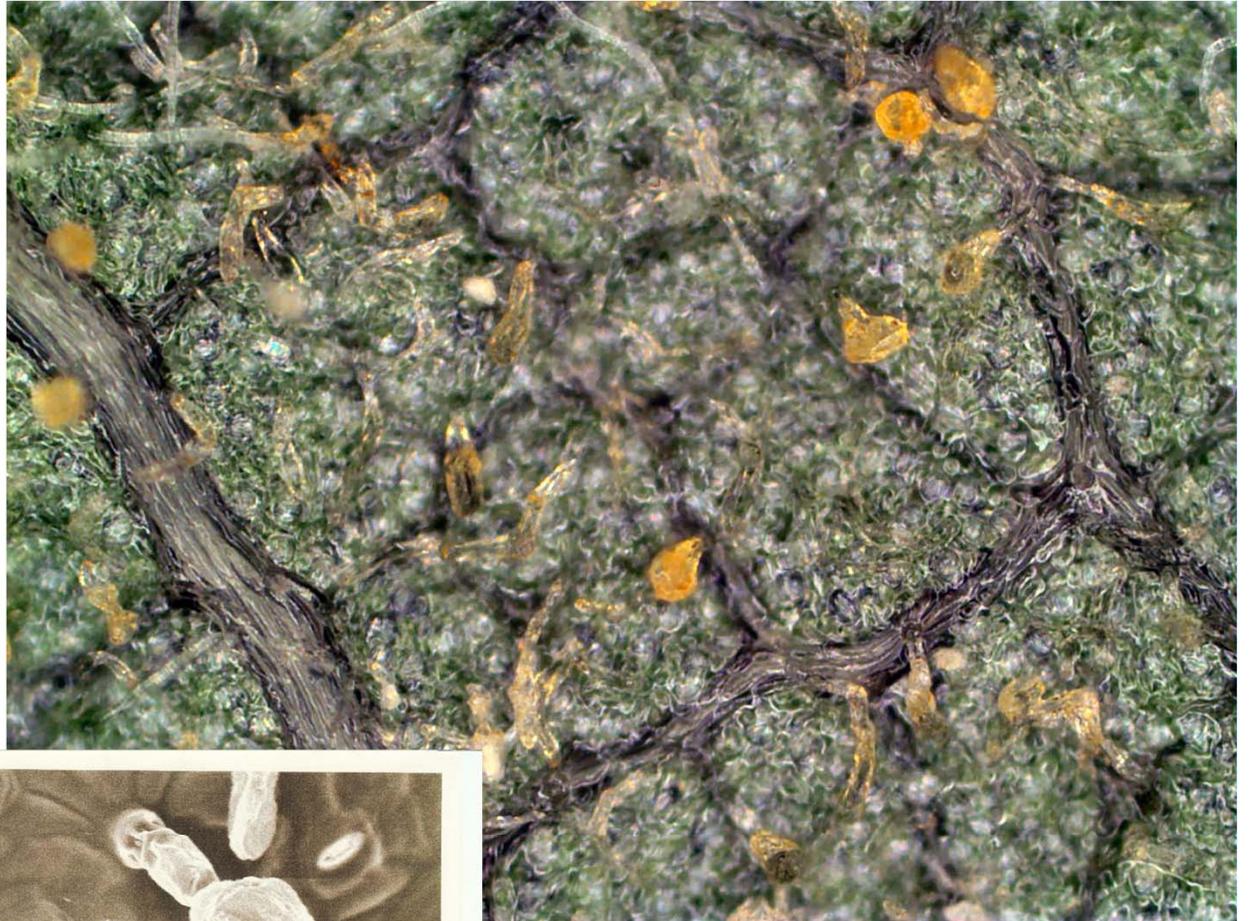
# European chestnut

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



European chestnut 1000x



