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## The gymnopoid fungi (Basidiomycota, Agaricales) from the Republic of São Tomé and Príncipe, West Africa.

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### Abstract

Thirty-one species of gymnopoid fungi are reported from the African island nation, Republic of São Tomé and Príncipe. Ten represent new species (*Arrhenia cystidiata*, *Callistosporium elegans*, *Campanella burkei*, *Gymnopus billbowesii*, *G. hirtelloides*, *G. irresolutus*, *G. mustachius*, *G. ocellus*, *G. pleurocystidiatus*, *G. rodhallii*), four are new nomenclatural combinations (*G. cervinus*, *G. hirtellus*, *G. ugandensis*, *Tricholomopsis aurea*), and all 21 previously described species represent new distribution records. Comprehensive descriptions, line drawings, colour photographs, comparisons with allied taxa, a dichotomous key to aid identification, and a phylogenetic analysis of members of the Omphalotaceae based on ITS rDNA sequence data are provided.

**Key words** – *Gymnopus* – *Marasmiellus* – fungal diversity – mushrooms – Gulf of Guinea

### Introduction

In April 2006 (two weeks) and April 2008 (three weeks), expeditions led by scientists from the California Academy of Sciences and joined by mycologists from San Francisco State University visited the West African islands of São Tomé and Príncipe to document the diversity of plants, amphibians, marine invertebrates and macrofungi. This is the fifth in a series of papers focused on documenting the basidiomycetous macrofungi from the Republic (Desjardin & Perry 2009, 2015a, b, 2016).

Gymnopoid fungi, also known as collybioid fungi, have a body form suggestive of members of the white-spored, saprotrophic genus *Gymnopus*. Currently, they are represented by select genera in the Omphalotaceae, such as *Anthracophyllum*, *Gymnopus*, *Lentinula*, *Mycetinis*, *Marasmiellus*, *Rhizomarasmius* and *Rhodocollybia*, as well as distantly related genera with similar basidiome body forms such as *Callistosporium*, *Cyptotrama*, *Lactocollybia*, *Ripartitella*, and others. Prior to the research published here, only five species with a gymnopoid body form were reported from the Republic. The earliest records were from Bresadola and Roumeguère (1890) as *Collybia collina* (Scop.) P. Kumm. (= *Marasmius collinus* (Scop.) Singer), *Marasmius amadelphus* (Bull.) Fr. (=

*Gymnopus ramealis* (Bull.) Gray) and *Marasmius splachnoides* (Hornem.) Fr. (= *Gymnopus quercophilus* (Pouzar) Antonín & Noordel.). Later, Coutinho (1925) reported *Agaricus xanthopus* Fr. (= *Gymnopus ocior* (Pers.) Antonín & Noordel.), and described the new species *Agaricus diffractus* Cout. (= *nom. illeg.*, non *A. diffractus* Fr. 1838). The latter species, described as having subglobose, rugulose basidiospores and a fibrillose-squamulose pileus remains a *nomen dubium*. None of these five species have been recollected by us. Our fieldwork yielded ten new species described herein, four new nomenclatural combinations, and 21 new distribution reports for São Tomé and Príncipe.

## Materials & Methods

Specimens were dried on a Nesco food dehydrator, packed in airtight plastic bags and hand carried back to the US. Macromorphological data were derived from fresh specimens, whereas micromorphological data were derived from dried specimens rehydrated in ethanol followed by distilled water, 3% KOH or Melzer's reagent. Colour terms and notations are those of Kornerup and Wanscher (1978). Basidiospore statistics include:  $x_m$ , the arithmetic mean of the spore length by spore width ( $\pm$  standard deviation) for  $n$  spores measured in a single specimen;  $x_{mr}$ , the range of spore means, and  $x_{mm}$ , the mean of spore means ( $\pm$  SD) when more than one specimen is available;  $Q$ , 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;  $Q_{mr}$ , the range of  $Q_m$  values and  $Q_{mm}$ , the mean of  $Q_m$  values where more than one specimen is available;  $n$ , the number of spores measured per specimen;  $s$ , the number of specimens involved. The subfusoid cells that are similar in size to the basidia, arise from the subhymenium on lamellar faces, dominate the hymenium layer, and are present in nearly all gymnopoid (and marasmioid) fungi are herein recognized as "basidioles". These cells have recently been redefined as "pleurocystidia" (Petersen and Hughes 2016). We recognize them as "basidioles" to differentiate them from the scattered, larger cells that arise from the subhymenium or lamellar trama, project beyond the basidia, are often refractive or exudative, and are present in very few gymnopoid fungi, which have been traditionally termed "pleurocystidia". In the line drawings, cross-hatching represents pigmented cell contents while stippling represents pigmented cell walls. All cited specimens are deposited in the H.D. Thiers Herbarium, Department of Biology, San Francisco State University (SFSU).

Total genomic DNA was extracted from dried material using the Extract-N-Amp Plant PCR Kit (Sigma-Aldrich, St. Louis, MO) following the manufacturer instructions. PCR protocols followed those outlined in Perry et al. (2007). For most species included the nuclear ribosomal internal transcribed spacer region (ITS) was amplified using primers ITS1-F/ITS4 (Gardes and Bruns 1993, White et al. 1990). For several taxa, the nuclear ribosomal large subunit gene (nSLU) was also amplified using primers LROR/LR7 (Moncalvo et al. 2002). Amplification products were cleaned using the Exo-SAPit kit (Affymetrix, Santa Clara, CA), and sent to Elim Biopharmaceuticals (Hayward, CA) for sequencing with the same primer pairs used for amplification. Resulting sequencing products were edited and assembled in Geneious 9.0 (Biomatters Ltd., Auckland, New Zealand). All ITS sequences generated as part of this study have been deposited in GenBank (accessions MF100952 – MF100994).

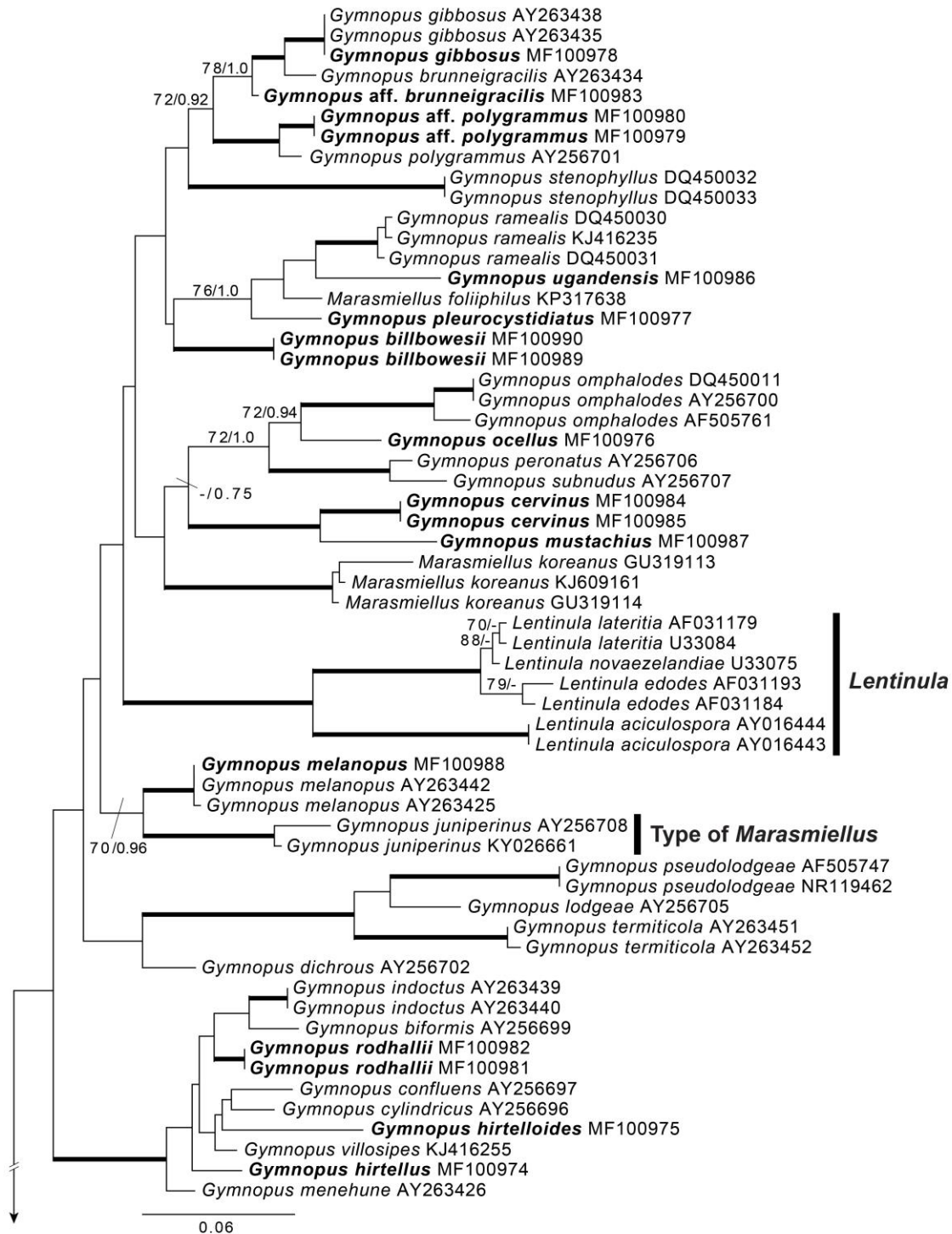
Phylogenetic analyses were performed to further investigate the taxonomic affinities of the African material referable to the Omphalotaceae. ClustalX (Larkin et al. 2007) and Mesquite (Maddison and Maddison 2015) were used to align sequences of the African material of Omphalotaceae within a broader sampling of the family downloaded from GenBank. Parsimony analyses were performed in PAUP\* 4.0a 1.52 (Swofford 2002), and consisted of a heuristic search with 500 random stepwise addition replicates, TBR branch swapping, collapse of zero length branches, equal weighting of all characters, and holding no more than 50 topologies per replicate. All remaining phylogenetic analyses were performed within the CIPRES Science Gateway (Miller et al. 2010). Maximum likelihood analyses were run in RAxML 8.2.10 (Stamatakis 2014) under a GTRGAMMA

model and consisted of 100 alternative runs using the default parameters, with node support estimated by 100 RAxML bootstrap replicates. Bayesian analyses were performed using Metropolis Coupled MCMC methods as implemented in MrBayes 3.2.6 (Huelsenbeck and Ronquist 2001, Ronquist and Huelsenbeck 2003) under a GTR+G model of sequence evolution as determined under the Bayesian Information Criterion in PAUP\* 4.0a.152. Bayesian analyses consisted of two parallel searches, run for 30 million generations and initiated with random starting trees, temperature set to 0.05 and 2 swaps per generation. Eight chains were sampled every 30000 generations for a total of 1001 trees each, sampled from the posterior distribution. Those trees sampled prior to the runs reaching an average standard deviation of split frequencies of 0.01 were discarded as the burn-in, while the remaining trees were used to calculate the posterior probabilities of the individual clades. Default settings were used in MrBayes to set unconstrained branch lengths and uninformative topology priors. The aligned Omphalotaceae ITS dataset and associated tree file have been deposited in TreeBase (submission #21098).

## Results

After removal of all ambiguously aligned and poorly represented regions, the ITS dataset consists of 548 characters for 134 ingroup taxa, and contains 310 variable positions of which 258 are parsimony informative. Parsimony analyses recovered 1050 equally parsimonious trees (1519 steps; data not shown). Maximum likelihood analyses recovered a single topology (Fig. 1;  $-\ln L = 8867.615776$ ) that does not differ significantly from those recovered in the parsimony analyses. Bayesian analyses reached an average standard deviation of split frequencies below 0.01 after 22.5 million generations, and the first 755 trees sampled from the posterior distribution were excluded as the burn-in.

The ITS dataset contains representatives of the Omphalotaceae, and includes 84 species currently recognized as belonging to the genera *Gymnopus*, *Lentinula*, *Marasmiellus*, *Mycetinis*, *Rhodocollybia*, *Connopus*, *Campanella* and *Tetrapyrgos*. *Omphalotus japonicus* and *O. illudens* were used as outgroup taxa. Most of the deep nodes are not strongly supported. *Gymnopus*, as currently delimited, is paraphyletic when *Lentinula*, *Marasmiellus* and *Mycetinis* are accepted as distinct genera (basal node <70% BS, 1.0 PP support). *Lentinula* species form a well-supported clade (94% BS, 1.0 PP) sister to a large number of *Gymnopus* species, but embedded in a grade with other *Gymnopus* species whose relationships have low support. The type species of *Marasmiellus* (*M. juniperinus*) is sister to *G. melanopus* (70% BS, 0.96 PP) embedded in this *Gymnopus* grade. *Mycetinus* (type species *M. alliaceus*) forms a well-supported clade (87% BS, 1.0 PP) that is sister (with <70% BS, 0.92 PP support) to a well-supported clade (82% BS, 1.0 PP) containing numerous *Gymnopus* species, including the type species of *Gymnopus* (*G. fusipes*) and *Setulipes* (*S. androsaceus*; accepted by most as a synonym of *Gymnopus*). Thirteen species of *Rhodocollybia*, mostly on long branches, form a well-supported clade (95% BS, 1.0 PP) that is sister to *Marasmius pallidocephalus*, but with limited support; together they are sister to *Gymnopus* + *Lentinula* + *Marasmiellus* + *Mycetinis*. *Connopus* (type *C. acervatus*), on a long branch, is sister to *S. afibulatus* and together are sister to the taxa reported above. At the base of the tree, in a well-supported clade (97% BS, 1.0 PP), are eleven species currently recognized in *Campanella*, *Tetrapyrgos* and *Marasmiellus* sect. *Candidi*. None of the latter taxa form well-supported independent clades. Two species with morphology suggestive of *G. androsaceus* (*Setulipes*), *Marasmius pallidocephalus* and *S. afibulatus*, hold isolated positions in the ITS phylogeny.



**Fig. 1** – (below) Maximum likelihood phylogeny of gymnopoid fungi (Omphalotaceae *pro parte*) based on ITS sequence data ( $-\ln L = 8867.615776$ ). Sequences of species from São Tomé and Príncipe are indicated in bold type. Values separated by / refer to nonparametric ML bootstrap proportions and Bayesian posterior probabilities. Only values greater than 70/0.70 are shown (- designates a value below 70% or 0.70). Nodes receiving support values greater than 90/0.95 are highlighted in bold.

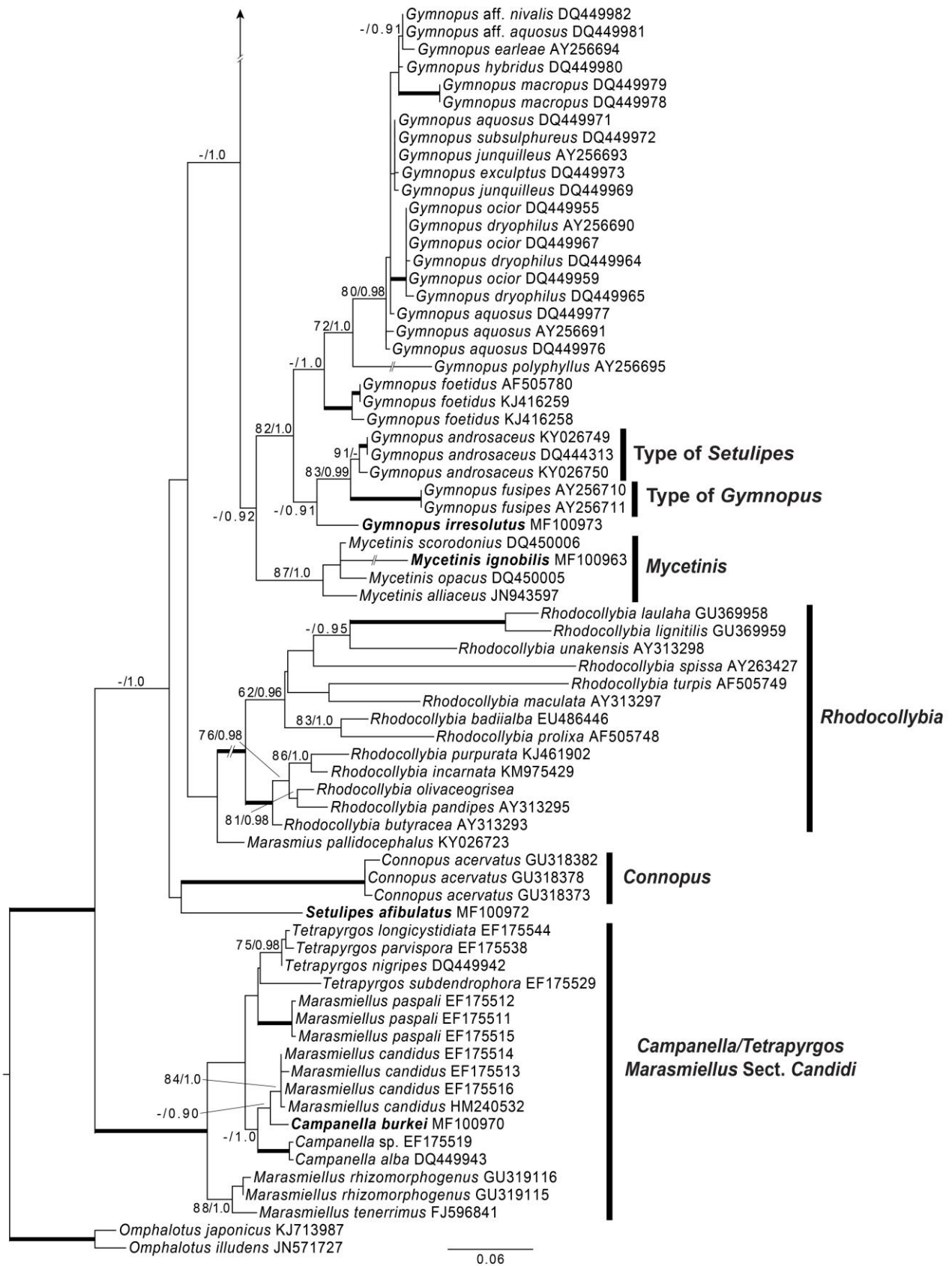


Fig. 1 continued.

## Key to Gymnoid Fungi of São Tomé and Príncipe

1. Basidiospores echinulate ..... 1. *Ripartitella brasiliensis*
1. Basidiospores smooth, lacking ornamentation ..... 2
2. Basidiospores amyloid ..... 2. *Heimiomyces tenuipes*
2. Basidiospores inamyloid, non-dextrinoid ..... 3
3. Basidiomes pleurotoid, lacking a stipe ..... 4
3. Basidiomes with a well-developed, eccentric or central stipe ..... 5
4. Pileus 2–3 mm diam, pale greyish brown; lamellae pale greyish brown; basidiospores 6.8–8 × 3.8–4.8 µm; cheilocystidia broadly clavate to sphaeropedunculate, 9.5–16 µm diam .. 3. *Arrhenia cystidiata*
4. Pileus 10–22 mm diam, brownish orange; lamellae greyish orange; basidiospores 2.8–3.5 × 2.2–2.8 µm; cheilocystidia irregularly cylindrical to flexuous, 2.2–3.5 µm diam .... 4. *Pleurocollybia imbricata*
5. Basidiomes purplish brown, violet brown or greyish violet; some basidiospores and cheilocystidia with purple contents (necropigments); clamp connections absent ..... 6. *Callistosporium elegans*
5. Basidiomes lacking purple tones; basidiospores and cheilocystidia lacking purple necropigments; clamp connections present or absent ..... 6
6. Pileus and stipe deep orange, orangish yellow or yellow ..... 7
6. Pileus and stipe differently colored, lacking deep orange or yellow tones ..... 8
7. Pileus and stipe base covered with erect, pyramidal furfuraceous squamules; lamellae subdistant, white; basidiospores 7.5–10 × 6–7.5 µm ..... 7. *Cyptotrampa asprata*
7. Pileus and stipe glabrous; lamellae crowded, deep yellow to orangish yellow; basidiospores 5–6.5 × 4.5–5.2 µm ..... 8. *Tricholomopsis aurea*
8. Pileus umbilicate to infundibuliform; lamellae decurrent (*Trogia*) ..... 9
8. Pileus convex, campanulate, plano-convex or shallowly depressed; lamellae adnexed or adnate, sometimes with a short decurrent tooth ..... 12
9. Pileus pale greyish red, deeply infundibuliform, perforate; caulocystidia absent .....  
..... 9. *Trogia infundibuliformis*
9. Pileus yellowish brown, often with a hint of olive, convex-umbilicate or shallowly infundibuliform, not perforate; caulocystidia present ..... 10
10. Pileus 35–50 mm diam; hymenophore venose-reticulate; stipe off-white to greyish yellow; pleurocystidia present ..... 10. *Trogia anthidepas*
10. Pileus 10–22 mm diam; hymenophore typically not venose-reticulate (if so only in older basidiomes); stipe dark yellowish brown to dark brown; pleurocystidia absent ..... 11
11. Stipe 7–10 mm long; lamellae not forked; pileus yellowish brown with a hint of olive ...  
..... 11. *Trogia* aff. *brevipes*
11. Stipe 15–30 mm long; lamellae forked; pileus pale greyish yellow streaked with yellowish brown ..  
..... 12. *Trogia* aff. *furcata*
12. Stipe strongly eccentric or nearly lateral ..... 13
12. Stipe central ..... 15
13. Lamellae extremely crowded; pileus canescent, brown, hygrophanous, fading to pale greyish orange; stipe up to 23 × 3 mm; basidiospores 3.5–4.2 × 2.5–3 µm ..... 5. *Pleurocollybia praemultifolia*
13. Lamellae distant; pileus glabrous, orangish white to white; stipe up to 10 × 1.5 mm; basidiospores 8–11 × 4.5–5.8 µm ..... 14
14. Odor of garlic; basidiomes on dicotyledonous twigs; basidiospore mean 8.4 × 5.2 µm .....  
..... 13. *Mycetinis ignobilis*
14. Odor not distinctive; basidiomes primarily on monocotyledonous debris (palm, banana); basidiospore mean 9–10.2 × 4.9–5.1 µm ..... 14. *Marasmius palmivorus*

15. Pileus white .....	16
15. Pileus more deeply pigmented .....	17
16. Lamellae distant, intervenose; hymenium lacking cystidia; basidiospores 14.5–18.5 × 5.2–6.5 μm .....	15. <i>Campanella burkei</i>
16. Lamellae close to subdistant, not intervenose; hymenium with large, chrysocystidia-like gloeocystidia 48–75 × 6.5–14.5 μm; basidiospores 7.4–9.6 × 5.1–6.4 μm .	16. <i>Lactocollybia variicystis</i>
17. Basidiomes formed on leaves .....	18
17. Basidiomes formed on logs or woody debris .....	21
18. Lamellae distant; clamp connections absent .....	19
18. Lamellae close to crowded; clamp connections present .....	20
19. Cheilocystidia broadly clavate, 8–16 μm diam, with numerous apical diverticula; caulocystidia 10–42 μm long, walls 0.5–1 μm thick, contents strongly dextrinoid .....	17. <i>Setulipes afibulatus</i>
19. Cheilocystidia broadly clavate or irregularly cylindrical, 5–8 μm diam, obtuse or bifid, non-diverticulate; caulocystidia 5–20 μm long, walls up to 0.5 mm thick, contents non-dextrinoid .....	18. <i>Gymnopus irresolutus</i>
20. Pileus rugulose-striate to the disc, glabrous, greyish orange in age; cheilocystidia with few knob-like outgrowths; basidiospore mean 6.7 × 3.5 μm .....	19. <i>Gymnopus hirtellus</i>
20. Pileus non-striate or seldom striatulate, appressed-felted, dull brown in age; cheilocystidia with numerous knob-like outgrowths; basidiospore mean 7 × 3.9 μm .....	20. <i>Gymnopus hirtelloides</i>
21. Pleurocystidia clavate to fusoid-ventricose, pedicellate, 32–60 × 8–13 μm, projecting beyond basidia and basidioles .....	22
21. Pleurocystidia absent (subfusoid basidioles 18–36 × 4–8 μm common, not projecting) .....	23
22. Lamellae crowded, 2–4 mm broad; pileus disc brown, with brown streaks towards the white margin; stipe 40–70 × 2–5 mm; caulocystidia 3–5 μm diam .....	21. <i>Gymnopus ocellus</i>
22. Lamellae subdistant, 1–2 mm broad; pileus disc cream with a few brown fibrils; stipe 22–33 × 1.5–2.5 mm; caulocystidia 4–10 μm diam .....	22. <i>Gymnopus pleurocystidiatus</i>
23. Pileus typically >20 mm diam; stipe >2 mm thick, non-insititious .....	24
23. Pileus typically <20 mm diam; stipe <1.5 mm thick, insititious or subsititious .....	27
24. Pileus non-striate, appressed-fibrillose .....	23. <i>Gymnopus gibbosus</i>
24. Pileus striate to rugulose-sulcate, glabrous or minutely pruinose .....	25
25. Cheilocystidia catenulate; pileocystidia common, irregularly cylindrical to clavate .....	24. <i>Gymnopus</i> aff. <i>polygrammus</i>
25. Cheilocystidia not catenulate; pileocystidia absent .....	26
26. Pileus 16–40 mm diam; lamellae close, 1–2 mm broad; stipe dark greyish brown overall, arising from coarse white rhizomorphs; cheilocystidia clavate to nearly sphaeropedunculate 38–66 × 7–11.5 μm .....	25. <i>Gymnopus rodhallii</i>
26. Pileus 30–70 mm diam; lamellae subdistant, 2–5 mm broad; stipe apex cream, base brown to dark greyish brown, rhizomorphs absent; cheilocystidia irregularly cylindrical to subclavate 24–30 × 4.8–7 μm .....	26. <i>Gymnopus</i> aff. <i>brunneigracilis</i>
27. Cheilocystidia with numerous apical diverticula 1.5–5 (–11) × 1–3.2 μm .....	28
27. Cheilocystidia non-diverticulate, simple or with a few knob-like outgrowths .....	30
28. Pileus 10–25 mm diam, dark brown to brown; lamellae greyish brown; stipe apex brown, base dark brown .....	27. <i>Gymnopus cervinus</i>
28. Pileus 7–15 mm diam, disc pale brownish grey, orange or white, margin orangish white or white; lamellae white; stipe apex white, base greyish red, reddish brown or dark brown .....	29
29. Pileus orange fading to white in age; basidiospore mean 9–10.2 × 4.9–5.1 μm; basidiomes primarily on monocotyledonous debris (palm, banana) .....	14. <i>Marasmius palmivorus</i>
29. Pileus disc pale brownish grey, margin orangish white; basidiospore mean 7 × 3.7 μm; basidiomes	

- on dicotyledonous twigs ..... 28. *Gymnopus ugandensis*  
 30. Lamellar edge dark brown; cheilocystidia incrusted with dark brown pigments; basidiospore mean  $9.2 \times 3.7$ ,  $Q_m = 2.47$  ..... 29. *Gymnopus mustachius*  
 30. Lamellar edge concolorous with the face; cheilocystidia hyaline, non-incrusted; basidiospore mean range  $5.7\text{--}7.7 \times 3.9\text{--}4.5$   $\mu\text{m}$ ,  $Q_m = 1.33\text{--}1.95$  ..... 31  
 31. Stipe dark brown to black overall; lamellae close to subdistant; basidiospores ellipsoid, mean  $7.7 \times 3.9$   $\mu\text{m}$  ..... 30. *Gymnopus melanopus*  
 31. Stipe apex white or greyish orange, base brown or dark reddish brown; lamellae distant; basidiospores ovoid, mean  $5.8 \times 4.4$   $\mu\text{m}$  ..... 31. *Gymnopus billbowesii*

## Taxonomy

***Ripartitella brasiliensis*** (Speg.) Singer, Lilloa 22: 452. 1951 (1949).

Fig. 2

Basionym: *Pleurotus brasiliensis* Speg., Boln Acad. Nac. Cienc. Córdoba 11(4): 398. 1889.

