

Three new species of *Marasmius* section *Sicci* from eastern Honshu, Japan

Haruki Takahashi

1–21–2, Nishitsuruma, Yamato-shi, Kanagawa 242–0005, Japan

Accepted for publication 31 May 2000

Three new species belonging to *Marasmius* section *Sicci* (Agaricales) are described and illustrated from eastern Honshu, Japan: *Marasmius nocturnus* sp. nov., forming a dark brown pileus and marginate lamellae, was found on leaf litter in *Pasania*–*Quercus* forests; *Marasmius occultatus* sp. nov., producing brownish orange or light brown basidiomata and long, cylindrical-fusoid basidiospores, was found on dead fallen twigs of *Aphananthe aspera* and *Quercus myrsinaefolia*; *Marasmius opulentus* sp. nov., having a reddish orange pileus and a pubescent stipe, was found on leaf litter in laurel-leaved forest.

Key Words—*Marasmius nocturnus*; *Marasmius occultatus*; *Marasmius opulentus*; *Marasmius* section *Sicci*; new species.

In this report, three new species of *Marasmius* section *Sicci* Singer are described and illustrated on the basis of the materials collected in the lowland forests of eastern Honshu, especially Kanagawa and Tokyo, Japan. In addition, their photographs are presented showing macro-morphological features. Color notations in parentheses are taken from Kornerup and Wanscher (1978). Specimens cited are preserved in the Natural History Museum and Institute, Chiba, Japan (CBM) and the Kanagawa Prefectural Museum of Natural History, Japan (KPM).

Species descriptions

Marasmius nocturnus Har. Takahashi, sp. nov. Figs. 1–3

Pileo 9–15 mm lato, primo hemisphaerico, dein plano-convexo vel applanato, subumbonato, velutino, ultime albo-pruinoso, fuliginoso; stipite 30–40 × 0.8–1.5 mm, subaequali, cavo, fuliginoso, glabro; mycelio basali albo vel brunneo, strigoso; lamellis adnexis, mediocriter subdistantibus, albis, brunneo-marginatis; basidiosporis 9–10.5 × 4–4.5 μm, fusoides, levibus, hyalinis, inamyloideis; basidiis tetrasporis; cheilocystidiis pileipelli similibus; pleurocystidiis cylindratis vel subfusoides, saepe strangulatis et mucronatis; pileipelle hymeniformi ex cellulis ad instar "*Marasmius* Sect. *Sicci*", pseudoamyloidea; hyphis fibulatis.

Holotypus: In foliis dejectis *Pasaniae edulis* Makino et *Quercus serratae* Thunb. ex Murray, Mt. Takao, Hachiouji-shi, Tokyo, Japonia, 12 Aug. 1998, H. Takahashi (KPM-NC-0006512).

Etymology: from Latin, *nocturnus* = nocturnal—referring to the dark brown color of the basidiomata reminiscent of nocturnal darkness.

Pileus 9–15 mm in diam, at first hemispherical, then plano-convex to applanate, often obtusely subumbonate,

often rugose at the center, smooth or slightly sulcate-striate toward the margin, dull, dry, opaque, minutely velutinous, pruinose in age, light yellow (4A5) to reddish yellow (4A6) or light orange (5A5) to orange (5A6) at primordial stages, then brown (7D7–7D8), finally dark brown (7F7–7F8). Flesh thin (up to 1 mm), paler concolorous with the pileus, odor and taste not distinctive. Stipe 30–40 × 0.8–1.5 mm, cylindrical but somewhat inflated at the base, central, slender, terete, tough, hollow, shiny, glabrous, apex white, dark brown (7F7–7F8) toward the base attached by a white or brownish, strigose mycelium to the substratum. Lamellae adnexed, subdistant (15–19 reach the stipe), up to 1.5 mm broad, white, not intervenose; edges even, concolorous with the pileus.

Spore print pure white. Basidiospores 9–10.5 × 4–4.5 μm, fusiform, smooth, colorless, inamyloid, thin-walled. Basidia 18–28 × 5–8 μm, clavate, four-spored; basidioles clavate. Cheilocystidia forming a compact sterile edge, similar to the pileipellis elements. Pleurocystidia numerous, 25–45 × 4–6 μm, cylindrical to subfusoid, often flexuous or strangulated, sometimes with one or two apical mucrones, smooth, colorless, dextrinoid, thin-walled. Hymenophoral trama regular; element hyphae similar to those of the pileipellis. Pileipellis a hymeniform layer of *Siccus*-typed cells 20–28.5 × 5–12 μm, clavate or irregular in outline, sometimes lobed, with pale brown apical setulae 3–8 × 0.5–2 μm, with smooth, hyaline to pale brown walls up to 1.5 μm thick, dextrinoid. Tramal hyphae of pileus 4–10 μm wide, subparallel or loosely interwoven, subcylindric, often inflated, smooth, colorless or pale brown, dextrinoid, thin-walled. Stipitipellis a cutis of parallel, repent hyphae 2–5 μm wide, cylindrical, smooth, brown, dextrinoid, thin-walled; caulocystidia absent. Stipe trama

