

## *Boletus kermesinus*, a new species of *Boletus* section *Luridi* from central Honshu, Japan

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Received: 5 December 2010 / Accepted: 7 April 2011 / Published online: 27 April 2011  
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**Abstract** *Boletus kermesinus*, a new species of *Boletus* section *Luridi*, is fully described and illustrated based on the materials collected in subalpine coniferous forests of central Honshu, Japan. It has distinctive features of dark-red basidiomata having distinct viscosity in the pileus surface, usually unchanging flesh, discolourous red pores, and an entirely reticulate stipe becoming coarsely lacerate-rimose with age.

**Keywords** Boletales · Japanese mycobiota · Taxonomy

*Boletus* section *Luridi* Fr. is well delimited in the genus macromorphologically in the boletoid habit, the small, often discolored, pores, and the reticulate or finely furfureaceous stipe surface (Singer 1986). The species of the section *Luridi* are mainly distributed in North America (Singer 1947; Snell and Dick 1970; Smith and Thiers 1971; Thiers 1975; Bessette et al. 1997, 2000), Europe (Singer 1967; Alessio 1985), and Southeast and East Asia (Corner 1972; Zang 2006). Excluding poorly known species and invalid names (<http://www.indexfungorum.org>), 14 taxa of the section *Luridi* have hitherto been recorded from Japan, namely, *B. brunneissimus* W.F. Chiu (= *B. umbriniporus* Hongo) (Hongo 1969; Wang and Liu 2002), *B. fusco-punctatus* Hongo and Nagas. (Hongo and Nagasawa 1976),

*B. obscureumbrinus* Hongo (Hongo 1968), *B. pseudocalopus* Hongo (Hongo 1972), *B. sensibilis* var. *sensibilis* Peck (Hongo and Nagasawa 1980), *B. subcinnamomeus* Hongo (Hongo 1977), *B. venenatus* Nagas. (Nagasawa 1996), *B. laetissimus* Hongo (1968), *B. luridiformis* var. *luridiformis* Rostk. (= *B. erythropus* Pers. sensu Imazeki 1952), *B. subvelutipes* f. *subvelutipes* Peck, (Nagasawa 1989), *B. bannaensis* Har. Takah. (Takahashi 2007), *B. quercinus* Hongo (Hongo 1967), *B. generous* Har. Takah. (Takahashi 1988), and *B. rhodocarpus* Uehara and Har. Takah. (Takahashi 2001). In this article, a peculiar new species of *Boletus* section *Luridi* is presented based on the materials collected in subalpine coniferous forests of central Honshu, Japan.

Macroscopic features are all based on fresh materials. For microscopic observations, free-hand sections of the fresh or dried materials were examined in Melzer's reagent, 30% NH<sub>4</sub>OH, 3% KOH, phloxine B, Congo red, or distilled water using a Nikon Eclipse 50i microscope. Basidiospores were measured in side view, excluding the hilar appendix; ± standard deviation, Q (length/width) range, and each average (median length, median width, median Q) were statistically derived from a random selection of all basidiospores measured. Color notations in parentheses are taken from Korerup and Wanscher (1983). Specimens cited here are deposited in the National Museum of Nature and Science in Tsukuba (TNS).

*Boletus kermesinus* Har. Takah., Taneyama & Koyama, sp. nov. Figs. 1–16  
Mycobank no.: MB 519342.

