Mycoscience (2002) 43:411–415 © The Mycological Society of Japan and Springer-Verlag Tokyo 2002

FULL PAPER

Takahito Kobayashi

Type studies of the new species of *Pluteus* described by Seiya Ito and Sanshi Imai from Japan

Received: February 20, 2002 / Accepted: August 1, 2002

Abstract Five species of the genus *Pluteus* described by S. Ito and S. Imai, and two species of *Pluteus* described by S. Imai alone, have been revised. Six type specimens of these species are preserved in SAPA, and the author has confirmed that they belong to the genus *Pluteus*. Metuloids were observed from *P. daidoi* and *P. horridilamellus*. *Pluteus daidoi*, having a cutis type of pileipellis, belongs to section *Pluteus*. *Pluteus horridilamellus* has a hymeniform pileipellis. A new section, *Pluteus* sect. *Horridus*, characterized by its metuloids with a thick wall and acute apex, is established for *P. horridilamellus*. Also, the type collections of *Pluteus bulbosus*, *P. machidae*, *P. okabei*, and *P. verruculosus* were studied.

Key words Agaricales · Japan · Pluteaceae · *Pluteus* · Type study

Introduction

Imai established a large number of new taxa belonging to the Agaricales (Nagasawa 1982). For the genus *Pluteus* Fr., collaborating with Ito, Imai described five new species from the Bonin Islands, namely *Pluteus horridilamellus*, *P. okabei*, *P. machidae*, *P. daidoi*, and *P. verruculosus* (Ito and Imai 1940). From Hokkaido, *Pluteus bulbosus* and *P. macrosporus* were established by Imai (1938). I searched the holotypes of these species and found five type specimens collected from Bonin Islands and one type specimen collected from Hokkaido, namely *P. bulbosus*, kept in SAPA.

T. Kobayashi (✉)
Systematic Botany, Northern Bioresources and Ecology, Graduate School of Agriculture, Hokkaido University, North 9, West 9, Kita-ku, Sapporo, Hokkaido 065-8589, Japan
Tel. +81-11-706-3742; Fax +81-11-706-4508
e-mail: tkobayas@museum.hokudai.ac.jp

Materials and methods

All specimens cited in this paper are deposited in the herbarium of the Hokkaido University Museum (SAPA). For microscopic observations, dried specimens were rehydrated in 10% NH_4OH. Length measurements excluded the apiculus for spores. The abbreviation Q is the ratio of spore length to spore width.

Taxonomy

Pluteus bulbosus S. Imai, J. Fac. Agric. Hokkaido Imp. Univ. **43**:162, 1938. Fig. 1

Spores 6.0–8.5 × 5.0–7.0 μm, on average 6.7 × 5.9 μm, Q = 1.1–1.2, globose to broadly ellipsoid, surface smooth, slightly yellow to slightly pink, thick-walled. Pleurocystidia 56–94 × 12.0–28.8 μm, narrowly ventricose, ventricose to fusiform, sometimes with a long neck, thin-walled, almost hyaline to slightly yellow. Caulocystidia descending to base, ventricose, with a short neck, thin-walled, almost hyaline to slightly yellow, sometimes with yellowish-brown content at upper part, scanty.

Collection examined: Japan, Hokkaido: Province Ishikari, Nopporo, on rotting wood in woods, autumn, leg. S. Imai, no. 348 in SAPA: holotype.

Imai (1938) placed *P. bulbosus* in the section *Pruinosi* S. Imai (a synonym of section *Celluloderma* Fayod) on the basis of its pruinose pileus surface. I could not confirm its pileipellis structure, however, because the type specimen was in poor condition. *Pluteus boudieri* P.D. Orton is close to *P. bulbosus* because of the bulbous base of its stipe, but the former has a whitish to pinkish pileus margin. *Pluteus plautus* (Weinm.) Gillet is similar to *P. bulbosus*, and the former is the same as *P. boudieri*, according to Vellinga and Schreurs (1985). However, *P. plautus* differs from *P. bulbosus* and *P. boudieri* by virtue of the translucently striate surface of its pileus.

