

New records of genus *Marasmius* (*Marasmiaceae*) from India

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ABSTRACT

Three species of *Marasmius*, viz. *M. fulvoferrugineus* Gilliam, *M. pallescens* Murrill and *M. pseudobambusinus* Desjardin are recorded from India. Comprehensive descriptions, photographs and discussion on each species is provided.

KEYWORDS: Broom cells, *Sicci*, non-institious, institious.

INTRODUCTION

Genus *Marasmius* Fr., (*Marasmiaceae*) is a saprotrophic genus with ca. 500 species known world over (Kirk *et al.*, 2008). In India 84 species are currently known (Upadhyay *et al.*, 2017; Bhosale *et al.*, 2019; Chakraborty, 2019). The genus is represented by persistent and marcescent carpophores having a unique ability to revive when rehydrated. Morphologically, the genus is characterized by convex to campanulate sporophores with long wiry either insititious or non-insititious stipes. Microscopically, this genus is represented by inamyloid basidiospores, non-hymeniform to hymeniform pileus cuticle with setulose or non-setulose broom cells. Characters like stipe insertion, presence or absence of mycelial mat, amyloidity of the basidiospores and the type of pileipellis elements are important taxonomic features in the infrageneric delimitation of marasmoid genera. Present paper provides detailed descriptions of three species of genus *Marasmius* viz. *M. fulvoferrugineus* Gilliam, *M. pallescens* Murrill and *M. pseudobambusinus* Desjardin, so far not known from India.

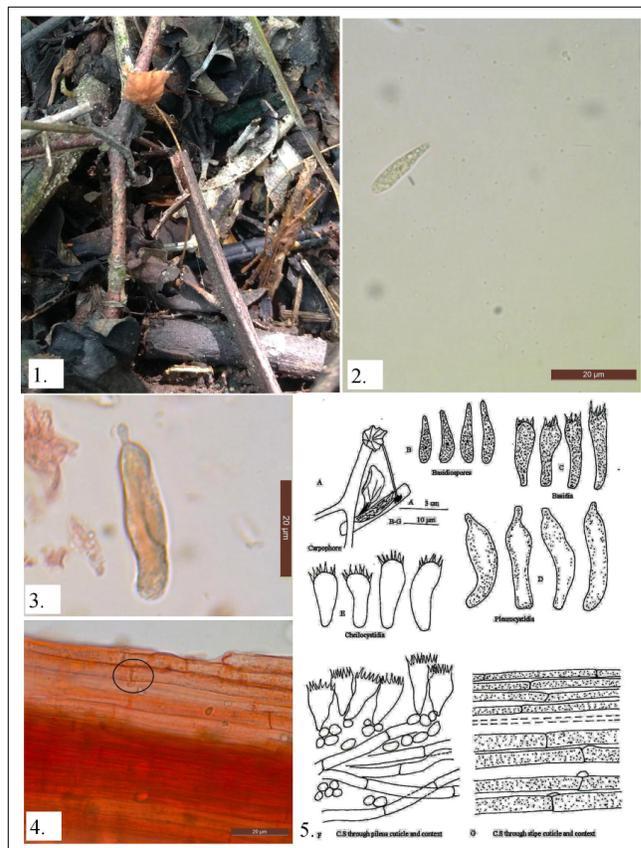
MATERIALS AND METHODS

Various localities of North India were visited during the monsoon season for collection of the specimens. Healthy and fresh fruit bodies growing on leaf litter were collected. Collection and preservation of carpophores was done using methodology given by Atri *et al.* (2005, 2017). Color terminology used is that of Komerup and Wanscher (1978). All the collections were deposited in the Herbarium of Botany Department, Punjabi University Patiala (Punjab), India (PUN).

TAXONOMY

Marasmius fulvoferrugineus Gilliam, *Mycotaxon* 4 (1): 82 (1976). **Figs. 1-5**

Carpophores 0.6 – 4.0 cm in height. Pileus 0.4 – 0.8 cm broad, convex to campanulate; umbonate, umbo acute; margin irregular, splitting at maturity, striate up to the centre; scales absent; surface dark brown (6D4) when young becoming greyish orange (6B3) when mature, dry. Lamellae non-collariate, free, subdistant; equal, narrow (up to 0.1 cm), creamish white (1A2), unchanging; gill edges smooth, normal; lamellulae absent. Stipe central, 0.5 – 3.9 cm long, up to 0.1 cm broad, equal in diameter throughout, wiry; surface light brown (7D5) near the apex to brown (7D7) in the middle and towards the base, unchanging; smooth, scales absent,



Figs. 1-5 *M. fulvoferrugineus*: 1. Carpophore growing solitary on dicotyledonous leaves, 2. Photomicrograph showing elongated basidiospore, 3. Fusoid ventricose pleurocystidium with tubular tip, 4. C.S. through stipe context showing clamp connection, 5 (A-G) A. Carpophore, B. Basidiospores, C. Basidia, D. Pleurocystidia, E. Cheilocystidia, F. C.S. through pileus cuticle and context showing epicuticular broom cells, G. C.S. through stipe cuticle and context showing clamp connection.

non-institious; white mycelial mat present at the base of the stipe, solid, exannulate. Flesh less than 0.1 cm thick, white, unchanging; odor mild; taste mild.

