

## The genus *Aureoboletus*, a world-wide survey. A contribution to a monographic treatment

### Die Gattung *Aureoboletus*, ein weltweiter Überblick. Ein Beitrag zu einer monographischen Bearbeitung

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**Key words:** *Basidiomycota*, *Boletales*, *Boletaceae*, *Aureoboletus*. – Taxonomy, species concept, key, new combinations. – Mycoflora of Asia, America, Europe.

**Abstract:** The problem of different interpretations of the autonomy of the genus *Aureoboletus* is discussed by means of anatomical and other morphological characters, descriptions and illustrations respectively, as well as findings of molecular studies. An annotated survey of *Aureoboletus* species hitherto described and a world-wide key to the species are given. Species of other genera but likely to be confused with *Aureoboletus* are discussed and included in the key. For the following taxa the transfer into *Aureoboletus* resp. a new combination is proposed: *Aureoboletus auriporus* var. *novoguineensis*, *A. citriniporus*, *A. flavimarginatus*, *A. flaviporus*, *A. moravicus*, *A. moravicus* f. *pallescens*, *A. roxanae*. *Aureoboletus viridiflavus* is described as spec. nova.

**Zusammenfassung:** Die Problematik der verschiedenen Auffassungen zur Selbständigkeit der Gattung *Aureoboletus* („Goldporröhrlinge“) wird an Hand anatomischer sowie anderer morphologischer Merkmale, Beschreibungen bzw. Abbildungen sowie Erkenntnissen molekularbiologischer Studien diskutiert. Ein kommentierter Überblick über die bisher beschriebenen *Aureoboletus*-Arten und ein weltweiter Schlüssel für die Gattung werden gegeben. Verschiedene Arten, die *Aureoboletus* ähnlich sind, jedoch anderen Gattungen angehören, werden diskutiert und im Schlüssel berücksichtigt. Für die folgenden Taxa wird die Überführung zur Gattung *Aureoboletus* resp. eine Neukombination vorgeschlagen: *Aureoboletus auriporus* var. *novoguineensis*, *A. citriniporus*, *A. flavimarginatus*, *A. flaviporus*, *A. moravicus*, *A. moravicus* f. *pallescens*, *A. roxanae*. *Aureoboletus viridiflavus* wird als spec. nova beschrieben.

#### 1. The genus *Aureoboletus* POUZAR 1957, Česká Mykol. 11: 48, emend. KLOFAC and its delimitation

**Diagnosis originalis:** Genus *Boletacearum* pileo glabro, statu humido viscido; poris cum vivis, tum post exsiccationem aureo-pigmentalis; trama tubulorum ut in *Boletis* laterali; stipite in statu vivo humidoque glutinoso, absque reticulo.

**Typus:** *Aureoboletus gentilis* (QUEL.) POUZAR, Česká Mykol. 11: 48, 1957.  
≡ *Boletus gentilis* (QUEL.) KALLENB.

#### History and delimitation:

SINGER (1942) made the basis for *Aureoboletus* when establishing the section *Auripori* (as section of *Xerocomus*): “Pileo et interdum stipite viscosis, glabris vel subglabris. Poris aureis-aurantiacis. Carne albida, vix caerulescente. Cystidiis partim luteis. In silvis frondosis”.

Five years later, SINGER (1947) transferred the section *Auripori* to *Pulveroboletus*: “*Poris aureis vel laetissime olivaceo-aureis et in statu sicco; velo nullo vel haud abundante, luteo-pulverulento, haud glutinoso; pileo aut stipite aut ambobus viscidis; elementis hymenophori frequenter succo luteo-citrino repletis (in solutione ammoniaca), cito diffundente*”.

The genus *Aureoboletus* POUZAR (1957) has for long time not been accepted by most mycologists, such as SINGER (1986), who stated: “*Pulveroboletus ravenelii*, the type species, is really not basically different from the section *Auripori* except by the veil”. ŠUTARA (2005) confirmed the now general view, that *Pulveroboletus* has to be restricted mainly to species around *P. ravenelii*: “with a universal veil, an infertile stipe surface consisting of an undifferentiated suprapellis, densely arranged strictly parallel with the stipe axis and no lateral stratum of the stipe trama (... there is neither a caulohymenium nor a trichoderm nor a palisadoderm nor any kind of an anticlinally arranged cuticle). *Pulveroboletus* in the widely extended concept adopted by SINGER represents an unnatural, very heterogeneous group of considerably different species, as was already pointed out by some authors (e.g., SMITH & THIERS 1971, CORNER 1972, PILÁT & DERMEK 1974, etc.)”, as also stated by WATLING & HILLS (2005).

Anatomical characters (fertile caulohymenium on the stipe, a typically boletoid, gelatinous lateral stratum of the stipe trama, and no veil) led ŠUTARA (2005) to treat *A. gentilis* as a member of *Boletus* but he had studied only *A. gentilis*. Caused by further anatomical studies and recent molecular analyses (e.g., BINDER 1999, BINDER & HIBBETT 2006), ŠUTARA (2008) developed a new concept of the *Boletaceae* (from a European point of view, considering mainly *A. gentilis*), defining the characters of *Aureoboletus* as following: “Hymenophoral trama in a fully developed state true boletoid, spore print when fresh with a more or less distinct olivaceous tint, e.g. olivaceous, brown-olivaceous or olive-brown, tube trama relatively thick, with lateral strata in a well-developed state 50–110 µm thick. Cheilocystidia and many other cells of the hymenophore contain a bright yellow sap. Hymenophore with a conspicuously bright yellow or golden-yellow colour which persists even in dried fruit bodies. Pileus glutinous or viscid when moist, shiny when dry, with pileipellis consisting of a gelatinous ixotrichoderm”.

Earlier, SINGER (1986) already defined the features of *Aureoboletus* (as section *Auripori*) in a more world-wide view “pileus or stipe or both viscid, pores golden yellow or brightly olive-gold even in dried condition, elements of the trama often filled with deep lemon yellow soluble (NH<sub>4</sub>OH) pigment; stipe covered by a gelatinous layer”. WANG & YAO (2005) describe the structure of pileus and stipe as viscid remains of veil. WATLING (2008) defines the genus as follows “basidiome epigeal, pileate with tubulate hymenophore, centrally stipitate, fleshy, putrescent, for type species velangiocarpic from gelatinised layer, possibly mixangiocarpic? Spore-print ochraceous buff. Pileus convex then expanding, brightly coloured, viscid, smooth but old minutely wrinkled. Stipe slender, cylindrical, attenuated or swollen slightly in the middle, often more or less rooting, smooth to striate-fibrillose, viscid often with watery droplets on the gelatinised surface. Veil reduced to a gelatinous coating. Tubes and pores concolourous, rich chrome-yellow from start, unchanging on bruising, angular, relatively large. Context whitish or slightly pinkish in the pileus, yellowish above the tubes and possibly in stipe-base, unchanging on exposure to air. Odour & taste pleasant, not astringent”.

In conclusion, when paying attention to recent molecular studies, the genus *Aureoboletus* has to be emended in several points: Pileus often viscid, but also subtomentose. Tubes

and pores with all shades of yellow. Smell and taste heterogeneous. Carpophores small to medium-sized. Hymenophoral surface more or less depressed around the stipe, broadly adnate or with decurrent tube walls. Stipe subequal or fusoid, nearly always slightly to distinctly swollen in the middle and more or less rooting or attenuated to the base, not distinctly reticulate and neither scabrous nor glandulose (*Suillus*-like), but many species of the genus having a yellow floccosity on surface of stipe, basal mycelium often withish. Most species ectomycorrhizal with frondose trees. The subequal to fusoid stipe with a swollen middle part and an attenuated to rooting base remains the only macroscopic character that seems characteristic for *Aureoboletus* species in the present concept.

In connection with the circumscription of *Aureoboletus*, it is referred also to - brightly yellow-pored species, easily to be confused with members of *Aureoboletus*, in other genera (e.g., *Boletus*, *Xerocomus*, *Leccinellum*, *Retiboletus*). Notice generic differences such as reticulated, scabrous or glandulose stipe, tomentose covering of pileus as well as microscopic features, such as hymenophoral trama of the *Phylloporus*-subtype, and structure of cystidia. Moreover, there exist many other *Boletales* with viscid pileus (e.g., in the genera *Fistulinella*, *Suillus*, *Boletus*).

The present state of knowledge of the species and (seven) sections that SINGER (1986) included in *Pulveroboletus* s. l. has been discussed above as to species around *P. ravenelii* (section 1. *Pulveroboletus*), and the genus *Aureoboletus* (section 5. *Auripori*). Section 2. *Sulphurei* has been transferred partly to *Buchwaldoboletus* (PILAT 1969) but obviously not all transferred species fit in this genus according to the results of molecular analysis. Differences between sections 5. *Auripori* (completely transferred to *Aureoboletus*) and 7. *Cartilaginei* are fleeting, based on the presence of veil-remnants or only some pulverulence on the stipe. Molecular analysis points to the possibility that the type species of the section, *P. curtisii* (BERK.) SINGER, is near to *Fistulinella* or *Retiboletus*. From section 3. *Reticulati*, *P. retipes* has been transferred to the new genus *Retiboletus* (BINDER & BRESINSKY 2002).

Unfortunately, convincing proofs of accuracy of molecular data are missing; doubts are caused by too few material and by obvious misidentifications of the species examined. Misidentifications particularly apply to (but are not restricted to) "exotic" species, such as *A. thibetanus*. YANG & al. (2003) recognized most descriptions and illustrations of this species in the literature as not conspecific.

## 2. Synopsis of *Aureoboletus* species

### 2A. European species

Today, in Europe only one species (*A. gentilis*) is recognized, although in the past some variation arising of other taxa has occurred. So BLUM (1969) keyed *Boletus sanguineus*, *B. cramesinus*, *B. gentilis*, *B. subspeciosus* BLUM (*B. sanguineus* ss. QUÉLET), and *B. lilaceus* in this group. ESTADÈS & LANNOY (2004) also mention these taxa as possible varieties of *Aureoboletus gentilis*.

Collections made in Austria are documented in the Database of fungi in Austria (AUSTRIAN MYCOLOGICAL SOCIETY 2009), which is also used for records from Austria concerning species of other genera considered below.

***Aureoboletus gentilis* (QUEL.) POUZAR**, Česká Mycol. **11**: 48, 1957**Basionym:** *Boletus sanguineus* var. *gentilis* QUEL., Compt. Rend. Assoc. Franc. Av. Sci. **12**: 504, (1883) 1884≡ *Boletus gentilis* (QUEL.) BIGEARD & H. GUILL., Fl. Champ. Sup. France: 386, 1909≡ *Boletus gentilis* (QUEL.) SACC., Syll. Fung. (Abellini) **6**: 8 (1888)≡ *Xerocomus gentilis* (QUEL.) SINGER, Rev. Mycol. **5**: 6, 1940≡ *Pulveroboletus gentilis* (QUEL.) SINGER, Amer. Midl. Naturalist. **37**: 17, 1947≡ *Boletus cramesinus* SECR., Mycogr. Suisse **3**: 39, 1833, nom. inval.≡ *Pulveroboletus cramesinus* (SECR.) M. M. MOSER, Kl. Krypt.-Fl. Iib: 33, 1955, comb. inval.≡ *Aureoboletus cramesinus* (SECR.) WATLING, Notes Roy. Bot. Gard. Edinburgh **25**: 265, 1969, comb. inval.= *Boletus auriporus* ss. KALLENBACH, Die Röhrlinge: 96, 1926-1929?= *Boletus lilaceus* ROSTK. in STURM, Deutschlands Flora **3**(5): 127, 1844?= *Boletus tenuipes* (COOKE) MASSEE, British Fungi **1**: 281, 1892**Diagnosis originalis:** Stipe grèle, aminci en bas, fibro-charnu, tendre, glabre, à peine fibrilleux, citrin pale, teinté de rose. Peridium convexe, (m 0,04-5), visqueux, rose incarnat, avec de fines rides plus foncées. Chair molle, humide, marbrée, blanc-citrin, puis rosée, douce, à a odeur de fruits. Tubes un peu decurrents, courts (5 mm), jaunes; pores composées (1-2 mm), anguleux, d'un jaune sulfurin brillant. Spore ellipsoïde-cylindrique (0,011-14 mm), guttulée, citrine. Été. Forêts ombragées de la plaine, Jura.**Type for *A. cramesinus*:** Suisse, Croix Blanche, Sauvabelin, Bois gentil (no material available).**Selected illustrations:** KONRAD & MAUBLANC (1924-1935): t. 413, KALLENBACH (1926-1938): t. 36, ALESSIO (1985): 70, BREITENBACH & KRÄNZLIN (1991): 3/40, KREISEL (1986): 14, MOSER & JÜLICH (1985): Pulv 1o., MUÑOZ (2005): 37, GALLI (1998): 145, BOLETS DE CATALUNYA (1987): 6/293, SINGER (1967): T. 1, DÄHNCKE (1993): 52, PILAT & DERMEK (1974): 25, MARCHAND (1974): 3/9, DERMEK (1987): 121c, (for a list of further illustrations see KLOFAC 2007: 253).**Characters:****Pileus:** 2-8 cm wide, pinkish-brownish, flesh-coloured, viscid, shiny, margin projecting.**Hymenophore:** tubes and pores bright golden yellow, tubes short.**Stipe:** slender, slightly viscid, bright chrome yellow (some places also orange), basal mycelium white.**Context:** whitish, under cuticle pinkish, above tubes also yellowish.**Macrochemical reactions:** most reactions not distinctive or weak.**Micromorphology:** spores brownish olivaceous in mass, (11-)12-15(-17) × (4.5-)5-6.5 μm, Q = 2.4. Cystidia fusoid, including also more clavate, with or without golden-yellow contents, (25-)35-55(-85) × (6-)8-12(-20) μm. Pileipellis an ixotrichoderm with filamentous hyphae 2-10 μm wide.**Habitat and distribution:** under various frondose trees, especially *Quercus*. Europe, northern Africa?, perhaps North America.**Collections examined:** **Austria:** Burgenland, Mattersburg, Pöttsching, Hirmer Wald-Pöttschinger Wald (MTB 8264/1), 4. 7. 1993, leg. W. KLOFAC (WU 11798); - Oberpullendorf, Großwarasdorf, Gornja loza-Zdolnja loza (MTB 8465/3), 1. 9. 2005, leg. W. KLOFAC (W); - Oberpullendorf, Großwarasdorf, Herrschaftswald Süd (MTB 8465/3), 30. 8. 1994, leg. W. KLOFAC (WU 13011); - - 12. 9. 1995, leg. W. KLOFAC (WU 14135); - Oberwart, Kohfidisch, Fidischer Wald (MTB 8864/1), 26. 7. 2005, leg. W. KLOFAC (WU 25996). **Niederösterreich,** Hollabrunn, Kleinkadolz, Hochstraße-Rohrleiten (MTB 7363/4), 30. 8. 2006, leg.

A. HAUSKNECHT & al. (WU 26653); - Hollabrunn, Sitzendorf an der Schmida, St. Barbara-Oberhohenau (MTB 7461/2), at *Quercus*, 14. 9. 2005, leg. A. HAUSKNECHT (WU 24117); - Baden, Bad Vöslau, Großau, Niederschlatten (MTB 8062/2), 26. 8. 1979, leg. R. SINGER C 9234 (WU 790); - - 20. 9. 1980, leg. E. MRAZEK, K. & A. MADER & L. SANDMANN (WU 5254, 23094); - Baden, Bad Vöslau, Totenkopf-Himmel (MTB 8062/2), 11. 10. 2000, leg. W. TILL (WU 20552); - - 4. 10. 2005, leg. I. KRISAI-GREILHUBER, H. VOGLMAYR, W. TILL (WU 26347); - Mödling, Kaltenleutgeben, Sulz, Sulzer Höhe (MTB 7862/4), 13. 9. 2005, leg. W. KLOFAC (WU 26121); - St. Pölten (Land), Michelbach, Mayerhöfen (MTB 7860/4), 22. 7. 2008, leg. W. KLOFAC (WU 28949); - St. Pölten (Land), Stössing, Hochstraß, Sonnleiten-Buchbach (MTB 7860/4), 21. 8. 1999, leg. W. KLOFAC (WU 19709); - St. Pölten (Land), Wilhelmsburg, Göblasbruck, Altenburg-Münichwald (MTB 7959/2), 10. 8. 1991, leg. W. KLOFAC (WU 9735); - Wien Umgebung, Purkersdorf, Kleines Steinbachtal-Kranawetten (MTB 7762/4), *Quercus*, 13. 9. 1995, leg. W. KLOFAC (WU 14112); - Wiener Neustadt (Land), Katzelsdorf, Rosaliengebirge Nord (MTB 8263/2), 26. 7. 2000, leg. G. KOLLER (WU 21014). Steiermark, Feldbach, Bad Gleichenberg, Kurpark (MTB 9161/1), 26. 9. 1992, leg. W. KLOFAC (WU 11048); - Feldbach, Merkendorf, Stradner Kogel Nordseite-Kogelwald (MTB 9161/2), 19. 10. 1991, leg. W. KLOFAC (WU 9868); - Radkersburg, Klösch, Deutsch-Haseldorf (MTB 9261/2), *Quercus*, 31. 8. 1994, leg. W. KLOFAC (WU 12991). Wien, Hietzing, Lainzer Tiergarten, T 1 (MTB 7863/1), 10. 10. 1981, leg. K. & A. MADER (WU 1800); - Liesing, Maurerwald (MTB 7863/1), 20. 9. 1981, K. & A. MADER, R. SCHÜTZ (WU 1372).

