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New species and new records in *Marasmius* sect. *Sicci* from China

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Abstract – During the re-examination of the Chinese *Marasmius* specimens of sect. *Sicci* preserved in the herbaria KUN and GDGM, four new species were discovered: *Marasmius albostipitatus* is characterized by an orange pileus, a white stipe, and the absence of pleurocystidia and caulocystidia; *M. hygrocybiformis* is recognized by an orange-red, plano-convex pileus, a grayish green hyaline stipe and medium large basidiospores; *M. sparsifolius* is characterized by an orange-white pileus, extremely distant lamellae not reaching the pileus margin; *M. subabundans* is similar to *M. abundans* in many respects, but has obviously smaller basidiospores and usually a paler pileus. In addition, *M. coklatus*, *M. confertus* var. *parvisporus*, *M. hinnuleus* and *M.* cf. *occultatiformis* are reported as new to China. All eight taxa are described and illustrated in detail according to the Chinese materials.

Agaricales / biodiversity / morphology / taxonomy

INTRODUCTION

The genus *Marasmius* Fr., as traditionally accepted by e.g. Singer (1986), is polyphyletic (e.g. Moncalvo *et al.* 2002, Wilson & Desjardin 2005). Only members of sect. *Marasmius*, *Hygrometrici* Kühner, *Globulares* Kühner and *Sicci* Singer belong here now; in addition, the *Sicci* and *Globulares* species form a joint large clade (e.g. Wannathes *et al.* 2009). The species of the former sect. *Alliacei* Kühner belong to a separate genus *Mycetinis* Earle of family *Omphalotaceae* (Antonín & Noordeloos 2010, Wilson & Desjardin 2005). Two species groups are a part of family *Physalacriaceae*: *Rhizomarasmius undatus* (Berk.) R.H. Petersen, the type species of the former *Marasmius* sect. *Chordales* Fr. (Petersen 2000), and sect. *Epiphylli* Kühner which forms a still unsettled group within this family (e.g. Antonín *et al.* 2010). *Marasmiellus* Murrill, formerly considered close to *Marasmius*, occupies now a very distant position and belongs to family *Omphalotaceae*, where it is found in several clades together with *Gymnopus* (Pers.) Roussel (e.g. Antonín & Noordeloos 2010, Wilson & Desjardin 2005).

On the other hand, close genera to *Marasmius* belonging to family *Marasmiaceae* are e.g. *Crinipellis* Pat., *Chaetocalathus* Singer, and *Moniliophthora* H.C. Evans *et al.* (e.g. Aime & Philips-Mora 2005, Antonín 2012), *Campanella* Henn. (Moncalvo *et al.* 2002), or resupinate *Neocampanella blastanos* (Boidin & Gilles) Nakasone *et al.* (Duhem & Buyck 2012).

Marasmius sect. *Sicci* was defined by Singer (1958, 1976, 1986) on the basis of a hymeniform pileipellis composed of broom cells of the *Siccus*-type and dextrinoid hyphae. The section comprises more than 200 known species worldwide, mostly tropical and subtropical in distribution (Antonín *et al.* 2010, Singer 1976, 1986; Tan *et al.* 2009, Wannathes *et al.* 2009).

In China, 31 taxa of section *Sicci* have been documented in the literature (Bi *et al.* 1985, 1993; Bi & Li 1987, Deng *et al.* 2011, Li *et al.* 1994, Tai 1979, Teng 1963). During recent research on the Chinese *Marasmius*, four new species and four additional new Chinese records were discovered. They are described and illustrated below.

MATERIALS AND METHODS

All the examined specimens are preserved in herbarium with field notes. Color codes in macroscopic description were cited according to Kornerup & Wanscher (1978). Microscopic studies were based on dried material using a light microscope Olympus BX-51 with magnifications up to 1000 ×. Observations were made on mounts in Congo-red aqueous solution, 5% KOH, and Melzer's reagent. The terms used to describe lamellae spacing refer to the number of entire lamellae (L) reaching the stipe or nearly so, lamellulae are indicated by the number of their series present. Spore statistics included: x_m, the arithmetic mean of the spore length by spore width (± standard deviation) for n spores measured in a single specimen; Q, the quotient of spore length by spore width in any one spore, indicated as a range of variation in n spores measured; Q_m, the mean of Q-values in a single specimen; n, the number of spores measured per specimen; s, the number of specimens involved. Specimens cited are deposited in the Herbarium of Cryptogams, Kunming Institute of Botany of the Chinese Academy of Sciences (KUN, with HKAS numbers) and the Fungal Herbarium of Guangdong Institute of Microbiology (GDGM). The following descriptions of the taxa are presented in alphabetical order.

RESULTS

Marasmius albostipitatus Chun Y. Deng & T.H. Li **sp. nov.** **Figs.** 1c, 2

MycoBank: MB 561808;

Etymology: named for the white stipe.

