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## Five new species of the Boletaceae from Japan

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**Abstract** Five new species of the Boletaceae (Agaricales) from Japan are described and illustrated: (1) *Boletus bannaensis* sp. nov. (section *Luridi*), forming a grayish-brown pileus and rufescent flesh, found in subtropical evergreen broad-leaved forests; (2) *Leccinum rhodoporosum* sp. nov., forming discolored red pores, a whitish stipe covered overall with violet-brown to blackish-brown furfuraceous scales and fusoid-cylindrical brown basidiospores, found in subtropical evergreen broad-leaved forests or warm-temperate *Quercus-Pinus* forests; (3) *Pulveroboletus brunneoscabrosus* sp. nov., forming a lemon-yellow pulverulent basidiomata covered overall with orange to brownish-orange appressed scales, found in subtropical to warm temperate evergreen broad-leaved forests; (4) *Rubinoboletus monstrosus* sp. nov., forming a brownish-orange to yellowish-brown pileus and a very short, nonreticulate, hollow stipe, found in subtropical evergreen broad-leaved forests; and (5) *Tylopilus fuligineoviolaceus* sp. nov., having a deep violet to blackish-brown pileus and brunnescent hymenophore, found in warm temperate *Quercus-Castanopsis* forests.

**Key words** *Boletus bannaensis* · *Leccinum rhodoporosum* · *Pulveroboletus brunneoscabrosus* · *Rubinoboletus monstrosus* · *Tylopilus fuligineoviolaceus*

### Introduction

This article reports five new species of the Boletaceae that occur in the subtropical to warm temperate broad-leaved forests of Japan (Hyogo, Kagoshima, Kanagawa, Miyazaki, Okinawa, Tokyo). These species are described and illustrated with photographs showing macromorphological features. For microscopic observations, free-hand sections of the fresh basidiomata were examined in distilled water. Color notations in parentheses are taken from Kornerup

and Wanscher (1978). Specimens cited are preserved in the Kanagawa Prefectural Museum of Natural History, Japan (KPM).

### Species descriptions

**1. *Boletus bannaensis*** Har. Takah., sp. nov. Figs. 1, 2

Pileo 60–110 mm lato, primo hemisphaerico, dein convexo vel applanato, sicco, minute velutino vel subglabro, griseo-brunneo; carne firma, alba, ad fractionem subcyanescenti et rufescenti; odore saporeque nullo; stipite 60–100 × 15–25 mm, subaequali vel ad basim leviter incrassato, solido, sicco, subglabro vel subtomentoso, superne pallide ochraceo, inferne obscure griseo-brunneo vel nigro-brunneo, non reticulato, per mycelio basali albo affixo; tubulis adnatis vel leviter decurrentibus, pallide flavis, ad fractionem cyanescentibus; poris subrotundatis, parvis, rubris, cyanescentibus; basidiosporis 6.5–9 × 3.5–4 μm, depressione vadoso suprahili praeditis, oblongo-ellipsoideis, levibus, melleis; basidiis tetrasporis; cheilocystidiis 28–31 × 5–6.5 μm, abundantibus, fusiformibus, rubris; pleurocystidiis cheilocystidii similibus sed hyalinis; pileipelle trichodermio composita; hyphis defibulatis.

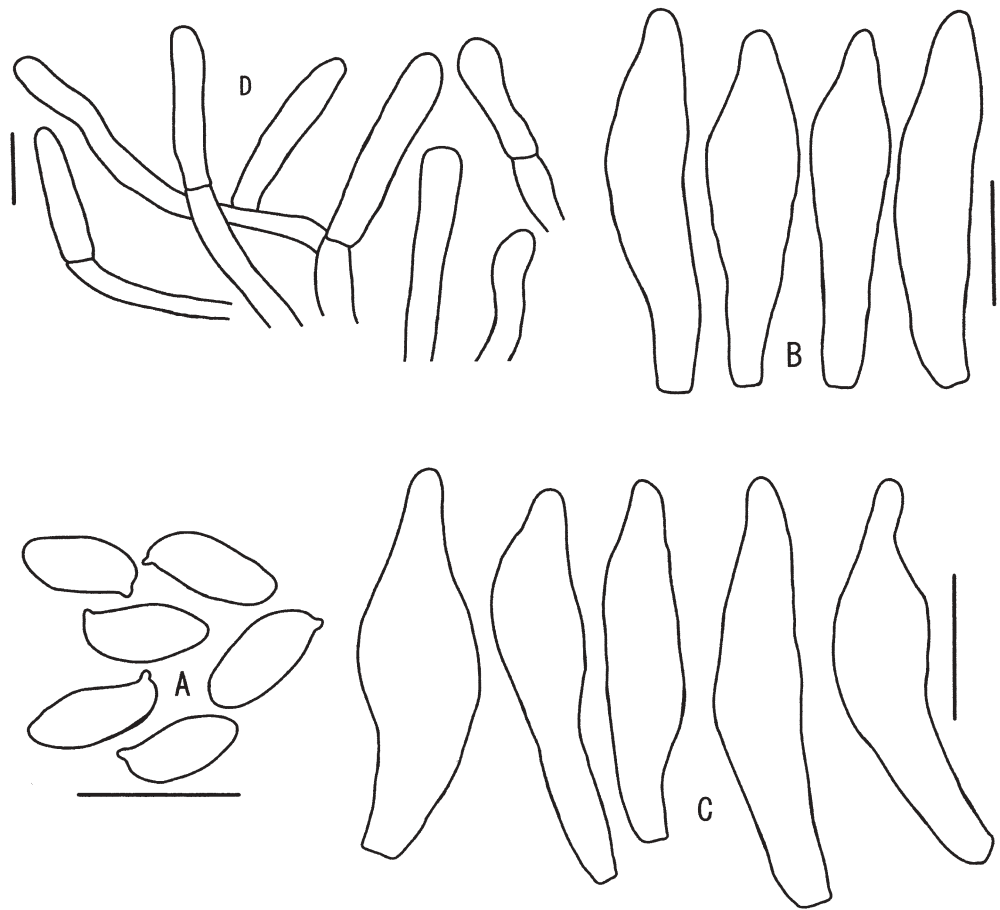
Holotypus: Ad terram in silvis, Banna-dake, Ishigaki-shi, Okinawa Pref., Sept. 15, 2003, H. Takahashi (KPM-NC0010094).

Etymology: Referring to the type locality, Mt. Banna (Ishigaki Island).