**Notes:** Regarding this species as a synonym of *A. auriporus* by KALLENBACH (1926-1938) the name "*A. auriporus*" was used for some time in European literature (e.g., KERN 1945).

## 2B. New species and new combinations in the genus *Aureoboletus*

### *Aureoboletus viridiflavus* COKER & BEERS ex KLOFAC, spec. nova

based on *Boletus viridiflavus* COKER & BEERS, Bol. of North Carolina: 53, 1943, nom. inval. (no Latin diagnosis).  
MycoBank MB 519298

**Diagnosis latina:** Differt ab *Aureoboletus auriporus* superficie pilei subtomentoso iam in juventute, margine non claro appendiculato, pileo, tubulis et poris paulum olivaceis vel subviridis tinctis. Tubulis et stipitibus tactis per occasionem rubescentibus.

**Holotypus:** USA, North Carolina, Highlands, 26. 8. 1940, COKER & BEERS no. 11960 (UNC).

**Selected illustrations:** COKER & BEERS (1943): pl. 2, 6-8, pl. 33 (b/w), KUO (2004 a): viridiflavus? (as '*Boletus auriporus*'), METZLER & METZLER (1992): 218?

### **Characters** (COKER & BEERS 1943):

"Cap 2-7.7 cm wide, convex to plane or rarely with margin uplifted, tomentose-felted in youth but distinctly viscid at all ages, glabrous at maturity and with a removable cuticle, colour a peculiar olivaceous gold with reddish areas or varying to alutaceous with olive tints especially toward the margin, which is free and incurved. Flesh up to 1.3 cm thick, vinaceous under the cuticle, whitish or pale yellow below and with rosy areas, not changing to blue; taste of flesh itself mild or slightly acid but cuticle distinctly acid, smell none. Tubes up to 1.7 cm long, mouths varying from ½-1 mm wide, angular, their surface irregular and usually ventricose and deeply depressed at stem, colour bright greenish yellow (about wax yellow of RIDGWAY) at all ages and if properly dried retaining this colour when dry; if bruised when fresh turning dull brick red.

Stem up to 7.5 cm long, nearly equal or slightly enlarged downward, then narrowed at very base, up to 1.8 cm thick but usually smaller, concolourous with tubes, but often brighter yellow above or nearly all over or concolourous with cap downward, glabrous and lined above (at times lightly reticulated there), minutely tomentose or scurfy below toward the white mycelium; bruised places becoming brick red. Spores (of no. 11960) strongly olive brown, fusiform-elliptic, smooth,  $4.5 \times 11.5\text{--}15\text{--}16.6 \mu$ ."'

**Collection examined:** USA: Tennessee, Union County, Big Ridge State Park, *Quercus*, *Pinus*, *Acer*, 8. 9. 1996, leg. I. KRISAI-GREILHUBER & H. VOGLMAYR no. 7700, det. W. KLOFAC (WU 30434).

**Notes:** Although most authors took *Boletus viridiflavus* as a synonym of *B. auriporus*, there are some differences macroscopically and in molecular data, as also confirmed by M. BINDER (pers. comm.) after own research and sequencing. Comparing with *A. auriporus*: Colours of *A. viridiflavus* differ in tubes, pores and in pileus, having more olivaceous to greenish yellow tinges, pileus when young tomentose-felted, less viscid, lack of distinctly projecting margin, stipe hardly viscid, tubes and stipe by chance bruising red, tubes deeply depressed at stem, up to 17.5 mm long, but cuticle also removable and taste of the pileipellis usually acidic. No remarkable differences in micromorphology. Most similar certainly is *Xerocomus subtomentosus* (L.: FR.) QUÉL., whose occurrence in North America in regard of conspecificity is doubtful.

***Aureoboletus flaviporus* (EARLE) KLOFAC, comb. nova**

Mycobank MB 519299

**Basionym:** *Boletus flaviporus* EARLE, Bull. New York Bot. Gard. **3**: 297, 1905

≡ *Ceratomyces flaviporus* (EARLE) MURRILL, Mycologia **1**: 147, 1909

≡ *Pulveroboletus flaviporus* (EARLE) SINGER, The Amer. Midl. Nat. **37**: 17, 1947

≡ *Xerocomus flaviporus* (EARLE) SINGER, Rev. Mycol. **6**: 6, 1940

**Diagnosis** in SACCARDO (1912): Pileo 6-9 cm lato, subtenui, e convexo expanso, nitide castaneo-brunneo, levi, viscid, sed non glutinoso, hymenio plano, circum stipitem profunde depresso sed 1 cm circodecurrente, primum nitido citrinoflavo, demum obscure flavido; poris angulosis, parvis 1 mm, pariete tenui; sporis flavis, anguste ellipsoideis, circ. 15/6; stipite exannulato, 6-9 cm longo, 18 mm cr. subaequali, v. leniter ventricosum, flavidoet levi v. supra granulis glutinosus signato, infra tomentoso albido et lateritio maculato, solido; carne ex albido brunnea, immutabili. Hab. inter folia quercina dejecta, Stanford Univ., California (C. F. BAKER).

**Diagnosis** in MURRILL (1910): Pileus rather thin, convex to expanded, 6-9 cm broad; surface smooth, viscid, not glutinous, shining, chestnut-brown: context whitish to brownish, unchanging, taste mild; hymenium plane, tubes usually deeply depressed, but decurrent for nearly 1 cm in anastomosing lines, young bright lemon-yellow, old becoming deep-yellow or flavid and retaining this colour in dried specimens, mouths small, 1 mm broad, angular, edges thin: spores narrowly ellipsoid, smooth, yellow,  $15 \times 6 \mu$ : stipe subequal or slightly ventricose, yellowish and smooth or marked with glutinous granules above, tomentose and white stained with brick-red below, solid, 6-9 cm long, 1.8 cm thick.

**Typus:** USA, California, Santa Clara County, Stanford University grounds, leg. C. F. BAKER, 11. 11. 1901, Pacific Slope Fungi no. 131 (FH).

**Selected illustrations:** BESSETTE & al. (2000): 292, ARORA (1986: 131), THIERS (1975: 11).

### Characters:

**Pileus:** 6-15 cm wide, old margin often wavy or irregular, surface viscid, pale cinnamon to dark reddish brown, old sometimes darker brown on the disc, margin projecting.

**Hymenophore:** Pore surface brilliant yellow at first, old becoming greenish yellow.

**Stipe:** 7-15 cm long, 1-3 cm thick, equal or tapered in either direction, viscid when fresh, soon dry, sometimes with shallow longitudinal ribs, or some reticulation on apex, yellowish near apex, sometimes with yellow floccosity, pale reddish brown on a whitish ground below, basal mycelium white.

**Context:** white to pinkish buff, unchanging when exposed, taste acidic, smell mild.

**Macrochemical reactions:** NH<sub>4</sub>OH on context pale lavender, FeSO<sub>4</sub> on context pale gray.

**Micromorphology:** Spores (dark) olive-brown in mass, 11-15(-18) × 4-6 μm. Cystidia wide and voluminous, clavate to obscurely fusoid-ventricose, hyaline, 30-50(-70) × (9-)10.5-15.5 μm, apex variable, widest in upper third. Pileipellis of interwoven gelatinous hyphae 3-4 μm wide.

**Habitat and distribution:** under broadleaf trees (oak, madrone, manzanita). USA (California, Oregon), Mexico, GOMEZ (1996) reports some collections "aff. *flaviporus*" from Costa Rica.

**Notes:** In *Aureoboletus flaviporus*, the dried tubes are yellow. The remarkable variation of spore sizes could suggest that more than one species are involved. H. D. THIERS provided a long list of spore measurements of 47 collections to E. E. BOTH (pers. comm.) from which was concluded that there exists only one species with a large variation in spore dimensions, viz. (9.5-)11.0-17.5(-18.5) × (4.0-)5.0-7.0(-8.5) μm, including many giant spores.

### *Aureoboletus flavimarginatus* (MURRILL) KLOFAC, comb. nova

Mycobank MB 519300

**Basionym:** *Ceratomyces flavimarginatus* MURRILL, Mycologia 31: 110, 1939

≡ *Boletus flavimarginatus* (MURRILL) MURRILL, Mycologia 31: 112, 1939

**Diagnosis originalis:** Pileo convexo, 8 cm lato, rubro-fulvo; tubulis flavo-virescentibus, sporis fusiformibus, flavo-brunneis, 14 × 4-5 μ; stipite flavo, reticulato, 3 × 0,8-1,5 cm.

**Typus:** USA, Florida, Gainesville, 14. Jun 1938, MURRILL F 16467 (FLAS holotype, TENN isotype).

**Illustration:** WEBER & SMITH (1985): 82? (as *Boletus viridiflavus*).

### Characters:

**Pileus:** about 8 cm wide, surface slightly viscid when moist, minutely tomentose, uniformly reddish-fulvous, margin sterile, yellow below.

**Hymenophore:** tubes reaching 1 cm or more in length, depressed about the stipe, bright yellow with a greenish tint, mouth large, angular, the young marginal tubes remaining yellow and forming a distinct band.

**Stipe:** tapering upward, glabrous, pale yellow and delicately reticulate above, ferruginous at the very base 3-5 × 1-2 cm, basal mycelium white.

**Context:** rather thin, white, unchanging, purplish under the cuticle.

**Micromorphology:** Spores:  $14-20.5 \times 5-6.3 \mu\text{m}$ ,  $Q = 3.0$ . Pleurocystidia  $30-49 \times 18-21 \mu\text{m}$  (BOTH 1998).

**Habitat and distribution:** under evergreen oak (*Quercus*). USA (Florida).

**Notes:** The relatively large spores are an important distinguishing character. When dried the stipe and marginal tubes with the vivid yellow colour are contrasting to the dark yellowish-green hymenium. SINGER (1945) listed *Boletus flavimarginatus* as a synonym of *Xerocomus illudens* (PECK) SINGER: "a subspecies, p. p.". SINGER (1947) studying recent material from MURRILL, as *B. flavimarginatus*, determined *B. auriporus* and *Xerocomus illudens* subsp. *xanthomycelinus* SINGER. This was obviously a misidentification, which could be avoided comparing spore and cystidia size or extent and robustness of reticulation, besides hymenophoral trama, and velvety, tomentose surface of pileus.

***Aureoboletus auriporus* var. *novoguineensis* (HONGO) KLOFAC, comb. & stat. nov.**  
MycoBank MB 519303

**Basionym:** *Aureoboletus novoguineensis* HONGO in Y. KOBAYASI & al., Bull. Natl. Sci. Mus. Tokyo **16**(3): 544, 1973

= *Aureoboletus tibetanus* ss. HONGO & NAGASAWA 1980, ss. auct. plur.

?= *Boletus auriporus*, forma, ss. SINGER 1945, 1947

**Diagnosis originalis:** Pileo 3-5 cm lato, e convexo explanato, radiatim subruguloso, viscido, glabro vel subtomentoso, rubro-brunneo vel badio; carne crassa, pallide rubella, sapore acidulo; tubulis depressis, flavis, immutabilis; poris laete flavis, mediis, irregularibus; stipite 5-7 cm longo, 6-10 mm crasso, subventricoso vel sursum attenuato, viscido, pileo pallidiore, obscure striato, basi albo-tomentoso; sporis sub microscopio melleis,  $11.5-15.5 \times 4.5-5.5 \mu\text{m}$ ,  $Q: 2.6-2.8$ , elongate-ellipsoideis vel subfusiformibus, laevibus; cystidiis ventricosis vel clavatis, aureis,  $34-66 \times 13-18 \mu\text{m}$ .

**Holotype:** New Guinea (West Sepik), Oksapmin, 21. 12. 1971, HONGO no. 6135 (TNS).

**Selected illustration:** IMAZEKI & HONGO (1981): pl. 29-186 (as *Pulveroboletus cramesinus*). Many illustrations retrievable in the world wide web as "*Aureoboletus tibetanus*" probably present *A. auriporus* var. *novoguineensis*.

### Characters:

**Pileus:** 3-5 cm wide, viscid when fresh, soon dry, radially rugose, reddish brown to brown.

**Hymenophore:** depressed around the stipe, pale yellow to vivid yellow, pores moderately large, vivid yellow, irregular.

**Stipe:** up to  $7 \times 1$  cm, subventricose or attenuated upward, viscid, pale reddish brown, greyish red or concolourous with the pileus, with deeper coloured stripes, white tomentose at the base with mycelium.

**Context:** rather soft, greyish red, pale pinkish brown or pale reddish, older more whitish, smell slight, taste acid.

**Micromorphology:** Spores  $11.5-15.5 \times 4.5-5.5 \mu\text{m}$ . Cystidia generally ventricose or clavate: pleurocystidia rather clavate-acuminate to ventricose or fusoid-ampullaceous, cheilocystidia more clavate(-acuminate), thin-walled with golden-yellow contents,  $34-66 \times 13-18 \mu\text{m}$ . Pileus surface an ixotrichodermium of hyphae  $3-12.5 \mu\text{m}$



wide with narrowly elliptical to cylindrical end cells.

**Habitat:** in forest of *Castanopsis*, sometimes subcespitose.

**Notes:** Distribution limits of *Aureoboletus auriporus* var. *novoguineensis* have yet to be established, but very probably in Asia it is often misnamed as *A. thibetanus* (HONGO & NAGASAWA 1980), and so erroneously taken as synonym of *A. thibetanus*. Already SINGER (1947, 1967) notifies the presence of *A. auriporus* in China ("a similar form, it is particularly important to find out about the status of the Chinese form mentioned here under *P. auriporus*"). This may well represent *A. auriporus* var. *novoguineensis*. Some collections in Japan, but perhaps also in similar climatic regions of Middle and South America, named *A. auriporus* but already macroscopically somewhat different, may represent *A. auriporus* var. *novoguineensis* as well.

Molecular data of material from Japan (as *Aureoboletus* cf. *thibetanus*) clusters near *A. auriporus* and far away from an other sequenced specimen of *A. thibetanus* (BINDER & HIBBETT 2006). *Aureoboletus auriporus* var. *novoguineensis* differs from *A. auriporus* mainly in the darker coloured, radially rugose cap with no distinctly appendiculate margin, the absence of the yellow flush on the stipe, and the rather ventricose or fusoid-ampullaceous pleurocystidia. See also notes under *A. thibetanus*.

As already YANG & al. (2003) mention, *Aureoboletus auriporus* var. *novoguineensis* differs from *A. thibetanus* by the radially rugose pileus, with no distinctly appendiculate margin, thin-walled cystidia with golden-yellow contents, and longer spores. The terminal hyphae of the pileipellis also are quite different.

In molecular analysis three taxa, viz. *Boletus citriniporus*, *B. moravicus*, and *B. roxanae*, show an unexpected proximity to the genus *Aureoboletus*, confirming the proposal of the following new combinations:

***Aureoboletus citriniporus* (HALLING) KLOFAC, comb. nova**

**Basionym:** *Boletus citriniporus* HALLING, *Mycologia* 69: 206, 1977

Mycobank MB 519301

**Diagnosis originalis:** Pileus 4-7 cm latus, siccus, velutinus, demum subtomentosus, aetate fibrillulis humidulis, atrobrunneus. Contextus 5-10 mm crassus, albus, immutabilis. Sapor et odor mitis. Tubuli 5-8 mm longi, vivide citrini, immutabiles. Stipes 5-6 cm longus, 1-1,5 cm crassus, siccus, glaber, pallidus, immutabilis. Sporae 12-13,5 × 3,75-4,5 µm, subfusiformis, inequilaterae, laeves. Cystidia 37,5-67,5 × 9-12,75 µm, clavata vel ventricoso-rostrata. Cuticula intertexta, erectiuscula.