= *Dendrosarcus brasiliensis* (Speg.) Kuntze, Revis. Gen. Pl. (Leipzig) 3(2): 463. 1898.

Possible heterotypic synonyms: refer to Pegler (1977, 1983).

Facesoffungi number: FoF03727

For a description of African material refer to Pegler (1977).

Habitat and known distribution – Gregarious to subcespitate on decaying wood in primary coastal forest. Africa (Kenya, São Tomé, Tanzania, Uganda), Caribbean region, South America.

Material examined – AFRICA. São Tomé, Macambrara, radio antenna area, N00°16.557', E06°36.326', elev. 1300 m, 25 April 2008, coll. by D.E. Desjardin, DED 8323 (MF100952, SFSU).

Notes – *Ripartitella brasiliensis* is a widely-distributed species in the New World subtropics and tropics, and first reported from Africa by Pegler (1977). The São Tomé specimen, collected in old growth forest at high elevation, matches nicely the description of African material provided by Pegler (1977), although the basidiospores from São Tomé are slightly larger ( $4.5\text{--}5.5 \times 3.5\text{--}4.2$   $\mu\text{m}$  v.s.  $3.7\text{--}4.5 \times 2.9\text{--}3.5$   $\mu\text{m}$ ). In age the basidiomes fade from cream (4A3) to pure white and the pileus becomes glabrous from a loss of the squamules.

Pairwise comparisons of aligned, overlapping ITS sequences of the São Tomé specimen of *Ripartitella brasiliensis* with the top ten BLAST results indicate closest similarity (96.1–96.4%) with two sequences determined as *Ripartitella* sp. (JX462554 – Belize; KF727403 – New Zealand).

***Heimiomyces tenuipes*** (Schwein.) Singer, Mycologia 35(2): 159. 1943.

Figs 3, 4a–f

Basionym: *Agaricus tenuipes* Schwein., Trans. Amer. Phil. Soc. 11. 4: 147. 1832.

= *Collybia tenuipes* (Schwein). Sacc. Syll. Fung. (Abellini) 5: 213. 1887.

= *Gymnopus tenuipes* (Schwein.) Murrill, N. Amer. Fl. (New York) 9(5): 361. 1916.

= *Xeromphalina tenuipes* (Schwein.) A.H. Sm., Pap. Mich. Acad. Sci. 38: 84. 1953.

Synonyms: For a list of potential heterotypic synonyms refer to Pegler (1977, 1983).

Facesoffungi number: FoF03728

Pileus 16–80 mm diam, convex becoming plane in age, margin decurved to uplifted, striate; surface moist, glabrous, subhygrophanous, disc dark orangish brown to orangish brown (6C–D6–7), margin brownish orange (6B–C5–6) to yellowish orange. Context thin, orangish brown. Lamellae ascending-adnate to adnate with a decurrent tooth, subdistant with 2–3 series of lamellulae, moderately broad (–5 mm), intervenose towards the margin in age, pale brownish orange (6B–C5–6). Stipe 20–35  $\times$  2–10 mm, central, initially terete, becoming compressed or cleft in age, cylindrical above an enlarged base, tough, pliant, hollow, non-insititious; surface dull, dry, pubescent to subvelutinous, apex brownish orange (6B–C5–6), base brown to dark brown (6–7E–F4–7). Odor and taste indistinct.





**Fig. 2** – Basidiomes of *Ripartitella brasiliensis* (DED 8323). Scale bar = 10 mm



**Fig. 3** – Basidiomes of *Heimiomyces tenuipes* (BAP 640). Scale bar = 10 mm

Basidiospores  $7.5\text{--}9.5 \times 4.2\text{--}5 \mu\text{m}$  [ $x_m = 8.42 \pm 0.63 \times 4.67 \pm 0.27 \mu\text{m}$ ,  $Q = 1.6\text{--}2.0$ ,  $Q_m = 1.8 \pm 0.08$ ,  $n = 25$ ,  $s = 1$ ], ellipsoid, smooth, hyaline, amyloid, thin-walled. Basidia  $38\text{--}42 \times 8\text{--}9.5 \mu\text{m}$  with sterigmata up to  $9.5 \mu\text{m}$  long, clavate, 4-spored. Basidioles broadly clavate. Pleurocystidia-like cells interspersed amongst basidioles, arising from deeper in the subhymenium and not projecting,  $40\text{--}60 \times 3.8\text{--}6.5 \mu\text{m}$ , narrowly fusoid. Lamellar edge heteromerous, fertile. Cheilocystidia common,  $22\text{--}48 \times 3\text{--}7 \mu\text{m}$ , irregularly cylindrical, often with a few apical lobes or knobs, hyaline, inamyloid, a few thin-walled, mostly with walls  $0.5\text{--}1.5 \mu\text{m}$  thick. Pileipellis a cutis of loosely interwoven hyphae with scattered pileocystidia; hyphae  $1.5\text{--}5 \mu\text{m}$  diam, cylindrical, branched, hyaline to pale yellow, inamyloid, pale red in 3% KOH, non-incrusted, weakly gelatinous. Pileocystidia  $30\text{--}55 \times 4\text{--}5.5 \mu\text{m}$ , cylindrical, seldom lobed, hyaline to pale yellow, faintly red in 3% KOH, thick-walled ( $\sim 2 \mu\text{m}$ ). Pileus trama bilayered: upper layer of loosely interwoven narrow hyphae  $1.5\text{--}2.5 \mu\text{m}$  diam, cylindrical, branched, hyaline, inamyloid, thin-walled, in a gelatinous matrix; lower layer more compact, hyphae  $(3\text{--})5\text{--}20 \mu\text{m}$  diam, short-celled, hyaline, inamyloid, gelatinous, with walls  $0.5\text{--}2 \mu\text{m}$  thick. Lamellar trama of subparallel hyphae  $1.5\text{--}8 \mu\text{m}$  diam, cylindrical to irregular in outline, hyaline, inamyloid, non-gelatinous, thin-walled or with walls  $0.5\text{--}1 \mu\text{m}$  thick. Stipitipellis a trichodermium of erect caulocystidia; cortical hyphae  $4\text{--}8 \mu\text{m}$  diam, cylindrical, hyaline to pale yellow, inamyloid, pale red in 3% KOH, non-gelatinous, with walls up to  $0.5 \mu\text{m}$  thick; medullary hyphae  $3\text{--}18 \mu\text{m}$  diam, cylindrical, hyaline, inamyloid, thin-walled or with walls up to  $2 \mu\text{m}$  thick. Caulocystidia  $(32\text{--})50\text{--}170 \times 5\text{--}10 \mu\text{m}$ , wavy-cylindrical, obtuse, lacking projections or rarely apically lobed, orangish yellow, inamyloid, pale red in 3% KOH, walls  $1\text{--}2.5 \mu\text{m}$  thick. Clamp connections common in all tissues.

Habitat and known distribution – Solitary to gregarious on decaying logs in secondary upland forest. Africa (Kenya, Príncipe, South Africa, Tanzania, Uganda), North America, Caribbean region, South America, Southeast Asia.

Material examined – AFRICA. Príncipe, along trail to Roça Pico Papagaio,  $N01^{\circ}37.182'$ ,  $E07^{\circ}23.474'$ , 21 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 640 (MF100953, SFSU).

Notes – *Heimiomyces tenuipes* is a morphologically variable, pantropical species, accepted by many in the genus *Xeromphalina*. Unpublished molecular data indicate a small group of species determined as belonging to the morpho-genus *Heimiomyces* (type: *H. rheicolor* (Berk.) Singer, a synonym of *H. tenuipes*) form a well-supported clade sister to taxa commonly accepted in *Xeromphalina*, and following Horak (1979), we recognize *Heimiomyces* as a distinct genus. The Príncipe specimen matches nicely material from Africa reported by Pegler (1977). *Heimiomyces neovelutipes* (Hongo) E. Horak, described from Papua New Guinea, differs subtly in forming a trichodermium pileipellis with more numerous and narrower pileocystidia, and cheilocystidia and caulocystidia with numerous knob-like outgrowths (Horak 1979).

Pairwise comparisons of aligned, overlapping ITS sequences of the Príncipe specimen of *Heimiomyces tenuipes* with the top ten BLAST results indicate closest similarity (98.4%) with a sequence determined as *Xeromphalina* sp. (AB509965) from Japan, and 85.9–89.3% similarity with two sequences of *Heimiomyces neovelutipes* (KT120056 – Nigeria; KM975407 – New Zealand).

***Arrhenia cystidiata*** Desjardin & B.A. Perry, sp. nov.

Fig. 5a–c

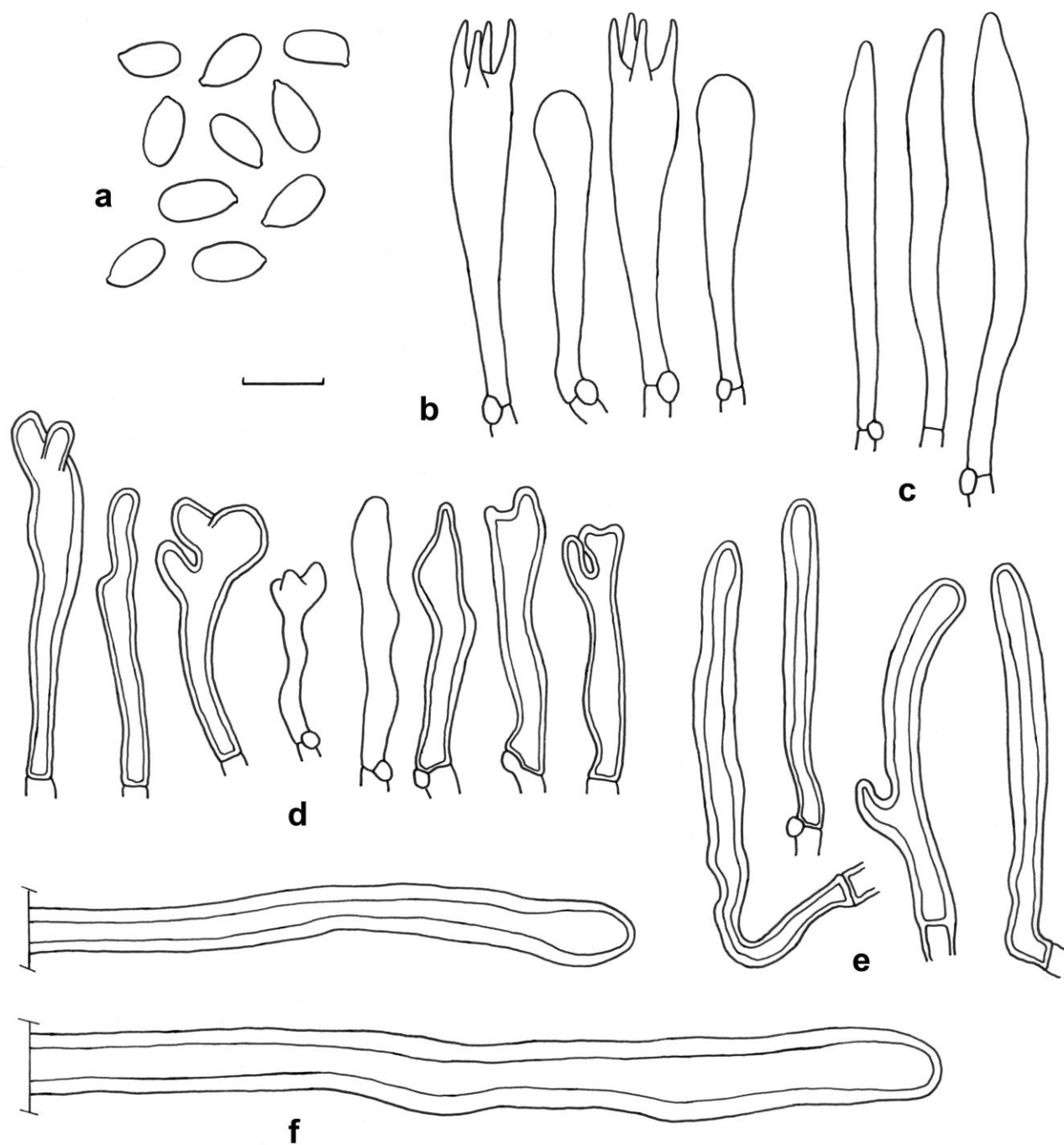
Mycobank: MB 821157; Facesoffungi number: FoF03729

Holotype – AFRICA. São Tomé, along main road (EN1) on north side of island, west of Ria Luisa at 33 km marker,  $N00^{\circ}19.606'$ ,  $E06^{\circ}30.667'$ , 18 April 2008, coll. by D.E. Desjardin, DED 8266 (SFSU)

Etymology – *cystidiata* = with cystidia, referring to the lamellar edge composed exclusively of broadly clavate to sphaeropedunculate cystidia.

Diagnosis – Pileus 2–3 mm diam, hoof-shaped in side view, ovoid to chordate or fan-shaped in face view; surface dull, dry, tomentose to felted, pale grey to greyish brown (6D2–3). Context 0.5 mm

thick, fragile, concolorous. Lamellae adnexed to point of attachment to substrate, subdistant (5–12) with 1–2 series of lamellulae, broad (1 mm), pale greyish brown (6D2) with white, granulose edges. Stipe absent; attached eccentrically to nearly laterally from pileus to the substrate.

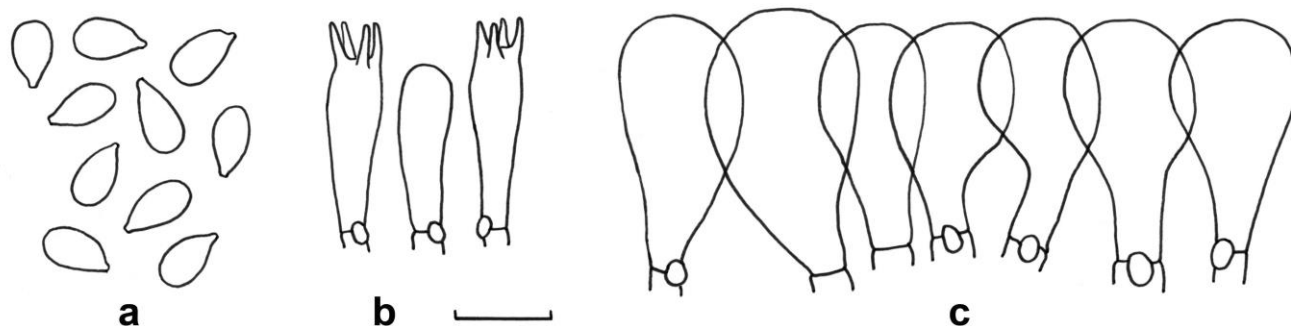


**Fig. 4** – Micromorphological features of *Heimomyces tenuipes* (BAP 640). a. Basidiospores. b. Basidia and basidioles. c. Pleurocystidia-like cells. d. Cheilocystidia. e. Pileocystidia. f. Caulocystidia. Scale bar = 10  $\mu$ m

Basidiospores  $6.8\text{--}8 \times 3.8\text{--}4.8 \mu\text{m}$  [ $x_m = 7.3 \pm 0.48 \times 4.2 \pm 0.25 \mu\text{m}$ ,  $Q = 1.6\text{--}2.0$ ,  $Q_m = 1.73 \pm 0.11$ ,  $n = 20$ ,  $s = 1$ ], lacrymoid, smooth, hyaline, inamyloid, thin-walled. Basidia  $17.5\text{--}19 \times 5.5\text{--}6.5 \mu\text{m}$ , clavate, 4-spored, clamped. Basidioles clavate. Pleurocystidia absent. Cheilocystidia abundant, lamellar edge sterile;  $19\text{--}30 \times 9.5\text{--}16 \mu\text{m}$ , broadly clavate to sphaeropedunculate, lacking apical projections, hyaline, thin-walled. Pileipellis a cutis of radially arranged to loosely interwoven hyphae  $4\text{--}10 \mu\text{m}$  diam, cylindrical, non-inflated, smooth or incrustated with pale grey pigments, non-diverticulate, non-gelatinous, hyaline, inamyloid, thin-walled; not a *Rameales*-structure, not an astrostromelloid-structure; terminal cells cylindrical, obtuse; some hyphae with glassy-reflective contents. Pileus trama interwoven; lamellar trama subregular to slightly interwoven; hyphae  $3.5\text{--}8 \mu\text{m}$  diam, smooth, hyaline or with greyish brown contents, inamyloid, non-gelatinous, thin-walled. Clamp connections present.

Habitat and known distribution – Gregarious, scattered on very rotten wood in coastal cacao-banana grove with secondary forest canopy. Africa (São Tomé).

Material examined – AFRICA. São Tomé, along main road (EN1) on north side of island, west of Ria Luisa at 33 km marker, N00°19.606', E06°30.667', 18 April 2008, coll. by D.E. Desjardin, DED 8266 (Holotype, nLSU–MF100992, ITS–MF100954, SFSU).



**Fig. 5** – Micromorphological features of *Arrhenia cystidiata* (Holotype, DED 8266). a. Basidiospores. b. Basidia and basidiole. c. Cheilocystidia. Scale bar =  $10 \mu\text{m}$

Notes – *Arrhenia cystidiata* is distinguished by very small, pleurotoid basidiomes with pale greyish brown, tomentose-felted pileus, distant greyish brown lamellae, no stipe, hyaline, inamyloid basidiospores with mean  $7.3 \times 4.2 \mu\text{m}$ , no pleurocystidia, broadly clavate to sphaeropedunculate cheilocystidia  $9.5\text{--}16 \mu\text{m}$  diam, a cutis-type pileipellis with non-diverticulate, non-gelatinous hyphae and undifferentiated terminal cells, and growth on very rotten wood. Although the molecular data (see below) suggest placement in *Arrhenia*, morphologically the species is more similar to members of *Marasmiellus*, Sect. *Marasmiellus*, Subsect. *Marasmiellus sensu* Singer (1973), where it shows some affinities to *M. goossensiae* (Beeli) Pegler and *M. purpureoalbus* (Petch) Singer. The latter two species differ, however, in forming larger basidiomes (pileus  $10\text{--}20 \text{ mm}$  diam) with purplish brown pigments, diverticulate cheilocystidia, and *Rameales*-structure pileipelli (Pegler 1977, 1986). *Marasmiellus epochnous* (Berk. & M.A. Curtis) Singer, another small taxon (pileus  $2\text{--}6 \text{ mm}$  diam), differs in forming a tiny stipe ( $0.5\text{--}3 \text{ mm}$  long), diverticulate cheilocystidia, and *Rameales*-structure pileipellis (Singer 1973, Pegler 1986). The small grey-brown basidiomes with cutis-type pileipellis of the new species are also reminiscent of *Resupinatus*, however, *Resupinatus* species have gelatinous tissues and astrostromelloid- or *Rameales*-structure pileipelli.

*Arrhenia cystidiata* is unusual in the genus, which is comprised mainly of bryophilous species

with poorly-developed hymenophores that lack cheilocystidia (Redhead 1984, Redhead et al. 2002). However, wood-rotting species with clavate cheilocystidia are known, e.g., *A. epichysium* (Pers.) Redhead, Lutzoni, Moncalvo & Vilgalys, although the latter species forms much larger, centrally stipitate basidiomes. *Arrhenia cystidiata* is most similar to *A. stercoraria* (Barrasa, Esteve-Rav. & Sánchez) Redhead, Lutzoni, Moncalvo & Vilgalys, but the latter forms cyphelloid basidiomes with a pseudostipe, grows on dung, and because it lacks lamellae has no cheilocystidia (Barrasa et al. 1998).

Pairwise comparisons of aligned, overlapping nLSU sequences of *Arrhenia cystidiata* with the top five BLAST results of taxa with 100% sequence coverage, indicate 97.5% similarity to *Arrhenia auriscalpium* (DQ071732) and 97.2% similarity to *Arrhenia griseopallida* (as *Phaeotellus griseopallidus*, U66436). Pairwise comparisons of aligned, overlapping ITS sequences of *Arrhenia cystidiata* with the top ten BLAST results of taxa with at least 60% sequence coverage, indicate only 82.4–83.3% similarity to two *Arrhenia lobata* sequences (U66429, GU234033). Although *Arrhenia cystidiata* belongs in the Hygrophoraceae, subfamily Lichenomphalioidae *sensu* Lodge et al. (2013) and is only distantly related to gymnopoid fungi, it is treated here because of its resemblance to flabelliform *Marasmiellus* species.

***Pleurocollybia imbricata*** T.J. Baroni, Lodge & Linder, Mycotaxon 103: 355. 2008. Figs 6 7a–d

Facesoffungi number: FoF03730

Pileus 10–22 mm broad, spatulate to flabelliform, plano-convex in profile, margin lobed or cleft, incurved; surface canescent, hygrophanous, brownish grey (6C3) to brownish orange (6C4–5), fading with moisture loss to nearly white, lacking lilac, purple, green or olive shades. Context thin, very fragile, white. Lamellae adnexed to point of attachment, close with 2–3 series of lamellulae, narrow (up to 1 mm), greyish orange (6B3) to pale brownish orange (6C4). Stipe absent; white-tomentose at lateral point of attachment; with numerous white rhizomorphs.

Basidiospores 2.8–3.5 × 2.2–2.8 μm [ $x_m = 3.1 \pm 0.24 \times 2.5 \pm 0.16$  μm, Q = 1.2–1.35,  $Q_m = 1.25 \pm 0.0$ , n = 20, s = 1], subglobose to ovoid, smooth, hyaline, inamyloid, thin-walled. Basidia 14–17 × 4–5 μm, clavate, 4-spored, rarely 2-spored, clamped. Basidioles clavate. Lamellar edge partially fertile. Pleurocystidia absent. Cheilocystidia 20–24 × 2.2–3.5 μm, irregularly cylindrical to flexuous, subcapitate or strangulate, hyaline, thin-walled. Lamellar trama hyphae subparallel, 2.5–9 μm diam, cylindrical or inflated up to 12.5 μm, smooth or roughened, hyaline, non-gelatinous. Pileipellis a cutis of repent, subparallel to interwoven hyphae 2–3.5 μm diam, cylindrical, non-diverticulate, hyaline to pale yellow in 3% KOH, pigment intraparietal and not soluble in KOH, non-gelatinous, giving rise to scattered pileocystidia, 6.5–15 × 2–3.5 μm, cylindrical, as intercalary outgrowths. Pileus trama hyphae 2.5–6.5 μm diam, cylindrical or irregular in outline, hyaline, non-gelatinous, thin-walled or with walls up to 0.5 mm thick. Clamp connections only at the base of basidia, absent in other tissues.

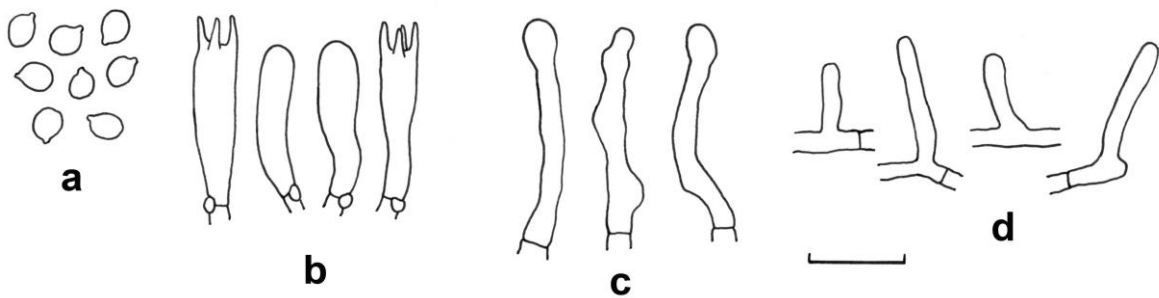
Habit and known distribution –Densely gregarious, imbricate, on soil over very rotten wood in primary forest. Africa (São Tomé), Belize.

Specimen examined – AFRICA. São Tomé, Parque Nacional Obo, on trail to Lagoa Amelia, between N00°17.112', E06°35.967' and N00°16.922', E06°36.062', 14 April 2008, coll. by D. E. Desjardin, DED 8232 (MF100955, SFSU).

Notes – Distinctive features of *Pleurocollybia imbricata* include: a spatulate-lobed, pale brownish grey to brownish orange, hygrophanous pileus; close, brownish orange lamellae; no stipe but with a white-tomentose, lateral attachment point with white rhizomorphs; small, smooth basidiospores with mean 3.1 × 2.5 μm; irregularly cylindrical, subcapitate cheilocystidia 2.2–3.5 μm diam; a cutis-type pileipellis of hyphae 2–3.5 μm diam with yellow parietal pigments; clamp connections present only at the base of basidia; and growth in soil over very rotten wood. Overall basidiome morphology is reminiscent in the field of a species of *Pyrrhoglossum*, for which it was initially confused, but the latter form rusty brown, verrucose basidiospores.



**Fig. 6** – Basidiomes of *Pleurocollybia imbricata* (DED 8232). Scale bar = 10 mm



**Fig. 7** – Micromorphological features of *Pleurocollybia imbricata* (DED 8232). a. Basidiospores. b. Basidia and basidioles. c. Cheilocystidia. d. Pileocystidia. Scale bar = 10  $\mu$ m

The São Tomé specimen is composed of basidiomes in the small end of the size range for *Pleurocollybia imbricata*, a species described recently from Belize (Baroni et al. 2008). Other differences include less crowded lamellae, unbranched and less contorted cheilocystidia, and the presence of clamp connections at the base of basidia. Pairwise comparisons of aligned, overlapping

ITS sequences of DED 8232 with the top ten BLAST results indicate 99% similarity with the holotype specimen of *P. imbricata* (HM105568).

*Pleurocollybia praemultifolia* (Murrill) Singer, Mycologia 39: 80. 1947.

Figs 8, 9a–c

Basionym: *Gymnopus praemultifolius* Murrill, Proc. Fla. Acad. Sci. 7 (2/3): 109. 1945 [1944].

= *Collybia praemultifolia* (Murrill) Murrill, Proc. Fla. Acad. Sci. 7 (2/3): 127. 1945 [1944].

Potential heterotypic synonyms: refer to Pegler (1983).

Facesoffungi number: FoF03731

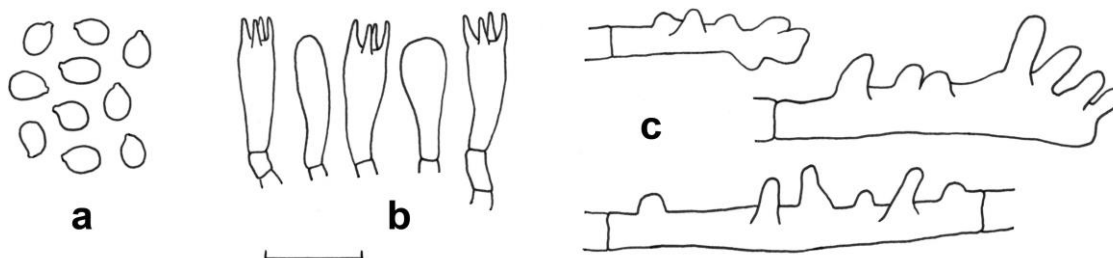
Pileus 45 mm diam, asymmetrically plano-convex with a low broad umbo, margin undulate, lobed, decurved, split in age, non-striate; surface dull, moist, hygrophanous, canescent, disc brown (6–7E5–6; "chestnut brown") to light brown (6D4–5; "hazel"), fading to pale greyish orange (5B3) to dingy buff with moisture loss; drying cream-brown. Context 1–1.5 mm thick, soft, watery greyish orange. Lamellae shallowly adnexed to adnate, extremely crowded with 5 series of truncate lamellulae, narrow (1–1.5 mm), dingy beige to orangish white (5A2); drying cream. Stipe 23 × 3 mm, strongly



**Fig. 8** – Basidiomes of *Pleurocollybia praemultifolia* (DED 8238). Scale bar = 10 mm

eccentric, curved, terete, cylindrical, hollow, tough, non-insititious; surface dull, dry, longitudinally fibrous, light brown 6D4–5) to greyish orange (5B3) overall. Odor not distinctive; taste not observed.