Basidiospores 15.4 – 18.0 × 3.5 – 4.9 μm, ($Q = 3.4$), elongated, inamyloid, thin walled, granular; apiculate, apiculus up to 0.7 μm long. Basidia 19.6 – 28.0 × 5.0 – 5.6 μm, clavate, granular; tetrasterigmate, sterigmata 3.5 – 5.0

μm long. Pleurocystidia $28.0 - 44.8 \times 7.0 - 11.2 \mu\text{m}$, fusoid-ventricose with beaked and tubular tips, granular, protruding out of the basidial layer, abundant. Lamella edge sterile. Cheilocystidia abundant $18.2 - 25.2 \times 8.4 - 9.8 \mu\text{m}$ (including setules), clavate with apical setules, 6–7 setules per cystidia, hyaline. Hymenophoral trama regular. Pileus cuticle made up of a uniform layer of dextrinoid broom cells measuring $15.4 - 25.2 \times 9.1 - 9.8 \mu\text{m}$, bearing 7–8 setules per broom cell; context made up of $4.2 - 5.6 \mu\text{m}$ broad, septate, hyphae intermixed with $5.0 - 9.0 \mu\text{m}$ broad cells; pileocystidia absent. Stipe cuticle hyphal, made up of longitudinally arranged, $3.5 - 4.2 \mu\text{m}$ broad, septate hyphae; caulocystidia absent; stipe trama hyphal, made up of $5.6 - 7.0 \mu\text{m}$ broad, septate hyphae. Clamp connections present throughout.

Collection examined: Jammu and Kashmir: Jasrota Wildlife Sanctuary, Kathua (550 m) $32^{\circ}29'06''\text{N} - 75^{\circ}24'20''\text{E}$, growing scattered on dead and decomposed dicotyledonous leaves, in mixed forest, Aakriti Gupta, PUN 10768, 15 August, 2017.

Distribution and ecology: *Marasmius fulvoferrugineus* was found growing either scattered or gregariously in mixed woods from mid- July to mid- October in the North- Eastern United States and adjacent Canada (Gilliam, 1976). The present collection was found growing scattered on dicotyledonous leaf litter and fallen twigs during mid-August in mixed forests of Jasrota Wildlife Sanctuary Jammu and Kashmir, at an altitude of 550 m.

Remarks: The above examined agaric matches well with the description of *Marasmius fulvoferrugineus* provided by Gilliam (1976). This species is different from the closely allied species, *Marasmius siccus* (Schwein.) Fr., in morphological and anatomical features, which is characterized in having smaller pileus with more orange shade and larger basidiospores ($16.0 - 21.0 \mu\text{m}$). *Marasmius fulvoferrugineus* is reported for the first time from India.

Marasmius pallescens Murrill, *North American Flora* 9 (4): 261 (1915).

Figs. 6-9

Carpophores $4.5 - 6.3 \text{ cm}$ in height. Pileus up to $1.9 - 3.3 \text{ cm}$ broad, convex to campanulate; umbonate, umbo broad; margin irregular, striate up to the centre; scales absent; surface reddish brown (8D7) in young carpophores becoming brownish orange (7C4) at maturity, dry. Lamellae non-collariate, adnexed, distant, moderately broad (up to 0.4 cm); yellowish white (1A2), unchanging; lamellae edges smooth, normal; lamellulae absent. Stipe central, $4.4 - 6.0 \times 0.1 \text{ cm}$ broad, equal, surface yellowish white (1A2) near the apex, brownish orange (5C4) in the middle and dark brown (7F4) at the base, unchanging, smooth, non-institious; white mycelial mat present towards the base of the stipe, solid, exannulate. Context membranous, thin, white, unchanging; odor mild; taste mild.

