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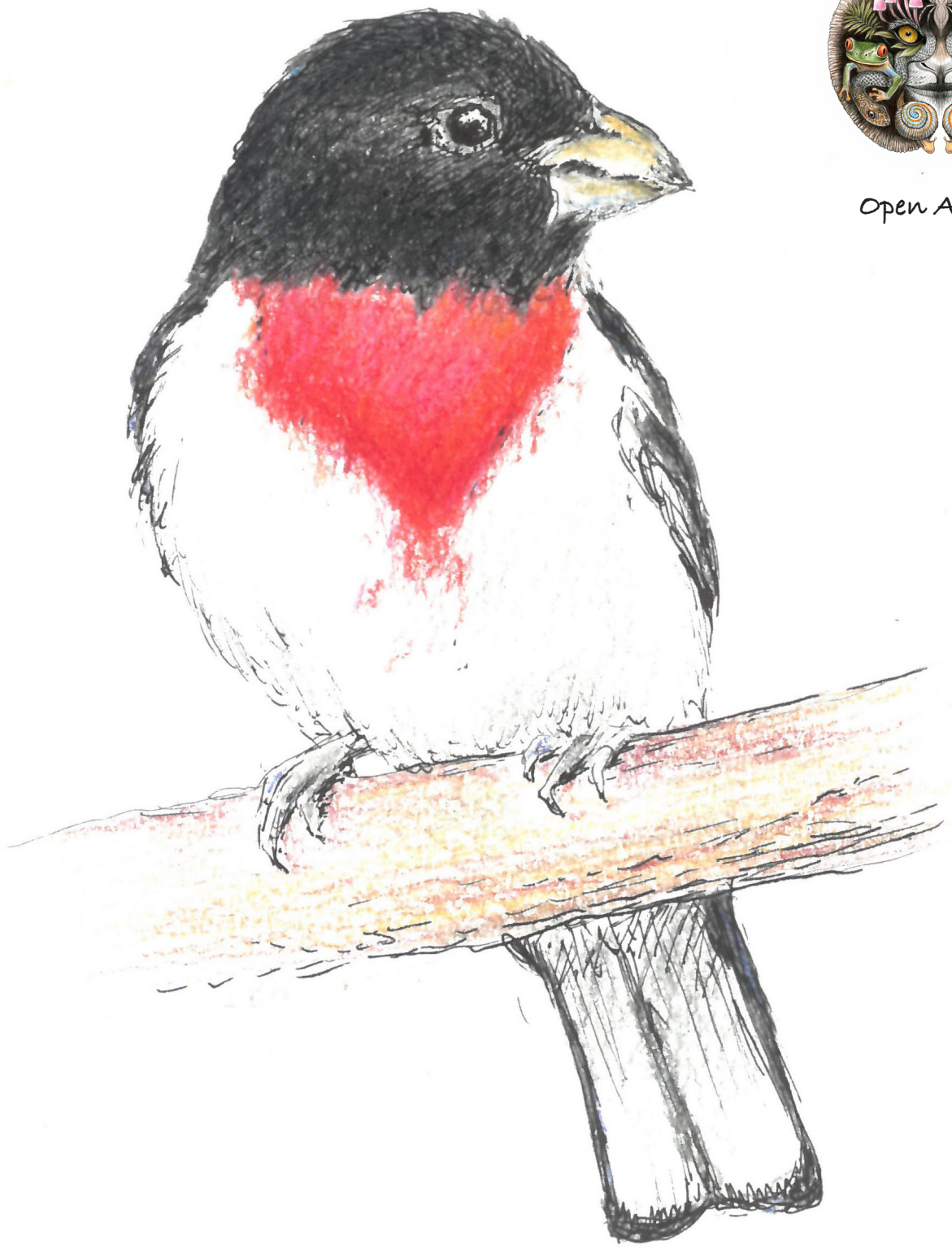

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Cover: Rose-breasted Grosbeak *Pheucticus ludovicianus*, pen & ink with colour pencil. © Lucille Betti-Nash.

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COMMUNICATION

Taxonomy and molecular systematics of marasmioid fungi (Basidiomycetes: Agaricales: Marasmiaceae) occurring in Puducherry, India

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Abstract: In this study, five species of *Marasmius* namely, *M. bambusiniformis*, *M. haematocephalus*, *M. leveilleanus*, *M. midnapurensis*, and *M rotalis*, plus *Paramarasmius palmivorus* are described, based on morphotaxonomic and molecular characters. Sequence data from internal transcribed spacers were used for phylogenetic analyses of the six species, supporting their identification based on macro and micromorphological characters. All of these species are reported for the first time from Puducherry region.

Keywords: *Agaricales*, *Basidiomycota*, litter fungi, *Marasmiaceae*, molecular characterization, morphotaxonomy, mushrooms, *Paramarasmius*, phylogeny, southern India.

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Author contributions: YK—undertook field trips to sample gilled fungi, recorded macro- and microscopic characters. TSM—analysed the ITS sequence and carried out phylogenetic analysis. SG—assisted in identifying and describing some of the species of agarics mentioned in the present study. VK—carried out field trips to various places in Puducherry to record gilled fungi. He reviewed the morphological and microscopic characterization of marasmioid fungi done by the scholar and wrote the manuscript.

