

BOLETACEAE

This presentation is focused primarily on members of the Boletales order which have pores and are in the Boletaceae family.

Boletus sp.

In 1753 Carl Linnaeus (1707-1778), the 'father of modern taxonomy' (a system of classification based on a nested hierarchy of kingdoms, [phylum]classes, orders, [families], genera, species) called **all tube-pored fungi "Boletus"**, including polypores, most of which are decomposers that grow from wood rather than the ground, because they shared the characteristic of pores.

Later, Elias Fries (1794-1878) separated polypores from boletes and assigned most most of them to the genus *Polyporus*.

Since then, many boletes were assigned new genus names based on the fact that they shared more strictly defined characteristics. For example, the pinkish-brown spored boletes became *Tylopilus*, and in the last century boletes with scabers on the stem became *Leccinum*.

Phylogenetic Ranking of the Boletaceae Family

DOMAIN - Eukarya
KINGDOM- Fungi
PHYLLUM - Basidiomycota
CLASS - Basidiomycetes
ORDER - Boletales
FAMILY - Boletaceae
GENUS - *Boletus* +++++++
SPECIES – *edulis* (Type species)

Note: genus and species names of all fungi are traditionally *italicised*.

In their own suborder within the Boletales are the following families:

- Boletaceae
- Boletinellaceae
- Displacystaceae
- Gomphidiaceae
- Gyroporaceae
- Hygrophoropsidaceae
- Paxillaceae
- Sclerodermataceae
- Suillaceae
- Tapinellaceae



Some atypical 'boletes'

with radiating pores, gill-like pores, gills, coral-like projections,
gleba, crusts, teeth:

www.mykoweb.com/articles/Homobasidiomycete_clades.html

- **Chroogomphus**



- **Fuscoboletinus**



- **Gomphidius**



- **Hygrophoropsis**



- **Paxillus**



- **Tapinella**



- **Phylloporus**

- **Gastroboletus**



- **Calostoma**



- **Astreas**



- **Pisolithus**



- **Rhizopogon**



- **Scleroderma**

- **Serpula**



- **Coniophora**



- **Hydnomerulius**



Boletus subvelutipes



Boletes typically produce reproductive spores in a fleshy spongy layer of vertical tubes that line the soft flesh of the fruit-body. Unlike the tubes of firmer and longer lasting polypores, these can be separated easily from the flesh.

BOLETACEAE (150+ species in NA)

1. Pores are usually ROUND, (not radial or elongated as are those in *Suillus*).
2. They have SOLID (not hollow) stems like *Gyroporus* spp.
3. One group, the *Leccinum* spp., has scabers on their stems.
4. Spores are generally smooth (lacking ornamentation) and olive-brown to brown in color.

OLIVE-BROWN SPORE PRINT



With few known exceptions,
'boletes' and their relatives are ectomycorrhizal* with
trees. Most grow on the ground. A few grow on wood.

*Ectomycorrhizal =
mycelium surrounds
tree roots.



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Xerocomellus (Boletus, Xerocomus) chrysenteron

A hardwood associate with a brownish cap that develops cracks revealing reddish flesh

The number of genera in the Boletaceae family is rapidly increasing due to the new emphasis on phylogenetic relationships. Currently the genera in our region include:

- *Aureoboletus*
- *Austroboletus*
- *Baorangia*
- *Boletellus*
- *Boletus*
- *Bothia*
- *Buchwaldoboletus*
- *Butyriboletus*
- *Caloboletus*
- *Chalciporus*
- *Cyanoboletus*
- *Exsudoporus*
- *Frostiella*
- *Harrya*

(Continued on next page)

- *Harrya*
- *Hemileccinum*
- *Hortiboletus*
- *Imleria*
- *Lanmaoa*
- *Leccinellum*
- *Leccinum*
- *Neoboletus*
- *Phylloporus*
- *Porphyrellus*
- *Pseudoboletus*
- *Pulveroboletus*
- *Retiboletus*
- *Rubroboletus*
- *Strobilomyces*
- *Suilliellus*
- *Sutorius*
- *Tylopilus*
- *Xanthoconium*
- *Xerocomellus*
- *Xerocomus*



Baorangia bicolor ((*Boletus bicolor*))

Identifying 'Boletes' to species is difficult.
(Appearance changes over the course of their fruiting)
Identifying them to genus is becoming challenging as well!

