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The Boletes of Taiwan (X)

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ABSTRACT: Six species of boletes are described as new records to Taiwan. They are *Boletellus projectelus* (Murrill) Singer, *Boletellus russellii* (Frost) Gilbert, *Heimiella nigricans* Zang, *Strobilomyces confusus* Singer, *Strobilomyces nigricans* Berk. and *Strobilomyces seminudus* Hongo.

KEY WORDS: Strobilomycetaceae, Taiwan.

INTRODUCTION

Traditionally the species of boletes producing ornamented basidiospores are placed in family Strobilomycetaceae. Of them the species exhibiting longitudinal costae, elongate spores are placed in genus *Boletellus* and the species with reticulate, globose to subglobose spores are placed in genera *Strobilomyces* (Singer, 1962) and *Heimiella*. In the latter, spores of *Strobilomyces* with a reticulate ornamentation differ from those of *Heimiella* in having a smaller mesh and a conspicuous suprahilar plage and depression, and being coloured fuscous brown (Pegler, 1981). The smooth-spored, viz. Boletaceae species of boletes are probably derived from more primitived ornamented-spored, viz. Strobilomycetaceae species (Corner, 1972). To date only seven species of family Strobilomycetaceae have been recorded from Taiwan (Chen *et al.*, 1997). In this paper, we describe six new recorded species of Strobilomycetaceous fungi from Taiwan. Among them, genus *Heimiella* Boedijn is a new record for the region.

MATERIALS AND METHODS

Fresh fruit bodies were collected and examined. Spore prints were made by placing segments of fruit bodies on white paper. Subsequently the fruit bodies were dried under circulating air at 40℃ and deposited in the mycological laboratory of the Taiwan Endemic Species Research Institute (TESRI). Mycological examination of specimens followed the techniques described by Largent (1977). The fruit bodies were sectioned by hand and

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mounted in mixture of 1% aqueous phloxine and 3% KOH solution for microscopic examination. Finally, they were stuck on specimen stubs with colloidal tape, sputter-coated with gold-palladium and examined with a Topcon ABT-150S Scanning Electron Microscope.

RESULTS AND DISCUSSION

1. Boletellus projectellus (Murrill) Singer, Farlowia 2 : 129. 1945. Figs. 1 & 7

Ceriomyces projectellus Murrill, Mycologia 30 : 524. 1938.
Boletus projectellus Murrill, Mycologia 30 : 525. 1938.

Pileus 4-8 cm broad, convex becoming plane, margin free, projecting and hanging straight down, surface subtomentose, soon areolate-squamulose; color in young rather light gray-brown with a tint of rose, becoming darker with age. Context thick, up to 1.5 cm near the stipe, pale rose color throughout, fading with age to more yellowish, color red around larval tunnels. When cut becoming flushed vinaceous near the cuticle but elsewhere slowly changing to yellow-brown, occasionally colored around larval tunnels. Tubes pale olivaceous, 0.8-1.2 cm long, depressed around the stipe, not staining when cut. Pores 0.5-1 mm broad, circular, color pale olive when young, finally dark brownish olive. Stipe 7-12 cm long, 1-2 cm thick, tapering upward or equal, surface concolorous with pilus, minutely granular, dingy vinaceous-buff to cinnamon-buff, unpolished and both coarsely and shallowly reticulate nearly to base. Spore print olivaceous brown. Spores 20-23 x 8-9 μm , ovate to boat-shaped in face view, in profile inequilateral and with a prominent suprahilar depression, smooth, lacking a distinct apical pore, golden yellow and wall measuring 1-1.5 μm thick in KOH. Basidia 27-35 x 14-17 μm, clavate, yellowish in KOH, fading to hyaline, sterigmata four, 4-6 μm long. Pleurocystidia 58-95 x 15-24 μm, ventricose to subobclavate, smooth, hyaline, readily collapsing. Tube trama parallel to subparallel, the outer hyphae diverging slightly to the subhymenium, hyphae 8-10 μm broad. Clamp connection absent.

