NOTES ON SEVERAL BOLETI FROM YUNNAN, CHINA

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Abstract: Revisions and notes on several boleti published or recorded from Yunnan are presented. One new combination is Boletellus punicus. Boletus megasporus is identical with B. punicus. Boletus tomentulosus and Boletus umbriniporus are synonyms of Boletus brunneissimus. Boletus crocipodium sensu W.F. Chiu is Leccinum extremiorientale. Notes are also made on Heimiella retispora based on several Yunnan specimens.

Key words: Types, Boletellus punicus, Synonym

In the last century many new or interesting species of boleti were reported from Yunnan, China (Chiu, 1948, 1957; Keissler & Lohwag, 1937; Teng, 1963: 545; Ying, 1986; Ying & Ma, 1995; Zang, 1980, 1983, 1991a, 1992; Zang et al., 1993). Some of them are endemic in China, East Asia or Southeast Asia. A recent re-examination of several types and additional collections deposited in HKAS, HMAS and TNS provided some noteworthy information on several taxa.


   =Boletus umbriniporus Hongo, Journ. Jap. Bot. 44: 235, Fig. 2. 4-7 (1969).

Pileus 4-10 cm in diam, convex, wholly velvety to sub-velvety, more or less viscid when wet, drying often cracked, light brown (5D7), brown (5E8) to dark brown when fresh, brown (6E6) to dark brown (6F5-6F6) in dry specimens. Stipe 3-7 cm long, 0.5-2 cm thick, cylindric, equal or swollen at base, solid, not reticulate, minutely scurfy with numerous dark brown dots, apex yellow to yellowish-brown (5D6), middle and base dark brown.

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brown (6F6), base prominently strigose with yellowish brown hairs. Tubes 5-6 mm long, almost free, yellowish; pores minute, deep yellowish brown to dark brown (6F6). Flesh 5-15 mm thick, yellow, flesh inside stipe yellowish brown, upper portion cyanescent, base slightly or not. All parts of the basidiome deeply and quickly cyanescent when bruised. Taste mild. Odor not distinctive.

Fig.1-4: Boletus brunneissimus (Holotype).
1. Basidiospores; 2. Pleurocystidia;

Spores [201/5/5] (8.0-)9.0-12.0(-14.0) × (3.7-)4.0-5.0(-5.8) μm [Q = (1.82-)2.20-2.86(-3.48), Q = 2.47 ± 0.20], smooth, boletoid, yellowish brown. Pleurocystidia 23.0-60.0 × 6.0-12.5 μm, abundant, fusiform, apex often sharply pointed, almost hyaline or with dense yellowish-brown contents. Cheilocystidia 25.0-55.0 × 6.0-10.5 μm, abundant, similar to pleurocystidia. Pileipellis a compact pile, 80-100 μm thick, composed of erect hyphae, 4-7 μm wide, with yellowish-brown contents, terminal cells with obtuse tips. Surface of the stipe covered with a compact hymenium of clavate sterile basidia and fusiform thin-walled cystidia. Hairs at stipe base composed of fasciculate hyphae, 2.5-5 μm wide, thin-walled to slightly thick-walled, yellowish brown, some branched, septate, terminal cells rounded to slightly attenuate. Clamps absent on all septa.


Hab.: Under Pinus or in mixed forests

Note: Some dark staining on the pores indicating that the hyme
nophore was cyanescent when bruised, and the dense hairs at the stipe base
were observed on the holotype. Both characters were also found on all of the other collections cited above. They are the most typical and distinctive characters of this fungus. However, because they were not mentioned by Chiu (1948, 1957: 136-141), they had been overlooked before. Due to the yellowish and cyanescent tubes and the brownish pores, B. bruneiissimus belongs to sect. Boletus subsect. Luridii (Fr.) A. H. Sm. et Thiers.

