

Four Species of Boletes Newly Recorded to Taiwan

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Abstract

This paper describes four species of the boletes belonging to the family Boletaceae as new records to Taiwan. They are *Boletus umbriniporus* Hongo, *Phylloporus orientalis* Corner, *Suillus placidus* (Bon.) Singer and *Tylopilus alboater* (Schw.) Murrill.

Key words: *Boletus umbriniporus*, *Phylloporus orientalis*, *Suillus placidus*, *Tylopilus alboater*, Taiwan

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Introduction

Since 1933 bolete surveys have been conducted in the northern and central portions of Taiwan, and 91 species have been documented. Of them 36 species with four novel species were reported by Chen *et al.* (1997a, b, 1998a, b). Their occurrence in Taiwan has been found to associate with the presence of their host plants, and also with altitude and other geographical factors. According to the nominal species that have been reported, the bolete flora of Taiwan is fairly similar to that of Southwest China and Northeast Asia. For an example, the genus *Sinoboletus* occurs in Taiwan (Zang and Chen 1998) and also in Yunnan and Sichuan of China (Zang 1992). This paper describes four species of boletes as the new records to Taiwan.

Specimens of fresh fruit bodies of boletes were collected and brought back to the laboratory. According to the conventional mycological methods described by Largent *et al.* (1977), the specimens were sectioned by hands, soaked in drops of the 10% NH₄OH solution,

mounted in drops of 1% aqueous phloxine solution, and then examined under a microscope with a magnification of 1,000-fold. Melzer's reagent was used in detecting amyloidity and dextrinoidity, and the ammoniac 1% Congo Red solution staining method was used for further examination (Bas 1969). After examination they were dried in warm air and deposited in the Taiwan Endemic Species Research Institute.

Taxonomy

Boletus umbriniporus Hongo, Journ. Jap. Bot. 44 (8): 235-237, 1969. (Fig. 1, 5a)

Pileus 4-9 cm broad, semiglobose at first, expanding to plano-convex, surface dry and minutely tomentous, color dull blue at first to umbrinous or olive-gray in age, context yellow, cyanescent when cut or bruised. Tubes nearly free from stipe, 0.5-0.8 cm deep, color umbrinous at center and pale to olive-yellow at margin, cyanescent where injured, pores minutely circular, about 2-3 per mm. Stipe 4-8 cm long, 0.6-1.0 cm broad, subequal and

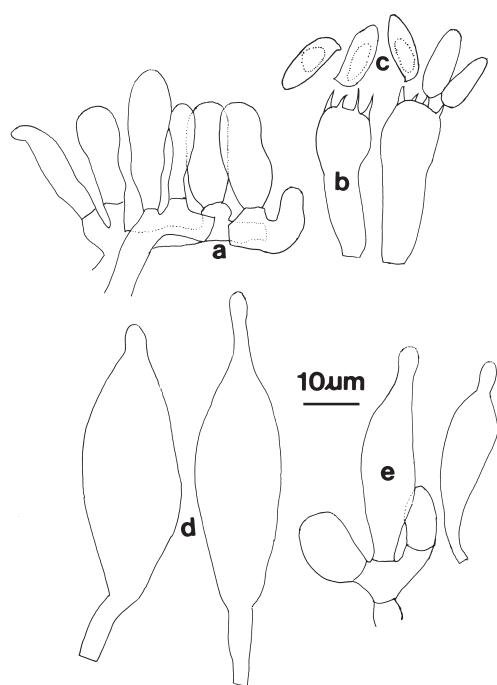


Fig. 1. *Boletus umbriniporus* (a, hymenium; b, basidium; c, basidiospores; d, pleurocystidia; e, cheilocystidium).

generally thicker at base, surface lemon-chrome, floccose with dull blue dots composed of grayish hyphae, base with several thick and brownish mycelium, context solid, color yellow, staining slightly dull blue when cut and rubellous at base. Spores $9.5\text{--}12 \times 4\text{--}5.5 \mu\text{m}$, smooth, wall slightly thickened, subcylindrical to subfusiform, dingy melleous in KOH, weakly ochraceous in Melzer's reagent. Basidia clavate, $28\text{--}33 \times 10.5\text{--}11.5 \mu\text{m}$, 4-spored, sterigmata $6\text{--}8 \mu\text{m}$ long, basal septa without clamp, hyaline in KOH, slightly yellowish in Melzer's reagent. Pleurocystidia abundant, conspicuous, $48\text{--}67 \times 16\text{--}20 \mu\text{m}$, ventricose-rostrate, apex subacute to rounded, thin-walled, yellowish to hyaline in KOH, filled with distinctive yellow content in Melzer's reagent. Cheilocystidia similar to pleurocystidia but smaller, the neck often flexuous, content dull

yellow in material revived in KOH. Tube trama of more or less parallel hyphae diverging to subhymenium, hyaline to yellow in KOH, inamyloid. Pileus cuticle a strong trichodermium, the elements $8\text{--}13(16) \mu\text{m}$ wide and arranged in a distinct palisade, the cells long and often flexuous but essentially tubular, end-cells elongate and apex mostly obtuse to rounded, tubular to weakly cystidioid, content brownish in KOH.