This species has smooth spores (Fig. 13), nevertheless, it has been classified in the Strobilomycetaceae because of its greatly elongated spores and other characteristics of the basidiocarp, that suggest its close relationship to rough-spored species of the family (Grand and Moore, 1971). The margin of its pileus is sterile for which the species was named (Murrill, 1938). The Melzer's reaction on the spores is much like that of *Boletus amylosporus* (Smith and Thiers, 1971). It differs from *Boletus badius* in wide sterile margin, lack of viscidity, much larger spores and somewhat different color.

Habitat : Solitary in the broad-leaved forest.

Distribution : Taiwan, North America.

Nantou : Shanlihsi, alt. 1750 m, June 3, 1992. Huang Hsin-Wen (267).

2. Boletellus russellii (Frost) Gilbert, Les Bolets, p. 107, 1931. Figs. 2 & 8

Boletus russellii Frost, Bull. Buff. Soc. Nat. Sci. 2:104. 1874.

Pileus 3-9 cm broad, hemispheric to convex with a strongly incurved margin, expanding to broadly convex with age; surface dry, subtomentose to tomentose, sometimes squamulose, becoming areolate; margin sterile, entire, incurved when young; color brown to brownish yellow, sometimes olive gray. Context up to 1.7 cm thick, whitish to pallid-yellow, becoming eventually melleous in the base of the stipe, and reddish under the cuticle, almost unchanging when cut. Tubes up to 1 cm long, depressed around the stipe, often extending for short distances down the stipe as lines, yellow to olive green, changing to dark blue when bruised. Pores up to 2 mm wide, angular, narrower in the marginal row, at first 0.3 mm wide, then becoming wider, most frequently 0.8-1 mm in diameter. Stipes 7-12 cm long, 0.9-1.6 cm broad, equal or expanding toward base, solid, flesh yellow, surface covered overall with coarse ridge-like reticulations, color brownish red or dull brick red, viscid at base, unchanging when cut. Spore print dark olive to near sepia. Spores 16-18 x 7-9 μm, in face view ellipsoid with a suprahilar depression, in profile view obscurely inequilateral, with 16 - 18 longitudinal striate and grooved in outer wall, bister in KOH. Basidia 40-53 x 14-18 μm, clavate, thin-walled, hyaline in KOH, pale yellow in Melzer's. Pleurooystidia 75-85 x 12-20 μm, mostly fusoid-ventricose, the apical half often elongation and the apex subacute, thin-walled, hyaline in KOH, pale yellow in Melzer's. Hymenophoral trama divergent. Clamp connection absent.

This species can be easily be confused with *Boletellus jalapensis* (Murr.) Gilbert, which differs the former by having smooth, glabrous stipe(Murrill, 1910). It similar to that of *Boletellus ananas* (Curt.) Murrill has a longitudinally winged or ribbed ornamentation. Its exosporial wall is brown with longitudinal, wing-like, lamellose ridges which run from the apical pole to the hilar tube, suddenly stopping at the apex. Occasionally some of the ridges are connected by a few scattered anastomosing ridges. The number of longitudinal ridges are about 16-18 at the poles, and which project 1.3-2.1 μm (Fig. 14). But the latter lacks cross connections between the longitudinal ornamentations, besides apex is smooth and rounded (Fig. 15).

Habitat : Solitary to scattered under *Myrsine sequinii* Levl.

Distribution : Taiwan, China (Anhwei, Yunnan), Japan, North America.

Nantou : Sun Moon Lake, alt. 850 m, Aug. 23, 1994. Chen Chien-Ming (722).