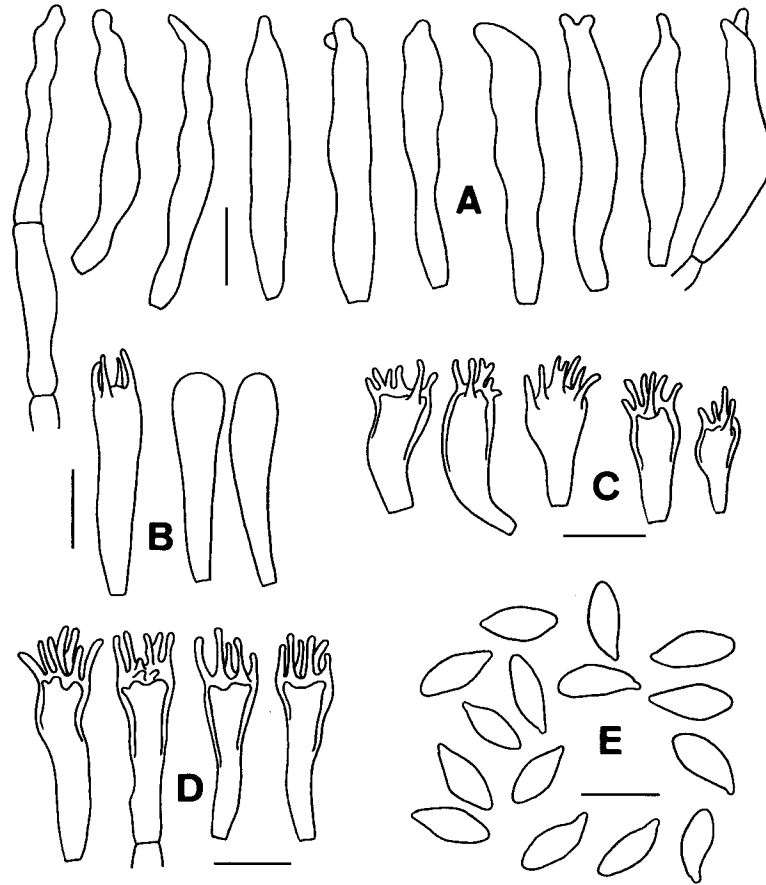


Fig. 1. *Marasmius nocturnus*.

A. Pleurocystidia. B. Basidium and basidioles. C. Cheilocystidia. D. Elements of the pileipellis. E. Basidiospores. Scales: 10 μ m. All figures from the holotype.

Fig. 2. Primordia of *Marasmius nocturnus*.
Scale: 1 mm. From CBM-FB-24141.