Basidiospores  $3.5\text{--}4.2 \times 2.5\text{--}3.0 \mu\text{m}$  [ $x_m = 3.7 \pm 0.21 \times 2.8 \pm 0.21 \mu\text{m}$ ,  $Q = 1.21\text{--}1.45$ ,  $Q_m = 1.35 \pm 0.06$ ,  $n = 20$ ,  $s = 1$ ], ovoid to ellipsoid, smooth, hyaline, inamyloid, non-dextrinoid, thin-walled. Basidia  $12\text{--}15 \times 4\text{--}5 \mu\text{m}$ , clavate, 4-spored, unclamped. Basidioles clavate. Pleurocystidia absent. Cheilocystidia absent; lamellar edge fertile. Pileipellis a cutis of radially arranged, interwoven hyphae forming a tissue layer several cells thick; hyphae  $2\text{--}6.5 \mu\text{m}$  diam, irregularly cylindrical, smooth or with scattered finger-like or knob-like diverticula, hyaline, inamyloid, non-incrusted, non-gelatinous, thin-walled; terminal cells repent or erect, undifferentiated. Pileus trama interwoven; hyphae  $4\text{--}10 \mu\text{m}$  diam, cylindrical, branched, hyaline, inamyloid, non-incrusted, non-gelatinous, thin-walled to thick-walled ( $-1 \mu\text{m}$ ). Lamellar trama regular; hyphae  $2.5\text{--}12$  ( $-20$ )  $\mu\text{m}$  diam, cylindrical to inflated, hyaline, inamyloid, non-gelatinous, thin-walled. Stipitipellis a cutis; cortical hyphae  $2\text{--}4 \mu\text{m}$  diam, cylindrical or irregular in outline, smooth or with a few scattered knobs, hyaline, inamyloid, non-incrusted, non-gelatinous, thin-walled; medullary hyphae  $5\text{--}16 \mu\text{m}$  diam, cylindrical, hyaline, inamyloid, non-gelatinous, with walls  $0.5\text{--}1.5 \mu\text{m}$  thick. Caulocystidia absent. Clamp connections absent in all tissues.



**Fig. 9** – Micromorphological features of *Pleurocollybia praemultifolia* (DED 8238). a. Basidiospores. b. Basidia and basidioles. c. Pileipellis hyphae and terminal cells. Scale bar =  $10 \mu\text{m}$

Habitat and known distribution – Solitary on a standing dead tree in primary forest. Africa (Príncipe), Caribbean region (Dominica, Guadeloupe, Martinique, Trinidad), North America (Florida), South America (Bolivia).

Material examined – AFRICA. Príncipe, Parque Nacional Obo, trail to Lagoa Amelia, between  $N00^{\circ}17.112'$ ,  $E06^{\circ}35.967'$  and  $N00^{\circ}16.922'$ ,  $E06^{\circ}36.062'$ , 14 April 2008, coll. by D.E. Desjardin, DED 8238 (MF100956, SFSU).

Notes – *Pleurocollybia praemultifolia* is distinguished by a light brown, hygrophane, plano-convex pileus, extremely crowded, narrow, orangish white lamellae, a strongly eccentric, greyish orange stipe, very small, inamyloid (non-dextrinoid) basidiospores with mean  $3.7 \times 2.8 \mu\text{m}$ , no hymenial cystidia or caulocystidia, a cutis-type pileipellis and stipitipellis with smooth or weakly diverticulate, non-dextrinoid hyphae, no clamp connections, and growth on dead wood. The Príncipe specimen matches quite nicely the material reported from the Caribbean region (type locality Florida) and South America (Singer 1970, Pegler 1983).

Pegler (1977) reported *Pleurocollybia brunescens* (Earle) Singer from East Africa and accepted *P. praemultifolia* as a synonym. He later reported both *P. brunescens* and *P. praemultifolia* from the Lesser Antilles (Pegler 1983), accepting them as distinct species, with *P. brunescens* differing in forming lamellae that dry dark brown, hence the specific epithet. He explicitly stated that "the two species are readily separable in the field." Interestingly, Pegler never mentioned dried dark brown lamellae in the African material he collected, and we have not seen this feature in our material. Accordingly, we recognize the African material as representing *P. praemultifolia*.



Pairwise comparisons of aligned, overlapping ITS sequences of *Pleurocollybia praemultifolia* with the top ten BLAST results indicate closest similarity (87.7–90.3%) with two sequences determined as *Pleurocollybia* sp. (KY559342 – Argentina; KP311477 – Australia).

*Callistosporium elegans* Desjardin & B.A. Perry, sp. nov.

Figs 10, 11a–d

Mycobank: MB821158; Facesoffungi number: FoF03732

Holotype – AFRICA. São Tomé, Parque Nacional Obo, trail to Lagoa Amelia, between N00°16.922', E06°36.062' and N00°17.112', E06°35.957', 14 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 617 (SFSU).

Etymology – *elegans* – elegant.

Diagnosis – Pileus 10–20 mm diam, hemispherical to convex, centrally depressed, margin at first inrolled, becoming decurved, non-striate; surface dull, moist to dry, minutely pruinose, dark purplish brown or violet brown (9–11F5–8), hygrophanous, becoming brown with moisture loss. Context 1–2 mm thick, soft, grey. Lamellae adnate, close with 1–2 series of lamellulae, often forked near pileus margin, moderately broad (2–3 mm), purplish brown to violet brown (9–11E6–7). Stipe 20–30 × 2.5–4 mm, central, terete, cylindrical, hollow; surface dull, dry, felted, greyish brown (7C–D3–4) with violet tones, base with white tomentum.



**Fig. 10** – Basidiomes of *Callistosporium elegans* (Holotype, BAP 617). Scale bar = 10 mm

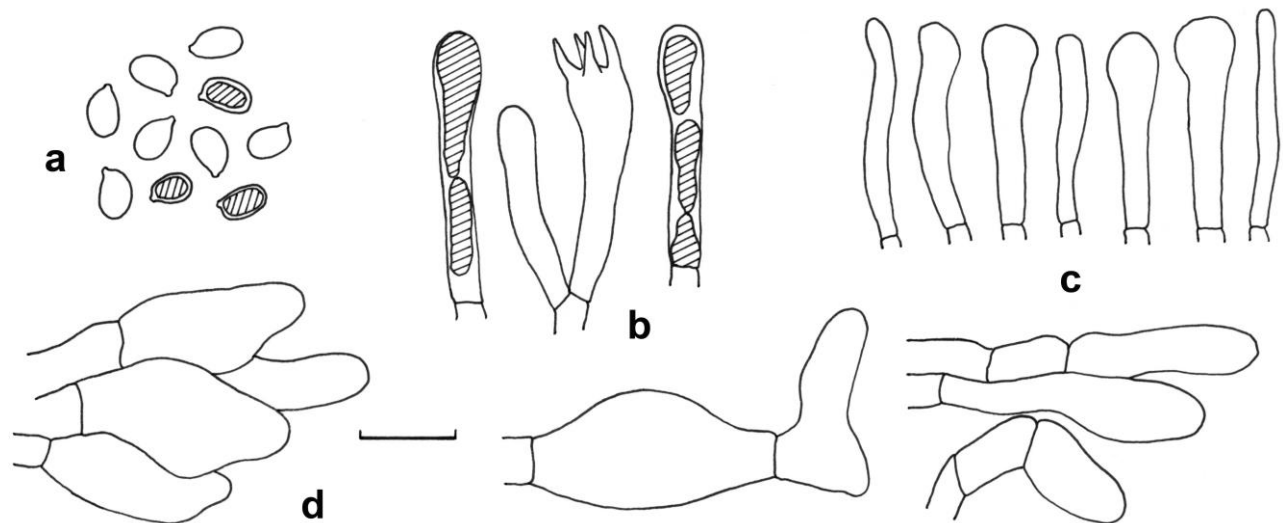
Basidiospores  $4.5\text{--}5.5 \times 3.0\text{--}3.5 \mu\text{m}$  [ $x_m = 4.8 \pm 0.32 \times 3.2 \pm 0.16 \mu\text{m}$ ,  $Q = 1.4\text{--}1.7$ ,  $Q_m = 1.5 \pm 0.12$ ,  $n = 20$ ,  $s = 1$ ], ellipsoid to subovoid, smooth, hyaline or some with purple contents (necropigments), inamyloid, thin-walled. Basidia  $22\text{--}26 \times 5.7\text{--}6.5 \mu\text{m}$ , clavate, 4-spored, hyaline or with purple globular contents, unclamped. Basidioles clavate. Pleurocystidia absent. Lamellar edge sterile. Cheilocystidia  $20\text{--}24 \times 2.2\text{--}4 \mu\text{m}$ , cylindrical to subclavate, apex sometimes subcapitate, up to  $6.5 \mu\text{m}$  diam, hyaline or with purple globular contents, thin-walled. Pileipellis a cutis of interwoven hyphae  $4\text{--}11 \mu\text{m}$  diam, cylindrical, brown (pigments intraparietal), non-incrusted, non-gelatinous, thick-walled; terminal cells erect to repent, cylindrical or narrowed toward apex, obtuse, similar to cheilocystidia,  $2.5\text{--}5 \mu\text{m}$  diam. Pileus trama interwoven; hyphae  $4\text{--}11 \mu\text{m}$  diam, cylindrical, hyaline, non-gelatinous, thin-walled. Lamellar trama regular; hyphae  $3\text{--}10 \mu\text{m}$  diam, cylindrical or inflated, hyaline or with purplish brown contents, non-incrusted, non-gelatinous, thin-walled. Stipitipellis a

cutis with erect caulocystidia; cortical hyphae 2.5–8  $\mu\text{m}$  diam, cylindrical, pale brown to yellowish brown, pigment intraparietal, some with brown globular contents, inamyloid, thin-walled; medullary hyphae 4–16  $\mu\text{m}$  diam, cylindrical to inflated, hyaline, inamyloid, thin-walled. Caulocystidia clustered, 12–30  $\times$  4.5–12.5  $\mu\text{m}$ , irregularly cylindrical to clavate, sometimes geniculate or intercalary, hyaline, inamyloid, thin-walled. Clamp connections absent in all tissues.

Habitat and known distribution – Scattered on decaying logs in upland forest. Africa (São Tomé).

Material examined – AFRICA. São Tomé, Parque Nacional Obo, trail to Lagoa Amelia, between N00°16.922', E06°36.062' and N00°17.112', E06°35.957', 14 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 617 (Holotype, MF100991, SFSU).

Notes – *Callistosporium elegans* is characterized by small, violet-brown basidiomes with forked, violet brown lamellae, inamyloid basidiospores with mean 4.8  $\times$  3.2  $\mu\text{m}$ , a sterile lamellar edge composed of cylindrical-subcapitate cheilocystidia, a cutis-type pileipellis with scattered erect terminal cells, clustered, irregularly cylindrical caulocystidia, no clamp connections, basidiospores and hymenial cells with purple necropigments, and growth on decayed logs. Of the vinaceous to purple-violet pigmented species of *Callistosporium*, *C. elegans* is most phenetically similar to *C. vinosobrunneum* Desjardin & Hemmes, described from native kipukas in the Hawaiian Islands, and *C. amazonicum* Singer, described from Brazil. *Callistosporium vinosobrunneum* differs in forming more reddish brown basidiomes with pellucid-striate pileus, a dark reddish brown stipe, and larger basidiospores with mean 7.1  $\times$  5.6  $\mu\text{m}$  (Desjardin and Hemmes 2011). *Callistosporium amazonicum* forms a pellucid-striate pileus, pinkish grey lamellae, a smaller and more gracile stipe (14–17  $\times$  1.5–2.5 mm), and smaller basidiospores in the range 3–4.5  $\times$  1.7–3.5  $\mu\text{m}$  (Singer 1977).



**Fig. 11** – Micromorphological features of *Callistosporium elegans* (Holotype, BAP 617). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. d. Caulocystidia. Scale bar = 10  $\mu\text{m}$

Pairwise comparison of aligned, overlapping regions of the ITS sequence of the holotype material with the top 10 BLAST hits, indicate closest similarity to *Callistosporium graminicolor* Lennox (87.6%; DQ484065) and an undetermined *Callistosporium* collection from Tennessee, USA (85.0%; KUO58492). It should be noted however that few *Callistosporium* sequences are currently available in public databases.

*Cyptotrama asprata* (Berk.) Redhead & Ginns, Can. J. Bot. 58(6): 731. 1980.

Fig. 12

Basionym: *Agaricus aspratus* Berk., London J. Bot. 6: 481. 1847.

= *Lepiota asprata* (Berk.) Sacc., Syll. Fung. (Abellini) 5: 48. 1887.

= *Mastocephalus aspratus* (Berk.) Kuntze, Revis. Gen. Pl. (Leipzig) 2: 859. 1891.

= *Armillaria aspratus* (Berk.) Petch, Ann. R. Bot. Gdns. Peradeniya 4(6): 386. 1910.

= *Xerula asprata* (Berk.) Aberdeen, Kew Bull. 16(1): 129. 1962.

= *Xerulina asprata* (Berk.) Pegler, Kew Bull. 27(1): 196. 1972.

Possible heterotypic synonyms: refer to Pegler (1977, 1986), Redhead and Ginns (1980).

Facesoffungi number: FoF03733

For a description of African material refer to Pegler (1977).

Habitat and known distribution – Solitary to scattered on decaying wood in primary and secondary forests. Old World tropics and the Pacific.

Material examined – AFRICA. Príncipe, Roça Pico Papagaio, N01°37.182', E07°23.474', 21 April 2008, coll. by B.A. Perry and D.E. Desjardin, DED 8294 (MF100957, SFSU). São Tomé, Macambrara, radio antenna area, N00°16.557', E06°36.326', elev. 1300 m, 11 April 2008, coll. by B.A. Perry, DED 8204 (MF100958, SFSU); along road to Bombain, N00°16.615', E06°38.942', elev. 400 m, 26 April 2008, coll. by D.E. Desjardin, DED 8336 (MF100959, SFSU).



**Fig. 12** – Basidiomes of *Cyptotrama asprata* (DED 8336). Scale bar = 10 mm

Notes – The material of *Cyptotrama asprata* from São Tomé and Príncipe matches quite nicely that reported from Africa (East Africa, Kenya, South Africa) by Pegler (1977; as *Xerulina asprata*), and the topotypical material from Sri Lanka described by Pegler (1986; as *X. asprata*). The pileus is initially deep orange (5–6A7–8) and covered with pyramidal furfuraceous squamules, then fades to pale orange (5A4–5), yellow (4A5–8) and eventually yellowish white to cream (4A2–3) on the margin with a squamulose disc and granulose margin. A recent treatment of *Cyptotrama* from Asia that used DNA sequences to aid in species recognition (Qin & Yang 2016), distinguished *C. asprata* from *C. chrysopepla* (Berk. & M.A. Curtis) Singer, the latter commonly accepted as a synonym of the former,

as follows: *C. asprata* has subacute hymenial cystidia, an epithelium-type pileipellis, and thin-walled cells of the stipe squamules, whereas *C. chrysopepla* has attenuate hymenial cystidia, a hymeniderm-type pileipellis, and thick-walled cells of the stipe squamules. Based on material of *C. asprata* that we have studied from throughout the Old World tropics, the hymenial cystidia are often obtuse but never subcapitate as in *C. chrysopepla*, and the cells of the stipe squamules are never thin-walled. Rather, they are usually solid (which may appear thin-walled) with only a thin line of lumen to thick-walled (1–4 µm).

Pairwise comparisons of aligned, overlapping ITS sequences of São Tomé specimens of *Cyptotrama asprata* with the top ten BLAST results indicate closest similarity (97.2–99%) to specimens of *C. asprata* from China (KR607174, KR607179, KR607189, KR607192), Korea (KF668296, KF668317) and Martinique (KM588682).

***Tricholomopsis aurea*** (Beeli) Desjardin & B.A. Perry, comb. nov.

Figs 13, 14a–d

Basionym: *Marasmius aureus* Beeli, Bull. Soc. R. Bot. Belg. 60(2): 155. 1928.

= *Collybia aurea* (Beeli) Pegler, Kew Bull. 21(3): 516. 1968.

Holotype – AFRICA. Democratic Republic of Congo, Eala, in groups on dead wood in an inundated forest, May 1923, *M. Goossens-Fontana* 149 (BR 31303-69).

Mycobank: MB821170; Facesoffungi number: FoF03734

Pileus 7–33 mm diam, convex to broadly convex, expanding to plano-convex, shallowly depressed or umbilicate in age; margin decurved, even, not striate, sometimes splitting; surface dull, moist, glabrous, hygrophanous, golden to orangish yellow (4–5A–B6–8), fading with moisture loss to yellow (4A4–5) or light yellow (3A3–4). Context 1 mm thick, yellow, soft. Lamellae adnate, sometimes with a short decurrent tooth, crowded with 3–5 series of lamellulae, narrow (1–2 mm), deep yellow (4A7–8) to deep orangish yellow (4B7–8). Stipe 10–50 × 2–5 mm, central to slightly eccentric, terete or cleft, cylindrical or with a flared apex and narrowed base, hollow, non-insititious; surface dull, dry, mostly glabrous, very apex with minute white pruinæ, base with appressed white tomentum, orangish yellow (4–5A–B6–8). Odor mild. Taste mild or faintly like bleach.

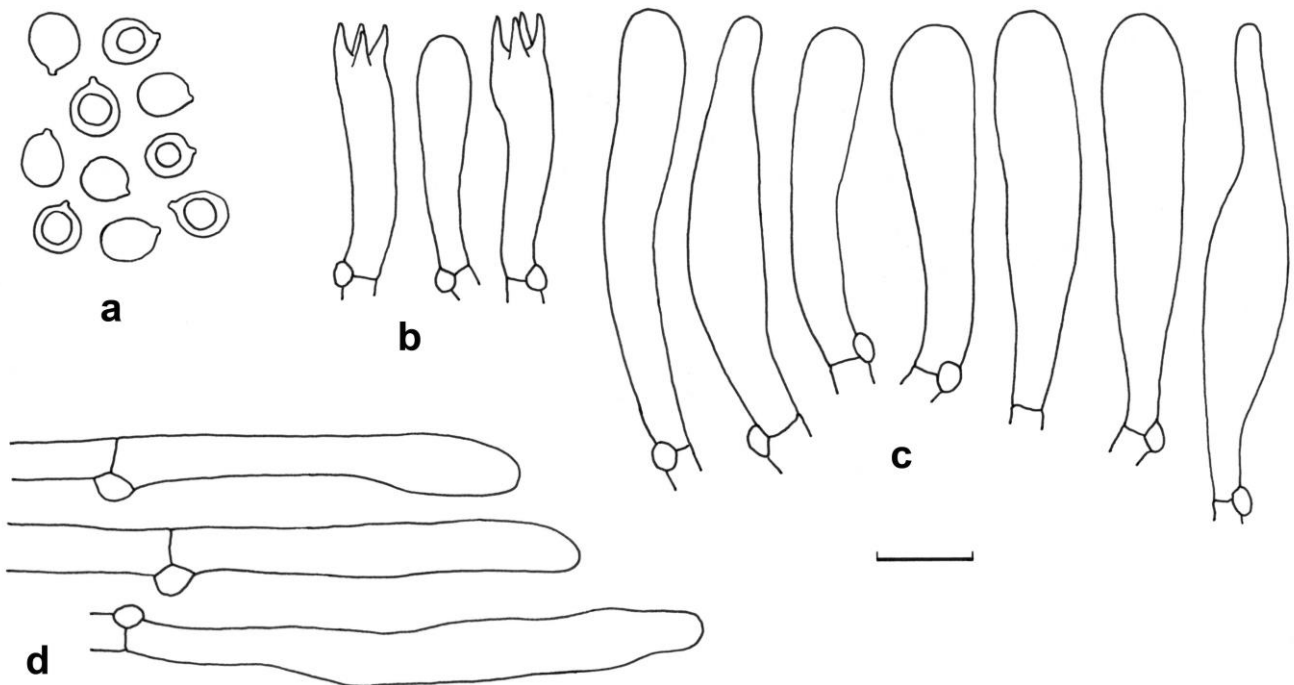
Basidiospores 5–6 (–6.5) × 4.5–5.2 µm [ $x_{mr} = 5.5–5.6 \times 4.8 \mu\text{m}$ ,  $x_{mm} = 5.5 \pm 0.07 \times 4.8 \pm 0.06 \mu\text{m}$ ,  $Q = 1.1–1.3$ ,  $Q_{mr} = 1.13–1.17$ ,  $Q_{mm} = 1.15 \pm 0.03$ ,  $n = 10–20$ ,  $s = 2$ ], subglobose to ovoid or broadly ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia 20–25 × 5.5–6.5 µm, clavate, 2-spored and 4-spored, with sterigmata up to 5.5 µm long, hyaline or with yellow amorphous globular contents. Basidioles clavate, hyaline, sometimes with yellow contents. Pleurocystidia absent. Lamellar edge sterile. Cheilocystidia 36–52 × 6–9.5 (–12) µm, subcylindrical to clavate, broadly obtuse, hyaline, inamyloid, thin-walled. Pileipellis a cutis of repent, radially arranged, weakly interwoven hyphae 3–10 µm diam, cylindrical, smooth, non-incrusted or with hyaline annular incrustations, non-diverticulate, hyaline to pale yellow, inamyloid, non-gelatinous, thin-walled. Pileus trama interwoven; hyphae 5–13 (–16) µm diam, cylindrical to inflated, smooth, hyaline to pale yellow, inamyloid, non-gelatinous, thin-walled. Lamellar trama subparallel; hyphae 2.5–8 µm, cylindrical or inflated up to 12 µm diam, hyaline to pale yellow, inamyloid, non-gelatinous, thin-walled; with scattered yellow oleiferous hyphae. Stipitipellis a cutis; cortical hyphae 3–7 µm diam, cylindrical, smooth, hyaline to yellow, inamyloid, non-gelatinous, thin-walled; medullary hyphae similar but 3–10 µm diam, cylindrical or inflated. Caulocystidia scattered or clustered on stipe apex, 43–64 × 5.5–8 µm, irregularly cylindrical to clavate, hyaline, thin-walled. Clamp connections present.

Habitat and known distribution – Scattered to gregarious on rotten wood in primary forest. Pantropical; Africa (DR Congo, Kenya, São Tomé, Tanzania, Uganda, Zaire), Caribbean (Guadeloupe, Martinique, Trinidad).

Material examined – AFRICA. São Tomé, Macambrara, radio antenna area, 1300 m elev., N00°16.557', E06°36.326', 25 April 2008, coll. by D.E. Desjardin, DED 8327 (nLSU–MF100993,



**Fig. 13** – Basidiomes of *Tricholomopsis aurea* (DED 8327). Scale bar = 10 mm



**Fig. 14** – Micromorphological features of *Tricholomopsis aurea* (DED 8327, BAP 618). a. Basidiospores. b. Basidia and basidiole. c. Cheilocystidia. d. Caulocystidia. Scale bar = 10  $\mu$ m

ITS–MF100960, SFSU); Parque Nacional Obo, along trail from Bom Sucesso to Lagoa Amelia, between N00°17.112', E06°35.967' and N00°16.922', E06°36.062', 14 April 2008, coll. by B.A. Perry, BAP 618 (nLSU–MF100994, ITS–MF100961, SFSU).

Notes – *Marasmius aureus* was described originally from Eala, DR Congo, and the material from São Tomé matches quite nicely with that reported in the protologue (Beeli 1928). Pegler (1968) transferred the species to *Collybia*, but the latter genus is now restricted to species allied with *C. tuberosa* (Bull.) P. Kumm., which form small, white basidiomes that arise from sclerotia. The micromorphology of this golden species is more similar to the genus *Tricholomopsis*, as first suggested by Dennis (1970: 27), with subglobose, inamyloid basidiospores, large, clavate cheilocystidia, and a cutis-type pileipellis. Moncalvo et al. (2002) were the first to show a sister relationship between *Collybia aurea* and *Tricholomopsis rutilans*, based on nLSU sequences of New World specimens. Their nLSU sequence of *C. aurea* (AF261403) was from a specimen collected in Puerto Rico (RV.PR98/27; DUKE), which has 99.5–99.8% sequence similarity to the two São Tomé specimens cited above. Pairwise comparisons of aligned, overlapping ITS sequences of *C. aurea* with the top ten BLAST results indicate 96.8–99.2% similarity to "uncultured fungus" sequences, and 91.1–91.6% similarity to *Tricholomopsis* sp. (KP012806). The "uncultured fungus" sequence with 99.2% similarity (KU2012-31) was from material isolated from a decayed stump of *Anthosthema aubryanum* (Euphorbiaceae) in Gabon, a substrate and region likely to host *C. aurea*. Pairwise comparisons of aligned, overlapping nLSU sequences of *C. aurea* with the top ten BLAST results indicate 95.2–95.6% similarity with sequences of *Tricholomopsis decora* (Fr.) Singer and *T. rutilans* (Schaeff.) Singer. Rather than retain *C. aurea* in *Collybia* where it surely does not belong, given that it shows closer molecular and morphological similarity to *Tricholomopsis* than to other known genera, and lacking substantial supportive data to erect a new genus for *C. aurea*, we formally transfer the taxon as *Tricholomopsis aurea*.

***Trogia infundibuliformis*** Berk. & Broome, J. Linn. Soc., Bot. 14(73): 45. 1873 (1875).

Figs 15, 16a–c

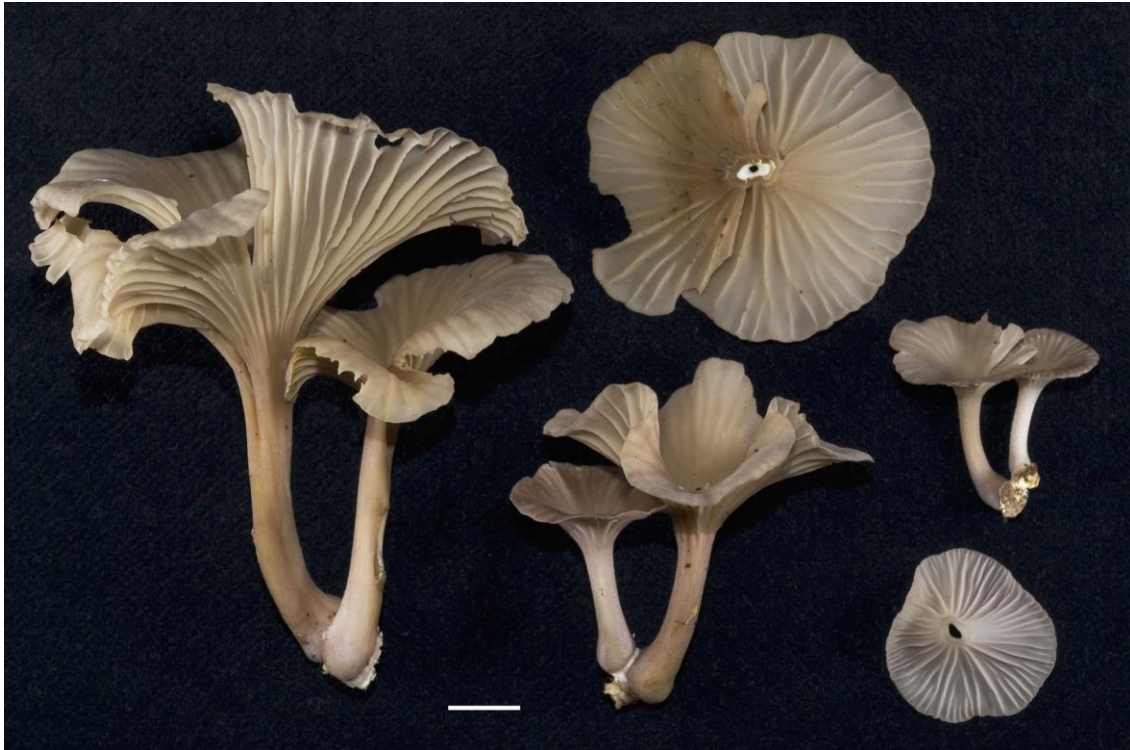
Potential heterotypic synonyms: refer to Corner (1966), Pegler (1986)

Facesoffungi number: FoF03735

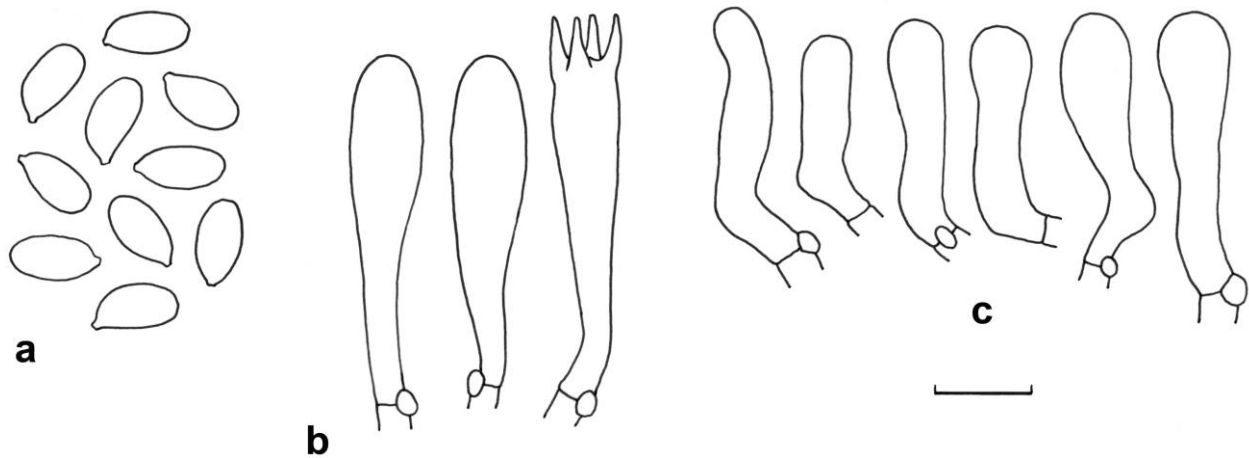
Pileus 15–70 mm diam, infundibuliform, perforate, striate to sulcate; surface moist to dry, dull, glabrous, hygrophanous, faintly radially streaked, pale greyish red (7–8B3) with a hint of violet, with slightly darker streaks. Context <1 mm thick, rubbery-pliant, concolorous with pileus surface. Lamellae long-decurrent, distant to remote with 2–3 series of lamellulae, narrow (0.5–1.5 mm), not intervenose, not forked, dingy buff to pale greyish red (7–8B3). Stipe 15–40 × 2–5 mm, central to eccentric, terete, seldom longitudinally cleft, centrally cylindrical with a flared apex and subbulbous base, tough, pliant, hollow, subsinistitious; surface dull, dry, glabrous, greyish red (8C3) or darker. Odor pleasant.