Basidiospores $14.0 - 19.6 \times 3.5 - 4.2 \mu\text{m}$, ($Q=4.0$), cylindrical to elongated, inamyloid, thin walled, fusoid, hyaline; apiculate, apiculus up to $0.7 \mu\text{m}$ long. Basidia $14.0 - 22.4 \times 6.3 - 7.0 \mu\text{m}$, clavate, hyaline; tetrasterigmate, sterigmata $3.5 - 4.2 \mu\text{m}$ long. Pleurocystidia $29.4 - 42.0 \times 5.6 - 8.4 \mu\text{m}$,



Figs.6-9 *M. pallescens*: 6. Carpophore growing on decomposed wooden logs, 7. Fusoid-ventricose pleurocystidium with capitate tip, 8. C.S through stipe cuticle showing clamp connection, 9. (A-G) A. Carpophores, B. Basidiospores, C. Basidia, D. Pleurocystidia, E. Cheilocystidia, F. C.S through pileus cuticle and context showing clavate epicuticular broom cells, G. C.S through stipe cuticle and context showing clamp connection.

fusoid ventricose to clavate with blunt and capitate tips, few mucronate with yellow refractive contents, hyaline to few granular at the apex, protruding out of the hymenium, abundant. Lamellae edges sterile. Cheilocystidia $19.6 - 23.8 \times 7.0 - 8.4 \mu\text{m}$ (including setules), clavate with broom like projections, 5–6 setules per cystidia, hyaline, abundant. Hymenophoral trama regular. Pileus cuticle made up of a regular turf of siccus shaped broom cells $15.4 - 22.4 \times 5.6 - 8.4 \mu\text{m}$ in size, bearing 6–7 setules per broom cell; context made up of $4.2 - 5.6 \mu\text{m}$ broad, septate, hyphae intermixed with $4.2 - 7.0 \mu\text{m}$ broad cells; pileocystidia absent. Stipe cuticle hyphal, made up of longitudinally arranged, $3.5 - 4.2 \mu\text{m}$ broad, septate hyphae; caulocystidia absent; stipe trama hyphal, made up of $5.2 - 7.0 \mu\text{m}$ broad, septate, hyphae. Clamp connections present throughout.

Collection examined: Jammu and Kashmir: Mansar along road side, (431m) $32^{\circ}36'06''\text{N} - 75^{\circ}14'28''\text{E}$, growing scattered on decomposed wooden logs, in mixed forest, Aakriti Gupta, PUN 10770, 29 August, 2017.

Distribution and ecology: *Marasmius pallescens* was reported from various localities of Lesser Antilles including Martinique (Pegler, 1983). Wannathes *et al.* (2009) collected *M. pallescens* from Northern Thailand growing scattered to

gregarious on dicotyledonous leaves.

Remarks: Present collection matches with the description given for *M. pallescens* Murrill (Wannathes *et al.*, 2009; Pegler, 1983). However, Wannathes *et al.* (2009) quoted slightly larger spores ($16.0 - 19.0 \times 4.0 - 5.0 \mu\text{m}$). Pegler (1983) reported slightly smaller spores ($12.0 - 17.5 \times 3.0 - 5.0 \mu\text{m}$). In the present collection, the cheilocystidia are comparatively larger i.e. $19.6 - 23.8 \times 7.0 - 8.4 \mu\text{m}$ rather than those provided by Wannathes *et al.* (2009) and Pegler (1983). This species is so far not recorded from India.

Marasmius pseudobambusinus Desjardin *Mycologia* **83**(1): 30 (1991). **Figs.10-13**

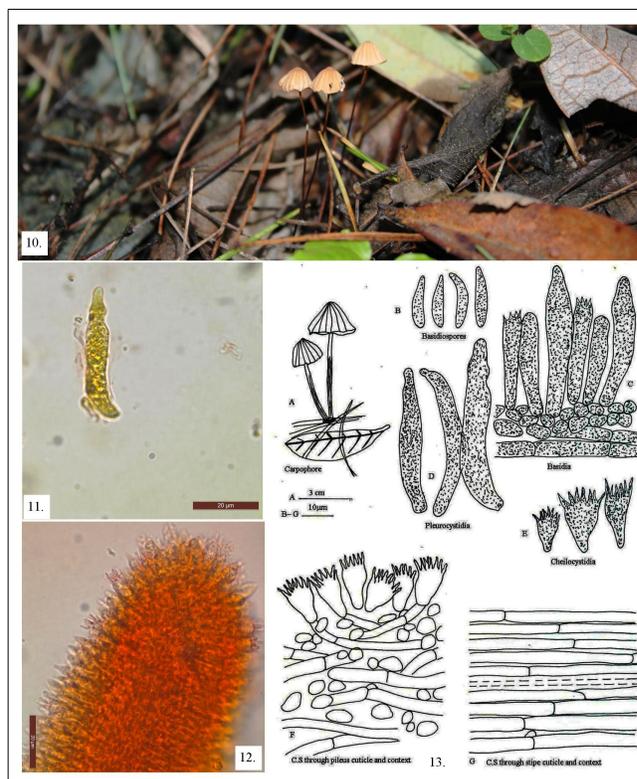
Carpophores 4.3 - 4.5 cm in height. Pileus 0.4 - 0.7 cm broad, convex, campanulate in some; broadly umbonate, margin irregular, striate up to the centre; smooth; surface brownish orange (6C4) with pale red (7A3) to pastel red (7A4) tinge at the centre, dry. Lamellae non-collariate, adnate, yellowish white (1A2), subdistant, narrow (up to 0.1 cm), unchanging; edges smooth, normal, lamellulae absent. Stipe central, 4.3 - 4.5 cm long, up to 0.2 cm broad, equal, wiry; surface reddish brown (8D5), unchanging; smooth, non-institious; white mycelial mat present at the base of the stipe, solid, exannulate. Context less than 0.1 cm thick, white, unchanging. Odour mild; taste mild.

