

## Boletales –Boletaceae

(draft, 26 October 2007, R. E. Halling)

### *Afroboletus* Pegler & Young

Pileus dry, coarsely fibrillose to squamose, black, often with appendiculate veil remnants, microscopically a trichodermium. Context white, staining red then black. Hymenophore adnexed, white then black, staining red then black. Peronate veil present. Stipe dry, squamose, sometimes annulate, white to gray to black. Spores black, short ellipsoid, longitudinally ridged with intercostal veins, a basal thickened rim around sterigmal appendage, lacking a plage. Hymenial cystidia present. Clamp connections absent. Apparently restricted to the African tropics. Ectomycorrhizae with Caesalpinoid Legumes.

### *Aureoboletus* Pouzar

Pileus viscid to dry, rugulose to even. Context white, unchanging. Hymenophore tubulose, bright yellow at first, unchanging. Stipe central, glabrous, sometimes superficially pruinose, viscid to dry. Spores olive brown in deposit, smooth, fusoid, inamyloid. Clamp connections absent. Mostly north temperate to northern tropics; perhaps southern tropics. Ectomycorrhizae with Pinaceae, Fagaceae.

### *Austroboletus* (Corner) C. B. Wolfe

Pileus viscid or dry, tomentose to subtomentose, microscopically a trichodermium or ixotrichodermium, sometimes with appendiculate remnants at margin. Context white or yellow, unchanging. Hymenophore tubulose, adnexed, white at first, pinkish flesh colored to brownish pink with maturity (rarely yellow), sometimes staining light brownish to pinkish brown. Stipe central, pruinose to alveolate-reticulate, dry or sometimes glutinous-viscid, not staining; basal mycelium white. Spores vinaceous pink in deposit, pitted to sinuous pitted, sometimes equatorially verrucose, elongate-fusoid, inamyloid or dextrinoid. Hymenial cystidia usually present. Clamp connections absent. KOH & NH<sub>4</sub>OH reactions negative. Mostly Australasian, some temperate New World, 3-4(5-6?) in Neotropics. Ectomycorrhizae with Pinaceae, Fagaceae, Myrtaceae, Dipterocarpaceae, Casuarinaceae.

### *Boletinellus* Murrill

Pileus dry, usually glabrous but sometimes finely tomentose to matted tomentose, soft textured, microscopically a repent entangled interwoven layer. Context pale yellowish, rarely cyanescent. Hymenophore tubulose, quite decurrent and with a radial boletinoid orientation, occasionally sublamellate, dull yellow, slowly cyanescent then brownish. Stipe lateral or eccentric, very rarely nearly central, dry, mostly glabrous. Sclerotia present. Spores olive brown in deposit, ovoid to nearly globose, smooth. Hymenial cystidia inconspicuous, often absent on the pores. Clamp connections present. Not ectomycorrhizal. The type of the genus, *B. merulioides* is widespread in eastern North America where it is associated with *Fraxinus*, but is not mycorrhizal. Rather it is associated with a parasitic aphid restricted to *Fraxinus* roots. There is a well-documented report of its occurrence (perhaps non-native) in Kyushu, Japan.

### *Boletellus* Murrill

Pileus typically dry, rarely subviscid, scaly or tomentose, microscopically a trichodermium, sometimes with appendiculate remnants at margin. Context white or yellow, often changing to blue. Hymenophore tubulose, adnexed, white at first, soon yellow, often staining blue. Stipe central, usually pruinose, rarely with an apical reticulum, dry, sometimes staining blue; basal mycelium white, very rarely yellow. Spores olive brown in deposit, longitudinally ridged/winged or slightly veined, inamyloid or rarely dextrinoid. Hymenial cystidia usually present. Clamp connections usually absent, rarely present (one sp., *B. fibuliger*). KOH & NH<sub>4</sub>OH reactions negative (more species need testing). Mostly N. Hemisphere, apparently not in S. Hemisphere (except Australia), Australasia, Mesoamerica, Andean Colombia, one sp. in Venezuela (*B. fibuliger*). Ectomycorrhizae with Pinaceae, Fagaceae, Myrtaceae, Dipterocarpaceae, Casuarinaceae (?), possibly with Caesalpinoid Leguminosae.