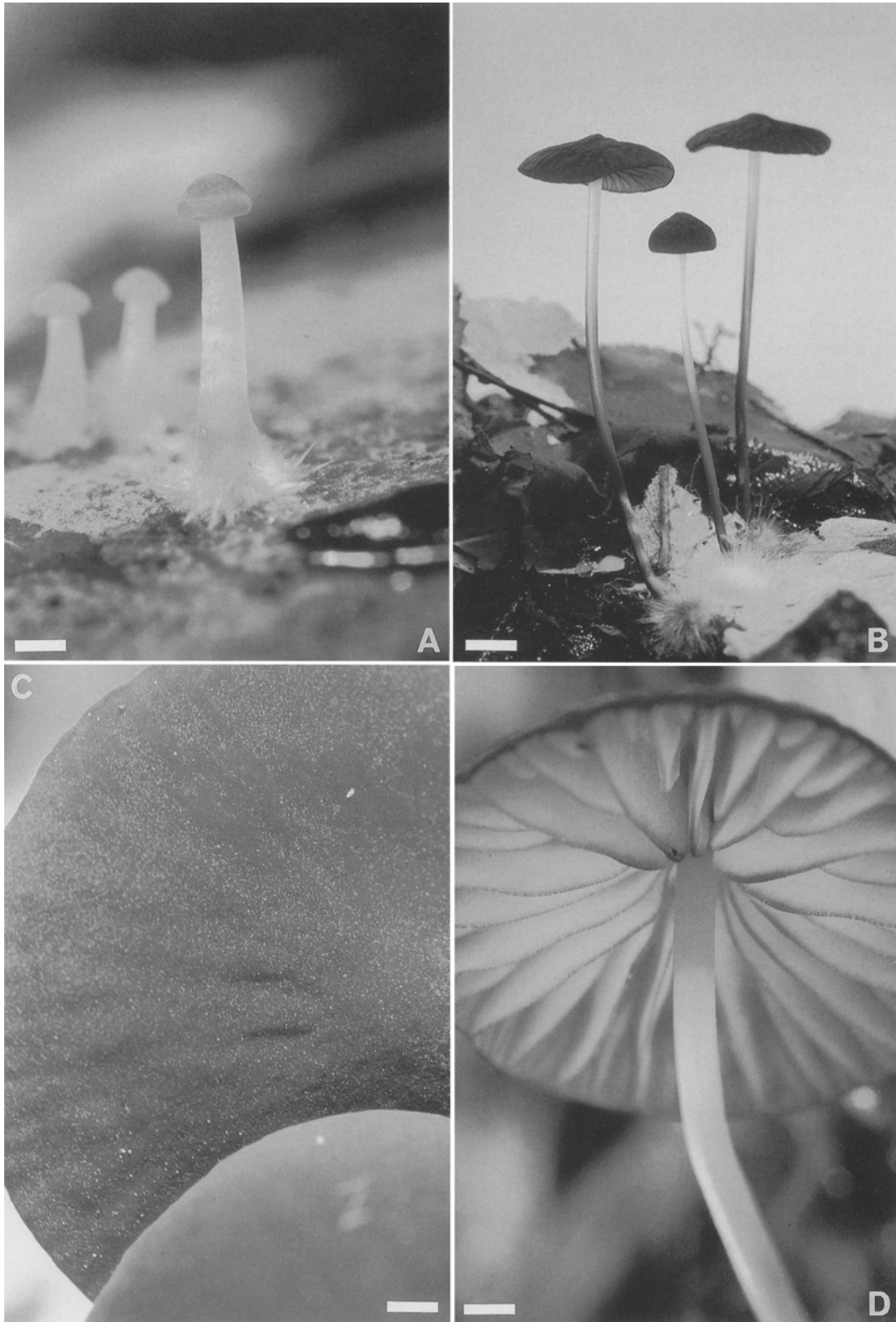


Fig. 3. *Marasmius nocturnus*. A. Immature basidiomata. B. Mature basidiomata. C. Surface view. D. Underside view. Scales: A, C, D=1 mm; B=5 mm. A, B. from CBM-FB-24140; C, D. from CBM-FB-24141.

composed of longitudinally running, cylindrical hyphae 3.5–8 μm wide, with smooth, brown walls up to 1 μm thick, dextrinoid. Clamps present in all tissues.

Known distribution: Japan (Tokyo).

Specimens examined: KPM-NC-0006512 (holotype), solitary to scattered, on leaf litter in lowland forests dominated by *Pasania edulis* Makino and *Quercus serrata* Thunb. ex Murray, Mt. Takao, Hachioji-shi, Tokyo, 12 Aug. 1998; CBM-FB-24139, *ibid.* 8 Aug. 1998; CBM-FB-24140, *ibid.* 10 Aug. 1998; CBM-FB-24141, *ibid.* 2 Sept. 1998.

Japanese name: Kurocha-ochibatake.

Notes: This species is characterized by its dark brown, minutely velutinous pileus with somewhat rugose, subumbonate disk, the dark brown marginate lamellae, the glabrous stipe with white to brownish, strigose basal mycelium, the fusiform basidiospores, the subcylindrical pleurocystidia, and the *Siccus*-typed elements in the pileipellis and lamella edges.

The strigose basal mycelium, the cylindrical pleurocystidia, and the *Siccus*-typed pileipellis elements suggest that *Marasmius nocturnus* belongs in the section *Sicci* Singer, subsection *Siccini* Singer, series *Hae-matocephali* Singer (Singer, 1976, 1986), where it appears to be closely related to *Marasmius brunneolus* (Berk. & Broome) Pegler var. *fuliginosus* Desjardin & E. Horak from Papua New Guinea (Desjardin & Horak, 1997) and *Marasmius grandisetulosus* Singer from East Africa (Pegler, 1977; Singer, 1964). *Marasmius brunneolus* var. *fuliginosus* differs in having a strongly plicate pileus, non-marginate lamellae, an insititious stipe, and much longer basidiospores (23–26 \times 2.5–4 μm : Desjardin and Horak, 1997). *Marasmius grandisetulosus* differs in having a deeply plicate-striate, glabrous, orange brown pileus, much longer basidiospores (15–21.5 μm : Pegler, 1977), and much larger pleurocystidia (31–75 \times 6–12 μm : Pegler, 1977). Aside from series *Hae-matocephali*, *M. nocturnus* has superficial resemblance to two taxa of series *Atrorubentes* Desjardin & Horak (Desjardin and Horak, 1997) because of a velutinous, dark brown pileus, viz. *Marasmius atrocastaneus* G. Stev. from New Zealand (Desjardin and Horak, 1997; Stevenson, 1964) and *Marasmius umbrinus* Pegler from East Africa (Pegler, 1968, 1977). These species differ from *M. nocturnus* in lacking pleurocystidia and in having

caulocystidia which form pruinosity on the stipe surface. *Marasmius nocturnus* is also similar to neotropical *Marasmius spiculosus* (Pegler, 1983; Singer, 1965), but the latter is distinct in having a pubescent stipe covered with broom-cells, much longer basidiospores (11.5–16 μm : Pegler, 1983), and setae on both pileus and stipe surface.

Marasmius occultatus Har. Takahashi, sp. nov. Figs. 4, 5

Pileo 12–27 mm lato, primo hemisphaerico, dein plano-convexo vel applanato, vix subumbonato, velutino, ultime albo-pruinoso, brunneo vel alutaceo; stipite 30–50 \times 0.8–1.3 mm, subaequali, cavo, glabro, brunneo vel alutaceo; mycelio basali albo, strigoso; lamellis liberis vel adnexis, mediocriter subdistantibus, albis; basidiosporis 14–16 \times 3–4 μm , cylindratis vel fusoidis, levibus, hyalinis, inamyloideis; basidiis tetrasporis; cheilocystidiis pileipelli similibus; pleurocystidiis nullis; pileipelle hymeniformi ex cellulis ad instar "*Marasmius* Sect. *Sicci*", pseudoamyloidea; hyphis fibulatis.

Holotypus: In ramulis delapsis in silva, Yamato-shi, Kanagawa-ken, Japonia, 5 Jul. 1998, H. Takahashi (KPM-NC-0006513).

Etymology: from Latin, *occultatus* = hidden.