- Is the cap dry, viscid, glabrous, velvety, hairy, cracked, wrinkled or pitted?
- Is there a color change to the cap when a drop of ammonia is applied to the cuticle?
- Is the margin even or overlapping the tubes?
- How does the tube layer meet the stipe apex?
- Is the tube layer long or short? Is the tube color different than the pore color?
- Are the pores circular or angular, large or tiny?
- What changes in pore color are observed as the fruit-body matures?
- Does any part stain a different color with bruising, cutting or exposure to air and if so, is the color change fast or slow?
- What color is the spore print?
- Is the stem of your bolete ringed, curved, bulbous, stained, reticulate, scabrous, resinous, streaked with lines, dots or ridges?
- Is the bolete solitary or gregarious?
- Does the bolete have a distinctive odor?
- Is it mild-tasting or bitter?
- Under which trees does it fruit?

White Pores

1. Stipe reticulation, no staining (*Boletus edulis* complex)
2. No stipe reticulation, no staining
3. No stipe reticulation, staining

Leccinum

Tylopilus

Yellow Pores

1. Stipe reticulation, no staining
2. Stipe reticulation, staining
3. No stipe reticulation, little or no staining
4. No Stipe reticulation, staining

Red, Red-brown to Brown Pores

1. Stipe reticulation, staining
2. No stipe reticulation, staining

BOLETACEAE

1. *Boletus edulis* complex:

a. White pores and flesh, white stipe reticulation, no bluing & associated mainly with conifers like Norway Spruce. (*Boletus edulis*, *Boletus pinophilis*)

b. White pores and flesh, white stipe reticulation, no bluing and found with hardwoods and in mixed woods: (*Boletus atkinsonii*, *Boletus clavipes*, *Boletus gertrudiae*, *Boletus nobilis*, *Boletus nobilissimus*, *Boletus separans*, *Boletus variipes*)

!Soon only the boletes in the *edulis* complex will retain the genus name "*Boletus*"!

Boletus edulis complex: “King Bolete”

Several species throughout much of the world.

2 kinds: **viscid** and dry-capped

Boletes in both groups exhibit varying amounts of **white reticulation** at least at the stipe apex.

Boletus edulis is the type species for the genus *Boletus*.
It is a European mushroom that grows mainly with conifers.

Description:

Large cinnamon-brown VISCID cap with whitish margin,

White flesh,

Non-staining small tubes rather than gills.

Spores are released through the white pores, which
age ochre-yellow.

Stout stem often larger at base

Covered with raised white netting (reticulations)

Mild tasting

Summer-Autumn fruiting

(*Boletus edulis*, *Boletus chippewaensis*, *Boletus pinophilus*)



Found
under
Norway
Spruce.

Appearance
triggered
by rain
following
hot dry
spell and by
cooler soil.

Dried
specimens
retain
flavor.

Boletus edulis



Grows in
association with
pines.



DRY-CAPPED
EASTERN
B. edulis group:

Boletus
atkinsonii,

Boletus clavipes,

Boletus nobilis,

Boletus
nobilissimus,

Boletus variipes

***Boletus variipes* (dry-capped)** Under hardwoods like oak and beech



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Boletus clavipes (dry-capped)



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Boletus nubilissimus



***Boletus separans* (*Xanthoconium separans*)**
has fine white reticulation at the stipe apex and rhubarb color below.

Inedible

Boletus edulis lookalikes:

Boletus huronensis (toxic)

Tylopilus felleus (bitter)



Boletus huronensis

Boletus huronensis is a *B. edulis* lookalike that has caused severe digestive upsets. It doesn't stain, but it differs from *B. edulis* in that the stipe is smooth with no reticulation.



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Tylopilus felleus
“Bitter Bolete”
Brown stipe reticulation
and pinkish spores.

LECCINUM

These mushrooms have scabrous stipes and are mostly mycorrhizal with beech, birch and sometimes conifers. Their pores are typically depressed around the stipe. The stem is usually longer than the cap is wide. Leccinums with brownish caps include the type species for the entire genus:

Leccinum scabrum.

Leccinums are edible boletes for most people, although edibility of the red to orange capped boletes has come into question.