Pileus 15-25 mm, primo campanulatus vel convexus dein planoconvexus, umbonatus, discum regulosum vel reticulatum, margine striatus, aurantiacus. Lamellae adnateae, albae, subdistantes (L = 12-16), angustae. Stipes 30-60 × 2-3 mm, centralis, cylindratus, albus, haud insititius, glaber, basali mycelio albo et tomentoso. Odor saporque nulli. Basidiosporae 7-13 × 3.5-5.6 µm, ellipsoideae, laeves, hyalinae, inamyloideae, tenuitunicatae. Basidia 2- vel 4- spora. Cheilocystidia typi Sicci, 12-25 × 4-20 µm, cylindrica vel clavata; setulae ad apicem 4-7 × 1-2(-3) µm,

Fig. 1. Photos of basidiocarps. **a., b.** *M. subabundans* (GDGM 26803) **c.** *M. albostipitatus* (HKAS 49338); **d.** *M. hygrocybiformis* (HKAS 49372); **e.** *M. sparsifolius* (GDGM 27385£); **f.** *M. confertus* var. *parvisporus* (GDGM 28395); **g.** *M. hinnuleus* (GDGM 26802); **h.** *M. coklatus* (HKAS 56115); **i.** *M.* cf. *occultatiformis* (HKAS 49300); Photos by: a., b. Y.J. Li; c., d., i. Z. W. Ge; e. N.K. Zeng; f. M. Zhang; h.Y.C. Li; g. C.Y. Deng.

cylindricae vel conicae, subacutae. Pleurocystidia nulla. Pileipellis hymeniformis, e cellulis typi Sicci; cellulae 9-24(-36) × 5-11 µm, cylindricae vel clavatae; setulae ad apicem 3-5 × 1.5-3 µm. Caulocystidia nulla. Fibulae presentes.

Holotypus: China, Sichuan Provincia, Serdar Comitatus, Kangle Vicus, 10 Aug. 2008, Z. W. Ge 843 (in herbario HKAS 49338 asservatur).

Pileus 15-25 mm broad, campanulate to convex when young, expanding to broadly convex in age, sometimes broadly umbonate, smooth to rugulose or reticulate at disc, striate at margin, orange (5A7-8) to deep orange (6A7-8), paler at margin. **Lamellae** adnate, subdistant (L = 12-16), with 1-2 series of lamellulae, non-marginate, narrow (up to 2 mm broad), white. **Stipe** 30-60 × 2-3 mm, central, cylindrical, white, non-insititous, glabrous, with white basal mycelium and tomentum. **Odor** and **taste** indistinctive.

Basidiospores 7-13 × 3.5-5.6 µm [x_m = 9.57 ± 1.4 × 4.56 ± 0.59 µm, Q = 1.7-2.5, Q_m = 2.0 ± 0.24, n = 25 spores, s = 1 specimen], amygdaliform, ellipsoid or subfusoid, smooth, hyaline, inamyloid, thin-walled. **Basidia** 30-40 × 6-10 µm, clavate, 2- or 4-spored. **Pleurocystidia** absent. **Cheilocystidia** abundant, in form of *Siccus*-type broom cells with main body 12-25 × 4-20 µm, cylindrical to clavate, thin- to thick-walled; apical setulae 4-7 × 1-2(-3) µm, crowded, cylindrical to conical, obtuse to subacute, brown, thick-walled. **Pileipellis** hymeniform, composed of *Siccus*-type broom cells, with main body 9-24(-36) × 5-11 µm, clavate, cylindrical, regular or irregular; apical setulae 3-5 × 1.5-3 µm, cylindrical to conical, light brown to brown, thin- to thick-walled. **Pileus trama** interwoven, dextrinoid. **Lamellar trama** of 4-15 µm wide, regular to interwoven, cylindrical, smooth, hyaline, dextrinoid, thin-walled, non-gelatinous hyphae. **Stipitipellis** of 3-6 µm wide, subparallel, cylindrical, smooth, dextrinoid hyphae. **Stipe trama** of 3-12 µm wide, parallel, cylindrical, hyaline, smooth, dextrinoid, thin-walled, non-gelatinous hyphae. **Caulocystidia** absent. **Clamp connections** present in all tissues.

Habitat. Scattered to gregarious on mixed forest humus.

Specimen examined. CHINA. Sichuan Prov., Serdar Co., Kangle Village, N32°15′2″, E 100°3′44″, 3810 m alt., 10 Aug. 2008, leg. Z. W. Ge 843 (HKAS 49338, holotype).

Discussion. The main features of *Marasmius albostipitatus* are its white stipe, an orange to deep orange, campanulate pileus with a broad umbo, and relatively large basidiospores (7-13 × 3.5-5.6 µm). The nearly pure white and somewhat hyaline stipe (rather typical in the genus *Mycena* (Pers.) Roussel) is a rather distinctive character in *Marasmius*.

Among the known species with orange pileus, one Southeast Asian and three South American species should be compared with *M. albostipitatus*. Although they are similar in color, the Malaysian species *M. acerosus* Y.S. Tan & Desjardin differs from the new species in its crowded lamellae (with 16-25 entire lamellae), a brownish orange stipe and larger basidiospores (13-15 × 4-4.5 µm) (Tan *et al.*, 2009). The Cuban *M. floriceps* Berk. & M.A. Curtis possesses smaller basidiomata (with pileus 10-17 mm wide), and marginate lamellae (Singer 1976, Desjardin & Horak 1997). The Brazilian *M. pseudosetosus* Puccinelli & Capelari differs by its reddish brown to vinaceous stipe, dimorphic cheilocystidia and well-developed pileipellis setae (Puccinelli & Capelari 2006). Finally, *M. trinitatis* Dennis from Trinidad has closer lamellae and only 3.5-4 µm wide basidiospores (Dennis 1951a).

Marasmius coklatus Desjardin, Retn. & E. Horak, *Sydowia* 52(1): 146. 2000.
Figs. 1h, 3

Pileus 20-35 mm broad, convex when young, expanding to broadly convex with a broad umbo in age, smooth to wrinkled in central part, weakly

striate, subvelutinous in margin, disc dark brown (7F7-8, 8F7-8), margin yellowish brown (5E7), brownish orange (7B6-7). **Context** thin, white. **Lamellae** adnexed to adnate, subdistant (L = 12-16) with 1-3 series of lamellulae, not intervenose, broad (4-8 mm), non-marginate, interveined, white. **Stipe** 45-75 × 4-5 mm, central, cylindrical, hollow, non-insititious, apex pale yellow (4A3) to reddish brown (8C6-8), base dark brown (8F8), basal mycelium white. **Odor** and **taste** not distinctive.