## 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



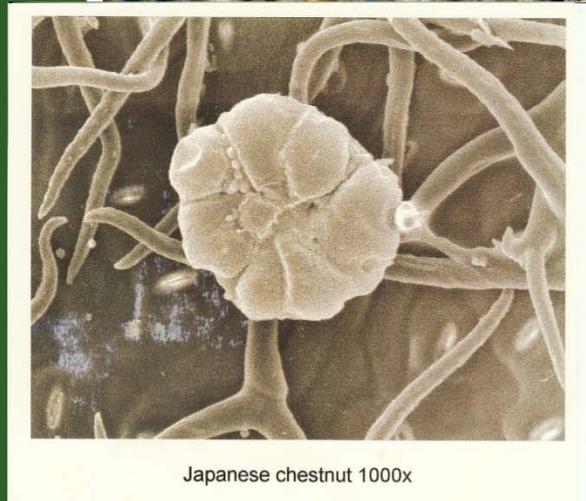
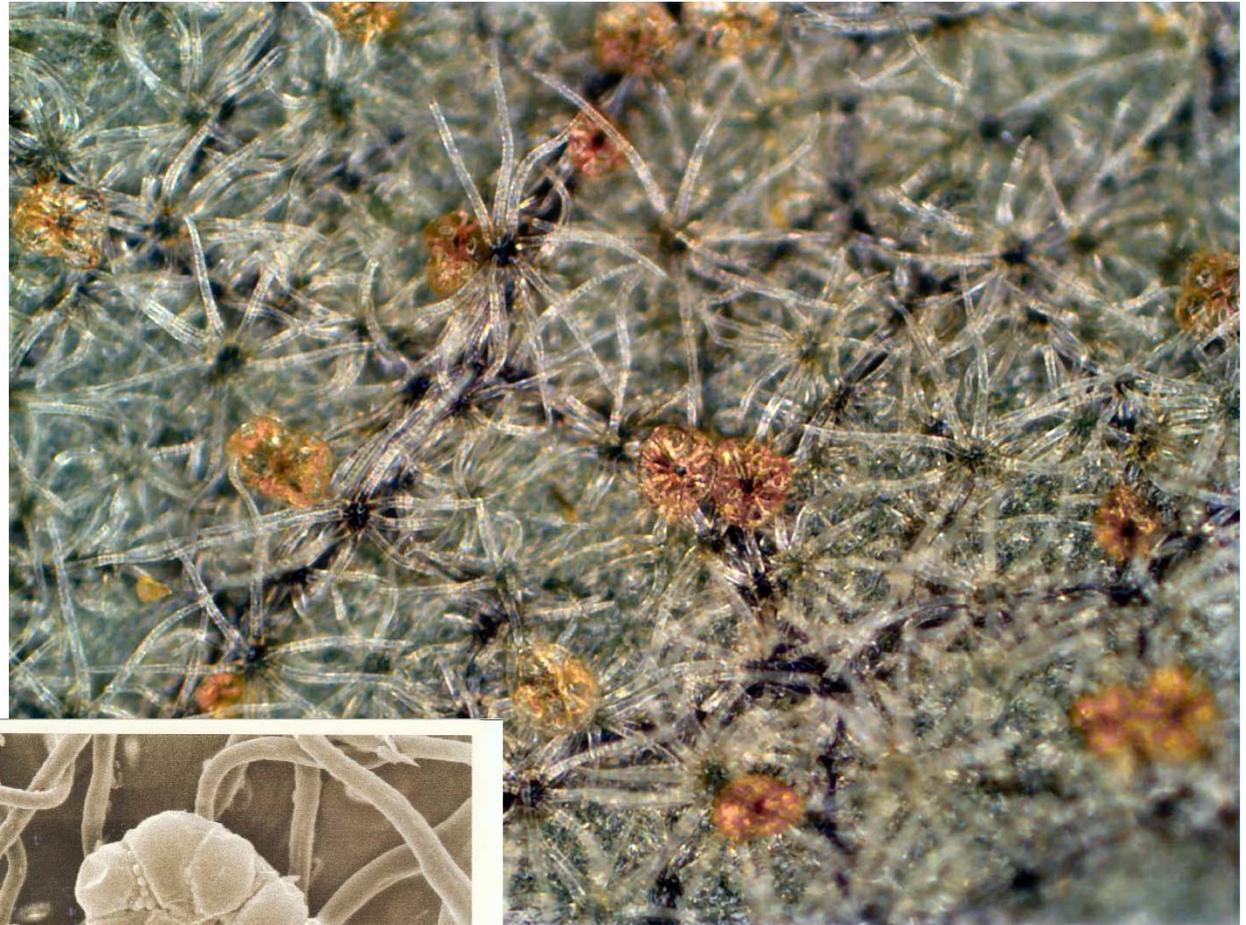
# Japanese chestnut