In subsect. Luridii there are several species similar to this species. The North American B. vermiculosus Peck can be distinguished from B. bruneiissimus in the pileus and pores with a red tone, not scurfy stipe and longer spores (11-15 × 4-4.5(-6) μm) (see Smith & Thiers, 1971: 333-336). Though the pileus and pores of B. vermiculosoides A. H. Sm. et Thiers lack a reddish tinge, its stipe is not punctate, pileipellis not trichodermium and spores much narrower (9-12 × 3-3.5 μm) (see Smith & Thiers, 1971: 337-338).

In Southeast Asia and adjacent regions, B. kumaeus R. Heim has several characters in common with B. bruneiissimus, but it differs by the reddish tinge on the pileus, stipe and pores (see Heim, 1963). Boletus kumaeus var. rubricollum Corner is more similar to B. bruneiissimus (Corner, 1972: 112-113), however, stipe apex of B. bruneiissimus is never red and the terminal cells of the pileipellis are not so acute as shown in Corner’s illustrations (see Corner, 1972: 112-113).

The three Japanese species with brownish pores, B. fuscopunctatus Hongo et Nagas., B. obscureumbrinus Hongo and B. umbriniporus Hongo are closer to this fungus. The basidiomes of the former two, however, are much stouter (see Hongo, 1968, 1976b, 1978) and, in particular, the stipe base of B. fuscopunctatus is not strigose (Hongo, 1976b, 1978) and the stipe of B. obscureumbrinus is not punctate (Hongo, 1968). Boletus umbriniporus, the species regarded to be close to B. erythropus (Fr.) Fr. and B. nigro-violaceus R. Heim (Hongo, 1969, 1978), actually fits B. bruneiissimus better. Re-examination of both holotypes HMAS 07249 (B. bruneiissimus) and TNS-F-174783 (B. umbriniporus) proved the two taxa are identical in every aspect.

Boletus tomentulosus M. Zang, W.P. Liu et M.R. Hu, a species reported from Fujian, China, differs from B. bruneiissimus only by the larger spores and the lack of pleuro- and cheilocystidia (see Zang et al., 1991). However re-examination of the holotype (HKAS 18718) showed that the spores are [40/1/1] (9.7-) 10.0-12.5 (-13.0) × 4.0-5.0 μm [Q = (1.82-) 2.20-2.86 (-3.48)]. Q = 2.47 ± 0.20, almost the same as those of B. bruneiissimus and the cystidia are abundant in the hymenium (see Fig. 5-6). We noticed that the cystidia of the two holotypes are somewhat different in dimension and color. The specimens collected at the same locality and sharing the same characters as those of the holotype of B. bruneiissimus bear cystidia with variable morphology. We suspect that the cystidia of B.
*brunneissimus* might be variable because of different environments and development stages of the basidiomes. Because there are no fundamental differences between *B. brunneissimus* and *B. tomentulosus*, we regard the latter as a synonym of the former.

This mushroom is sold as an edible fungus in large quantity on the markets in Central Yunnan. Its local name "Cat Eye Mushroom" and "Black Goat Liver" suggest the color of the basidiomes.

Only reported in China and Japan up to now, it might be a typical element of East Asia.


≡ *Boletus megasporus* [as "megasporus"] M. Zang, Acta Micro. Sin. 20(1): 30, Fig.1.3-4 (1981).

Pileus 3.5–8 cm in diam, hemispheric to convex, subvelvety to subtomentose all over, margin minutely squamulose, carmine to light rose-reddish. Stipe 6–11 cm long, 0.8–2 cm thick, cylindric, equal or slightly attenuate upwards, almost glabrous to minutely fibrillose, concolorous with pileus. Tubes 1–1.7 cm long, sinuate, bright yellow, not cyanescant; pores 1–2.5 mm wide, angular, bright yellow. Flesh whitish, not cyanescant. Taste bitter. Odor not distinctive.