Basidiospores 8-11.5 × 4.5-7 µm [x_m = 9.97 ± 0.98 × 5.49 ± 0.6 µm, Q = 1.6-2.0, Q_m = 1.8 ± 0.21, n = 20 spores, s = 1 specimen], ellipsoid, ellipsoid-fusoid, subfusoid, cylindrical-fusoid, smooth, hyaline, inamyloid, thin-walled. **Basidia** 25-30 × 5-9 µm, clavate. Basidioles 26-35 × 5-7 µm, narrowly clavate. **Cheilocystidia** abundant, of 2 types of cells: a) *Siccus*-type broom cells with main body 10-25 × 5-10 µm, cylindrical to clavate, hyaline, inamyloid, thick- to thin-walled; apical setulae 4-12 × 1-3 µm, cylindrical to conical, obtuse to subacute, brown, thick-walled; b) cheilosetae 20-44 × 4-6 µm, fusoid to lanceolate, often forked, subacute to acute, brown, inamyloid, thick-walled. **Pleurosetae** abundant, similar to cheilosetae. **Pileipellis** hymeniform, composed of the *Siccus*-type broom cells with main body 7-24 × 5-9 µm; apical setulae 4-8 × 1-3 µm, thick-walled. **Caulocystidia** in form of the *Siccus*-type broom cells with main body 18-24 × 5-7 µm, cylindrical or irregular in outline, often lobed, inamyloid, thick-walled, yellow; apical setulae 15-28 × 2-3 µm, ranging from 2-4 setulae per cell, cylindrical, subacute to acute, thick-walled, yellow to light brown. **Pileus trama** interwoven, dextrinoid. **Lamellar trama** of 6-12 µm wide, interwoven, cylindrical to inflated, smooth, hyaline, inamyloid, thin-walled, not gelatinized hyphae. **Stipitipellis** of 6-9(-12) µm wide, parallel, cylindrical, smooth, inamyloid, thick-walled (up to 2 µm), not gelatinized, brown to light brown hyphae. **Stipe trama** of 7-17 µm wide, parallel, cylindrical, hyaline, smooth, weakly dextrinoid to dextrinoid, thin-walled, non-gelatinous hyphae. **Clamp connections** present in all tissues.

Habitat. Scattered to gregarious on dicotyledonous leaves.

Material examined. China, Yunan Province, Lijiang County, Yulong village, alt. 2400 m, 17 July 2008, leg. Y.C. Li 1261 (HKAS 56115).

Discussion. In comparison with data from literature, the Chinese material has a lighter pileus color and a broader range of basidiospore size (Desjardin *et al.*, 2000: 10-11 × 4.5-6 µm vs Wannathes *et al.*, 2009: 11-12 × 6-7 µm); the other characters are perfectly identical with the specimens from the type locality in Indonesia (Desjardin *et al.*, 2000) and from Northern Thailand (Wannathes *et al.*, 2009).

Marasmius confertus* var. *parvisporus Antonín, *Mycotaxon* 89(2): 401. 2004
Figs. 1f, 4.

Pileus 18-23 mm broad, campanulate to convex, broadly convex to plane in age, smooth to striate, orange (8B6-7), grayish red (8B6-7), reddish orange (7A8) dark orange (5A8, 6B8), disc fading to light brown (6D6). **Lamellae** adnate, close (L = 24-30) with 2-3 series of lamellulae, narrow (2 mm broad), non-marginate, intervenose, white. **Stipe** 30-70 × 2-3 mm, cylindrical, non-insititious, white at apex, becoming orange (6B8), brown (7D8), reddish orange (8E-F8) towards base, with white or light yellow basal mycelium. **Odor and taste** not distinct.

Basidiospores 7-10.5 × 3-4.5 µm, [x_m = 8.67 ± 0.67 × 3.56 ± 0.4 µm, Q = 2.2- 2.7, Q_m = 2.43 ± 0.28, n = 20 spores, s = 1 specimen], ellipsoid, ellipsoid-fusoid or lacrimoid, smooth, hyaline, inamyloid, thin-walled. **Basidia** 25-34 × 6-9 µm, clavate, 4-spored. **Pleurocystidia** common, 32-43 × 5-7.5 µm, cylindrical to fusoid or irregular in outline, hyaline, inamyloid, thin-walled. **Cheilocystidia** common, in form of the *Siccus*-type broom cells; main body 7-20 × 4-10 µm, cylindrical to

fusoid, hyaline, inamyloid, thin-walled; apical setulae 3-10 × 1-2 µm, cylindrical, obtuse to subacute, hyaline, thin-walled. **Pileipellis** hymeniform, mottled, composed of the *Siccus*-type broom cells; main body 8-14 × 4-7 µm, cylindrical to clavate or irregular in outline, often branched, light brown, inamyloid, thin- to thick-walled; apical setulae 4-15 × 1-3 µm, crowded, cylindrical, obtuse to subacute, brown, thick-walled. **Pileus trama** interwoven, dextrinoid. **Caulocystidia** absent. **Clamp connections** present in all tissues.

Habitat. Scattered to gregarious on dicotyledonous leaves.

Material examined. China, Hubei Province, Shennongjia National Nature Reserve, 14 Sept. 2010, leg. H. Huang & M. Zhang (GDGM 28395).

Discussion. This collection agrees well with a description by Antonín (2004), but the Chinese material has less obviously fading pileus color and also stipes that are less tapering downward compared to the holotype.

