

## A STUDY OF THE TYPE AND ADDITIONAL MATERIALS OF *BOLETUS THIBETANUS*\*

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**Abstract:** Based on study of the type and additional materials, *Boletus thibetanus* was described and illustrated in detail. Data showed this species is a member of the genus *Aureoboletus*. Misinterpretation of the concept of this species in the literature was discussed.

**Key words:** *Aureoboletus*, new description

*Boletus thibetanus* was described by Patouillard (1895) based on a collection made from southwestern China. Although this species is very characteristic, it has poorly been documented in the literature (see Chiu, 1948, 1957; Zang *et al.*, 1993; Ying & Zang, 1994; Zang, 1996). Thus, misinterpretation of the concept of this species is unavoidable (see remarks). Furthermore, the systematic position of this species is still uncertain. In the past, *Boletus thibetanus* was transferred into the genera *Suillus* P. Micheli ex Gray (Tai, 1979), *Aureoboletus* Pouzar (Hongo & Nagasawa, 1980), and then *Pulveroboletus* Murrill (Singer, 1986).

The first two authors made some field observations of this species in the last few years, and restudied the type deposited in Farlow Herbarium (FH), Harvard University, and additional materials in the Herbarium of Cryptogams of Kunming Institute of Botany (HKAS). The last author

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made a phylogenetic analysis of this species with some members of boletoid fungi based on large-subunit ribosomal DNA sequences (data unpublished). Our morphological and molecular data showed this species is a member of *Aureoboletus*. In this article, a detailed description and illustrations for this species are provided. Methodology and notation follow those of Yang (2000), and Yang *et al.* (2001). Figures 1–4, 6–7 were illustrated using fresh material.

***Aureoboletus thibetanus*** (Pat.) Hongo & Nagas., Rept. Tottori Mycol. Inst. (Japan) 18: 133, 1980; Zang, Yuan & Gong, Acta Mycol. Sinica 12: 275, fig. 1/1-2, 1993; Ying & Zang, Economic Macrofungi Southwestern China: 226, 1994; Zang, Fungi Hengduan Mountains: 256, 1996.

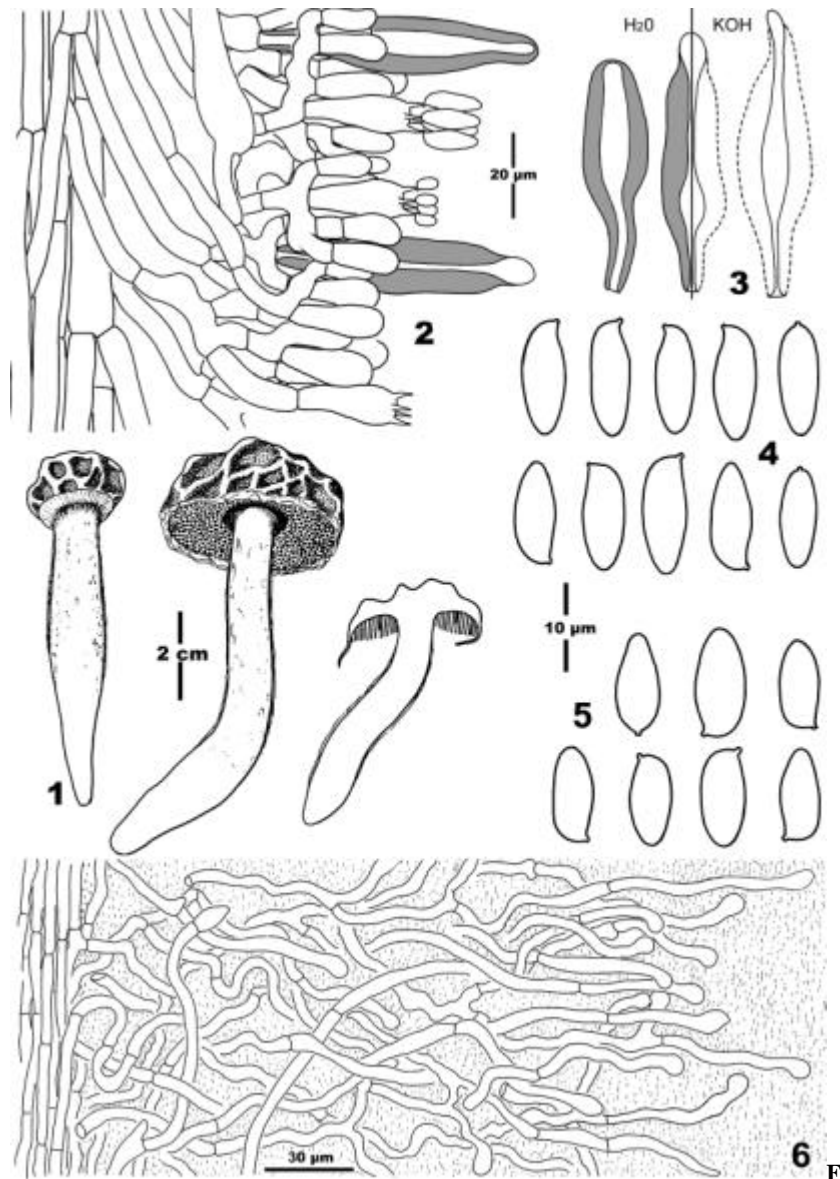
*Boletus thibetanus* Pat., Bull. Soc. Mycol. France 11: 196, Pl. XIII, fig. 2, 1895; Chiu, Mycologia 40: 204, 1948; Chiu, Atlas Yunnan Boletes: 26, 1957.