### *Boletochaete* Singer

Pileus velutinous, bay-colored. Tubes gray. Stipe brownish, nearly smooth. Flesh white, unchanging. Spore deposit cinnamon brown, spores ovoid, smooth, inamyloid. Pileipellis a palisade with conical terminal elements. Seta-like or pseudocystidia-like hymenial cystidia present. Clamp connections absent. Not well studied. Two species known from the Paleotropics (Africa, SE Asia). Ectomycorrhizae not determined with certainty (possibly Caesalpinoid Leguminosae and/or Dipterocarpaceae).

***Boletus*** Dill. ex Fr.

(including *Xerocomus*)

Pileus dry to subviscid, glabrous to tomentose to fibrillose, microscopically a trichodermium or ixotrichodermium. Context white to yellow, staining blue or not changing. Hymenophore adnexed to adnate to subdecurrent, white to yellow to greenish yellow, staining blue to blue-green or not changing with pores concolorous or sometimes red to brownish red. Stipe dry, rarely viscid, glabrous to subpruinose to reticulate or sometimes alveolate, with basal mycelium variously colored. Spore deposit olive brown. Spores smooth, fusoid. Hymenial cystidia present. Clamp connections absent. Temperate and Tropical. Ectomycorrhizae with Pinaceae, Fagaceae, Betulaceae, Dipterocarpaceae, Myrtaceae, Casuarinaceae, Caesalpinoid Legumes.

Note: This genus remains as the basic genus after all others have been separated based on idiosyncratic features. It may not be homogeneous or monophyletic.

***Bothia*** Halling, Baroni & Binder

Pileus dry, coarsely tomentose to subtomentose to aggregated fibrillose or appressed fibrillose, microscopically a trichodermium. Context soft textured, whitish, not cyanescent. Hymenophore decurrent, shallow, conspicuously boletinoid, often with compound pores, pale brown, staining darker brown. Stipe dry, central or eccentric, pale brown, staining darker brown, frequently reticulate at least at the apex, with white basal mycelium. Spore deposit yellow brown. Spores ellipsoid to long ovoid, smooth, inamyloid. Hymenial cystidia present and conspicuous. Clamp connections absent. Eastern North America. Ectomycorrhizae with Fagaceae (*Quercus*).

***Chalciporus*** Bataille

Pileus dry or subviscid, glabrous, microscopically a trichodermium. Context pale yellow or white or rarely pale pinkish, staining blue in some. Hymenophore adnate to subdecurrent, dull red, cinnamon brown, carmine to salmon pink, not staining or rarely staining blue. Stipe dry, pruinose to glabrous, with bright yellow basal mycelium. Spore deposit brown. Spores fusoid or short ellipsoid, smooth. Hymenial cystidia present. Clamp connections absent. North Temperate and Pantropical. Ectomycorrhizae with Pinaceae and Fagaceae.

***Fistulinella*** Henn.

(=*Mucilopilus*?)

Pileus dry or viscid, glabrous, fibrillose or tomentose, often scrobiculate, microscopically a trichodermium, cutis, ixotrichodermium, or ixocutis. Context white, unchanging. Stipe dry or viscid, glabrous or pruinose. Spore deposit brownish pink. Spores smooth, fusoid. Clamp connections absent. Eastern North America, Mexico, Caribbean, Brazil, Africa, New Zealand, Japan, Indonesia. Ectomycorrhizae possible in some species with Fagaceae, Nothofagaceae, Leguminosae, Sapotaceae, Myrtaceae; doubtfully present in others.