Specimens examined: Kaohsiung County, Terngjiy, alt. 1,800m, *C.M. Chen* 2370 (6.VII. 2000.).

Habitat: Scattered under broad-leaved forest.

Distribution: Taiwan, Japan, China (Guizhou).

Remarks: *B. umbriniporus* belongs to the section *Nigaris*, which is distinguishable from the section *Rubropori* by having a character of combining blackish pores and stipe without squamulose (Zang 1999). It is also characterized by its yellow flesh, which changes to pallid blue and rubellous base of stipe when exposed to air. *B. umbriniporus* is closely related to *Boletus nigrican* Zang of the section *Nigris*, but the two species are distinguishable in the field. *B. umbriniporus* has a dark brown pileus, non-reticulate stipe, and cyanescent tube when bruised, whereas *B. nigrican* has intense black pileus, reticulate stipe, and reddening tube. Also, *B. umbriniporus* has pleurocystidia of $48\text{--}67 \times 16\text{--}20 \mu\text{m}$ in size, which is larger than $34\text{--}48 \times 8\text{--}12 \mu\text{m}$ for *B. nigrican*, but the former has spores of $4\text{--}4.5 \mu\text{m}$ in breadth, which is smaller than $5\text{--}5.6 \mu\text{m}$ of *B. nigrican*.

Phylloporus orientalis Corner, Nova Hedwigia 20: 809-810, 1970. (Fig. 2, 5b)

Pileus 2-17 cm wide, plano-convex to plane, sometimes cyathiform, surface dry, opaque, villous then subtomentose, fuliginous umber when young, fuscous rosaceous or vinaceous in age, context 5-11 mm thick in the

centre of the pileus, soft, spongy, pale yellow, reddish brown below the surface of the pileus, turning blue on exposure especially above the gills (not reddening or blackening). Stipe 4-6.5 cm x 3-7 mm, cylindric, stout, the base attenuate and attached by yellowish white fibrils, surface brown, rufescent or reddish, paler downwards, wholly finely brown or reddish scurfy pruinose, the apex often yellow and ribbed by the gills, context solid, color brightly yellow, staining reddish at base on exposure. Gills lurid golden yellow with rubellous edges, deeply decurrent, 4-13 mm wide, 3-4 ranks, cyanescent on bruising. Spores 11-16.5 x 5-6 μm , brown in KOH, mostly brown and some ochraceous in Melzer's reagent, ellipsoid, smooth. Basidia 43-55 x 9-12 μm , clavate, the base 4-6 μm wide without clamp; sterigmata

7-8 μm long. Pleurocystidia 90-130 x 16-26 μm , ventricose with obtuse apex, very abundant on gill-edge and surface. Caulocystidia 51-103 x 10-17.5 μm , clavate to subventricose. Tube trama of subparallel type, hyphae 5-10 μm wide and mucilaginous hyphae divergent from a central strand; subhymenium 40-50 μm thick with short cells 8-12 x 4-6 μm . Cuticle of pileus a pile of erect, 2-3 septate hyphae 7-13(22) μm wide, the end-cells 32-120 μm long, cylindric to subclavate or subventricose, apex obtuse, with dense brownish opalescent content.

Specimens examined: Nantou County, Hui-Sun Forest Experimental Station, alt. 1,850m, *C.M. Chen* 2479 (10. VIII. 2000.).

Habitat: Solitary under broad-leaved or *Pinus taiwanensis* Hay. forest.

Distribution: Taiwan, Japan, North Borneo, Singapore, China (Sichuan, Tibet, Yunnan).

Remark: This species is evidently a *Phylloporus* but not conspecific with *P. rhodoxanthus* (Schw.) Bres. and *P. bellus* (Mass.) Corner which were collected by Yeh and Chen (1980) and Chen *et al.* (1994). The flesh of *P. orientalis* is reddish or reddish brown below the surface of pileus and in stem, its gills are strongly cyanescent on bruising, its stem surface is reddish furfuraceous, and its spores are slightly longer as compared to the other two species. The flesh of *P. bellus* is pale yellow or, if reddish in the stem, its gills unchanging or slightly cyanescent on bruising, its stem surface is pallid yellow, and its spores are slightly smaller as compared to the other two species. The flesh of *P. rhodoxanthus* is pale yellow, the areas under the cuticle of pileus and occasionally at the base of stipe are vinous-red flushed, the gill are unchanging or occasionally reddish on bruising, and the stipe surface yellowish with a red coating.