Marasmius hinnuleus Berk. & M.A. Curtis, *J. Linn. Soc. Bot.* 10 (no. 45): 297. 1869. **Figs.** 1g, 5

Pileus 8-10 mm broad, convex, campanulate to plane, sulcate, tomentose, centre brown, dark brown (6F8, 7 E-F8), margin orangish brown (6C5), yellowish brown (6D5-7). **Lamellae** adnexed to free, subdistant (L = 10-13), with 0-3 series of lamellulae, intervenose, narrow (1-1.5 mm), white. **Stipe** 25-35 × 0.5-1 mm, central, cylindrical, non-insititious, apex white, becoming light brown (7D6, 7E7) ochre (7F8), basal mycelium light yellow, tomentose or strigose.

Basidiospores 8-11 × 3.8-5 µm [x_m = 9.79 ± 0.72 × 4.2 ± 0.33 µm, Q = 1.8-2.6, Q_m = 2.3 ± 0.23, n = 25 spores, s = 1 specimen], ellipsoid, long-ellipsoid, inamyloid, thin-walled, hyaline. **Basidia** 24-35 × 5-8 µm, clavate. **Pleurocystidia** 25-35 × 5-10 µm, fusoid, subclavate, lacrimoid, thin-walled. **Cheilocystidia** in form of the *Siccus*-type broom cells; main body 7-14 × 4-7 µm, irregularly shaped; apical setulae 4-7 × 1.5-3 µm, conical to cylindrical, obtuse or subobtuse. **Pileipellis** a hymeniderm composed of the *Siccus*-type broom cells; main body 5-10 × 3-7 µm, fusoid, clavate to irregularly shaped; apical setulae 3-9 × 1-3 µm, light brown in KOH. **Caulocystidia** absent. **Clamp connections** present in all tissues.

Habitat. Scattered to gregarious on dicotyledonous leaves.

Material examined. China, Guangdong Province, Chebaling National Nature Reserve, 2 March 2010, leg. H. Huang & Y. J. Li (GDGM 26802).

Discussion. The material of *M. hinnuleus* collected in China is quite identical with the holotype from Cuba, except for the pileus color which is a slightly lighter, and the stipe is thicker (0.5-1 mm vs 0.2 mm). A possible explanation could be that the descriptions by Singer (1976) and Dennis (1951b) were based on dryer material. With the brief description of the fresh material by Berkeley & Curtis (1869), no obvious differences could be found from the Chinese specimens.

Marasmius hygrocybiformis Chun Y. Deng & T.H. Li **sp. nov.** **Figs.** 1d, 6

MycoBank: MB 561809

Etymology: named after the translucent, vivid reddish orange pileus and the subtranslucent stipe which are common characters in *Hygrocybe*.

Pileus 15-30 mm, plano-convexus, rubro-aurantiacus, lardum, translucide striatus. Lamellae adnateae, albae vel pallide flavae, subdistantes (L = 12-16), marginatae vel haud marginatae. Stipes 30-50 × 2-3 mm, centralis, cylindricus, griseolo-viridis, subtranslucidus, haud insititius, glaber, mycelio basali strigoso et flavide-aurantiaco. Odor saporque nulli. Basidiosporae 8.5-10.5 × 4-5.7 µm, ellipsoideae, laeves, hyalinae, inamyloideae, tenuitunicatae. Cheilocystidia typi Sicci, 5-20 × 4-8 µm,

cylindrica vel clavata; setulae ad apicem 3-8 × 1-2 µm, cylindricae vel conicae, subacutae. Cheilosetae 15-35 × 3-7 µm, fusoideae usque lanceolatae, subacutae usque acutae, hyalinae, inamyloideae, tenui- usque crassetunicatae. Pleurocystidia typi Sicci, 8-22 × 4-6 µm, cylindrica vel clavata; setulae ad apicem 3-10 × 1-2.5 µm, cylindricae vel conicae, subacutae. Pleurosetae rarae, 20-40 × 3-6 µm. Pileipellis hymeniformis, e cellulis typi Sicci, cellulae 5-22 × 4-12 µm, cylindricae vel clavatae, setulae ad apicem 3-6 × 1.5-3 µm. Caulocystida nulla. Fibulae presentes.

Holotypus: China, Sichuan Provincia, Luhuo Comitatus. 12 Aug. 2005, Z.W. Ge 877 (in herbario HKAS 49372 asservatur).

Pileus 15-30 mm broad, plano-convex, reddish orange (7A7-8), orange red (8A7-8, 8B8), translucently striate. **Lamellae** adnate, subdistant (L = 12-16), with 1-2 series of lamelluae, marginate or non-marginate, narrow (up to 2 mm broad), white to light yellow. **Stipe** 30-50 × 2-3 mm, central, cylindrical, grayish green (30B4-5), hyaline, non-insititious, glabrous, basal mycelium yellowish orange, strigose. **Odor and taste** not distinctive.