**Typus:** USA, California, prope Pine Grove, Amador County, Nov. 25, 1975, HALLING 1151 (SFSU).

**Selected illustration:** BESSETTE & al. (2000): 289.

**Characters:**

**Pileus:** up to 8 cm, convex to plano-convex, becoming irregular in outline, margin with a narrow band of sterile tissue; dry, velutinous to finely subtomentose, becoming moist and minutely rimose when old, raw umber to dark brown, old often becoming blackish.

**Hymenophore:** tubes and pores intensely lemon-yellow, unchanging when bruised, adnate to slightly depressed near the stipe when old.

**Stipe:** subclavate to nearly equal, with a constricted base, dry, glabrous, occasionally with a very slight reticulum at the apex, whitish to pale yellow, orange yellow at the apex, basal mycelium whitish.

**Context:** whitish to pallid, unchanging, taste and smell mild.

**Macrochemical reactions:** NH<sub>4</sub>OH on pileus cuticle dark vinaceous.

**Micromorphology:** Spores 10.5-13.5 × (3.75-)4-4.5(-5) μm. Cystidia up to 67.5 × 12.75 μm, clavate to ventricose rostrate to cylindrical. Pileus cuticle a tangled trichodermium, old sometimes appearing subgelatinous, apical cells of hyphae 3-4.5 μm wide.

**Habitat and distribution:** under *Quercus* (*Q. chrysolepis*, *Q. agrifolia*). USA (California).

**Notes:** On the occasion of the description of his new species HALLING (1977) discusses the relationship to *Boletus auriporus* and *B. flaviporus*.

***Aureoboletus moravicus* (VACEK) KLOFAC, comb. nova**

MycoBank MB 519302

**Basionym:** *Boletus moravicus* VACEK, *Studia Bot. Čechosl.* 7: 36, 1946

≡ *Xerocomus moravicus* (VACEK) HERINK, *Česká Mykol.* 18: 198, 1964

≡ *Xerocomus boudieri* SINGER, *Ann. Mycol.* 40: 43, 1943, nom. inval.

≡ *Boletus tumidus* FR. ss. PELTEREAU, *Bull. Soc. Mycol. France* 40, 1924

≡ *Xerocomus tumidus* (FR.) E.-J. GILBERT, *Les Bolets*: 116, 1931 ss. auct. pl.

?= *Boletus rostkovii* FR., *Hymenomycetes Europaei*: 521, 1874

?= *Boletus lividus* BULL. ss. ROSTKOVIVUS in STURM: *Deutschl. Flora* 3(5): 71, 1844

= *Boletus leonis* REID, *Col. Icon. Rar. Int. Fungi* 1: 7, 1966 ss. auct. p. p.

= *Xerocomus leonis* (REID) BON, *Doc. mycol.* 14(56): 16, 1985 ss. auct. p. p.

**Diagnosis originalis:** Carposomata singularia, rarissime subcaespitosa (2 ex.). Pileus 2,5-7 cm diam., carnosus, primum fere semiglobosus, margine acuto, ad stipitem adpresso destitutus, dein explanatus; pulvinatus, margine tenui, membranaceo, tubulos anguste, superanti, subinvolutu denticulatoque munitus, plus minus laete brunneolo-ochraceus (isabellinus), colore carneo-roseo inhalatus, sub lente subtiliter tomentosus, vertice saepe areolatus, haud lucidus vel subnitidus, Jove udo viscidulus. Stipes 3-6 cm longus, apice 1,3-2,5 cm crassus, primum basi- albido-tomentosus, haud reticulatus, solum parte superiore dum subcylindricus vel fusosideo-cylindricus, basi semper acutatus, firmus, pileo concolor, apice colore carneo-roseo leviter inhalatus, parte inferiore luteolus, sub lente flavo-tomentosus, basi-albido-tomentosus, haud reticulatus, solum parte superiore e tubulis decurrentibus costatus, basin versus tantum minute costatus vel gibbulosus, Jove udo viscidulus. Tubulae confertae, subbreves (in pileo 7 cm diam., 6 mm longae) ad stipitem rotundatae, adnexae usque subdecurrentes, juventute pallidae; dein fulvae usque brunneo-luteae vel olivaceo-brunneo-lutae, vulneratae immutabiles, poris carne-subrosellis, dein tubulis concoloribus, parvis, e orbiculari subangulatis destitutae. Caro pilei apicisque stipitis in juventute sordide pallideque rubella (pallide camea), dein albida, solum marginem versus carneo-rubella, basi stipitis flavida, immutabilis, odore fungineo, sapore subamarescenti. Sporae in cumulo olivaceo-luteo-brunneae, sub lente luteolae, subhyalinae, 8,5-12 × 5-6 μ (creberrime 9,5 × 5,5 μ), fusosideo-ellipsoideae vel ellipsoideae. Basidia tetraspora, 24-29 × 7-9 μ (inclus. sterigmata 3-3,5 mm longa). Cystidia hyalina, 24-40 × 6-7 μ, lageniformia (apice 3,5-5 μ crassa). Hab. Cechoslovakia: Moravia meridionalis, in silvis frondosis, xerothermibus prope Zarosice.

**Typus:** Czech Republic, Moravia, Zarosice, „Ochozy“, 26. 8. 1945, leg. V. VACEK, PR no. 203552.

**Selected illustrations:** LADURNER & SIMONINI (2003): f. 9, 22, 96, 07, p. 508; ALESSIO (1985): 48, 49; BREITENBACH & KRÄNZLIN (1991): 3/57; MOSER & JÜLICH (1987): *Xer.* 1 u.; GALLI (1998): 99, 118, 119; BOLETS DE CATALUNYA (2005): 1200; SINGER (1965): t. X: 11-15 (“*Boletus tumidus*”); PILÁT & DERMEK (1974): 38; MARCHAND (1974): 211; DERMEK (1987): 122b; ENGEL & al. (1996): 74, 75 (T36/41), 76 (T38/43); (for a list of further illustrations see KLOFAC 2007: 210-211).

### Characters:

**Pileus:** surface dry, finely tomentose, older glabrous, yellow-ochre, tan, brownish yellow to copper-brown, margin slightly projecting, up to 8 cm wide.

**Hymenophore:** tubes and pores pale ochre-yellow, buff-yellow, dark yellow.

**Stipe:** ventricose-fusiform with pointed base, pale yellow, ochraceous yellow, brownish-fibrillose or veined ornamented, basal mycelium pale yellowish.

**Context:** whitish to pale ochraceous yellow, darker beneath the pileipellis, orange beneath the tubes.

**Macrochemical reactions:** Melzer's reagent on hymenophore (bluish-)green.

**Micromorphology:** Spore deposit ochraceous. Spores 8-11(-12) × 4.5-5.5(-6) µm, Q < 2.3. Cystidia up to 60 × 13 µm, cylindrical to ventricose-fusiform, rarely with yellow content in KOH. Pileipellis a trichodermium of irregular hyphae, up to 9.5 µm wide.

**Habitat and distribution:** under deciduous trees, mostly *Quercus*. Europe.

**Collections examined:** There are 49 reports in AUSTRIAN MYCOLOGICAL SOCIETY (2009), all from eastern Austria, 19 collections deposited in WU and five in GJO (selection): **Austria:** Burgenland, Stoob, Mitterwald Ost, MTB 8465/3, 20. 9. 1986, leg. W. KLOFAC (WU 5583); - - 26. 8. 1988, leg. W. KLOFAC (WU 7153); - - 7. 8. 1993, leg. W. KLOFAC (WU 11852); - - 2. 10. 1994, leg. W. KLOFAC (WU 13253); - - 29. 9. 2001, leg. W. KLOFAC (WU 21542); - Pötttsching, Keltenberg, Hirmer Wald, MTB 8264/1, 19. 9. 1998, leg. W. KLOFAC (WU 18659). Niederösterreich, Sitzendorf an der Schmida, St. Barbara-Oberhohenau, MTB 7461/2, 14. 9. 2005, leg. A. HAUSKNECHT (WU 24113); - Kaltenleutgeben, Sulzer Höhe, MTB 7862/4, 13. 9. 2005, leg. W. KLOFAC (WU 26118). Wien, Penzing, Hütteldorf, Satzberg am Steinhof, MTB 7763/4, 21. 9. 1996, leg. W. KLOFAC (WU 16796); - Liesing, Maurerwald, MTB7873/1, 18. 8. 1991, leg. W. KLOFAC (WU 9731); - - 17. 9. 1991, leg. I. KRISAI-GREILHUBER (WU 19367).

**Notes:** The synonymy of *Xerocomus leonis* is discussed fully by PÖDER (1990).

### *Aureoboletus moravicus* (VACEK) KLOFAC f. *pallescens* (HERINK) KLOFAC, comb. nova

Mycobank MB 519304

**Basionym:** *Xerocomus moravicus* (VACEK) HERINK f. *pallescens* HERINK, Česká Mykol. 18: 198, 1964

= *Boletus leonis* REID, Col. Icon. Rar. Int. Fungi 1: 7, 1966 ss. auct. p. p.

**Diagnosis originalis:** A typo differt colore pilei et partis superioris stipitis pallide isabellino-ochraceo, qui modo progredienti ex insolatione provenit (inveniuntur etiam carposomata juvenilia iam decolorata).

**Typus:** Czech Republic, Moravia merid., Žarosice, vicus Zdrava Voda, 4. 11. 1962, leg. J. HERINK (Herb. HERINK no. 580/62, cotypus in herbario Musei Nationalis Pragae asservatur).

**Illustrations:** For a list of illustrations possibly presenting this taxon, see KLOFAC (2007: 211).

### Characters:

This is a pale form of *Aureoboletus moravicus*, with ochraceous-yellowish colours.

### *Aureoboletus roxanae* (FROST) KLOFAC, comb. nova

Mycobank MB 519305

**Basionym:** *Boletus roxanae* FROST, Bull. Buffalo Soc. Nat. Sci. 2: 104, 1874

≡ *Ceromyces roxanae* (FROST) MURRILL, Mycologia 1: 153, 1909

≡ *Xerocomus roxanae* (FROST) SNELL, *Mycologia* **37**: 383, 1945

**Diagnosis originalis:** Pileus flat convex, yellowish brown, fasciculated red pilose, subtomentose when young. Tubes at first whitish, then light yellow, not large, falling away around the stem, or arcuate adnate. Stem light cinnamon or weak gamboge color, striate at apex, thickened downwards, and sub-tuberous. Flesh yellowish white, just tinged. Spores .0105-.0042 m.m. Borders of woods, August and September.

**Typus:** USA, Vermont, Brattleboro, VT no. 3204.

**Selected illustrations:** BESSETTE & al. (2000): 308, COKER & BEERS (1943): pl. 38 (b/w), SNELL & DICK (1970): pl. 27, SMITH & THIERS (1971): pl. 98 (b/w), BESSETTE & al. (1995): 10?, IMLER (1984): pl. 71.

### Characters:

**Pileus:** up to 8(-9) cm, dry, when young granulose-roughened (finely scaly-squamulose), nearly glabrous at maturity, yellow-brown or dark rusty red to reddish brown at first, becoming dull orange, margin typically paler than the disc, even and straight.

**Hymenophore:** slightly decurrent, up to 10 mm deep, whitish, becoming pale yellow and finally darker yellow, sometimes olive yellow, darkening or developing pale cinnamon stains when injured, not easily separable.

**Stipe:** enlarged downwards, often pointed at the base, dry, faintly pruinose and longitudinally more striate, mustard-yellow to golden or orange-yellow below, typically with a distinct dull orange zone at the apex, up to 9 × 1.6 cm, mycelium whitish.

**Context:** whitish to pale yellow, also sometimes slightly brownish at the stipe base, not staining when exposed, smell indistinctive to pleasant like *Xerocomus badius* to weakly pungent, taste pleasant to acid-disagreeable.

**Macrochemical reactions:** KOH brownish on context.

**Micromorphology:** Spores 9.5-11(-13) × 3.5-4(-4.5) µm. Pileipellis hyphae up to 12(-16) µm wide.

**Habitat and distribution:** under oak (*Quercus*) in mixed deciduous sandy woods. Eastern North America, from eastern Canada to South Carolina, west to Tennessee and Michigan.

**Collection examined:** USA: North Carolina, Transsylvania County, Pisgah National Forest, mixed *Pinus-Quercus*-forest, with *Acer*, *Tsuga*, *Liriodendron*, *Carya*, *Fagus*, *Castanea*, 29. 8. 1996, leg. I. KRISAI-GREILHUBER & H. VOGLMAYR, no. 7656, det. W. KLOFAC (WU 24618).

**Notes:** SINGER (1945, 1965) already believed *Aureoboletus roxanae* to be close to *Xerocomus boudieri* (see under *A. moravicus*), also IMLER (1984) cites: "...is nearest to *B. leonis* REID, differential characters include the stipe with yellow striae, ... and microscopical elements ...".

### 2C. Comments on some further taxa of the genus *Aureoboletus*

*Aureoboletus auriporus* var. *auriporus* (PECK) POUZAR, *Česká Mycol.* **11**: 49, 1957

**Basionym:** *Boletus auriporus* PECK, Ann. Rep. New York State Cabinet **23**: 133, 1872

≡ *Suillus auriporus* (PECK) KUNTZE, Rev. Gen. Pl. **3**: 595, 1898

≡ *Ceromyces auriporus* (PECK) MURRILL, *Mycologia* **1**: 147, 1909

≡ *Xerocomus auriporus* (PECK) SINGER, Rev. Mycol. **5**: 6, 1940

≡ *Pulveroboletus auriporus* (PECK) SINGER, Amer. Midl. Nat. **37**: 13, 1947

**Diagnosis** PECK: Boleti of the United States: *Boletus auriporus* PK. Golden-pore-Boletus Rep. 23, p. 133: Bull. New York State Mus. 2, no. 8, 1889. Pileus convex or nearly plane, glabrous or merely pruinose-tomentose, grayish-brown, yellowish-brown or reddish-brown, flesh white, unchangeable; tubes plane or slightly depressed around the stem, adnate or subdecurrent, bright golden-yellow, retaining their colour when dried, stem equal or slightly thickened at the base, viscid or glutinous when moist, especially toward the base, coloured like or a little paler than the pileus; spores .0003 to .0004 in. long, .00016 to .0002 broad. Pileus 1 to 3 in. broad; stem 1 to 3 in. long, 2 to 4 lines thick. Thin woods and shaded banks. New York, PECK. New England, FROST.

This species is remarkable for the rich yellow colour of the tubes, which is retained unchanged in the dried specimens, and for the viscid stem. This character, however, is not noticeable in dry weather and was overlooked in the original specimens. *Boletus glutinipes* FROST is not distinct.

**Typus:** New York, North Elba, Essex County, 8. 1869; New Baltimore, Green County, 7. 1869 (NYS).

**Selected illustrations:** BESSETTE & al. (2000): 286, BESSETTE & al. (2007): 49, KUO (2004 a), PHILLIPS (1991): 220.

### Characters:

**Pileus:** 2-8 cm wide, colours variable pinkish cinnamon-reddish brown, vinaceous to vinaceous brown, very viscid when wet but drying quickly, pileipellis thin, deterrent, margin strongly incurved, projecting 2-3 mm (narrow band of sterile tissue). Taste of the pileipellis usually acidic to salty.

**Hymenophore:** and pore surface young brilliant golden-yellow, old becoming dull yellow.

**Stipe:** up to 11.5 cm long and 1.7 cm thick, nearly equal, narrowed at the base, viscid when fresh, pale yellow at the apex, costate-reticulated from decurrent tube-walls, streaked and flushed pale pinkish brown downward, with yellow floccosity. Basal mycelium copious, white.

**Context:** yellowish-cream in pileus, under pileipellis vinaceous also above stipe apex, whitish in stipe but streaked and mottled pinkish-vinaceous or orange-brownish in stipe base. Smell fungoid-fragrant. Taste of context sweetish to sour or salty.

**Macrochemical reactions:** ammonia on pileus burgundy-red to dull blood-red.

**Micromorphology:** Spores olive-brown in mass,  $11-16 \times 4-6 \mu\text{m}$ ,  $Q = 2.8$ , (measures by BOTH 1998, from types). (Note: There are deviating statements in literature,  $8-18 \times 3.5-8 \mu\text{m}$ , caused probably by confusion with other species.) Cystidia clavate to somewhat fusoid, up to  $55 \times 16 \mu\text{m}$ . Pileipellis a gelatinized cutis of entangled, interwoven hyphae  $3-9.5(-12) \mu\text{m}$  wide.