Leccinum scabrum "Rough-stemmed Bolete"



Leccinum holopus var. americanum

associated with birch and boggy areas. Note the blue-green stains at the bottom of the stipe and the reddish staining at the apex.

Pink-red stains turn gray.



Leccinellum abellum
associated with dry oak woods.
It has a rugose cap.

The more highly colored leccinums have cap margins with overlapping sterile tissue and pale or dark scabers. Long considered edible, there is a controversy regarding possible toxicity of the orange capped leccinums.

Leccinum atrostopitatum

Leccinum discolor

Leccinum insigne

Leccinum rugosiceps

Leccinum vulpinum (L. aurantiacum)



Leccinum atrospitatum

The stipe has numerous blackish scabers from youth onward.



Leccinum rugosiceps

Note the distinctive rugose (wrinkled) cap.
Associated with oaks.



Leccinum vulpinum

Its scabers are pale in youth and become darker brown as the mushroom matures. Grows in association with conifers. The European *L. aurantiacum* is found under oak.

TYLOPILUS

All have **dry** caps.

Some are colorful.

With some notable exceptions, **spore-prints** are mostly **pinkish to rust-brown**.

Context (and usually the **pore-surface**) are whitish becoming yellow, brown, gray or black.

Stipes are often **reticulated**, at least at the apex.

Many species in the genus are bitter-tasting, while several are good to eat.

About 40 species are native to North America.

Ectomycorrhizal with pines and hardwoods.

COMMON *TYLOPILUS* IN THE NORTHEAST

Tylopilus alboater

Tylopilus atratus

Tylopilus atronicotianus

Tylopilus badiceps (mild)

Tylopilus felleus (Type species - bitter)

Tylopilus ferrugineus (mild)

Tylopilus indecisus (mild)

Tylopilus plumbeoviolaceus (bitter)

Tylopilus rubrobrunneus (bitter)

Tylopilus (Porphyrellus) sordidus (unknown)

Tylopilus tabacinus (bitter)

Tylopilus violatinctus (bitter)



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Tylopilus badiceps (mild)



Tylopilus alboater (mild, edible)
“Black-velvet Bolete”



Tylopilus plumbeoviolaceus (bitter)



Tylopilus rubrobrunneus (bitter)

Tylopilus ferrugineus



Tylopilus ferrugineus (mild)



Austroboletus gracilis var. *gracilis*

With its pinkish-tan spores, would macroscopically key out as a *Tylopilus* species, but its spores are minutely pitted rather than smooth.



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Harrya chromapes

Another *Tylopilus* or *Leccinum*-like bolete. Pinkish cap; non-staining white context, white pores becoming pink. Stipe has pink scabers above and a bright chrome base. Ectomycorrhizal with pine, beech and birch.

Dry capped, brown to wine-brown. Whitish bloom on young cap. Context white to unevenly brownish. Small pores lilac to chocolate brown. Reddish-brown spores. Ectomycorrhizal with hardwoods and pine.

Sutorius eximius
(*Tylopilus eximius*)
“Lilac-brown Bolete”



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Not edible

XANTHOCONIUM

Mushrooms in this genus have **white flesh** and their **pore-surface is white to pale yellowish** and they don't stain blue on exposure to air. They have **dry, subvelutinous caps** and **smooth stipes**.

Spores are yellowish, brownish, rusty or olivaceous, but never olive-brown like the boletes. All are edible.

*Xanthoconium affine (var. affine)**

*Xanthoconium affine (var. maculosus)**

Xanthoconium purpureum

* Index Fungorum, a website used to find currently accepted names of fungi, no longer recognizes these as separate species.

Xanthoconium affine (var.
affine)

no prominent or yellow spots on its darkish brown cap.



Index fungorum treats both
as simply
Xanthoconium affine.

Xanthoconium affine
(var. *maculosus*)

exhibits prominent white or yellow
spots on its cap.

STROBILOMYCES

White pores, no reticulation,
pores turn red, then black.