Basidiospores 8–9.6 × 4.5–5.4 μm [ $x_m = 8.71 \pm 0.53 \times 4.96 \pm 0.29$  μm, Q = 1.6–1.9,  $Q_m = 1.76 \pm 0.05$ , n = 12, s = 1], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia 32–38 × 7–8.5 μm, clavate, 4-spored. Basidioles clavate. Pleurocystidia absent. Lamellar edge fertile. Cheilocystidia clustered, inconspicuous, 19–32 × 4.8–8 μm, basidiole-like, cylindrical to clavate, hyaline, thin-walled. Pileipellis a cutis of repent hyphae with a few, erect, cylindrical to irregularly clavate outgrowths 3–15 × 2.5–5 μm; hyphae 2.5–5 μm diam, cylindrical, hyaline, inamyloid, non-incrusted, non-gelatinous. Pileus trama and lamellar trama sarcodimitic; hyphae 2.2–5 μm diam, cylindrical, branched, and 8–24 μm diam, fusiform, hyaline, inamyloid, non-gelatinous, thin- to thick-walled. Stipitipellis like the pileipellis, with scattered outgrowths; medullary hyphae sarcodimitic, with cylindrical cells 2.5–5 μm diam, and fusiform cells 5–24 μm diam, hyaline, inamyloid, non-gelatinous, thin-walled or with walls up to 2 μm thick. Caulocystidia absent. Clamp connections present.

Habitat and known distribution – Scattered to gregarious on wood in secondary forest. Africa (Príncipe, Uganda, Zaire), Malaysia, Sri Lanka, Thailand.



**Fig. 15** – Basidiomes of *Trogia infundibuliformis* (DED 8286). Scale bar = 10 mm



**Fig. 16** – Micromorphological features of *Trogia infundibuliformis* (DED 8286). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. Scale bar = 10  $\mu$ m

Material examined – AFRICA. Príncipe, Roça Pico Papagaio, N01°37.182', E07°23.474', 21 April 2008, coll. by D.E. Desjardin, DED 8286 (SFSU).

Notes – *Trogia infundibuliformis*, described from Sri Lanka, is paleotropical in distribution, and easily recognized by the large, deeply infundibuliform, rubbery-pliant basidiomes with pale greyish red

to pinkish violet, perforate pileus, very narrow, deeply decurrent lamellae, basidiospores in the range (6.3–) 7–9.6 × 4.5–6 μm, sarcodimitic tissues, inconspicuous cheilocystidia, and lacks pleurocystidia, pileocystidia and caulocystidia. The Príncipe material matches nicely that reported from Africa (Pegler 1977), Sri Lanka (Pegler 1986) and tropical Asia (Corner 1966), but has basidiospores at the larger end of the range. Although the type species of the genus *Trogia* Fr. (*Cantharellus aplorutis* Mont. = *Trogia montagnei* Fr.) from India is poorly known, *T. infundibuliformis* is one of the species most phenetically similar to the protologue of *Trogia*, representing what we recognize as the core morphotype for the genus. Repeated attempts to obtain quality DNA sequences from DED 8286 were unsuccessful.

*Trogia anthidepas* (Berk. & Broome) Corner, Monogr. Cantharelloid Fungi: 195. 1966.

Figs 17, 18a–f

Basionym: *Agaricus anthidepas* Berk. & Broome, J. Linn. Soc., Bot. 11(56): 527. 1871

= *Omphalia anthidepas* (Berk. & Broome) Sacc., Syll. Fung. (Abellini) 5: 325. 1887.

= *Hydropus anthidepas* (Berk. & Broome) Singer, Fl. Neotrop. Monogr. 32: 53. 1982.

Potential heterotypic synonyms: refer to Corner (1966), Pegler (1986).

Facesoffungi number: FoF03736

Pileus 35–50 mm diam, convex, becoming plane-depressed to shallowly umbilicate, pellucid-striate, margin decurved to straight; surface dull, dry, glabrous, hygrophanous, yellowish brown (5E4–5) to light yellowish brown (5D5–6) with olive tones, with darker radial streaks. Context ≤1 mm thick, rubbery-pliant, pale yellowish olive. Lamellae decurrent to adnate with a decurrent tooth, distant with 3–4 series of lamellulae, broad (2–3 mm), strongly intervenose to reticulate at maturity, pale yellowish white (4A2) to greyish yellow (4B4–5). Stipe 25–35 × 3–5 mm, central, terete, cylindrical above a subbulbous base, tough, pliant, hollow, subsinistitious; surface dull, dry, glabrous, apex off-white, greyish yellow (4B4–5) at the base.



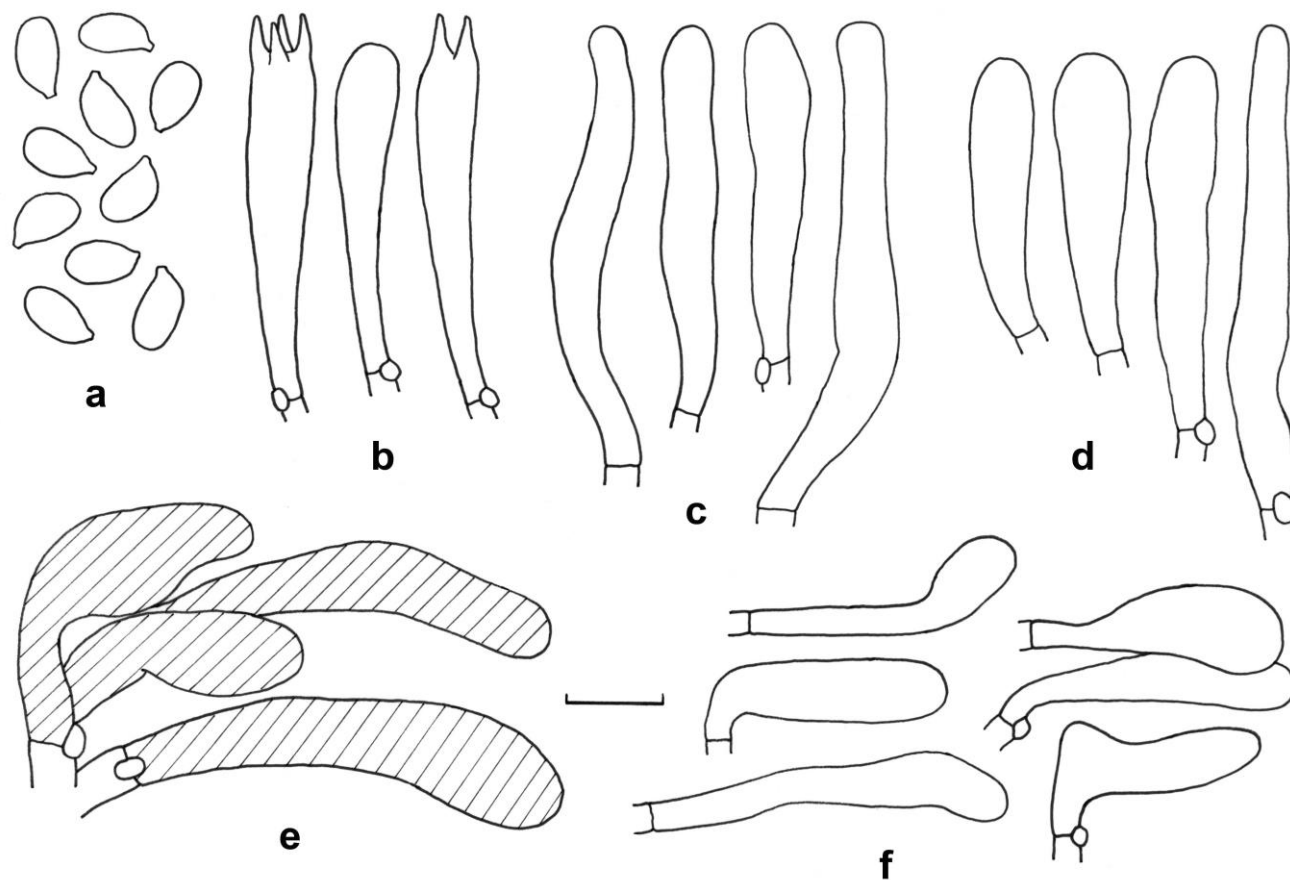
**Fig. 17** – Basidiomes of *Trogia anthidepas* (DED 8291). Scale bar = 10 mm



Basidiospores 7–8.3 × 4.2–4.8 μm [ $x_m = 7.68 \pm 0.42 \times 4.41 \pm 0.2 \mu\text{m}$ ,  $Q = 1.6\text{--}1.8$ ,  $Q_m = 1.74 \pm 0.07$ ,  $n = 20$ ,  $s = 1$ ], ellipsoid, smooth, hyaline, inamyloid. Basidia 30–36 × 6.5–7 μm, clavate, 2-spored and 4-spored. Basidioles clavate. Pleurocystidia inconspicuous, scattered, often collapsed, 37–54 × 5–7 μm, cylindrical to clavate, arising from just below the subhymenium, not projecting above basidia, with hyaline (apex) to greyish brown (base) walls. Lamellar edge fertile. Cheilocystidia clustered, scattered, 24–52 × 6.5–8 μm, cylindrical to clavate, hyaline, thin-walled. Pileipellis a cutis of radially arranged hyphae 3–5 μm diam, cylindrical, non-diverticulate, giving rise to scattered, clustered or solitary pileocystidia 25–50 × 7–11 μm, cylindrical, clavate or ventricose, similar to the cheilocystidia but with brown contents. Pileus trama and lamellar trama sarcodimitic; hyphae 3–5 μm diam, cylindrical, and 5–18 μm diam, fusiform, hyaline, inamyloid, thin-walled, non-gelatinous. Stipe cortical hyphae 2–8 μm diam, parallel, cylindrical, hyaline, inamyloid, non-gelatinous, thin- to thick-walled; medullary hyphae sarcodimitic, with long fusiform cells up to 20 μm diam and shorter cylindrical hyphae 2–5 μm diam. Caulocystidia abundant, clustered, 19–40 × 5–7 μm, subcylindrical to clavate or irregular in outline, hyaline or with brown contents, thin-walled. Clamp connections present.

Habitat and known distribution – Solitary on woody debris in secondary forest. Africa (Príncipe), Malaysia, Singapore, Sri Lanka,

Material examined – AFRICA. Príncipe, Roça Pico Papagaio, N01°37.182', E07°23.474', 21 April 2008, coll. by D.E. Desjardin, DED 8291 (SFSU).



**Fig. 18** – Micromorphological features of *Trogia anthidepas* (DED 8291). a. Basidiospores. b. Basidia and basidiole. c. Pleurocystidia. d. Cheilocystidia. e. Pileocystidia. f. Caulocystidia. Scale bar = 10 μm

Notes – *Trogia anthidepas* was described originally from Sri Lanka. It is variable in size and coloration and has been described independently at least four times (see synonymy reported by Pegler 1986). The Príncipe specimen matches nicely the Malaysian material reported by Corner (1966), differing subtly in a few features. Our material forms basidiospores at the shorter end of the range, and has very inconspicuous pleurocystidia. In comparison Corner (1966) reported the basidiospores as  $7\text{--}10 \times 4\text{--}5.5 \mu\text{m}$ , and the species as lacking pleurocystidia. Pegler (1986) recognizes the species as belonging to the genus *Hydropus*, and reported the basidiospores with mean  $8 \times 4.7 \mu\text{m}$ , and no pleurocystidia. Repeated attempts to obtain quality DNA sequences from DED 8291 were unsuccessful.

*Trogia* aff. *brevipes* Corner, Gdns' Bull., Singapore, Suppl. 2: 20. 1991.

Figs 19, 20a–e

Facesoffungi number: FoF03737

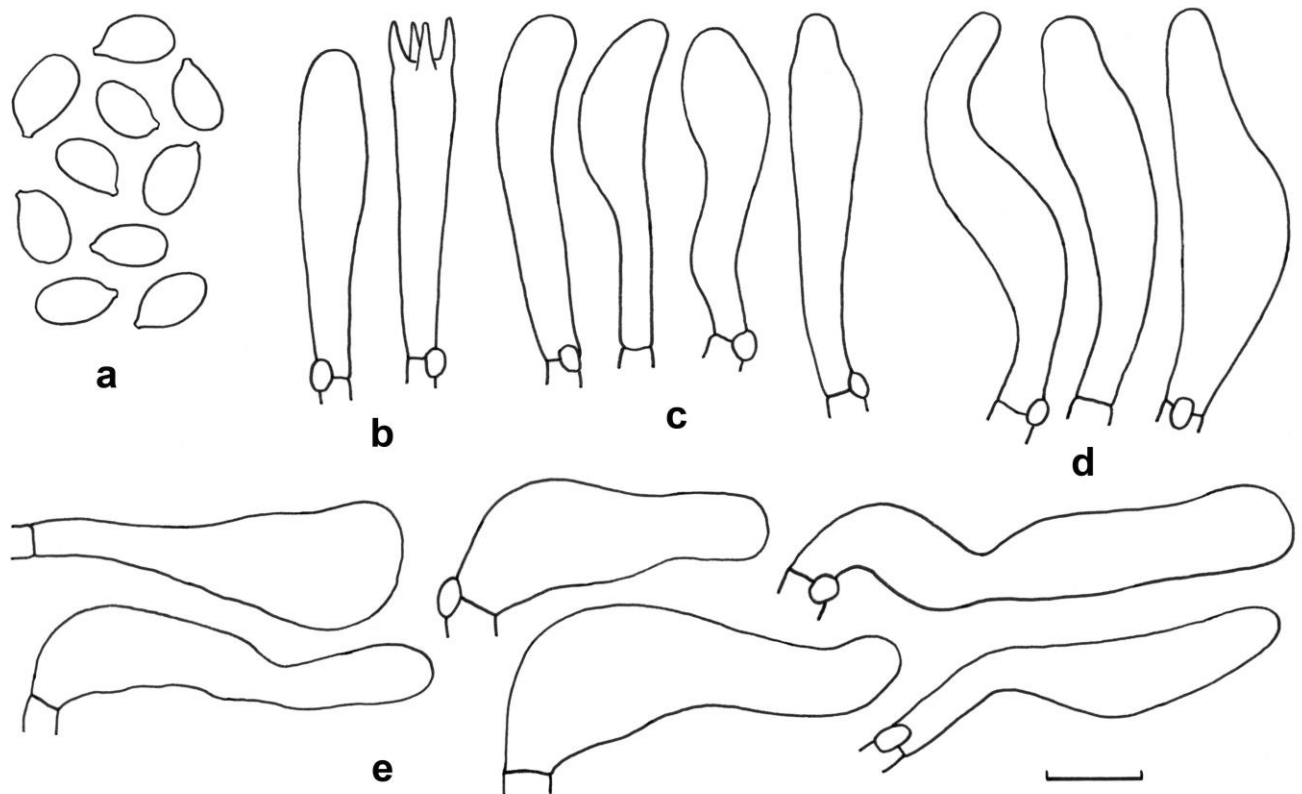
Pileus 12–22 mm diam, convex, umbilicate becoming plane-umbilicate, margin decurved, striate; surface dull, dry, glabrous, radially streaked, yellowish brown (5E6–8) with a hint of olive, with darker streaks, in age becoming dark yellowish brown (5–6F6–8) overall. Context <1 mm thick, pliant,



**Fig. 19** – Basidiomes of *Trogia* aff. *brevipes* (DED 8241). Scale bar = 10 mm

concolorous with pileus surface. Lamellae decurrent, subdistant (16–23) with 1–2 series of lamellulae, brown (1–3 mm), yellowish brown (5D6–8). Stipe 7–10 × 1–3 mm, central to eccentric, cylindrical or slightly narrowed downward, curved, tough, hollow, subsinistitious; surface dull, dry, glabrous, yellowish brown (5D6–8) to dark yellowish brown (5–6F6–8). Basidiomes entirely yellowish brown with a hint of olive in age.

Basidiospores  $7.4\text{--}9 \times 4.5\text{--}5.5 \mu\text{m}$  [ $x_m = 7.85 \pm 0.39 \times 4.82 \pm 0.34 \mu\text{m}$ ,  $Q = 1.5\text{--}1.8$ ,  $Q_m = 1.63 \pm 0.07$ ,  $n = 20$ ,  $s = 1$ ], ellipsoid, smooth, inamyloid, thin-walled. Basidia  $32\text{--}40 \times 7\text{--}8 \mu\text{m}$ , clavate, 4-spored. Basidioles clavate. Pleurocystidia absent. Lamellar edge fertile. Cheilocystidia scattered,  $35\text{--}43 \times 6\text{--}9 \mu\text{m}$ , subcylindrical to clavate or subventricose, hyaline, thin-walled. Pileipellis a cutis with scattered pileocystidia; hyphae  $2.5\text{--}5 \mu\text{m}$  diam, cylindrical, non-diverticulate, hyaline or with brown contents, inamyloid, non-incrusted, non-gelatinous; pileocystidia  $35\text{--}56 \times 8\text{--}13.5 \mu\text{m}$ , subcylindrical to clavate or ventricose, walls hyaline to brown, with brown contents, inamyloid, thin- to thick-walled. Pileus trama and lamellar trama sarcodimitic; hyphae  $2.5\text{--}5 \mu\text{m}$  diam, cylindrical, and  $5\text{--}16 \mu\text{m}$  diam, fusiform, hyaline, inamyloid, non-gelatinous. Stipe cortical hyphae  $2.5\text{--}10 \mu\text{m}$  diam, cylindrical, parallel, hyaline to pale brown, inamyloid, thin-walled; medullary hyphae sarcodimitic, with cylindrical cells  $2.5\text{--}10 \mu\text{m}$  diam and fusiform cells up to  $25 \mu\text{m}$  diam, hyaline, inamyloid, non-gelatinous, thin-walled. Caulocystidia scattered to clustered,  $25\text{--}65 \times 6.5\text{--}13 \mu\text{m}$ , subcylindrical to clavate, ventricose or irregular in outline, yellowish brown, thin-walled. Clamp connections present.



**Fig. 20** – Micromorphological features of *Trogia* aff. *brevipes* (DED 8241). a. Basidiospores. b. Basidium and basidiole. c. Cheilocystidia. d. Pileocystidia. e. Caulocystidia. Scale bar =  $10 \mu\text{m}$

Habitat and known distribution – Scattered on woody debris in primary forest. Africa (São Tomé), Borneo.

Material examined – AFRICA. São Tomé, Parque Nacional Obo, on trail to Lagoa Amelia,

between  $00^{\circ}17.112'$ ,  $E06^{\circ}35.967'$  and  $N00^{\circ}16.922'$ ,  $E06^{\circ}36.062'$ , 14 April 2008, coll. by D.E. Desjardin, DED 8241 (SFSU).

Notes – *Trogia* aff. *brevipes* is characterized by rather small, yellowish-olivaceous brown basidiomes with deeply umbilicate-striate pileus, subdistant, broad lamellae, a short glabrous stipe, basidiospores with mean  $7.8 \times 4.8 \mu\text{m}$ , subcylindrical to clavate cystidia on lamellae edges, pileipellis and stipitipellis, no pleurocystidia, sarcodimitic tissues, and growth on woody debris. *Trogia brevipes*, described from Borneo, is indistinguishable micromorphologically but differs subtly in forming more obviously pruinose pileus and stipe surfaces, and has narrower and more crowded lamellae. A side-by-side comparison with *Trogia* aff. *furcata* reveals nearly indistinguishable micromorphology, but the latter forms paler basidiomes lacking olive tones, and has a forked to venose-reticulate hymenophore at maturity. Repeated attempts to obtain quality DNA sequences from DED 8241 were unsuccessful.

*Trogia* aff. *furcata* Corner, Monogr. Cantharelloid Fungi: 210. 1966.

Figs 21, 22a–c

Facesoffungi number: FoF03738

Pileus 10–18 mm diam, broadly convex-umbilicate to shallowly infundibuliform, margin striate, wavy, often lobed; surface dull, dry, glabrous, radially streaked, disc and streaks yellowish brown (5E5–6), elsewhere pale greyish yellow (4B3–5) to cream-buff, in age darkening overall to dark yellowish brown (5F4–8). Context <1 mm thick, pliant, pale greyish yellow (4B3). Lamellae decurrent, close to subdistant with 2–3 series of lamellulae, often forked or anastomosing, venose-reticulate in age, narrow (0.5–1 mm), nearly white when young, becoming dingy pale yellowish grey in age. Stipe 15–30  $\times$  1–3 mm, central to eccentric, terete or compressed, tough, hollow, subsinistitious; surface dull, dry, glabrous; apex greyish yellow (4B3–4), base dark brown to black. Odor strongly fungal.

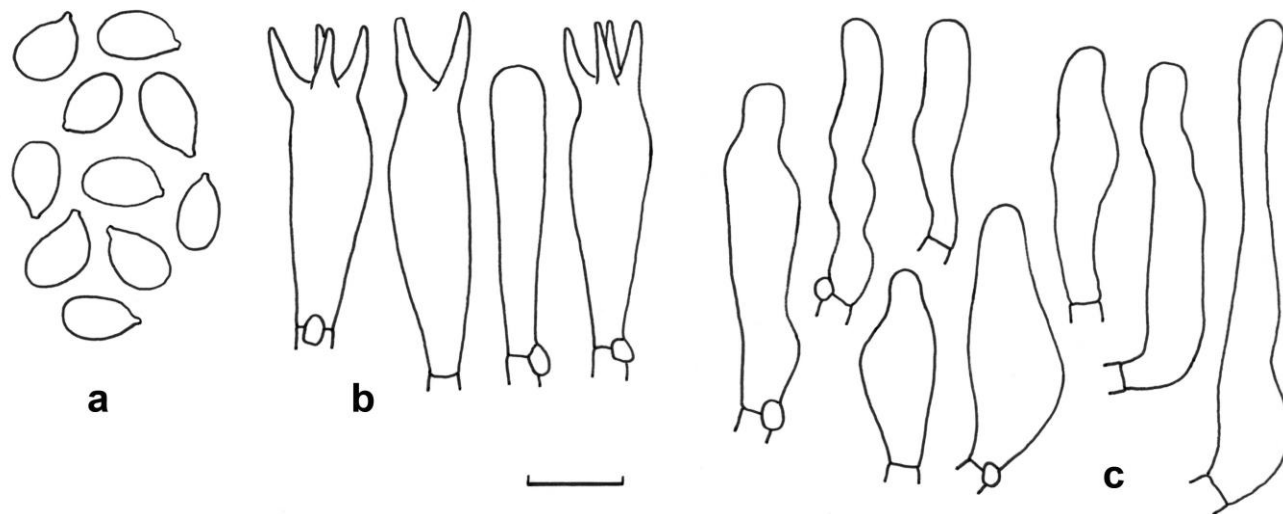


**Fig. 21** – Basidiomes of *Trogia* aff. *furcata* (DED 8260). Scale bar = 10 mm

Basidiospores  $7.4\text{--}8.5 \times 4.2\text{--}5.5 \mu\text{m}$  [ $x_m = 8.05 \pm 0.4 \times 5.14 \pm 0.33 \mu\text{m}$ ,  $Q = 1.5\text{--}1.7$ ,  $Q_m = 1.57 \pm 0.08$ ,  $n = 20$ ,  $s = 1$ ], ellipsoid, smooth, hyaline, inamyloid. Basidia  $25\text{--}38 \times 7\text{--}8 \mu\text{m}$ , clavate, 4-spored with sterigmata up to  $8 \mu\text{m}$  long, many 2-spored with sterigmata up to  $12 \mu\text{m}$  long, few 1- or 3-spored. Basidioles clavate. Pleurocystidia absent. Lamellar edge sterile near the margin of pileus, fertile elsewhere. Cheilocystidia  $22\text{--}36$  ( $-52$ )  $\times 4\text{--}9.5 \mu\text{m}$ , irregularly cylindrical to subclavate or ventricose, hyaline. Pileipellis a cutis of repent hyphae  $3\text{--}8 \mu\text{m}$  diam, cylindrical, non-diverticulate, hyaline to yellow, non-incrusted, non-gelatinous; pileocystidia absent or few, similar to the cheilocystidia. Hypodermium absent. Pileus trama and Lamellar trama sarcodimitic; hyphae  $2.5\text{--}5 \mu\text{m}$  diam, cylindrical, and  $5\text{--}13 \mu\text{m}$  diam, fusiform, hyaline, inamyloid, non-gelatinous. Stipe cortical hyphae  $2.5\text{--}8 \mu\text{m}$  diam, cylindrical, hyaline, inamyloid, non-gelatinous; medullary hyphae sarcodimitic, with cylindrical hyphae  $2.5\text{--}5 \mu\text{m}$  diam, and fusiform hyphae  $5\text{--}16 \mu\text{m}$  diam, hyaline, inamyloid, thin-walled. Caulocystidia few, scattered or clustered, similar to the cheilocystidia. Clamp connections present.

Habitat and known distribution – Gregarious on rotten wood in coastal secondary forest. Africa (São Tomé), Brunei.

Material examined – AFRICA. São Tomé, Shipwreck Cove, along EN-1 on north side of the island at 18 km marker, N00°23.687', E06°36.302', 17 April 2008, coll. by D.E. Desjardin. DED 8260 (MF100962, SFSU).