Fig. 2. *Phylloporus orientalis* (a, hymenium; b, basidium; c, basidiospores; d, pleurocystidia; e, caulocystidia).

Suillus placidus (Bonorden) Singer, *Farlowia* 2: 42-43, 1945. (Fig. 3, 5c, 5d)

Boletus placidus Bonorden, Mohl's Bot. Zeitung. 19: 204. 1861.

Ixocomus placidus (Bonorden) Gilbert, Boletes p. 132. 1931.

Pileus 5-12 cm broad, convex, expanding to almost plane; surface viscid, polished when dry; margin entire, inrolled when young; color white when young, golden brown in age with bister brown on the base of a slant; context very soft, pallid yellow, unchanging when injured or bruised; taste and odor not distinctive. Tubes 7-14 mm deep, at first adnate to depressed around the stipe but soon decurrent, yellowish pallid when young, becoming yellow, unchanging when injured; pores pale yellow becoming yellow, 1-2 per mm, glandular dots, often with pinkish droplets of exudate when young. Stipe 6-14 cm long, 9-18 mm thick, attenuated upwards, solid, becoming hollow and soft, surface white with vinaceous to pinkish glandular dots and smears, but ground color yellow in age and the glandular areas discoloring to gray on drying; no veil present at any stage. Spore print dull cinnamon. Spores 16-19 x 5.5-6.5 μm , inequilateral in profile, oblong in face view, smooth, hyaline to melleous in KOH, mostly pale yellow to nearly hyaline in Melzer's reagent. Basidia 43-50 x 14.5-19 μm , subcylindric to subclavate, thin-walled, 4-spored, sterigmata 4-5 μm long, hyaline in KOH, slightly yellowish in Melzer's. Pleurocystidia 45-70 x 5-9 μm , subcylindric to narrowly clavate, scattered, typically in fascicles, hyaline in KOH, often with bister content and dark brown amorphous pigment masses incrusting the bundle at the level of the hymenium, pale yellow in Melzer's reagent. Caulocystidia 20-40 x 6-18 μm , mostly sphaeropedunculate or capitate, often with long narrow pedicels, thin-walled, hyaline in KOH. Pileal cuticle a viscid or gelatinous pellicle, composed of hyaline to pallid brown hyphae (with gelatinizing walls), hyphae

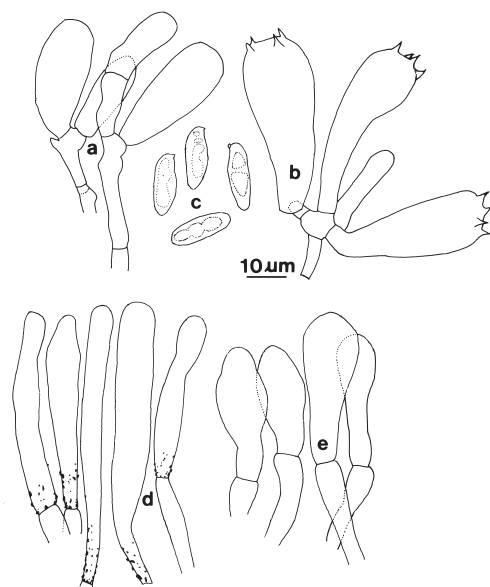


Fig. 3. *Suillus placidus* (a, hymenium; b, basidium; c, basidiospores; d, pleurocystidia; e, caulocystidium).

8-19 μm wide, often a more compact layer of gelatinizing hyphae immediately under the gelatinous epicutis, no clamps observed.

Specimens examined: Nantou County, Hui-Sun Forest Experimental Station, alt. 1,850m, *C.M. Chen* 3032 (15. VIII. 2001.).

Habitat: Solitary under *Pinus morrisonicola* Hay. forest.

Distribution: Taiwan, Japan, North America, China (Sichuan, Tibet, Guizhou, Yunnan).