Pileus 12–27 mm in diam, at first hemispherical, then convex to plane, rarely subumbonate, smooth toward a somewhat striatulate margin, dull, dry, opaque, minutely velutinous, strongly pruinose in age, brownish orange (7C7–7C8) to brown (7D7–7D8) or brownish orange (6C5–6C6) to light brown (6D5–6D6), with a slightly darker disk. Flesh thin (up to 1 mm), paler concolorous with the pileus, odor and taste not distinctive. Stipe 30–50 \times 0.8–1.3 mm, cylindrical, central, slender, terete, tough, hollow, shiny, glabrous, concolorous with the pileus, paler toward the apex; base covered with white, mycelioid bristles. Lamellae subfree to adnexed, subdistant to subclose (17–20 reach the stipe), up to 2.5 mm broad, white, not intervenose; edges even, concolorous.

Spore print pure white. Basidiospores 14–16 \times 3–4 μm , narrowly clavate to cylindrical-fusoid, smooth, colorless, inamyloid, thin-walled. Basidia 23–32 \times 6–8 μm , clavate, four-spored; basidioles fusiform to subfusiform-clavate. Edges of lamellae fertile. Cheilocystidia infrequent, similar to the pileipellis elements but

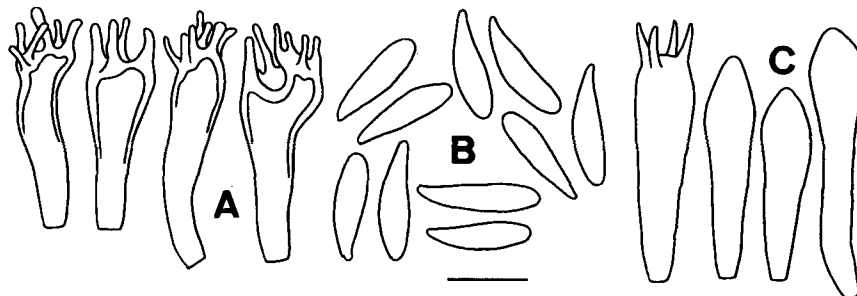


Fig. 4. *Marasmius occultatus*.

A. Elements of the pileipellis. B. Basidiospores. C. Basidium and basidioles. Scale: 10 μm . All figures from the holotype.

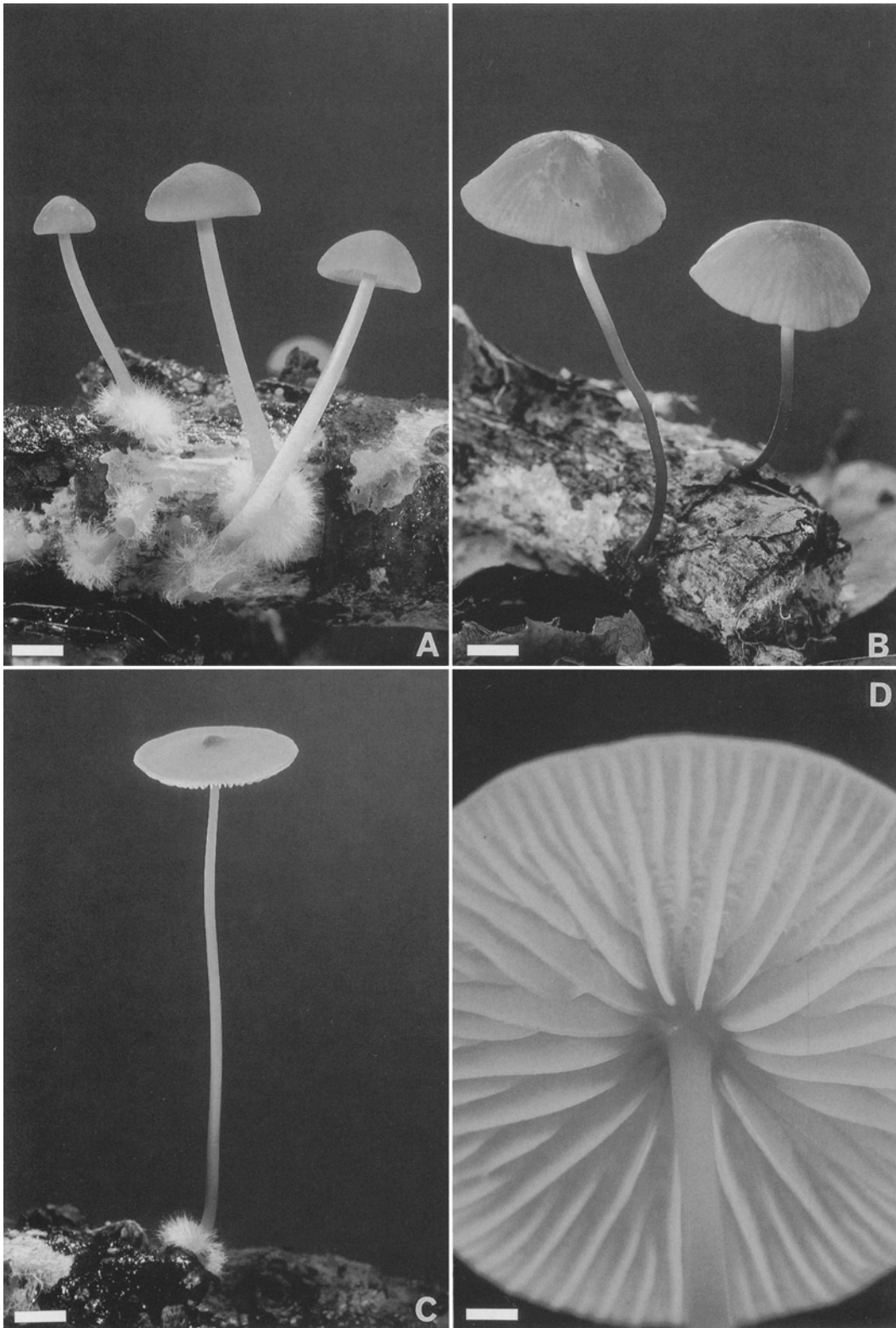


Fig. 5. *Marasmius occultatus*.