3. Heimiella nigricans Zang, Acta Botanica Yunnanica 7(4): 395, 1985. Figs. 3 & 9

Pileus 4-6 cm broad, convex, expanding to plano-convex and margin up-lifted with age, surface siccous, subtomentose; color nigro-brunneous. Context 5-7 mm thick, palid brunneous, unchanging when injuried. Tube 4-6 mm long, depressed around the stipe, ventricose in profile, color brown or black. Pores 0.3-0.5 mm wide, circular. Stipes 4-5 cm long, 0.9-1.2 cm thick at apex, clavate and up to 1.8 cm thick at base, surface with longitudinal reticulum, color black, flesh spongiose and mycelium brunneous. Spore print olive-brown. Spores 11-14 x 6-7.5 μm, subglobose or broadly elliptic, exosporium with warts and covered by an incomplete network of irregular ridges to form an reticulum which dropping easily (Fig. 16), olivaceous-hyaline or brunneous-hyaline in KOH. Basidia 28-39 x 10.5-14 μm, clavate, hyaline in KOH, pale yellow in Melzer's, sterigmata four, 6-7 μm long. Pleurocystidia 45-65 x 15-20 μm, subobclavate or ventricose. Hymenophoral trama boletoid type. Clamp connection absent.

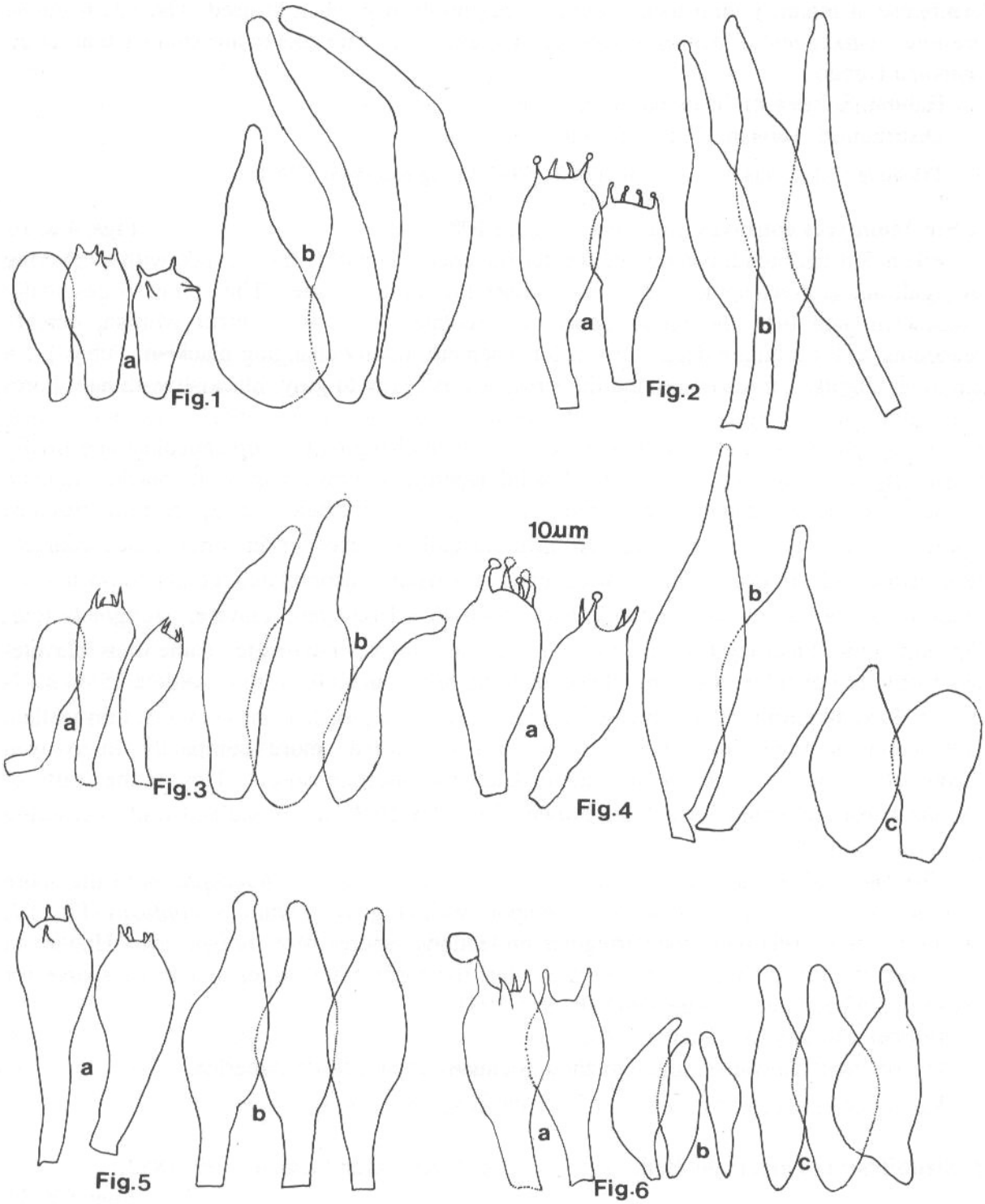


Fig. 1. *Boletellus projectellus*; Fig. 2. *Boletellus russellii*; Fig. 3. *Heimiella nigricans*; Fig. 4. *Strobilomyces confusus*; Fig. 5. *Strobilomyces nigricans*; Fig. 6. *Strobilomyces seminudus*. a: basidia; b: pleurocystidia; c: cheilocystidia.

This species is distinguishable from other species in family Strobilomycetaceae by having the subcircular spores with irregular netted exosporium and the tubes conspicuously ventricose at maturity with their mouths dark pink-brown when bruised. The pileus colors are much darker and a lack of vinaceous or orange tint. The spores are smaller than in *H. japonica* Hongo.

Habitat: Solitary in the mixed forest.

Distribution: Taiwan, China (Yunnan).

Taichung : Lilenglintao, alt. 2050 m, June 22, 1995. Huang Hsin-Wen (1212).

4. Strobilomyces confusus Sing., Farlowia: 2: 108, 1945. Figs. 4 & 10

