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Seiji Takehashi · Taiga Kasuya

First record of *Pluteus chrysophaeus* and reexamination of *Pluteus leoninus* from Japan

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Abstract *Pluteus chrysophaeus* is described as a new record for Japanese mycobiota. *Pluteus leoninus*, reported for the first time from Japan by Imai (1938), probably represents *P. chrysophaeus*. The new Japanese specimens of *P. leoninus* is redescribed and illustrated.

Key words Japan · Pluteaceae · *Pluteus chrysophaeus* · *Pluteus leoninus* · Taxonomy

Imai (1938) reported a large number of agarics, including new taxa, from Hokkaido, Northern Japan. For the genus *Pluteus* Fr., he described eight species from Hokkaido, and two of those are new, i.e., *Pluteus bulbosus* Imai and *P. macrosporus* Imai (Imai 1938; Kobayashi 2002). However, his descriptions are mainly based on macroscopic characters and without detailed description of microscopic features. Recently, two species of pluteoid fungi with yellowish pileus were collected in Hokkaido of Japan. These fungi are identified as *Pluteus chrysophaeus* (Schaeff.) Quél. and *P. leoninus* (Schaeff.) P. Kumm. *Pluteus chrysophaeus* was hitherto known from Europe (Vellinga and Schreurs 1985; Orton 1986; Bas et al. 1990), and this is the first distributional report from Japan. Vellinga and Schreurs (1985) treated “*Pluteus leoninus*” auct. non (Schaeff.) P. Kumm: Imai (1938), as *P. chrysophaeus*. However, they have not examined the authentic materials of Imai (Vellinga, personal communication). In this article, we reexamine and discuss authentic specimens of “*P. leoninus*” auct. non (Schaeff.) P. Kumm: Imai (1938). According to our morphological observations, these materials of Imai cannot be identified as *P. leoninus*, and they probably represent

P. chrysophaeus. Therefore, we redescribed and illustrated *P. leoninus* based on the new Japanese material.

The specimens examined in this study are deposited in the herbaria of the Hokkaido University Museum (SAPA) and the National Museum of Nature and Science (TNS). Macroscopic characters were described by observations on dried or fresh materials. For light microscopic observations, sections of dried specimens were mounted in water, 3% or 5% (w/v) KOH, and phloxine B solution on glass slides. Thirty randomly selected basidiospores were measured under a light microscope at 1000× magnification. Length measurements excluded the apiculus for basidiospores. The abbreviation *Q* is the ratio of length to width of basidiospores.

Pluteus chrysophaeus (Schaeff.) Quél., Mém. Soc. Émul. Montbéliard, Sér. II 5:82, 1872. Figs. 1–6

Basidiomata pluteoid. Pileus 1.7–2.3 cm broad, campanulate when young, later expanded to convex or applanate, yellow to lemon-yellow or sometimes ocraceous, with pale brownish umbo at center, irregularly pulvinate, rugose-striate, strongly yellow with radially sulcate-striate at margin, subcutis yellow to pale yellow. Lamellae free, crowded, pinkish, edges sometimes pale brown. Stipe 2.9–3.5 × 0.2–0.4 cm, cylindrical, often compressed, pale lemon yellow to yellowish-white, basal part pale brown, lengthwise fibrillose striate, solid, at base clavate, with white rhizomorphs, context yellowish-white. Spore print pinkish.

Basidiospores ovoid to broadly ellipsoid, rarely subglobose, 6–7 × 5–6 μm, *Q* = 1.0–1.4, surface smooth, with small oil drops. Basidia 18–33 × 7–9 μm, short clavate, 4-spored, without basal clamp-connections. Cheilocystidia crowded, 30–75 × 15–23 μm, colorless to pale yellow, lageniform with peduncle, fusiform to clavate, with granular contents at upper part, without clamp-connections, thin-walled. Pleurocystidia scattered, 50–75 × 12–21 μm, colorless to pale brown, ampulliform to lageniform with peduncle, often with elongate rostriform at apex, without clamp-connections, thin-walled. Pileipellis hymeniform, composed of pyriform to clavate with pedunculate elements, 22–40 ×