A. Immature basidiomata. B. Brownish orange mature basidiomata. C. light brown mature basidioma. D. Underside view. Scales: A=2 mm; B, C=5 mm; D=1 mm. All figures from the holotype.

smaller and colorless. Pleurocystidia not seen. Hymenophoral trama subregular to irregular; element hyphae similar to those of the pileitrama. Pileipellis a hymeniform layer of *Siccus*-typed cells $27\text{--}34 \times 7\text{--}11 \mu\text{m}$, clavate or irregular in outline, sometimes lobed, with yellowish brown apical setulae $2\text{--}7 \times 0.8\text{--}1.5 \mu\text{m}$, with smooth, yellowish brown walls up to $1 \mu\text{m}$ thick, dextrinoid. Tramal hyphae of pileus $4\text{--}13 \mu\text{m}$ wide, subparallel or loosely interwoven, subcylindric, often inflated, smooth, colorless, dextrinoid, thin-walled. Stipitipellis a cutis of parallel, repent hyphae $2\text{--}4 \mu\text{m}$ wide, cylindric, smooth, brown, dextrinoid, thin-walled; caulocystidia absent. Stipe trama composed of longitudinally running, cylindric hyphae $5\text{--}8 \mu\text{m}$ wide, with smooth, pale yellowish brown walls up to $1 \mu\text{m}$ thick, dextrinoid. Clamps present in all tissues.

Known distribution: Japan (Kanagawa).

Specimens examined: KPM-NC-0006513 (holotype), solitary to scattered, on dead fallen branches in lowland forests dominated by *Aphananthe aspera* (Thunb. ex Murray) Planch. and *Quercus myrsinaefolia* Blume, Yamato-shi, Kanagawa-ken, 5 Jul. 1998; *ibid.* 11

July 1996; *ibid.* 23 Sept. 1997; *ibid.* 17 Sept. 1998; KPM-NC-0006039, *ibid.* 10 Nov. 1999.

Japanese name: Hikage-ochiedatake.

Notes: *Marasmius occultatus* is characterized by its brownish orange or light brown pileus and stipe, the white, strigose basal mycelium, and the lignicolous habitat. In addition, this species is distinct because of the relatively long, cylindrical-fusoid basidiospores, the fusiform basidioles, and the *Siccus*-typed pileipellis elements. The combination of these features suggests that *M. occultatus* is a member of the section *Sicci* Singer, subsection *Siccini* Singer, series *Leonini* Singer (Singer, 1976, 1986).

Marasmius occultatus is macromorphologically similar to *Marasmius cohaerens* (Pers.: Fr.) Cooke & Quél., a well defined temperate species (Antonín and Noordeloos, 1993; Breitenbach and Kränzlin, 1991; Gilliam, 1976), and North American *Marasmius plicatulus* Peck (Desjardin, 1987a, 1987b). *Marasmius cohaerens* differs in producing much shorter basidiospores ($8.0\text{--}10.5 \times 4.0\text{--}5.5 \mu\text{m}$; Antonín & Noordeloos, 1993) and setiform cystidia in the cuticle and hymenium. *Maras-*