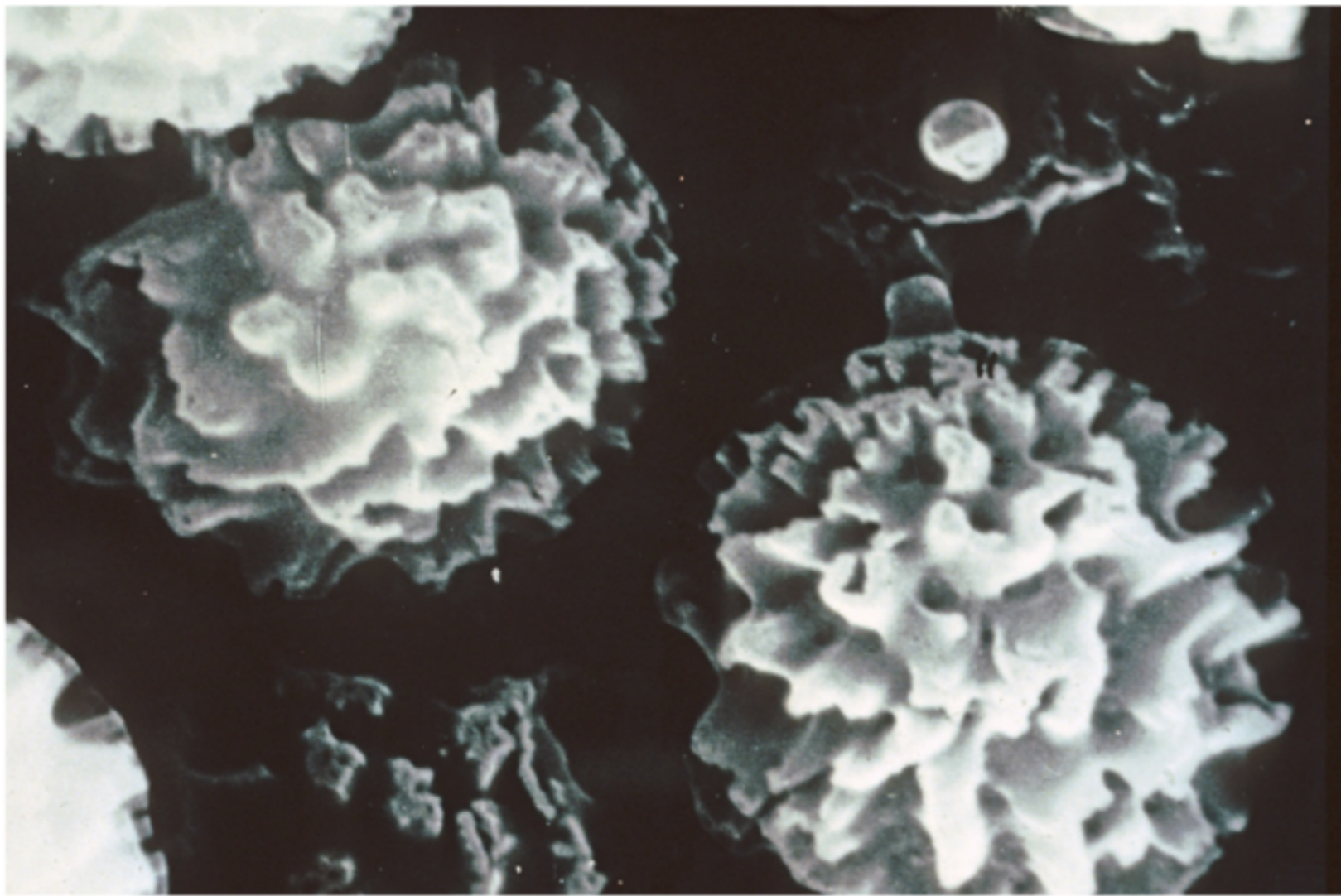
Strobilomyces strobilaceus (*Strobilomyces floccosus*)
Strobilomyces confusus

Strobilomyces strobilaceus (*Strobilomyces floccopus*)

“Old Man of the Woods”