Pileus 60–110 mm in diameter, at first hemispherical, expanding to broadly convex, with inrolled then straight margin; surface dry, minutely velutinous to subglabrous, dark grayish brown (8F1-2 to 9F1-2) when young, then paler in age. Flesh up to 25 mm thick, firm, whitish, slowly rufescent (11A4-7) (especially at the upper part of the pileus, the lower part of the stipe, and around worm holes) and faintly staining light blue (23A4-5) when cut; odor and taste indistinct. Stipe 60–100 × 15–25 mm, subequal or somewhat enlarged toward the base, central, terete, solid; surface dry, entirely subglabrous to subtomentose, dark grayish brown

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**Fig. 1.** *Boletus bannaensis*. **A** Basidiospores. **B** Cheilocystidia. **C** Pleurocystidia. **D** Terminal elements of the pileipellis hyphae. All figures from the holotype. Bars 10µm



(8F1-2 to 9F1-2) to brownish-gray (7F2) at the lower portion, grayish-yellow (3B5-4B5) at the upper portion, sometimes with reddish (9A8-10A8) spots at the apex, non-reticulate; base covered with whitish mycelium. Tubes up to 5 mm deep, short in comparison with the size of the pileus, adnate to slightly decurrent, light yellow, slowly staining blue when cut; pores small (2–3 per millimeter), subcircular, light yellow when young, soon becoming deep red (9A8-10A8) to reddish-orange (7A8), then brownish-orange (7C8) with age, slowly staining blue where handled.

Basidiospores ( $n = 63$  spores of 5 basidiocarps)  $6.5\text{--}9 \times 3.5\text{--}4\ \mu\text{m}$ , Q (length/breadth) = 1.8–2.3, inequilateral with a shallow suprahilar depression in profile, oblong ellipsoid in face view, smooth, melleous in  $\text{H}_2\text{O}$ , thick-walled (up to  $1\ \mu\text{m}$ ). Basidia  $18\text{--}30 \times 6\text{--}9\ \mu\text{m}$ , clavate, four-spored. Cheilocystidia gregarious,  $28\text{--}31 \times 5\text{--}6.5\ \mu\text{m}$ , fusiform, smooth, reddish in  $\text{H}_2\text{O}$ , thin-walled. Pleurocystidia scattered, similar in shape to the cheilocystidia but colorless. Hymenophoral trama divergent, composed of hyphae  $4\text{--}10\ \mu\text{m}$  wide, cylindrical, smooth, hyaline, thin-walled. Pileipellis composed of a trichoderm formed by loosely interwoven hyphae,  $2\text{--}5\ \mu\text{m}$  wide, cylindrical, smooth, hyaline or with intracellular brown (in  $\text{H}_2\text{O}$ ) pigment, thin-walled. Pileitrama of cylindrical, loosely interwoven hyphae  $5\text{--}8\ \mu\text{m}$  wide, smooth, colorless, thin-walled. Stipe trama composed of longitudinally arranged, cylindrical cells  $4\text{--}10\ \mu\text{m}$  wide, un-

branched, smooth, colorless, thin-walled. Clamps absent in all tissues.

Known distribution: Japan (Okinawa).

Habitat: Solitary to scattered, on ground in subtropical evergreen broad-leaved forests dominated by *Quercus miyagii* Koidz. and *Castanopsis cuspidata* (Thunb.) Schottky var. *sieboldii* (Makino) Nakai, May to June.

Specimens examined: KPM-NC0010094 (holotype), Banna-dake, Ishigaki-shi, Okinawa Pref., May 30, 2002, coll. H. Takahashi; same place, June 2, 2002, coll. H. Takahashi; same place, June 6, 2004, coll. H. Takahashi.

Japanese name: Nanyou-urabeni-iguchi.

Notes: Distinctive features of this species include its grayish-brown pileus, the rufescent and faintly cyanescent flesh, the relatively short tubes in comparison with the size of the pileus, the minute pores discolored red, the relatively small ( $6.5\text{--}9 \times 3.5\text{--}4\ \mu\text{m}$ ), oblong-ellipsoid basidiospores, and the habitat in subtropical evergreen broad-leaved forests.

The *Boletus*-habit of its basidiomata with the minute pores discolored red suggests that this species belongs in the section *Luridi* Fr. as defined in Singer (1986). Within this section, *B. bannaensis* seems to be closely related to *Boletus satanas* Lenz, originally described from Europe (Singer 1967; Alessio 1985; Bessette et al. 2000), *Boletus firmus* Frost from North American (Snell and Dick 1970; Bessette



**Fig. 2.** Basidiomata of *Boletus bannaensis*. **A** Photo by S. Uehara. All figures from the holotype. Bars **A** 20mm; **B**, **C** 10mm

et al. 2000), and *Boletus quercinus* Hongo from Japan (Hongo 1967; Hongo and Nagasawa 1975). These taxa are distinct from *B. bannaensis* mainly in having nonrufescent flesh, much longer tubes, and much larger basidiospores:  $9\text{--}15 \times 3.5\text{--}5\mu\text{m}$  in *B. firmus* (Bessette et al. 2000);  $10\text{--}12 \times 3.5\text{--}5\mu\text{m}$  in *B. quercinus* (Hongo and Nagasawa 1975);  $11\text{--}16 \times 5\text{--}7.5\mu\text{m}$  in *B. satanas* (Alessio 1985). Moreover, *B. satanas* has a massive bulbous stipe covered with a pinkish reticulation on the upper portion, *B. firmus* has a whitish to grayish pileus and stipe, and *B. quercinus* (probably conspecific with *B. firmus*) forms a pinkish stipe covered with a fine reticulation on the apex, a pileipellis with intercellular, encrusting pigments, and a disrupted hymeniform stipitipellis consisting of clavate to ventricose-fusoid terminal cells.

## 2. *Leccinum rhodoporosum* Har. Takah., sp. nov. Figs. 3, 4

Pileo 40–70mm lato, primo hemisphaerico, dein late convexo, sicco, subtomentoso vel subglabro, obscure brunneo vel brunneo; carne firma, pallide flavida, ad fractionem cyanescenti; odore saporeque nullo; stipite 30–60 × 10–20mm, subaequali vel ad basim leviter incrassato, solido, obscure violaceo-brunneo furfuraceo, non reticulato, per mycelio basali albo affixo; tubulis depressis circa stipitem, flavis, ad fractionem cyanescentibus; poris subrotundatis, parvis, ru-

bris, cyanescentibus; basidiosporis 15–16.5 × 4.5–5μm, depressione suprahili praeditis, fusoido-cylindricis, levibus, brunneis; basidiis tetrasporis; cheilocystidiis 22–37 × 4–7μm, abundantibus, subclavatis, brunneo-rubris; pleurocystidiis 37–55 × 7–11μm, fusoido-ventricosis, hyalinis; pileipelle trichodermio paliformi composita; stipitipelle hymeniformi ex caulobasidiis et caulocystidiis composita; caulocystidiis, 25–65 × 6–13μm, abundantibus, late claviformibus vel fusoido-ventricosis, brunneo-rubris; hyphis defibulatis.