S. Takehashi (✉)
Kanayama 1-3-10-3, Teine-ku, Sapporo, Hokkaido 006-0041, Japan
Tel. +81-11-685-2153; Fax +81-11-685-2153
e-mail: BXG05024@nifty.com

T. Kasuya
Graduate School of Life and Environmental Sciences, University of
Tsukuba, Ibaraki, Japan

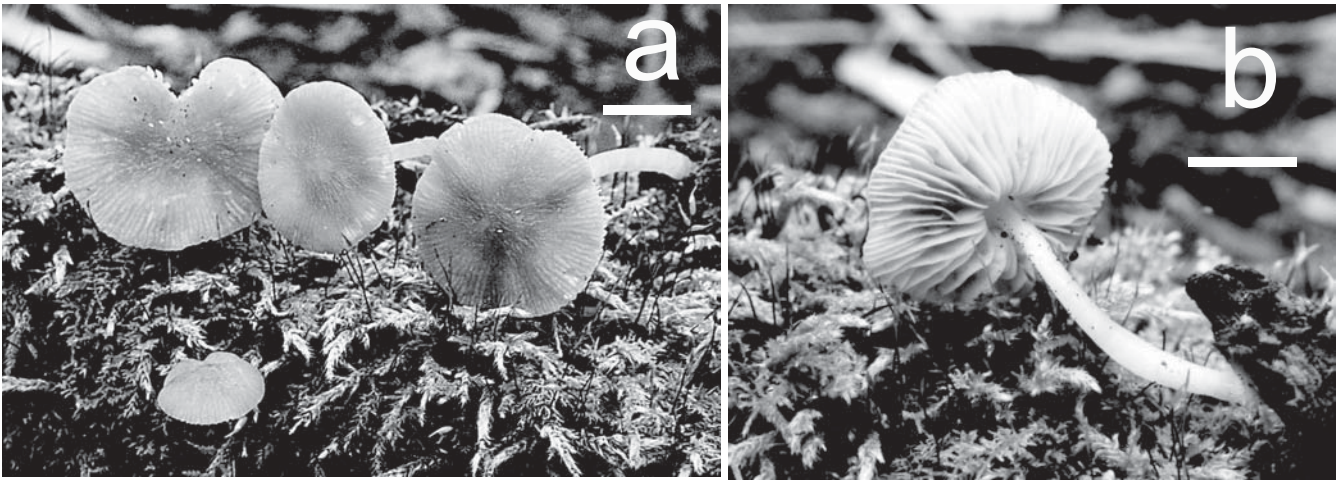
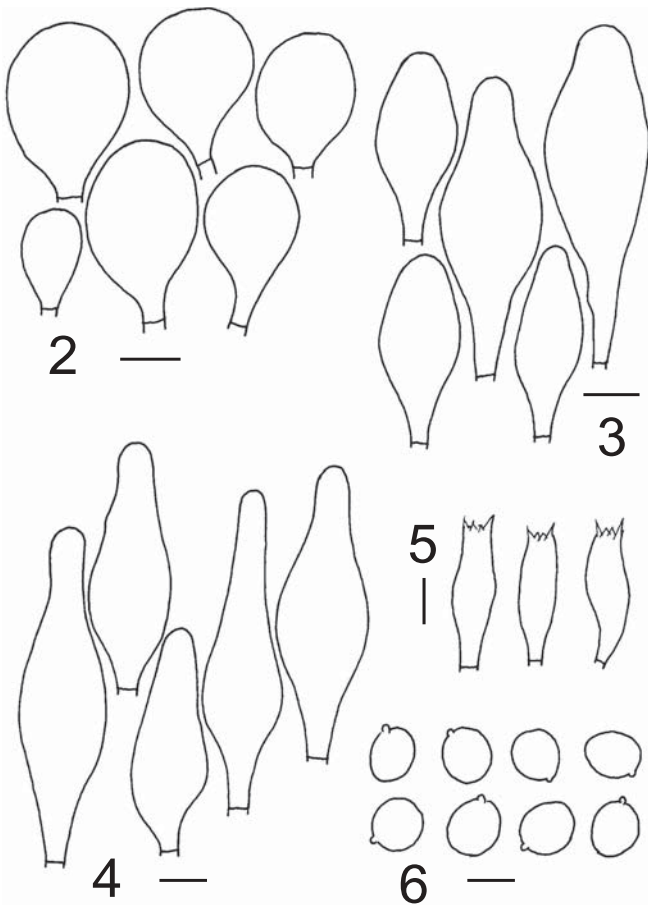