**Habitat and distribution:** under oak (*Quercus*). America, USA, from New Jersey to Florida west to Mississippi and Texas, south to Mexico and very probably Costa Rica and Columbia (HALLING 1989, HALLING & MUELLER 2005).

**Collections examined:** USA: North Carolina, Jackson County, Salt Rock and Panthertown Valley, bog between Big Green and Little Green Mountain, disturbed *Sphagnum*-transition bog (*Drosera*), *Quercus*, *Pinus*, *Acer*, *Sasafras*, 8. 8. 1996, leg. I. KRISAI-GREILHUBER & H. VOGLMAYR, no. 7176 (WU 24681). - North Carolina, Clay County, Glade Branch of Buck Creek, 2.7 miles NW of the intersection of Road 64 and Wallace Gap Road, young *Betula-Carpinus* forest, *Quercus*, *Carya*, *Tsuga*, *Pinus*, *Rhododendron*, 16. 8. 1996, leg. I. KRISAI-GREILHUBER & H. VOGLMAYR, no. 7364 (WU 24696).

**Notes:** HALLING (1989) provided a description of *Boletus atkinsonianus* based on material from Colombia. The data (spores up to  $16.8 \times 6.3 \mu\text{m}$ ) are to all appearances a hint to *A. auriporus* (BOTH 1998). Also, collections from Costa Rica (NYBG, as „*Boletus auriporus*-

*Boletus atkinsonianus*“) seem to belong to *A. auriporus* var. *auriporus*, although the dark, soon matted tomentose pilei, the olivaceous pores, and white context from some specimens are not typical for *A. auriporus*. Compare also macroscopically (only divergent in tubes and pores bruising greenish blue) and microscopically very similar collections from Belize (ORTIZ- SANTANA & al. 2007: figs. 17, 23; as “*A. cf. auriporus*”). Collections from Costa Rica pictured by MATA (2003: 145) show atypically red pileus and stipe. Other pictures, accompanying material from Columbia and Costa Rica in NYBG by HALLING (compare also HALLING 2005) with radially rugose pileus point to *A. auriporus* var. *novoguineensis*. Reports of “*Boletus atkinsonianus*” from this area by GOMEZ (1996) may be identical *A. auriporus* var. *novoguineensis*. See also notes under *A. thibetanus*.

***Aureoboletus thibetanus* (PAT.) HONGO & NAGASAWA**, Rept. Tottori Mycol. Inst. **18**: 133, 1980 ss. PAT. vix ss. HONGO & NAGASAWA, vix ss. auct. p. p.

**Basionym:** *Boletus thibetanus* PAT., Bull. Soc. Mycol. France **11**: 196, 1895

≡ *Aureoboletus thibetanus* (PAT.) MANFR. BINDER, Zur molekularen Systematik der *Boletales: Boletineae* und *Sclerodermatineae* subordo nov. – Dissertation Universität Regensburg: 103, 1999, not val. publ. and comb. superfl.

≡ *Pulveroboletus thibetanus* (PAT.) SINGER, *The Agaricales* in modern taxonomy 4<sup>th</sup> edn: 774, 1986

≡ *Suillus thibetanus* (PAT.) TAI, *Sylloge Fungorum Sinicorum*: 736, 1979

**Diagnosis originalis:** Pileo convexo-plano, carnosulo, venis anastomosantibus reticulato castaneo-rufo, pellicula crassa, viscosa obducto, margine appendiculato, hyalino; tubulis adnatis, poris minutis, radiantibus, olivaceis; sporis luteis, fusiformibus, levibus, 1-2 guttulis (10-13 × 5 µm); stipite viscosa, gracili, levi, sursum attenuato, castaneo, deorsum albicante. Stipe haut de 5-8 centim.

**Typus:** China, Sichuan Province, Kangding (“Tchen-Keou-Tin”), in 1894, R. P. FARGES s. n. (Herb. PATOULLARD, FH 3711), type designated by ZANG & al. (1993).

**Selected illustrations:** PATOULLARD (1895): BSMF 11, Pl. XII, f. 2, MAO (2000): f. 827-2 (as *Boletellus longicollis*), YUAN & SUN (2007): no. 366 (below!).

### Characters:

**Pileus:** 1.5-5 cm in diam. (fruitbody usually small), veined-reticulate to coarsely rugose, strongly viscid when wet, pileal margin appendiculate, with yellowish then hyaline gelatinous veil, chestnut-brown, rusty brown to pale brown, sometimes with dull reddish tinge.

**Hymenophore:** depressed around the stipe, yellow (hardly changing when dried), but with olivaceous tinge when over-mature (olive-yellow to dark olive-buff), unchanging or discolouring bluish very slowly; pores yellow.

**Stipe:** 4-8 × 0.3-1 cm, subcylindric to subfusiform, whitish, creme to yellowish, often with pinkish tinge, sometimes longitudinally fibrillose, gelatinous to strongly viscid when young or wet, basal mycelium white.

**Context:** whitish yellow to yellow, occasionally brownish, unchanging, purplish brown beneath the pileipellis. Smell none. Taste mild.

**Micromorphology:** Spores light brownish olive to somewhat paler then citrine-drab in mass, 9.5-13 × 4.5-5(-5.5) µm, Q = 2.4. Pleurocystidia 30-75 × 4-10 µm, variable formed, outer surface covered with a 5-8 µm thick layer of strongly refractive, yellow(ish) substance (soluble in KOH in fresh material), contents nearly colourless, (sub)hyaline. Pileipellis an ixotrichoderm of hyphae 4-8(-12) µm in diam., surface often

with yellowish granular incrustation, sometimes with yellowish to brownish vacuolar pigment, apical elements subcylindrical to lanceolate.

**Habitat and distribution:** under frondose trees, especially *Quercus*. China.

**Notes:** Generally the statement of YANG & al. (2003): “misinterpretation of the concept of this species is unavoidable”, is to be confirmed. Reports of *Aureoboletus thibetanus* ss. HONGO & NAGASAWA (1980) from Japan (HONGO & NAGASAWA (1980), Singapore (CORNER 1972) and Sarawak (WATLING & HOLLANDS 1990) may, according to the descriptions and illustrations given, possibly be not conspecific with *A. thibetanus*. This misidentification may have caused HONGO & NAGASAWA (1980) to consider *A. auriporus* var. *novoguineensis* a synonym of *A. thibetanus*. Obviously, most illustrations of “*A. thibetanus*” from Japan (perhaps also from Singapore and most of China), including many pictures available online in the world wide web, represent *A. auriporus* var. *novoguineensis*. Moreover the statement by CHIU (1948): “the reticulation is the result of the shrinking of the gelatinous membrane. Thus the veins on the cap become distinct only when the gelatinous membrane is dried and shrunken” cannot be confirmed when comparing pictures cited, where the rugose-reticulated pileus surface of *A. thibetanus* is so much the more pronounced as the fruit body is much the more younger.

*Aureoboletus subacidus* (MURRILL ex SINGER) POUZAR, Česká Mycol. 11: 49, 1957

**Basionym:** *Ceromyces subacidus* MURRILL, Mim. Contr. Herb. Univ. Florida Agr. Exper. Station, Florida Boletes: 3, 1942, nom. nud.

≡ *Pulveroboletus subacidus* (MURRILL ex SINGER) SINGER, Amer. Midl. Naturalist 37: 12, 1947

**Diagnosis originalis:** Pileo alutaceo-carnoso vel ferrugineo-rubido, glabro, viscido, convexo vel plano, 60-105 mm. lato; hymenophoro laete flavo, adnato vel depresso, convexo, poris usque ad 2 mm. amplis; sporis in cumulo aeneo-olivaceis, circa 14,8-18,5 × 4,5-6,5 μ; cystidis 34-50 × 8-13,7 μ, fusoidis vel ampullaceis; stipite albo vel pallide flavido, roseolo-zonato vel -striato apicem versus, plus minusve flavo-tincto vedi sparsi haud annuliformis gratia, sicco vel subviscidulo, levi, 50-65 × 12-18 mm.; mycelio albo; carne pilei flava, stipitis alba, immutabili, inodora, subacidula; hyphis non fibuligeris. Prope *Quercus* in silvis siccioribus.

**Typus:** North America, USA, Florida, Dade Co., just outside Fairchild Tropical Garden near Miami, in a somewhat open stand of pines and oaks (no pines closer than 12 ft.), October 1942, R. SINGER (FH).

**Illustrations:** none.

### Characters:

**Pileus:** pale cinnamon pink, especially on margin, other places with buff, testaceous, brown ferruginous, sienna, center often paler, viscid, glabrous, scrobiculate or rugulose, at least on the margin.

**Hymenophore:** adnate or depressed around the stipe, yellow (citrine) to orange citrine, older with olive tints, often surrounded by a white projecting sterile margin, pores wide, darker and more sordid on pressure.

**Stipe:** up to 6.5 × 1.8 cm, white to pale yellow with pink stripes or zone near apex, yellow to lemon-chrome veil-like remnants on the other parts on a glabrous, nearly smooth ground, forming a sparse floccosity, being fugacious, only more conspicuous at an annular belt at stipe apex, dry or very slightly viscid when wet, base

often acuminate, basal mycelium whitish.

**Context:** of pileus yellow, partly paler, somewhat concolourous with the pileus below the cuticle, of stipe white, unchanging, smell none, or agreeable, taste somewhat acid, especially in the pellicle.

**Macrochemical reactions:** NH<sub>4</sub>OH on surface of pileus vinaceous grey, later dull cinnamon buff, on context of pileus greenish.

**Micromorphology:** spores in mass between orange-citrin and bronze, (13.5-)14.5-18.5(-20.5) × 4.5-6.5 μm. Cheilocystidia 34-50 × 8-13.5 μm, hyaline, fusoid with the apex attenuate to an obtuse tip or also ampullaceous above.

**Habitat and distribution:** on soil and on trunks (e.g., *Sabal*), near oaks (*Quercus virginiana*), in dry woods. USA (Florida).

**Notes:** It seems that collections since have been misidentified as other species (e.g., *A. auriporus*).

*Aureoboletus africae* RUIZ, MENDAZA & RUBIO, Ciencia 2003: 20, nom. nud.?

**Illustrations:** C. GELPI in RUIZ FERNANDEZ (2003): Ciencia 14: 20.

Pileus up to 5 cm, viscid in wet weather, in the dry state areolated and appearing scaly, yellow, at the disc more ochraceous, tubes yellow, older becoming more greenish yellow, pores brilliant yellow, stipe long (longer than pileus wide), base buried deep in the soil, radicating, above coloured as the pores, below whitish and the buried zone white. Context white, under cuticle pinkish. Spores up to 18 × 6.5 μm. Europe, Spain, Navalmoral de la Mata (Cáceres).

**Notes:** Obviously it is not validly published until now.

### 3. Keys

#### 3a. World-wide key to the species of *Aureoboletus*

The key was mainly made for the determination of fresh material. For additional information use also the species descriptions included in the present article. Microscopy is absolutely necessary for final confirmation of the determination.

- |       |   |    |
|-------|---|----|
| 1     | Pileus surface distinctly lubricous to viscid or glutinous even when not wet or moist (but if not too dried), with dominant pinkish brownish, flesh-coloured, pinkish cinnamon-reddish brown, vinaceous brown colours | 3  |
| 1*    | Pileus surface not viscid or only when wet and moist; with similar but also other colours   | 2  |
| 2     | Wet or moist pileus somewhat viscid   | 12 |
| 2*    | Wet or moist pileus hardly viscid or not at all   | 17 |
| 3 (1) | Pores in all stages (bright) yellow   | 4  |
| 3*    | Pores yellow, developing olivaceous or greenish tints, or with other colours and development  | 6  |



- 4 Margin of pileus distinctly projecting 5  
4\* Margin of pileus not distinctly projecting. - Pileus radially rugose, reddish brown to brown, stipe pale reddish brown, greyish red or concolourous with the pileus, with deeper coloured stripes, context greyish red, pale pinkish brown or pale reddish, older more whitish, known from East Asia, also in America?  
*A. auriporus* var. *novoguineensis*
- 5 Stipe with conspicuous yellow floccosity, reddish-brownish, context yellowish, pinkish vinaceous or orange-brownish in stipe base, cystidia clavate to somewhat fusoid. - Pileipellis thin, determinable, known from America  
*A. auriporus* var. *auriporus*
- 5\* Stipe without conspicuous yellow floccosity, most parts bright chrome-yellow, context whitish, under cuticle pinkish, above tubes also yellowish, cystidia fusoid, including also more clavate ones  
*A. gentilis*
- 5\*\* Stipe with brown granulae on paler ground, rugose-subreticulate or ribbed, with dry, velutinous-granular pileus surface, compare 18
- 6 (3) Pores yellow, developing olivaceous or greenish tints 7  
6\* Pores with other colours or other development, not from the very first olivaceous yellow or greenish when bruised (no *Aureoboletus* species, but compare 13\*\*) 10  
6\*\* Pores from the very first olivaceous yellow or greenish when bruised (no *Aureoboletus* species) 11
- 7 With rugose pileus surface 8  
7\* Without rugose pileus surface 9
- 8 Pileus small (up to 5 cm), veined-reticulate, rugose, pileus margin often with whitish yellowish gelatinous veil, stipe without yellow floccosity, spores only up to  $13 \times 5 \mu\text{m}$ , known from East Asia  
*A. thibetanus*  
(with similar pileus surface, but otherwise other characters, see also *Boletus reticuloceps*, *B. castanopsidis*, and *B. mottiae*).
- 8\* Pileus large (up to 10.5 cm), always scrobiculate or rugulose, pileus margin projecting, stipe with yellow veil-like floccosity, spores up to  $18.5 \times 6.5 \mu\text{m}$ , known from North and Central America  
*A. subacidus*
- 9 (7) Pileus up to 15 cm, margin projecting, chestnut-brown, stipe viscid when fresh, soon dry, sometimes with shallow longitudinal ribs, or some reticulation on apex, yellowish near apex, sometimes with yellow floccosity or granules, pale reddish brown on a whitish ground below, context whitish to brownish, spores up to  $15(-18) \times 6 \mu\text{m}$  known from America  
*A. flaviporus*

- 9\* Pileus only up to 4.5 cm, margin characters unknown, brown, stipe dry, fawn-coloured, context pale brownish, spores up to  $11.5 \times 5 \mu\text{m}$ , known from Borneo  
*Boletus lubricus* (= *Xerocomus*)
- 10 (6) Pores yellow, dotted with reddish glandules, tubes long, yellowish, old dingy yellow, pileus only up to 3 cm, yellow with red on disk, context pallid, whitish, stipe viscid, yellow, dotted with livid-yellow glandules, basal mycelium colour and habitat unknown, known from North America  
*Boletus inflexus*
- 10\* Pores whitish to buff or pale yellow, darkening at maturity, tube characters unknown, pileus viscid to glutinous, bright yellow to orange-yellow, older with brownish or whitish tints, up to 10 cm, context whitish, stipe viscid to glutinous when fresh, yellow, the gluten having an acidic taste and staining fingers yellow, basal mycelium white, sheathing the base volvalike, in conifer (*Pinus*) or mixed wood, known from USA  
*Boletus curtisii*
- 10\*\* Pores pale apricot becoming fawn to darker brown, tube characters unknown, pileus scarlet, shading darker above when young, surface slightly sticky, context around the junction of stipe and cap staining blue, stipe in greater part crimson, basal mycelium colour unknown, known from forest of dipterocarps in Sarawak (Malaysia)  
“*Aureoboletus thibetanus*” ss. WATLING & HOLLANDS
- 11 (6) Pores from the very first olivaceous-yellow, pileus up to 13 cm, pale fawn-ochraceous coloured, context white, stipe dry, pale fawn-coloured, middle pallid reticulated, known from Borneo  
*Boletus subreticulatus*
- 11\* Pores near mustard yellow, turning dark dingy green especially when bruised; pileus up to 12.5 cm, context yellowish, turning bluish-green and later sometimes reddish-brown, known from Australia  
*Boletus sinape-cruentus*
- 12 (2) Pileus margin not or scarcely projecting, with yellow basal mycelium 13  
12\* Pileus margin not or scarcely projecting, with white basal mycelium. - Pileus up to 8 cm, olivaceous gold with reddish areas or varying to alutaceous with olive tints especially toward the margin, pores bright greenish yellow, if bruised when fresh turning dull brick red, stipe often brighter yellow above or nearly all over or concolourous with cap downward, bruised places becoming brick-red, spores up to  $15 \times 5 \mu\text{m}$ , known from North America  
*A. viridiflavus*
- 12\*\* Pileus margin distinctly projecting, surface becoming areolate-rimose or not, basal mycelium white or cream (in one taxon colour unknown)