Holotypus: Ad terram in silvis, Banna-dake, Ishigaki-shi, Okinawa Pref., May 30, 2002, H. Takahashi (KPM-NC0010093).

Etymology: Latin, *rhodo-* (rose-) + *porosum* (porous), referring to the deep red pores.

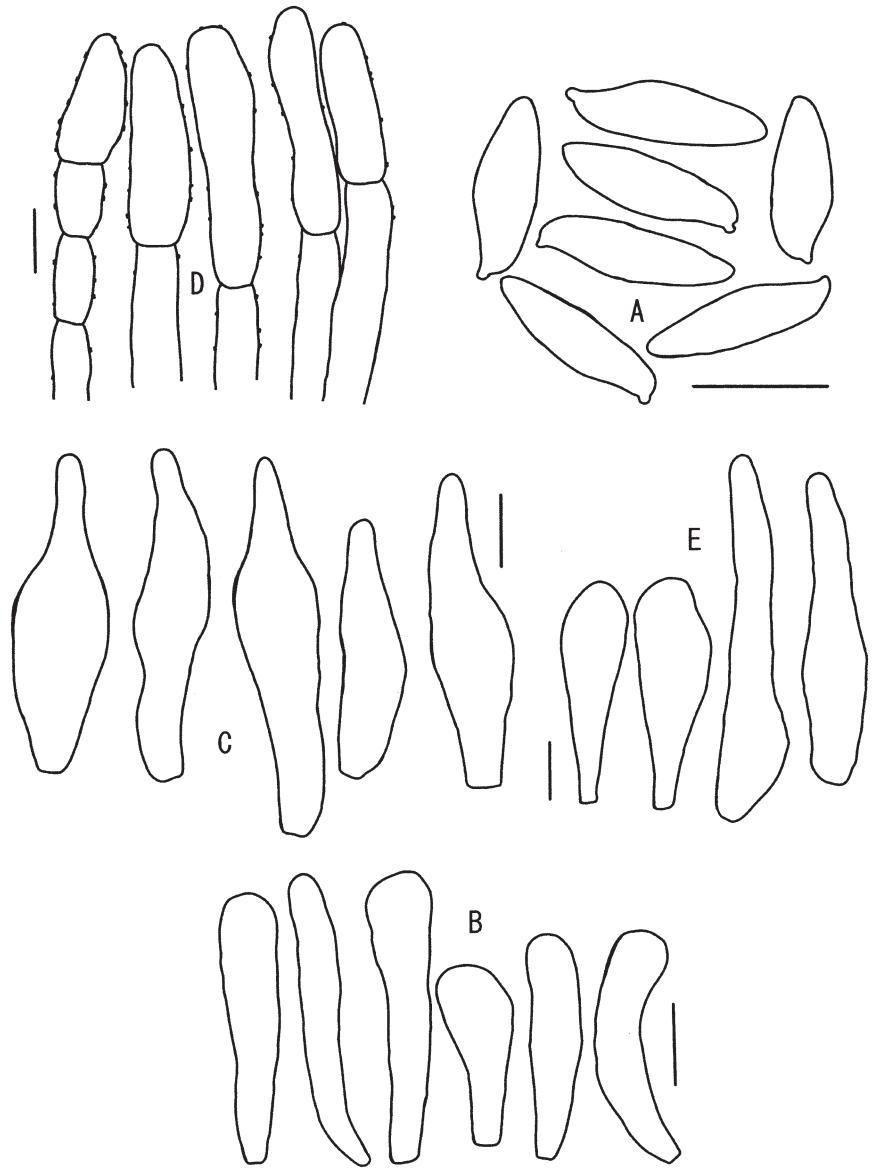
Pileus 40–70mm in diameter, at first hemispherical, expanding to broadly convex, with inrolled then straight margin; surface dry, subtomentose to nearly smooth, at first evenly colored reddish-brown (8E7-8) to dark reddish brown (8F6-8), then somewhat paler in age, unchanging when bruised. Flesh up to 10mm thick, firm, whitish in the pileus, whitish to light yellow in the stipe, slowly changing to blue when cut; odor and taste indistinct. Stipe 30–60 × 10–20mm, subequal or somewhat enlarged toward the base, central, terete, solid; surface dry, distinctly covered overall with violet-brown (11E8-11F8) to blackish-brown, furfuraceous scales on a whitish ground color, not reticulate; base covered with whitish mycelium. Tubes up to 12mm deep, deeply depressed around the stipe, yellow, slowly staining blue when cut; pores small (2–3 per millimeter), subcircular, at first yellow, soon becoming deep red (9A8-10A8) to reddish-orange (7A8), then brownish-orange (7C8) in age, slowly staining blue where handled.

Basidiospores ( $n = 87$  spores of 6 basidiocarps)  $15\text{--}16.5 \times 4.5\text{--}5\mu\text{m}$ , Q (length/breadth) = 3.3, inequilateral with a suprahilar depression in profile, elongate-fusiform in face view, smooth, brown (7E6-7) in  $\text{H}_2\text{O}$ , thick-walled (up to 1μm). Basidia 18–27 × 8–11μm, clavate, four-spored. Cheilocystidia gregarious, 22–37 × 4–7μm, subclavate, smooth, brownish-red in  $\text{H}_2\text{O}$ , thin-walled. Pleurocystidia scattered, 37–55 × 7–11μm, fusoid-ventricose, smooth, colorless, thin-walled. Hymenophoral trama composed of elements 6–20μm wide, cylindrical, divergent, smooth, pale yellow, thin-walled. Pileipellis composed of a trichodermial palisade formed by vertically and compactly arranged hyphae, 5–12μm wide, cylindrical, encrusted with granular brown pigment, thin-walled. Pileitrama of cylindrical, loosely interwoven hyphae 6–30μm wide, smooth, colorless, thin-walled. Stipitipellis a disrupted hymeniform, consisting of caulocystidia and caulobasidia. Caulocystidia of two types: (1) broadly clavate, 25–35 × 6–13μm, smooth, brownish-red in  $\text{H}_2\text{O}$ , thin-walled; (2) narrowly fusoid-ventricose, 40–65 × 7–11μm, smooth, brownish-red in  $\text{H}_2\text{O}$ , thin-walled. Stipe trama composed of longitudinally arranged, cylindrical hyphal cells 7–12μm wide, unbranched, smooth, colorless, thin-walled. Clamps absent in all tissues.

Known distribution: Japan (Hyogo, Okinawa).

Habitat: Solitary to scattered, on ground in subtropical evergreen broad-leaved forests dominated by *Q. miyagii* and *C. cuspidata* var. *sieboldii* or warm temperate *Quercus-*

**Fig. 3.** *Leccinum rhodoporum*. **A** Basidiospores. **B** Cheilocystidia. **C** Pleurocystidia. **D** Terminal elements of the pileipellis hyphae. **E** Caulocystidia. All figures from the holotype. Bars 10µm



*Pinus* forests dominated by *Q. acuta* Thunb. ex Murray, *Q. myrsinaefolia* Blume, and *Pinus densiflora* Sieb. et Zucc., May to September.