*Suillus thibetanus* (Pat.) F.L. Tai, Syll. Fung. Sinic.: 736, 1979.

*Pulveroboletus thibetanus* (Pat.) Singer, Agaricales Modern Taxon. (4th ed.): 774, 1986.

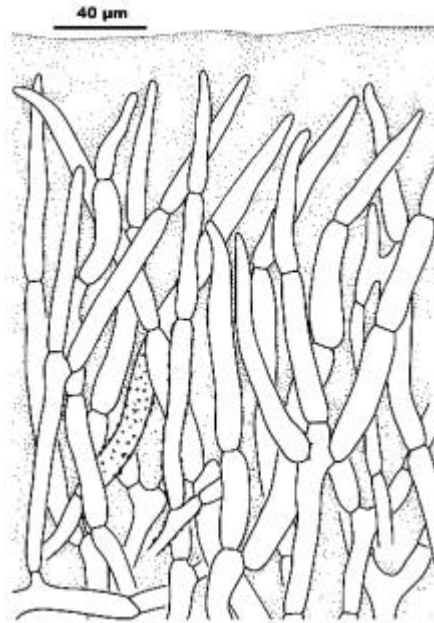
#### Figs. 1–7

Fruitbody (Fig. 1) usually small. Pileus 1.5–5 cm in diam., convex to applanate, chestnut-brown, rusty brown to pale brown, sometimes with dull reddish tinge, distinctly reticulate, sometimes coarsely rugose, rarely nearly flat, strongly viscid when wet; margin appendiculate with yellowish then hyaline to subhyaline, strongly gelatinized veil remnants. Context up to 8 mm thick at center, whitish-yellow to yellow, occasionally brownish, unchanging, purplish brown beneath the pileipellis. 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 discoloring bluish very slowly; pores 0.5–1(1.5) mm in diam., round to angular, sometimes compound, yellow; tubes yellow, up to 8 mm deep. Stipe 4–8 × 0.3–1 cm, subcylindric to subfusiform; surface whitish, cream to yellowish, often with rosa tinge, smooth, without nets, sometimes longitudinally fibrillose, gelatinous to strongly viscid especially when young and wet, basal mycelium white. Odor none. Taste mild. Spore print “Light Brownish Olive” to somewhat paler than “Citrine-Drab” [4D5–6 to 4E7–8].



**igs. 1–6: *Aureoboletus thibetanus*.** 1. Basidiocarps; 2. Lamellar trama, basidia, subhymenium and pleurocystidia; 3. Cystidia in H<sub>2</sub>O and 5% KOH; 4–5. Basidiospores; 6. Stipipellis (HKAS 38216).  
 1–4 from HKAS 41151, 5 from type, 6 from HKAS 38216.  
 Shaded parts are strongly refractive.

Lamellar trama bilateral (Fig. 2). Mediostratum yellowish, composed of branching hyphae 3–10  $\mu\text{m}$  wide, hardly to only slightly gelatinized. Lateral stratum composed of branching hyphae 3–7 (10)  $\mu\text{m}$  wide, gelatinized, diverging at an angle of  $30^\circ$ – $60^\circ$  to the mediostratum. Subhymenium ca. 20  $\mu\text{m}$  thick, composed of frequently branching and septate hyphae 3–8  $\mu\text{m}$  wide. Basidia 24–30  $\times$  8–10.5  $\mu\text{m}$ , clavate, 4-spored, rarely 2-spored; sterigmata 3–4  $\mu\text{m}$  long; basal septa without clamps. Spores (Figs. 4–5) (9.0) 9.5–13.0 (15.0)  $\times$  (4.0) 4.5–5.0 (5.5)  $\mu\text{m}$  [ $Q = 2.1$ – $2.7$  (3.0),  $Q = 2.4 \pm 0.2$ ], boletoid, inequilateral in