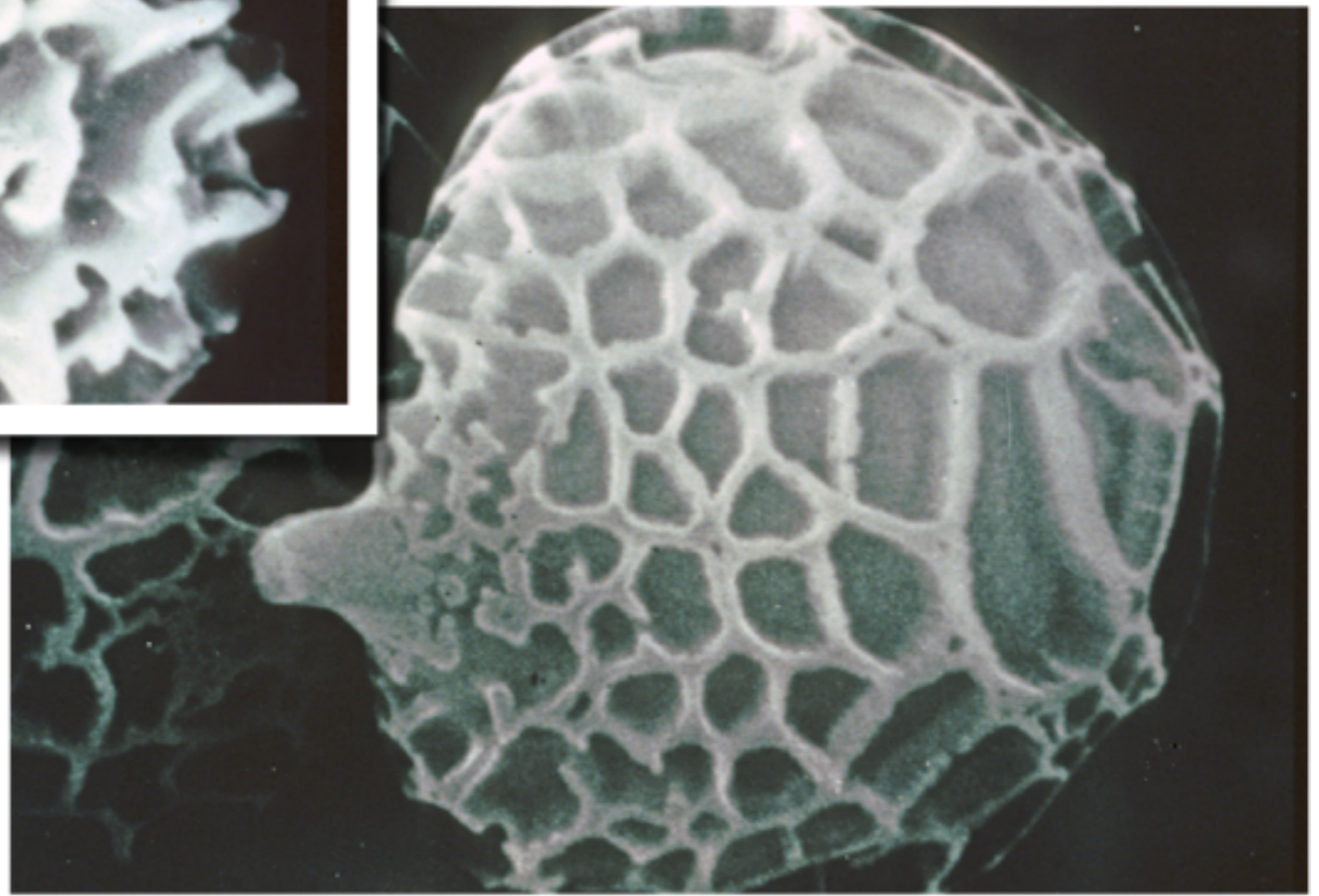
Context and pores are white and stain red, then black. Sometimes stipe has a veil.
Ectomycorrhizal with hardwoods.





Strobilomyces spores
are globose.

Strobilomyces confusus
has spiny spores



Strobilomyces strobilaceus
(*floccopus*)
has reticulate spores.

‘Boletes’ with:

**Yellowish pores, stipe reticulation,
NO blue staining**

Aureoboletus aurisseimus (*Boletus auripes*)

Retiboletus ornatipes

Retiboletus griseus

Xerocomus illudens (*Boletus illudens*)

Xerocomus tenax (*Boletus tenax*)



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Boletus aureissimus
(*Boletus auripes* var. *aureissimus*)



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***Boletellus russellii* (Frostiella russellii)**

Ragged reticulate stipe. Mycorrhizal with oak, hemlock and pine.
Edible, but “soft and insipid”.