Specimens examined: KPM-NC0010093 (holotype), Banna-dake, Ishigaki-shi, Okinawa Pref., May 30, 2002, coll. H. Takahashi; same place, June 15, 2003, coll. H. Takahashi; KPM-NC0013136, same place, June 4, 2004, coll. H. Takahashi; KPM-NC0014100, Kita-ku, Koube-shi, Hyougo Pref., Sept. 11, 2006, coll. S. Koutoku.

Japanese name: Urabeni-yamaiguchi.

Notes: This species is characterized by its reddish-brown to dark reddish brown pileus, the whitish stipe covered overall with violet-brown to blackish-brown, furfuraceous scales, the deep red to reddish-orange pores, the large, fusoid-cylindrical, brown basidiospores, the pileipellis composed of a trichodermial palisade, and the habitat in subtropical evergreen broad-leaved forests or warm temperate *Quercus-Pinus* forests.

Except for its pores, which are discolored red, the morphological features such as the coarsely furfuraceous stipe

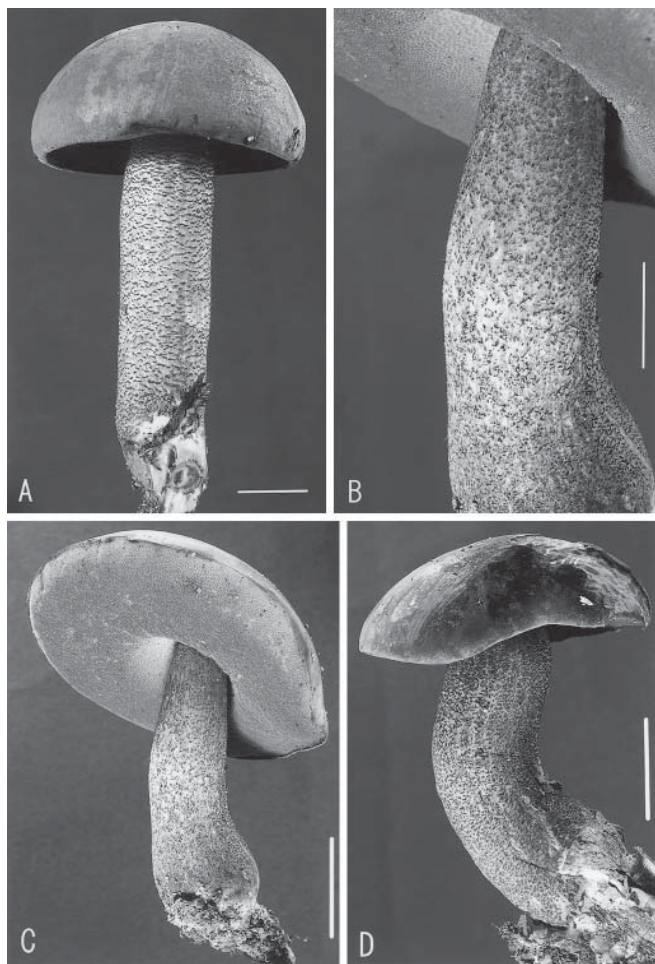
surface and the rather large (15–16.5µm long), elongate-fusiform, brown basidiospores strongly suggest that *L. rhodoporum* belongs to the genus *Leccinum*.

*Leccinum australiense* Bougher & Thiers, recently reported from tropical northern Australia (Bougher and Thiers 1991), appears to be closely related to *L. rhodoporum* in having discolored pores, a reddish-brown pileus, and a palisade-trichodermium structure in the pileipellis. The former species, however, has a white context soon turning pale gray, unchanging, cream-yellow tubes, pores discolored dark reddish brown, and habitat in *Eucalyptus* forests.

### 3. *Pulveroboletus brunneoscabrosus* Har. Takah., sp. nov.

Figs. 5, 6

Pileo 20–50mm lato, primo hemisphaerico, dein convexo vel applanato, flavido-pulverulento, brunneo-aurantiaco furfuraceo; carne pallide flavida; odore saporeque nullo; stipite 60–100 × 15–25mm, subaequali vel ad basim leviter



**Fig. 4.** Basidiomata of *Leccinum rhodoporosum*. All figures from the holotype. Bars **A**, **B** 10 mm; **C** 20 mm; **D** 15 mm

incrassato, solido, viscido in humido, flavido, omnino pulvere flavido oblecto, saltem partibus inferioribus cum squamis adpressis aurantiacis vel brunneo-aurantiacis praedito, per mycelio basali albo affixo; tubulis leviter depressis circa stipitem, pallide flavis, dein brunneolis; poris subrotundatis, parvis, flavis; basidiosporis 7–10 × 4–5 μm, leviter depressione suprahili praeditis, late ellipsoideis, levibus, melleis; basidiis tetrasporis; cheilocystidiis pleurocystidii similibus; pleurocystidii 35–52 × 6–10 μm, fosoideo-ventricosis, hyalinis; tramate notabiliter gelatinoso; hyphis defibulatis.