Pileus 3-8 cm broad, convex, the center flattened when old, dry, surface with a covering of rigid, acute, erect spines which are denser toward the center. The spines occasionally evanescent, and then the pileus appearing areolate-squamose. Context whitish, quickly reddening and reaching a deep carrot color when cut, finally changing blackish. Tubes 1-1.8 cm long, slightly depressed around the stipe, whitish-gray to gray, blackish with age. Pores 1-1.5 mm wide, angular, usually sublamellate near the stipe, concolorous with tubes, becoming spotted with cinnamon when bruised, then changing to deep chocolate and finally black. Stipes 4-8 cm long, 1-2 cm broad, solid, tapering downward, gray and black, reticulate at the apex above the remnants of the veil, shaggy-woolly below it. Spore print fuscous. Spores 11-13 x 10.5-12 μm, short-ellipsoid to globose, exosporium ornamented coarsely tuberculate, 1-2 μm deep, often confluent and subcristate, incompletely connected with each other to form a fragmentary network. Basidia 40-45 x 16-20 μm, clavate, sterigmata four, 7-8 μm long. Pleurocystidia 56-84 x 16-22 μm, fusoid-mucronate, sometimes clavate-mucronate or vesiculose with ampullaceous neck, brown in KOH. Cheilocystidia 35-43 x 17-21 μm, fusoid-ventricose or subfusoid-clavate, hyaline to pale fuscous contents, thin-walled. Hymenophoral trama of bilateral type with a colored, more compactly interwoven mediostratum and a paler lateral stratum. Clamp connection absent. Tips of the warts of strands of parallel hyphae which are brown, 25-121 x 10-32 μm broad and wall measuring 1 μm thick in KOH.

The major difference between *Strobilomyces confusus* and *S. floccopus* is in the spore morphology. *S. floccopus* has a reticulate spore wall (Fig. 18), while *S. confusus* (Fig. 17) has quite rough, relatively long irregular projections. Spores of *S. polypyramis* Hooker in Berk. are similar to those of *S. confusus,* but the former are larger and more sparse for exosporial tuberculate than the latter (Pegler, 1981).

Habitat: Solitary to scattered in the broad-leaved forest.