Fig. 1. *Pluteus chrysophaeus* (Schaeff.) Quél. (TNS-F-12383). **a** Surface of basidioma. **b** Lamellae and stipes of basidiomata. Bars 10 mm



Figs. 2–6. *Pluteus chrysophaeus* (TNS-F-12383). **2** Hyphae of the epicutis of pileus. **3** Cheilocystidia. **4** Pleurocystidia. **5** Basidia. **6** Basidiospores. Bars 2–5 10 μ m; 6 5 μ m

11–28 μ m, with pale yellowish to yellow-brownish intracellular pigments in KOH solution, clamp-connections absent.

Habitat: Solitary or sparse on dead trunks of deciduous trees, summer to fall.

Distribution: Japan (Hokkaido) and Europe (Vellinga and Schreurs 1985; Orton 1986; Bas et al. 1990).

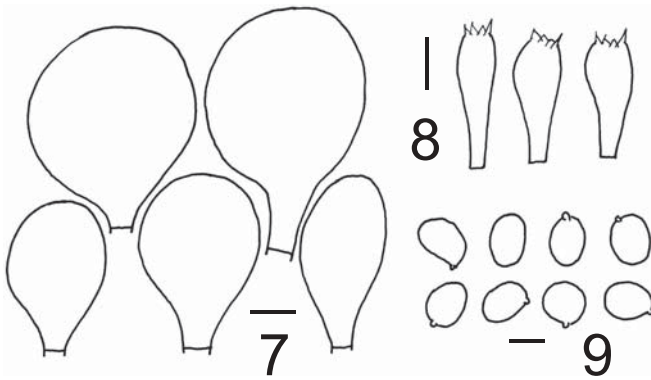
Specimens examined: Japan, Hokkaido Pref., Sorachi Prov., Iwamizawa-shi, Tonebetsu, on dead trunks in deciduous woods, August 30, 2005, S. Takehashi and C. Takehashi, TNS-F-12382; September 17, 2005, S. Takehashi and C. Takehashi, TNS-F-12383.

Japanese name: Kiiro-urabenigasa (newly named).

Remarks: *Pluteus chrysophaeus* is well characterized by its yellowish pileus, terminal elements of pileipellis that contain yellowish intracellular pigments, and cheilocystidia and pleurocystidia which are mainly lageniform with peduncle. Morphological characters of the specimens examined are in good agreement with the descriptions of *P. chrysophaeus* (Vellinga and Schreurs 1985; Bas et al. 1990). This species is newly recorded from Japan.

Pileipellis of the Japanese materials is hymeniform and is composed of pyriform to clavate elements with peduncle. Cheilocystidia and pleurocystidia are thin-walled. These morphological characters suggest it is placed in section *Celluloderma*, subsection *Eucellulodermini* (Singer 1986). Moreover, it is belonging to stirps *Lutescens* (Singer 1986) because it has a yellowish pileus and ovoid to broadly elliptical basidiospores. There are three species of *Pluteus* that belong to section *Celluloderma*, subsection *Eucellulodermini*, stirps *Lutescens* in the world (Singer 1986). In stirps *Lutescens*, *P. romellii* (Britzelm.) Lapl. and *P. melleipes* Murrill are clearly distinguished from *P. chrysophaeus* by the following morphological features: *P. romellii* has vesicular to pyriform cystidia and brownish intracellular pigments of pileipellis (Singer 1956; Vellinga and Schreurs 1985; Orton 1986; Bas et al. 1990; Breitenbach and Kränzlin 1995); *P. melleipes* has vesiculose cystidia and hyaline or very pale fuscidulous pigments of pileipellis (Singer 1956).