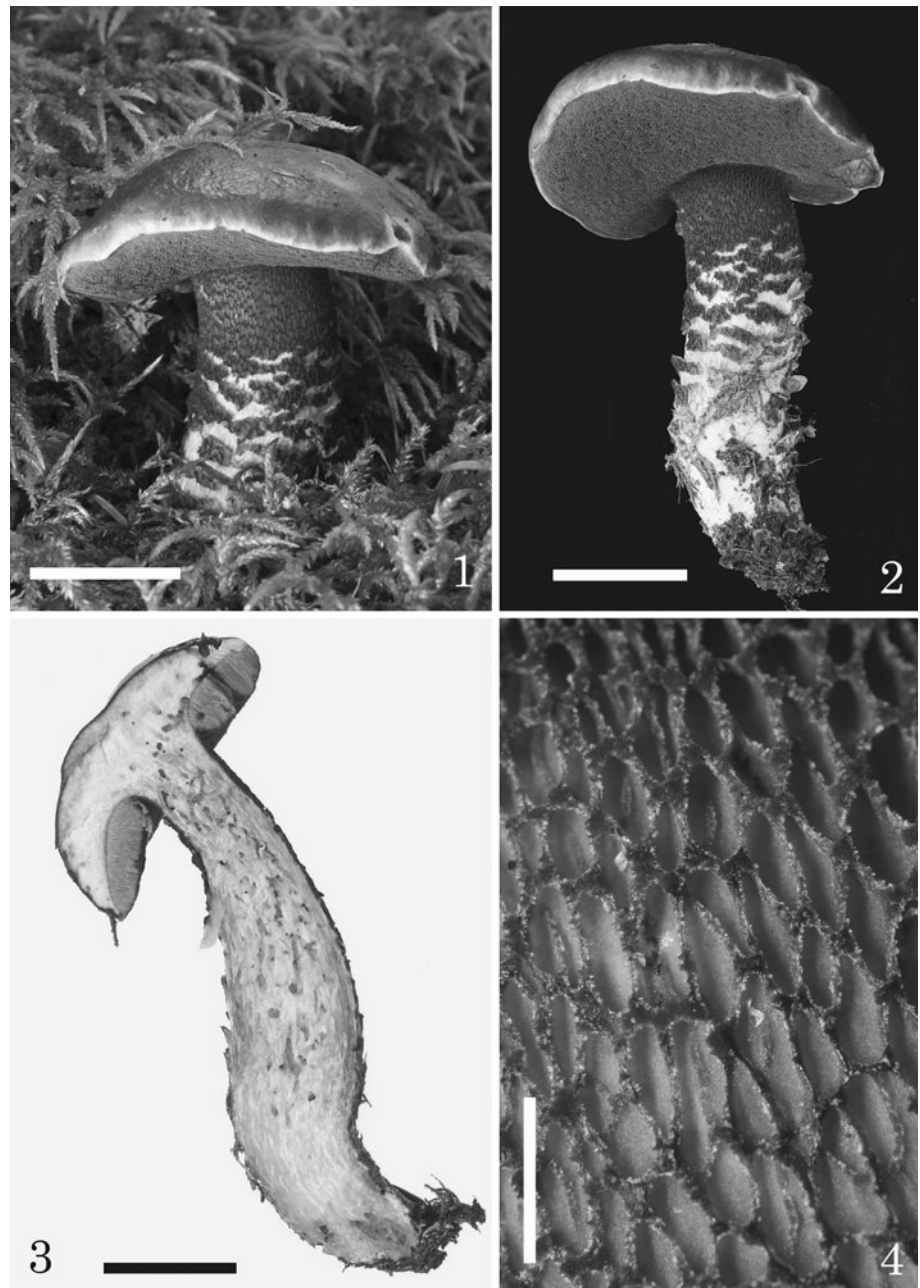
Pileo (20–)52–68(–87) mm lato, convexo dein late convexo, viscido in humidis, glabro, rubro, margine leniter pallidiore; carne pallide flavida, immutabili, odore saporeque nullo; stipite 50–80 (–120) × 8–20 mm, subaequali vel

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**Figs. 1–4** Basidiomata of *Boletus kermesinus*. **1** Basidioma in habitat. **2** Mature basidioma. **3** Vertical section of the mature basidioma (TNS-F-37404). **4** Close-up of the somewhat raised reticulations on the young stipe. Bars **1–3** 20 mm; **4** 2 mm. Color photographs of *Boletus kermesinus* can be seen at <http://www7a.biglobe.ne.jp/~har-takah/page137.html>