- 13 The brilliant yellow tubes retaining their colour when dried. Pileus up to 8 cm, pileipellis not easily detersible, old often areolate, stipe typically distinctly swollen above a tapered base, context with unpleasant smell pungent like *Sclerodema*, basal mycelium yellow, spores  $9-12.5 \times 3-5 \mu\text{m}$ , comparatively small, known from North America  
*B. innixus*
- 13\* Similar but reddish tone on cap, pore surface staining brown when bruised, no unpleasant smell, known from North America  
*B. caespitosus* ss. LAMOUREUX
- 13\*\* The yellow tubes assuming a slight greenish shade. With similar yellowish basal mycelium, but yellow external velvet of the pileus of different structure, compare 20
- 14 (12) Surface becoming areolate-rimose 16
- 14\* Surface not becoming areolate-rimose (but compare also 16\*) 15
- 15 Pileus up to 8 cm, stipe delicately reticulate above, young marginal tubes and pores remaining yellow and forming a distinct band, context whitish, spores  $14-20.5 \times 5-6.3 \mu\text{m}$ , comparatively large, cystidia relatively short but wide,  $Q = 3$ , known from Florida  
*A. flavimarginatus*
- 15\* Pileus up to 7 cm, stipe without a reticulum, dry, with yellow floccosity, tubes and pores vivid yellow to bright olive-yellow, bruising greenish blue, context whitish, becoming slowly pale yellow-green, spores up to  $16 \times 6.4 \mu\text{m}$ , cystidia fusoid-ampullaceous, relatively long and small,  $Q = 5$ , known from Belize  
*A. cf. auriporus* ss. ORTIZ-SANTANA & al.
- 16 (14) Spores up to  $18 \times 6.5 \mu\text{m}$ . Pileus up to 5 cm, viscid when wet, in the dry state areolated and appearing scaly, yellow, at the disc more ochraceous, pores brilliant yellow, stipe long (longer than pileus wide), base buried deep in the earth, radicating, above coloured as the pores, below whitish, context white, under cuticle pinkish, known from Europe, Spain.  
*A. africanae*
- 16\* Spores  $11-13 \times 4-5 \mu\text{m}$ , finely striate. Pileus up to 14 cm, viscid when wet, sometimes becoming rimose-areolate, leather-coloured to fulvous, often with a pinkish tinge, pores young straw-coloured, not changing when bruised, old becoming olivaceous, stipe tapering upward, somewhat bulbous at the base, glabrous, even, subconcolourous, cartilaginous, pale-yellow at the apex, context white, becoming pale rose-coloured when bruised known from North America  
*Boletus atkinsonianus*
- 17 (2) Tubes and/or context becoming blue or green when injured or bruised 18
- 17\* Tubes and context unchanging when exposed 19

- 18 Tubes and pore surface ochraceous-citrinous with pores blueing when bruised, context of pileus slowly becoming blue; pileus brown, velutinous-granular to velvety, margin rimulose or submentose, dry up to 7 cm, stipe with brown granulae on paler ground, rugose-subreticulate or ribbed, only up to 1 cm thick, basal mycelium sordid-pallid to white, known from Florida  
*Boletus granuloseiceps*
- 18\* Tubes young flavous, greenish yellow old, pore surface yellow, becoming greenish yellow, bruising blue to blue-green; pileus dry and somewhat velvety, up to 4 cm in diam., old surface becoming finely rimose (especially maginal areas), young rose-red or deeper, becoming paler pinkish red, brick-red, stipe flavous at apex, downwards concolorous with pileus, pruinose, context pallid yellow to bright yellow in the stipe, bruising greenish blue, basal mycelium yellow, under hardwoods, known from North America  
*Boletus campestris*
- 18\*\* Tubes orange yellow then olive ochre, pore surface golden-ochraceous, bruising blue; pileus dry, tomentose, up to 8 cm, brownish, ochraceous, stipe umber brown, yellowish to orange ochraceous upwards, finely brownish scurfy pruinose, context yellowish, brownish in the stipe, becoming weakly blue above tubes when bruised, in stipe somewhat reddish, then blackish, basal mycelium yellow, known from Borneo  
*Boletus poeticus*
- 18\*\*\* Only context bruising indigo near tubes which then fades, stipe on the top half bruising indigo, pileus vinaceous/bay/blood, known from Africa  
“*Aureoboletus*” spec. 1
- 19 (17) Pileus raw umber to dark brown, up to 7 cm, margin projecting, tubes and pores intensely lemon-yellow, unchanging when bruised, context white, unchanging, under *Quercus*, known from California  
*A. citriniporus*
- 19\* Not with these characters 20
- 20 Pileus with a pale yellow, tender, detersible tomentum on brown ground. – Pileus 3-4 cm wide, margin not projecting, hymenophore chrome-yellow, tinged slightly greenish, stipe whitish to yellow and yellow pruinose, context whitish or yellow, unchanging, basal mycelium yellow, in tropical hammock, known from Florida  
*Boletus subsolarius*
- 20\* Pileus without such a tomentum 21
- 21 Pileus without projecting margin. – Granular-scaly when young, nearly glabrous at maturity, yellowish brown to dark rusty, becoming dull orange, up to 9 cm, context whitish to pale yellow, pore surface whitish, becoming pale yellow and finally darker yellow, developing

pale cinnamon stains when injured, stipe mustard-yellow to golden, enlarged downwards, under oak, known from North America

*A. roxanae*

21\* Pileus with (slightly) projecting margin, or margin forming a sterile band 22

22 Margin forming a sterile band, pileus chamois to pale tawny olive to cinnamon or clay-coloured, with yellow hues, pores yellow becoming olive-yellow, stipe longitudinally striate at apex, very minutely pruinose, pale tan, tawny olive to sayal-brown, pallid white streaked throughout, context white, unchanging, sometimes in pileus bruising pale (greyish) vinaceous, spores up to  $18.5 \times 6.5(-7) \mu\text{m}$ , under *Pinus*, known from Belize

*Boletus projectelloides*

22\* Margin slightly projecting, pileus up to 8 cm wide, surface dry, finely tomentose, older glabrous, yellow-ochre, tan, brownish yellow to copper-brown, tubes and pores pale ochre-yellow, buff-yellow, stipe ventricose-fusiform with pointed base, pale yellow, ochraceous yellow, brownish fibrillose or veined, context whitish to pale ochraceous yellow, darker beneath the pileipellis, orange beneath the tubes, basal mycelium pale yellowish, spore deposit ochraceous, spores up to  $12 \times 6 \mu\text{m}$ , under deciduous trees, mostly *Quercus*, known from Europe

*A. moravicus*

**3b. Weltweiter Schlüssel für Arten der Gattung *Aureoboletus***

Der Schlüssel wurde hauptsächlich zur Bestimmung von Frischfunden geschrieben. Für weitere Informationen sind auch die Artbeschreibungen im Artikel heranzuziehen. Ein gesicherter Beweis einer richtigen Bestimmung ist nur durch begleitende Untersuchung der Mikromerkmale möglich.

- |      |   |    |
|------|---|----|
| 1    | Hutoberfläche deutlich schmierig bis klebrig, auch wenn weder nass noch feucht (falls nicht zu trocken), überwiegend roslich-bräunlich, fleischfarben, roslich zimtrötlichbraun, weinrötlichbraun | 3  |
| 1*   | Hutoberfläche nicht klebrig oder nur feucht und nass so, mit ähnlichen aber auch mit anderen Farben   | 2  |
| 2    | Hut, wenn nass oder feucht, klebrig   | 12 |
| 2*   | Hut, wenn nass oder feucht, kaum oder gar nicht klebrig   | 17 |
| 3(1) | Poren in allen Stadien (leuchtend) gelb   | 4  |
| 3*   | Poren gelb, später mit olivlichen oder grünlichen Tönen, oder mit anderen Farben und Farbentwicklung  | 6  |
| 4    | Hutrand deutlich überstehend  | 5  |

- 4\* Hutrand nicht deutlich überstehend. – Hutoberfläche radial gerunzelt, rötlichbraun bis braun, Stiel blass rötlichbraun, graulich rot oder hutfarben mit dunkleren Streifen, Fleisch graulich rot, blass rosulich braun oder blass rötlich, älter mehr weißlich, aus Ostasien bekannt, auch in Amerika?

*A. auriporus* var. *novoguineensis*

- 5 Stiel mit auffälligen gelben Flocken, rötlichbräunlich, Fleisch gelblich, rosulich-weinrötlich oder orangebräunlich in der Stielbasis, Zystiden keulig bis etwas spindelrig, Huthaut dünn, abziehbar, aus Amerika bekannt

*A. auriporus*

- 5\* Stiel ohne auffällige gelbe Flocken, großteils leuchtend chromgelb, Fleisch weißlich, unter der Huthaut rosulich, über den Röhren auch gelblich, Zystiden spindelrig, daneben auch mehr keulige

*A. gentilis*

- 5\*\* Stiel mit brauner Körnelung auf blasserem Grund, faltig bis fast genetzt oder rippig, mit trockener, samtig-körniger Hutoberfläche, vergleiche

18

- 6 (3) Poren gelb, später mit olivlichen oder grünlichen Tönen

7

- 6\* Poren mit anderen Farben oder anderer Farbentwicklung, nicht von Beginn an olivgelb oder grünlich auf Druck (kein *Aureoboletus*, aber vergleiche 13\*\*)

10

- 6\*\* Poren von Beginn an olivlich-gelb oder grünlich auf Druck (kein *Aureoboletus*)

11

- 7 Hutoberfläche runzelig

8

- 7\* Hutoberfläche nicht runzelig

9

- 8 Hut klein (bis zu 5 cm), aderig-netzig, runzelig, am Hutrand oft ein weißliches bis gelbliches gelatinöses Velum sichtbar, Stiel ohne gelbe Flocken, Sporen nur bis zu  $13 \times 5 \mu\text{m}$ , aus Ostasien bekannt

*A. thibetanus*

(mit ähnlicher Hutoberfläche, aber sonst anderen Merkmalen, siehe auch *Boletus reticuloceps*, *B. castanopsidis* und *B. mottiae*)

- 8\* Hut groß (bis zu 10,5 cm), immer grubig oder runzelig, Hutrand überstehend, Stiel mit gelben velumartigen Flocken, Sporen bis zu  $18,5 \times 6,5 \mu\text{m}$ , aus Nord- und Mittelamerika bekannt

*A. subacidus*

- 9 (7) Hut bis 15 cm breit, kastanienbraun, Rand überstehend, Stiel frisch klebrig, bald trocken, zeitweise mit flachen Längsrippen, oder an der Spitze undeutlich genetzt, und dort gelblich, bisweilen mit gelben Flocken oder Körnchen, darunter auf weißlichem Untergrund blass rötlich braun, Fleisch weißlich bis bräunlich, Sporen bis  $15 (-18) \times 6 \mu\text{m}$ , aus Amerika bekannt

*A. flaviporus*

- 9\* Hut nur bis 4,5 cm breit, Hutrandverhältnisse unbekannt, braun, Stiel trocken, rehbraun gefärbt, Fleisch blass bräunlich, Sporen bis  $11,5 \times 5 \mu\text{m}$ , aus Borneo bekannt

*Boletus lubricus* (= *Xerocomus*)

- 10 (6) Poren gelb, mit rötlichen Drüsenpünktchen getüpfelt, Röhren lang, gelblich, alt schmutzig gelb, Hut nur bis 3 cm breit, gelb, Mitte mit Rottönen, Fleisch blass, weißlich, Stiel klebrig, gelb, mit fahlgelben Drüsenpünktchen, Basalmyzelfarbe und Standort unbekannt, aus Nordamerika bekannt

*Boletus inflexus*

- 10\* Poren weißlich bis fahl, lederfarben oder blass gelb, mit der Reife dunkelnd, Röhrenmerkmale unbekannt, Hut klebrig, leuchtend gelb bis orange gelb, älter mit bräunlichen oder weißlichen Tönen, bis 10 cm breit, Fleisch weißlich, Stiel frisch klebrigschleimig, gelb, Schleim mit schärflichen Geschmack und die Finger gelb färbend, Basismyzel weiß, die Basis volvaartig umhüllend, in Nadel- (*Pinus*) oder Mischwäldern, aus den USA bekannt

*Boletus curtisii*

- 10\*\* Poren blass aprikosenfarben, rehbraun bis dunkler braun werdend, Röhrenmerkmale unbekannt, Hut scharlachrot, am Scheitel jung dunkler, Fleisch bei Stiel- und Hutübergang blau fleckend, Stiel zum Großteil hochrot, Basalmyzelfarbe unbekannt, aus *Dipterocarpaceae* Wäldern von Sarawak bekannt

“*Aureoboletus thibetanus*” ss. WATLING & HOLLANDS

- 11 (6) Poren von Anfang an olivgelb, Hut bis 13 cm breit, blass rehbraun-ockerlich gefärbt, Fleisch weiß, Stiel trocken, blass rehbraun, Mitte blass genetzt, aus Borneo bekannt

*Boletus subreticulatus*

- 11\* Poren etwa senfgelb, auf dunkel schmutzig grün verfärbend, besonders auf Druck, Hut bis 12,5 cm breit, Fleisch gelblich, bläulich-grün und später zeitweilig rötlich-braun verfärbend, aus Australien bekannt

*Boletus sinape-cruentus*

- 12 (2) Hutrand nicht oder kaum überstehend, mit gelbem Basismyzel

13

- 12\* Hutrand nicht oder kaum überstehend, mit weißem Basismyzel. – Hut bis 8 cm breit, olivlich goldfarben mit rötlichen Zonen oder auch nach lederfarben mit olivlichen Tönen, besonders gegen den Rand zu, variierend, Poren leuchtend grünlich gelb, frisch auf Druck schmutzig ziegelrot verfärbend, Stiel oft leuchtender gelb oben, oder nahezu überall, oder nach unten hutfarben, gedrückte Stellen ziegelrot verfärbend, Sporen bis  $15 \times 5 \mu\text{m}$ , aus Nordamerika bekannt

*A. viridiflavus*

- 12\*\* Hutrand deutlich überstehend, Hutoberfläche felderig aufreißend oder nicht

14

- 13 Röhren leuchtend gelb, ihre Farbe im Alter und getrocknet behaltend, Hut bis 8 cm breit, Huthaut nicht leicht ablösbar, im Alter oft felderig aufgerissen, Stiel typischerweise über der verschmälerten Basis angeschwollen, Basismyzel gelb, Fleisch mit unangenehmem, *Scleroderma*-ähnlichem Geruch, Sporen  $9-12,5 \times 3-5 \mu\text{m}$ , vergleichsweise schmal, aus Nordamerika bekannt
- B. innixus*
- 13\* Ähnlich aber wenn ohne Geruch, Poren auf Druck bräunend und mit rötlichem Ton am Hut
- B. caespitosus* ss. LAMOUREUX
- 13\*\* Die gelben Röhren einen leicht grünlichen Ton annehmend, mit ähnlichem Myzel, aber Hut mit äußerem gelben Samt, von anderer Struktur, vergleiche 20
- 14 (12) Hutoberfläche felderig-rissig werdend 16
- 14\* Hutoberfläche nicht felderig-rissig werdend (aber vgl. 16\*) 15
- 15 Hut bis 8 cm breit, Stiel oben fein genetzt, die jungen Röhren nahe dem Hutrand zu gelb bleibend und eine deutliche Zone formend, Fleisch weißlich, Sporen  $14-20,5 \times 5-6,3 \mu\text{m}$ , vergleichsweise groß, Zystiden relativ kurz, aber breit,  $Q = 3$ , aus Florida bekannt
- A. flavimarginatus*
- 15\* Hut bis 7 cm breit, Stiel ohne Netz, trocken, mit gelben Flocken, Röhren und Poren lebhaft gelb bis leuchtend olivgelb, gedrückt grünlichblau, Fleisch weißlich, langsam blass gelbgrün, Sporen bis zu  $16 \times 6,4 \mu\text{m}$ , Zystiden spindelig-flaschenförmig, relativ lang und schmal,  $Q = 5$ , aus Belize bekannt
- A. cf. auriporus* ss. ORTIZ-SANTANA & al.
- 16 (14) Sporen bis zu  $18 \times 6,5 \mu\text{m}$ , Hut bis 5 cm breit, feucht klebrig, im trockenen Stadium felderig-rissig und schuppig erscheinend, gelb, am Scheitel mehr ockerlich, Poren leuchtend gelb, Stiel lang (länger als der Hut breit), basal tief im Boden vergraben wurzelnd, oben wie die Poren gefärbt, unten weißlich, Fleisch weiß, unter der Huthaut roslich, aus Europa (Spanien) bekannt
- A. africae*
- 16\* Sporen  $11-13 \times 4-5 \mu\text{m}$ , fein gestreift; Hut bis 14 cm breit, nass klebrig, zeitweise felderig-rissig werdend, lederfarben bis fahl gelbrot, oft mit einem rosa Ton, Poren strohgelb bei jungen Exemplaren, unveränderlich, im Alter olivlich, Stiel nach oben verschmälert, an der Basis etwas knollig verdickt, glatt, gerade, fast gleichfarben, blass gelb an der Spitze, knorpelig, Fleisch weiß, verletzt blass rosa, aus Nordamerika bekannt
- Boletus atkinsonianus*
- 17 (2) Röhren und/oder Fleisch bei Verletzung oder Druck blauend oder grünend 18