Basidiospores 8.5-10.5 × 4-5.7 µm [x_m = 9.58 ± 0.68 × 5 ± 0.58 µm, Q = 1.53-2.25, Q_m = 1.9 ± 0.22, n = 25 spores, s = 1 specimen], ellipsoid, smooth, hyaline, inamyloid, thin-walled. **Basidia** 20-30 × 6-10 µm, slenderly clavate. **Pleurocystidia** in form of the *Siccus*-type broom cells; main body 8-22 × 4-6 µm, cylindrical to clavate or irregular in outline, often branched, thin- to thick walled; apical setulae 3-10 × 1-2.5 µm, cylindrical, obtuse to subacute. **Pleurosetae** scattered, 20-40 × 3-6 µm, fusoid to lanceolate, often forked, subacute to acute. **Cheilocystidia** in form of the *Siccus*-type broom cells with main body 5-20 × 4-8 µm; apical setulae branched, numerous, 3-8 × 1-2 µm. **Cheilosetae** 15-35 × 3-7 µm, fusoid, lanceolate, subacute to acute, hyaline, inamyloid, thin- to thick-walled. **Pileipellis** hymeniform, composed of the *Siccus*-type broom cells, 5-22 × 4-12 µm, clavate, cylindrical to irregularly shaped; apical setulae 3-6 × 1.5-3 µm, cylindrical to conical, light brown to brown, thin- to thick-walled. **Caulocystidia** absent. **Clamp connections** present in all tissues.

Habitat. Solitary to gregarious on fallen dicotyledonous and monocotyledonous leaves.

Specimen examined. China. Sichuan Province, Luhuo County, 31°35′55″N, 100°42′52″E, 3, 440 m alt, 12 Aug. 2005, Z.W. Ge 877 (HKAS 49372, holotype).

Discussion. The somewhat translucent vivid reddish orange pileus and the subtranslucent grayish green stipe make this species distinctive from any other known *Marasmius* species. These characters macroscopically resemble those of some species of genera *Hygrocybe* (Fr.) P. Kumm and *Mycena*, but the hymeniform pileipellis composed of the *Siccus*-type broom cells, and the presence of the hymenium setae indicate that the fungus belongs to the genus *Marasmius* sect. *Sicci*.

Concerning the pileus color, the new species is similar to Bolivian *Marasmius ruber* Singer and American *M. aurantiacus* (Murrill) Singer. However, *M. ruber* is different in the absence of hymenial setae and its narrow basidiospores (2.8-4 µm) (Singer 1976); whereas *M. aurantiacus* is distinguished by its narrower basidiospores (3-3.7 µm) and the lack of hymenial setae (Singer 1976).

Marasmius* cf. *occultatiformis Antonín, R. Ryoo & H.D. Shin, *Mycological Progress* 11: 616. 2012. **Figs.** 1i, 7

Pileus 1-25 mm broad, hemispherical, convex to plane, smooth, disc reddish brown (8D8), margin orange brown (7C8). **Lamellae** adnate to adnexed, moderately close (L = 20-30), with 1-3 series of lamellulae, pale cream to white,

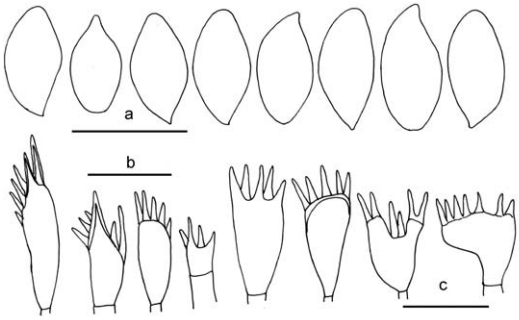

Fig. 2. *Marasmius albostipitatus* (HKAS 49338). **a.** Basidiospores; **b.** Cheilocystidia; **c.** Pileipellis cells. Scale bar = 10 μm.

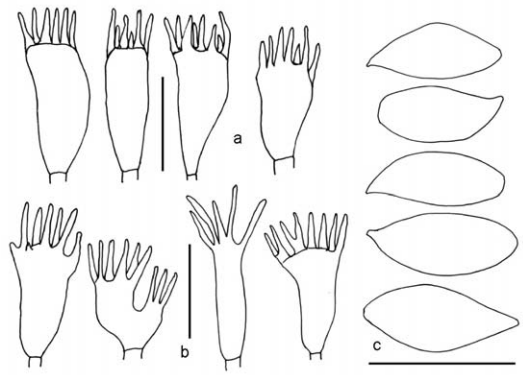

Fig. 4. *Marasmius confertus* var. *parvisporus* (GDGM 28395). **a.** Cheilocystidia; **b.** Pileipellis; **c.** Basidiospores. Scale bar = 10 μm.

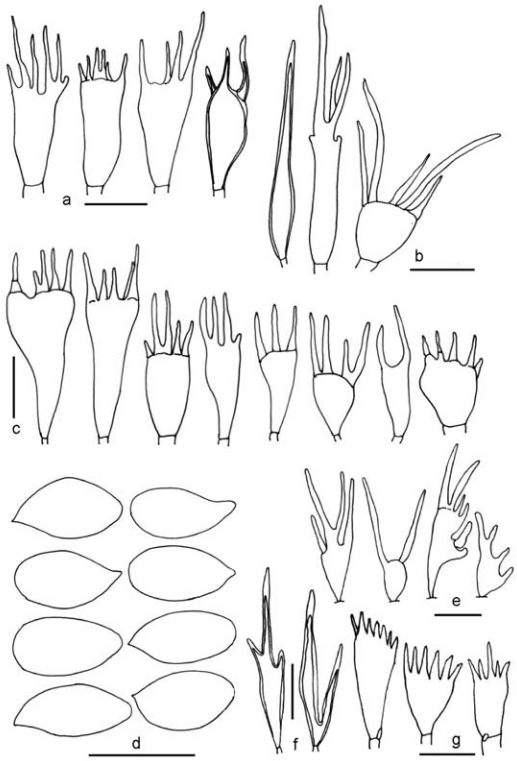

Fig. 3. *Marasmius coklatus* (HKAS 56115). **a.** Cheilocystidia; **b.** Cheilosetae; **c.** Pileipellis; **d.** Basidiospores; **e.** Caulocystidia; **f.** Pleurosetae; **g.** Pleurocystidia. Scale bar = 10 μm.