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INTRODUCTION

The genus *Marasmius* Fr. (*Marasmiaceae* Roze ex Kühner) was first accepted by Elias Magnus Fries in 1835 (Tan et al. 2009). Singer (1986) recognized 12 different sections, viz., *Androsacei*, *Hygrometrici*, *Leveilleani*, *Scotophysini*, *Epiphylli*, *Marasmius*, *Sicci*, *Inaequales*, *Fusicystides*, *Neosessiles*, *Alliacei*, and *Globulares* that were represented by 356 species. However, the genus *Marasmius* sensu lato, according to Singer (1986), is polyphyletic. Based on the phylogenetic analysis of nuclear ribosomal Large Subunit rRNA gene (nLSU), the members of the section *Androsacei* were merged into the genus *Gymnopus*, whereas the section *Alliacei*, along with some other members, was elevated to the generic level as *Mycetinis*. The sections *Hygrometrici, Leveilleani*, *Scotophysini*, *Marasmius*, *Sicci*, *Neosessiles*, and *Globulares* were recognized by Wilson & Desjardin (2005).

The genus *Marasmius* is one of the largest genera of the order *Agaricales,* comprising about 600 species that are distributed worldwide, particularly in tropical regions (Wannathes et al. 2009). A review of literature revealed that more than 80 species have been listed in India (Manjula 1983; Natarajan et al. 2005; Kaur & Gupta 2019). Of these, 13 species have been newly described from different regions (Dutta et al. 2015; Farook & Manimohan 2015; Das et al. 2019; Manoharachary et al. 2022). The present study records the occurrence of five species of *Marasmius* in Puducherry, namely, *M. bambusiniformis* Singer, *M. haematocephalus* (Mont.) Fr., *M. leveilleanus* (Berk.) Sacc. & Trotter, *M. midnapurensis* A.K.Dutta, P.Pradhan & K.Acharya, and *M. rotalis* Berk. & Broome and a species of *Paramarasmius*, viz., *P. palmivorus* (Sharples) Antonín & Kolařík. All these species are being reported for the first time in the Puducherry region. *Marasmius midnapurensis,* a recently described new species from West Bengal, India (Dutta et al. 2014), was also collected and studied, and is being reported for the first time in southern India. It is pertinent to mention that Kumaresan et al. (2021) reported three species belonging to *Marasmiaceae* among 33 species of gilled fungi reported from Puducherry, but none belonging to the genus *Marasmius*.

MATERIALS AND METHODS

Study area

The basidiomes of *Marasmius* spp. were collected from various places of Puducherry, India during the north-east monsoon season of November and December 2021.

Sampling and morphological characterization

During sampling, photographs of basidiomes were taken, and morphological characters such as colour (Kornerup & Wanscher 1978), size, and gill attachment were recorded in the field (Senthilarasu & Kumaresan 2018). The basidiomes were dried using an electric drier at 50°C for an hour or more depending on their delicate nature or thick fleshy texture. The dried basidiomes were sealed carefully in polythene covers after labeling, for further microscopic studies. The samples are being maintained in the mushroom herbarium collection in the Department of Botany, Kanchi Mamunivar Government Institute for Postgraduate Studies and Research, Puducherry, India by designating unique alphanumeric numbers.

The thin hand-made sections taken from basidiomes were revived in 5% KOH, stained in 1% phloxine B and observed under the microscope (Labomed iVu 3100); camera lucida diagrams were drawn. Microscopic characters such as shape and size of basidia, basidioles, basidiospores were observed, presence or absence of pluerocystidia, cheilocystidia, pileocystidia, and caulocystidia with their shape and size were recorded following Largent et al. (1977). Around 20 measurements for basidia and cystidia were derived from each specimen. X_m is the arithmetic mean of the spore length and spore width with standard deviation for n spores. The spore quotient (Q) was obtained by dividing the spore length by its width and Q_m was calculated by the mean of Q-values (Zhang et al. 2017).

DNA extraction and PCR amplification

Basidiomes of *Marasmius* spp. were processed for genomic DNA isolation following the method of Gardes & Bruns (1993). Primers ITS1 (TCCGTAGGTGAACCTGCGG) and ITS4 (TCCTCCGCTTATTGATATGC) were used for PCR amplification of the internal transcribed spacer (ITS) region (White et al. 1990). The PCR reaction mixture consisted of 2X Phire Master Mix 5 µL, distilled water 4 µL, ITS1 0.25 µL, ITS2 0.25 µL, and genomic DNA 50 ng. The PCR amplification was formed as follows: 98 °C for 30 s, 40 cycles of 98 °C for 5 s, 58 °C for 10 s, 72 °C for 15 s; 72 °C for 60 s, 4 °C for ∞. The PCR products were purified and sequenced using ABI 3500 DNA Analyzer (Applied Biosystems), prior to which sequencing reaction was done in a PCR thermal cycler (GeneAmp PCR System 9700, Applied Biosystems) using the BigDye Terminator v3.1 Cycle sequencing Kit (Applied Biosystems, USA).