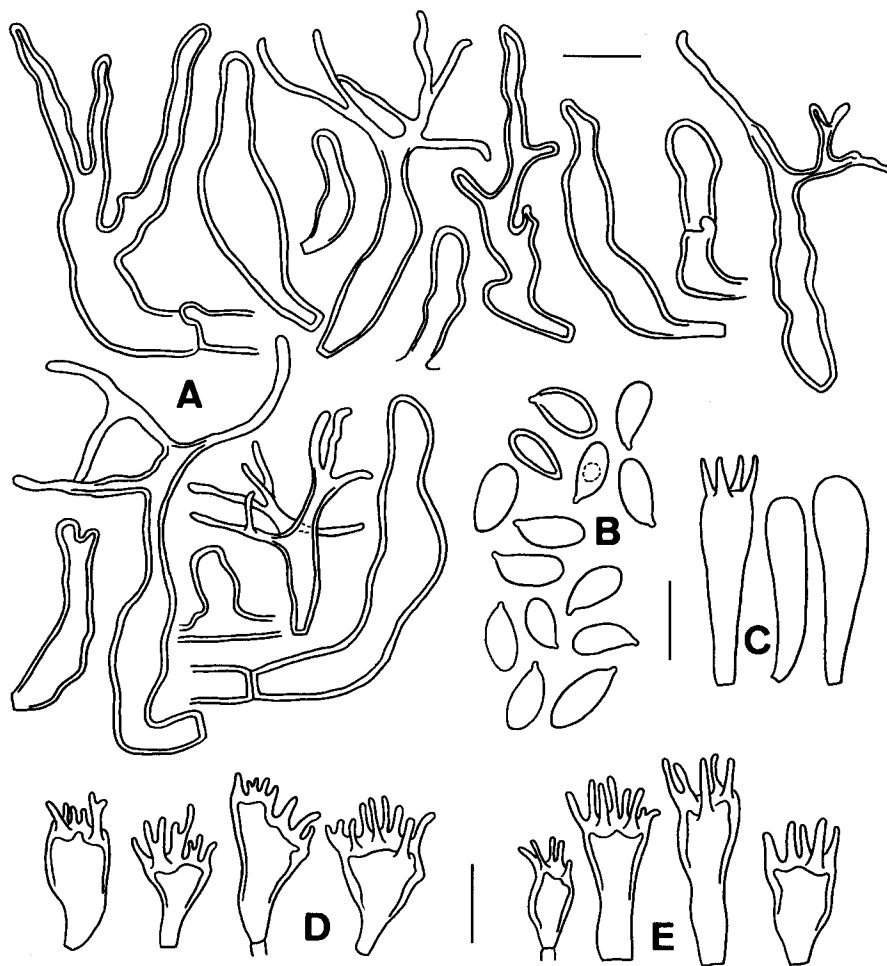


Fig. 6. *Marasmius opulentus*.

A. Caulocystidia. B. Basidiospores. C. Basidium and basidioles. D. Cheilocystidia. E. Elements of the pileipellis. Scales: $10 \mu\text{m}$. All figures from the holotype.

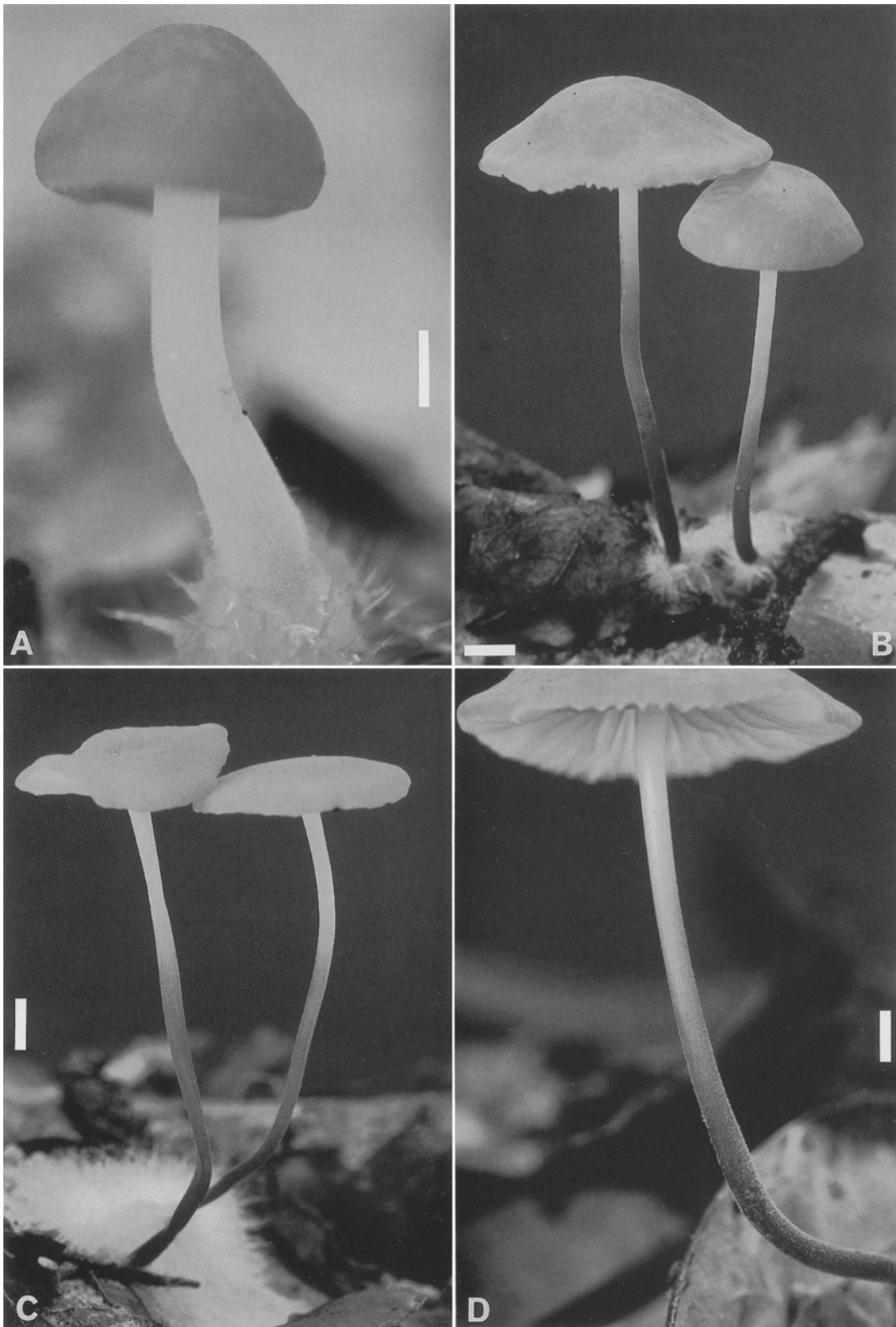


Fig. 7. *Marasmius opulentus*.