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Boletus aureissimus (Boletus auripes)



Boletus subtomentosus
(*Xerocomus subtomentosus*)
'Yellow-cracked Bolete'



Retiboletus ornatipes (*Boletus ornatipes*)

Yellow pores and flesh,
stipe reticulation, NO blue staining



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Xerocomus illudens (*Boletus illudens*)

grows under conifers



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Xerocomus tenax (Boletus tenax)

**Boletes with yellow pores, no reticulation
on stipe & little or no bluing**

Aureoboletus auriporus (*Boletus auriporus*)

Aureoboletus roxanae (*Boletus roxanae*)

Baorangia bicolor (*Boletus bicolor*)

Boletus curtisii,

Boletus pallidus

Leccinum longicurvipes (*Boletus longicurvipes*)

Hemileccinum subglabripes (*Boletus*, *Leccinum*
subglabripes)

Pulveroboletus innixus (*Boletus innixus*)

Pseudoboletus parasiticus (*Boletus parasiticus*)

Xerocomus hortonii (*Boletus hortonii*)

Context white and unchanging with age. Bright yellow pores.
Ectomycorrhizal with pine and beech.



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Aureoboletus auriporus
(Viscid)



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Aureoboletus roxanae
(Dry)



Baorangia bicolor (*Boletus bicolor*)
Blues slowly and faintly



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Boletus hortonii
Wrinkled cap



VISCID-CAPPED

(Aureoboletus auriporus)

Leccinum longicurvipes

Leccinum rubropunctum

Boletus longicurvipes (*Leccinum longicurvipes*)

Viscid Cap. Pink-brown to reddish dots on stem.
Found with oak and beech.



Boletus pallidus

is associated with oaks. Sometimes it blues slightly. Edible.



Leccinum rubropunctum (*Boletus rubropunctus*)

Tacky, rugose cap. Bright yellow pores. Reddish scabers on stem.
Found with oak, beech and birch.



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Leccinum subglabripes (*Boletus subglabripes*)

Somewhat wrinkled dry cap. Yellow pores.
Inconspicuous scabers.

Phylloporus sp.

Dry-capped with white or yellow context that sometimes stains blue.
Olive-brown spores.

They are ectomycorrhizal with conifers and/or deciduous trees.

Phylloporus leucomycelinus has white mycelium at base.



Phylloporus boletinoides
has boletinoid gills



Phylloporus rhodoxanthus
has yellow basal mycelium.



Pseudoboletus parasiticus (*Boletus parasiticus*)

In this strange case, we have a bolete that doesn't exist, except in association with another mushroom, the gastromycete and clade-relative *Scleroderma citrinum*, the 'Poison Pigskin Puffball.'

The bolete part of this curious fruiting body is edible, though the poison puffball is not!



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Pulveroboletus innixus

**Boletes with
yellow pores, stipe reticulation
and quick bluing**

Boletus speciosus,
Butyriboletus brunneus,
(*Boletus speciosus* var. *brunnescens*)
Butyriboletus peckii (*Boletus peckii*),
Butyriboletus roseopurpureus
(*Boletus roseopurpureus*)



Butyriboletus brunneus
(*Boletus speciosus* var. *brunneus*)
Dry-capped fruits under conifers (edible)

**Yellow pores, bluing reaction but no
reticulation on stem**

Boletellus chrysenteroides

Boletus carminipes

Boletus miniato-olivaceus

Boletus miniato-pallescent

Boletus pseudosensibilis

Boletus pseudosulphureus var. *pallidus*

Boletus roseipes

Butyriboletus roseopurpureus

Caloboletus inedulis

Cyanoboletus pulverulentus

Lanmaoa carminipes

Lanmaoa sensibilis

Pulveroboletus ravenelii



Boletellus chrysenteroides

Often seen growing on conifer wood. Ectomycorrhizal with conifers and deciduous trees. Usually dry-capped, sometimes with appendiculate remains on the margin. Context and pores white or yellow, frequently bruising blue. Central stipe pruinose.



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Buchwaldoboletus lignicola

fruits on conifer wood

and is parasitic on *Phaeolus schweinitzii*.

Somewhat velvety cap; pale context; pore surface yellow to olivaceous.



Caloboletus inedulius
(*Boletus inedulius*)

is bitter.