- 17\* Röhren und Fleisch bei Verletzung oder Druck unveränderlich 19
- 18 Röhren und Poren ockerlich-zitronengelb mit auf Druck blauenden Poren; Hut braun, samtig-körnig, Rand feinrissig oder fast filzig, trocken bis 7 cm breit, Fleisch im Hut langsam blau werdend, Stiel mit brauner Körnelung auf blasserem Grund, faltig bis fast genetzt oder rippig, nur bis 1 cm dick, Basismyzel schmutzigblass bis weiß, aus Florida bekannt
- Boletus granuloseiceps*
- 18\* Röhren jung goldgelb, alt grünlich gelb, Poren gelb, grünlich gelb werdend, auf Druck blau bis blaugrün; Hut trocken und etwas samtig, bis 4 cm breit, Oberfläche im Alter fein rissig (besonders Randzonen), rosenrot oder satter rot in der Jugend, blasser rosarot werdend, ziegelrot, Fleisch blassgelb bis leuchtend gelb im Stiel, auf Druck grünlich blau, Stiel oben goldgelb bis blassgelb, nach unten zu hutfarben, bereift, Basismyzel gelb, unter Laubbäumen, aus Nordamerika bekannt
- Boletus campestris*
- 18\*\* Röhren orangegelb, dann olivlichocker, Poren goldfarben ockerlich, verletzt blauend, Hut trocken, filzig, bis 8 cm breit, bräunlich, ockerlich, Fleisch gelblich, im Stiel bräunlich, über den Röhren verletzt schwach blauend, im Stiel etwas rötlich, dann schwärzlich verfärbend, Stiel umbrabraun, nach oben gelblich bis orange ockerlich, fein bräunlich schorfig bereift, Basismyzel gelb, aus Borneo bekannt
- Boletus poeticus*
- 18\*\*\* nur Fleisch über den Röhren indigoblau verfärbend, dann ausblasend, Stiel auf der oberen Hälfte rasch indigoblau verfärbend, Hut weinrot, blutrot, rötlichbraun, aus Afrika bekannt
- „*Aureoboletus*“ sp.1
- 19 (17) Hut umbra bis dunkelbraun, bis 7 cm breit, Rand überstehend, Röhren und Poren intensiv zitronengelb, auf Druck unveränderlich, Fleisch weiß, unveränderlich, unter *Quercus*, aus Kalifornien bekannt
- A. citriniporus*
- 19\* Nicht mit diesen Merkmalen 20
- 20 Hut mit blass gelbem, schwachem, entfernbarem Filz auf braunem Grund. – Hut 3-4 cm breit, Rand nicht überstehend, Hymenophor chromgelb, leicht grünlich getönt, Stiel weißlich bis gelb und gelb bereift, Fleisch weißlich oder gelb, unveränderlich, Basismyzel gelb, im Tropenwald, aus Florida bekannt
- Boletus subsolarius*
- 20\* Hut ohne solchem Filz 21
- 21 Hut ohne überstehendem Rand. – Hut jung körnig-schuppig, reif nahezu glatt, gelblich-braun bis dunkel rostfarben, schmutzig orange werdend, bis 9 cm breit, Fleisch weißlich bis blass gelb, Poren weißlich, blass gelb werdend und zuletzt mehr dunkel gelb, verletzt blass

- zimtfarbene Flecken entwickelnd, Stiel senfgelb bis goldfarben, nach unten verbreitert, unter *Quercus*, aus Nordamerika bekannt
- A. roxanae*
- 21\* Hutrand (leicht) überstehend oder einen sterilen Saum bildend 22
- 22 Hutrand einen sterilen Saum bildend, Hut chamois bis blass gelbbraun-oliv bis zimtfarben oder lehmfarben, mit gelben Tönen, Poren gelb, olivgelb werdend, Stiel oben längsgestreift, ganz fein bereift, blass lohbraun, gelbbraun oliv bis braun, durchgehend blass gestreift, Fleisch weiß, unveränderlich, bisweilen in Hüten auf Druck blass (graulich-)weinrötlich, Sporen bis  $18,5 \times 6,5(-7) \mu\text{m}$ , unter *Pinus*, aus Belize bekannt
- Boletus projectelloides*
- 22\* Hutrand leicht überstehend, Hut bis 8 cm breit, Oberfläche trocken, fein filzig, älter glatt, gelbocker, lohfarben, bräunlichgelb bis kupferbraun, Röhren und Poren blass ockergelb, (leder)falb bis gelb, Stiel bauchig-spindelrig mit zuspitzender Basis, blass gelb, ockergelb, bräunlich-faserig oder -aderig, Fleisch weißlich bis blass ockergelblich, unter der Huthaut dunkler, unter den Röhren orange, Basismyzel blass gelblich, Sporenpulver ockerlich, Sporen bis  $12 \times 6 \mu\text{m}$ , unter Laubbäumen, meistens *Quercus*, aus Europa bekannt
- A. moravicus*

### 3c. Synoptic key to *Aureoboletus* and similar species

The key includes all *Aureoboletus* spp. and similar species with viscid pileus respectively bright yellow pores, including microscopy.

**Comments:** When using this key, note that missing data (not yet available in publications) cause a special handling: select all characters which best match your fungus and note down the appropriate letters. Should you have more letters as cited here, check where in the code list you find the sequence matching best.

- A. basal mycelium white(ish)
- B. basal mycelium yellow(ish)
- C. pileus surface veined, rugose
- D. pores bright yellow, unchanging; or later darkening
- E. pores yellow, old olivaceous or greenish
- F. pores with other colours from start (white, ochraceous, olivaceous, greenish...)
- G. pores (bruised) changing to green(ish), blue(ish)
- H. pileus with olivaceous tints
- I. stipe somewhat reticulated
- J. pileus margin projecting
- K. largest spores not longer than  $15 \mu\text{m}$
- L. largest spores longer than  $15 \mu\text{m}$
- M. largest spores not wider than  $5 \mu\text{m}$

- N. largest spores wider than 5  $\mu\text{m}$
- O. cystidia not longer than 55  $\mu\text{m}$
- P. cystidia longer than 55  $\mu\text{m}$
- Q. cystidia wider than 15  $\mu\text{m}$
- R. cystidia not wider than 15  $\mu\text{m}$
- S. pileus wider than 8.5 cm
- T. stipe with yellow floccosity
- U. context white(ish), excluding places under the cuticle
- V. context yellow(ish), excluding places under the cuticle
- W. context with other colours, excluding places under the cuticle
- X. context staining blue when injured

**Key codes**

ACDLMPRW	<i>Aureoboletus auriporus</i> var. <i>novoguineensis</i>
ACEGJKMQRU	<i>A. thibetanus</i>
ACEGJKMQRV	<i>A. thibetanus</i>
ACEGJKMQRW	<i>A. thibetanus</i>
ACEGJKNQRU	<i>A. thibetanus</i>
ACEGJKNQRV	<i>A. thibetanus</i>
ACEGJKNQRW	<i>A. thibetanus</i>
ACEJKMQRU	<i>A. thibetanus</i>
ACEJKMQRV	<i>A. thibetanus</i>
ACEJKMQRW	<i>A. thibetanus</i>
ACEJKNQRU	<i>A. thibetanus</i>
ACEJKNQRV	<i>A. thibetanus</i>
ACEJKNQRW	<i>A. thibetanus</i>
ACEJLNORSTU	<i>A. subacidus</i>
ACEJLNORSTV	<i>A. subacidus</i>
ADJLN	<i>A. africae</i>
ADJLNOQTV	<i>A. auriporus</i>
ADJLNPQTV	<i>A. auriporus</i>
ADJLNPQU	<i>A. gentilis</i>
AEIJKNOQSTU	<i>A. flaviporus</i>
AEIJKNOQSTW	<i>A. flaviporus</i>
AEIJKNOQSU	<i>A. flaviporus</i>
AEIJKNOQSW	<i>A. flaviporus</i>
AEIJLNOQSTU	<i>A. flaviporus</i>
AEIJLNOQSTW	<i>A. flaviporus</i>
AEIJLNOQSU	<i>A. flaviporus</i>
AEIJLNOQSW	<i>A. flaviporus</i>
AFGIKNORWX	<i>Boletus granuloseiceps</i>
AFGIKNPRWX	<i>Boletus granuloseiceps</i>
AFGKNORWX	<i>Boletus granuloseiceps</i>
AFGKNPRWX	<i>Boletus granuloseiceps</i>
AFHLMU	<i>Aureoboletus viridiflavus</i>

AFHLMV	<i>A. viridiflavus</i>
AFHLMW	<i>A. viridiflavus</i>
AFHLNU	<i>A. viridiflavus</i>
AFHLNV	<i>A. viridiflavus</i>
AFHLNW	<i>A. viridiflavus</i>
AFJKNPRSU	<i>Boletus curtisii</i>
AFKMORSU	<i>Aureoboletus roxanae</i>
AFKMORSV	<i>A. roxanae</i>
BCFIJLNPQSU	<i>Boletus reticuloceps</i>
BDJKNPRU	<i>Aureoboletus moravicus</i>
BDKMPRU	<i>Boletus innixus</i>
BDKMPRV	<i>Boletus innixus</i>
BDKMPRW	<i>Boletus innixus</i>
BEGJKMORVX	<i>Boletus campestris</i>
BEGKNORVX	<i>Boletus poeticus</i>
BEKNORTU	<i>Boletus subsolarius</i>
BEKNORTV	<i>Boletus subsolarius</i>
BFKMPRU	<i>Boletus innixus</i>
BFKMPRV	<i>Boletus innixus</i>
BFKMPRW	<i>Boletus innixus</i>
CFHILNOQU	<i>Boletus castanopsidis</i>
CFIJLNSU	<i>Boletus mottiae</i>
DIJKMPRU	<i>Aureoboletus citriniporus</i>
DJKMPRU	<i>A. citriniporus</i>
DKNORVX	<i>Aureoboletus</i> spec. 1 ss. WATLING & TURNBULL
DKNORWX	<i>A. thibetanus</i> ss. WATLING & HOLLANDS
EGJLNORTU	<i>A. cf. auriporus</i> ss. ORTIZ-SANTANA & al.
EGKMPQSVX	<i>Boletus sinapecruentus</i>
EIJLNOQU	<i>Aureoboletus flavimarginatus</i>
EJKMORSUW	<i>Boletus atkinsonianus</i>
EJLNPRU	<i>Boletus projectelloides</i>
EKMORW	<i>Boletus lubricus</i>
FIJLMSU	<i>Boletus subreticulatus</i>
JKMPRTU	<i>Boletus inflexus</i>

#### 4. Genera easily to be confused

- a. Species with conspicuously reticulate stipe, often bitter taste and intense yellow colour of the context. Spore deposit olive brown  
*Retiboletus* MANFR. BINDER & BRESINSKY
- b. Stipe typically with glandular dots or smears. Spore deposit pale cinnamon brown  
Hymenial cystidia usually clustered  
*Suillus* ADANS.
- c. Pileus dry, subtomentose, never viscid. Hymenophoral trama from the "Phylloporus-type" (subregular), sectioned hymenophore showing broken tubes (a single tube not removeable from it)  
*Xerocomus* QUÉL.

d. Stipe more or less furfuraceous or squamulose-scabrous

*Leccinellum* BRESINSKY & MANFR. BINDER, *Pseudoleccinum* MANFR. BINDER

e. Pileus viscid, glabrous, or dry, fibrillose or tomentose. Context white, unchanging, stipe dry or viscid, glabrous or pruinose. Spore deposit brownish pink

*Fistulinella* HENN.

## 5. Comments on some further taxa

The following taxa are either similar to *Aureoboletus* species and occur in the same locations or habitats or they are species where preliminary molecular data refer to a possible relationship to *Aureoboletus* (to be confirmed by further studies).

### 5.1 American species:

*Boletus innixus* FROST, Bull. Buff. Soc. Nat. Sci. 2: 103, 1874

≡ *Aureoboletus innixus* (FROST) MANFR. BINDER, Zur molekularen Systematik der Boletales: Boletineae und Sclerodermatineae subordo nov. – Diss. Univ. Regensburg: 103, 1999, not val. publ. (not in KIRK 2008)

≡ *Aureoboletus caespitosus* (PECK) MANFR. BINDER, Zur molekularen Systematik der Boletales: Boletineae und Sclerodermatineae subordo nov. – Diss. Univ. Regensburg: 102, 1999, not val. publ. (not in KIRK 2008)

?= *Boletus caespitosus* PECK, Bull. Torrey Bot. Club 27: 17, 1900

≡ *Aureoboletus innixus* (FROST) LAMOUREUX in LAMOUREUX & DESPRES, Champignons du Québec, Tome 1, Les bolets: 49, 1997, comb. inval. (as “comb. prov.”)

?= *Aureoboletus caespitosus* (PECK) LAMOUREUX in LAMOUREUX & DESPRES, Champignons du Québec, Tome 1 Les bolets: 50, 1997, comb. inval. (as “comb. prov.”)

**Diagnosis originalis:** Pileus flat convex, smooth, yellowish brown, slightly areolated when old, yellow in the interstices. Tubes lemon yellow, unchanging, adnate. Stem slender, short, in large specimens very much thickened at base, yellowish streaked with brown. Flesh white in pileus, brownish in stem. The whole often reclines as if for support. Spores .0105-.0052 mm. In grassy woods. July.

**Typus:** USA, Vermont, Brattleboro, July, C. C. FROST VT 3169.

**Selected illustrations:** BESSETTE & al. (2000): 297 (= WEBER & SMITH 1985: 83), BESSETTE & al. (2007): 50, ROODY (2003): 327, KUO (2003), PHILLIPS (1991): 236, LAMOUREUX & DESPRES (1997): 39.

### Characters:

**Pileus:** 3-8 cm wide, colours variable, from brownish or tan with reddish tones to tarnished brass colour, rarely with greenish tinges, dry, viscid when wet, pileipellis not easily detersible, margin not projecting, old often areolate.

**Hymenophore:** bright golden-yellow, old dulling to rusty brownish yellow or rusty gold, not olivaceous, the brilliant yellow tubes retaining their colour when dried.

**Stipe:** 3-6 cm long, 1-1.5 cm wide, viscid near the base, typically distinctly swollen above a tapered base, a gourd-like stipe base that tapers to a point, yellowish, some shade of brownish or reddish brown, with sparse, brown pruina, basal mycelium yellow.

**Context:** white to pale yellow, vinaceous under the pileipellis, in stipe with pale brownish tinges, smell pungent like *Scleroderma*, unpleasant.

**Macrochemical reactions:** Ammonia on pileus pale blue to pale greenish flash, becoming reddish to reddish-black.

**Micromorphology:** spores olivaceous in mass, drying to dingy brownish or yellowish brown, 9-12.5 × 3-5 µm, Q = 2.35, cystidia fusoid, pileipellis hyphae 4-7 µm wide.

**Habitat and distribution:** often growing in clusters under broadleaf trees (*Quercus*). Eastern Canada and USA south to North Carolina, west to Michigan.

**Collection examined:** USA: Tennessee, Smoky Mountains National Park, *Liriodendron*, *Ulmus*, *Acer*, 25. 7. 1996, leg. I. KRISAI-GREILHUBER & H. VOGLMAYR, no. 6819, det. W. KLOFAC (WU 30221).