A, B. Immature basidiomata. C. Mature basidiomata. D. Close-up of stipe surface. Scales: A=1 mm; B=4 mm; C=5 mm; D=2 mm. A, B. from CBM-FB-24137; C, D. from CBM-FB-24138.

mius plicatulus differs in having dark reddish brown pileus, broader basidiospores (4.8–6.3 μm : Desjardin, 1987b), and basidiome formation on humus or grassy areas.

Marasmius opulentus Har. Takahashi, sp. nov. Figs. 6, 7

Pileo 14–22 mm lato, primo convexo, dein applanato, velutino, aurantiaco; stipite 25–33 \times 0.8–1.5 mm, subaequali, cavo, fuliginoso, villosopruinoso; mycelio basali albo, strigoso; lamellis adnexis, mediocriter subdistantibus, albis, aurantio-marginatis; basidiosporis 8–10 \times 3.5–4 μm , ellipsoideis, levibus, hyalinis, inamyloideis; basidiis tetrasporis; cheilocystidiis pileipellis similibus; pleurocystidiis nullis; pileipelle hymeniformi ex cellulis ad instar "*Marasmius* Sect. *Sicci*", pseudoamyloidea; caulocystidiis irregulariter cylindraceis vel ex cellulis ad instar "*Marasmius* Sect. *Sicci*", crassitunicatis; hyphis fibulatis.

Holotypus: Ad folia dejecta in silva, Zushi-shi, Kanagawa-ken, Japonia, 16 Sept. 1998, H. Takahashi (KPM-NC-0006514).

Etymology: from Latin, *opulentus* = abundant - referring to the gregarious growth habit.

Pileus 14–22 mm in diam, at first convex, then nearly plane, not umbonate, disk often rugulose in age, smooth toward a somewhat striatulate margin, dull, dry, opaque, minutely velutinous, evenly colored deep orange (6A8) to orange (6A7), fading to orange (6A6 or 6B6–6B7). Flesh thin (up to 0.8 mm), pallid, odor and taste not distinctive. Stipe 25–33 \times 0.8–1.5 mm, cylindrical, central, slender, terete or compressed, tough, hollow, pruinose to pubescent or minutely velvety overall, apex white, brownish orange (7C7–7C8) to brown (7D7–7D8) toward a dark brown (7F8) base attached by a white, strigose mycelium to the substratum. Lamellae adnexed, subdistant to subclose (19–23 reach the stipe), up to 2.5 mm broad, white, more or less intervenose; edges even, concolorous with the pileus.

Spore print pure white. Basidiospores 8–10 \times 3.5–4 μm , ellipsoid to amygdaliform, smooth, colorless, inamyloid, thin- or slightly thick-walled. Basidia 22–25 \times 5–7 μm , clavate, four-spored; basidioles clavate. Cheilocystidia forming a compact sterile edge, similar to pileipellis elements. Pleurocystidia none. Hymenophoral trama regular; element hyphae similar to those of the pileitrama. Pileipellis a hymeniform layer of *Siccus*-typed cells 15–24 \times 7–12 μm , clavate or irregular in outline, sometimes lobed, with pale orange apical setulae 2–7 \times 0.5–2 μm , with smooth, pale orange walls up to 1.5 μm thick, inamyloid or pigmented portions dextrinoid. Hyphae of pileitrama 4–14 μm wide, subparallel or loosely interwoven, subcylindric, inflated or not, smooth, colorless, dextrinoid, thin-walled. Stipitipellis a cutis of parallel, repent hyphae 4–7.5 μm wide, cylindric, with smooth, light brown walls up to 1 μm thick, dextrinoid. Caulocystidia of two types: 1) numerous irregularly cylindrical to fusoid cells 15–60 \times 5–12 μm , flexuous or strangulated, with obtuse apex, occasionally branched, with smooth, melleous walls up to 1 μm thick, dextrinoid; 2) scattered *Siccus*-typed cells with long setulae,

with smooth, melleous walls up to 1 μm thick, dextrinoid; main cell bodies 12–30 \times 3–9 μm , cylindric or irregular in outline; setulae 10–32 \times 0.5–3.5 μm , cylindric with obtuse apex, flexuous, often forked. Stipe trama composed of longitudinally running, cylindric hyphae 7.5–12 μm wide, smooth, colorless, dextrinoid, thin-walled. Clamps present in all tissues.

Known distribution: Japan (Kanagawa).

Specimens examined: KPM-NC-0006514 (holotype), often gregarious, on leaf litter in lowland forests dominated by *Ardisia japonica* (Thunb.) Blume, *Castanopsis cuspidata* (Thunb. ex Murray) Schottky var. *sieboldii* (Makino) Nakai, *Quercus salicina* Blume, and *Quercus acuta* Thunb. ex Murray, Zushi-shi, Kanagawa-ken, 16 Sept. 1998; CBM-FB-24137, *ibid.* 25 Sept. 1997; CBM-FB-24138, *ibid.* 20 Jul. 1998.

Japanese name: Kaen-ochibatake.

Notes: This species is characterized by its entirely reddish orange pileus, the orange marginate lamellae, the entirely pubescent to minutely velutinous stipe with white, strigose basal mycelium, the cheilocystidia and pileipellis composed of *Siccus*-typed cells, and the thick-walled, irregularly cylindric or *Siccus*-typed caulocystidia with long and forked setulae.