**Fig. 22** – Micromorphological features of *Trogia* aff. *furcata* (DED 8260). a. Basidiospores. b. Basidia and basidiole. c. Cheilocystidia. Scale bar =  $10 \mu\text{m}$

Notes – *Trogia* aff. *furcata* is characterized by small, shallowly infundibuliform basidiomes with yellowish brown, streaked pileus, long decurrent, forked to venose-reticulate lamellae, a tough brown stipe, inamyloid basidiospores with mean  $8 \times 5.1 \mu\text{m}$ , scattered cylindrical to subclavate cheilocystidia, no pleurocystidia, sarcodimitic tissues, sparse pileocystidia and caulocystidia, and growth on rotten wood. It differs slightly from *T. furcata*, described from Brunei, which forms darker fuscous pileus, a shorter stipe ( $8\text{--}14 \text{mm}$ ), and larger, weakly amyloid basidiospores ( $8\text{--}10.5 \times 6.5\text{--}8.5 \mu\text{m}$ ) (Corner 1966). Both taxa form 2- and 4-spored basidia and have cells on the lamellar sides described by Corner as "cystidia ... like sterile basidia with a sterigma-like process  $7\text{--}16 \mu\text{m}$  long." The latter are aborted 1-spored basidia. *Trogia mellea* Corner is a similar honey-yellow species with inamyloid basidiospores

in the range  $7\text{--}9.5 \times 4.5\text{--}5.5 \mu\text{m}$ , but differs in forming basidiomes with more yellow pigments, less venose-reticulate lamellae, and pileipellis and stiptipellis with more numerous cystidia (Corner 1966, 1991).

Pairwise comparisons of aligned, overlapping ITS sequences of *T. aff. furcata* with the top ten BLAST results indicate closest similarity (89.5–90.5%) to uncultured Tricholomataceae sequences, and 87.9–89.3% similarity to *Porothelium fimbriatum* (Pers.) Fr., a poroid resupinate taxon.

***Mycetinus ignobilis*** (Berk. & Broome) Desjardin & B.A. Perry, comb. nov. Figs 23, 24a–e  
Basionym: *Marasmius ignobilis* Berk. & Broome, J. Linn. Soc., Bot. 14(73): 40. 1873 (1875).

= *Marasmius ignobilis* (Berk. & Broome) Pegler, Kew Bull., Addit. Ser. 6: 124. 1977. (Superfluous combination)

= *Marasmiellus ignobilis* (Berk. & Broome) Singer, Beih. Nova Hedwigia 44: 264. 1973.

Potential heterotypic synonyms: refer to Pegler (1986).

Mycobank: MB822662; Facesoffungi number: FoF03739

Type: Sri Lanka (Ceylon), 'south of the island', on dead wood, Nov. 1868, Thwaites 683 p.p. (K).

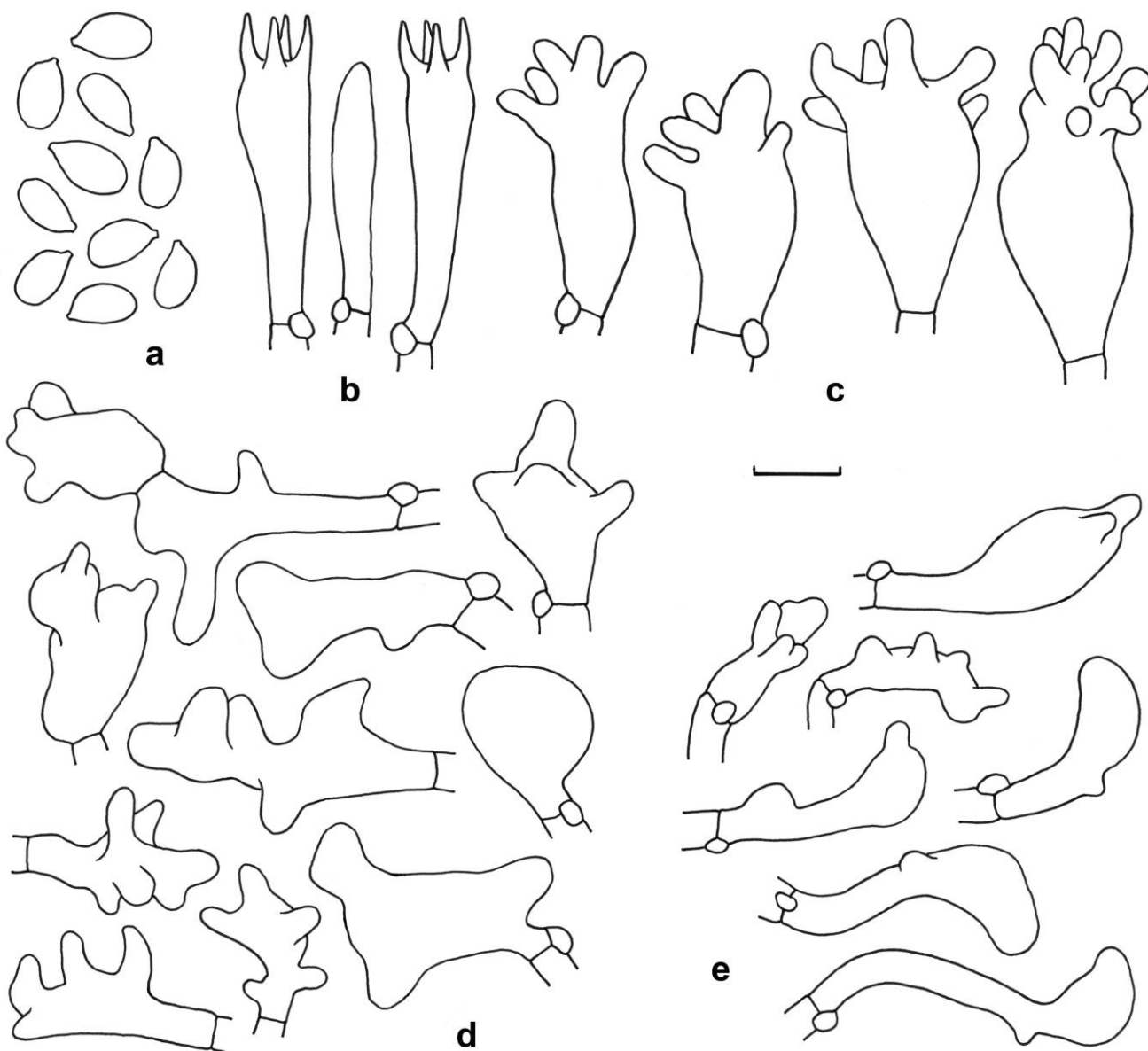
Pileus 4–17 mm diam, convex to plano-convex; margin decurved, short-sulcate to rugulose-striate; surface dull, dry, glabrous, pale orangish white (5A2–3) to greyish orange (5B3–4) when young, white in age. Context <0.5 mm thick, soft, white. Lamellae horizontal, adnate, distant with 1–2 series of lamellulae, broad (1–2 mm), white with a hint of pale orangish white. Stipe 1–3 × 0.5 mm, strongly eccentric to nearly lateral, terete, cylindrical, curved, tough, solid, insititious; surface dull, dry, minutely pruinose, white to pale orangish white (5A2–3). Odor and taste strongly of garlic.



**Fig. 23** – Basidiomes of *Mycetinus ignobilis* (DED 8207). Scale bar = 10 mm

Basidiospores  $8\text{--}9 \times 4.8\text{--}5.8 \mu\text{m}$  [ $x_m = 8.43 \pm 0.40 \times 5.23 \pm 0.36 \mu\text{m}$ ,  $Q = 1.5\text{--}1.7$ ,  $Q_m = 1.61 \pm 0.09$ ,  $n = 20$ ,  $s = 1$ ], ellipsoid to pip-shaped, smooth, hyaline, inamyloid, thin-walled. Basidia  $28\text{--}32 \times 8\text{--}9 \mu\text{m}$ , clavate, 4-spored. Basidioles subclavate to fusoid. Pleurocystidia absent. Lamellar edge

mostly sterile. Cheilocystidia abundant,  $22\text{--}32 \times 9.5\text{--}16 \mu\text{m}$ , clavate, with numerous finger-like apical projections  $3\text{--}7 \times 2.5\text{--}5 \mu\text{m}$ , hyaline, inamyloid, thin-walled. Pileipellis a cutis, a poorly-developed *Rameales*-structure; hyphae  $3.5\text{--}6.5 \mu\text{m}$  diam, cylindrical to irregular in outline, with scattered branchlets or broad knob-like diverticula, hyaline, inamyloid, non-incrusted, non-gelatinous; terminal cells versiform, repent to erect, broadly clavate, subangular to irregular in outline with a few broad diverticula,  $6.5\text{--}16 \mu\text{m}$  diam. Pileus trama loosely interwoven; hyphae  $3\text{--}6.5 \mu\text{m}$  diam, cylindrical, hyaline, inamyloid, thin-walled; lamellar trama regular, hyphae similar. Stipe cortical hyphae  $2.5\text{--}7 \mu\text{m}$  diam, cylindrical or irregular in outline, smooth or with scattered diverticula, a poorly-developed *Rameales*-structure, hyaline, inamyloid, non-gelatinous, thin-walled; stipe medullary hyphae similar but non-diverticulate. Caulocystidia abundant,  $16\text{--}40 \times 5.5\text{--}9.5 \mu\text{m}$ , clavate to irregular in outline,



**Fig. 24** – Micromorphological features of *Mycetinus ignobilis* (DED 8207). a. Basidiospores. b. Basidia and basidiole. c. Cheilocystidia. d. Pileipellis terminal cells. e. Caulocystidia. Scale bar =  $10 \mu\text{m}$

smooth or with a few knob-like diverticula, hyaline, inamyloid, thin-walled. Clamp connections present.

Habitat and known distribution – Gregarious on undetermined dicotyledonous twigs in primary forest. Africa (Kenya, São Tomé, Tanzania, Uganda), Indonesia (Bali, Java), Mexico, Sri Lanka.

Material examined – AFRICA. São Tomé, Macambrara, radio antenna area, 1300 m elev., N00°16.557', E06°36.326', 11 April 2008, coll. by B.A. Perry and D.E. Desjardin, DED 8207 (MF100963, SFSU).

Notes – *Mycetinus ignobilis*, described originally from Sri Lanka, is characterized by small, pleurotoid basidiomes with pale brown to orangish white pileus that fades to white, distant lamellae, a strongly eccentric to nearly lateral, pruinose white stipe, a poorly-developed *Rameales*-structure on pileipellis and stipitipellis, broad, clavate cheilocystidia with apical projections, and growth on woody debris. In the field, it is easily recognized by the strong garlic odor and taste. The São Tomé specimen differs slightly from the material reported from Sri Lanka (Pegler 1986), Africa (Pegler 1977) and Indonesia (Retnowati 2011) in forming a less well-developed *Rameales*-structure on the pileus and stipe, and has a paler pileus. Basidiospore size has been reported in a wide range: 6.5–8.5 × 4.3–6 µm ( $x_m = 7.5 \times 4.7$  µm) from Africa (Pegler 1977); 9.5–12.2 × 4.5–6.5 µm from Mexico (Singer 1973); 8.0–8.8 × 3.2–4.8 µm from Indonesia (Retnowati 2011); and 7.5–10 × 4.5–5.5 µm ( $x_m = 9.2 \times 5$  µm) from Sri Lanka (Pegler 1986). The São Tomé specimen falls nicely in the range reported for topotypical material with basidiospores 8–9 × 4.8–5.8 µm ( $x_m = 8.4 \times 5.2$  µm), and the basidiomes match nicely with those figured in a color plate of *Marasmius alliarius* Petch (synonym of *M. ignobilis*) from Sri Lanka (Plate 2, Fig. 12; Petch 1948).

Pairwise comparisons of aligned, overlapping ITS sequences of *Mycetinus ignobilis* with the top ten BLAST results indicate closest similarity (96.1–97%) to six sequences of *Marasmius scorodonius* (Fr.) Fr. (= *Mycetinus scorodonius* (Fr.) A.W. Wilson & Desjardin), a species that shares the garlic odor, but forms centrally stipitate basidiomes with a hymeniform pileipellis of clavate cells and an absence of caulocystidia. Our ITS phylogeny (Fig. 1) places *M. ignobilis* on a long branch in a clade with other *Mycetinus* species with 87% BS and 1.0 PP support. Most other members of *Mycetinus* (e.g., *M. alliaceus* (Jacq.) Earle ex A.W. Wilson & Desjardin, *M. applanatipes* (Desjardin) A.W. Wilson & Desjardin, *M. copelandii* (Peck), A.W. Wilson & Desjardin, *M. querceus* (Britzelm.) Antonín & Noordel., *M. salalis* (Desjardin & Redhead) Redhead), also share the garlic odor, which may be a synapomorphy of the lineage.

***Marasmius palmivorus*** Sharples, Malay. Agric. Journal 16(9–10): 345. 1928.

Figs 25, 26a–d

Type: not designated in protologue; no original material located.

Facesoffungi number: FoF03740

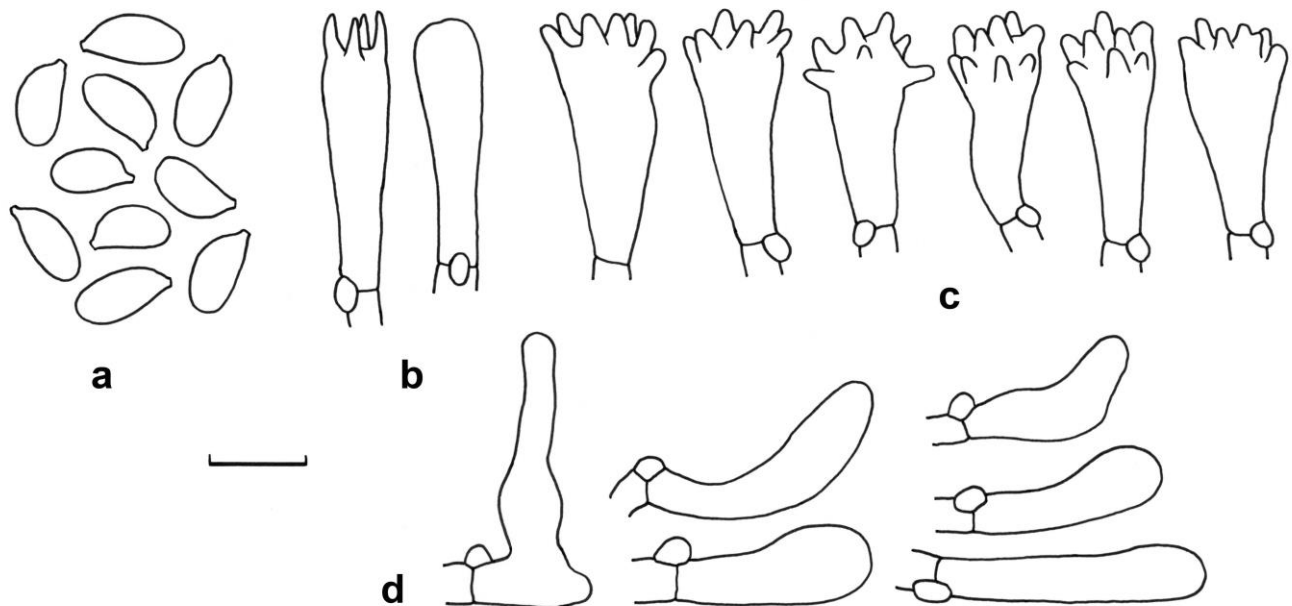
Pileus 7–45 mm diam, hemispherical to convex, expanding to plano-convex, in age depressed to subumbilicate; margin initially smooth, soon striate to sulcate or rugulose-striate, sometimes wavy or cleft; surface dull, moist to dry, glabrous to felted or radially appressed-fibrillose, subhygrophanous; when young white to cream (4A2–3) or more commonly pinkish buff (6–7A2–3) to orange (5A5–6), in age retaining pink or orange tones on the disc, fading elsewhere to white, sometimes with small, orange to brownish orange (6C4–5) or cinnamon (6D6) spots or splotches. Context <1 mm thick, soft, pliant, white. Lamellae horizontal, adnate, distant with 1–3 series of lamellulae, often intervenose in age, rarely forked, broad (2–4 mm), white, sometimes discoloring pink to orangish red. Stipe 2–10 (–25) × 0.5–1.5 mm, central to eccentric, terete, cylindrical, base often enlarged, curved, solid, tough, subsinistitious or arising from a pad of appressed white to pale orange mycelium; surface dull, dry, glabrous or minutely silky-pruinose, at first white overall, base darkening in age to greyish red (7B3–4), reddish orange (7–8B6–7) or reddish brown (8F5); often with fan-like white mycelium over substrate. Odor not distinctive.





**Fig. 25** – Basidiomes of *Marasmius palmivorus* (DED 8281–left; DED 8337–right). Scale bar = 10 mm

Basidiospores (8–)  $8.5\text{--}11 \times 4.5\text{--}5.5 \mu\text{m}$  [ $x_{mr} = 9.0\text{--}10.2 \times 4.9\text{--}5.1 \mu\text{m}$ ,  $x_{mm} = 9.7 \pm 0.4 \times 5.0 \pm 0.1 \mu\text{m}$ ,  $Q = 1.7\text{--}2.3$ ,  $Q_{mr} = 1.9\text{--}2.0$ ,  $Q_{mm} = 1.94 \pm 0.1$ ,  $n = 7\text{--}20$ ,  $s = 6$ ], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia  $25\text{--}34 \times 6.5\text{--}10 \mu\text{m}$ , clavate, 4-spored. Basidioles clavate, subfusoid cells absent. Pleurocystidia absent. Lamellar edge mostly sterile. Cheilocystidia  $17.5\text{--}24 \times 8\text{--}12 \mu\text{m}$ , clavate with numerous apical setulae, similar to *Siccus*-type broom cells, hyaline, inamyloid, thin-walled; setulae  $1.5\text{--}3.5 \times 1\text{--}3.2 \mu\text{m}$ , irregularly cylindrical or knob-like, sometimes forked, obtuse to acute, hyaline. Pileipellis a cutis of loosely interwoven, repent hyphae, not a hymeniform layer, not a *Rameales*-structure; hyphae  $4.5\text{--}12 \mu\text{m}$  diam, cylindrical, non-diverticulate, smooth or incrusted with annular to helical hyaline or yellow pigments; walls hyaline, inamyloid, non-dextrinoid, non-gelatinous; thin-walled; terminal cells undifferentiated, cylindrical. Pileus trama interwoven, lamellar trama regular; hyphae  $3\text{--}15 \mu\text{m}$  diam, cylindrical or inflated, smooth, hyaline, inamyloid, non-dextrinoid, non-gelatinous, thin-walled or with walls up to  $1 \mu\text{m}$  thick. Stipe cortical hyphae  $3\text{--}6.5 \mu\text{m}$  diam, cylindrical, parallel, non-diverticulate, smooth, hyaline, inamyloid, non-dextrinoid, non-



**Fig. 26** – Micromorphological features of *Marasmius palmivorus* (DED 8219, BAP 628). a. Basidiospores. b. Basidium and basidiole. c. Cheilocystidia. d. Caulocystidia. Scale bar =  $10 \mu\text{m}$

gelatinous, thin-walled; medullary hyphae similar but many fusoid, up to 22  $\mu\text{m}$  diam, some with walls up to 1  $\mu\text{m}$  thick. Caulocystidia scattered, 25–32  $\times$  5.5–9  $\mu\text{m}$ , cylindrical to clavate or fusoid, non-diverticulate, hyaline, thin-walled. Clamp connections present.

Habitat and known distribution – Gregarious on rotten coconut palm wood or fruits, on leaves and stems of banana, or on undetermined woody debris in coastal coconut groves and banana-cacao groves. Africa (São Tomé), Hawaiian Islands, Indonesia (Java), Malaysia.

Material examined – AFRICA. São Tomé, along main road (EN1) on north side of island, west of Ria Luisa at 33 km marker, N0°19.606', E06°30.667', 18 April 2008, coll. by B.A. Perry, BAP 628 (MF100964, SFSU); same location, 26 April 2006, coll. by D.E. Desjardin (material lost); São Tomé, along main road (EN1) on north side of island at 18.25 km marker, N0°23.687', E06°36.302', 17 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 625 (MF100965, SFSU); São Tomé, along main road (EN2) on south side of island, N0°12.126', E06°42.362', 13 April 2008, coll. by D.E. Desjardin, DED 8219 (MF100966, SFSU); São Tomé, along road to Bombain, N0°16.615', E06°38.942', elev. 400 m, 26 April 2008, coll. by D.E. Desjardin, DED 8337 (MF100967, SFSU). Príncipe, along road to Roça Pico Papagaio, N01°38.538', E07°23.890', elev. 250 m, 21 April 2008, coll. by D.E. Desjardin, DED 8281 (MF100968, SFSU); same location and date, coll. by D.E. Desjardin and B.A. Perry, BAP 641 (MF100969, SFSU).

Notes – *Marasmius palmivorus* is characterized by small to moderate-sized basidiomes with a pink to orange, striate, plano-convex pileus that fades to white in age, distant, occasionally intervenose, white lamellae, a central to eccentric, white stipe that becomes reddish orange to reddish brown at the base in age, basidiospores with mean 9.7  $\times$  5  $\mu\text{m}$ , clavate cheilocystidia with apical setulae, a cutis-type pileipellis of non-diverticulate hyphae, non-dextrinoid tissues, clavate, thin-walled caulocystidia, and growth on monocotyledonous debris. It was described originally from material causing "bud rot" of palms in Malaysia, and the protologue provided extensive details of the disease, ecology and basidiome morphology of the species (Sharples 1928). Our African material is indistinguishable from that reported in the protologue. Sharples (1928) reported obtaining pure cultures of *M. palmivorus* from basidiomes growing on African oil palms (*Elaeis guineensis*), dwarf and tall coconuts (*Cocos nucifera*), and on a variety of bananas. Subsequent studies have confirmed the pathogenic nature of the species on these host plants (Turner 1981, Almaliky et al. 2011). Hemmes and Desjardin (2002) tentatively recognized the species as belonging in *Marasmiellus*, reporting the taxon from coconut palms on Hawaii island. Wilson and Desjardin (2005) were the first to include the species (as *Marasmiellus palmivorus comb. prov.*) in a phylogenetic analysis of marasmioid and gymnopoid taxa, based on a nLSU sequence of the Hawaiian material (AY639434). Subsequently, Pong et al. (2012) provided nLSU sequences of six specimens of *M. palmivorus* from the type locality in Malaysia (JQ654219–JQ654224) that matched the Hawaiian material with 99.7% similarity, and the authors recently deposited in GenBank numerous ITS sequences of their Malaysian specimens. We obtained ITS sequences from six specimens of *M. palmivorus* from São Tomé and Príncipe that showed 99.7–100% similarity to each other, and 99.3–99.7% similarity to 10 sequences from Malaysia, confirming the conspecificity of our African material with that from Malaysia.

The generic placement of *Marasmius palmivorus* is problematical. Morphologically, *M. palmivorus* is more similar to *Marasmiellus* than to *Marasmius sensu stricto*. As currently delimited, *Marasmius* species form a hymeniform pileipellis of broom cells or clavate, non-setulose cells and have dextrinoid tissues, whereas *Marasmiellus* species have cutis-type pileipelli and non-dextrinoid tissues, as seen in *M. palmivorus*. The phylogenetic analysis of gymnopoid and marasmioid fungi by Wilson and Desjardin (2005) placed *M. palmivorus* as sister to *Crinipellis* (but with only 0.54 PP support) and together were sister to *Marasmius* species in a well-supported Marasmiaceae clade (1.0 PP). Pairwise comparisons of aligned, overlapping nLSU sequences of *Marasmius palmivorus* with the top 250 BLAST results indicate 97.5–98.3% similarity to 25 different species of *Marasmius*,

suggesting placement in the Marasmiaceae. Indeed, our ITS sequences of *M. palmivorus* are so divergent from those of members of the Omphalotaceae (Fig. 1) that they are unalignable. Until further analyses with molecular sequences from multiple gene regions are performed to clarify the generic placement of this taxon, we conservatively retain the taxon in *Marasmius*.

*Marasmius palmivorus* is most phenetically similar to a complex of *Marasmiellus* species and forms that are reportedly pathogenic on a range of economically important monocots, including banana, palms, sugar cane and corn (Singer 1973). Within this group of taxa, it is difficult to distinguish *M. palmivorus* from *Marasmiellus troyanus* (Murrill) Dennis, *Ma. semiustus* (Berk. & M.A. Curtis) Singer and *Ma. inoderma* (Berk.) Singer. *Marasmiellus troyanus* differs in forming a pure white pileus when young, lacks intervenose lamellae at maturity, and has slightly smaller basidiospores (mean  $9 \times 5 \mu\text{m}$ ). *Marasmiellus semiustus* and *Ma. inoderma* differ primarily in forming a *Rameales*-structure on the pileus and stipe surfaces; other macro- and micromorphological features span a range of variation overlapping that of *Ma. troyanus* and *M. palmivorus*.

***Campanella burkei*** Desjardin & B.A. Perry, sp. nov.

Figs 27, 28a–b

Mycobank: MB821159; Facesoffungi number: FoF03741

Holotype – AFRICA. Príncipe, Bom Bom Island Resort area, along trail to top of island, 20 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 632 (SFSU).

Etymology – named in honor of Coleman P. Burke who has supported this project since its inception.

Diagnosis – Pileus 7–16 mm diam, broadly convex to plano-convex with a shallow central depression, sulcate, rugulose-reticulate between sulcae; surface dull, dry to moist, glabrous, hygrophanous, white. Context very thin, pliant, white. Lamellae adnate to subdecurrent, distant (9–13) with 0–1 series of lamellulae, sometimes forked, intervenose, thru-lamellae relatively broad (1–2 mm), white with concolorous edges, not discoloring in age. Stipe 7–12  $\times$  0.5–1 mm, central, terete, cylindrical or gradually narrowed downward, tough, pliant, solid, insititious; surface dull, dry, minutely white-pruinose, glabrescent, apex white, base greyish brown to dark greyish brown (6F3–4). Odor slightly musty, pungent.

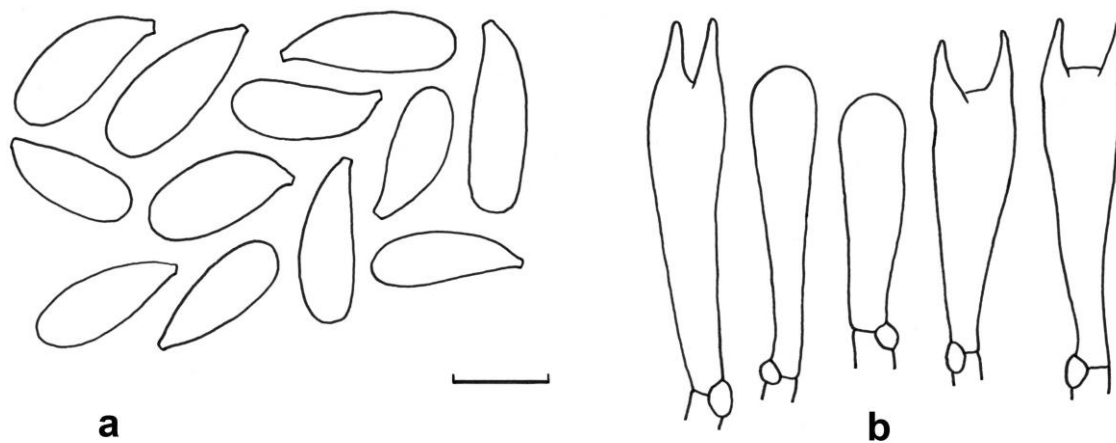


**Fig. 27** – Basidiomes of *Campanella burkei* (Holotype, BAP 632). Scale bar = 10 mm

Basidiospores  $14.5\text{--}18.5$  ( $-22$ )  $\times$   $5.2\text{--}6.5$  ( $-7.5$ )  $\mu\text{m}$  [ $x_m = 16.2 \pm 1.18 \times 6.2 \pm 0.76 \mu\text{m}$ ,  $Q = 2.0\text{--}2.9$ ,  $Q_m = 2.66 \pm 0.17$ ,  $n = 20$ ,  $s = 1$ ], elongate-ellipsoid to subfusoid, smooth, hyaline, inamyloid, thin-walled. Basidia  $28\text{--}36 \times 7.7\text{--}9.5 \mu\text{m}$ , clavate, 2-spored, clamped. Basidioles clavate. Pleurocystidia

absent. Cheilocystidia absent. Pileipellis a loosely interwoven cutis; hyphae 4–12 (–20)  $\mu\text{m}$  diam, cylindrical to slightly inflated, non-diverticulate or with scattered, small, finger-like diverticula, smooth or hyaline-incrusted, hyaline, inamyloid, non-gelatinous, thin-walled; pileocystidia and sclerocystidia (setae) absent. Pileus trama interwoven; hyphae as in pileipellis. Lamellar trama regular to slightly interwoven; hyphae 2–5  $\mu\text{m}$  diam, cylindrical, hyaline, inamyloid, non-gelatinous, thin-walled. Stipitipellis a cutis with scattered caulocystidia; cortical hyphae 4–8  $\mu\text{m}$  diam, repent, parallel, cylindrical, non-diverticulate or with scattered finger-like diverticula, hyaline (stipe apex) to pale brown (stipe base), inamyloid, non-gelatinous, thin-walled; medullary hyphae 4–16  $\mu\text{m}$  diam, cylindrical to inflated, hyaline, otherwise similar to cortical hyphae. Caulocystidia absent or as repent to geniculate terminal cells, cylindrical, obtuse, hyaline, thin-walled. Clamp connections present.

