

Type study of *Pluteus atrofuscens* (Agaricales, Pluteaceae)

Seiji Takehashi · Taiga Kasuya

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Abstract Specimens including the holotype of *Pluteus atrofuscens*, a morphologically poorly known species reported from Japan, are examined, and it is newly defined as the third species belonging to the section *Villosi*. This species is described with the aid of line drawings showing the microscopic characteristics.

Keywords Japan · Infrageneric classification

Hitherto, 25 taxa of *Pluteus*, including ten new species, have been described from Japan (Imai 1938; Ito and Imai 1940; Ito 1959; Hongo 1963; Imazeki and Hongo 1987; Imazeki et al. 1988; Singer 1989; Takahashi 2001a, b; Kobayashi 2002; Takehashi and Kasuya 2007, 2009). *Pluteus atrofuscens* Hongo has been described as a new species from Japan (Hongo 1963). However, detailed microscopic characters of *P. atrofuscens* are poorly known, and infrageneric classification of this species has not been discussed in previous works. We examined the Japanese materials of this fungus, including the holotype. As a result, *P. atrofuscens* is newly defined as the third species belonging to the *Pluteus* section *Villosi* Schreurs & Vellinga based on the concept of infrageneric classification

proposed by Vellinga and Schreurs (1985) and Vellinga (1990).

The fungal specimens studied were deposited in the mycological herbarium of the National Museum of Nature and Science (TNS), Japan. Light microscopic observations were performed, as described by Takehashi and Kasuya (2007, 2009). Colors of microscopic structures were from 3 to 5% (w/v), determined by using potassium hydroxide (KOH) solution.

Pluteus atrofuscens Hongo, J. Jpn. Bot. 38:8, 1963. Figs. 1–6

Type of specimen examined: Shiga Pref., Otsu-shi, Sen-cho, September 21, 1962, coll. T. Hongo, TNS-F-237484 (holotype).

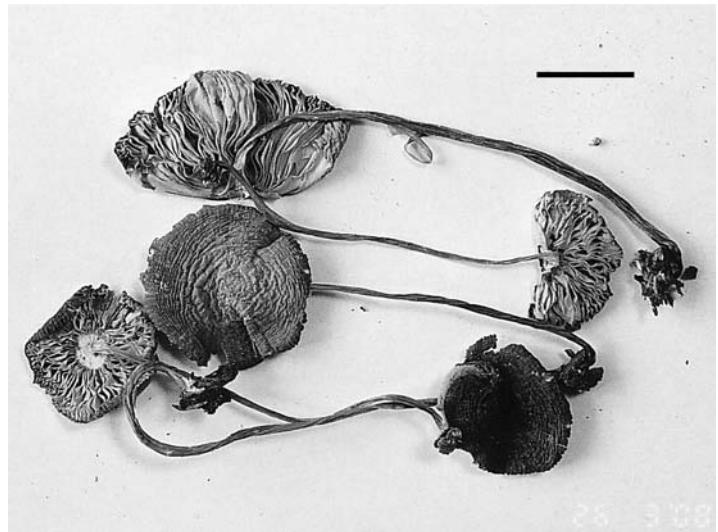
Information from other collections from Japan is incorporated in the description below.

Pileus 1.7– to 2.3-cm broad; convex to applanate; umbilicate; surface smooth; margin involute. Lamellae free, crowded, even edge. Stipe 4.5–5.1 cm; narrowly cylindrical; equal to enlarged toward the apex and base; longitudinally fibrillose; tortuous; solid. Pileipellis a cutis with ascending bundles of hyphae; terminal elements 5- to 16- μ m broad; narrowly fusiform with attenuate apex; brownish to brown intracellular pigments; thin-walled; without clamp connections. Caulocystidia on apex of stipe 57–85 \times 16–24 μ m; scattered; utriform to clavate; irregularly fusiform with finger-like projections; hyaline; sometimes apex covered with amorphous mucilaginous clots; thin-walled. Pleurocystidia 40–95 \times 15–28 μ m; scattered; fusiform to lageniform; sometimes with subcapitate apex (up to 9- to 12- μ m broad); hyaline; sometimes with conspicuously granular contents; apex covered with amorphous mucilaginous clots; thin-walled to slightly thick-walled (up to 0.2 μ m) at upper part. Cheilocystidia 20–55 \times 12–24 μ m;

S. Takehashi (✉)
Non Profit Organization, The Forum of Fungi in Northern Japan,
1-3-10-3, Kanayama, Teine-ku, Sapporo,
Hokkaido 006-0041, Japan
e-mail: BXG05024@nifty.com

T. Kasuya
Laboratory of Plant Parasitic Mycology,
Graduate School of Life and Environmental Sciences,
University of Tsukuba, 1-1-1 Ten-nodai, Tsukuba,
Ibaraki 305-8572, Japan

Fig. 1 *Pluteus atrofuscens*
(TNS-F-237484, holotype).
Bar 10 mm



crowded; narrowly to broadly clavate; sometimes with finger-like to tubercular projection at apex; hyaline; thin-walled; rooting in hymenophoral trama. Basidia $21\text{--}28 \times 8\text{--}10 \mu\text{m}$; clavate; four-spored; with or without central constriction; without basal clamp-connections. Basidiospores $6\text{--}8\text{--}(9) \times (5.5\text{--})6\text{--}7\text{--}(7.5) \mu\text{m}$; $Q_{\text{ave.}} = 1.10$ [$Q = (1\text{--})1.1\text{--}1.2\text{--}(1.3)$, $n = 60$]; subglobose to ovoid; occasionally globose (12 in 60 basidiospores of two collections) or, rarely, broadly ellipsoid (2 in 60 basidiospores of two collections); pinkish; surface smooth.