Spores [266/8/7] (14.0-15.0-18.5(-20.0) × 6.0-8.0(-9.0) μm [Q = (1.90-2.07-2.69(-2.92), Q = 2.37 ± 0.19], broadly fusoid, ochraceous brown, with inconspicuous longitudinal striations. Basidia 37.5-50.0 × 10.0-17.5 μm, clavate. Pleuro- and cheilocystidia 50–70 × 10–18 μm, scattered, conspicuous, ventricose, apex subcapitate, thin-walled, often with yellowish-brown content. Pileipellis composed of somewhat inflated hyphae, as a pile, end cells about 10–15 μm wide. Surface of the stipe composed of longitudinal parallel hyphae, 4.5–9 μm wide. Clamps absent.

Hab.: On soil in mixed forest under Camellia, Castanopsis, Lithocarpus, Pinus yunnanensis, Taiwania flousiana, bamboo.
Plate 1 Scanning Electron Micrographs of Spores

A: Boletellus puniceus (HKAS 38218)  B: Boletus megasporus (Holotype)

Note: The holotype of Boletus puniceus W.F. Chiu was transferred from the Plant Pathology Herbarium of Tsinghua University to HMAS. No. 7825 was assigned as the type when the species was published. In HMAS, however, the type is HMAS 3852 (Tsinghua 7852). 7825 is clearly a typographic error.

The species was transferred into Xerocomus by Tai (1979) for the tomentose pileus. Without studying the type of B. puniceus, Corner (1972: 101) questioned the presence of smooth spores and suspected that B. puniceus is the same as B. obscurecoccineus (Höhn.) Singer. Chiu (1948, 1957: 80-81) described and illustrated its spores as smooth. Re-examination of the holotype showed that it is a Boletellus with very faintly longitudinally striated spores. The striations are rather clear under SEM (see Pl. 1). The large and longitudinally ornamented spores combined with the broad pores of this species indicate placement in the genus Boletellus. Thus the new combination is proposed here.

With the carmine basidiomes and large spores, the Yunnan species B. megasporus M. Zang was considered to be close to B. puniceus but differs from the latter by its smooth stipe, bitter flesh and larger spores (Zang, 1980). The spores of both holotypes were re-measured: B. megasporus (HKAS 3963): [72/2/1] (14.5-15.0-19.0-20.0) × (6.5-6.5-8.0-9.0) μm [Q = (2.00-2.12-2.69/(2.77), Q = 2.38 ± 0.17]; B. puniceus (HKAS 3852): [74/1/1] 15.0-18.0(-19.3) × (6.3-)6.7-8.0(-9.0) μm [Q = (1.90-2.05-2.54 (-2.64), Q = 2.30 ± 0.16]. The spores of both holotypes are faintly longi-
tudinally striated. Both stipes are composed of longitudinally arranged parallel hyphae. The collections most like *B. puniceus* recently obtained from the type locality and the adjacent areas have bitter flesh. No essential difference was found.

Singer (1945) reported that the type of *B. obscure-coccineus* bears large spores with distinct ridges; those of *B. puniceus* are only faintly striated to even smooth.


≡*Boletus retisporus* Pat. et Baker, Journ. Straits Branch. R. Asiatic Soc. 87. 72 (1918).

Pileus 3-7 cm in diam, hemispherical then convex, subtomentose, slightly greasy when wet, red to deep red, darker at center. Stipe 6-14 cm long, 0.6-1.2 cm thick at apex, 1.0-3.0 cm thick at the base, attenuate towards the apex, the apex clear yellow, middle and base dark-red, over whole length coarsely reticulate, meshes on the upper and middle portion bright yellowish, at base reddish, mycelium at base whitish or with faint ochraceous tinge. Tubes up to 1.5 cm long, deeply depressed, yellow; pores small to medium-size, yellowish near pileus margin, often red and with orange tinge towards the center, unchanging or faintly cyanescent. Flesh 4-6 mm thick halfway to the margin, yellow, red beneath cutis, unchanging or faintly cyanescent only. Taste mild. Odor not distinctive.