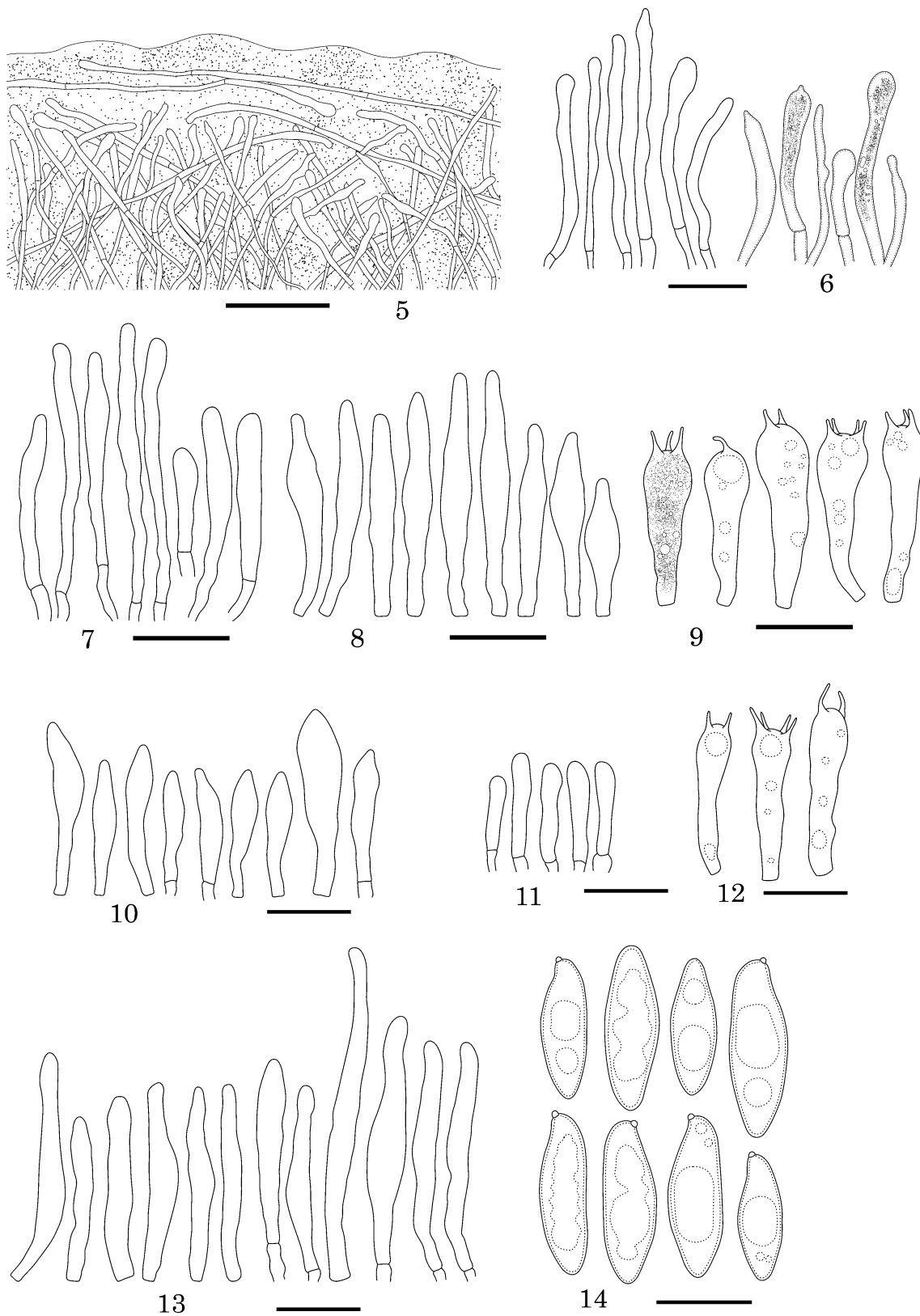
subventricosis, solido, rubro, manifeste rubro-reticulato, dein rimoso-areolato; tubulis depressis ad stipitem, flavis, fractis immutabilis; poris subrotundatis, parvis, rubris, immutabilis; basidiosporis (13.4–)15.5–18.6(–21.1) × (4.9–)5.6–6.6(–7.2) μm, fusoideis vel subfusoideis, levibus, depressione suprahilari praeditis, sub microscopio in KOH hyalinis vel melleis; basidiis (32.1–)39.7–50.1(–53.9) × (9.2–)10.4–12.5(–14.8) μm, (1–2–)3–4 sporis; cheilocystidiis (34.6–)52.7–71.0(–76.5) × (3.8–)4.5–6.3(–7.1) μm, subcylindricis; pleurocystidiis (36.6–)44.9–58.4(–75.2) × (5.9–)6.9–8.6(–9.0) μm, fusoideo-ventricosis, apicem versus attenuatis; tramate hymenophori laterali subtypo

*Boletus*; pileipelle ex hyphis ixotrichodermialibus subcylindricis vel subclavatis composita; stipitipelle hymeniformi ex caulocystidiis fusoideo-ventricosis vel subcylindricis, rubris composita; hyphis defibulatis.