Phylogenetic analyses

Sequences with significant matches obtained using NCBI Blast were selected and aligned using ClustalW (Thompson et al. 1994), and evolutionary history was inferred using the Neighbour-Joining Approach and Maximum Likelihood approach using MEGA11 (Tamura et al. 2021). A bootstrap test (1,000 replicates) was performed and the percentage of replicate trees in which the same taxa clustered together is given next to the branches (Felsenstein 1985). For neighbour joining tree, evolutionary distances were calculated using maximum composite likelihood model (Tamura et al. 2004), while Tamura-Nei model was used for maximum likelihood tree (Tamura & Nei 1993). The species *Crinipellis zonata* was used as an out-group for the analysis. Accession numbers of sequences belonging to the genera *Marasmius* and *Paramarasmius* included in the phylogenetic analysis are given in Table 1.

RESULTS

Marasmius bambusiniformis, *M. haematocephalus*, *M. leveilleanus*, *M. midnapurensis, M. rotalis*, and *P. palmivorus* collected and described in this study are newly reported to Puducherry.

Taxonomy

***Marasmius bambusiniformis* Singer**, *Fl. Neotrop.*, Monogr. 17: 1C7 (1976) (Image 1a–e)

Pileus 4–11 mm diam., conical with small umbo, dull, disc brownish orange (5C5), pale red (7B3) towards margin. Lamellae adnexed, subdistant, cream white. Stipe 12–26 × 2–3 mm, brown (7D7), light yellow towards the apex, central, wiry, non-insititious.

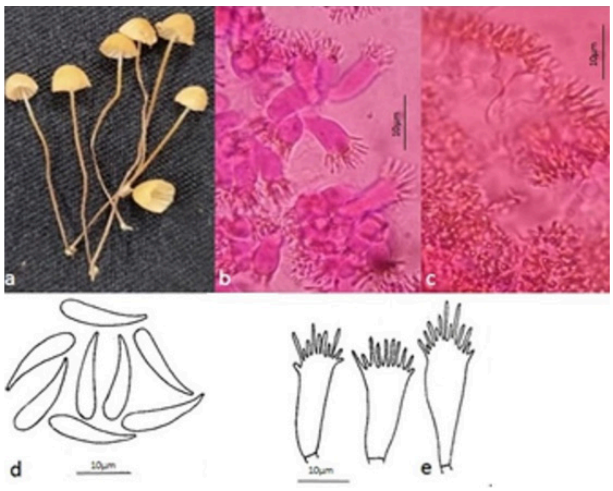

Image 1. ***Marasmius bambusiniformis:*** **a—Fruit body | b, e—Cheilocystidia | c—Pileipellis | d—Basidiospores. © Yuvarani Krishnan.**

Basidiospores 14–16 × 3–4 µm (X_m = 15.4 ± 0.7 × 3.8 ± 0.1 µm, Q = 3.5–4.0, Q_m = 3.9 ± 0.1), narrowly fusoid, thin-walled, hyaline, inamyloid. Basidia not observed. Basidioles 20–24 × 4–6 µm, fusoid to clavate. Cheilocystidia of *Siccus*-type broom cells, main body 8–17 × 7–10 µm, cylindrical to clavate, inamyloid, thin-walled, apical setulae 2–6 × 1–1.5 µm. Pleurocystidia absent. Pileal elements composed of *Siccus*-type broom cells, main body 9–15 × 8–11 µm, cylindrical to clavate, crowded, thick-walled, apical setulae 2–6 × 1–1.5 µm. Clamp connections present.

Specimen examined: Lawspet, Puducherry, gregarious on twig litter. K. Yuvarani (PYKM136, GenBank: OP415534).

Notes: The basidiomes of *M. bambusiniformis* reported from Thailand is similar in pileal size (3–10 mm diam.) with slight variation in having reddish brown to brownish orange pileus (Wannathes et al. 2009). The Malaysian species of *M. bambusiniformis* slightly differs from present collection morphologically in smaller pileus (1.5–5 mm diam.) and microscopically having slightly longer basidiospores of up to 19 µm (Tan et al. 2009). This is the first record from southern India.

***Marasmius haematocephalus* (Mont.) Fr.**, *Epicr. syst. mycol* (Upsaliae): 382 (1838) [1836–1838] (Image 2a–g)

Pileus 4–11 mm diam., convex, sulcate striate, dull, orangish red (8B6) to pastel red (8B5). Lamellae free to adnexed, subdistant, white. Stipe 10–28 × 3–4 mm, central, cylindrical, wiry, smooth, white above, reddish brown (8D5) towards base.

Basidiospores 17–19 × 4–5 µm (X_m = 18.4 ± 0.7 × 4.9 ± 0.1, Q = 3.4–3.8, Q_m = 3.7 ± 0.1), clavate to fusoid, often curved, inamyloid. Basidia not observed. Basidioles 23–26 × 5–6 µm, fusoid to clavate. Cheilocystidia composed of *Siccus*-type of broom cells 9–16 × 5–8 µm, cylindrical to clavate, crowded, inamyloid, thin-walled, apical setulae 2–5 × 1 µm. Pleurocystidia 35–39 × 7–9 µm, gloeocystidioid, fusoid to clavate, at times mucronate, inamyloid, thin-walled. Pileal elements hymeniform, composed of *Siccus*- type broom cells, 10–19 × 6–8 µm, clavate, inamyloid, apical setulae 2–6 × 1–2 µm. Clamp connections present.

Specimen examined: Veerampattinam, Puducherry, gregarious on soil along with grass, 28 October 2021, K. Yuvarani (PYKM110, GenBank: OP415535).