***Gyrodon*** Opatowsky

Pileus glabrous or rarely subsquamose, dry, microscopically a trichodermium. Context pale yellow to whitish. Hymenophore decurrent, with tubes and pores radially elongated, staining blue. Stipe central to eccentric, often curved and short. Spore deposit olive brown to brown. Spores smooth, short-ellipsoid to phaseoliform. Hymenial cystidia present to rarely present. Clamp connections present. Cosmopolitan. Ectomycorrhizae with *Alnus*; sometimes apparently not (at least in *G. exiguus* and perhaps others).

***Gyroporus*** Quélet

Pileus dry, glabrous to fibrous-subsquamose, microscopically a trichodermium. Context white to pale yellow, staining blue in some. Hymenophore adnexed, white then pale yellow. Stipe dry, glabrous or

fibrous-subfurfuraceous, hollow or solid, composed of circumferentially arranged hyphae (not longitudinal). Spore deposit yellow. Spores smooth, ellipsoid. Hymenial cystidia present. Clamp connections present. North Temperate and Pantropical; rare to absent in the South Temperate zone. Ectomycorrhizae with Pinaceae, Fagaceae, possibly with Myrtaceae.

***Heimioporus*** Horak  
(=*Heimiella*)

Pileus dry, subtomentose, microscopically a palisadic trichodermium. Context white to yellow, not staining. Hymenophore adnexed, yellow, sometimes staining blue. Stipe dry, pruinose to reticulate, with white basal mycelium. Spore deposit olive brown. Spores alveolate-reticulate to reticulate or with pit-like perforations, elongate-ellipsoid to short ellipsoid, lacking a suprahilar place. Hymenial cystidia present. Clamp connections absent. Eastern Asia, SE Asia, Australia, Mexico, Belize, and Costa Rica. Ectomycorrhizae with Fagaceae, Dipterocarpaceae, Myrtaceae, Casuarinaceae.

***Leccinellum*** Bresinsky & Binder

Accommodates most of the taxa with yellow hymenophore formerly placed in *Leccinum* sect. *Luteoscabrum*. This includes *L. albellum* from the USA and several European taxa (e.g., *L. nigrescens*, *carpini*, *corsicum*, *crocipodium*, *griseum*, *lepidum*, & *luteoscabrum*). Apparently restricted to the Northern Hemisphere (Europe, E North America). Ectomycorrhizae with Fagaceae, Betulaceae.

***Leccinum*** S. F. Gray

Pileus viscid or dry, glabrous to subtomentose, microscopically a trichodermium or hymeniform. Context white or pale yellow, unchanging or staining red, pink, gray, or blue to blue-green. Hymenophore adnexed, white to tan to yellow, often staining pale brown. Stipe dry, scabrous. Spore deposit brown or olive brown. Spores smooth, fusoid. Hymenial cystidia present. Clamp connections absent. North Temperate, montane Neotropics, Asian and African tropics. A few reports from Australia. Ectomycorrhizae with Pinaceae, Fagaceae, Betulaceae, Caesalpinoid legumes and possibly Dipterocarpaceae.

***Paragyrodon*** (Singer) Singer

Pileus viscid, microscopically an ixocutis. Context white to yellowish, staining brown. Hymenophore adnate to decurrent, bright yellow then brown, staining bright brown. Peronate veil present, forming an annulus. Stipe central to eccentric. Spore deposit olive to mustard brown. Spores smooth, globose to subglobose. Hymenial cystidia present. Clamp connections present. Well-known species in north central North America, but of controversial disposition. One species (*P. sphaerosporus*). Ectomycorrhiza with *Quercus* suspected but not confirmed.

***Phlebopus*** (Heim) Singer  
(=*Phaeogyroporus*)

Pileus dry to subviscid, glabrous, microscopically a trichodermium. Context white or pale yellow, unchanging or staining blue. Hymenophore adnate, staining blue or not. Stipe dry, glabrous. Spore deposit olive brown. Spores smooth, short-ellipsoid. Hymenial cystidia (?). Clamp connections present. Pantropical and subtropical. Ectomycorrhizae absent or facultative with Leguminosae.