Remark: Gilbert (1931) reviewed the boletes, and grouped the two closely related species, *I. placidus* (Bonorden) Gilbert and *I. leptopus* (Pers.) Gilbert (= *Suillus granulatus* (L. : Fr. Kuntze ssp. *leptopus* (Pers.) Sing.), under the genus *Ixocomus* (= *Suillus*). *I. placidus* has a white-lemon pileus and an elongated stipe, and occurs under the pine tree *Pinus strobus* and *P. cembra*, whereas *I. leptopus* has a short stipe and its habitat is associated with Mediterranean

pinus. Also, spores of *I. placidus* are longer than $8\ \mu\text{m}$, whereas those of *I. leptopus* are less than $8\ \mu\text{m}$. Singer (1945a) recognized *I. placidus* as a distinctive species and placed it under the genus *Suillus*. Later Singer (1945b) considered *I. placidus* an exannulate form of *S. acidus* (Perk) Sing. *S. placidus* is fairly similar to *S. acidus* in many aspects, particularly the characters of the pileus. However, these two species are distinguishable in the field. *S. placidus* has a long, exannulate and “<” shape stipe, which is longer than the diameter of pileus, and has slime on pileus that becomes gray to black with age. *S. acidus* has a long, annulate but straight stipe, and slime on pileus is yellow in color.

Tylopilus alboater (Schw.) Murrill, Mycologia 1: 16. 1909. (Fig. 4, 5e)

Boletus alboater Schweinitz, Schr. Naturf. Ges. Leipzig 1: 95. 1822.

Pileus 3.5-6 cm broad, convex becoming nearly flat or irregular in age; color dark smoky drab to brownish gray, often with a flesh colored tint, surface dry, distinctly velutinous then glabrous, with at first incurved then narrowly projecting sterile margin. Context white to creamy gray, changing to pinkish or purplish brown when bruised, eventually becoming blackish. Stipe 4-9 cm long, 6-13 mm thick, clavate becoming equal, concolorous with the pileus but paler at the apex when young, pruinose to velvety, lackening when rubbed, usually heavy and often irregular, or slightly tapering upwards, rarely tapering downwards, solid, context pale grayish and changing to reddish and then black when bruised, basal mycelium sordid white. Tubes 4-8 mm long, white to pale gray, later flesh colored, when injured changing slowly to black or reached blackish through pink or purplish brown, adnate to depressed with decurrent lines; pores somewhat variable in shape and folded together,

later mostly rounded-angular, about 2 per mm, concolorous with the tubes and changing as tubes when bruised. Spore print vinaceous to brownish-flesh color; spores $11-15.5 \times 3.5-4\ \mu\text{m}$, obclavate or oblong to fusoid, pale brownish melleous in KOH, pale dingy yellow-brown to dull rusty brown in Melzer's reagent, smooth, wall scarcely thickened, narrowly ovate in face view, somewhat inequilateral in profile. Basidia $23-34 \times 9-12\ \mu\text{m}$, 4-spored, sterigmata $4-5\ \mu\text{m}$ long, clavate, yellowish to pale brownish in KOH. Pleurocystidia $45-73 \times 13-15\ \mu\text{m}$, fusoid-ventricose, thin-walled, smooth, content pale bister in KOH, darker bister in Melzer's reagent. Cheilocystidia little differentiated but smaller. Many hyphae in the tube trama of the *Boletus*

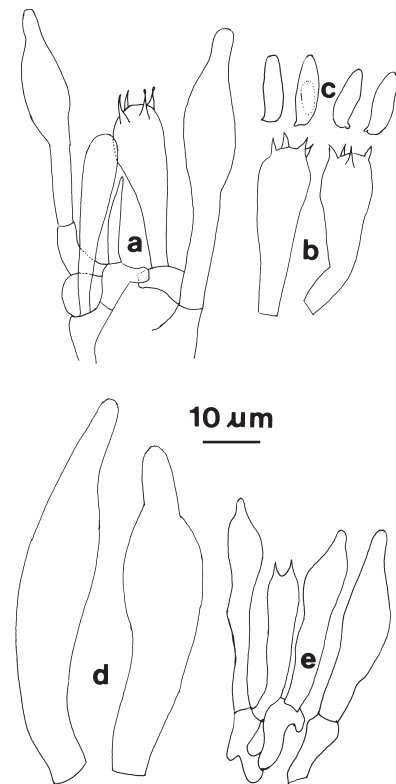


Fig. 4. *Tylopilus alboater* (a, hymenium; b, basidium; c, basidiospores; d, pleurocystidia; e, cheilocystidium).

type with dark granules in KOH or in Melzer's reagent but inamyloid. Epicutis of the pileus made up of a palisade of hair-like hyphae which are dark fuscous, slightly attenuated upwards, but obtuse at the tip, rarely subacute, brittle, wall 0.5-0.9 μm thick, densely arranged, 4-7.5(12) μm broad. Similar hairs also found on the covering layer of the stipe. The palisadic structure eventually disorganized and approached a trichodermium.