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



Japanese chestnut 1000x



## Allegheny chinquapin

Leaf usually **hairy** on underside

Leaf margins slightly to deeply **toothed**

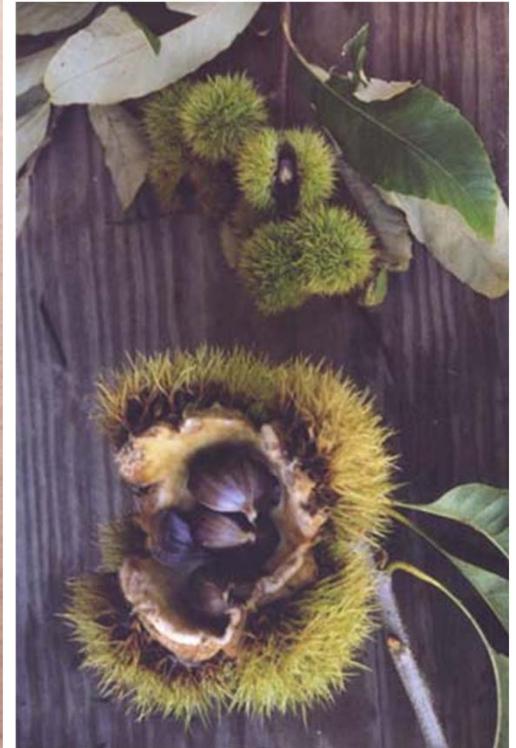
**One pointed nut per bur**, instead of three