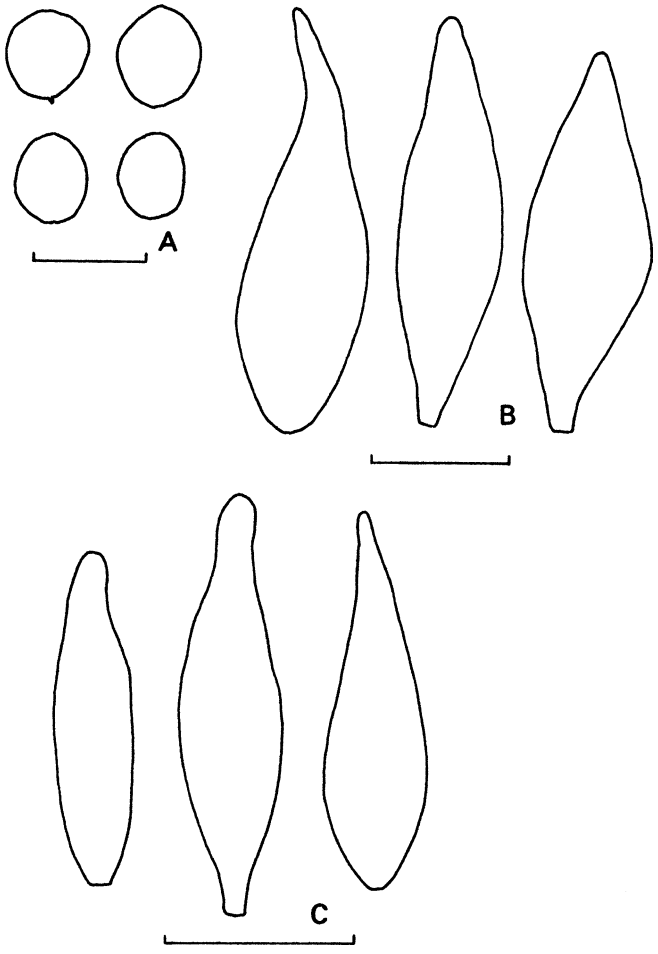

Fig. 1. *Pluteus bulbosus* S. Imai. **A** Spores. **B** Pleurocystidia. **C** Caulocystidia of lower stipe. *Bars* **A** 10 μm; **B**, **C** 20 μm