Holotypus: Ad terram in silvis *Abietis mariesii* Mast., Sakuho-cho, Minamisaku-gun, Nagano Pref., Japonia, 29 Aug. 2009, M. Taneyama (TNS-F-37407).

Etymology: from Latin, *kermesinus* = crimson-red.

Pileus (Figs. 1, 2) (20–)52–68(–87) mm in diameter, at first hemispherical, expanding to broadly convex, with straight margin, often slightly appendiculate; surface glabrous,



**Figs. 5–14** Micromorphological features of *Boletus kermesinus* (holotype). **5** Vertical section of the pileipellis showing the ixotrichoderm consisting of loosely interwoven hyphae. **6** Terminal elements of the pileipellis. **7** Cheilocystidia. **8** Pleurocystidia.

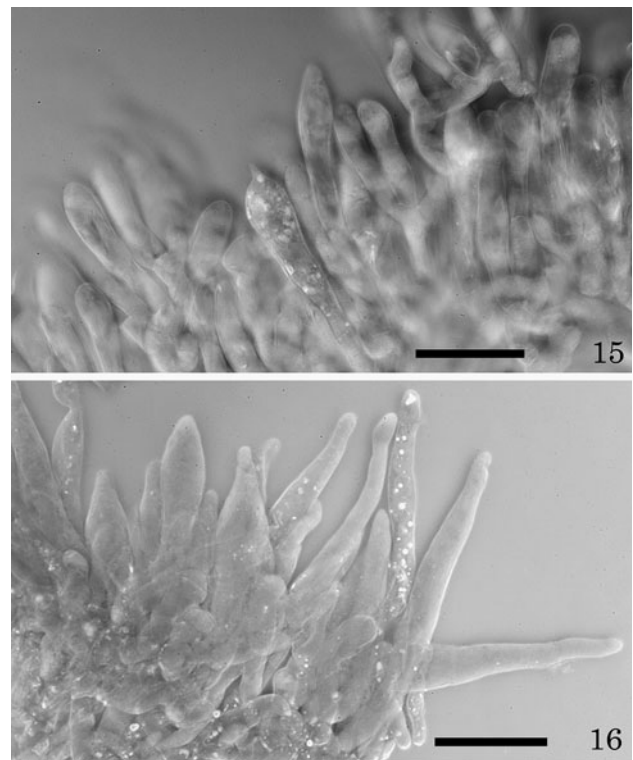
**9** Basidia. **10–13** Terminal elements of the stipitipellis (**10, 11** from between the reticula; **13** from the reticulum). **12** Caulobasidia. **14** Basidiospores. Bars **5** 50  $\mu\text{m}$ ; **6–13** 20  $\mu\text{m}$ ; **14** 10  $\mu\text{m}$

smooth, viscid when wet, brownish red (10C7) to dark red (10C8) overall when young, often with a high red (10A8) to red (10B7–8) margin, becoming violet brown (10E7–8 to 10F7–8) in age, at times with faded portions in patches. Flesh (Fig. 3) up to 12 mm thick, yellowish white (3A2) to pale yellow (3A3), red (10A6 to 10B7) immediately beneath the pileus and the stipe surface, unchanging or rarely slightly changing to blue only around the tubes when cut; odor and taste indistinct or somewhat sour. Stipe (Figs. 1, 2, 4) 50–80(–120) × 8–20 mm, subcylindrical or subventricose, often tapering toward the base, central, terete, solid; surface dry, concolorous with the pileus, initially entirely covered with a somewhat raised reticulum colored brownish red (10C7) to dark red (10C8) or blackish when older; as the stipe grows, the reticulated surface disrupting into large to small scaly patches particularly at the lower portion; base covered with pale yellowish mycelium. Tubes to 10 mm deep, depressed around the stipe, light yellow (3A5) to yellow (3A6), changing to blue when bruised; pores 2–3/mm when young, 1–2/mm in age, subcircular, brownish red (10C7) to dark red (10C8), changing to blue when bruised.