Notes: *Marasmius haematocephalus* is known to occur widely and has been reported from Tamil Nadu

Image 2. *Marasmius haematocephalus*: a—Fruit body | b, g—Pileipellis | c—Basidiospores | d, f—Cheilocystidia (d—Non-setulose Cheilocystidia & f—Siccus- type Cheilocystidia) | e—Pleurocystidia. © Yuvarani Krishnan.

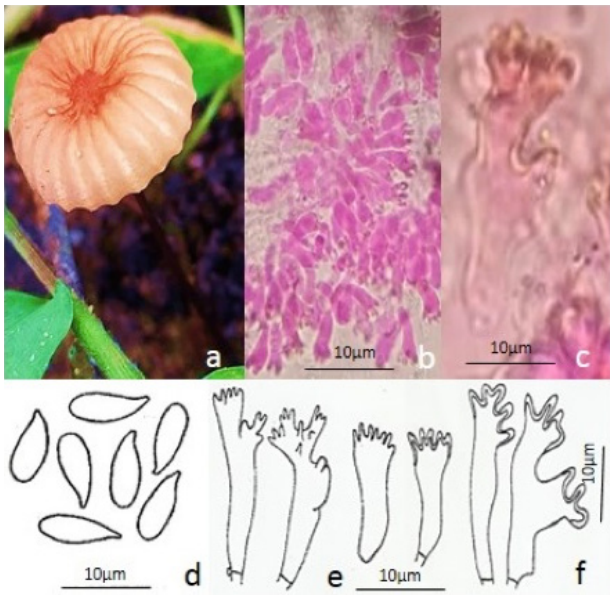

Image 3. *Marasmius leveilleanus*: a—Fruit body | b, e—Cheilocystidia | c, f—Pileipellis | d—Basidiospores. © Yuvarani Krishnan.

(Natarajan and Manjula 1983), Kerala & Maharashtra (Manoharachary et al. 2022), and Assam (Roy et al. 2022).

***Marasmius leveilleanus* (Berk.) Sacc. & Trotter**, *Syll. fung*. (Abellini) 23: 149 (1925) (Image 3a–f)

Pileus 5–18 mm diam., convex to hemispherical when young, becoming convex to depressed in the central part, umbilicate, dull to shiny, reddish-orange (7B6) to pastel red (8B3); margin brownish-orange (5C5). Lamellae free, subdistant, broad, white or cream. Stipe 9–25 × 5–8 mm, central, cylindrical, brownish-red (8E7), insititious.

Basidiospores 10–12 × 4–5 µm (X_m = 10.8 ± 0.6 × 4.7 ± 0.4, Q = 2.2–2.5, Q_m = 2.3 ± 0.1), ellipsoid, inamyloid, thin-walled. Basidia 20–23 × 6–9 µm, cylindrical to clavate, 4-spored, inamyloid. Cheilocystidia of *Siccus*-type broom cells, main body 16–28 × 6–9 µm, cylindrical to clavate, thin-walled, inamyloid with apical setulae 1–4 × 1–1.5 µm. Pileipellis hymeniform, composed of *Siccus*-type broom cells, main body clavate to oblong, 15–22 × 7–10 µm, thin to thick-walled, inamyloid, with apical setulae 3–5 × 1.5–3 µm. Clamp connections present.

Specimen examined: Puthupattu, Puducherry, scattered on twigs and decaying wood, 7 December 2021, K. Yuvarani (PYKMS14, GenBank: OP415538).

Notes: *Marasmius leveilleanus* has been recorded from Tamil Nadu (Natarajan & Manjula 1982) and Kerala (Manoharachary et al. 2022).

***Marasmius midnapurensis* A.K.Dutta, P.Pradhan & K.Acharya**, in Dutta, Chandra, Pradhan & Acharya, *Mycotaxon* 128: 119 (2014) (Image 4a–f)

Pileus 8–24 mm diam., convex to broadly convex, umbonate, smooth, moist, light brown (5D5) to light greyish-brown (6D3) with irregular light yellowish brown (5D6) patches in the pileus surface, hygrophanous, striate. Lamellae adnexed, subdistant, white (1B1), margin creamy, slightly undulating or even. Stipe 51–81 × 1.5–2 mm, central, creamy near the apex, reddish-brown (7D7) below, terete, hollow, dry, smooth, non-insititious, white to light yellow at the base.

Basidiospores 10–12 × 3–4 µm (X_m = 10.9 ± 0.9 × 3.9 ± 0.1, Q = 2.5–3.4, Q_m = 2.7 ± 0.3) narrowly ellipsoid to fusoid, slightly curved, smooth, inamyloid, thin walled. Basidia 21–25 × 5–7 µm, clavate, 4-spored. Basidioles 19–23 × 5–7 µm, clavate. Cheilocystidia of *Siccus*-type broom cells, 11–17 × 6–10 µm, cylindrical to clavate, with thin to thick-walled apical setulae, 4–10 × 1–1.5 µm. Pleurocystidia absent. Pileipellis composed of *Siccus*-type broom cells, 12–16 × 7–11 µm, clavate, inamyloid, apical setulae crowded, 4–10 × 1–1.5 µm. Caulocystidia present. Clamp connections present.

Specimen examined: Lawspet, Puducherry, gregarious and scattered on twig and leaf litter, 27th August 2021, K. Yuvarani (PYKM76 & PYKM78, GenBank: OP415532, OP415533); Lawspet, gregarious and scattered, 30 August 2021, K. Yuvarani (PYKM87).