Habitat and known distribution – Scattered to gregarious on bark at the base of a standing dicotyledonous tree in coastal forest. Africa (Príncipe).



**Fig. 28** – Micromorphological features of *Campanella burkei* (Holotype, BAP 632). a. Basidiospores. b. Basidia and basidioles. Scale bar = 10  $\mu\text{m}$

Material examined – AFRICA. Príncipe, Bom Bom Island Resort area, along trail to top of island, 20 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 632 (Holotype, MF100970, SFSU).

Notes – *Campanella* v.s. *Tetrapyrgos* v.s. *Marasmiellus* Sect. *Candidi* — Wilson and Desjardin (2005) provided nLSU sequence data that showed that *Marasmiellus candidus* (Fr.) Singer, type species of *Marasmiellus* Sect. *Candidi* Singer, was not closely related to the type species of *Marasmiellus*, *M. juniperinus* Murrill, but rather was sister to several species of *Tetrapyrgos* (1.0 PP, 99% BS support) in a clade sister to all other gymnopoid fungi. Subsequently, Mata et al. (2007) confirmed the distant relationship of *M. candidus* to *M. juniperinus* with ITS sequence data, but suggested that *M. candidus* was sister to *Mycetinis*. In a taxonomic revision of *Tetrapyrgos* supported with ITS sequence data, Honan et al. (2015) reported *M. candidus* as sister to *Campanella* (0.92 PP support), but embedded within *Tetrapyrgos*. They acknowledged the difficulty in distinguishing species of *Campanella* from *Tetrapyrgos*, and suggested that they may represent a single genus (*Campanella* has nomenclatural priority), but hesitated to accept the synonymy until the type species of both genera were clearly circumscribed with morphological and molecular data. They encouraged further studies incorporating a broad sampling of *Campanella* species and members of *Marasmiellus* Sect. *Candidi*. Singer (1973) accepted four species in Sect. *Candidi*, and additional taxa were added later (Singer 1989, Desjardin et al. 1992, Antonín et al. 2010). Our ITS data set (Fig. 1) contains four species of *Tetrapyrgos*, two of *Campanella*, four of *Marasmiellus*, and the new species from Príncipe.

All 11 species belong to a well-supported clade (100% BS, 1.0 PP) whose position relative to other gymnopoid fungi was variable depending on the analysis. The new species from Príncipe is sister to *M. candidus*. Because *M. candidus* clearly does not belong in the genus *Marasmiellus* (if one accepts that genus as distinct from *Gymnopus*), the question arises to which genus does the new species belong? Rather than describe the new taxon in *Marasmiellus*, we have chosen to accept it in *Campanella*, the oldest available name for all taxa in the *Campanella/Tetrapyrgos/Marasmiellus* Sect. *Candidi* clade. Addressing nomenclatural transfers of additional members of Sect. *Candidi* is beyond the scope of this paper.

Distinctive features of *Campanella burkei* include a rugulose-sulcate, white pileus, distant, intervenose white lamellae, an insititious, greyish brown stipe, basidiospores with mean  $16.2 \times 6.2 \mu\text{m}$  and  $Q_m = 2.66$ , 2-spored basidia, no cheilocystidia or pleurocystidia, non-diverticulate or sparsely diverticulate pileipellis and stiptipellis hyphae, and growth on bark of an undetermined dicotyledonous tree. *Campanella burkei* shows some similarities to *M. candidus*, *M. pacificus* Desjardin, and *M. coilobasis* (Berk.) Singer. *Marasmiellus candidus* differs in forming distinctive filiform to sublageniform pileocystidia, cheilocystidia and caulocystidia, shorter and narrower basidiospores ( $11.5\text{--}15 \times 3.5\text{--}5.5 \mu\text{m}$ ), 4-spored basidia, and older basidiomes discolor pinkish (Desjardin 1987, Antonín & Noordeloos 2010). *Marasmiellus pacificus* forms narrower basidiospores (mean width  $5.0 \mu\text{m}$ ;  $Q_m = 3.2$ ), predominantly 4-spored basidia, conspicuous ventricose-rostrate pileocystidia and cheilocystidia, and grows on leaf bases and stalks of red ginger (Desjardin et al. 1992). *Marasmiellus coilobasis*, known from Brazil and Bolivia, has been reported to have all or nearly all basidia 2-spored as in *M. burkei*, with basidiospores in the same size range, but the former species forms a disc at the base of the subsititious white stipe, and has ventricose to subcylindrical pleurocystidia up to  $100 \mu\text{m}$  long (Singer 1973).

Pairwise comparisons of aligned, overlapping ITS sequences of *Campanella burkei* with the top ten BLAST results indicate closest similarity (93.2–95.3%) to six specimens of *M. candidus* (KJ906507–Pakistan; EF175513, EF175514, EF175515–California; DQ480088–unknown, HM240532–British Columbia).

***Lactocollybia variicystis*** D.A. Reid & Eicker, Mycotaxon 66: 159. 1998.

Figs 29, 30a–f

Facesoffungi number: FoF03742

Pileus 8–22 mm diam, broadly convex to plano-convex, sometimes with a low, broad umbo; margin pellucid-striate, undulating; surface moist, glabrous, white overall or with a pale yellowish brown (2–3B4–5) disc. Context up to 1 mm thick, soft, white. Lamellae ascending-adnate with a short decurrent tooth, close to subdistant with 2–3 series of lamellulae, broad (1–2.5 mm), rarely forked at margin, white with concolorous edges, developing yellowish brown stains where bruised. Stipe 5–12  $\times$  1–2 mm, central to eccentric, tough, pliant, hollow, non-insititious, base with scant white mycelium; surface dull, dry, minutely pruinose, white when young, becoming yellowish brown (2–3C–D5–6) in age. Odor cruciferous; taste mildly bitter.

Basidiospores  $7.4\text{--}9.6 \times 5.1\text{--}6.4 \mu\text{m}$  [ $x_m = 8.5 \pm 0.63 \times 5.7 \pm 0.39 \mu\text{m}$ ,  $Q = 1.4\text{--}1.7$ ,  $Q_m = 1.48 \pm 0.05$ ,  $n = 12$ ,  $s = 1$ ], ellipsoid to broadly amygdaliform, smooth, hyaline, inamyloid, thin-walled. Basidia 24–28  $\times$  6.5–8  $\mu\text{m}$ , clavate, 4-spored. Basidioles cylindrical to subclavate. Pleurocystidia scattered, similar to the cheilocystidia, versiform, majority cylindrical-capitate. Cheilocystidia abundant, scattered along a fertile lamellar edge; 48–75  $\times$  6.5–14.5  $\mu\text{m}$ , versiform, narrowly cylindrical to fusoid, ventricose or lageniform, sometimes capitate, hyaline, inamyloid, thin-walled. Chrysocystidia-like gloeocystidia common on lamellar sides, less common on lamellar edges, 88–136  $\times$  11–18  $\mu\text{m}$ , clavate to fusoid-ventricose, obtuse, arising from the lamellar trama as terminal cells of the gloeosystem, contents yellow to golden, refractive. Pileipellis a cutis of radially arranged hyphae 2.5–5  $\mu\text{m}$  diam, cylindrical, hyaline, inamyloid, non-gelatinous, thin-walled, interspersed with

elements of the gloeosystem, the latter as fusoid intercalary swellings 9–24  $\mu\text{m}$  diam, narrowing at both ends to 2.5–4  $\mu\text{m}$  diam, with refractive, yellow to golden contents; terminal cells as gloeocystidia  $>100 \times 9.5\text{--}18$  (–23)  $\mu\text{m}$ , versiform, fusoid-ventricose to clavate, repent, with refractive, yellow to golden contents. Pileus trama loosely interwoven; hyphae 2.5–20  $\mu\text{m}$  diam, cylindrical to inflated, hyaline, inamyloid, non-gelatinous, thin-walled. lamellar trama subparallel; hyphae 3.5–18  $\mu\text{m}$  diam, cylindrical, hyaline, inamyloid, non-gelatinous, thin-walled; with interspersed hyaline to yellow gloeohyphae. Stipitipellis a cutis of parallel, repent hyphae giving rise to caulocystidia; hyphae 2.5–8  $\mu\text{m}$  diam, cylindrical, smooth, hyaline, inamyloid, non-gelatinous, thin-walled; overlaying a gloeosystem as in the pileipellis, with versiform intercalary swellings 9.5–16  $\mu\text{m}$  diam, with refractive, yellow to golden contents; medullary hyphae 5–16  $\mu\text{m}$  diam, cylindrical, hyaline, inamyloid, thin-walled. Caulocystidia similar to the cheilocystidia, versiform. Clamp connections present.



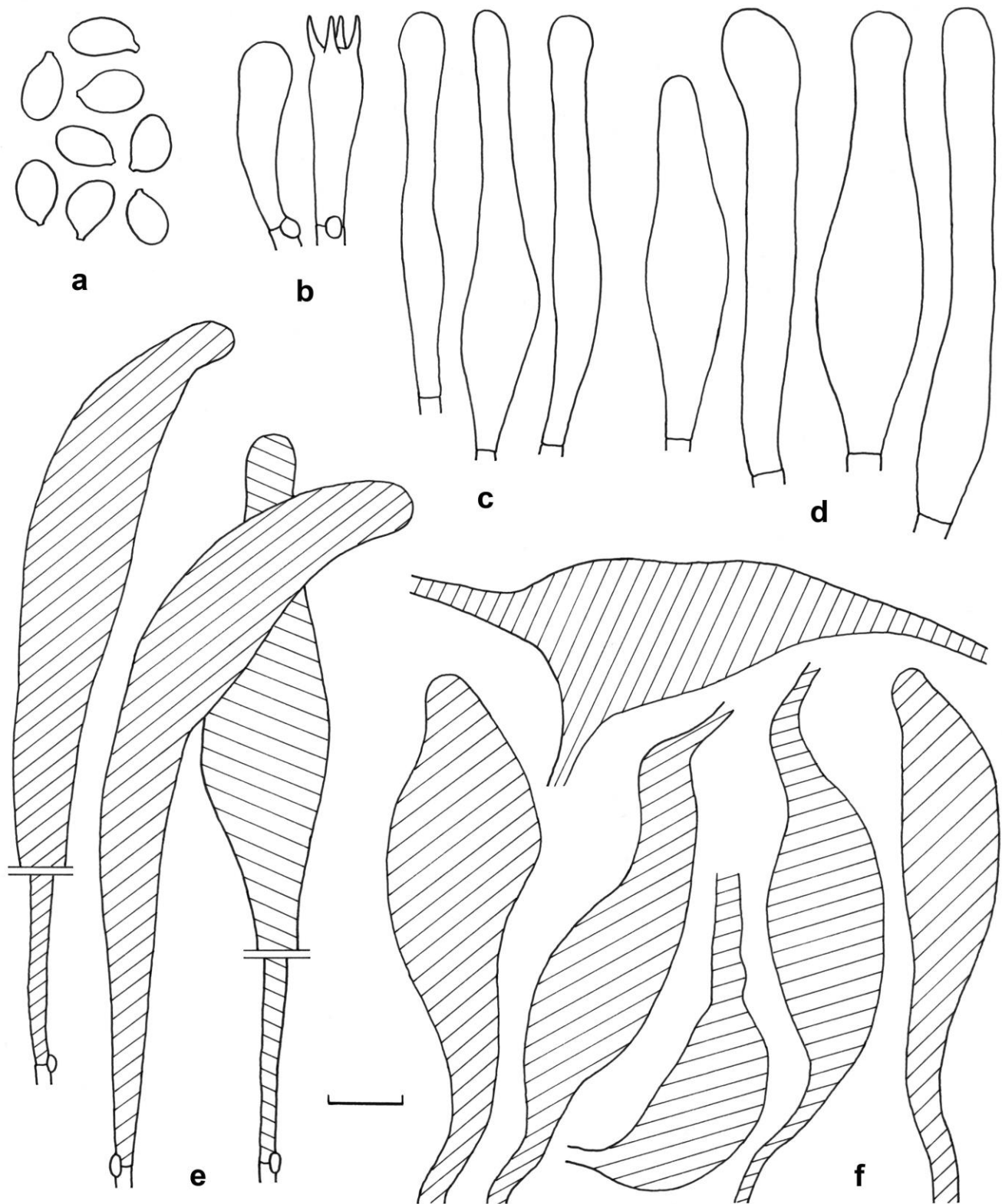
**Fig. 29** – Basidiomes of *Lactocollybia variicystis* (BAP 598). Scale bar = 10 mm

Habitat and known distribution – gregarious on decaying wood in coastal forest with cacao and banana. Africa (São Tomé).

Material examined – AFRICA. São Tomé, along road EN1 near Conde, N00°22.802', E06°39.334', 12 April 2008, coll. by B.A. Perry and D.E. Desjardin, BAP 598 (MF100971, SFSU).

Notes – *Lactocollybia variicystis* was described from material collected in South Africa (Reid and Eicker 1998). The common pantropical *L. epia* (Berk. & Broome) Pegler differs in forming larger basidiomes (pileus 10–55 mm diam, stipe 20–80  $\times$  2–5 mm) with more elongate basidiospores ( $x_m = 8.5 \times 4.5 \mu\text{m}$ ;  $Q = 1.88$ ) and more consistently cylindrical-clavate cheilocystidia (Pegler 1977, 1986).

Pairwise comparisons of aligned, overlapping ITS sequences of *Lactocollybia variicystis* with two GenBank sequences of *L. epia* (KP840552 – Sicily; KU320581 – India) showed only 90.8% and 85.6% similarity, respectively.



**Fig. 30** – Micromorphological features of *Lactocollybia variicystis* (BAP 598). a. Basidiospores. b. Basidium and basidiole. c. Pleurocystidia. d. Cheilocystidia. e. Chrysozystidia-like gloeocystidia from lamellar sides. f. Pileipellis terminal cells and elements of the gloeosystem. Scale bar = 10  $\mu$ m

*Setulipes afibulatus* Antonín, Mycotaxon 88: 69. 2003.

Figs 31, 32a–e

Holotype – AFRICA. Malawi, Nyika National Park, Gîte Chelinda, 4 Dec. 1981, J. Rammeloo 7652 (BR 11989–58).

Mycobank: MB821166; Facesoffungi number: FoF03743

Pileus 4–10 mm diam, convex to plano-convex or plane, centrally depressed in age, rugulose-sulcate to striate; surface dull, dry, glabrous; disc light brown (7D5–6), margin greyish orange (6B–C3). Context <1 mm thick, buff. Lamellae adnate to a pseudocollarium, distant (11–13) with 1 series of lamellulae, moderately broad (1–1.5 mm), greyish orange (6B3). Stipe 12–20 × 0.2 mm, central, filiform, wiry, tough, insititious; surface dull, dry, glabrous or minutely pruinose (20× hand lens), dark brown (8F7–8) overall; rhizomorphs absent.

Basidiospores 7.4–8.3 × 3.5–4.0 μm [ $x_m = 7.8 \pm 0.28 \times 3.8 \pm 0.17 \mu\text{m}$ ,  $Q = 1.8\text{--}2.2$ ,  $Q_m = 2.07 \pm 0.07$ ,  $n = 20$ ,  $s = 1$ ], ellipsoid to subcylindrical, smooth, hyaline, inamyloid, thin-walled. Basidia 22–26 × 6.5–7.5 μm, clavate, 4-spored. Basidioles clavate to subfusoid. Pleurocystidia absent. Cheilocystidia abundant, lamellar edge mostly sterile, of *Siccus*-type broom cells; main body 13–30 × 8–16 μm, broadly clavate to vesiculose, often lobed, hyaline, inamyloid, thin-walled; apical setulae/diverticula 1.5–3.5 × 1–2 μm, rod-like to knob-like, obtuse, hyaline, thin-walled. Pileipellis a cutis to nearly a *Rameales*-structure of radially arranged hyphae 3–6 μm diam, non-diverticulate or with scattered diverticula, brown-incrusted, non-gelatinous, thin-walled; terminal cells of *Siccus*-type broom cells similar to the cheilocystidia. Pileus trama of loosely interwoven hyphae 2.5–6 μm diam, cylindrical, non-diverticulate, smooth or incrusted, hyaline to pale yellowish brown, inamyloid. Stipitipellis a cutis of cylindrical hyphae 2.5–4 μm diam, smooth, dark brown, dextrinoid, thick-walled, giving rise to scattered caulocystidia; medullary hyphae 3–8 μm diam, cylindrical, hyaline to pale brown, weakly dextrinoid, thin-walled. Caulocystidia 10–42 × 3–6.5 μm, cylindrical to fusoid or acicular, sometimes geniculate, hyaline to pale brown, contents strongly dextrinoid; walls smooth, inamyloid to weakly dextrinoid, 0.5–1 μm thick. Clamp connections absent in all tissues.



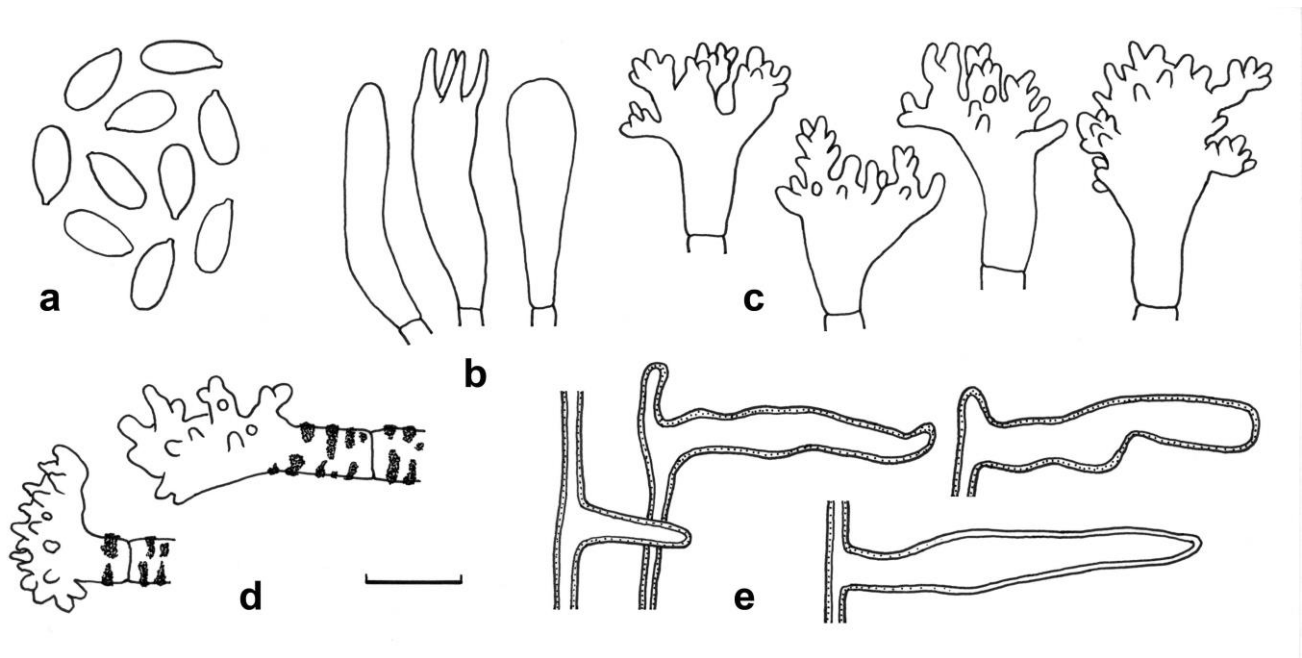
**Fig. 31** – Basidiomes of *Setulipes afibulatus* (DED 8208). Scale bar = 10 mm

Habitat and known distribution – Solitary, scattered on leaves of undetermined dicotyledonous trees in primary forest. Africa (Burundi, DR Congo, Malawi, Nigeria, São Tomé, Tanzania).



Material examined – AFRICA. São Tomé, Macambrara, radio antenna area, 1300 m elev., N00°16.557', E06°36.326', 11 April 2008, coll. by B.A. Perry and D.E. Desjardin, DED 8208 (MF100972, SFSU); same location, 25 April 2006, coll. by D.E. Desjardin (material lost).

Notes – *Setulipes* was established by Antonín (1987) to encompass what was once considered *Marasmius* sect. *Androsacei*. Mata et al. (2007) presented ITS sequence data that indicated that the type species of the genera *Gymnopus* (*G. fusipes*) and *Setulipes* (*S. androsaceus*), belonged in the same well-supported clade. Accordingly, Mata et al. (2007), Antonín and Noordeloos (2010), and others accept *Setulipes* as a synonym of *Gymnopus*. In our ITS phylogeny (Fig. 1), *S. afibulatus* is distantly related to *G. fusipes* and outside any clade containing currently recognized *Gymnopus* species, indicating the species does not belong in *Gymnopus*. Moreover, *S. afibulatus* is distantly related to the type species of *Setulipes*, with which it shares most morphological features, and hence does not belong in *Setulipes*, which we recognize as a synonym of *Gymnopus*. However, it holds an isolated position in the ITS phylogeny, sister to *Connopus*, a genus with which it shares few morphological features. Until additional molecular sequences data from additional loci are available to help clarify its taxonomic position, we refrain from transferring the species to a different genus or from establishing a new genus, and refer to it here as *S. afibulatus*.



**Fig. 32** – Micromorphological features of *Setulipes afibulatus* (DED 8208). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. d. Pileipellis terminal cells. e. Caulocystidia. Scale bar = 10  $\mu\text{m}$

*Setulipes afibulatus* is distinguished by a small, greyish orange, rugulose-sulcate pileus, distant, greyish orange lamellae, a wiry, dark brown, insititious stipe, basidiospores with mean  $7.8 \times 3.8 \mu\text{m}$ , *Siccus*-type cheilocystidia and pileipellis terminal cells, brown-incrusted pileipellis hyphae, dextrinoid stipe tissues, thick-walled, cylindrical to fusoid, dextrinoid caulocystidia, an absence of clamp connections, and growth on dicot leaves. The material from São Tomé matches nicely with other African material reported by Antonín (2007), although the basidiospores are in the shorter part of the range. The distinctly dextrinoid tissues distinguish this taxon from other unclamped species in *Marasmiellus* sect. *Defibulati sensu* Singer (1973). Overall *Setulipes* morphology suggests an affinity with *Marasmius pallidocephalus*, another species with small basidiomes with wiry insititious stipe,

dextrinoid stipe tissues, *Siccus*-type pigment-incrusted pileipellis cells and lacks clamp connections. The latter differs, however, in lacking cheilocystidia and caulocystidia, forms rhizomorphs, and grows on conifer needles in North America (Desjardin 1987, 1989, 1990).

Pairwise comparisons of aligned, overlapping ITS sequences of *Setulipes afibulatus* with the top ten BLAST results indicate a closest match (80.9–81.0% similarity, 94.39–94.89% coverage) to *Gymnopus sp.* from Korea (KF251067, KF251068).

*Setulipes afibulatus* may represent what was reported from São Tomé by Bresadola and Roumeguère (1890) as *Marasmius splachnoides* (Hornem.) Fr., the latter considered by some authors as a synonym of *Gymnopus quercophilus* (Pouzar) Antonín & Noordel and by others as a *nomen dubium*.

***Gymnopus irresolutus*** Desjardin & B.A. Perry, sp. nov.

Figs 33, 34a–e

Mycobank: MB821161; Facesoffungi number: FoF03744

Holotype – AFRICA. São Tomé, Macambrara, radio antenna area, 1300 m elev., N00°16.557', E06°36.326', 11 April 2008, coll. by B.A. Perry and D.E. Desjardin, DED 8209 (SFSU).

Etymology – *irresolutus* (Latin) = doubtful, referring to the uncertainty in its generic placement.

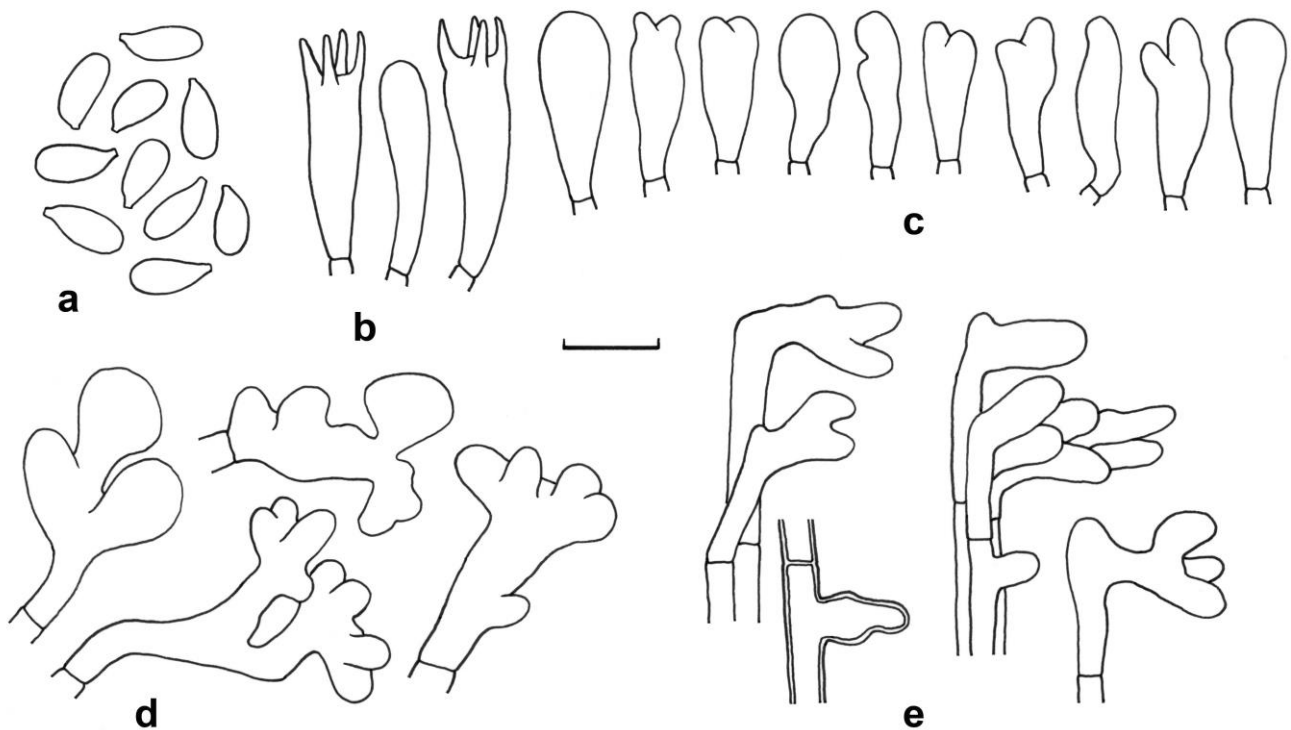
Diagnosis – Pileus 2–6 mm diam, convex to plano-convex or plane-depressed; margin decurved, striate; surface dull, dry, glabrous; disc dark brown (7F6–8), margin paler to greyish brown (7D3). Context <1 mm thick, soft, off-white. Lamellae horizontal, shallowly adnate, non-collariate, distant with 1 series of lamellulae, broad (–1 mm), pale brownish grey (6C3). Stipe 8–10 (–15) × 0.1–0.2 mm,



**Fig. 33** – Basidiomes of *Gymnopus irresolutus* (Holotype, DED 8209). Scale bar = 10 mm

central, filiform, wiry, solid, insititious; surface dull, dry, minutely pruinose; apex pale greyish brown (6C3), base black; rhizomorphs absent. Odor and taste not distinctive.