Basidiospores $14.0 - 19.7 \times 4.2 - 5.0 \mu\text{m}$, ($Q=4.0$), cylindrical to few curved, inamyloid, thin-walled, granular; apiculate, apiculus up to $0.7 \mu\text{m}$ long. Basidia $28.0 - 36.4 \times 5.6 - 7.0 \mu\text{m}$, clavate, tetrasterigmate; sterigmata $3.5 - 4.2 \mu\text{m}$ long. Pleurocystidia $36.4 - 54.6 \times 6.3 - 8.4 \mu\text{m}$, fusoid ventricose to cylindrical, capitate with constricted tips, wavy in outline, abundant with yellow refractive contents, granular, protruding out of the basidial layer. Lamellae edges sterile. Cheilocystidia $8.4 - 15.4 \times 7.0 - 8.4 \mu\text{m}$ (excluding setules), abundant, clavate with verrucose apical setules, 6 - 7 setules per cystidia. Hymenophoral trama regular. Pileus cuticle made up of a regular turf of siccus shaped broom cells measuring $14.0 - 18.2 \times 5.6 - 6.3 \mu\text{m}$ in size, bearing 6 - 7 verrucose setules per broom cell. Context made up of $4.2 - 5.0 \mu\text{m}$ broad, septate, hyphae intermixed with $5.0 - 8.4 \mu\text{m}$ broad cellular elements. Pileocystidia absent. Stipe cuticle hyphal, made up of longitudinally arranged, $4.2 - 5.0 \mu\text{m}$ broad, septate hyaline hyphae. Caulocystidia absent. Stipe context hyphal, made up of $5.0 - 5.6 \mu\text{m}$ broad, septate hyphae. Clamp connections present throughout.

Collection examined: Himachal Pradesh: Kullu, Jibhi Forest, (2468 m) $31^{\circ}40'55''\text{N} - 77^{\circ}13'41''\text{E}$, growing scattered in groups on gymnosperm needles and dicotyledonous leaves, Aakriti Gupta, PUN 10771, 3 September, 2017.

Distribution and ecology: Desjardin (1991) recorded *Marasmius pseudobambusinus* growing gregarious on senescent leaves of various grasses in open lawns, during the month of May to August from Southern Appalachian Mountains of North America. In Himachal Pradesh it is found growing scattered on mixed leaf litter during September.

Remarks: The above collection matches well with the details of *Marasmius pseudobambusinus* (Desjardin, 1991). This



Figs. 10-13 *M. pseudobambusinus*: **10.** Carpophore growing on gymnosperm needles and dicot leaves, **11.** Fusoid-ventricose pleurocystidium with capitate to constricted tip and yellow refractive contents, **12.** Gill edge showing siccus shaped cheilocystidia, **13.** (A-G) **A.** Carpophores, **B.** Basidiospores, **C.** Basidia, **D.** Pleurocystidia, **E.** Cheilocystidia, **F.** C.S through pileus cuticle and context showing clavate epicuticular broom cells, **G.** C.S. through stipe cuticle and context showing clamp connection.

species is closely related to *M. bambusinus* Fr. and *M. bambusiniiformis* Singer but markedly differs from both the species. *M. pseudobambusinus* has medium sized carpophores whereas they are larger in *M. bambusinus* and smaller in *M. bambusiniiformis*. It also differs in its spore size and shape of pleurocystidia. The spore length of *M. bambusinus* is $16.1 - 19.3 \mu\text{m}$ while that of *M. bambusiniiformis* is $15.0 - 19.0 \mu\text{m}$. But in *M. pseudobambusinus* the spore length is $14.0 - 19.7 \mu\text{m}$. Further, the pleurocystidia in *M. pseudobambusinus* are fusoid, apically constricted and wavy in outline but capitate in *M. bambusinus* and totally absent in *M. bambusiniiformis*. This is a new record for India.

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