Moreover, *Pluteus chrysophaeus* is macroscopically similar to *Pluteus phlebophorus* (Ditmar) P. Kumm., *Pluteus chrysophlebius* (Berk. & Rav.) Sacc. subsp. *sublaevigatus* Sing. and *Pluteus chrysophlebius* subsp. *bruchii* (Speg.)



Figs. 7–9. “*Pluteus leoninus*” auct. non (Schaeff.) P. Kumm.: Imai (1938, SAPA s.n.). **7** Pileipellis cells. **8** Basidia. **9** Basidiospores. Bars 7–8 10 μ m; 9 5 μ m

Singer in its yellowish pileus and stipe. However, *P. phlebophorus* belongs to stirps *Jamaicensis* that differs from *P. chrysophaeus* by its brownish intracellular pigments of pileipellis (Singer 1956; Vellinga and Schreurs 1985; Orton 1986; Bas et al. 1990). Further, *P. chrysophlebius* subsp. *sublaevigatus* and *P. chrysophlebius* subsp. *bruchii*, belonging to stirps *Chrysophlebius*, clearly differ from *P. chrysophaeus* by their hyaline pileipellis (Singer 1958; Lee et al. 1992).

“*Pluteus leoninus*” auct. non (Schaeff.) P. Kumm.: Imai, J. Fac. Agric. Hokkaido Imp. Univ. 18:163, 1938. Figs. 7–9

Basidiospores ovoid to broadly ellipsoid or ellipsoid, 6–9 \times 4–6 μ m, $Q = 1.1$ –1.5, surface smooth, hyaline. Basidia short clavate, 24–29 \times 6–9 μ m, 4-spored. Cystidia not observed. Pileipellis hymeniform, composed of pyriform to clavate with pedunculate element, colorless or with pale yellowish to yellow-brownish intracellular pigments in KOH solution, clamp-connections absent.

Specimens examined: Japan, Hokkaido Pref., Ishikari Prov., Nopporo, on decayed wood of deciduous trees, October 10, 1926, S. Imai s.n. (SAPA); Japan, Hokkaido Pref., Ishikari Prov., Sapporo-shi, Sapporo Botanic Garden, on decayed wood of deciduous trees, September 13, 1932, G. Hayashi s.n. (SAPA); September 4, 1937, S. Imai s.n. (SAPA).

Remarks: Cheilocystidia and pleurocystidia cannot be observed because the specimens are in poor condition. However, basidiospores of these materials are ovoid to broadly ellipsoid or ellipsoid. Besides, the pileipellis is hymeniform and is composed of pyriform to clavate cells. These features clearly suggest that Imai’s authentic materials are belonging to section *Celluloderma* Fayod subsection *Eucellulodermini* Sing. (Singer 1986), and his specimens are undoubtedly different from *P. leoninus*. Although basidiospores and pileipellis of these specimen are morphologically very similar to *P. chrysophaeus*, we cannot conclude that Imai’s authentic materials belong to *P. chrysophaeus* because of the lack of morphological examination of cystidia.