Basidiospores (Fig. 14) (13.4–)15.5–18.6(–21.1) × (4.9–)5.6–6.6(–7.2) μm ( $n = 100$ , median length = 17.03 ± 1.52, median width = 6.11 ± 0.51,  $Q = (2.4)2.6$ –3.0(–3.2), median  $Q = 2.8 ± 0.2$ ), inequilateral with a distinct suprahilar depression in profile, fusoid to subfusoid in face view, with a rounded apex, smooth, with dull yellow (3B4) to greyish yellow (3B5) contents (in water) turning greyish yellow (4B6) to orange yellow (4B7) in KOH, inamyloid or weakly dextrinoid, with slightly thickened walls (up to 0.5 μm). Basidia (Fig. 9) (32.1–)39.7–50.1(–53.9) × (9.2–)10.4–12.5(–14.8) μm, clavate, (1–2–)3–4-spored; sterigmata (2.8–)3.7–6.9(–9.0) × (1.3–)1.8–2.5(–2.9) μm. Basidioles clavate. Cheilocystidia (Fig. 7) abundant, forming a compact sterile edge, (34.6–)52.7–71.0(–76.5) × (3.8–)4.5–6.3(–7.1) μm ( $n = 36$ ), subcylindrical with an obtuse apex, smooth, with intracellular orange red (8A6–7) to brownish red (8C6–7) pigments, inamyloid, thin-walled. Pleurocystidia (Fig. 8) scattered, (36.6–)44.9–58.4(–75.2) × (5.9–)6.9–8.6(–9.0) μm ( $n = 38$ ), narrowly fusoid-ventricose to ventricose-rostrate with an obtuse apex, smooth, hyaline in water and KOH, inamyloid, thin-walled. Hymenophoral trama bilateral-divergent of the *Boletus* subtype; elements 4.9–6.6 μm wide, cylindrical, smooth, gelatinized, colorless in lateral strata, pale melleous in a mediostratum, inamyloid, thin-walled. Pileipellis (Fig. 5) of an ixotrichoderm consisting of loosely interwoven hyphae (2.0–)2.2–3.4(–4.9) μm wide, cylindrical, smooth, gelatinized, with orange red (8A6–7) to brownish red (8C6–7) contents (in water), which instantly turn olivaceous (near to greyish yellow: 3B5–6) and then gradually fade to more yellowish (near to

4B5–6) in KOH, inamyloid, thin-walled; terminal cells (Fig. 6) (25.4–)34.2–65.4(–75.3) × 2.9–5.2(–6.4) μm, subcylindrical to subclavate, occasionally mucronate at the apex. Pileitrama of cylindrical, loosely interwoven hyphae 3.4–6.2 μm wide, smooth, colorless in water, inamyloid, thin-walled. Stipitipellis (Figs. 10–13, 15, 16) hymeniform, consisting of subclavate to fusiform cells that are distributed over the entire stipe surface, 32.1–41.2 × 5.9–7.2 μm, smooth, with orange red (8A6–7) contents (in water) turning greyish yellow (4B5–6) in KOH, inamyloid, thin-walled, and of scattered caulobasidia (Fig. 12) (29.9–)36.4–44.6(–47.1) × (7.8–)8.1–10.0(–11.2) μm, (1–)2–3–4-spored; edges of the reticulum mainly made up of subcylindrical to ventricose-rostrate caulocystidia (Figs. 13, 16) (40.1–)47.5–67.8(–85.2) × (4.5–)5.2–7.6(–9.7) μm ( $n = 32$ ), smooth, with obtuse apices, with orange red (8A6–7) contents (in water) turning greyish yellow (4B5–6) in KOH, inamyloid, thin-walled. Stipe trama composed of longitudinally running, cylindrical cells (3.2–)4.6–7.7(–11.2) μm wide, unbranched, smooth, colorless in water, greyish yellow (4B5–6) in KOH, inamyloid, thin-walled. Clamp connections absent.

Habitat: Solitary to scattered, on ground in highland (subalpine) forests dominated by *Tsuga diversifolia*



**Figs. 15, 16** Terminal elements of the stipitipellis. **15** Terminal elements between the reticulum (in annular illumination, holotype). **16** Terminal elements on the edge of the reticulum (in phloxine B, TNS-F-37404). Bars 20 μm

(Maxim.) Mast., *A. mariesii*, and *Abies veitchii* Lindl., 1,800–2,100 m alt., July to October, not common.

Known distribution: Japan (Nagano).