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

Nantou : Shanlihsi, alt. 1750 m, July 21, 1994. Chen Chien-Ming (611).

5. Strobilomyces nigricans Berk., Hook. J. Bot. & Kew Gdn Misc. 4 : 139, 1852. Figs. 5 & 11

Pileus 4-5 cm broad, greyish brown, with acute warts that base smaller than 2 x 1 mm, rigid, confined to the disk; the marginal half merely appressed, angular, dull black, squamulose, margin appendiculate. Context 4-7 mm thick, color gray to drab gray. Tubes 7-10 mm long, gray near drab. Pores 3-6 mm wide, circular, whitish at first then greyish with

Figs. 7-12. Basidiomes Fig. 7: *Boletellus projectellus*; Fig. 8: *Boletellus russellii*; Fig. 9: *Heimiella nigricans*; Fig. 10: *Strobilomyces confusus*; Fig. 11: *Strobilomyces nigricans*; Fig. 12: *Strobilomyces seminudus.*

age, rubescent when bruised. Stipe 5-8 cm long, 6-12 mm broad, tapering upwards or equal, surface with grey, thick, woolly annular zone near the apex and an elongate reticulum of black fibers below. Spore print black. Spores 14-17 x 12-14.5 μm, globose or subglobose, adaxially applanate, exosporial ornamentation consisting of a complete reticulum with a mesh 2-3.5 μm diam., 1-3 μm deep, drab in KOH. Basidia 51-67 x 17-19 μm, clavate, sterigmata four, 5-8 μm long. Pleurocystidia 61-68 x 16-19 μm, numerous, fusoid to ventricose, often with an elongate neck that diminishing easily with age. Hymenophoral trama bilateral of the boletus-type. Clamp connections absent.

The spores of genus *Strobilomyces* have a very strongly developed exosporial ornamentation, whose shape is reticulate with a large or small mesh to verrucose or echinate. Of the species in the genus, *S. nigricans* (Fig. 19) has the largest ornamentation with a complete reticulum, 1-3 μm deep, almost doubling the overall volume. Its larger spores are distinguishable from those of *S. mollis* by having a similar reticulum, only 1-2 μm deep (Pegler, 1981).

Habitat: Solitary to scattered in the broad-leaved forest.

Distribution: Taiwan, China (Yunnan), Japan, Indonesia, North America.

Nantou : Shanlihsi, alt. 1750 m, June 8, 1994. Chen Chien-Ming (1146).