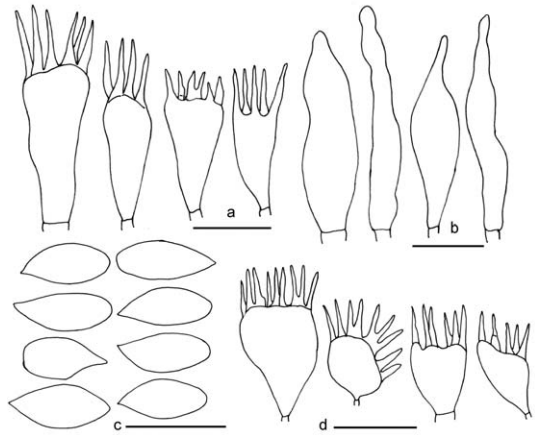

Fig. 5. *Marasmius hinnuleus* (GDGM 26802). **a.** Cheilocystidia; **b.** Pleurocystidia; **c.** Basidiospores; **d.** Pileipellis. Scale bar = 10 μm.

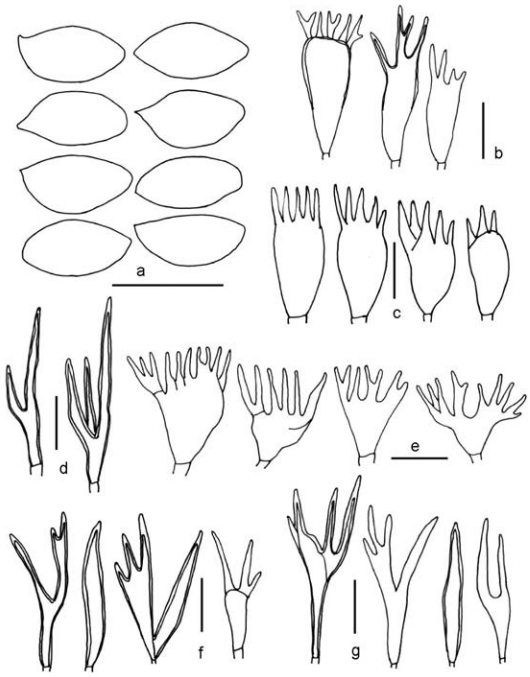

Fig. 6. *Marasmius hygrocybiformis* (HKAS 49372). **a.** Basidiospores; **b.** Pleurocystidia; **c.** Cheilocystidia; **d.** Pleurosetae; **e.** Pileipellis cells; **f.** Pileosetae; **g.** Cheilosetae. Scale bar = 10 μm.

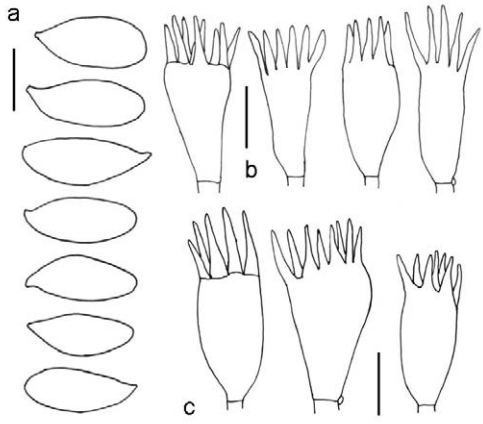

Fig. 7. *Marasmius* cf. *occultatiformis* (HKAS 49300). **a.** Basidiospores; **b.** Cheilocystidia; **c.** Pileipellis. Scale bar = 10 μm.

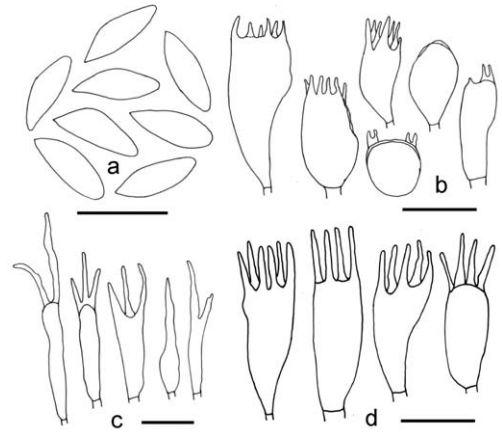

Fig. 8. *Marasmius sparsifolius* (GDGM 27385). **a.** Basidiospores; **b.** Pileipellis cells; **c.** Pileosetae; **d.** Cheilocystidia. Scale bar = 10 μm.

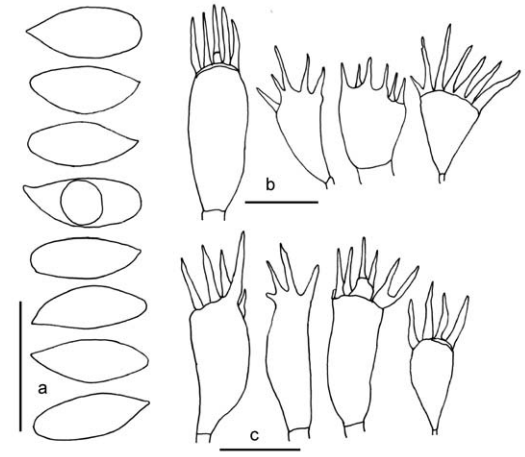

Fig. 9. *Marasmius subabundans* (GDGM 26803). **a.** Basidiospores; **b.** Pileipellis; **c.** Cheilocystidia. Scale bar = 10 μm.

non-marginate. **Stipe** 40-70 × 2-3 mm, central, cylindrical, smooth, glabrous, lustrous, white and hyaline at apex, becoming reddish brown (8D8) to dark brown (8F8) towards base; basal tomentum sparse, whitish.