Notes: *Marasmius midnapurensis* was first described

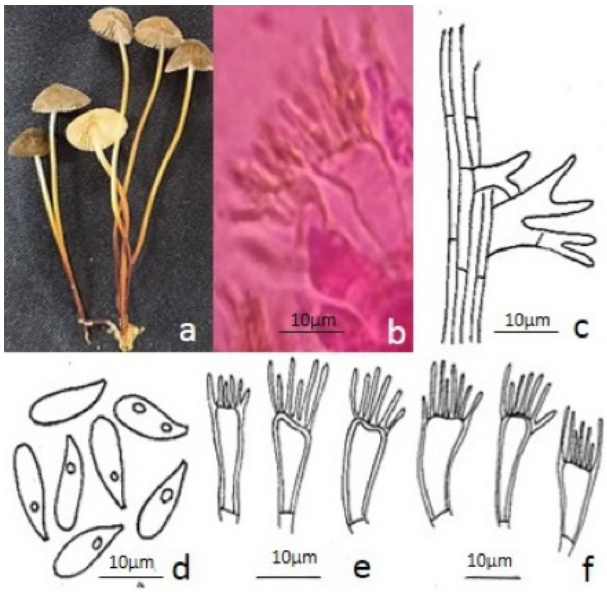

Image 4. ***Marasmius midnapurensis*****: a—Fruit body | b, e—Cheilocystidia | c—Caulocystidia | d—Basidiospores | f—Pileipellis. © Yuvarani Krishnan.**

from Midnapur district of West Bengal, India (Dutta et al. 2014). Morphotaxonomically, the present collection resembles *M. midnapurensis* in all the characters, but slightly differs in having longer stipe (51–81 mm vs 53–65 mm).

Marasmius rotalis **Berk. & Broome**, *J. Linn. Soc.*, Bot. 14 (no.73): 40 (1873) [1875] (Image 5a–f)

Pileus 3–6 mm diam., convex, umbilicate, striate, to sulcate; surface dull, dry, uniformly pale orange (5A3) to pale white (5A1), umbilicus with a darker central spot; margin undulating. Lamellae horizontal, distant, white. Stipe 14–10 × 2 mm, central, surface shiny, dry, reddish-brown (8E8) to brownish-red. Mycelium running over on attached leaf.

Basidiospores 6–8 × 4–5 µm (X_m = 7.6 ± 0.4 × 4.3 ± 0.4, Q = 1.6–2, Q_m = 1.7 ± 0.1), ellipsoid, inamyloid, thin-walled. Basidia 20–23 × 4.5–5.5 µm, clavate, 4 spored, inamyloid. Cheilocystidia 10–12 × 8–10 µm, scattered of *Rotalis*-type broom cells, broadly clavate, thin walled. Pleurocystidia absent. Pileal surface with *Rotalis*-type broom cells, 10–15 × 10–12 µm, broadly clavate or pyriform or sub-vesiculose, thin-walled, inamyloid, Clamp connections present. Stipe hyphae up to 5 µm broad, thick-walled.

Specimen examined: Lawspet, Puducherry, scattered on leaf litter and fallen *Caesalpinia* fruit, 30 October 2021, K. Yuvarani (PYKM101, GenBank: OP415536).

Notes: *Marasmius rotalis* was previously described from Madras (now Chennai), Tamil Nadu by Natarajan & Manjula (1982). The specimen examined in the present work is similar to *M. rotalis* described from Chennai in all the morphotaxonomic characters.

Paramarasmius palmivorus **(Sharples) Antonín & Kolařík**, in Antonín, Hosaka & Kolařík, *Pl. Biosystems*: 10.1080/11263504.2022.2100503, 2 (2022) (Image 6a–f)

Pileus 6–34 mm diam., hemispherical to convex, surface dull, moist to dry, young white, becoming yellowish white (1A2) when mature. Lamellae adnate, subdistant to distant, with 4 series of lamellulae. Stipe

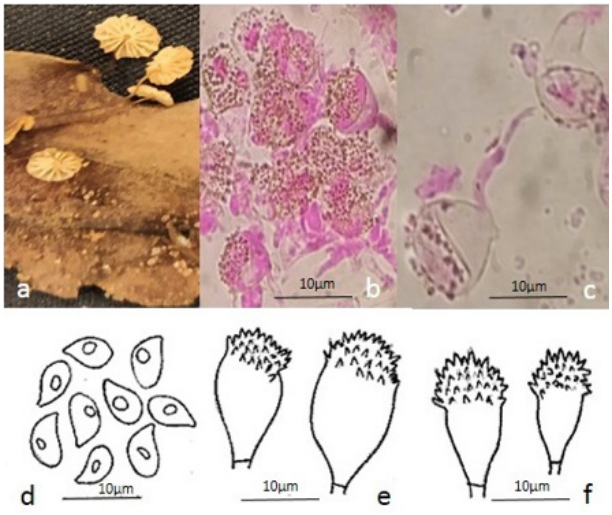

Image 5. ***Marasmius rotalis*****: a—Fruit body | b, e—Cheilocystidia | c, f—Pileocystidia | d—Basidiospores. © Yuvarani Krishnan.**