**Holotypus:** Ad terram in silvis, Banna-dake, Ishigaki-shi, Okinawa Pref., May 30, 2002, H. Takahashi (KPM-NC0010098).

**Etymology:** Latin, *brunneo-* (brown-) + *-scabrosus* (scabrous), referring to the brownish-orange, appressed scales.

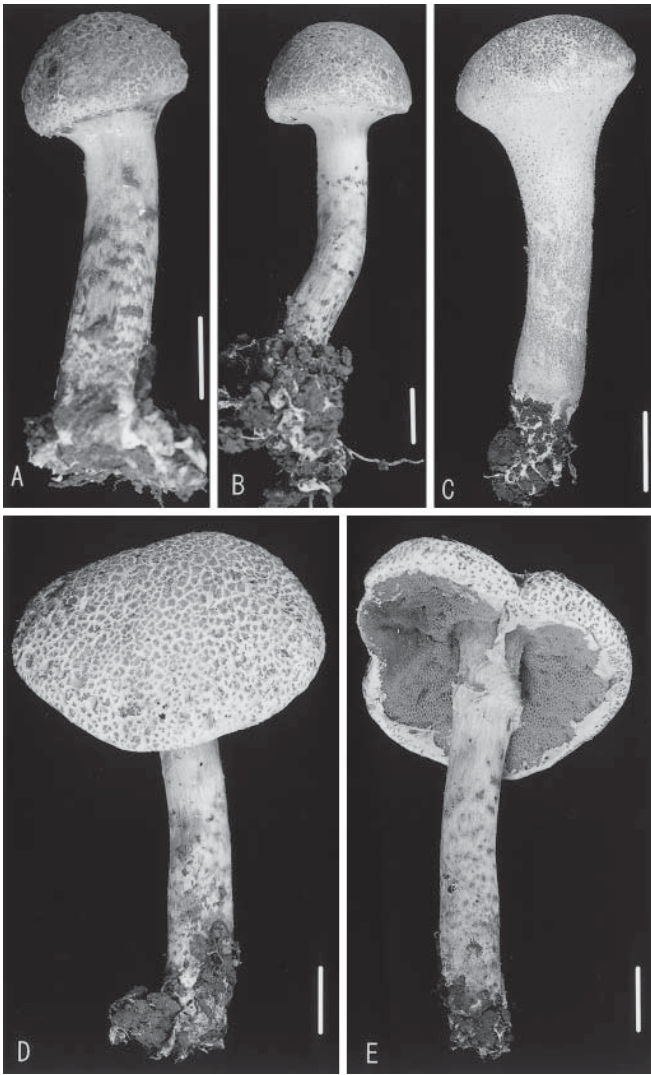
**Pileus** 20–50 mm in diameter, at first hemispherical, expanding to broadly convex; surface wholly yellow (2A6-7 to 3A6-7) pulverulent, subviscid when wet, at first covered overall with an orange (6B7) to brownish-orange (6C7-8) veil that soon breaks up into appressed scales, ground color lemon-yellow (under scales), unchanging when bruised. Flesh up to 4 mm thick, light yellow, strongly fleshy-gelatinous, unchanging when cut; odor and taste indistinct. Stipe



**Fig. 5.** *Pulveroboletus brunneoscabrosus*. **A** Basidiospores. **B** Cheilocystidia. **C** Pleurocystidia. All figures from the holotype. Bars 10 μm

60–100 × 15–25 mm, subequal or somewhat enlarged toward the base, central, terete, solid; surface entirely yellow (2A6-7 to 3A6-7) pulverulent, viscid to subglutinous when wet, lemon-yellow, sheathed at least over the lower part with orange (6B7) to brownish-orange (6C7-8), appressed scales, unchanging when bruised, veil rarely leaving a faint fibrillose annulus; base covered with whitish mycelium. Tubes up to 6 mm deep, slightly depressed around the stipe, at first light yellow, brown (6B7) at maturity, unchanging; pores small (2–3 per millimeter), subcircular, concolorous with the tubes, unchanging when bruised.

**Basidiospores** ( $n = 138$  spores of 6 basidiocarps) 7–10 × 4–5 μm,  $Q$  (length/breadth) = 1.75–2.0, inequilateral with a shallow suprahilar depression in profile, broadly ellipsoid in face view, smooth, melleous in H<sub>2</sub>O, thick-walled (up to 1 μm). **Basidia** 25–35 × 6–10 μm, clavate, four-spored. **Cheilocystidia** 25–40 × 5–8 μm, narrowly fusoid-ventricose, colorless, thin-walled. **Pleurocystidia** scattered, similar in shape to the cheilocystidia but larger (35–52 × 6–10 μm). **Hymenophoral trama** composed of hyphal hyphae 3–7 μm wide, cylindrical, parallel with each other, strongly gelatinized, smooth, pale yellow, thin-walled. **Pileipellis** consisting of repent, appressed, interwoven, gelatinized hyphal elements;



**Fig. 6.** Basidiomata of *Pulveroboletus brunneoscabrosus*. All figures from KPM-NC0013148. Bars 10 mm

constituent hyphae 2.5–6 µm wide, parallel, cylindrical, with intracellular brownish (in H<sub>2</sub>O) pigment, with intercellular yellow granular matter, thin-walled. Pileitrama of cylindrical, loosely interwoven hyphae 2.5–15 µm wide, strongly gelatinized, smooth, colorless, thin-walled. Stipitipellis composed of repent, appressed, interwoven, gelatinized hyphal elements; constituent hyphae 2.5–7 µm wide, parallel, cylindrical, with intracellular brownish (in H<sub>2</sub>O) pigment, with intercellular yellow (in H<sub>2</sub>O) granular matter, thin-walled. Stipe trama composed of longitudinally arranged, cylindrical cells 3–8 µm wide, occasionally branched, strongly gelatinized, smooth, colorless in H<sub>2</sub>O. Clamps absent in all tissues.

Known distribution: Japan (Kagoshima, Miyazaki, Okinawa).

Habitat: Solitary to scattered, on ground in subtropical evergreen broad-leaved forests dominated by *Q. miyagii* and *C. cuspidata* var. *sieboldii* or warm temperate evergreen broad-leaved forests dominated by *Q. gilva* Blume, May to September.

Specimens examined: KPM-NC0010098 (holotype), Banna-dake, Ishigaki-shi, Okinawa Pref., May 30, 2002, coll. H. Takahashi; KPM-NC0013148, same place, June 6, 2004, coll. H. Takahashi; KPM-NC0013147, Omoto-dake, Ishigaki-shi, Okinawa Pref., May 25, 2003, coll. H. Takahashi; KPM-NC0013155, Takaharu-cho, Miyazaki Pref., Sept. 21, 2001, in evergreen forest dominated by *Q. gilva*, coll. S. Kurogi; KPM-NC0013156, Uken-son, Amamiyoshi-ma, Kagoshima Pref., Sept. 22, 2002, coll. E. Hadano.

Japanese name: Uroko-kiiroiguchi.

Notes: *P. brunneoscabrosus* is characterized by its lemon-yellow pulverulent pileus and stipe covered overall with orange to brownish-orange, appressed scales, the yellow pulverulent, floccose-membranous to floccose-fibrillose, soon-collapsing annulus, the noncyanescent (unchanging), strongly fleshy-gelatinous flesh, and the habitat in subtropical to warm temperate evergreen broad-leaved forests.

*Pulveroboletus brunneoscabrosus* is most similar in appearance to *P. ravenelii* (Berk. & M.A. Curtis) Murrill (Singer 1947; Snell and Dick 1970; Smith and Thiers 1971; Corner 1972; Grund and Harrison 1976; Bessette et al. 2000), but it differs in the orange to brownish-orange, appressed scales on the pileus and stipe surface, the strongly fleshy-gelatinous, unchanging flesh, and the habitat in evergreen broad-leaved forests. *Pulveroboletus frians* Corner from Malaysia (Corner 1972) seems also closely allied with *P. brunneoscabrosus*. The Malaysian taxon, however, differs in forming an orange to tawny-yellow, thickly floccose-squamose sheath on the pileal and stipe surfaces, and cyanescent flesh. *Pulveroboletus brunneoscabrosus* also bears some resemblance to *P. aberrans* Heinem. & Gooss.-Font. from Congo (Heinemann 1951, 1954), which differs in having an entirely orange-brown, tomentose pileus and stipe and cyanescent flesh.