***Phylloboletellus*** Singer

Pileus dry. Context changing to blue when exposed (white?). Hymenophore lamellate, decurrent, somewhat intervenose. Spores olive brown in deposit, ovoid, longitudinally winged/ridged, inamyloid. Clamp connections present or absent (?). Known from Mexico and Argentina. Ectomycorrhizae not determined with certainty.

***Phylloporus*** Quélet

Pileus dry, tomentose to subtomentose, microscopically a trichodermium or a modified hymeniform layer. Context usually white, sometimes yellow, sometimes changing to blue when exposed. Hymenophore lamellate to subtubulose to radically boletinoid, sometimes changing to blue when bruised.

Stipe central, rarely slightly eccentric, usually pruinose; basal mycelium white or yellow (IMPORTANT!). Spore deposit olive brown, smooth, fusoid or ovoid, dextrinoid. Hymenial cystida present. Clamp connections absent (present in 1 or 2 species). NH<sub>4</sub>OH reactions negative or positive (blue or blue green – IMPORTANT!). Mostly tropical, but a few temperate (north and south).  
Ectomycorrhizae with Pinaceae, Fagaceae, Myrtaceae, Dipterocarpaceae, Casuarinaceae.

***Porphyrellus*** E.-J. Gilbert

Name especially used for the somber colored taxa with very dark brown to dark pinkish brown colored spore print. They are often cyanescent. Based on *P. pseudoscaber* nom. inval. (= *P. porphyrosporus*). (see *Tylopilus*).

***Pseudoboletus*** Šutara

A *Boletus* with xerocomoid habit that is associated with *Scleroderma* and *Astraeus*. Northern hemisphere.  
Considered parasitic, but one of the pair is ectomycorrhizal.

***Pulveroboletus*** Murrill

Pileus dry or barely subviscid, glabrous, microscopically a collapsed trichodermium. Context white to pale yellow, slowly staining blue. Hymenophore adnate to adnexed, yellow, staining blue. Peronate veil present, collapsing to form annular zone. Stipe dry to sticky, apparently glabrous. Spore deposit olive brown. Spores smooth, fusoid. Hymenial cystidia present. Clamp connections absent. North America, East Asia, Southeast Asia, Australia, Africa, montane Neotropics.  
Ectomycorrhizae with Fagaceae, Myrtaceae, possibly Dipterocarpaceae, Caesalpinoid Legumes.

***Retiboletus*** Binder & Bresinsky

Recently recognized as distinct from *Boletus*. Produces a unique group of butenolide compounds called retipolides (rarely without) that are responsible for the bitter taste and the intense yellow color of the context. Spore deposit olive brown. Spores are fusoid, smooth. Hymenial cystidia present. Clamp connections absent. Circumscribes *R. flavoniger*, *grisesus*, *ornatipes*, *retipes*, & *nigerrimus*; species with conspicuously reticulate stipes. Temperate New World (& Japan?) to montane Neotropics.  
Ectomycorrhizae with Fagaceae.

***Rubinoletus*** Pilát & Dermek

Pileus dry, variously colored. Context firm, unchanging or cyanescent. Hymenophore adnate or decurrent, often tinted a bit of pink. Spores a pale pinkish in deposit(?). Spores short ellipsoid to somewhat phaseoliform. Originally based on *R. rubinus* from Europe where that taxon is quite localized. Quite a mixture of entities mostly documented from central Africa, but the name has been used for collections in Australia and elsewhere that have been recognized in *Tylopilus*. Quite likely they are not monophyletic and widely distributed.  
Ectomycorrhizae with Pinaceae, Fagaceae, Myrtaceae, Casuarinaceae, Dipterocarpaceae, caesalpinoid Legumes.

***Sinoboletus*** Zang

The hymenium is produced on tubes with cross veins; the tubes are distinctly stratified in two layers at the pores. Spores ovoid to ellipsoid, smooth. Hymenial cystidia present. Pileipellis an erect trichodermium. Clamp connections absent. Originally described from SW Yunnan, China.  
Ectomycorrhizae with Fagaceae.