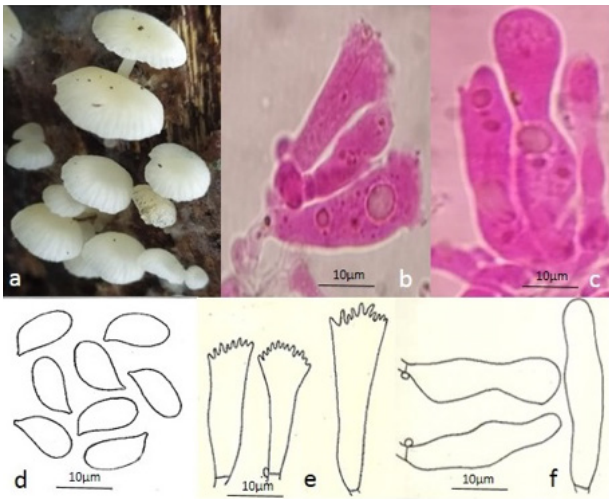

Image 6. ***Paramarasmius palmivorus*****: a—Fruit body | b, e—Cheilocystidia | c, f—Pileipellis hyphae | d—Basidiospores. © Yuvarani Krishnan.**

Table 1. List of Marasmius species used for phylogenetic analysis.

Species	Country	Section	GenBank accession no.
Marasmius cystidiatus	India	Globulares	MH216191
Marasmius cystidiatus	India	Globulares	MH216042
Marasmius leveilleanus	India	Leveilleani	KX154213
Marasmius leveilleanus	India	Leveilleani	OP415538*
Marasmius leveilleanus	Thailand	Leveilleani	MW426440
Marasmius leveilleanus	Sri Lanka	Leveilleani	KR733544
Marasmius brunneoaurantiacus	China	Marasmius	MZ133622
Marasmius rotalis	India	Marasmius	MF189068
Marasmius rotalis	India	Marasmius	MF189069
Marasmius rotalis	India	Marasmius	OP415536*
Marasmius somalomoensis	USA	Marasmius	KX149002
Marasmius tenuissimus	China	Neosessiles	MF061773
Marasmius midnapurensis	India	Sicci	KY785179
Marasmius midnapurensis	India	Sicci	MF189041
Marasmius midnapurensis	India	Sicci	OP415532*
Marasmius midnapurensis	India	Sicci	OP415533*
Marasmius haematocephalus	Thailand	Sicci	EU935525
Marasmius haematocephalus	Thailand	Sicci	EU935527
Marasmius haematocephalus	Thailand	Sicci	MW426462
Marasmius haematocephalus	India	Sicci	OP415535*
Marasmius auranticapitatus	Brazil	Sicci	ON502671
Marasmius bambusiniformis	Thailand	Sicci	MW504974
Marasmius bambusiniformis	Thailand	Sicci	EU935521
Marasmius bambusiniformis	Thailand	Sicci	EU935522
Marasmius bambusiniformis	India	Sicci	MW453134
Marasmius bambusiniformis	India	Sicci	OP415534*
Marasmius coasiaticus	Brazil	Sicci	ON502681
Marasmius graminicola	Korea	Sicci	FJ917618
Marasmius graminicola	Korea	Sicci	FJ917617
Marasmius nodulocystis	USA	Sicci	KX953740
Marasmius nodulocystis	USA	Sicci	KX953742
Marasmius ochroleucus	Russia	Sicci	KF912952
Marasmius rubicundus	Brazil	Sicci	ON502659
Marasmius rubicundus	Brazil	Sicci	ON502663
Marasmius strobiluriformis	Korea	Sicci	GU266263
Paramarasmius palmivorus	India	-	MK788181
Paramarasmius palmivorus	USA	-	MF100969
Paramarasmius palmivorus	India	-	MG251431
Paramarasmius palmivorus	India	-	OP415537*#
Paramarasmius palmivorus	Thailand	-	MW647877
Crinipellis zonata	USA	-	MK217458

**Marasmius* spp. and *Paramarasmius palmivorus* recorded in the present study
#Submitted as *Marasmius palmivorous*, presently basionym of *Paramarasmius palmivorus* (Sharples) Antonín & Kolařík (2022).

4–12 × 1–1.5 mm, central to slightly eccentric, slightly enlarged at the base, white near the apex, light yellowish brown towards the base, insititious.

Basidiospores 10–12 × 5–6 µm (X_m = 11.4 ± 0.7 × 5.1 ± 0.6, Q = 2–2.6, Q_m = 2.2 ± 0.2) ellipsoid, smooth, inamyloid, thin-walled. Basidia 35–37 × 7–9 µm, clavate, to cylindrical, 4-spored. Pleurocystidia absent. Cheilocystidia 24–26 × 8–11 µm, cylindrical to clavate, inamyloid, thin-walled, irregular in outline, with apical lobules. Pileipellis loosely interwoven, not a hymeniform layer, hyphae up to 8 µm wide, thin-walled.

Specimen examined: Puthupattu, Puducherry, sacred grove (Near Puducherry), gregarious on decaying coconut fibre, 28 October 2021, K. Yuvarani (PYKMS40, GenBank: OP415537).

Notes: The present collection resembles *M. palmivorus* (presently *Paramarasmius palmivorus*) reported by Dutta & Acharya (2018) from West Bengal in all the morphotaxonomic characters, but slightly differs in having longer cheilocystidia (24–26 µm vs up to 19 µm).