6. Strobilomyces seminudus Hongo, Trans. mycol. Soc. Japan **23**: 197, 1982. Figs. 6 & 12

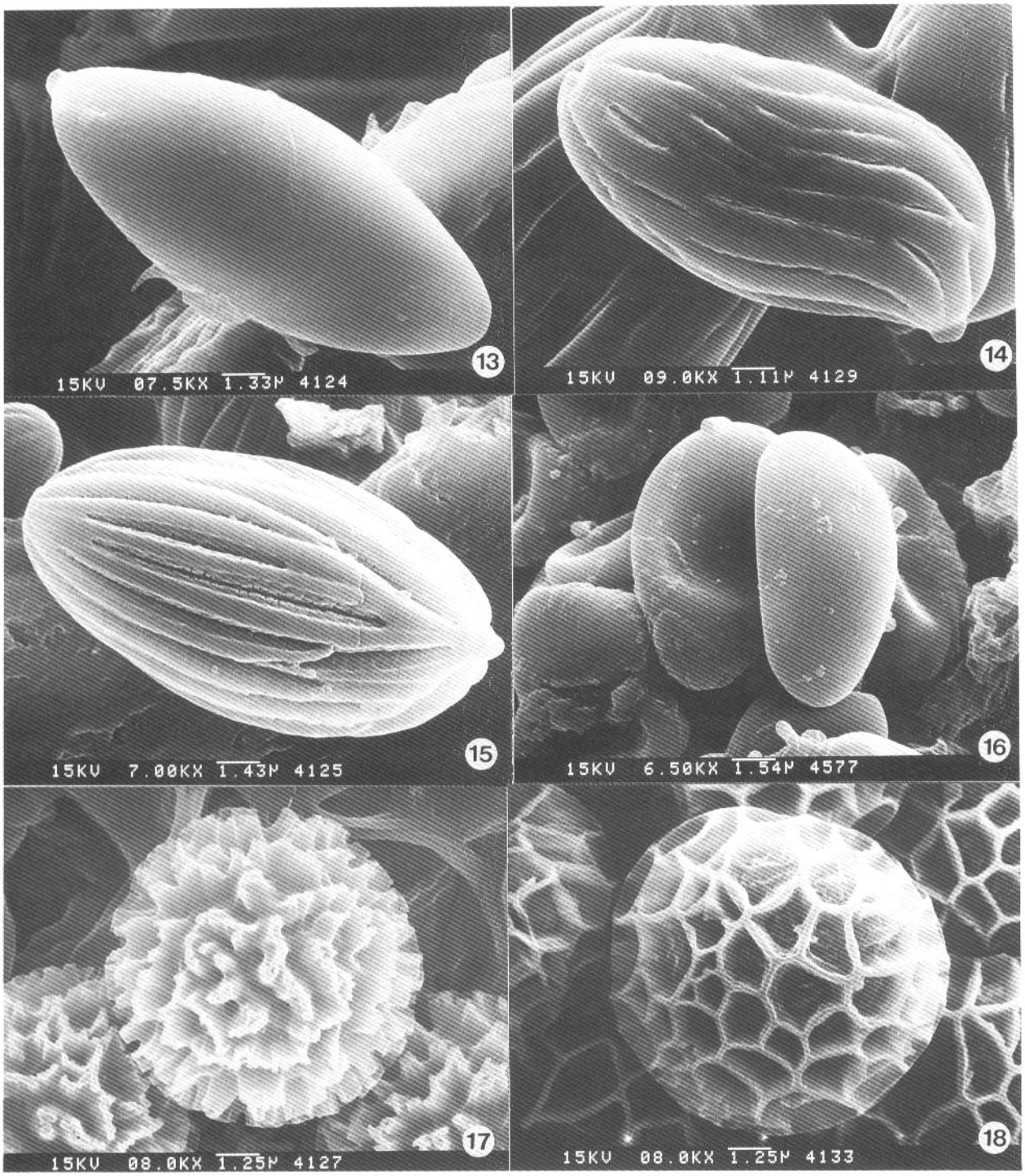
Pileus 3-7.5 cm broad, convex, becoming broadly convex to nearly plane; surface tomentose to tomentose-squamulose, dry, hair brown to drab, often cracked into adnate scaly patches, showing whitish to grayish flesh in the cracks; margin widely appendiculate with a floccose-membranous concolorous veil. Context firm, whitish, rubescent then nigrescent on bruising; taste mild, odor none. Tubes adnate, sometimes becoming somewhat depressed around the stipe with age, 3-9 mm long, whitish gray then fuliginous. Pores angular, 0.5-1 mm wide, whitish to grayish, rubescent-nigrescent on bruising. Stipe 5-9.5 cm long, 5-9 mm thick at apex, equal or enlarged downward to 8-11 mm at base with white mycelium over base, solid; surface pale drab to fuscous, reticulate with elongate meshes above and floccose-squamulose below, with gray, thick, woolly annular zone near the apex. Spores 10-11 x 8-10 μm, subglobose, dark brown in KOH, with fragments of network and spines. Basidia 32-41 x 15-17 μm, sterigmata two or four, 7-8 μm long. Pleurocystidia 32-54 x 9-17 μm, fusoid to ventricose, often with an elongate neck, with melleous to umbrinous contents. Cheilocystidia 35-61 x 16-21 μm, numerous, clavate to subfusoid-clavate or fusoid-ventricose, hyaline or with brownish to pale fuscous contents, thin-walled. Hymenophoral trama boletoid type. Clamp connections absent. Pileal cuticle a trichodermium of brown septate hyphae, 5-18 μm thick, the end cells often slightly attenuated toward the apex.