***Strobilomyces*** Berkeley

Pileus dry, coarsely fibrillose to squamulose, black, infrequently dark brown, very rarely pale yellow, often with appendiculate veil remnants, microscopically a trichodermium. Context white, staining red then black, or sometimes slowly blackening straightaway. Hymenophore adnexed to adnate, sometimes with subdecurrent lines, white then black, staining red then black or slowly black straightaway. Peronate veil present. Stipe dry, squamose, sometimes annulate, white to gray to black. Spore deposit black. Spores globose, reticulate to irregularly echinate or sparsoid to cristate. Hymenial cystidia present. Clamp connections absent. North Temperate zone, montane Neotropics, Southeast Asia, Australia.

Ectomycorrhizae with Fagaceae, Myrtaceae, Dipterocarpaceae, Caesalpinoid Legumes.

***Suillus*** Micheli ex S. F. Gray

Pileus viscid and glabrous or dry and squamulose, sometimes with appendiculate remnants, microscopically an ixotrichodermium or a trichodermium. Context white or pale yellow, unchanging or sometime staining a pale reddish. Hymenophore adnate to adnexed, yellow or pale cinnamon brown. Stipe dry, annulate or not, typically with glandular dots or smears. Spore deposit pale cinnamon brown. Spores smooth, short fusoid. Hymenial cystidia usually clustered, with amorphous brown pigmentation at the base. Clamp connections absent. North Temperate and southward into the tropics to the southern limit of Pinaceae (*S. subaureus* with *Betula*). Absent in Africa. Obligate ectomycorrhizae with Pinaceae.

***Tuboseta*** Horak

Pileus dry, subvelutinous to tomentose, microscopically a trichodermium or subhymeniform. Context white. Hymenophore adnate to adnexed, olive yellow, staining ???. Stipe dry, subvelutinous to glabrous. Spore deposit brownish yellow. Spores smooth, fusoid. Hymenial cystidia present as thick-walled, pigmented setae. Clamp connections absent. Africa and Indomalaya. Ectomycorrhizae with Caesalpinoid legumes, possibly Fagaceae or Dipterocarpaceae.

***Tylopilus*** P. Karsten

Pileus dry, glabrous to subtomentose, microscopically a trichodermium or subhymeniform. Context white, unchanging or staining pale brown, red then black, or rarely blue. Hymenophore adnexed, white then pinkish flesh colored to purplish brown to rusty brown, staining brown. Stipe dry, pruinose to glabrous to reticulate, to finely scabrous. Spore deposit pinkish flesh colored to purplish brown, to rusty brown. Spores smooth, fusoid. Hymenial cystidia present, usually as pseudocystidia. Clamp connections absent. (includes *Porphyrellus* and possibly some *Rubinoboletus* q.v.). North Temperate zone, montane Neotropics, northern South America, East Asia, Southeast Asia, Australia, New Zealand, Africa. Ectomycorrhizae with Pinaceae, Fagaceae, Betulaceae, Myrtaceae, Casuarinaceae, Caesalpinoid Legumes.

***Veloporphyrillus*** Gómez & Singer

Pileus dry, tomentose, lacking pigmentation, microscopically a trichodermium. Context white, pale burgundy red. Hymenophore white to pinkish flesh color, unchanging. Veil present. Stipe white, annulate. Spore deposit possibly purplish brown (?). Spores smooth, fusoid. Hymenial cystidia present. Clamp connections absent. One species known (*V. pantoleucus*) from Costa Rica. Very rare and many characteristics not completely known. Undoubtedly ectomycorrhizal with *Quercus*.

***Xanthoconium*** Singer

Pileus dry, subtomentose, often wrinkled, microscopically hymeniform. Context white, unchanging. Hymenophore adnate or adnexed, white to straw yellow, not staining. Stipe dry, glabrous. Spore deposit bright rusty brown. Spores smooth, fusoid to cylindrical. Hymenial cystidia present. Clamp connections absent. Often (+) greenish blue with hydroxides. Eastern North America south to southern Colombia, East Asia, possibly Southeast Asia and Australia. Ectomycorrhizae with dicots.