A phylogenetic analysis was performed on 41 ITS sequences of different species of *Marasmius* (seven from the current study and 33 from public databases) with *Crinipellis zonata* as outgroup. All ambiguous positions were removed for each sequence pair and the final dataset included 286 positions. Both Neighbour joining analysis and Maximum likelihood approach provided similar results with all our isolates clustered together in separate clades (Figures 1, 2). The boostrap support for different clades was found to be generally low across all nodes. When the isolates were separated based on the section to which they belonged, the members of section *Marasmius* formed a monophyletic clade with strong support (100%) while the species belonging to *Paramarasmius* (earlier reported as *Marasmius palmivorus*) were grouped together (100% bootstrap support).

DISCUSSION

Of the five species of *Marasmius* examined, *M. midnapurensis*, *M. bambusiniformis* and *M. haematocephalus* belong to sect. *Sicci*, *M. leveilleanus* to sect. *Leveilleani* and *M. rotalis* to sect. *Marasmius*. *Marasmius palmivorus* displays unique pileipellis morphology (Dutta & Acharya 2018) and hence, Antonin et al. (2022) proposed a new combination *P. palmivorous* for *M. palmivorous* due to the absence of hymeniderm pileipellis in the latter. *Marasmius*

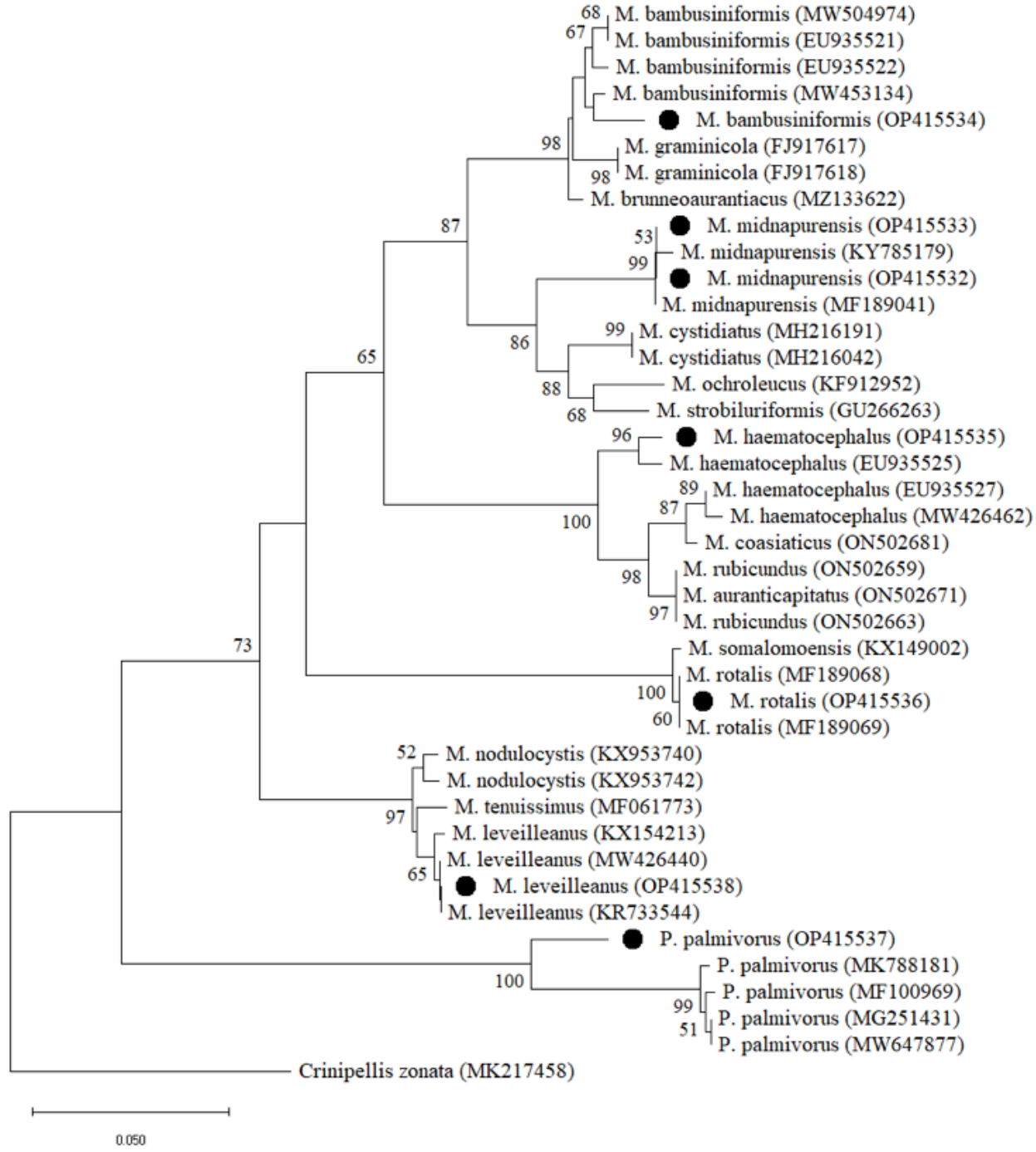

Figure 1. Phylogenetic relationship of *Marasmius* and *Paramarasmius* spp. inferred from ITS sequences analysis by neighbour joining method. The solid black circle indicates the taxa reported in the present study. Numbers next to branches indicate bootstrap support from 1,000 replicates.