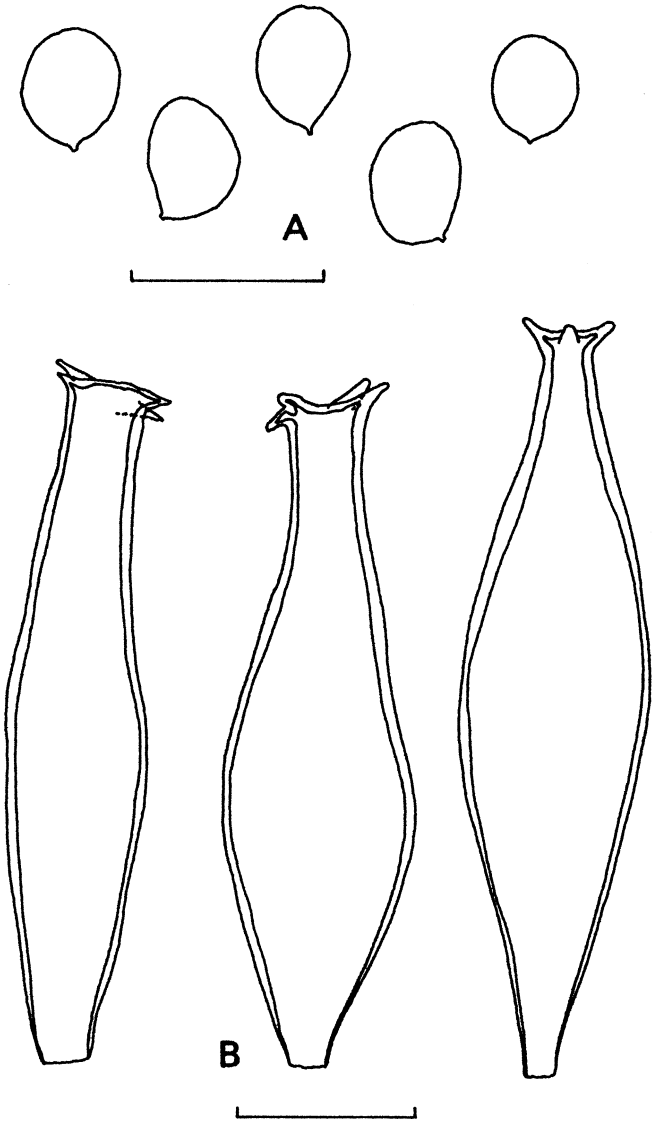

Fig. 2. *Pluteus daidoi* S. Ito & S. Imai. **A** Spores. **B** Pleurocystidia. *Bars* **A** 10 μm; **B** 20 μm

Pluteus daidoi S. Ito & S. Imai, Trans Sapporo Nat. Hist. Soc. **16**:47, 1940. Fig. 2

Spores 7.0–9.0 × 6.5–7.5 μm, on average 7.9 × 7.0 μm, Q = 1.1–1.2, subglobose to broadly ellipsoid, surface smooth, pale yellow, thick-walled. Pleurocystidia as metuloids 68–88 × 14.4–28.8 μm, ventricose to fusiform, with four apical hooks, thick-walled, almost hyaline to slightly yellow. Caulocystidia not observed. Pileipellis a cutis, duplex, with the uppermost layer up to 45 μm thick, composed of subregular to regular hyphae, 3.0–6.0 μm in diameter, almost hyaline to grayish-brown, the subtending layer up to 221 μm thick, composed of subregular hyphae 5.5–7.5 μm in diameter, almost hyaline to pale yellow, with horizontally ellipsoid holes. Clamp connections not observed.

Collection examined: Japan, Tokyo: Bonin Islands, Hahashima, Okimura, Kuwanokiyama, on the ground in woods, Nov. 20, 1936, collected by K. Daido, in SAPA: holotype.

I could not observe basidia and cheilocystidia because the specimen was in poor condition.

Pluteus daidoi belongs to the section *Pluteus* (= section *Fibrillosi* S. Imai). *Pluteus daidoi* is related to *Pluteus atricapillus* (Batsch) Fayod [= *P. cervinus* (Schaeff.) P. Kumm.], but the former has olive-brown fibrils at margin of its pileus, and it lacks brown fibrils on the surface of its stipe. Murrill (1911) established *Pluteus harrisii* Murrill as "cystidia none." However, Banerjee and Sundberg (1995) found thick-walled pleurocystidia with versiform apical projections in the holotype of *P. harrisii*. Thus, *P. harrisii* is close to *P. daidoi*. However, *P. harrisii* is different from the latter in having irregular hooks on its pleurocystidia and a trichodermal pileipellis.

Pluteus horridilamellus S. Ito & S. Imai, Trans. Sapporo Nat. Hist. Soc. **16**:46, 1940. Fig. 3

Spores 5.0–6.5 × 3.8–5.0 μm, on average 5.8 × 4.3 μm, Q = 1.1–1.5, subglobose to broadly ellipsoid, surface smooth, slightly violet to pale violet, thick-walled. Pleurocystidia as metuloids 77–94 × 19.9–29.5 μm, ventricose to fusiform, with an acute apex usually, without hooks, thick-walled, filled with slightly brown pigment, rather scanty. Thin-