Basidiospores 6.5-8(-10) × 3-4 µm [x_m = 7.45 ± 0.82 × 3.5 ± 0.39 µm, Q = 1.62-2.3, Q_m = 2.14 ± 0.27, n = 25 spores, s = 1 specimen], ellipsoid-fusoid, lacrimoid, smooth, hyaline, thin-walled. **Basidia** 28-40 × 6-9 µm, clavate, 2- or 4-spored. **Basidioles** 20-28 × 6-9 µm, subcylindrical, clavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** in form of the *Siccus*-type broom cells with main body 10-20 × 6-10 µm, apical setulae 2-3 × 0.5-1.5 µm. **Trama hyphae** cylindrical or subinflated, thin-walled, hyaline, up to 15 µm wide. **Pileipellis** a hymeniderm composed of broom cells of the *Siccus*-type, with main body 14-25 × 6-10 µm, clavate, subcylindrical, thin-walled at base, slightly thick-walled at apex, mixed with scattered thick-walled ones; projections up to 30 µm, digitate to nodulose, slightly thick-walled, up to 7(-8) × 1(-1.5) µm; thick-walled parts yellow-red-brown in KOH. **Pileocystidia** absent. **Stipitipellis** a cutis of cylindrical, parallel, slightly thick-walled, minutely incrusted, up to 5 µm wide hyphae with brown walls in KOH. **Caulocystidia** absent. **Clamp connections** present in all tissues.

Habitat. Scattered to gregarious on detritus of *Acer* sp. and *Juglans mandzhurica* in a mixed forest.

Specimen examined. China, Sichuan Province, Serdar County, 31°58′56″N, 100°57′52″E, alt. 3090 m, 7 Aug. 2005, leg. Z.W. Ge 805 (HKAS 49300).

Discussion. The Chinese collection has larger basidiomata (pileus 25 mm vs. 12 mm broad, stipe 40-70 × 2-3 mm vs. 30 × 0.75 mm), a darker stipe, and a less obvious pileus umbo in comparison with literature (Antonín *et al.*, 2011); the other characters and the habitat are perfectly fitting. Because of these macroscopical differences, our specimens are identified here as *M.* cf. *occultatiformis*.

Marasmius sparsifolius Chun Y. Deng & T.H. Li **sp. nov.** **Figs.** 1 e, 8

MycoBank: MB 561823

Etymology: named after the distant and rare lamellae.

Pileus 15-40 mm, convexus, plano-convexus vel applanatus, inaequalis ambitus, cadmio-aurantiacus, fuscescens, glaber, plicatus. Lamellae adnateae, albae, distantes (8-11), angustae, haud marginatae. Stipes 30-50 × 1-2 mm, centralis, cylindricus, apice albus, basi clara brunneo-aurantiacus, laete brunneus, haud insititius, glaber. Odor saporque nulli. Basidiosporae 7.5-10 × 3-4 µm, ellipsoideae, laeves, hyalinae, inamyloideae, tenuitunicatae. Cheilocystida typi Sicci, 12-22 × 4-7 µm, cylindrica vel clavata; setulae ad apicem 5-10 × 1-2.5 µm, cylindricae vel conicae, subacutae. Pleurocystidia disseminata, typi Sicci; cellulae 6-22 × 4-7 µm, cylindricae vel clavatae; setulae ad apicem 6-23 × 0.5-3 µm. Pileipellis hymeniformis, e cellulis typi Sicci; cellulae 10-18 × 5-8 µm, cylindricae vel clavatae; setulae ad apicem 10 × 2 µm. Caulocystida nulla. Fibulae presentes.

Holotypus: China, Hainan Provinicia, Diaoluoshan mons. 28 July 2010, N.K. Zeng 740 (in herbario GDGM 27385 asservatur).

Pileus 15-40 mm broad, convex, plano-convex or applanate, often irregularly undulate at margin, glabrous, smooth to plicate, orangish white (6A2) to pale orange (6A3), with irregular orange (6A-B7) stains, partially nearly white, usually deeper colored at disc. **Lamellae** adnate, extremely distant (L = 8-11), hardly reaching the pileus margin, often not exceeding half of the radius, narrow (less than 1 mm), white, edges concolorous. **Stipe** 30-50 × 1-2 mm, cylindrical, white at apex, becoming brownish orange (7C8) to light brown (8C8) at base, glabrous, non-insititious.

Basidiospores 7.5-10 × 3-4 μm [x_m = 8.67 ± 0.67 × 3.56 ± 0.4 μm, Q = 2.2-2.7, Q_m = 2.43 ± 0.28, n = 25 spores, s = 1 specimen], ellipsoid, smooth, hyaline, inamyloid, thin-walled. **Basidia** 25-37 × 6-8 μm, clavate. **Pleurocystidia** scattered, in form of the *Siccus*-type broom cells, present near gill edges, main body 6-22 × 4-7 μm, clavate, cylindrical, thick-walled, apical setulae 6-23 × 0.5-3 μm, subconical to cylindrical, less-branched. **Cheilocystidia** common, in form of the *Siccus*-type broom cells; main body 12-22 × 4-7 μm, cylindrical to clavate, hyaline, inamyloid, thin- to thick-walled; apical setulae 5-10 × 1-2.5 μm long, tapered to a subacute apex, erect or angled. Hyphae of **lamellae trama** interwoven, 3-6 μm wide, hyaline, dextrinoid. **Pileipellis** a hymeniform layer of the *Siccus*-type broom cells; main body 10-18 × 5-8 μm, cylindrical to clavate; setulae up to 10 μm long, 2 μm wide at base, tapered to a subacute apex, erect. **Caulocystidia** absent. **Clamp connections** present.