The tomentose to tomentose-squamulose, rimose-areolate surface of pileus, and more rounded and more spiny spores (Fig. 20) are the characteristics, making this species easily and accurately recognizable. Reticulation of the stipe is much coarser, and its cap without rigid, acute and erect scales is more smooth than that of *S. confusus* Sing..

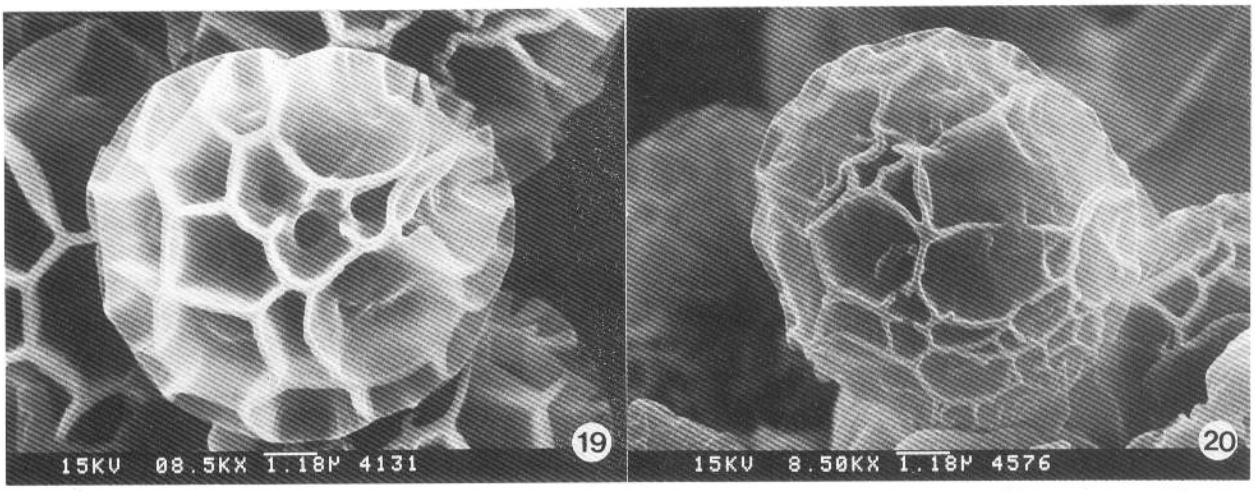
Habitat: Solitary to scattered in the mixed leaved forest.

Distribution: Taiwan, China (Zhejiang, Fujian), Japan.

Nantou : Tiehpiluchi, alt. 1550 m, June 24, 1994. Huang Hsin-Wen (515).



Figs. 13-18. Scanning electron micrograph of the basidiospores; Fig. 13: *Boletellus projectellus*; Fig. 14: *Boletellus russellii*; Fig. 15: *Boletellus ananas*; Fig. 16: *Heimiella nigricans*;. Fig. 17: *Strobilomyces confusus*; Fig. 18: *Strobilomyces floccopos.*



Figs. 19-20. Scanning electron micrograph of the basidiospores. Fig. 19: *Strobilomyces nigricans*; Fig. 20: *Strobilomyces seminudus*.

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臺灣之網孔蕈類(十)

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摘　　要

本文描述在台灣首次被發現的六種牛肝菌新紀錄種，分別是突緣條孢牛肝菌 (*Boletellus projectellus* (Murrill) Singer)、金黃條孢牛肝菌 (*Boletellus russellii* (Frost) Gilbert)、黑圓花孢牛肝菌 (*Heimiella nigricans* Zang)、多型松塔牛肝菌 (*Strobilomyces confusus* Sing.)、 黑松塔牛肝菌 (*Strobilomyces nigricans* Berk.) 及半裸松塔牛肝菌 (*Strobilomyces seminudus* Hongo)。

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