**Diagnosis originalis of *Boletus caespitosus* PECK:**

Pileus broadly convex or nearly plane, sometimes slightly concave by the elevation of the margin, even, brown or blackish brown, the margin often a little paler or reddish brown, flesh slightly tinged with red, tubes adnate or slightly decurrent, yellow, their mouths rather large, angular, concolourous; stem short, even, solid, glabrous, tapering upward, brown or reddish brown; spores oblong elliptic, 10 µ long, 5 µ broad. Pileus 1-2.5 cm broad; stem 2-2.5 cm long, 4-6 mm thick. Cespitose.

**Typus:** Virginia. Danville, August (1889). R. S. PHIFER (NYS).

**Notes:** *Boletus innixus* is a small species growing in tufts and referable to the tribe *Subtomentosi*. The tubes retain their bright yellow colour in the dried specimens. The statement by WATLING & TURNBULL (1992): "*Boletus pulverulentus* OPAT., indeed the same fungus to which the true *B. caespitosus* PECK is related" is unexplicable. Most authors, such as LAMOUREUX & DESPRES (1997), distinguish *B. caespitosus* from *B. innixus* by some characters: reddish tone on darker pileus, pore surface staining brown when bruised, no unpleasant smell (see illustration in LAMOUREUX & DESPRES 1997: 40). Microscopical measures of the spores of both types (*B. caespitosus*, *B. innixus*) by BOTH (1998) were nearly identical, molecular studies (BINDER & HIBBETT 2006) show almost no difference between them. The taxon of LAMOUREUX (in LAMOUREUX & DESPRES 1997, see also LAMOUREUX & NEUMANN 1993, with illustration fig. 1) may be a variety of *B. innixus*.

***Boletus atkinsonianus* (MURRILL) SACC. & TROTT.,** Syll. Fung. **21:** 236, 1912

**Basionym:** *Ceratomyces atkinsonianus* MURRILL, North American Fl. **9:** 144, 1910

≡ *Boletus atkinsonianus* (MURRILL) COKER & BEERS, Bol. of North Carolina: **49**, 1943 (comb. superfl.)

≡ *Pulveroboletus atkinsonianus* (MURRILL) L. D. GÓMEZ, Rev. Biol. Trop. **44** (Suppl. 4): **85**, 1997

= *Boletus obsonium* (PAULET) FR. ss. G. F. ATK. 1900

**Diagnosis originalis:** Pileus convex to nearly plane, 9-14 cm broad, about 2.5 cm thick; surface smooth, glabrous, viscid when wet, sometimes becoming rimose-areolate, leather-coloured to fulvous, often with a pinkish tinge; margin inrolled when young, extending 3 mm beyond the tubes, entire at first, slightly hoary; context white, becoming pale rose-coloured when wounded, sweet to the taste, tubes adnate, plane in mass, becoming slightly depressed near the stem, straw-coloured in young plants, not changing when wounded, old becoming olivaceous owing to the ripening of the spores, mouth small, circular, concolourous, 4-5 to a mm, not stuffed when young, edges thin, entire; spores fusiform, smooth, dark-olivaceous to dull-brownish in mass, 11-13 × 4-5 µ; stipe tapering upward, somewhat bulbous at the base, glabrous, even, subconcolourous, cartilaginous, pale-yellow at the apex, solid, white and unchanging within, about 9-12 cm long and 1-3 cm thick. Type collected on the ground in deciduous woods. Distribution: North Carolina and New York.

**Typus:** USA, North Carolina, Pink Bed Valley, July 1908, W. A. MURRILL & H. D. HOUSE 64 (holotype NY, isotype FH).

**Selected illustrations:** COKER & BEERS (1943): pl. 31 ab (b/w), ATKINSON

(1901): pl. 61, b/w = ATKINSON (1900): pl. 55, fig. 165, b/w.

### Characters:

**Pileus:** glabrous, viscid and shining when wet, else slightly subtomentose, smooth and glabrous, sometimes rimose-areolate, up to 14 cm, young dark reddish brown, becoming paler, leather-coloured to fulvous, often with a pinkish or vinaceous tinge, margin strongly projecting.

**Hymenophore:** pale yellowish, straw-coloured, old dulling to olivaceous, pores bruising bright mustard-yellow, tubes adnate, becoming slightly depressed near the stem, mouth small.

**Stipe:** up to 15 × 3 cm, clavate, tapering upward, somewhat bulbous at the base, cartilaginous, viscid, longitudinally streaked, pale-yellow above, pallid to pale flesh colour, reddish tan below, streaked dull pink to paler, or becoming so in entire length, and then often with yellowish base. Basal mycelium cream.

**Context:** in pileus white, becoming pale rose-coloured, staining vinaceous when injured, white and unchanging within stipe, or slowly yellowing when cut, yellow near apex, old grub channels brown. Smell sometimes unpleasant, taste sweet to slightly tart.

**Micromorphology:** spores olivaceous to dull brownish in mass, 11-14(-15.5) × (3.5-)4-4.8(-5.5) μm, with fine striations. Cheilocystidia hyaline, fusoid, ventricose portion in the middle, apex ampullaceous, up to 45 × 7 μm.

**Habitat and distribution:** in deciduous or mixed woods (oak, pine, rhododendrons). America, USA (New York south to Georgia).

**Collection examined:** USA: North Carolina, Macon County, Nanthahala National Forest, Standing Indian Camp Ground, about 15 miles from Fanklin of US route 64, *Quercus*, *Tsuga*, *Carpinus*, *Rhododendron*, *Betula*, 9. 8. 1996, leg. I. KRISAI-GREILHUBER & H. VOGLMAYR, no. 7214, det. W. KLOFAC (WU 25645).

**Notes:** Macroscopically it reminds of *Boletus edulis* agg. or *Boletus projectellus*. The description follows ATKINSON (1901), MURRILL (1910), COOKER & BEERS (1943), and BOTH & al. (2003). In USA the species does not seem to have been described in detail since 1943 until 2000, when B. NEILL and D. AURORA found it at Bigelow Hollow State Park, CT, and B. ROODY found it in 2001 at Monongahelia National Forest, WV (BOTH & al. 2003).

***Boletus projectelloides* B. ORTIZ, BOTH, HALLING & T. J. BARONI**, Fungal Diversity 27(2): 319, 2007

**Diagnosis originalis:** Pileus coactus, cinnamomeus, margo decurvatus, sterilis. Contextus albus. Tubi flavi demum olivaceo-flavi, pori concolores. Stipes minutissimis pruinatus, pallid avellaneus vel brunneus, intus albus, immutabilis. *Boletus projectellus* et *B. atkinsonianus* in mentem revocavit.

**Typus:** Belize, Cayo District, Mountain Pine Ridge Forest Reserve, Douglas da Silva, Forestry Station camp ground, 13. Oct. 2002, TJB 9385, BZ 2105 (CORT, holotype; CFMR, isotype).

**Selected illustration:** ORTIZ-SANTANA & al. (2007): f. 55.

### Characters:

**Pileus:** up to 8 cm, felty overall, slightly tacky to touch, not viscid, chamois to pale tawny-olive to cinnamon or clay colour, with yellow hues, margin forming a sterile band.

**Hymenophore:** deeply adnexed, tubes up to 12 mm long, yellow or pale green

becoming olive, pores yellow becoming olive yellow, 1-2 per mm.

**Stipe:** up to 8(-14) cm long, up to 1.5(-3) cm wide, equal (sub)clavate, longitudinally striate at apex, very minutely pruinose, pale tan, tawny olive to sayal-brown, pallid white streaked throughout. Colour of basal mycelium not mentioned.

**Context:** white, unchanging, sometimes in pileus bruising pale (greyish) vinaceous.

**Macrochemical reactions:** NH<sub>4</sub>OH on pileus with a transient flash of deep blue green, then fuscous, fading to brown with a deep mahogany red drop.

**Micromorphology:** spores 14.5-18.5 × 5.5-6.5(-7) μm, Q = 2.7, fusiform with a germ-pore. Cystidia (32-)48-96 × 7.2-12 μm, cylindrical(-fusoid). Pileipellis a tangled ixotrichoderm of hyphae up to 9.5(-11) μm wide, some incrustated.

**Habitat and distribution:** gregarious under *Pinus caribaea*. Belize.

**Notes:** Some characteristics differentiate *Boletus projectelloides* from the macroscopically similar *Boletus atkinsonianus* (with similar free sterile pileus margin but with viscid pileus, smaller spores up to 13 × 5 μm and absent germ-pore), *Aureoboletus auriporus* (with a bright yellow hymenophore, yellow floccules on the stipe and the absence of spores with germ-pore) and *B. projectellus* (having a reddish brown rather than pale yellowish brown pileus, a rosy context, a reticulate stipe and large basidiospores up to 33 × 12 μm that lack a germ-pore).

***Boletus curtisii* BERK.,** Ann. Mag. Nat. Hist. Ser. 2, **12:** 429, 1853

≡ *Pulveroboletus curtisii* (BERK.) SINGER, Amer. Midl. Naturalist **37:** 18, 1947

≡ *Suillus curtisii* (BERK.) KUNTZE, Rev. Gen. Pl. **3(2):** 535, 1898

≡ *Ceromyces curtisii* (BERK.) MURRILL, Mycologia **1:** 150, 1909

= *Boletus carolinensis* BEARDSLEE, J. Elisha Mitch. Sci. Soc. **31:** 147, 1915

**Selected illustrations:** COKER & BEERS (1943): frontispiece, SNELL & DICK (1970): pl. 31, BESSETTE & al. (2000): 289 (= BESSETTE & al. 2007: 49 p.p., = WEBER & SMITH 1985: 67 p.p., = METZLER & METZLER 1992: 217 p.p.).

### Characters:

Basidioma with a viscid to glutinous surface when fresh, pileus glabrous, margin with a narrow band of sterile tissue, incurved when young, bright yellow to orange-yellow, older with brownish or whitish tints, up to 10 cm, context whitish, unchanging, pore whitish to buff or pale yellow, darkening at maturity, stipe viscid to glutinous when fresh, pale yellow above, yellow below, basal mycelium white, sheathing the base volvalike, spores 9.5-15(-17) × 4-6 μm, in conifer (*Pinus*) or mixed wood, USA.

**Collection examined:** USA: Tennessee, Union County, Big Ridge State Park, N New Loyston, mixed wood (*Quercus*, *Pinus*, *Acer*), 8. 9. 1996, leg. I. KRISAI-GREILHUBER & H. VOGLMAYR, no. 7699 (WU 30341).

**Notes:** The gluten has an acidic taste and stains fingers yellow. The aspect of *Boletus curtisii* resembles a *Suillus*.

***Boletus inflexus* PECK,** Bull. Torrey Bot. Club **22:** 207, 1895

≡ *Suillus inflexus* (PECK) KUNTZE, Rev. Gen. Pl. **3:** 535, 1898



**Characters:**

Pileus viscid, yellow with red on disk, margin inflexed, context pallid, whitish, unchanging, tubes long, yellowish, old dingy yellow, pores dotted with reddish glandules, stipe viscid, yellow, dotted with livid-yellow glandules, in open woods. USA.

**Notes:** SINGER (1947) regarded *Boletus inflexus* as a synonym of *B. curtisii*, while SMITH & THIERS (1971) stated: "it may belong in section *Pseudoleccinum* of *Boletus*". Description reads like a *Suillus*.

*Boletus mottiae* THIERS (sec. Index of Fungi: 402, published as *Boletus mottii* THIERS), California Mushrooms: 36, 1975

**Selected illustration:** THIERS (1975): 10.

**Characters:**

Pileus brown, cinnamon-brown on disk, fading to buff towards margin, conspicuously wrinkled-reticulate over entire surface during all stages of development, glabrous, up to 12 cm, with white, unchanging context; pores white, then yellow, olive-yellow, stipe buff to pinkish buff, finely concolourous reticulated over entire surface. USA, California, under *Quercus* (not under conifers, as in publication cited, H. D. THIERS, pers. comm.). Besides, there are collections in Europe, examined and confirmed by H. D. THIERS (see collections examined).

**Collections examined:** **Austria:** Niederösterreich, Hollabrunn, Maissau, Limberg, Würfelmaiß-Gäns-graben (MTB 7461/1), *Quercus*, 17. 6.1988, leg. A. HAUSKNECHT (WU 09290); - Hollabrunn, Maissau, Grünhof-Fischteiche (MTB 7460/2), *Quercus*, 24. 7. 1997, leg. A. HAUSKNECHT (WU 17564); - Hollabrunn, Maissau, Sonndorferstraße (MTB 7460/2), *Quercus*, 8. 10. 2005, leg. E. HAMMERSCHMIED (WU 23986).

**Notes:** *Boletus mottiae* is one of the *Boletales* with wrinkled-reticulate pileus surface (such as *Aureoboletus thibetanus*, *Boletus castanopsidis*, *B. reticuloceps*). It is a member of sect. *Boletus*, named after LILLIAN MOTT; hence the specific epithet has to be *mottiae* (H. D. THIERS in pers. comm. to E. E. BOTH). The cause of missing new - reports seems to be the assumed association with conifers (and here it was misidentified and confused with *Boletus fibrillosus* THIERS).

*Boletus subsolarius* SINGER, Mycologia 37: 798, 1945

**Diagnosis originalis:** pileo cinnamomeo-fusco, ferrugineo-brunneo, atrofusco, subtiliter granuloso-furfuraceo vel subtomentoso et plerumque strato velutino tenuissimo flavo obtecto, 32-38 mm, lato; margine hymenio tecto; hymenophoro citrino vel aurato, circa stipitem subdepresso, immutabili, poris latis; sporis 8-13,5 × 4,7-5,5 μ, olivaceo-brunneis in cumulo; cystidiis fusoidis; tramate typico *Boletorum*; stipite flavido vel albidulo, apice furfuraceo, 33-38 × 11-12 mm.; mycelio tomentum luteum efformante; carne albida vel flavida, immutabili. In dumetis tropicalibus prope Miami, Fla.

**Typus:** North America, USA, Florida, Dade Co., Matheson Hammock, R. SINGER, F 894 (FH); F 1065, F 1233, F 1336 (co-types), (FH).

**Characters:**

**Pileus:** 3-4 cm wide, with a pale yellow, tender, detersible tomentum on brown ground, later margin light brownish olive, centre more amber-brown, dry, smooth or somewhat rugulose.

**Hymenophore:** lemon-chrome, soon assuming a slight greenish shade, unchanging on pressure, adnate or slightly depressed around the stipe, tubes up to 6 mm long; pores concolourous, unchanging, medium wide to wide.

**Stipe:** 3-4 × 1-1.25 cm, white to yellowish, apex usually concolourous with pores, often with yellow furfurations, strongly tapering towards base, yellow tomentose from mycelium.

**Context:** whitish or yellow, unchanging when injured, smell none, taste mild.

**Macrochemical reactions:** KOH on surface of pileus black, NH<sub>3</sub> on pileus lilaceous black, NH<sub>4</sub>OH on pores green, on context green or negative.

**Micromorphology:** spores in mass olive-brown, 8-13.5 × 4.7-5.5 μm. Cystidia 40-55 × 6.8-8.8 μm, strictly fusoid. Cuticle hyphae 5-10 μm in diam.

**Habitat and distribution:** in tropical hammock under *Coccolobis*, *Ficus*. USA (South Florida).

**Notes:** *Boletus subsolitarius* reminds of *Boletus innixus* or *B. subacidus*, but it is not cespitose and with dry stipe, and the yellow external velvet of the pileus is with different structure (SINGER 1947). SINGER (1947) considered it as member of section *Subpruinosi*.

***Boletus granuloseps* SINGER, Mycologia 37: 797, 1945**

**Characters:**

Similar to *Boletus subsolitarius*, pileus up to 6.6 cm in diam., close in colour to pileus and stipe in dried and fresh condition but differing from *B. subsolitarius* by the following characters: tubes and pores more ochraceous, pores bluing when pressed, white to whitish tomentum at stipe base, showing brown instead of yellowish granulae on the stipe, stipe never viscid, context changing to blue when quite fresh and young, cystidia wider (up to 11 μm). Under tropical trees and *Quercus* in Florida. It is a member of section *Subpruinosi*.

**Note:** SINGER (1947) compares *Boletus granuloseps* with *Aureoboletus auriporus*, stating that "the hymenophore is much less golden yellow, and cystidia are not as broad above".