#### 4. *Rubinoboletus monstrosus* Har. Takah., sp. nov.

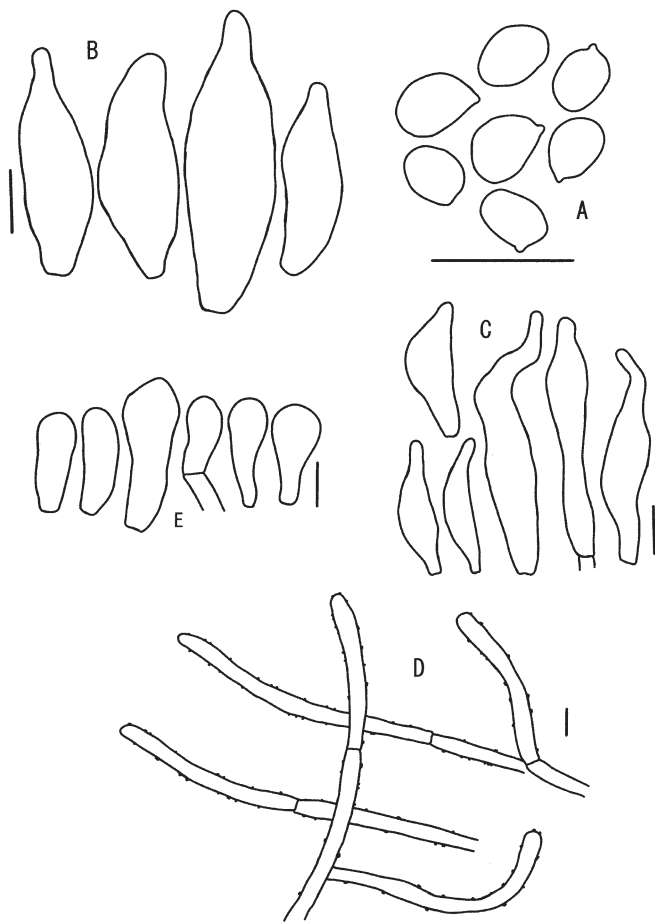
Figs. 7, 8

Pileo 50–140 mm lato, primo hemisphaerico, dein late convexo, sicco, interdum rimoso-areolato, subtomentoso vel subglabro, primo rubro-brunneo, dein pallide ochraceo; carne albo; odore foetido; sapore felleo; stipite 20–40 × 15–45 mm, valde brevis, subaequali vel ad basim leviter tenui, cavo, sicco, subglabro vel subtomentoso, pallide flavido; mycelio basali nullo; tubulis adnatis vel leviter depressis circa stipitem, ochraceis; poris rotundatis, parvis, ochraceis; basidiosporis 5–6 × 3.5–4 µm, ovoideo-ellipsoideis, levibus, pallide flavidis; basidiis tetrasporis; cheilocystidiis 34–52 × 8–13 µm, abundantibus, fusoido-ventricosis, hyalinis; pleurocystidiis 30–60 × 5–15 µm, fusoido-ventricosis, flavidis; pileipelle trichodermio composita; caulocystidiis 12–35 × 4–10 µm, late claviformibus, hyalinis; hyphis defibulatis.

Holotypus: Ad terram in silvis, Banna-dake, Ishigaki-shi, Okinawa Pref., May 19, 2004, H. Takahashi (KPM-NC0013139).

Etymology: Latin, *monstrosus* (monstrous), referring to the peculiar habit of its basidiomata.

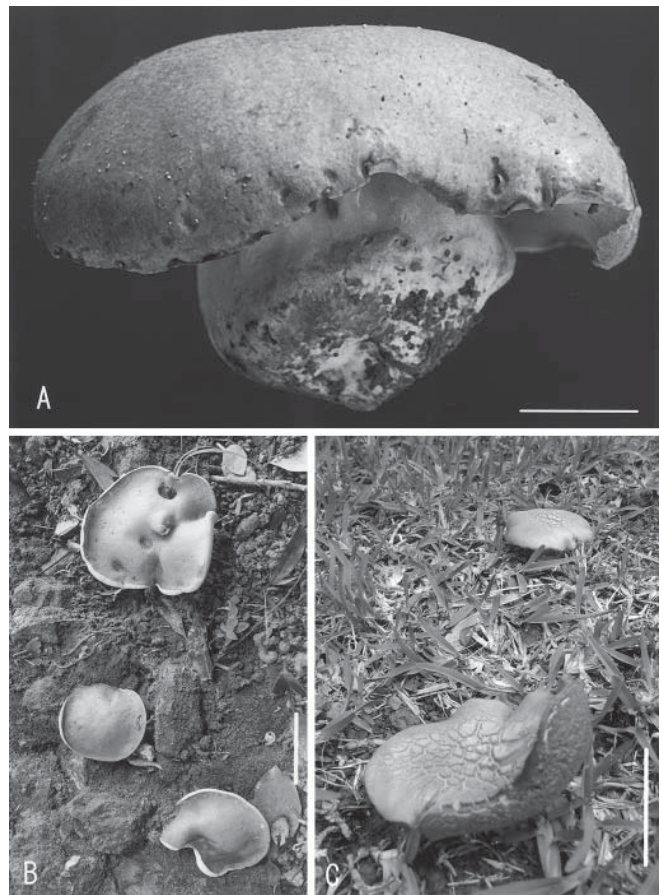
Pileo 50–140 mm in diameter, at first hemispherical, expanding to broadly convex; surface dry, sometimes rimose-



**Fig. 7.** *Rubinoboletus monstrosus*. **A** Basidiospores. **B** Cheilocystidia. **C** Pleurocystidia. **D** Terminal elements of the pileipellis hyphae. **E** Caulocystidia. All figures from the holotype. Bars 10  $\mu$ m

areolate at the center, entirely grayish-orange (5B6) or brownish-orange (5C5-6) to yellowish-brown (5D5) from the outset, sometimes reddish-brown (8D7) when young and fresh, subtomentose to nearly glabrous. Flesh up to 12 mm thick, whitish, unchanging when exposed; odor strongly disagreeable (resembling rotten meat), taste bitter. Stipe 20–40  $\times$  15–45 mm, very short, subequal or tapering toward the base, central, terete, hollow from the outset; surface dry, entirely almost glabrous to subtomentose, yellowish-brown (5D4-5), nonreticulate; basal mycelium not observed. Tubes up to 10 mm deep, adnate or slightly depressed around the stipe, grayish-orange (5B4-5) when young, then yellowish-brown (5D6) in age, unchanging when exposed; pores small (2–3 per millimeter), rounded to subangular, concolorous.