The strigose basal mycelium, the *Siccus*-typed pileipellis elements, the absence of pleurocystidia and setiform cells, and the stipitipellis anatomy suggest that *Marasmius opulentus* belongs in the section *Sicci* Singer, subsection *Siccini* Singer, series *Leonini* Singer (Singer, 1976, 1986). Within the series, *M. opulentus* appears to be allied with several other taxa with a reddish- or orange-colored pileus, such as *Marasmius floriceps* Berk. & M. A. Curtis from neotropical regions (Singer, 1976) and Papua New Guinea (Desjardin and Horak, 1997), *Marasmius abundans* Corner from Malay Peninsula (Corner, 1996), *Marasmius leoninus* Berk. from South America (Singer, 1965, 1976), and *Marasmius croceus* G. Stev. from New Zealand (Stevenson, 1964) and Australia (Desjardin and Horak, 1997). *Marasmius floriceps* and *M. abundans* differ primarily in having a plicate to sulcate-striate pileus and no caulocystidia. *Marasmius leoninus* has a deeply furrowed-sulcate pileus, non-marginate lamellae, and lignicolous habitat. *Marasmius croceus* has non-marginate lamellae and lacks irregularly cylindrical caulocystidia. Aside from series *Leonini*, there are several similar North American taxa: *Marasmius sullivantii* Mont. (Gilliam, 1976), *Marasmius corrugatus* (Pat.) Sacc. & Sydow var. *aurantiacus* (Murrill) Singer (Singer, 1965, 1976), and *Marasmius ciliatomarginatus* Desjardin (Desjardin, 1989). *Marasmius sullivantii* has numerous cylindric to fusiform pleurocystidia and *Siccus*-typed caulocystidia with short setulae. *Marasmius corrugatus* var. *aurantiacus* has a pileus with distinctly corrugated disk, a subglabrous stipe, and lignicolous habitat. *Marasmius ciliatomarginatus* has a rugulose-striate pileus, much longer, clavate basidiospores (13.5–18 \times 3.2–4.7 μm : Desjardin, 1989), and cylindric, gloeocystidioid cheilocystidia.

Acknowledgements—I am grateful to Dr. Toshimitsu Fukiharuru

(CBM) for allowing the specimens cited to be kept in the Natural History Museum and Institute, Chiba. Thanks are also owed to Dr. Yousuke Degawa (KPM) for allowing the specimens cited to be kept in the Kanagawa Prefectural Museum of Natural History.

Literature cited

- Antonín, V. and Noordeloos, M. E. 1993. A monograph of *Marasmius*, *Collybia* and related genera from Europe. Part 1: *Marasmius*, *Setulipes*, and *Marasmiellus*. Lib. Bot. **8**: 1–229.
- Breitenbach, J. and Kränzlin, F. 1991. Fungi of Switzerland 3. Boletes and agarics 1st part. Edition Mykologia, Lucerne.
- Corner, E. J. H. 1996. The agaric genera *Marasmius*, *Chaetocalathus*, *Crinipellis*, *Heimiomyces*, *Resupinatus*, *Xerula* and *Xerulina* in Malesia. Beih. Nova Hedwig. **111**: 1–164.
- Desjardin, D. E. 1987a. New and noteworthy marasmioid fungi from California. Mycologia **79**: 123–134.
- Desjardin, D. E. 1987b. The Agaricales (gilled fungi) of California. 7. Tricholomataceae I. Marasmioid fungi: the genera *Baeospora*, *Crinipellis*, *Marasmiellus*, *Marasmius*, *Micromphale*, and *Strobilurus*. Mad River Press, Eureka.
- Desjardin, D. E. and Horak, E. 1997. *Marasmius* and *Gloiocephala* in the South Pacific region: Papua New Guinea, New Caledonia and New Zealand taxa. Bibl. Mycol. **168**: 1–152.
- Desjardin, D. E. and Petersen, R. H. 1989. Studies on *Marasmius* from eastern North America. II. New species. Mycotaxon **34**: 71–92.
- Gilliam, M. S. 1976. The genus *Marasmius* in the northeastern United States and adjacent Canada. Mycotaxon **4**: 1–144.
- Kornerup, A. and Wanscher, J. H. 1978. Methuen handbook of colour, 3rd. ed. Methuen & Co., London.
- Pegler, D. N. 1968. Studies on African Agaricales. I. Kew Bull. **21**: 499–533.
- Pegler, D. N. 1977. A preliminary Agaric flora of East Africa. Kew Bulletin Add. Ser. VI. Her Majesty's Stationery Office, London.
- Pegler, D. N. 1983. Agaric flora of the Lesser Antilles. Kew Bulletin Add. Ser. IX. Her Majesty's Stationery Office, London.
- Singer, R. 1964. *Marasmius* congolais recueillis par Mme Goossens-Fontana et d'autres collecteurs Belges. Bull. Jard. Bot. Brux. **34**: 317–388.
- Singer, R. 1965. Monographic studies on South American Baidiomycetes, especially those at the east slope of the Andes and Brazil 2. The genus *Marasmius* in South America. Sydowia **18**: 106–358.
- Singer, R. 1976. Marasmiaceae (Basidiomycetes—Tricholomataceae). Flora Neotropica Monograph **17**: 1–347.
- Singer, R. 1986. Agaricales in modern taxonomy, 4th. ed. Koeltz Scientific Books, Koenigstein.
- Stevenson, G. 1964. The Agaricales from New Zealand. V. Tricholomataceae. Kew Bull. **19**: 1–59.