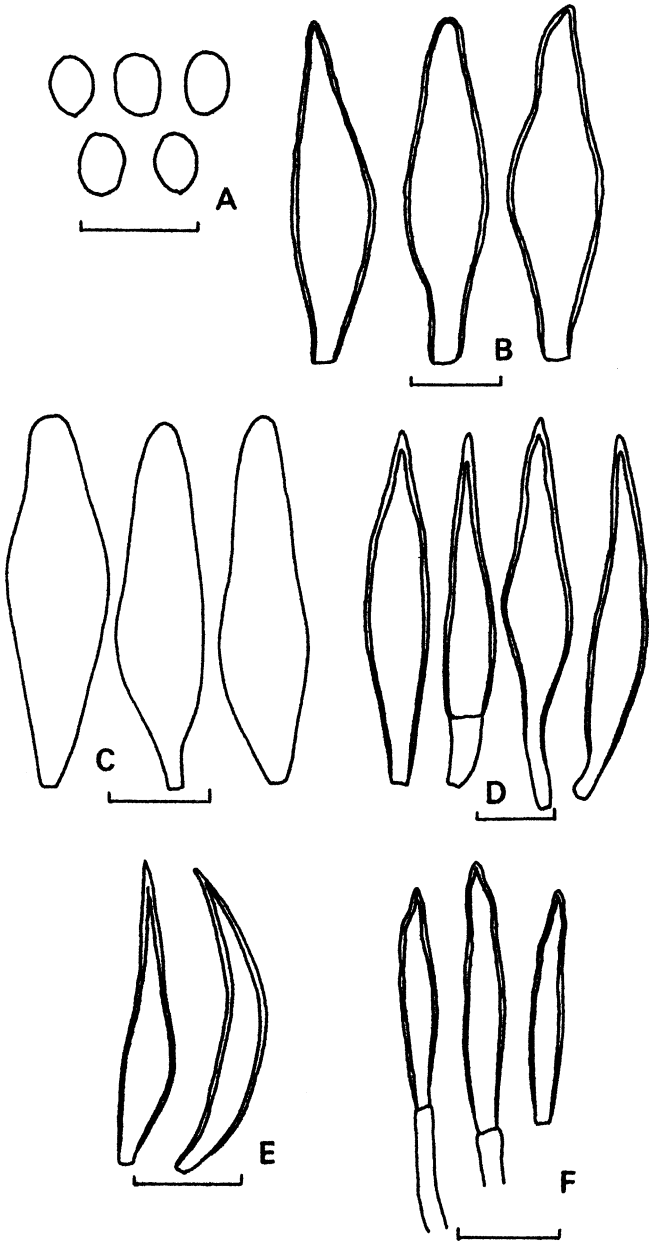

Fig. 3. *Pluteus horridilamellus* S. Ito & S. Imai. **A** Spores. **B** Pleurocystidia (metuloids). **C** Pleurocystidia (thin-walled cystidia). **D** Cheilocystidia. **E** Caulocystidia at base. **F** Pileipellis. *Bars* **A** 10 μm; **B–F** 20 μm

walled pleurocystidia also present, 74–84 × 20.4–25.2 μm, fusiform to ventricose, slightly yellow or filled with slightly brown pigment, abundant. Cheilocystidia as metuloids 48–95 × 9.6–16.8 μm, fusiform to narrowly ventricose, with an acute apex, sometimes with a pedicellate base, without hooks, thick-walled, sometimes septate at lower part, filled with orange-brown pigment. Caulocystidia as metuloids descending to base, similar to cheilocystidia, without hooks, thick-walled, rather scanty. Pileipellis a hymeniform, composed of pileocystidia 30–54 × 6.0–8.4 μm, narrowly fusiform to narrowly cylindrical with an acute apex, thick-walled, filled with orange-brown pigment. Clamp connections not observed.

Collection examined: Japan, Tokyo: Bonin Islands, Hahashima, Okimura, Kuwanokiyama, on rotten wood in shady woods, Nov. 18, 1936, no. 56 in SAPA: holotype.