Basidiospores ( $n = 115$  spores of 6 basidiocarps) 5–6  $\times$  3.5–4  $\mu$ m, Q (length/breadth) = 1.4–1.5, ovoid-ellipsoid, smooth, pale yellow in  $H_2O$ , walls up to 0.5  $\mu$ m. Basidia 25–30  $\times$  6–8  $\mu$ m, clavate, four-spored. Basidioles clavate. Cheilocystidia gregarious, 34–52  $\times$  8–13  $\mu$ m, fusoid-ventricose, smooth, hyaline, thin-walled. Pleurocystidia scattered, 30–60  $\times$  5–15  $\mu$ m, fusoid-ventricose, smooth, with yellowish-brown to golden-yellow (in  $H_2O$ ) contents, thin-walled. Hy-



**Fig. 8.** Basidiomata of *Rubinoboletus monstrosus*. **A** From the holotype; **B**, **C** from KPM-NC0013142. Bars **A** 10 mm; **B** 50 mm; **C** 70 mm

menophoral trama composed of hyphal elements 6–10  $\mu$ m wide, cylindrical, paralleling each other, smooth, hyaline, thin-walled. Pileipellis composed of a trichoderm formed by loosely interwoven hyphal elements, 5–8  $\mu$ m wide, cylindrical, incrustated with granular yellowish-brown (in  $H_2O$ ) pigment, thin-walled. Pileitrama of cylindrical, loosely interwoven hyphae 4–13  $\mu$ m wide, smooth, colorless, thin-walled. Stipitipellis composed of parallel, repent hyphae 2–5  $\mu$ m wide, cylindrical, smooth, colorless, thin-walled; caulocystidia 12–35  $\times$  4–10  $\mu$ m, broadly clavate, smooth, hyaline, thin-walled. Stipe trama composed of longitudinally arranged, cylindrical cells 6–20  $\mu$ m wide, unbranched, smooth, colorless, thin-walled. Clamps absent in all tissues.

Known distribution: Japan (Okinawa).

Habitat: Solitary to scattered, on ground in subtropical evergreen broad-leaved forests dominated by *Q. miyagii* and *C. cuspidata* var. *sieboldii*, May.

Specimens examined: KPM-NC0013139 (holotype), Banna-dake, Ishigaki-shi, Okinawa Pref., May 19, 2004, coll. H. Takahashi; KPM-NC0013141, same place, May 20, 2003, coll. H. Takahashi; KPM-NC0013142, same place, May 25, 2004, coll. H. Takahashi; KPM-NC0013143, same

place, May 14, 2005, coll. H. Takahashi; KPM-NC0013140, same place, May 20, 2005, coll. H. Takahashi.

Japanese name: Daruma-iguchi.

Notes: Features delimiting this species include the medium-to-large, peculiar habit of its basidiomata, the brownish-orange to yellowish-brown pileus, the very short, nonreticulate, hollow stipe, the short ellipsoid, light yellowish basidiospores, the prominent pleurocystidia containing yellowish-brown to golden-yellow contents, and the habitat in subtropical evergreen broad-leaved forests.

Its whitish, unchanging flesh and its pale yellow, short ellipsoid basidiospores suggest that this species belongs in the genus *Boletus*, *Gyroporus*, or *Tylopilus*. However, if greater taxonomic emphasis is placed on the nonreticulate stipe, the short ellipsoid, light yellowish basidiospores, and its prominent pleurocystidia with yellowish-brown to golden-yellow contents, it would be better placed in the genus *Rubinoboletus* Pilát & Dermek in the sense of Heinemann and Rammeloo (Heinemann and Rammeloo 1983; Watling and Gregory 1988; Li and Watling 1999; Watling and Li 1999).

Within the genus, it seems to be allied with *R. ballouii* (Peck) Heinemann & Rammeloo, originally described from North America (Singer 1947; Snell and Dick 1970; Corner 1972; Heinemann and Rammeloo 1983; Bessette et al. 2000). The latter species, however, differs mainly in its much longer, solid stipe and its angular pores reaching 2 mm at maturity. The Australian species *R. caespitosus* T.H. Li & Watling (Cleland 1924; Grgurinovic 1997; Li and Watling 1999; Watling and Li 1999) is somewhat similar in appearance, but differs in having much larger basidiospores and a caespitose habit with a solid stipe.

##### 5. *Tylopilus fuligineoviolaceus* Har. Takah., sp. nov.

Figs. 9, 10

Pileo 40–80 mm lato, primo hemisphaerico, dein convexo vel applanato, subtomentoso, primo atro-violaceo, dein saepe nigro-brunneo; carne firma, alba, interdum ad fractionem immutabili; odore nullo; saporeq felleo; stipite 50–80 × 10–25 mm, subaequali vel ad basim leviter incrassato, solido, subtomentoso vel subglabro, atro-violaceo, per mycelio basali albo affixo; tubulis adnatis vel subadnexis, primo albis, dein brunneo-incarnatis, ad fractionem brunnescentibus; poris subrotundatis, parvis, concoloribus, brunnescentibus; basidiosporis 7–9 × 4–4.5 μm, ellipsoideo-subfusiformibus, depressione suprahili praeditis, levibus, brunneo-incarnatis; basidiis tetrasporis; cheilocystidiis 20–35 × 4–6 μm, abundantibus, subfusoides, hyalinis; pleurocystidiis cheilocystidii similibus; pileipelle trichodermio composita; hyphis defibulatis.

Holotypus: Ad terram in silvis, Iryuda, Odawara-shi, Kanagawa Pref., Sept. 26, 2001, coll. M. Nishimura (KPM-NC0008740).

Etymology: Latin, *fuligineo-* (fuliginous-) + *-violaceus* (violaceous), referring to the color of basidiomata.

Pileus 40–80 mm in diameter, at first hemispherical, becoming broadly convex to nearly plane in age, with inrolled then straight margin; surface dry, subtomentose, at first en-