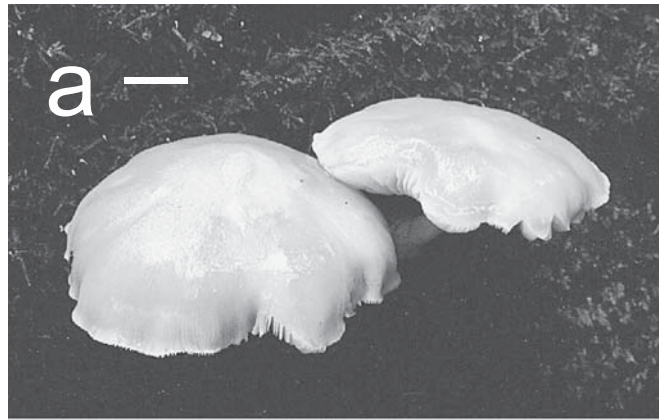
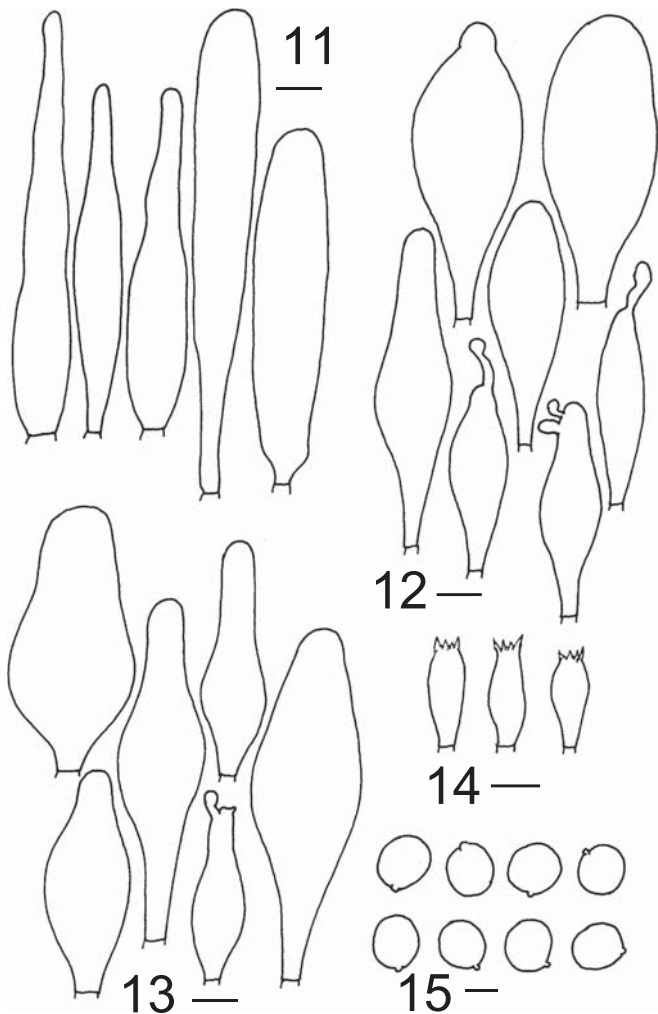


Fig. 10. *Pluteus leoninus* (Schaeff.) P. Kumm. (TNS-F-12378). **a** Surface of basidioma. **b** Lamellae and stipes of basidiomata. Bars 10 mm

After the first report of Imai (1938), *P. leoninus* was frequently recorded from Japan (Ito 1959; Imazeki and Hongo 1987; Imazeki et al. 1988). However, macro- and microscopic detailed features of this species were hitherto not described from Japan. Therefore, redescription of *P. leoninus* based on the new Japanese material is given as defined next.

Pluteus leoninus (Schaeff.) P. Kumm., Führ. Pilzk.:98. 1871. Figs. 10–15

Basidiomata pluteoid. Pileus 7.1–7.6 cm broad, campanulate when young, later plano-convex with a broad umbo, hygrophanous, yellow to yellowish-brown or lemon-yellow, smooth at center, pinkish at margin with a translucent-striate marginal zone, context thin, yellow to yellowish-brown. Lamellae free, subdistant, pinkish to later pale pink, 0.8–1.2 cm broad. Stipe 6.4–7.3 \times 0.6–0.9 cm, cylindrical, tapering toward apex, broadened toward base, white to grayish-white, with pale yellowish, lengthwise fibrillose



Figs. 11–15. *Pluteus leoninus* (TNS-F-12378). **11** Hyphae of the pileipellis. **12** Cheilocystidia. **13** Pleurocystidia. **14** Basidia. **15** Basidiospores. Bars **11–14** 10 μ m; **15** 5 μ m

striate, at base clavate to bulbous, up to 1.5 cm broad, solid, with white rhizomorphs, context white. Smell indistinct but strongly raphanoid when dried. Spore print pinkish.