Specimens examined: Nantou County, Hui-Sun Forest Experimental Station, alt. 1,850m, *C.M. Chen* 2428 (1. VIII. 2000.); Taichung County, Chingjing alt. 1,900m, *C.M. Chen* 2845 (7. VI. 2001.).

Habitat: Scattered in the mixed forest.

Distribution: Taiwan, Japan, North America, China (Sichuan, Yunnan, Guangdong, Guangxi, Fujian, Anhwei).

Remark: Singer (1947) established the species *Tylopilus nigricans* Singer, including different forms with differences in shapes of cystidia and sizes of spores and carpophores. Corner (1972) still treated these forms as the species *Tylopilus alboator*. In spite of its color and dark flesh, this species is not readily distinguishable in the field, and apparently has different forms of varieties required for further study (Smith and Thiers 1971). For an example, the short tubes and externally compact and hard stipes, *T. alboator* was once placed under the genus *Gyroporus*, which is characterized by elliptical spores and white or citrine when it is in mass. Also, paler specimens of *T. alboator* are often confused with *T. ferrugineus*, but the former has a bister content of cystidia in KOH, whereas the content of the latter is yellow.

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Literature Cited

- Bas, C. 1969. Morphology and subdivision of *Amanita* and a monograph of its section *Lepidella*. *Persoonia* 5: 285-579.
- Chen, C. M., H. W. Huang, and J. J. Peng. 1994. The illustrations of wild mushrooms in Taiwan Vol.(I). Taiwan Endemic Species Research Institute, Chichi, Taiwan.
- Chen, C. M., H. W. Huang, and K. W. Yeh. 1997a. The boletes of Taiwan (VII). *Taiwania* 42: 174-179.
- Chen, C. M., J. J. Peng, and K. W. Yeh. 1997b. The boletes of Taiwan (VIII). *Taiwania* 42: 316-323.
- Chen, C. M., J. J. Peng, and K. W. Yeh. 1998a. The boletes of Taiwan (IX) . *Taiwania* 43: 132-139.
- Chen, C. M., and J. J. Peng. 1998b. Four *Tylopilus* new to Taiwan. *Fungal Science* 13: 11-16.
- Corner, E. J. H. 1972. *Boletus* in Malaysia. Government Printing Office, Singapore.
- Gilbert, E. J. 1931. *Les Bolets*. Librairie E. Le Francois, Paris.
- Largent, D. L., D. Johnson, and R. Watling. 1977. How to identify mushrooms to genus III: Microscopic features, second edition. Mad River Press Inc., Eureka, Ca., USA.
- Singer, R. 1945a. Notes on Farlow's Agaricales from Chocorua. *Farlowia* 2: 42-43.
- Singer, R. 1945b. The Boletineae of Florida with notes on extralimital species II. The Boletaceae. *Farlowia* 2(2): 271.
- Singer, R. 1947. The Boletoidae of Florida. *The American Midland Naturalist* 37: 106.



Fig. 5. Basidiomes (a, *Boletus umbriniporus*; b, *Phylloporus orientalis*; c and d, *Suillus placidus*; e, *Tylopilus alboater*).

Smith, A. H., and H. D. Thiers. 1971. The boletes of Michigan. University of Michigan Press, Ann Arbor.
 Yeh, K. W., and Z. C. Chen. 1980. The boletes of Taiwan (I). *Taiwania* 25: 167-169.
 Zang, M. 1992. *Sinoboletus*, a new genus of Boletaceae from China. *Mycotaxon* 45:

223-227.

Zang, M., and C. M. Chen. 1998. Four new taxa of Basidiomycota from Taiwan. *Fungal Science* 13(1, 2): 23-28.
 Zang, M. 1999. An annotated check-list of the genus *Boletus* and its sections from China. *Fungal Science* 14(3, 4): 79-87.

四種牛肝菌新紀錄種

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摘 要

本文描述並討論在台灣首次被發現的四種牛肝菌新紀錄種，分別是褐孔牛肝菌(*Boletus umbriniporus* Hongo)、東方褶孔牛肝菌(*Phylloporus orientalis* Corner)、琥珀乳牛肝菌(*Suillus placidus* (Bonorden) Singer)及黑蓋粉孢牛肝菌(*Tylopilus alboater* (Schw.) Murrill)。

關鍵詞：褐孔牛肝菌、東方褶孔牛肝菌、琥珀乳牛肝菌、黑蓋粉孢牛肝菌、台灣

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