Fayod (1889) established a section *Hispidoderma* characterized by a hispid cuticle and assigned *P. leoninus* (Schaeff.: Fr.) P. Kumm. alone to this section. The pileipellis of *P. leoninus* is composed of thin-walled elements (Vellinga 1990). Thus, *P. horridilamellus* is excluded from the section *Hispidoderma* because it has thick-walled pileocystidia. *Pluteus horridilamellus* does not belong to *Micaceae* J.E. Lange (no rank indicated), because this group is characterized by globular cells of cuticle (Lange 1917). The section *Pluteus* (= section *Trichoderma* Fayod) is characterized by numerous metuloids and pilose or hyphous elements in the pileipellis (Singer 1986). *Pluteus horridilamellus* has metuloids, but it has a hymeniform pileipellis. Pegler (1986) allowed for the section *Pluteus* having a trichodermal pileipellis in his key to sections of the genus *Pluteus*. However, elements on the pileus of *P. horridilamellus* are not trichoderm hyphae but metuloids characterized by a thick wall and an acute apex. Therefore, no section for *P. horridilamellus* could be found in the previous literature. A new section of *Pluteus* for this species is required as defined below.

Pluteus section ***Horridus*** Takahito Kobayashi, sect. nov.

Epicutis pilei hymeniformis; pileocystidia crassitunicata; pleurocystidia crassitunicata; elementa pileipellis metuloidea, crassitunicata, apice acuta; sporae globosae vel ellipsoideae.

Pileipellis a hymeniform, composed of metuloids, thick-walled. Pleurocystidia thick-walled. Spores globose to ellipsoid, surface smooth, thick-walled, slightly yellow to pale violet.

Type species: *Pluteus horridilamellus* S. Ito & S. Imai.

Pluteus magnus McClatchie is similar to *P. horridilamellus* because of the acute apex of pleurocystidia (metuloids), but the pileipellis of *P. magnus* is composed of filamentous hyphae (Banerjee and Sundberg 1995). *Pluteus conizatus* (Berk. & Broome) Sacc. is also similar to *P. horridilamellus*, but the former has a disrupted trichodermal pileipellis (Pegler 1986).

Pluteus machidae S. Ito & S. Imai, Trans. Sapporo Nat. Hist. Soc. **16**:47, 1940. Fig. 4

Spores 5.3–7.5 × 5.0–6.5 μm, on average 6.4 × 5.4 μm, Q = 1.0–1.3, globose to subglobose, surface smooth, slightly yellow to slightly red, thick-walled. Pleurocystidia 38–53 × 10.8–17.5 μm, often with an acute apex, sometimes with a cylindrical neck, sometimes with a short pedicel at base, often filled with yellow to gray-yellow pigment, slightly yellow rarely, thin-walled. Caulocystidia not observed. Pileipellis a hymeniform, pileocystidia narrowly obovoid to narrowly ventricose, often with a long neck, often with a pedicel, filled with orange-brown pigment, thin-walled. Clamp connections present, scanty.

Collection examined: Japan, Tokyo: Bonin Islands, Hahashima, Kitamura, Sekimonzan, on a dead trunk in woods, Nov. 20, 1936, no. 63 in SAPA: holotype.