Basidiospores broadly ellipsoid, rarely subglobose, 6–7 \times 5–6 μ m, $Q = 1.0$ –1.2, surface smooth, with small oil drops. Basidia 23–25 \times 7–8 μ m, short clavate, 4-spored, without basal clamp-connections. Cheilocystidia crowded, 25–73 \times 8–30 μ m, colorless, lageniform with peduncle, narrow to broadly fusiform, clavate, often without or with papilla excrescences and one or a few rostriform at apex, with granular contents, without clamp-connections, thin-walled. Pleurocystidia scattered, 40–82 \times 12–28 μ m, colorless, lageniform with peduncle, fusiform, often with excrescences at apex, without clamp-connections, thin-walled. Pileipellis of terminal hyphae composed of fusiform, cylindrical to clavate elements, 9–21 μ m broad, rarely septate, with yellowish intracellular pigment in KOH solution, clamp-connections absent.

Habitat: Fasciculate or sparse on dead trunks or sawdust in deciduous forests. Summer to fall.

Distribution: Japan, Asia (Chen and Huang 1995), North America (Singer 1956), Europe (Vellinga and Schreurs 1985; Orton 1986; Bas et al. 1990; Breitenbach and Kränzlin 1995), North Africa (Malençon and Bertault 1970).

Specimen examined: Japan, Hokkaido Pref., Sorachi Prov., Iwamizawa-shi, Tonebetsu, on dead trunks in deciduous woods, September 24, 2005, S. Takehashi and C. Takehashi, TNS-F-12378.

Japanese name: Beni-hida-take (Imai 1938).

Remarks: *Pluteus leoninus* is well characterized by a pileus that is yellow to yellowish-brown, especially lemon-yellow in central part, and terminal elements of pileipellis which contain yellowish intracellular pigments and lack clamp-connections. Morphological characteristics of the specimen examined are in good agreement with the descriptions of *P. leoninus* (Vellinga and Schreurs 1985; Orton 1986; Bas et al. 1990; Breitenbach and Kränzlin 1995).

Pileipellis of the Japanese material is composed of terminal elements that are elongated to fusiform, cylindrical, or clavate. Cheilocystidia and pleurocystidia are thin-walled. These morphological characters suggest it is placed in section *Hispidoderma* Fayod (Singer 1986). Moreover, it belongs to stirps *Leoninus* (Singer 1986) because the pileus is yellow to yellowish-brown or lemon-yellow. There are ten species of *Pluteus* that belong to section *Hispidoderma*, stirps *Leoninus*, in the world (Singer 1986). In the stirps *Leoninus*, *P. roseipes* Höhn., *P. rubrotomentosus* Singer, and *P. flavofuliginosus* G.F. Atk. differ from *P. leoninus* by their pileus color (Singer 1956, 1958; Vellinga and Schreurs 1985; Bas et al. 1990; Breitenbach and Kränzlin 1995). *Pluteus glabrescens* Murrill is distinguished from *P. leoninus* by its surface features of pileus (Singer 1956). *Pluteus whiteae* Murrill differs from the present fungus by its whitish stipe (Singer 1956). Another four species of stirps *Leoninus*, i.e., *P. luteomarginatus* Rolland, *P. glyphidatus* (Berk. & Broome) Sacc., *P. citrinus* Murrill, and *P. conizatus* (Berk. & Broome) Sacc., are clearly distinguished from the present species by the following microscopic characters: *P. citrinus* has hyaline or light brownish pigments of pileipellis (Singer 1956); *P. luteomarginatus* has more subglobose basidiospores (7.5 \times 6 μ m) than *P. leoninus* (Singer 1956); and cystidia of *P. conizatus* and *P. glyphidatus* have different features from *P. leoninus* (Singer 1956).

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