Mycorrhizal with oaks



Caloboletus roseopurpureus
(*Boletus roseopurpureus*)



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Cyanoboletus pulverulentus
(*Boletus pulverulentus*)



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Lanmmaoa sensibilis
(*Boletus sensibilis*)



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Pulveroboletus ravenelii

Dry yellow cap ages reddish brown.
It has a powdery bright yellow partial veil. Pores are yellow and stain blue.
Smooth stipe has yellow fibrils. Fruitbody stains instantly dark blue.
Ectomycorrhizal with pine, beech and other deciduous trees.

Boletes with Cracked Caps

Yellow pores, bluing,
but no reticulation

Some easily confused boletes have red to brown dry caps that are often rimose (cracked) in age. They have yellow, angular pores, and blue with bruising.

Medium-sized Fruitbodies

Boletellus chrysenteroides

Boletellus intermedius

Boletellus pseudochrysenteroides

Boletus spadiceus

Boletus subtomentosus

Hortiboletus campestris

Xerocomellus chrysenteron

Small fruit bodies

Boletus subfraternus

Hortiboletus rubellus



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Boletellus pseudochrysenteroides
'rosy-red cracked cap'



Boletus subtomentosus



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Hortiboletus campestris (*Boletus campestris*)
found in grassy areas



Hortiboletus rubellus (*Xerocomellus rubellus*)
(*Boletus fraternus*)

Yellow pores and pale yellow flesh turn blue
Cracks in cap are yellowish.
It has yellow mycelium at stipe base



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Xerocomellus chrysenteron

(Boletus chrysenteron) "Red-cracked Bolete"

(has a brownish cap with red peaking through, a red stipe, and angular pores. It grows in association with pine, oaks and other hardwoods.)

Boletes with red or brownish pores, not bluing

Bothia castanella

Chalciporus piperatus

Chalciporus rubinellus

Xerocomus morrisii

*There are only a handful of boletes in the genus *Chalciporus* in the northeast . They all tend to be small in size, have cinnamon to reddish pores and grow in mixed woods under deciduous and coniferous trees.



Bothia castanella

has been placed in seven different genera before getting its own. Pileus is velutinous. Context is whitish. Short stipe. Decurrent, radial or boletinoid pores are initially pale and become yellow-brown with age. Associated with oak.



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Chalciporus piperatus

is far too peppery for most people to tolerate, unless first dried and crushed finely to make a condiment used in cooking.



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Chalciporus rubinellus “Ruby Bolete”
Edibility unknown.



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Xerocomus morrisii (*Boletus morrisii*)
“Red-speckled Bolete”

Not edible

**Boletes with red to red-brown pores,
bluing quickly.**

Boletus miniato-olivaceus

Boletus miniato-pallescent

Boletus rubroflammeus

Boletus subluridellus

Boletus subvelutipes

Boletus vermiculosoides

Boletus vermiculosus

Exsudoporus frostii (*Boletus frostii*)

Neoboletus luridiformis (*Boletus discolor*)



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Boletus minato-olivaceus



© Dianna Smith

Boletus miniato-pallescent



Boletus subvelutipes
is the most common of this group in our area of the country.



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Boletus vermiculosus



Exsudoporus frostii
(*Boletus frostii*)



© Dianna Smith

Neoboletus luridiformis
(*Boletus discolor*)

References

Elias Magnus Fries - all fungi with pores were called Boletus, later
Polyporus and *Boletus*

In early 1800's Lewis David von Schweinitz was the first American
mycologist to describe a N.A. bolete

Charles Frost, A Catalog of Boleti of New England – 46 boletes

Charles Peck, Boleti of the United States, 1889

William Murrill in early 20th c. described over 50 new species

Snell and Dick, The Boleti of Northeastern North America, 1941 (first
color monograph with watercolor illustrations)

Coker and Beers, The Boletaceae of North Carolina, 1943

Smith and Thiers, The Boletes of Michigan, 1971

Ernst Both, The Boletes of North America, A Compendium, 1993
(600 boletes)

Bessette and Roody, North American Boletes, 2000

Roy Halling – www.sweetgum.nybg.org

QUESTIONS:

Name an edible red-pored bolete.

Scabers characterize which genus of boletes?

Name a bolete which has prominent reticulation.

Which genus has pinkish-brown spores?

What characteristics do boletes in the
B. edulis group have?