Specimens examined: TNS-F-37407 (holotype), Sakuhocho, Minamisaku-gun, Nagano Pref., on ground in highland forests dominated by *A. mariesii*, 29 Aug. 2009, coll. Taneyama, M.; TNS-F-37408, same place, 6 Sept. 2009, coll. Arano, T.; TNS-F-37409, same place, 29 Aug. 2009, coll. Kitahara, K.; TNS-F-36806, same place, on ground in highland forests dominated by *T. diversifolia* and *A. veitchii*, Oct. 3, 2010, coll. Koyama, A.; TNS-F-36805, same place, Aug. 3, 2010, coll. Koyama, A.; TNS-F-36804, same place, July 25, 2010, coll. Koyama, A.; TNS-F-36802, same place, Sept. 5, 2008, coll. Koyama, A.; TNS-F-37404, Azumino-shi, Nagano Pref., on ground in highland forests dominated by *A. mariesii*, 6 Sept. 2008, coll. Itahana, K.; TNS-F-37405, Nagano-shi, Nagano Pref., on ground in highland forests dominated by *A. mariesii*, 16 July 2009, coll. Fujisawa, T.; TNS-F-37406, Yamanouchi-cho, Simotakai-gun, Nagano Pref., on ground in highland forests dominated by *A. mariesii*, 8 Aug. 2009, coll. Taneyama, Y.; TNS-F-37410, Suzaka-shi, Nagano Pref., on ground in highland forests dominated by *A. mariesii*, 29 Aug. 2009, coll. Fujisawa, T.; TNS-F-36803, Ina-shi, Nagano Pref., on ground in highland forests dominated by *T. diversifolia* and *A. veitchii*, Sept. 7, 2008, coll. Koyama, A.; TNS-F-36801, same place, Sept. 18, 2006, coll. Koyama, A.

Japanese name: Akane-amiasi-iguchi.

Comments: The diagnostic features of this species are the dark red to violet brown, boletoid basidiomata having a viscid pileus and an entirely reticulate stipe, the usually unchanging flesh, the discolourous red pores, the olivaceous, fusiform basidiospores, and the habitat in subalpine, coniferous forests. In addition, the coarsely lacerate-rimose stipe surface in aged specimens is its unique characteristic. In the combination of the features mentioned previously, *B. kermesinus* can be referable to the section *Luridi* Fr. sensu Singer (1986).

The young basidiomata of *B. kermesinus*, which possess an entirely reticulate stipe, bear a striking resemblance to the following two species: *B. frostii* J.L. Russell from eastern North America (Snell and Dick 1970; Smith and Thiers 1971; Bessette et al. 1997, 2000) and Costa Rica (Halling and Mueller 2005), and *B. pseudofrostii* B. Ortiz from Belize (Ortiz-Santana et al. 2007). *Boletus frostii* is distinct in its characteristics of distinctly cyanescent flesh and a consistently alveolate-reticulate stipe in which the reticulum is much coarser and deeper than that of *B. kermesinus*. *Boletus pseudofrostii* is easily separated from *B. kermesinus* because it produces much smaller basidiomata with pilei 17–20 mm in diameter (Ortiz-Santana et al.

2007), with yellow ground color on the stipe surface, ellipsoid basidiospores without a suprahilar depression in profile, and pileipellis consisting of entangled, repent hyphae encrusted with red pigmentation. *Leccinum rubrum* M. Zang from Tibet (Zang 1986) also has dark red basidiomata with unchanging flesh and a distinctly viscid pileus in common with *B. kermesinus*. However, *L. rubrum* can be discerned from *B. kermesinus* by forming a non-reticulate, squamulose-punctate stipe becoming yellow or orange at the apex, having reddish hymenophoral trama, and lacking cheilocystidia. Among the Japanese members of the section *Luridi*, *B. generous* Har. Takah. (Takahashi 1988) is most similar macromorphologically, but apparently differs from *B. kermesinus* in the stipe being finely reticulated and densely dotted with brownish red on the yellowish ground, distinctly cyanescent flesh, and habitat in deciduous oak forests.

**Acknowledgments** We are grateful to Professor Dr. Zhu Liang Yang, Kunming Institute of Botany, the Chinese Academy of Sciences, for his valuable information about *Leccinum rubrum*, and to Dr. Tsuyosi Hosoya for allowing the specimens cited to be kept in the National Museum of Nature and Science in Tsukuba (TNS).

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