**Fig. 7:** *Aureoboletus thibetanus*  
Pileipellis (HKAS 41151).

side view with a weak or distinct suprahilar depression, elliptic-fusiform to subfusiform in ventral view, yellowish in KOH. Pleurocystidia (Figs. 2, 3) 30–75  $\times$  4–10  $\mu\text{m}$  (yellow substance on surface excluded), subcylindrical, subfusiform to clavate, thin walled, nearly colorless, but outer surface covered with a 5–8  $\mu\text{m}$  thick layer of strongly refractive yellow substance which can quickly and completely be solved in 5% KOH when fresh material studied (Fig. 3). Cheilocystidia similar to pleurocystidia in form and size. Pileipellis (Fig. 7) an ixotrichodermium composed of loosely and more or less vertically arranged (but such arrangements often collapsed when fruitbody dried), frequently septate hyphae 4–8 (12)  $\mu\text{m}$  in diam. embedded in a gelatinized matrix, hyphal surface often with yellowish granular incrustation soluble in 5% KOH, sometimes with yellowish to brownish vacuolar pigments; apical elements subcylindrical to lanceolate, 30–80  $\times$  5–8  $\mu\text{m}$ , apical part often narrower. Hyphae of pileal context often with yellow to golden yellow vacuolar pigments. Veil remnants on pileal margin composed of strongly gelatinized filamentous hyphae 3–6  $\mu\text{m}$  in diam., often colorless. Stipipellis (Fig. 6) ixotricho-

dermium, about 250–400  $\mu$ m thick, composed of branching hyphae 4–7  $\mu$ m wide, terminal cells 35–50  $\times$  4–8  $\mu$ m, tips often swollen.

**Specimens examined:** CHINA. YUNNAN PROVINCE: Kunming, Xishan (“Shishan”), 11-VIII-1942, W. F. Chiu 7851 (HMAS 3851); the same location, 22-VII-1942, W. F. Chiu 7896 (HMAS 3896); Kunming, Heilongtan, under *Quercus acutissima*, 13-VII-1991, M. Zang 11881 (HKAS 23349); Kunming, Heilongtan, Botanical Garden, 1980 m, under *Quercus franchetii*, 4-IX-1999, Z. L. Yang 2633 (HKAS 34077); the same location, 4-VII-2001, F. Q. Yu 425 (HKAS 38216); the same location, 11-VIII-2002, Z. L. Yang 3225 (HKAS 41151); Jianchuan, Shibaoshan, under Fagaceae forest, 19-VIII-1999, X. H. Wang 853 (HKAS 35889); SICHUAN PROVINCE: Kangding (“Tchen-Kéou-Tin”), in 1894, R. P. Farges *s.n.* (Herb. Patouillard, FH 3711-type).

**Remarks:** Patouillard (1895) described *Boletus thibetanus* from southwestern China, without any citation of vouchers. The first author found a sole collection labeled as "*Boletus thibetanus*" with handwriting of N. Patouillard in the Patouillard's herbarium housed in Farlow Herbarium (FH 3711). It is probably the only voucher specimen based on which the name was proposed and, thus, was designated as the type for the taxon by Zang *et al.* (1993). Ying & Zang (1994), and Zang (1996) stressed that the pileus of the type specimen of *A. thibetanus* is smooth, not reticulate. The first author studied the type, which consists of only one fruitbody in very poor condition, and only the spores could be measured. They are [30/1/1] (9.0) 9.5–12.0  $\times$  4.0–5.0 (5.5)  $\mu$ m [Q = 2.1–2.4 (2.7), Q = 2.3  $\pm$  0.1]. Whether the pileus is smooth or not couldn't be concluded with certainty from the observation of the dried type specimen. However, Patouillard's original description and illustration clearly showed that the pileal surface is reticulate, and the pileal margin is appendiculate, which were also observed by Chiu (1948, 1957) and us from the material cited above (see Fig. 1).

Chiu (1948, 1957) described that the pileus was “densely covered with dark-brown-dotted elements”. His collections preserved in HMAS (3851, 3879) showed that such “dots” are just the still unexpanding reticulum of a young pileus.

The cystidia of *A. thibetanus* are very characteristic with a thick layer of strongly refractive yellow substance on the surface. The

substance can completely be dissolved in 5% KOH when fresh material studied (Fig. 6), but only partially disappears in 5% KOH when dried material examined. The content of the cystidia are nearly colorless, hyaline to subhyaline.