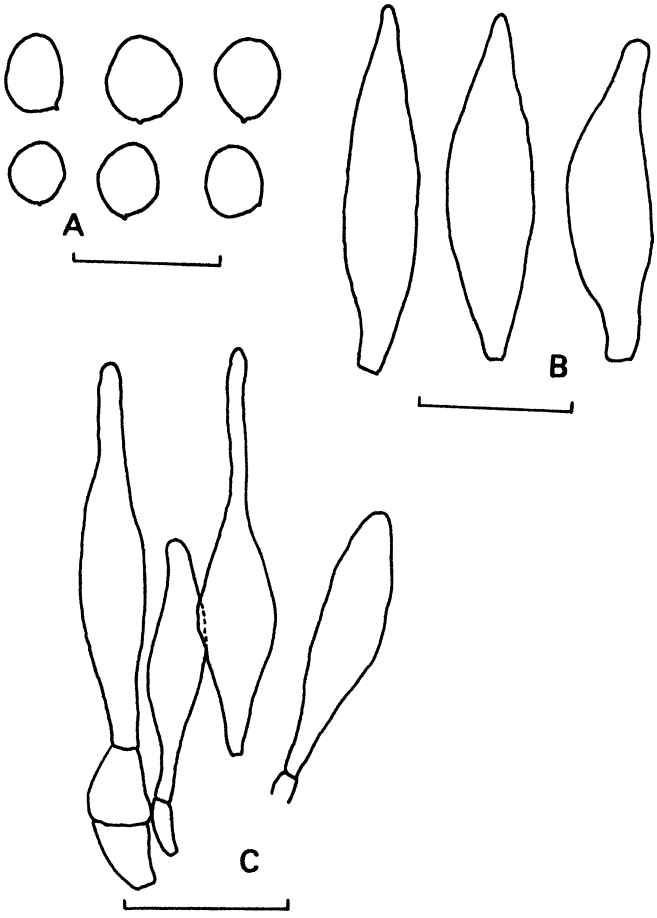

Fig. 4. *Pluteus machidae* S. Ito & S. Imai. **A** Spores. **B** Pleurocystidia. **C** Pileipellis. *Bars* **A** 10 μm; **B**, **C** 20 μm

I could not observe basidia and cheilocystidia because the specimen was in poor condition.

This species belongs to the section *Celluloderma* Fayod., although the type specimen of *P. machidae* rarely has clamp connections.

Pluteus machidae is close to *P. thomsonii* (Berk. & Broome) Dennis due to its hymeniform pileipellis, but *P. machidae* has a smooth pileus. *Pluteus machidae* is similar to *P. pouzarianus* Singer var. *albus* Bonnard in appearance (Bonnard 1993), but the latter has metuloids. *Pluteus romellii* (Britzelm.) Sacc., recorded in Japan recently by Takahashi (2001), was distinguished from *P. machidae* by having a yellow to lemon stipe and broadly ellipsoid to broadly clavate cells in its pileipellis. *Pluteus splendidus* A. Pearson was synonymized with *P. romellii* by Vellinga and Schreurs (1985), but Wuilbaut (2001) kept this taxon as a variety of *P. romellii*, namely *Pluteus romellii* var. *splendidus* (A. Pearson) Wuilb. It is also different from *P. machidae* in having chrome-yellow at the center of its pileus and stipe surface (Pearson 1952).

Pluteus macrosporus S. Imai, J. Fac. Agric. Hokkaido Imp. Univ. **43**:160, 1938.

No type collection was found at SAPA.

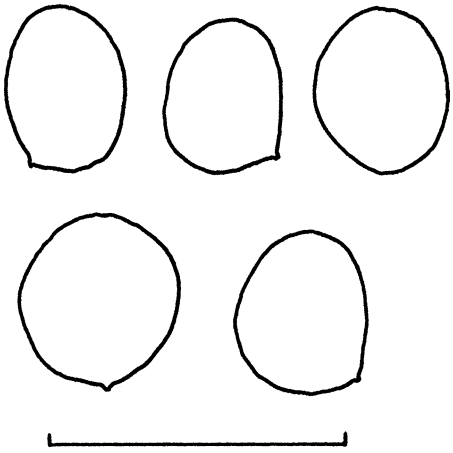

Fig. 5. Spores of *Pluteus okabei* S. Ito & S. Imai. *Bar* 10 μm

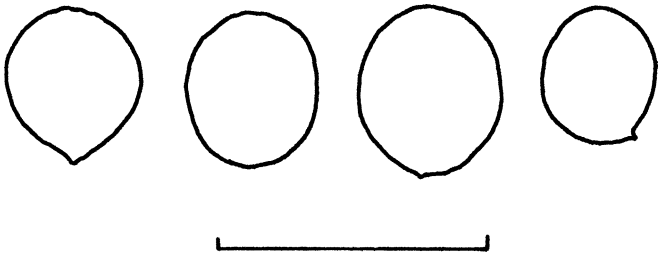

Fig. 6. Spores of *Pluteus verruculosus* S. Ito & S. Imai. *Bar* 10 μm

Pluteus okabei S. Ito & S. Imai, Trans. Sapporo Nat. Hist. Soc. **16**:46, 1940. Fig. 5

Spores 6.0–7.0 × 5.5–6.5 μm, on average 6.8 × 6.1 μm, Q = 1.0–1.3, globose to broadly ellipsoid, surface smooth, slightly yellow, thick-walled. Caulocystidia not observed.