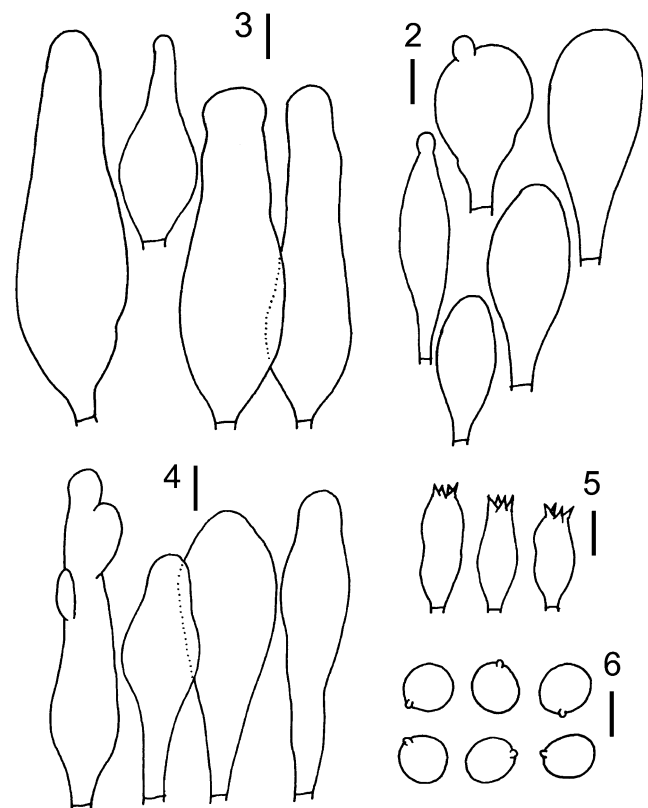
Habitat: Gregarious to subfasciculate on decaying straw in bamboo groves, or sawdust and debris of conifers (Hongo 1963; Imazeki and Hongo 1987). Summer to fall.

Distribution: Known only from Japan [Shiga (Hongo 1963; Imazeki and Hongo 1987) and Ishikawa (Ikeda 2005)].

Other specimen examined: Shiga Pref., Otsu-shi, Sato, July 15, 1971, coll. T. Hongo, TNS-F-237664.

Remarks: *Pluteus atrofuscens* belongs to the section *Villosi*, because this fungus has a differentiated cutis pileipellis, thin-walled pleurocystidia without hooks at the apex, and cheilocystidia rooting in hymenophoral trama. Pleurocystidia of *P. atrofuscens* are often thin-walled or slightly thick-walled (up to $0.2 \mu\text{m}$) at the upper part, whereas those of the other species belonging to section *Villosi* are thin-walled or absent (Vellinga and Schreurs 1985; Vellinga 1990). However, the other microscopic characteristics, particularly pileipellis and cheilocystidia of the fungus described here, clearly suggest that it is placed in section *Villosi*. Therefore, we newly define *P. atrofuscens* as the third species belonging to section *Villosi*.

Additional microscopic characteristics of the holotype in the original descriptions of *P. atrofuscens* (Hongo 1963) are as follows: (1) Caulocystidia are present, with sometimes finger-like projections; (2) pleurocystidia have thin to



Figs. 2–6 *Pluteus atrofuscens* (TNS-F-237484): **2** Cheilocystidia. **3** Pleurocystidia. **4** Caulocystidia. **5** Basidia. **6** Basidiospores. Bars 2–5 10 μm ; 6 5 μm (Hongo, J Jpn Bot 38:8, 1963)

slightly thick walls (up to $0.2 \mu\text{m}$) at upper part, sometimes covered with amorphous mucilaginous clots at the apex; (3) cheilocystidia sometimes have finger-like to tubercular projections at the apex; (4) basidiospores are subglobose to ovoid and sometimes globose.

Pluteus ephebeus (Fr.) Gillet and *P. hispidulus* (Fr.) Gillet, other species belonging to the section *Villosi* are clearly distinguished from *P. atrofuscens* by the following characteristics; *P. ephebeus* has the pileus surface covered with brown squamules (Vellinga and Schreurs 1985; Vellinga 1990; Breitenbach and Kränzlin 1995); pleurocystidia of *P. hispidulus* are absent or very scarce (Kühner and Romagnesi 1956; Orton 1986; Vellinga 1990), cheilocystidia are obtuse without finger-like projection at the apex, and basidiospores are broadly-ellipsoid to ellipsoid (Vellinga 1990). Moreover, *P. atrofuscens* is macroscopically very similar to *P. satur* Kühner & Romagn, having dark brown to black brown pileus. However, *P. satur* is distinguished from *P. atrofuscens* by a hymenidermal pileipellis (Kühner and Romagnesi 1956; Orton 1960, 1986; Breitenbach and Kränzlin 1995).

Recently, Horak (2008) described 15 new species of *Pluteus* from New Zealand. Among them, *P. hispidilacteus* E. Horak has pileipellis, which is constituted by tightly bundled cylindrical hyphae; and terminal elements of the pileipellis, which consist of conical or slender fusoid hyphae. Moreover, pleurocystidia of *P. hispidilacteus* are thin-walled. Therefore, we believe that *P. hispidilacteus* is a morphologically related species to section *Villosi*. However, infrageneric classification of *P. hispidilacteus* has not been mentioned by Horak (2008), and further study of this species is needed to clarify its infrageneric placement. *Pluteus hispidilactes* is clearly distinguished from *P. atrofuscens* by its white pileus.

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