Burs form in **clusters**

Burs open in **two parts**, instead of four



Shrub or small tree





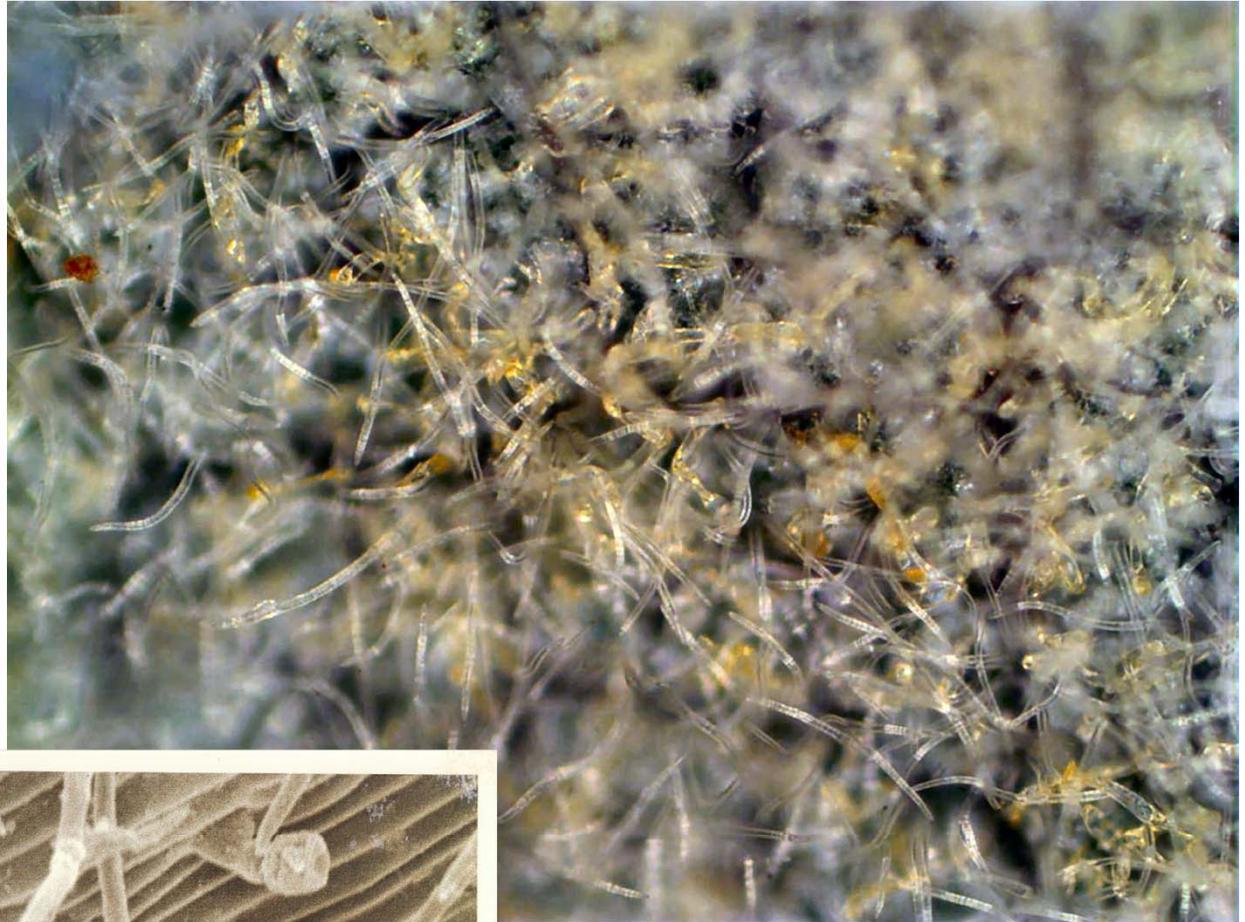
# Allegheny chinquapin

Underside of the leaf:

Sun leaf usually **very hairy**

Both **simple** and **stellate** hairs

**Bulbous** glandular hairs (trichomes) on leaf surface



Chinkapin 1000x

# Species Comparisson



Top side of leaves:

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

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## Commonly Confused Species

Horsechestnuts are actually buckeyes, not “true chestnuts”

Palmately compound leaves

Sticky buds

1 “nut” per “husk”



[http://upload.wikimedia.org/wikipedia/commons/thumb/0/05/Aesculus\\_hippocastanum-1.jpg/799px-Aesculus\\_hippocastanum-1.jpg](http://upload.wikimedia.org/wikipedia/commons/thumb/0/05/Aesculus_hippocastanum-1.jpg/799px-Aesculus_hippocastanum-1.jpg)

## Common Horsechestnut



[http://upload.wikimedia.org/wikipedia/commons/thumb/1/14/Aesculus\\_hippocastanum\\_fruit.jpg/800px-Aesculus\\_hippocastanum\\_fruit.jpg](http://upload.wikimedia.org/wikipedia/commons/thumb/1/14/Aesculus_hippocastanum_fruit.jpg/800px-Aesculus_hippocastanum_fruit.jpg)



## Commonly Confused Species

Also in the  
Fagaceae family  
with oaks and  
chestnuts; exotic

Looks very much  
like Japanese  
chestnut

Note three  
terminal buds



[http://www.treetopics.com/quercus\\_acutissima/sawtooth\\_oak\\_3262.jpg](http://www.treetopics.com/quercus_acutissima/sawtooth_oak_3262.jpg)



<http://www.invasive.org/eastern/images/768x512/1237024.jpg>

UGA1237024

## Sawtooth oak – *Quercus acutissima*



## 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/thumb/b/b6/Chestnut\\_Oak\\_Bark.jpg/220px-Chestnut\\_Oak\\_Bark.jpg](http://upload.wikimedia.org/wikipedia/commons/thumb/b/b6/Chestnut_Oak_Bark.jpg/220px-Chestnut_Oak_Bark.jpg)

**Chestnut oak –**  
*Quercus prinus*



## Commonly Confused Species

Also in the Fagaceae family with oaks and chestnuts

Long buds

More coarse dentation

Bark stays grey and smooth



<http://upload.wikimedia.org/wikipedia/commons/thumb/8/8c/07-03AmericanBeechFL.jpg/800px-07-03AmericanBeechFL.jpg>

American beech –  
*Fagus grandifolia*



<http://web.cortland.edu/broyles/beechevolution2.jpg>



[http://www.bio.brandeis.edu/fieldbio/Editable\\_Plants\\_Ramer\\_Silver\\_Weizmann/Images\\_Edited/AmBeech\\_N&Bud\\_275\\_ES2.jpg](http://www.bio.brandeis.edu/fieldbio/Editable_Plants_Ramer_Silver_Weizmann/Images_Edited/AmBeech_N&Bud_275_ES2.jpg)