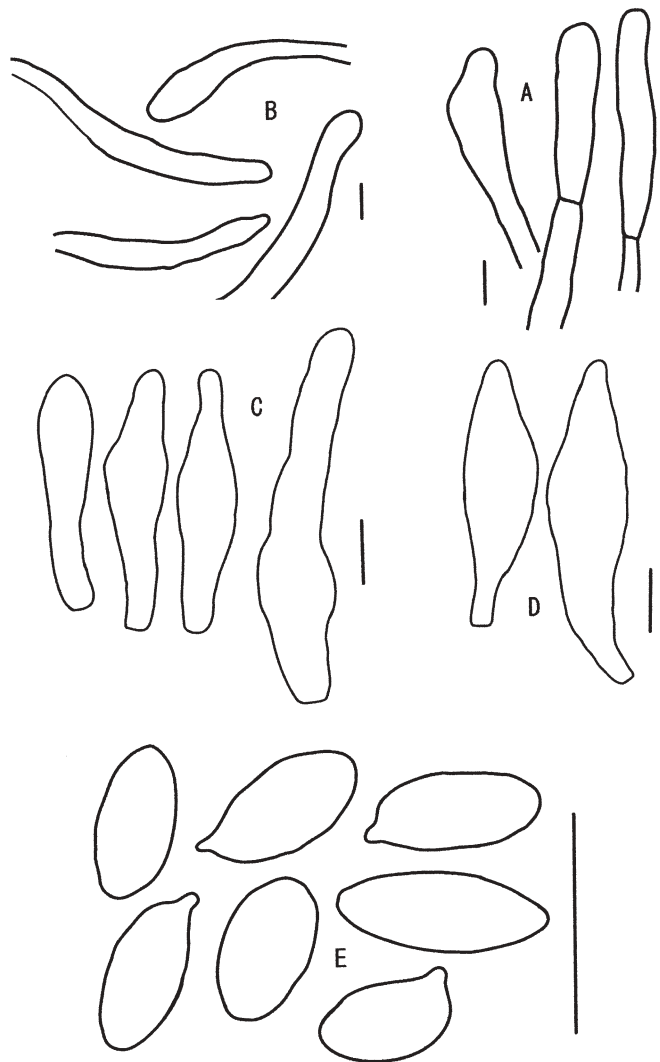


Fig. 9. *Tylopilus fuligineoviolaceus*. A Terminal elements of the pileipellis hyphae (when young). B Terminal elements of the pileipellis hyphae (when mature). C Cheilocystidia. D Pleurocystidia. E Basidiospores. (All figures from the holotype). Bars 10 μm

tirely deep violet (15E8–16E8) to dark violet (15F8), usually becoming blackish-brown overall at maturity, sometimes almost blackish-brown from the outset. Flesh up to 10 mm thick, firm, white, unchanging or rarely changing to pale brown above the tubes and beneath the pileus surface when exposed; odor indistinct, taste bitter. Stipe 50–80 × 10–25 mm, equal or somewhat enlarged toward the base, central, terete, solid; surface dry, entirely subtomentose to subglabrous, sometimes longitudinally rugulose, sometimes slightly reticulated by a thin-veined, purplish reticulum at the apex, deep violet (15E8–16E8) to dark violet (15F8), often paler toward the base, whitish at the very apex; base covered with whitish mycelium. Tubes up to 7 mm deep, adnate to slightly adnexed, white when young, dull pinkish in age, slowly changing to brown when cut; pores small (2–3 per millimeter), subcircular, concolorous, slowly changing to brown where handled.





**Fig. 10.** Basidiomata of *Tylopilus fuligineoviolaceus* (all figures from the holotype). Bars **A** 20mm; **B** 10mm

Basidiospores ( $n = 122$  spores of 5 basidiocarps)  $7-9 \times 4-4.5 \mu\text{m}$ , Q (length/breadth) =  $1.75-2.0$ , ellipsoid to subfusiform, inequilateral with a shallow suprahilar depression in profile, smooth, pinkish in  $\text{H}_2\text{O}$ , thick-walled (up to  $1 \mu\text{m}$ ). Basidia  $18-20 \times 5-7 \mu\text{m}$ , clavate, four-spored. Basidioles clavate. Cheilocystidia gregarious,  $20-35 \times 4-6 \mu\text{m}$ , fusiform to subfusiform, smooth, hyaline, thin-walled. Pleurocystidia scattered, similar in shape to the cheilocystidia but larger. Hymenophoral trama divergent, composed of hyphae  $4-10 \mu\text{m}$  wide, cylindrical, smooth, hyaline, thin-walled. Pileipellis a trichodermium of vertically arranged, loosely interwoven hyphal elements, with violet-brown (in  $\text{H}_2\text{O}$ ) vacuolar pigment, thin-walled; terminal cells subcylindrical,  $3-6 \mu\text{m}$  wide, without pilocystidia. Pileitrama consisting of cylindrical, loosely interwoven hyphae  $4-10 \mu\text{m}$  wide, smooth, colorless, thin-walled. Stipe trama composed of longitudinally arranged, cylindrical cells  $4-10 \mu\text{m}$  wide, smooth, colorless, thin-walled. Clamps absent in all tissues.

Known distribution: Japan (Kanagawa, Tokyo).

Habitat: Solitary to scattered, on ground in broad-leaved forests dominated by *Ardisia japonica* (Thunb.) Blume, *C. cuspidata* var. *sieboldii*, *Quercus salicina* Blume, and *Q. acuta*, July to September.

Specimens examined: KPM-NC0008740 (holotype), Iryuda, Odawara-shi, Kanagawa Pref., Sept. 26, 2001, coll. M. Nishimura; same place, July 20, 2000, coll. H. Takahashi; same place, Sept. 10, 1999, coll. H. Takahashi; Yoyogikamizono-cho, Shibuya-ku, Tokyo-Metropolis, July 13, 1986, coll. H. Takahashi; same place, July 19, 1986, coll. H. Takahashi; same place, July 29, 1986, coll. H. Takahashi; Zushi-shi, Kanagawa Pref., July 14, 1985, coll. H. Takahashi.

Japanese name: Kuro-murasaki-nigaiguchi.

Notes: This species is characterized by its deep violet to blackish-brown pileus, the white, bitter flesh, the brunnescent hymenophore, and the habitat in warm temperate *Quercus-Castanopsis* forests.

This species is somewhat similar in appearance to *T. obscureviolaceus* Har. Takah. from subtropical Japan (Takahashi 2004) and *T. vinosobrunneus* Hongo from warm temperate Japan (Hongo 1979). *Tylopilus obscureviolaceus* forms a persistently dark purple pileus, unchanging hymenophore, and a brownish stipe. *Tylopilus vinosobrunneus* is distinct in forming a light brown to reddish-brown pileus, rufescent flesh, pleurocystidia with ochraceous oily contents, and pileipellis composed of erect chains of short cylindrical elements.

*Tylopilus fuligineoviolaceus* might be mistaken also for the North American *T. plumbeoviolaceus* (Snell & E.A. Dick) Snell & E.A. Dick (Snell 1936; Snell and Dick 1941, 1970; Singer 1947; Smith and Thiers 1971; Grund and Harrison 1976; Wolfe 1986; Bessette et al. 2000), but can be distinguished from it because in the latter, the pileus fades to purple-brown, purple-gray, brown, dull cinnamon, or tan; the tubes and pores never change in color when exposed or injured; the basidiospores are much longer,  $10-13 \times 3-4 \mu\text{m}$  (Bessette et al. 2000); and, according to Wolfe's type study (Wolfe 1986), the pileipellis is a hymeniform composed of fusoid-ventricose to narrowly fusoid-ventricose pilocystidia.

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