Corner (1972) reported *Boletus thibetanus* from Singapore. Hongo & Nagasawa (1980), and Imazeki *et al.* (1988) reported *A. thibetanus* from Japan. However, according to their descriptions and illustrations, the Singapore and Japanese boletes may not be conspecific with the material described here, because there are a few important discrepancies between the materials made from southwestern China and Japan, or from southwestern China and Singapore. For example, no reticulate pileus with appendiculate margin, and no thin-walled cystidia with refractive substance on the surface were reported by them.

Hongo & Nagasawa (1980) regarded *A. novoguineensis* Hongo as a synonym of *A. thibetanus*. However, Hongo's species has a radially rugose pileus, thin-walled cystidia with golden-yellow contents, and the pileal margin may not be appendiculate (Hongo, 1973).

Mao *et al.* (1993) described *A. thibetanus*, under the name "*Austroboletus thibetanus* (Pat.) Hongo & Nagasawa". According to their descriptions and illustration, they may not deal with the true *A. thibetanus*. Mao (2000) published a photo under the name "*Austroboletus thibetanus* (Pat.) Hongo & Nagasawa". The photo (fig. 830) may be a representative of *Boletellus obscurecoccinus* (Höhn.) Singer. In the same book under the name *Boletellus longicollis* (Ces.) Pegler & T.W.K. Young two photos (figs. 827-1, and 827-2) were accompanied. Fig. 827-2 is *A. thibetanus*.

*Boletus umbilicatus* Mass., a species also with viscid fruitbody and somewhat rugose pileus, is similar to *A. thibetanus* (see Corner: 136), but can be distinguished from the latter by the smearily zoned stipe, grayish white then olivaceous yellowish hymenophore and thin-walled colorless cystidia.

*Aureoboletus reticuloceps* M. Zang *et al.*, originally described from southwestern China, also possesses a reticulate pileus (Zang *et al.*, 1993). However, *A. reticuloceps* has much stouter fruitbody with a dry pileus, a dry stipe with a whitish reticulum, a whitish then yellowish hymenophore, significantly larger spores and lacks gloeocystidia. Whether it is a member of *Aureoboletus* or not needs studying further.

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## References

- Chiu WF (1948) The boletes of Yunnan. *Mycologia* 40: 199–231.
- Chiu WF (1957) “Atlas of the Yunnan Boletes”. Beijing: Science Press.
- Corner EJH (1972) *Boletus* in Malaysia. Singapore: Government Printing Office.
- Hongo T (1973) Enumeration of the Hygrophoraceae, Boletaceae and Strobilomycetaceae. *Bull. Natn. Sci. Mus.*, Tokyo 16: 537–557.
- Hongo T, Nagasawa E (1980) Notes on some boleti from Tottori V. *Rept. Tottori Mycol. Inst. (Japan)* 18: 133–141.
- Imazeki R, Otani Y, Hongo T (1988) “Fungi of Japan”. Tokyo: Yama-kei Publishers Co., Ltd..
- Mao XL (ed.) (1998) “Economic Fungi of China”. Beijing: Science Press.
- Mao XL (ed.) (2000) “The Macrofungi in China”. Zhengzhou: Henan Science & Technology Press.
- Mao XL, Jiang CP, Ouzhu CW (1993) “Economic Macrofungi of Tibet”. Beijing: Beijing Science and Technology Press.
- Patouillard N. (1895) Énumération des champignons récoltés par les RR. PP. Farges et Soulié, dans le Thibet oriental et Su-tchuen. *Bull. Soc. Mycol. France* 11: 196–199.
- Singer R (1986) “Agaricales in Modern Taxonomy”. 4<sup>th</sup> Edit. Vaduz: J. Cramer.
- Tai FL (1979) “Sylloge Fungorum Sinicorum”. Beijing: Science Press.
- Yang ZL (2000) Type studies on agarics described from N. Patouillard (and his co-authors) from Vietnam. *Mycotaxon* 75: 431–476.

- Yang ZL, Li TH, Wu XL (2001) Revision of *Amanita* collections made from Hainan, southern China. *Fungal Diversity* 6: 149–165.
- Ying JZ, Zang M (eds.) (1994) “Economic Macrofungi from Southwestern China”. Beijing: Science Press.
- Zang M (ed.) (1996) “Fungi of the Hengduan Mountains”. Beijing: Science Press.
- Zang M, Yuan MS, Gong MQ (1993) “Notes on and additions to Chinese members of the Boletales”. *Acta Mycol. Sinica* 12: 275–282.