Habitat. Scattered to gregarious on the fallen dicotyledonous and monocotyledonous twigs.

Specimen examined. China, Hainan Province, Diaoluoshan Nature Reserve, 28 July 2010, leg. N.K. Zeng 740 (GDGM 27385, holotype).

Discussion. Marasmius sparsifolius has extremely distant lamellae which usually do not reach the pileus margin, often not exceeding half of the pileus radius. This character is rare in the *Marasmius* species. With the combination of its smooth stipe, *Siccus*-type pleurocystidia and moderately large basidiospores (7.5-10 × 3-4 μm), the new species can be distinctive from any known species.

Macroscopically, the new species is similar to tropical African *M. haediniformis* Singer and Brazilian *M. tageticolor* Berk. *Marasmius haediniformis* differs in the paler and more obviously sulcate pileus, chestnut stipe, the absence of pleurocystidia and large basidiospores (113.5 × 3-4 μm) (Antonín 2007, Mossebo & Antonín 2004, Singer 1976); *M. tageticolor* differs by a red pileus, a non-insititious stipe with an abundant white mycelium and large basidiospores (15-20 × 3-4 μm) (Singer 1976).

Microscopically, the presence of pleurocystidia in form of the *Siccus*-type broom cells is also a rare character in *Marasmius*. Our new species shares this character with the Asian *M. luteolus* Berk. & M.A. Curtis. However, the latter species differs in forming a bright brownish orange pileus, a short (10-35 mm) and pruinose stipe (Wannathes *et al.*, 2009).

Marasmius subabundans Chun Y. Deng & T.H. Li, **sp. nov.** **Figs.** 1a-b, 9.

MycoBank: MB 561814

Etymology: named after the basidiomata macroscopically resemble to the species of *Marasmius abundans*.

Pileus 8-10 mm, conico-convexus dein fere planus, leavis, disco pallidulus aurantiacus vel aurantiacus, margine cremeus to albo-cremeus. Lamellae adnateae, albae, subdistantes usque coarctatae (14-19), angustae (1 mm), albae vel creameae. Stipes 30-50 × 0.5-1 mm, centralis, cylindricus, apice albus, basi pallidulo-brunneus, haud insititius, mycelio basali strigoso et albo vel pallido-auro. Basidiosporae 7-9 × 3.1-4.5 μm, ellipsoideae usque subfusoideae, laeves, hyalinae, inamyloideae. Badidiolae 23-34 × 7-10 μm clavtae. Cheilocystida typi Sicci, 10-22 × 4-10 μm, fusoidea vel clavata; setulae ad apicem 6-9 × 1-2 μm, cylindricae vel conica. Pileipellis hymeniformis, e cellulis typi Sicci; cellulae 10-20 × 5-10 μm, fusoideae vel clavatae; setulae ad apicem 4-9 × 1-2.5 μm. Caulocystida nulla. Fibulae presentes.

Holotypus: China, Guangdong Province, Chebaling National Nature Reserve, 2 March 2010, Y.J Li et H. Huang (holotypus in herbario GDGM 26803 asservatur).

Pileus 8-10 mm broad, conico-convex then more or less plane, smooth, dry, pale orange (5A3), light orange (5A4-5) to orange (5A6) at center, cream to cream-white near margin. **Lamellae** adnate, subdistant to close (L = 14-19), with 4-5 series of lamellulae, narrow (up to 1 mm broad), white to cream color. **Stipe** 30-50 × 0.5-1 mm, central, cylindrical, non-insititious, white at apex, becoming light brown (6D7-8), otherwise brown (7E8) downwards, with white to light yellow basal mycelium, tomentose or strigose at base.

Basidiospores 7-9 × 3.1-4.5 µm [x_m = 8.47 ± 0.71 × 3.45 ± 0.34 µm, Q = 2-2.85, Q_m = 2.47 ± 0.26, n = 25 spores, s = 1 specimen], hyaline, smooth, ellipsoid or subfusiform, inamyloid. **Basidia** 23-34 × 7-10 µm, clavate. **Cheilocystidia** in form of the *Siccus*-type broom cells; main body 10-22 × 4-10 µm, clavate, fusoid to irregular shaped; apical setulae 6-9 × 1-2 µm, conical to cylindrical; some *Siccus*-type broom cells also present on the sides of lamellae near lamellar edge. **Pileipellis** a hymeniderm composed of *Siccus*-type broom cells with main bodies 10-20 × 5-10 µm, fusoid, clavate to irregularly shaped; apical setulae 4-9 × 1-2.5 µm, light brown in KOH. **Caulocystidia** absent. **Clamp connections** present.

Habitat. Scattered to gregarious on dead dicotyledonous leaves in the forest.

Specimen examined. China, Guangdong Province, Chebaling National Nature Reserve, 2 March 2010, leg. Y.J Li & H. Huang (GDGM 26803).

Discussion. This species is macroscopically similar to Malaysian *Marasmius abundans* Corner, but the latter species has adnexed to free lamellae, larger basidiospores (Corner 1996: 10-13 × 3-4 µm, Tan *et al.*, 2009: 12-18(-20) × 4-5 µm), and lacks broom cells in the hymenium near lamellar edge (Corner 1996). *Marasmius subabundans* is similar to *M. setulosifolius* Singer in having broom cells near lamellar edge, but the latter species differs in forming a larger (9-30 mm), rusty sulcate pileus and thick-walled, melleous to brownish broom cells on the sides of the lamellae with few, spreading up to 24 µm long apical setulae (Singer 1976).

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