***Boletus campestris* A. H. SMITH & THIERS, Boletes of Michigan: 266, 1971**

**Selected illustrations:** BESSETTE & al. (2000): 288, WEBER & SMITH (1985): 85, PHILLIPS (1991): 221, KUO (2004 b), METZLER & METZLER (1992): 206.

**Characters:**

Pileus dry and somewhat velvety, up to 4 cm in diam., old surface becoming finely rimose, rose-red or deeper, becoming paler pinkish red, brick-red with a hint of yellow showing in

the cracks, context pallid yellow to bright yellow in stipe, staining greenish blue, stipe nearly equal, slender (not tapering at base), pale yellow above, below deeper yellow and reddish pruinose, base with yellow mycelium, pore surface yellow, becoming greenish yellow, bruising blue to blue-green, pores small, 1-2 per mm, NH<sub>4</sub>OH on pileipellis negative, spores up to 15 × 7 µm, pileipellis a trichodermium, hyphae –up to 12 µm wide, with yellow content in KOH. North America. On lawns, parks, open woodlands.

**Collection examined:** USA: Tennessee, Great Smoky Mountains National Park, Abrams Creek, *Pinus-Quercus-Liriodendron-Tsuga-Rhododendron* forest, 28. 7. 1996, leg. I. KRISAI-GREILHUBER & H. VOGLMAYR, no. 6912, det. W. KLOFAC (WU 29667).

**Notes:** In molecular analysis (BINDER & HIBBETT 2006) *Boletus campestris* shows an unexpected proximity to the genus *Aureoboletus*, but due to the numerous similar species in this group, investigation of additional material is necessary to confirm the present results.

## 5.2 Asian species:

*Boletus poeticus* CORNER, *Boletus* in Malaysia: 113, 1972

### Characters:

Pileus up to 8 cm, tomentose, dry fuscous to ochraceous, stipe up to 9 × 2 cm, subcylindrical, dull ochraceous or orange above, brownish pruinose-furfuraceous when fresh, basal mycelium yellow, tubes orange-yellowish, then olivaceous-ochraceous, pores dull golden-ochraceous, tubes and pores blueing when injured, context yellowish, brownish in the stipe, becoming weakly blue above tubes when injured, in stipe somewhat reddish, then blackish, spores 12-15 × 4.5-5.3 µm, olivaceous-brownish in mass. Borneo. Obviously a member of section *Subpruinosi*.

**Notes:** CORNER (1972) compares *Boletus poeticus* with *Aureoboletus*: “the golden pores suggest *Aureoboletus*, but they do not dry unusually yellow.”

*Boletus subreticulatus* CORNER, *Boletus* in Malaysia: 129, 1972

**Diagnosis originalis:** Pileus -13 cm, convexus viscidus, pallide cervino-ochraceus, centro brunneo, margine aliquando appendiculato. Stipes -8 × 2 cm, subcylindricus pallid cervinus, supra medium pallide reticulatus, siccus; mycelio albo. Tubi -10 mm, olivaceo-flavi; poris 0,3-0,5 mm, olivaceo-flavis. Caro -18 mm, alba immutabilis. Sporae 12-15,5 × 4-5 µm, olivaceo-brunneae s.m., leves. Ad humum in querceto.

**Typus:** Borneo, Kinabalu, fl. Bembangan, 1700 m alt., 3 March 1964, RSNB 5607 (CGE).

**Notes:** *Boletus subreticulatus* “differs from *B. phaeocephalus* (ss. CORNER; = *Boletellus umbrinellus* sec. SINGER) in the very viscid pileus without a pile of hyphal ends, the short cheilocystidia and, perhaps, the absence of pleurocystidia. The pores did not seem to have been closed at first. It differs, also, from *B. reticulatus* BOUD. [should read SCHAEFF. = *B. edulis* subsp. *reticulatus*, or *B. edulis* var. *reticulatus*, resp.] in the subcylindric stem, and the shorter spores. Possibly *B. (Xerocomus) lubricus* with shorter spores and, perhaps, phylloporoid trama is allied. Compare, also the American *B. atkinsonianus* with non-reticulate stem (COKER & BEERS 1943, SINGER 1947) and the Australian *B. sinapecruentus* CLELAND (1934-1935)” (CORNER 1972).

***Boletus lubricus* CORNER, *Boletus* in Malaysia: 243, 1972**

**Diagnosis originalis:** Pileus -4,5 cm, convexus viscidus umbrinus levis. Stipes -10 × 0,8 cm, basim versus 1 cm, subcylindricus siccus, cervino-brunneus, apicem versus brunneo-furfuraceus v. pruinosus. Tubi -5 mm, adnexi flavidi (primrose yellow) dein olivacei; poris parvis concoloribus. Caro 8 mm crassa, pallide brunneo-alba, haud cyanescens. Sporae pallide flavae s.m. leves boletoideae, 9-11,5 × 4,5-5 µm. Ad humum in silva. Borneo, Kinabalu, fl. Bembangan 1700 m alt., 3 March 1964, RSNB 5612 (CGE).

**Characters:**

**Micromorphology:** Cheilocystidia mostly like small sterile basidia but some subfusoid up to 45 × 5-9 µm. Trama of the tubes phylloporoid or ?sub-boletoid. Surface of the pileus with interwoven and radiating, adpressed hyphae 3-6 µm wide with mucilaginous walls.

**Notes:** *Boletus lubricus* is placed in subgenus *Xerocomus* (CORNER 1972). Further studies are necessary to reveal the true relationship.

***Boletus reticuloceps* (M. ZANG, M. S. YUAN & M. Q. GONG) Q. B. WANG & Y. J. YAO, Sydowia 57(1): 132, 2005**

**Basionym:** *Aureoboletus reticuloceps* M. ZANG, M. S. YUAN & M. Q. GONG, Acta Mycol. Sinica 12: 277, 1993.

**Selected illustrations:** WANG & YAO (2005): 24, YUAN & SUN (2007): no. 393.

**Diagnosis originalis:** Pileus 12-15 cm latus, convexus demum planoconvexus, siccus, punctulatus, rugulosus, reticulate-venosus, flavus, brunneo-flavus. Superficies pilei hyphis 8-19 µm, intertextis. Contextus 1,5-2 cm crassus, flavus, immutabilis. Hymenium aureum. Tubuli 0,6-1,5 cm longi, flavi, adnexi vel sinuatoadnexi. Pori angulares vel irregulares, 2-3 per mm. Stipes 8-10 cm longus, 2-3 cm crassus, clavatus, reticulatus, basin versus bulbosus, flavus. Mycelio flavo vel albido. Basidiosporae 19-22 × 5,2-7 µm, ellipsoideae, angusto-ellipsoideae, leves, hyalino-aurantiacaе. In solutione Melzeri brunneo-aurantiacaе, pleurocystidia 27-35 × 9-13 µm, fusiformia. Cheilocystidia 30-45 × 10-13 µm, clavata. Fibulae adsunt. Habitat: in sylvis praecipue *Abietis faxonianaе* REHD. et WILS. Sichuan: Hong Yuan County, Shua Jing Temple 3600 m, alt. 23. VIII. 1991. YUAN MING-SHENG 1662 (Typus HKAS 23856).

**Characters:**

**Pileus:** 5-15 cm in diam., hemispherical to convex, young margin incurved, with an obvious band of sterile tissue at the pileus margin; surface dry, ochraceous brown to ochraceous, paler at the margin, distinctly rugose, wrinkles forming a reticulate structure when fresh, densely covered with brown to grey-brown granular squamules.

**Hymenophore:** tubes 1.5-2.5 cm long, greenish, becoming greenish yellow to yellow, unchanging when bruised, adnate around the stipe, pores round to subangular, 1-2 pores per mm, young white and stuffed, yellow to ochreous when mature, unchanging when bruised.

**Stipe:** robust, 6-11 cm long, 1.5-3.0 cm thick, grey-brown to ochreous, solid, enlarging downwards, sometimes bulbous, conspicuously reticulate with pallid raised meshes; basal mycelium pale yellow.

**Context:** white, often with pinkish tinge in cap, unchanging when bruised, smell and taste mild.

**Micromorphology:** spores in mass pale olive-brown to brown, 15-17.5(-19.5) × 5-6.5(-7.5) μm, Q = 2.8, statement in the original description (see above) incorrect! Pleurocystidia rare, 40-64 × 8-16 μm, clavate to fusoid. Tube trama of the *Boletus*-type. Pileipellis of interwoven hyphae, protruding hyphal clusters up to 360 μm high (i.e. the granular squamules on the pileus).

**Habitat and distribution:** under *Abies* spp. China.

**Notes:** WANG & YAO (2005) state: *Boletus reticuloceps* “was considered by ZANG & al. (1993) as similar to *Aureoboletus thibetanus* which also has a reticulate and rugose pileus. Moreover, the stipe of *A. thibetanus* is not reticulate. Neither macro- nor micro-characters of *A. reticuloceps* fit the concepts of *Aureoboletus* or *Pulveroboletus*. In fact, the dry pileus, the reticulate stipe, the white hymenophore when young, and the lack of veil on both the pileus and the stipe, and the absence of golden yellow pigment in tramal hyphae in *A. reticuloceps* conform to the characters found in the genus *Boletus* FR.” (sect. *Boletus*).

***Boletus castanopsisidis* HONGO** in KOBAYASI & al., Bull. Natl. Sci. Mus., Tokyo **16**(3): 574, 1973

#### **Characters:**

Pileus glabrous (not viscid), similar wrinkled as in *A. thibetanus*, up to 7 cm in diam., but colour olivaceous, olive-brown or greyish yellow; flesh white; tubes whitish then greyish yellow or sordid brownish; spores up to 23 × 7 μm. It is a member of sect. *Boletus*.

**Habitat and distribution:** under *Castanopsis*, *Quercus*, *Araucaria*. New Guinea.

### **5.3 Australian species:**

***Boletus sinape-cruentus* CLELAND**, Trans. Proc. Roy. Soc. South Australia **58**: 213, 1934

**Diagnosis originalis:** Pileus 7,5-12,5 cm, convexus, raro in centro depressus, viscidus, sinape-croceus et cruentus et brunneus. Tubuli 5-25 mm, circum stipitem sulcus, intus attenuati, subventricosi, angulati, sinaprocerei vel lutei vel melleo-flavi; oribus 0,5-1 mm. Stipes 5-7,5 × 1,8 cm, infra et interdum supra attenuates, luteus ad sinape-croceum, rubro-punctatus. Caro primulino-crocea, in locis cyaneo-viridis. Sporae elongatae, brunneae, 10,5-15 × 4-5 μ. Australia, S. A.-National Park, Mount Lofty, Eagle-on-the-Hill.

#### **Characters:**

**Pileus:** viscid, mustard-yellow with brown patches and finally deep brown, with yellow-brown patches around margin, or bay in centre passing to mustard-yellow peripherally, up to 12.5 cm.

**Hymenophore:** tubes angular, unequal, near mustard-yellow, colonial buff, honey-yellow to golden, turning dark dingy green especially when bruised.

**Stipe:** buff to light cadmium- to mustard-yellow, with a broad band of punctae, red or reddish brown in the middle or at the base.

**Context:** yellowish, turning bluish-green and later sometimes reddish-brown, in stipe sometimes primuline-yellow above, turning bluish-green in places, sometimes dark red at base.

**Micromorphology:** spores 11.4-16.8 × 5.5-7.4 μm, Q = 2.2. Pleurocystidia up

to  $82 \times 22.5 \mu\text{m}$ , clavate to cylindro-ventricose. Pileipellis a trichodermium of filamentous hyphae up to  $6 \mu\text{m}$  in diam., encrusting pigment present.

**Notes:** *Boletus sinape-cruentus* "is characterised by being viscid when moist, by the yellow and reddish-brown pileus, the mustard yellow tubes, and yellow stem punctate with red below, and by the flesh turning blue in parts" (CLELAND 1934-1935). GRGURINOVIC (1997) adds: "The *Boletus*-habit, the viscid pileus, and the pore size indicate that this species belongs in section *Luridi*, as defined in SINGER". A species, described as "*Boletus sinape-cruentus*" by WATLING & GREGORY (1989) from Western Australia is not conspecific (WATLING & LI 1999).

Especially the blue turning flesh distinguishes *B. sinape-cruentus* from *Aureoboletus*.

## 6. Excluded and critical species named „*Aureoboletus*“

*Aureoboletus cramesinus* ss. auct. sin. = ? *Boletus* spec.

As keyed in ZANG (2006), with *Picea*, stipe reticulated, pileus diam. more than 6 cm, pileus not viscid, spores up to  $20 \mu\text{m}$  long, it is not a clear taxon.

*Aureoboletus* spec. 1 ss. WATLING & TURNBULL (1992)

Pileus 40 mm, convex, somewhat irregular, smooth, dry, vinaceous/bay/blood, stipe  $45 \times 15 \text{ mm}$ , tapering upwards, solid vinaceous/bay, yellow near tubes, darkening towards base, centre pale yellow, the top half rapidly bruising indigo. Context pure yellow, firm 14 mm thick at disc, near tubes bruising indigo, then fading. Tubes adnate pure yellow (chrome), 7 mm long; pores small, angular, pure-yellow. Taste not distinctive. Spores up to  $10.5 \times 5.7 \mu\text{m}$ , cystidia lageniform to cucurbitiform up to  $35 \times 7.5 \mu\text{m}$ .

Based on dried material from M. H. IVORY (31), 7. 4. 1975, FP 380/1, Zambia, Kitwe, in relic miombo woodland, in side of trench (WATLING & TURNBULL 1992). WATLING & TURNBULL (1992) comment: "This collection closely approaches the North American *Boletus innixus* FROST".

*Aureoboletus thibetanus* ss. WATLING & HOLLANDS (1990), = ? *Boletus* spec.

Cap (0,7,1,5-), 1.7(2,1)", scarlet (dark blood red) pileus, surface slightly sticky; pores pale apricot becoming fawn to darker brown, stipe yellowish just below cap and sometimes at base, greater part crimson shading darker often in indistinct lines or patches and often overlaying a paler yellowish red, context in pileus pale cream yellow, in stipe also but usually pinkish, the area around the junction of stipe and pileus staining blue, spores up to  $11.5 \times 5.5 \mu\text{m}$ , pleurocystidia ampulliform, up to  $35 \times 10 \mu\text{m}$ , cheilocystidia similar, some also elongate clavate.

Based on dried material from P. J. B. WOODS, (14) 9. 7. 1962, Sarawak, Miri, Lam-bir Hills, dry forest of dipterocarps and *Dryobalanops* spec., specimen accompanied by colour transparencies (E) (WATLING & HOLLANDS 1990).

*Aureoboletus thibetanus* ss. IMAZEKI & al. (1988) = ? *Boletus* spec.

**Selected illustration:** IMAZEKI & al. (1988): 314.

It has a dry, not veined-reticulate pileus.

## 7. Further excluded and critical species

### *Boletus glutinosipes* SNELL & HESLER 1940]

Details of the original description following BOTH (1993): “pileus pale yellow-brown tinged olivaceous and streaked reddish-brown, context pallid, unchanging; tubes lemon-yellow to light greenish yellow, unchanging; stipe glutinous most of its length, pallid yellow above, pale reddish-brown in mid-portion, base white, tomentose”.

This dubious taxon from Tennessee, Great Smoky Mountains, has not been reported in literature since its publication (also not even in HESLER 1960). E. E. BOTH (pers. comm.) notes: “It appears to be close to *Boletus auriporus*”.

### *Boletus tunetanus* PAT. 1897

Pat. Cat. Tunisie (Pat. Explor. Tun. Ill. bot. t. 5 f. 1)

Description by SARTORY & MAIRE (1931): “Pileo convexo, carnosio, laevi, glabro, viscidulo, pallide ocraceo, 4-5 cm lato, margine concolori; tubulis aureis, labyrinthiformis, radiantibus, mediis, versus marginem minoribus, 5-8 mm longis, longe lateque decurrentibus; 0 cystid.; sporis ovato-fusiformibus pluriguttulatis ocraceis, 12-15 × 5-6; stipite circiter 10 cm longo, 10-12 mm crasso, cylindraceo-flexuoso, medio incrassato, deorsum regulariter attenuato, luteo, apice cristato-lamellato; carne alba, dein incarnata; stipite cavo, annulo nullo. Under *Quercus*”.

**Notes:** *Boletus tunetanus* is remarkable by the brilliant yellow, labyrinthiform, large tubes far decurrent (2 cm) from the top of the stipe, and the reddening context. After its original description, the species has obviously never more been discovered until now and has to be considered as a nomen dubium.

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