Basidiospores  $7\text{--}8.3 \times 3.2\text{--}3.8 \mu\text{m}$  [ $x_m = 7.8 \pm 0.43 \times 3.5 \pm 0.21 \mu\text{m}$ ,  $Q = 2.1\text{--}2.4$ ,  $Q_m = 2.23 \pm 0.15$ ,  $n = 21$ ,  $s = 1$ ], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia  $19\text{--}24 \times 6\text{--}7 \mu\text{m}$ , clavate, 4-spored, rarely 2-spored, unclamped. Basidioles clavate. Pleurocystidia absent. Lamellar edge heteromorphous, fertile. Cheilocystidia scattered,  $14.5\text{--}20 \times 5\text{--}8 \mu\text{m}$ , broadly clavate to irregularly cylindrical, often bifid, hyaline, inamyloid, thin-walled. Pileipellis a cutis of repent hyphae  $3\text{--}6 \mu\text{m}$  diam, smooth or brown-incrusted, non-diverticulate or with rare knob-like projections (not a *Rameales*-structure), hyaline to pale brown, inamyloid, non-gelatinous; terminal cells lobed or branched, with large bulbous knobs  $3\text{--}10 \mu\text{m}$  diam, smooth or incrusted, hyaline, inamyloid, thin-walled. Pileus and lamellar trama of hyphae  $3\text{--}6 \mu\text{m}$  diam, smooth, hyaline, inamyloid, thin-walled. Stipitipellis a cutis of parallel, cylindrical hyphae  $2\text{--}7 \mu\text{m}$  diam, smooth, pale brown, inamyloid, slightly thick-walled, giving rise to caulocystidia; medullary hyphae  $3\text{--}8 \mu\text{m}$  diam, cylindrical, hyaline, inamyloid. Caulocystidia clustered to scattered,  $5\text{--}20 \times 3\text{--}5 \mu\text{m}$ , cylindrical to subclavate, obtuse, sometimes broadly knobby like the pileipellis terminal cells, hyaline to brown, inamyloid, slightly thick-walled ( $-0.5 \mu\text{m}$ ), thicker walled and darker near stipe base. Clamp connections absent in all tissues.



**Fig. 34** – Micromorphological features of *Gymnopus irresolutus* (Holotype, DED 8209). a. Basidiospores. b. Basidia and basidiole. c. Cheilocystidia. d. Pileipellis terminal cells. e. Caulocystidia. Scale bar =  $10 \mu\text{m}$

Habitat and known distribution – Solitary on leaves of undetermined dicotyledonous trees in primary forest. Africa (São Tomé).

Material examined – AFRICA. São Tomé, Macambrara, radio antenna area, 1300 m elev., N00°16.557', E06°36.326', 11 April 2008, coll. by B.A. Perry and D.E. Desjardin, DED 8209 (Holotype, MF100973, SFSU).

Notes – *Gymnopus irresolutus* is characterized by small, *Setulipes*-like basidiomes with brown, striate pileus, distant pale brownish grey lamellae, a black, wiry, insititious stipe, no rhizomorphs, basidiospores with mean  $7.8 \times 3.5 \mu\text{m}$ , no pleurocystidia, broadly clavate and often bifid cheilocystidia, a cutis-type pileipellis with broadly knobby terminal cells, cylindrical to subclavate or apically knobby caulocystidia, non-gelatinous, inamyloid (non-dextrinoid) tissues, an absence of clamp connections, and growth on dicotyledonous leaves. In combination, these features suggest placement in *Marasmiellus* sect. *Defibulati*, subsect. *Subcoracini* of Singer (1973), where the African taxon would key close to *M. picipes* (Murr.) Singer, a species known from Cuba, Mexico and Brazil. The latter species differs in a paler pileus (Arabian brown to auburn), white lamellae, a chestnut brown stipe, and much larger caulocystidia ( $6\text{--}85 \times 4\text{--}11 \mu\text{m}$ ), many of which are subacute. *Gymnopus irresolutus* shows many similarities to *Marasmius atlanticus* Singer, a species described from Florida, USA that belongs in the *Setulipes* clade of *Gymnopus*. The latter differs in a reddish brown pileus with white margin, white lamellae, a fibrillose-furfuraceous stipe, cheilocystidia with more knob-like outgrowths, larger caulocystidia ( $32\text{--}48 \times 8\text{--}12.5 \mu\text{m}$ ), and dextrinoid stipe cortical hyphae (Holotype F!). *Gymnopus irresolutus* does not match any of the taxa from Africa referable to *Marasmiellus*, *Gymnopus* or *Setulipes* by Antonín (2007: 146–160; Excluded and doubtful taxa).

Pairwise comparisons of aligned, overlapping ITS sequences of *Gymnopus irresolutus* with the top ten BLAST results indicate closest similarity (90.5–91.6%) to unidentified Agaricales spp., uncultured fungus clones, or *Marasmius androsaceus* (JN943605–Sweden, GU234007–Sweden, FR717227–Czech Republic). In the ITS phylogeny (Fig. 1), *G. irresolutus* is sister to *G. fusipes* (type species of *Gymnopus*) and *G. androsaceus* (0.91 PP).

***Gymnopus hirtellus*** (Berk. & Broome) Desjardin & B.A. Perry, comb. nov. Fig. 35a–d  
Basionym: *Marasmius hirtellus* Berk. & Broome, J. Linn. Soc., Bot. 14(73): 39. 1873 (1875).

= *Collybia hirtella* (Berk. & Broome) Dennis, Trans. Brit. Mycol. Soc. 34: 444. 1951.

= *Marasmiellus hirtellus* (Berk. & Broome) Pegler, Kew Bull., Addit. Ser. 6: 130. 1977.

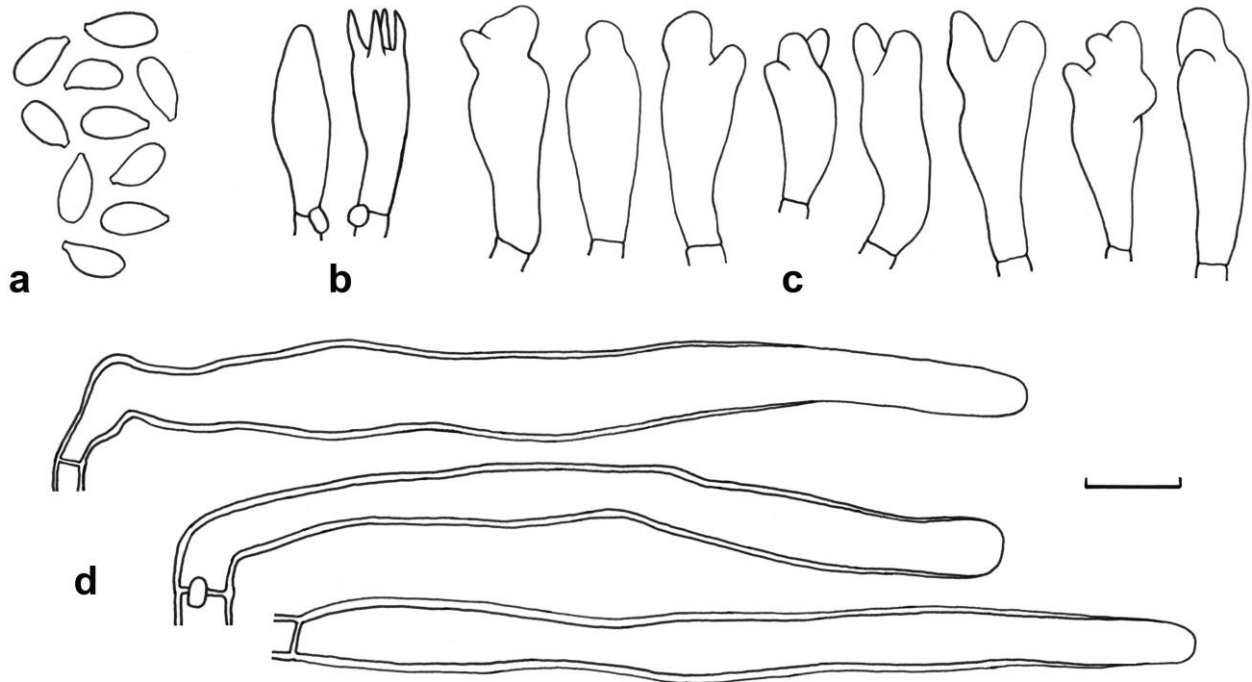
Holotype – SRI LANKA. Kandy District, Peradeniya, on dead herbaceous plants, Nov. 1867, Thwaites 102 p.p. (K).

Mycobank: MB821168; Facesoffungi number: FoF03745

Pileus 7–15 mm diam, convex, soon broadly plano-convex to plane, depressed in age; margin decurved to straight, rugulose-striate when young, often striate to disc in age; surface dull, dry, glabrous, dull brown (8E–F4) overall when young, fading in age to greyish orange (6B3), dingy cream (4A3) or tan-buff. Context thin (–0.5 mm), soft, white. Lamellae horizontal, adnate, close to crowded with 2–3 series of lamellulae, narrow (0.5–1 mm), greyish orange (6B3) to white; edges pruinose. Stipe 10–20 × 1 mm, central, terete, cylindrical, tough, pliant, hollow, insititious; surface dull, dry, pruinose to hispid; apex greyish orange (6B3), base brown to dark brown (7E–F4–6); rhizomorphs absent.

Basidiospores  $6.4\text{--}7.4 \times 3.2\text{--}3.8 \mu\text{m}$  [ $x_m = 6.7 \pm 0.31 \times 3.5 \pm 0.23 \mu\text{m}$ ,  $Q = 1.7\text{--}2.1$ ,  $Q_m = 1.93 \pm 0.13$ ,  $n = 10$ ,  $s = 1$ ], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia  $16\text{--}20 \times 6\text{--}6.8 \mu\text{m}$ , clavate, 4-spored. Basidioles subfusoid. Pleurocystidia absent. Lamellar edge sterile. Cheilocystidia  $20\text{--}30 \times 5\text{--}8 \mu\text{m}$ , irregularly clavate, usually with 1–3 (–4) broadly rounded apical lobes, hyaline, thin-walled. Pileipellis a cutis of radially arranged, repent hyphae 4–5.5  $\mu\text{m}$  diam, cylindrical, most with brown, annular to helical pigment incrustations, few smooth, non-diverticulate, inamyloid, non-gelatinous; terminal cells cylindrical to subclavate, often with a few scattered, broad, knob-like outgrowths, not a *Rameales*-structure. Pileus and lamellar trama of loosely interwoven hyphae 4–6  $\mu\text{m}$

diam, cylindrical, smooth, hyaline, inamyloid, non-gelatinous, thin-walled. Stipe tissue monomitic; hyphae 3–6  $\mu\text{m}$  diam, cylindrical, hyaline to pale brown, inamyloid, smooth, non-gelatinous. Caulocystidia abundant, 32–160  $\times$  7–12  $\mu\text{m}$ , cylindrical to wavy-cylindrical, hyaline, inamyloid, thick-walled, tip seldom bifid. Clamp connections present.



**Fig. 35** – Micromorphological features of *Gymnopus hirtellus* (DED 8299). a. Basidiospores. b. Basidium and basidiole. c. Cheilocystidia. d. Caulocystidia. Scale bar = 10  $\mu\text{m}$

Habitat and known distribution – Scattered to gregarious on undetermined dicotyledonous leaves and twigs in secondary forest. Africa (Kenya, Príncipe, Tanzania, Uganda), Sri Lanka.

Material examined – AFRICA. Príncipe, Roça Pico Papagaio, N01°37.182', E07°23.474', 21 April 2008, coll. by D.E. Desjardin, DED 8299 (MF100974, SFSU).

Notes – *Gymnopus hirtellus* is characterized by a small, striate, brown to greyish orange pileus, adnate, crowded lamellae with pruinose edges, an insititious, pruinose stipe, relatively small ellipsoid basidiospores with mean 6.7  $\times$  3.5  $\mu\text{m}$ , irregularly clavate, apically lobed cheilocystidia, a pileipellis of non-diverticulate, brown-incrusted hyphae, numerous hyaline, thick-walled, cylindrical caulocystidia, and growth on leafy debris. The species was described originally from Sri Lanka (Berkeley and Broome 1875, as *Marasmius*) and reported subsequently from East Africa (Pegler 1977, as *Marasmiellus*).

Pairwise comparisons of aligned, overlapping ITS sequences of *G. hirtellus* with the top ten BLAST results indicate 92.1% similarity to *Gymnopus* sp. (KF430218) from Thailand, and 91.9–92.1% similarity to *G. villosipes* (KJ416255–New Zealand, DQ450058–USA). In the ITS phylogeny (Fig. 1) *Gymnopus hirtellus* belongs in a well-supported clade (93% BS, 1.0 PP) with eight other *Gymnopus* species whose relationships with each other show low support.

*Gymnopus hirtelloides* Desjardin & B.A. Perry, sp. nov.

Mycobank: MB821160; Facesoffungi number: FoF03746

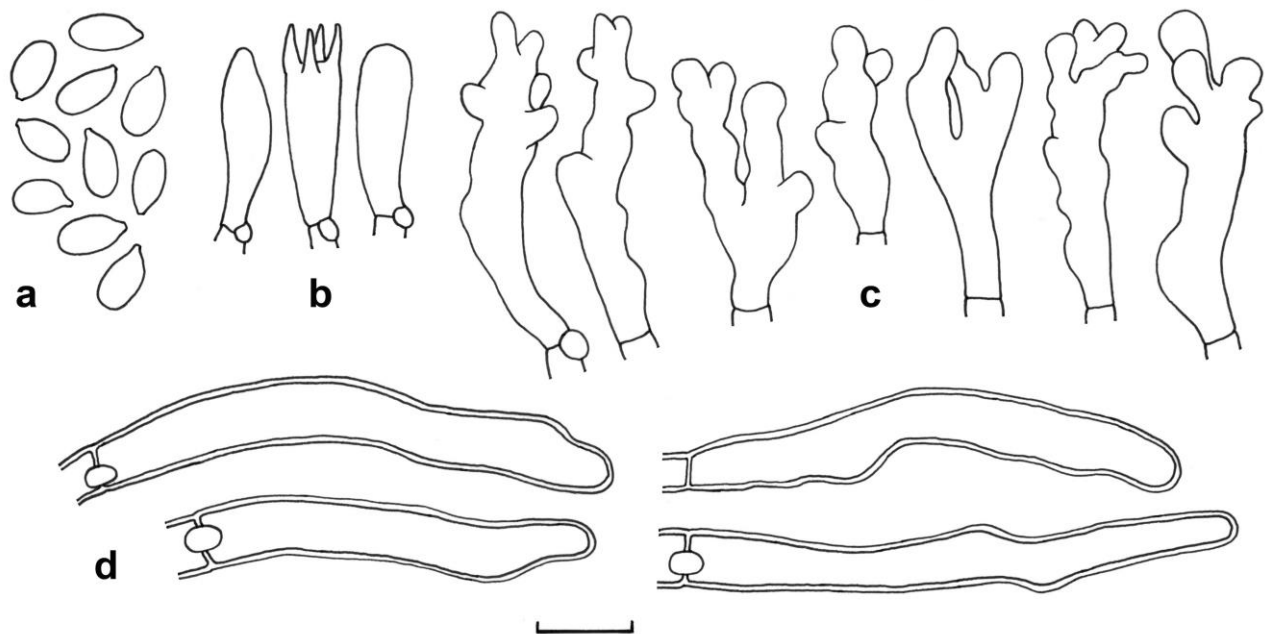
Fig. 36a–d

Holotype – AFRICA. Príncipe, Dois Irmãos area, N01°34.889', E07°25.548', elev. 100 m, 23 April 2008, coll. by D.E. Desjardin, DED 8318 (SFSU).

Etymology – *hirtelloides*, similar to *Gymnopus hirtellus*.

Diagnosis – Pileus 4–12 mm diam, convex, soon plano-convex to plane, margin non-striate or seldom faintly rugulose-striatulate; surface dull, dry, appressed-felted, dull brown (7E4) overall. Lamellae adnate, crowded with 3–4 series of lamellulae, narrow (<1 mm), white; edges granulose, concolorous. Stipe 15–20 × 1 mm, central, terete, cylindrical, tough, pliant, insititious; surface dull, dry, pruinose overall; apex white, centrally light brown (7D5–6), base brown (7E4); rhizomorphs absent. Odor indistinct.

Basidiospores 6.0–8.0 × 3.5–4.5 μm [ $x_m = 7.06 \pm 0.72 \times 3.93 \pm 0.28$  μm,  $Q = 1.6–2.1$ ,  $Q_m = 1.8 \pm 0.06$ ,  $n = 20$ ,  $s = 1$ ], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia 16–23 × 5–7 μm, clavate, 4-spored. Basidioles clavate to subfusoid. Pleurocystidia absent. Lamellar edge sterile. Cheilocystidia 19–36 × 4.5–8 μm, irregularly cylindrical with broad knob-like outgrowths, often apically lobed, hyaline, inamyloid, thin-walled. Pileipellis a cutis of repent, radially arranged hyphae 3.5–6.5 μm diam, cylindrical, non-diverticulate, coarsely incrustated with brown, granular pigments; walls thin, hyaline, inamyloid, non-gelatinous; terminal cells undifferentiated. Pileus trama interwoven; hyphae 2.5–8 (–10) μm diam, cylindrical, branched, hyaline, inamyloid, non-incrustated, non-gelatinous, thin-walled. Lamellar trama regular; hyphae similar to pileus trama. Stipitipellis a cutis with clustered caulocystidia; cortical hyphae 2.5–7 μm diam, parallel, cylindrical, non-diverticulate, hyaline (apex) to pale yellowish brown (base), inamyloid, non-incrustated, non-gelatinous, thick-walled (0.5–1 μm); medullary hyphae 3–10 μm diam, cylindrical, hyaline, inamyloid, non-gelatinous, thin-walled or with walls up to 0.8 μm thick. Caulocystidia 32–70 × 5–8 μm, cylindrical to subclavate, broadly obtuse, hyaline, inamyloid, thick-walled (0.5–1 μm). Clamp connections common in all tissues.



**Fig. 36** – Micromorphological features of *Gymnopus hirtelloides* (Holotype, DED 8318). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. d. Caulocystidia. Scale bar = 10 μm

Habitat and known distribution – Gregarious on undetermined dicotyledonous leaves in secondary coastal forest. Africa (Príncipe).

Material examined – AFRICA. Príncipe, Dois Irmãos area, N01°34.889', E07°25.548', elev. 100 m, 23 April 2008, coll. by D.E. Desjardin, DED 8318 (Holotype, MF100975, SFSU).

Notes – Macro- and micromorphological features of *Gymnopus hirtelloides* are nearly indistinguishable from those of *G. hirtellus*, and indeed, without molecular data DED 8318 was considered conspecific with other material from Príncipe determined as *G. hirtellus* (DED 8299). However, pairwise comparisons of aligned, overlapping ITS sequences of DED 8318 (*G. hirtelloides*) with DED 8299 (*G. hirtellus*) showed only 91.1% similarity. Subtle morphological differences include: a primarily non-striate, felted, dull brown pileus, basidiospores with mean  $7 \times 3.9 \mu\text{m}$ , and cheilocystidia with numerous knob-like outgrowths in *G. hirtelloides*, compared to a rugulose-striate, glabrous, greyish orange pileus, basidiospores with mean  $6.7 \times 3.5 \mu\text{m}$ , and cheilocystidia with few knob-like outgrowths in *G. hirtellus*. *Gymnopus johnstonii* (Murrill) A.W. Wilson, Desjardin & E. Horak is similar to *G. hirtelloides*, but differs in forming fewer lamellae, a non-insititious stipe, and less nodulose cheilocystidia (Wilson et al. 2004).

Pairwise comparisons of aligned, overlapping ITS sequences of *G. hirtelloides* with the top ten BLAST results indicate 93.9% similarity to *Gymnopus sp.* (AB512321) from Japan, 92% similarity to *Gymnopus sp.* (AY781255) from Sweden, and 91.8% similarity to an uncultured Agaricales clone (FJ179476) from the Caribbean island of Guadeloupe. In the ITS phylogeny (Fig. 1), *G. hirtelloides* belongs to the same clade well-supported clade as *G. hirtellus* (93% BS, 1.0 PP).

***Gymnopus ocellus*** Desjardin & B.A. Perry, sp. nov.

Figs 37, 38a–d

Mycobank: MB821163; Facesoffungi number: FoF03747

Holotype – AFRICA. Príncipe, along road to Roça Pico Papagaio, N01°38.600', E07°23.827', 21 April 2008, coll. by D.E. Desjardin, DED 8280 (SFSU).

Etymology – *ocellus* (Latin) = eye, referring to the iris-like pigmentation pattern on the pileus surface

Diagnosis – Pileus 20–55 (–70) mm diam, broadly convex to plano-convex with a depressed disc; margin wavy-undulate, sometimes cleft, decurved, rugulose-pellucid-striatulate; surface dull, moist to dry, hygrophanous, glabrous; disc brown (7E6–8), margin streaked light brown (6D5–6) to brownish grey or greyish orange (6B–C3), fading to dingy cream (4A3) or white with moisture loss and in age. Context 1 mm thick, soft, white. Lamellae adnate to shallowly adnexed, crowded with 3–4 series of lamellulae, narrow to moderately broad (2–4 mm), off-white. Stipe 40–70  $\times$  2–5 (apex)  $\times$  4–8 (base) mm, central, terete, apex flared, cylindrical below to an enlarged base, twisted-striate, fibrous, tough, pliant, non-insititious; surface dull, dry, pubescent; apex buff, base greyish brown (6D–E3) to dark greyish brown (7E3–4). Odor strongly fungal.

Basidiospores not observed; material apparently sterile. Basidia not observed. Basidioles 17.5–21  $\times$  4–5  $\mu\text{m}$ , clavate to subfusoid. Pleurocystidia scattered, common, 32–40  $\times$  8–11  $\mu\text{m}$ , broadly clavate to fusoid-ventricose, pedicellate, hyaline, inamyloid, thin-walled. Lamellar edge sterile. Cheilocystidia 32–58  $\times$  6.5–16  $\mu\text{m}$ , versiform, pedicellate, fusoid-ventricose to lageniform, subcylindrical or clavate, hyaline, inamyloid, thin-walled or with walls up to 0.5  $\mu\text{m}$  thick. Pileipellis a cutis of repent, radially arranged hyphae 4.5–9.5  $\mu\text{m}$  diam, cylindrical, non-diverticulate, hyaline with scattered brown granulate incrustations, non-gelatinous, thin-walled; terminal cells undifferentiated, repent to suberect, cylindrical to subclavate. Pileus trama interwoven; hyphae 3–6.5  $\mu\text{m}$  diam, cylindrical, branched, hyaline, inamyloid, non-incrusted, non-gelatinous, thin-walled. Lamellar trama regular; hyphae 2.5–6.5 (–10)  $\mu\text{m}$ , cylindrical, hyaline, inamyloid, subgelatinous, thin-walled. Stipitipellis an interwoven lattice of tangled hyphae with erect caulocystidia; cortical hyphae 2.5–6  $\mu\text{m}$  diam, wavy-cylindrical, hyaline, inamyloid, non-incrusted, non-gelatinous, thin-walled; medullary hyphae 3–10 mm diam, cylindrical,

hyaline, inamyloid, thick-walled (0.5–1  $\mu\text{m}$ ); with scattered hyaline oleiferous hyphae interspersed. Caulocystidia 16–78  $\times$  3–5  $\mu\text{m}$ , sinuous to cylindrical, obtuse, seldom with a small lobe, hyaline, inamyloid, thin-walled. Clamp connections present in all tissues.

Habitat and known distribution – Scattered on decaying wood in secondary forest. Africa (Príncipe).

Material examined – AFRICA. Príncipe, along road to Roça Pico Papagaio, N01°38.600', E07°23.827', 21 April 2008, coll. by D.E. Desjardin, DED 8280 (Holotype, MF100976, SFSU).



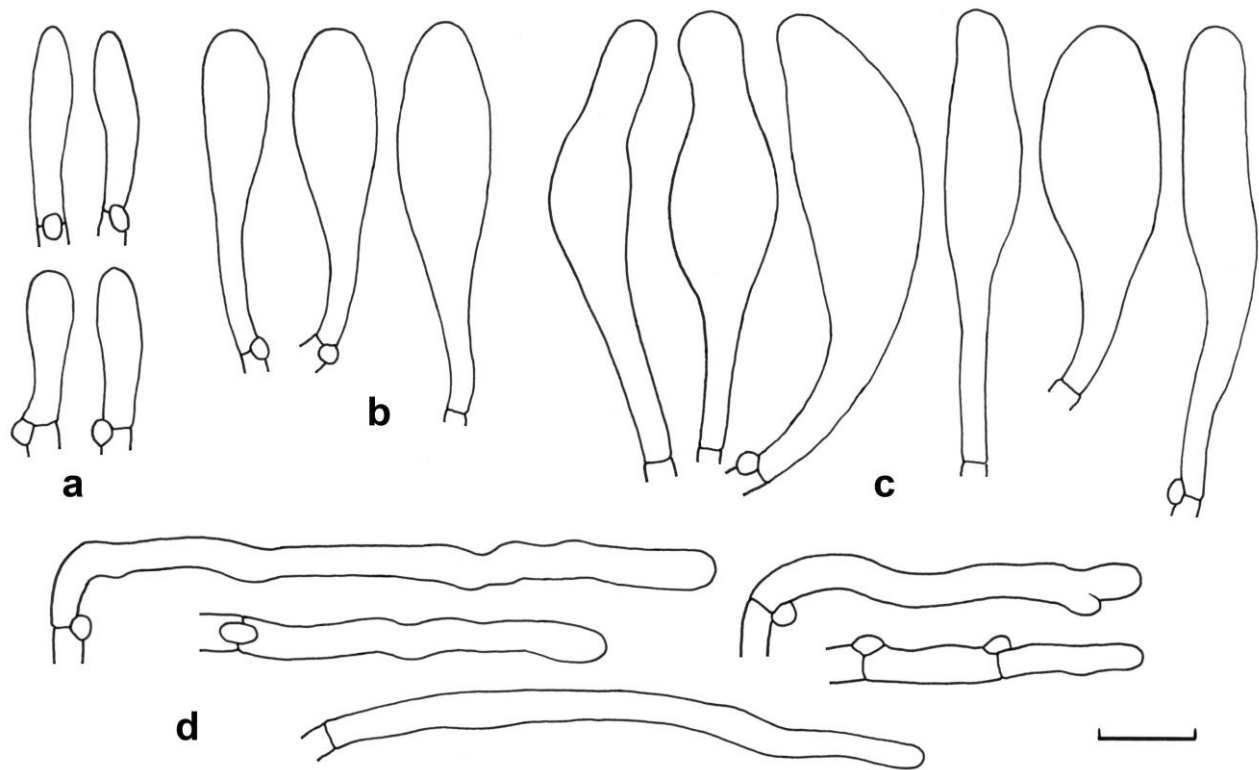
**Fig. 37** – Basidiomes of *Gymnopus ocellus* (Holotype, DED 8280). Scale bar = 10 mm

Notes – *Gymnopus ocellus* is characterized by a glabrous, hygrophanous, plane-depressed pileus with brown disc and streaked brown-white margin, crowded, narrow, off-white lamellae, a stout pubescent stipe, clavate to fusoid-ventricose, pedicellate pleurocystidia and cheilocystidia, inamyloid and non-dextrinoid, clamped hyphae, narrow (3–5  $\mu\text{m}$ ), sinuous caulocystidia, and growth on rotten logs. The presence of large, conspicuous pleurocystidia is unusual in *Gymnopus*, with the Príncipe material showing morphological affinity to *G. termiticola* (Corner) A.W. Wilson, Desjardin & E. Horak, *G. omphalodes* (Berk.) Halling & J.L. Mata, *G. lodgeae* (Singer) J.L. Mata and *G. pseudolodgeae* J.L. Mata. *Gymnopus termiticola*, from Java, differs in forming a conspicuously rugulose-sulcate, greyish red pileus, distant lamellae, much longer basidioles (21–38  $\mu\text{m}$ ), lobed cheilocystidia, lanceolate pleurocystidia, and growth on old termite nests (Wilson et al. 2004).