midnapurensis is being described for the first time from southern India. Natarajan & Manjula (1982) reported *M. haematocephalus*, *M. leveilleanus* and *M. rotalis* from southern India. Wannathes et al. (2009) recognized six different forms of *M. haematocephalus* although not formally established and, to confirm this more specimens have to be analyzed. Further, *Marasmius* species are known to have their morphologically vicariant taxon in other geographical areas (Antonin et al. 2014) making molecular analysis an important tool in differentiating such species. Phylogenetic analysis using both neighbour joining method and maximum likelihood method gave similar results (Figures 1, 2). Our phylogenetic analysis further showed that Internal Transcribed Spacer

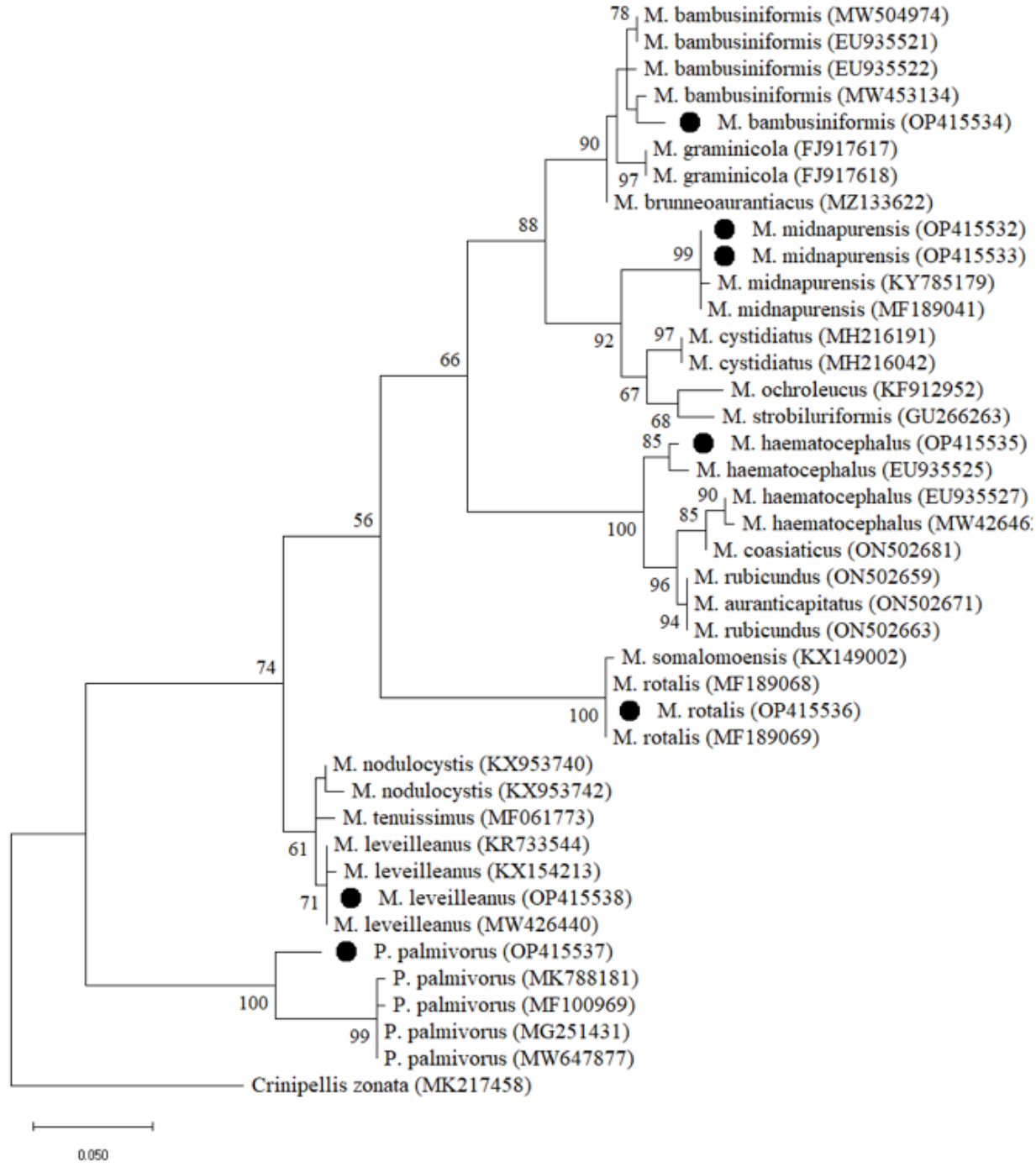

Figure 2. Phylogenetic relationship of *Marasmius* and *Paramarasmius* spp. inferred from ITS sequences analysis by maximum likelihood method. Tree with highest log likelihood is shown. The solid black circle indicates the taxa reported in the present study. Numbers next to branches indicate bootstrap support from 1,000 replicates.

might not be a reliable marker to distinguish different sections in genus *Marasmius* but had strong support for members of section *Marasmius*. A similar result was obtained by nuclear large subunit sequence analysis by Douanla-Meli and Langer (2008). Our results also agreed with that of Oliveira et al. (2020) in that the members of *Globulares* to be non-monophyletic and the clade included members from different sections and lacked stronger support.

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