Plate 2 Scanning Electron Micrographs of Spores of *Heimiella retispora* (IIKAS 32686)

Spores (including ornamentation) [80/4/4] (14.5-)16.0 -19.0(-25.0) × (9.5-)10.5-13.0 (-14.0) μm, spores body (excluding ornamentation) [69/4/4] (12.0-)12.5-16.0(-22.0) × (7.0-)7.5-10.0(-11.0) μm, broadly elliptical, with irregular ridges and meshes, golden yellowish brown. Basidia 32.0-40.0 × 13.0-15.0 μm, 4-spored, clavate. Pleurocystidia (60-)80.0-120.0 × 12.0-20.0 μm, scattered, attenuate towards the apex, thin-walled. Cheilocystidia 33.0-55.0 × 7.0-12.0 μm, numerous, clavate to subfusoid, most hyaline, some with yellowish content, thin-walled, forming sterile edge on the pores.
Pileipellis with a pile of moniliform hyphal ends, about 80-100 μm thick, the terminal cells clavate to cylindric, 20-40 μm long, 6-15(-22) μm wide.


**Hab.:** On soil in mixed or coniferous forests.

**Note:** The above description was drawn from several collections obtained from the markets in Central Yunnan. It agrees with Chiu's *B. retisporus*. These Yunnan specimens bear much larger spores than those of

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**Fig. 14-17:** *Heimiella retispora* (HKAS 32686).

Corner’s (1972) and the type measured by Singer (1945). The pileipellis is also somewhat different with that illustrated by Corner (1972). However, they are identical with *H. retispora* in the other points.

Boedijn (1951) suspected that Chiu’s collections were not the same as his *H. retispora* and Corner (1972) suggested that Chiu’s might be *H. subretispora* Corner. We think that Boedijn’s collection is more similar to *H. mandarina* Corner with the brownish basidiomes, pileus with acute umbo and reflexed margin and nearly smooth stipe. Although the spores of Chiu’s specimens are much larger, *Strobilomyces retisporus sensu* W.F. Chiu is not *H. subretispora* because the pileus and stipe are wholly reddish rather than brownish, the stipe is coarsely reticulate rather than longitudinally striated and the stipe apex is clear yellowish rather than reddish.

Among the specimens examined, HKAS 32685 bear much smaller spores, a character similar to *H. japonica* Hongo. However, sphaerocysts, the most diagnostic character of *H. japonica* (Hongo, 1969), were not found in the pileus surface of HKAS 32685.

This species was encountered in the markets in Central Yunnan mixed with other edible boleti such as *B. speciosus* Frost and *B. rubellus sensu* W.F. Chiu. Some local people regarded it as poisonous. It may be one of the fungi causing intoxication.


*Leccinum rugosiceps sensu* J.Z. Ying et al., Edible Mushrooms (1982), non Peck.


**Hab.** On soil in coniferous forests.

**Note:** This is one of the most famous delicious mushrooms sold in large quantity in Yunnan especially Central Yunnan markets. The robust basidiome, the velvety and radially cracked grooved pileus, the projecting pileus margin, the yellowish and minute pores and the densely punctate stipe make it easily recognized. The collections both cited by Chiu and collected by us agree perfectly with the description given by Hongo (1976a).

This fungus was first regarded as *Boletus crocipodium* Letel. by Chiu (1948) and later as *L. rugosiceps* (Peck) Singer by Ying et al. (1982: 187-188). Thereafter the two names, as well as *L. extremiorientale*, were used for the same mushroom (see Ying & Zang, 1994: 259-264; Zang, 1991b: 215-217; Zhang, 1999: 70). In fact the differences between the three species are obvious (see Imazeki & Hongo, 1979: 100, Smith & Thiers, 1971: 216-217). *L. extremiorientale* is the proper name for this eastern Asian fungus.
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