Collection examined: Japan, Tokyo: Bonin Islands, Chichishima, Mt. Asahiyama, on decayed wood in woods, Nov. 12, 1936, no. 36 in SAPA: holotype.

The type is in bad condition. I confirmed that *Pluteus okabei* is a member of the genus *Pluteus* by spore character, but did not observe the pileipellis or metuloids.

Pluteus verruculosus S. Ito & S. Imai, Trans. Sapporo Nat. Hist. Soc. **16**:47, 1940. Fig. 6

Spores 5.8–7.0 × 5.3–6.5 μm, on average 6.3 × 5.8 μm, Q = 1.0–1.1, globose to subglobose, surface smooth, slightly yellow, thick-walled. Caulocystidia not observed.

Collection examined: Japan, Tokyo: Bonin Islands, Hahashima, Kitamura, Sekimonzan, on the ground in woods, Nov. 20, 1936, in SAPA: holotype.

The specimen is badly preserved because the bottle has dried out. The specimen of *P. verruculosus* shows smooth and globose to subglobose spores, and *P. verruculosus* belongs to the genus *Pluteus*. However, I could not see the pileipellis or cystidia.

Acknowledgment I am indebted to Professor Hideki Takahashi, Hokkaido University Museum, for critical reading of this manuscript.

References

Banerjee P, Sundberg WJ (1995) The genus *Pluteus* section *Pluteus* (Pluteaceae, Agaricales) in the midwestern United States. Mycotaxon 53:189–246

Bonnard J (1993) Clé provisoire des Plutées européens à boucles. Mycol Helv 6:203–205

Fayod V (1889) Prodrome d'une histoire naturelle des Agaricinés. Ann Soc Nat Bot VII 9:181–411

Imai S (1938) Studies on the Agaricaceae of Hokkaido. 1. J Fac Agric Hokkaido Imp Univ 43:1–178, 3 pl

Ito S, Imai S (1940) Fungi of the Bonin Islands. IV. Trans Sapporo Nat Hist Soc 16:45–56

Lange JE (1917) Studies in the Agarics of Denmark. Part 3. *Pluteus*. *Collybia*. *Inocybe*. Dansk Bot Ark 2:1–50, 3 pl

Murrill WA (1911) The Agaricaceae of tropical north America. IV. Mycologia 3:271–282

Nagasawa E (1982) A list of agaric and bolete taxa published by Dr. Sanshi Imai (1900–1976). Rep Tottori Mycol Inst (Jpn) 20:76–82

Pearson AA (1952) New records and observations. V. Trans Br Mycol Soc 35:97–122, 1 pl

Pegler DN (1986) Agaric flora of Sri Lanka. Kew Bull Addit Ser 12

Singer R (1986) The Agaricales in modern taxonomy, 4th edn. Koenigstein, p 981, pl 88

Takahashi H (2001) *Pluteus romellii* (Agaricales, Basidiomycetes), new to Japan, found in Odawara. Nat Hist Rep Kanagawa 22:21–23

Vellinga EC (1990) *Pluteus* Fr. In: Bas C, Kuyper TW, Noordeloos ME, Vellinga EC (eds) Flora Agaricina Neerlandica, vol 2. Balkema, Rotterdam, pp 31–55

Vellinga EC, Schreurs J (1985) Notulae ad floram Agaricinam Neerlandicam. VIII. *Pluteus* Fr. in West Europe. Persoonia 12:337–373

Wuilbaut JJ (2001) Le genre *Pluteus*. Misc Mycol 68:22–39