*Gymnopus omphalodes*, described from Brazil, forms a more conspicuously striate, paler ("cartridge buff") pileus, narrower stipe (1–2 mm), and irregularly cylindrical cheilocystidia 5–9 µm diam (Dennis 1951, Pegler 1983). *Gymnopus lodgeae*, from Costa Rica, differs in conspicuously striate-sulcate pileus, subdistant to distant lamellae, dark purplish brown stipe, and dimorphic hymenial cystidia with one type acute-fusoid (Singer 1989), while *G. pseudolodgeae* has a deeply sulcate pileus, distant pinkish brown lamellae, and apically diverticulate cheilocystidia (Mata et al. 2004).

Pairwise comparisons of aligned, overlapping ITS sequences of *Gymnopus ocellus* with the top ten BLAST results indicate closest similarity (89.4–90.5%) to three specimens of *G. omphalodes*



**Fig. 38** – Micromorphological features of *Gymnopus ocellus* (Holotype, DED 8280). a. Basidioles. b. Pleurocystidia. c. Cheilocystidia. d. Caulocystidia. Scale bar = 10 µm

(AF505761, AY256700 – Costa Rica; KJ609160 – Korea). *Gymnopus ocellus* forms a clade with *G. omphalodes* (72% BS, 0.94 PP) in our ITS phylogeny (Fig. 1), but interestingly, they are distantly related to the other morphologically similar pleurocystidia-formers, *G. lodgeae*, *G. pseudolodgeae* and *G. termiticola*, who form a well-supported clade (100% BS, 1.0 PP) sister to *G. dichrous*.

***Gymnopus pleurocystidiatus*** Desjardin & B.A. Perry, sp. nov.

Figs 39, 40a–e

Mycobank: MB821164; Facesoffungi number: FoF03748

Holotype – AFRICA. Príncipe, Dois Irmãos area, N01°34.889', E07°25.548', elev. 100 m, 23 April 2008, coll. by B.A. Perry and D.E. Desjardin, BAP 651 (SFSU).

Etymology – referring to the abundant pleurocystidia, unusual in species of *Gymnopus*.

Diagnosis – Pileus 15–33 mm diam, broadly convex, smooth to minutely rugulose, margin short-striatulate; surface dull, dry, glabrous to appressed-fibrillose or felted, cream (4A3) with brown fibrils on the disc. Context thin (–1 mm), white. Lamellae adnate to shallowly adnexed, subdistant with 3–4

series of lamellulae, narrow (1–2 mm), off-white to buff, edges concolorous. Stipe 22–33 × 1.5–2.5 mm, central to slightly eccentric, cylindrical above a slightly broader or subbulbous base, though, pliant, hollow, insititious; surface dull, dry, white-pruinose overall; apex off-white to buff, grading below to brown or dark brown (7–8E5–6).

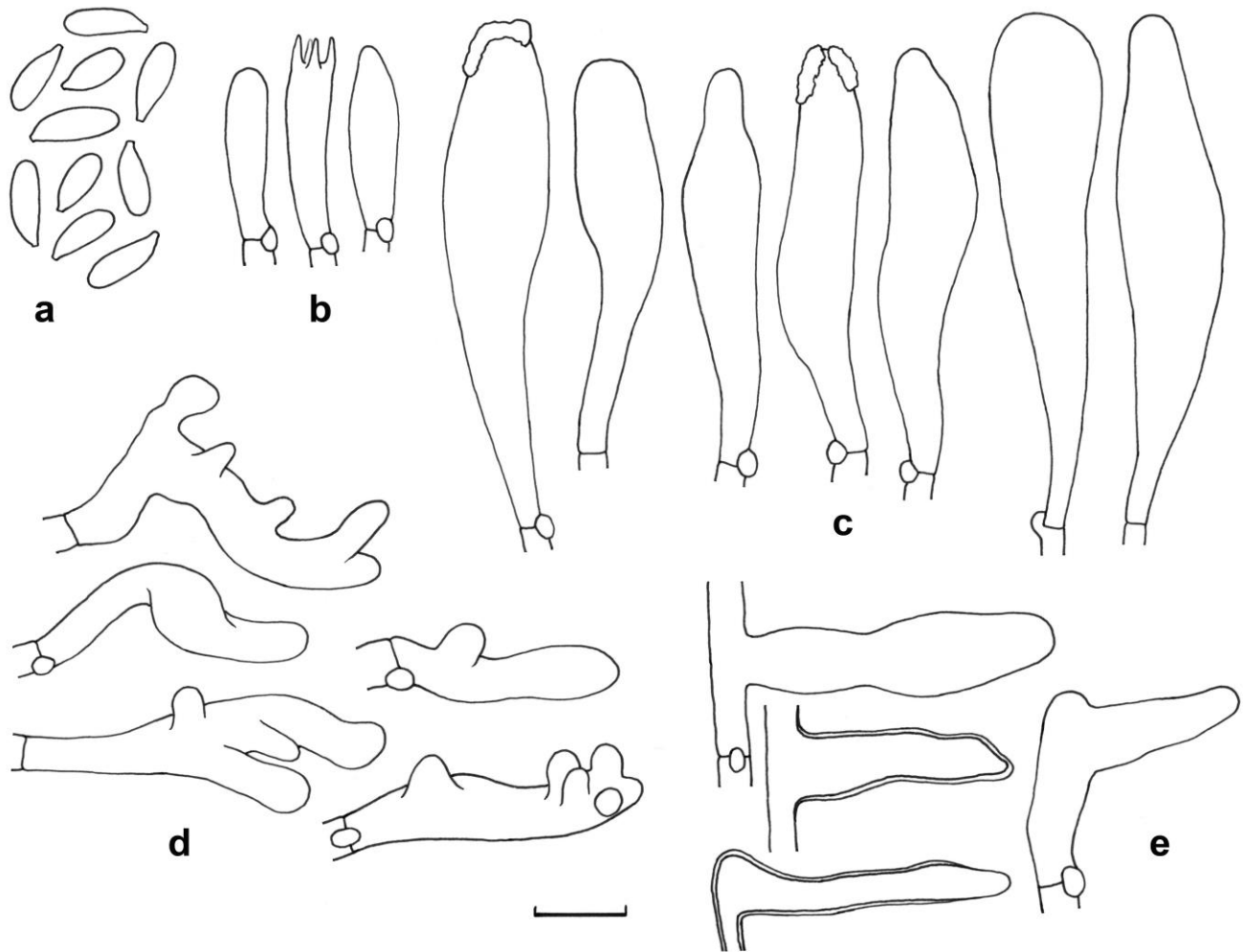
Basidiospores 7.7–10 × 2.5–3.5 μm [ $x_m = 8.8 \pm 0.7 \times 3.0 \pm 0.28 \mu\text{m}$ ,  $Q = 2.4\text{--}3.4$ ,  $Q_m = 2.99 \pm 0.19$ ,  $n = 20$ ,  $s = 1$ ], subcylindrical to elongate-ellipsoid or subfusoid, smooth, hyaline, inamyloid, thin-walled. Basidia not observed, presumably 4-spored (spore-tetrads observed). Basidioles 16–24 × 4.5–6 μm, cylindrical to fusoid, clamped. Hymenial cystidia abundant, present as cheilocystidia (lamellar edge primarily sterile) and pleurocystidia, exudative, arising from the lamellar trama; 45–60 × 8–13 (–16) μm, subcylindrical to clavate or fusoid, seldom subfusoid, pedicellate, obtuse, hyaline, inamyloid, thin-walled. Pileipellis a cutis of repent, radially arranged to slightly interwoven hyphae 2.5–6.5 (–8) μm diam, cylindrical, smooth or weakly incrustated, non-diverticulate or with scattered rod-like to knob-like outgrowths (a poorly developed *Rameales*-structure), pale yellow to yellowish brown, pigments intraparietal, inamyloid, non-gelatinous, thin-walled or with walls up to 0.8 μm thick; terminal cells undifferentiated or with a few broad, cylindrical to knob-like outgrowths. Pileus trama interwoven; hyphae 3–13 μm diam, cylindrical, hyaline, inamyloid, non-gelatinous, thin-walled. Lamellar trama subparallel to nearly divergent; hyphae 3–13 μm diam, cylindrical, hyaline, inamyloid, non-gelatinous, thin-walled or with walls up to 0.8 μm thick. Stipitipellis a cutis with abundant, scattered to clustered caulocystidia; cortical hyphae 2.5–6.5 μm diam, cylindrical, hyaline (apex) to yellowish brown (base), inamyloid, non-incrustated, non-gelatinous, thin-walled; medullary hyphae 2.5–10 μm diam, cylindrical, hyaline, inamyloid, thin-walled. Caulocystidia 22–64 (–86) × 4–10 μm, cylindrical to subfusoid,



**Fig. 39** – Basidiomes of *Gymnopus pleurocystidiatus* (Holotype, BAP 651). Scale bar = 10 mm

obtuse, sometimes geniculate, hyaline, inamyloid, thin-walled or with walls up to 1 mm thick. Clamp connections present in all tissues.

Habitat and known distribution – Scattered on decaying wood in secondary coastal forest. Africa (Príncipe).



**Fig. 40** – Micromorphological features of *Gymnopus pleurocystidiatus* (Holotype, BAP 651). a. Basidiospores. b. Basidium and basidioles. c. Hymenial cystidia (pleurocystidia and cheilocystidia). d. Pileipellis terminal cells. e. Caulocystidia. Scale bar = 10 µm

Material examined – AFRICA. Príncipe, Dois Irmãos area, N01°34.889', E07°25.548', elev. 100 m, 23 April 2008, coll. by B.A. Perry and D.E. Desjardin, BAP 651 (Holotype, MF100977, SFSU).

Notes – *Gymnopus pleurocystidiatus* is characterized by convex, felted, cream-colored pileus with central brown fibrils, subdistant, buff lamellae, a white-pruinose, buff to brown stipe, relatively long and narrow basidiospores with mean  $8.8 \times 3.0 \mu\text{m}$ , abundant, cylindrical to fusoid cheilocystidia, pleurocystidia and caulocystidia, clamp connections, and growth on woody debris. This may represent what Pegler (1977) reported as *Marasmiellus omphalodes* (Berk.) Singer (= *Gymnopus omphalodes* (Berk.) Halling & J.L. Mata) from Uganda, although he described the lamellae as drying brown and with smaller basidiospores,  $6\text{--}8.3 \times 2\text{--}3 \mu\text{m}$  ( $x_m = 7.5 \times 2.4 \mu\text{m}$ ). We consider *Gymnopus omphalodes*, described originally from Brazil, as distinct from the taxon reported by Pegler (1977), differing in

forming a more well-developed *Rameales*-structure on the pileipellis and stiptipellis (with diverticulate cortical hyphae), smaller basidiospores (6.0–7.8 × 1.8–3 µm), some diverticulate cheilocystidia, shorter pleurocystidia (16–32 µm), and shorter (–20 µm), diverticulate caulocystidia (Singer 1973).

Pairwise comparisons of aligned, overlapping ITS sequences of *Gymnopus pleurocystidiatus* with the top ten BLAST results indicate closest similarity (92.5–94.7%) to uncultured, undetermined Agaricales clones. Comparisons with ITS sequences of *Gymnopus omphalodes* from Costa Rica (DQ450010, DQ450011, AY256700, AF505761) showed only 86–87% similarity. Indeed, in the ITS phylogeny (Fig. 1) *G. pleurocystidiatus* belongs in a clade (76% BS, 1.0 PP) with taxa once considered typical for *Marasmiellus* sect. *Rameales*, distant from *G. omphalodes*.

***Gymnopus gibbosus*** (Corner) A.W. Wilson, Desjardin & E. Horak, Sydowia 56: 175. 2004.

Figs 41, 42a–c

Basionym: *Marasmius gibbosus* Corner, Beih. Nova Hedwigia 111: 55. 1996.

Facesoffungi number: FoF03749

Pileus 18–24 mm diam, convex; margin decurved, non-striate, eroded and split in age; surface dull, dry, appressed-fibrillose, disc brown (5–6F6–7), margin cream-brown (4–5C–D4–5). Context 1–2 mm thick, soft, white. Lamellae adnate with a short decurrent tooth, close with 2 series of lamellulae, moderately broad, cream (4A3), edges concolorous. Stipe 45–50 × 2.5–3 mm, central, cylindrical, terete or flattened, sometimes once-cleft, stuffed, non-insititious; surface dull, dry, glabrous, fibrous-streaked; apex pale greyish brown (5–6E3–4), base dark greyish brown (5–6F4–5), with white basal tomentum.

Basidiospores only 5 seen, 8–9.2 × 4.5–4.8 µm [ $x_m = 8.5 \times 4.7 \mu\text{m}$ ], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia few seen, clavate, 4-spored. Basidioles 25–32 × 5.5–7.5 µm, clavate to fusoid-ventricose. Pleurocystidia absent. Cheilocystidia scattered, few seen (lamellar edges eroded); 28–42 × 3.5–6.5 µm, irregularly cylindrical, with or without a few knob-like outgrowths, hyaline, inamyloid, thin-walled. Pileipellis a cutis of radially arranged hyphae 3–7 µm diam, cylindrical, non-diverticulate, smooth or brown-incrusted, yellowish brown to brown, inamyloid, weakly gelatinous, thin-walled; terminal cells repent, similar to the cheilocystidia. Pileus trama interwoven to radially arranged; hyphae 4.5–10 µm diam, cylindrical, hyaline, inamyloid, non-gelatinous, thin-walled. Lamellar trama regular; hyphae 3–12 µm diam, cylindrical or inflated, hyaline, inamyloid, non-gelatinous, thin-walled. Stiptipellis a cutis with scattered caulocystidia; cortical hyphae 3–6.5 µm diam, cylindrical, non-diverticulate, smooth, hyaline to pale brown, inamyloid, non-gelatinous, thin-walled; medullary hyphae 4–8 µm diam, hyaline, otherwise like cortical hyphae. Caulocystidia repent, similar to the cheilocystidia. Clamp connections present.

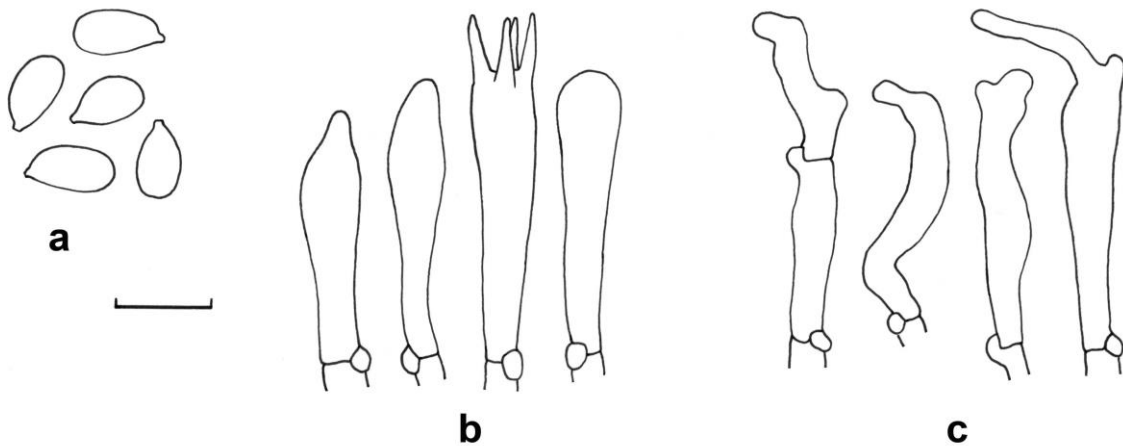
Habitat and known distribution – Solitary on tough, persistent bracts of baobab fruits. Africa (São Tomé), Indonesia (Java), Singapore.

Material examined – AFRICA. São Tomé, along main road (EN1) on north side of island at 16.5 km marker, N00°24.374', E06°37.092', 17 Apr. 2008, coll. by B.A. Perry and D.E. Desjardin, BAP 620 (MF100978, SFSU).

Notes – Described originally from Singapore (Corner 1996), *Gymnopus gibbosus* was redescribed from material collected in Java (Wilson et al. 2004). The São Tomé specimen matches nicely with the Javanese material. *Gymnopus gibbosus* has a moderately-sized, appressed-fibrillose pileus with brown disc and cream-brown margin, close cream-colored lamellae, a brown stipe, basidiospores with mean 8.5 × 4.7 µm, irregularly cylindrical cheilocystidia, caulocystidia and pileipellis terminal cells, a cutis-type pileipellis of non-diverticulate, brown-incrusted hyphae, non-dextrinoid tissues, clamp connections, and growth on woody debris. An ITS sequence of BAP 620 showed 99.3–99.9% similarity to nine GenBank sequences determined as *Gymnopus gibbosus* in



**Fig. 41** – Basidiomes of *Gymnopus gibbosus* (BAP 620). Scale bar = 10 mm



**Fig. 42** – Micromorphological features of *Gymnopus gibbosus* (BAP 620). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. Scale bar = 10  $\mu$ m

pairwise comparisons of aligned, overlapping sequences. *Gymnopus gibbosus* is sister to *G.*

*brunneigracilis* with 93% BS and 1.0 PP support (Fig. 1).

***Gymnopus* aff. *polygrammus*** (Mont.) J.L. Mata, in Mata & Petersen, Mycotaxon 86: 313. 2003.

Figs 43, 44a–e

Basionym: *Marasmius polygrammus* Mont., Anns. Sci. Nat., Bot., Sér. 4(1): 118. 1854.

= *Chamaeceras polygrammus* (Mont.) Kuntze, Revis. Gen. Pl. (Leipzig) 3(2): 456. 1898.

= *Collybia polygramma* (Mont.) Dennis, Trans. Brit. Mycol. Soc. 34(4): 447. 1951.

Facesoffungi number: FoF03750

Pileus 17–70 mm diam, hemispherical or convex to shallowly campanulate, soon plane-depressed with wavy-undulate, often split margin, initially smooth to striatulate, in age rugulose-sulcate to the disc; surface dull, dry, glabrous to minutely pruinose, at first dark grayish brown (5–6E–F4) overall, subhygrophanous, disc soon brown (5E5–6) to pale brownish orange (5C4), margin fading to pale greyish brown, beige, tan or dingy cream (<4A3). Context 1–2 mm thick, soft to tough and pliant, white under pileipellis, brown closer to the lamellae. Lamellae ascending-adnexed to adnate, close with 2–4 series of lamellulae, narrow to moderately broad (1–4 mm), when young yellowish white to cream (4A2–3), in age becoming pale greyish brown (5D3–4) and often spotted reddish brown; edges concolorous, short-ciliate. Stipe 35–60 × 2–5 mm, central, terete, cylindrical or gradually enlarged downward, hollow, tough, pliant, non-insititious; surface dull, dry, fibrous; apex felted, cream (4A3) to pale whitish grey; base tomentose, pale brownish orange (5C3) to brownish grey (3–4E3–4), covered with white tomentum. Odor and taste indistinct.



**Fig. 43** – Basidiomes of *Gymnopus* aff. *polygrammus* (DED 8324). Scale bar = 10 mm

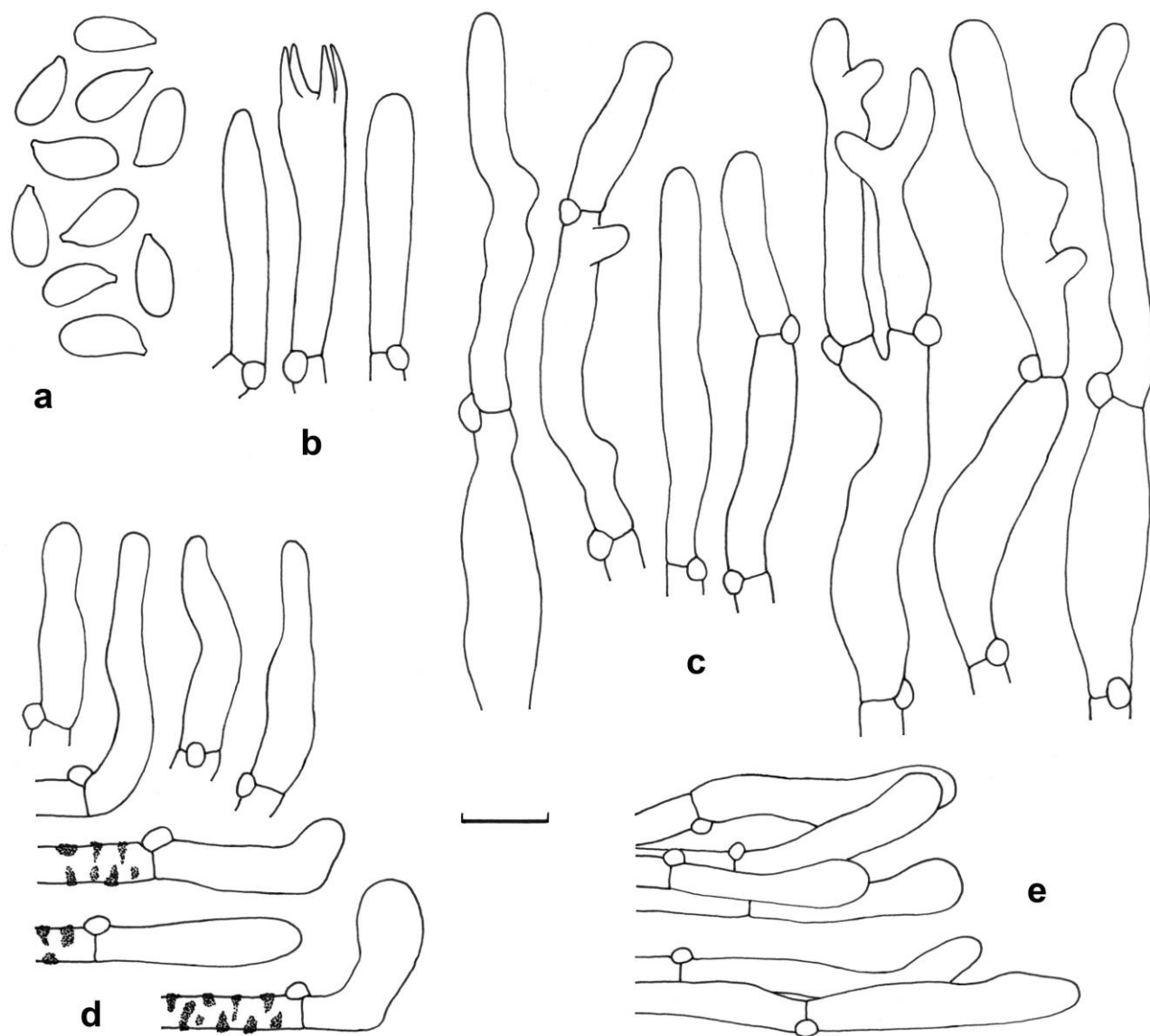
Basidiospores  $8\text{--}10.2 \times 4.0\text{--}5.0 \mu\text{m}$  [ $x_m = 9.2 \pm 0.66 \times 4.6 \pm 0.28 \mu\text{m}$ ,  $Q = 1.8\text{--}2.1$ ,  $Q_m = 2.0 \pm 0.06$ ,  $n = 20$ ,  $s = 1$ ], a few  $12\text{--}13 \times 4.8\text{--}5.0 \mu\text{m}$  from 2-spored basidia, ellipsoid, smooth, hyaline, inamyloid, non-dextrinoid, thin-walled. Basidia  $28\text{--}32 \times 6.5\text{--}8 \mu\text{m}$ , clavate, 4-spored, rarely 2-spored. Basidioles subclavate to subfusoid. Pleurocystidia absent. Lamellar edge sterile. Cheilocystidia catenulate; terminal cells  $22\text{--}60 \times 3.2\text{--}8 \mu\text{m}$ , irregularly cylindrical to subfusoid, subclavate, narrowly ventricose or sinuous, often with one or more knob-like outgrowths, seldom lobed, hyaline, inamyloid, thin-walled; subtending cells  $3.2\text{--}12 \mu\text{m}$  diam, inflated, otherwise like terminal cells. Pileipellis a cutis with numerous repent to erect pileocystidia; hyphae  $3.2\text{--}8 \mu\text{m}$  diam, radially arranged, cylindrical, non-diverticulate, non-incrusted or weakly incrusted with brown granular pigments, hyaline or pale brown, inamyloid, non-gelatinous, thin-walled; pileocystidia scattered, as lateral outgrowths or as repent to erect terminal cells,  $12.5\text{--}36 \times 3.5\text{--}8 \mu\text{m}$ , irregularly cylindrical to clavate or narrowly ventricose, obtuse, often geniculate, hyaline, inamyloid, thin-walled. Pileus trama of slightly interwoven hyphae  $3\text{--}13 \mu\text{m}$  diam, cylindrical or irregular in outline, branched, hyaline to very pale brown, inamyloid, non-incrusted, non-gelatinous, thin-walled or with walls up to  $1.2 \mu\text{m}$  thick. Lamellar trama regular; hyphae  $2.5\text{--}10 \mu\text{m}$  diam, cylindrical to slightly inflated, hyaline, inamyloid, non-gelatinous, walls up to  $0.5 \mu\text{m}$  thick. Stipitipellis a lattice of tangled hyphae giving rise to erect caulocystidia; cortical hyphae  $3\text{--}6.5 \mu\text{m}$  diam, cylindrical, parallel, non-incrusted, hyaline, dextrinoid, non-gelatinous, thin-walled; medullary hyphae similar but up to  $13 \mu\text{m}$  diam. Caulocystidia similar to cheilocystidia, single or catenulate,  $25\text{--}80 \times 3.5\text{--}6.5 \mu\text{m}$ , cylindrical to sinuous, obtuse, lacking outgrowths, hyaline, inamyloid, non-gelatinous, thin-walled. Clamp connections common in all tissues.

Habitat and known distribution – Scattered to gregarious on decayed wood in primary forests or cacao-banana groves. Africa (São Tomé), British Honduras, Guyana, India, Martinique, Puerto Rico, Trinidad,

Material examined – AFRICA. São Tomé, Macambrara, radio antenna area,  $N00^{\circ}16.557'$ ,  $E06^{\circ}36.326'$ , elev. 1300 m, 25 April 2008, coll. by D.E. Desjardin, DED 8324 (MF100979, SFSU); road EN1 near Santa Catarina,  $N0^{\circ}14.458'$ ,  $E06^{\circ}28.278'$ , elev. 10 m, 27 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 668 (MF100980, SFSU).

Notes – The São Tomé material is characterized by a rather large, broadly campanulate to plane-depressed, rugulose-sulcate, greyish brown pileus, close, moderately broad lamellae with ciliate margin, a felted-tomentose, non-insititious, lignicolous, brownish grey stipe, basidiospores with mean  $9.2 \times 4.6 \mu\text{m}$ , sinuous-catenulate cheilocystidia, a cutis-type pileipellis with numerous short, cylindrical pileocystidia, and a tangled lattice of cylindrical-sinuous caulocystidia. Our material differs slightly from published accounts of *G. polygrammus*, wherein the pileus is reported as pinkish cinnamon to pale greyish cream (Pegler 1983), the lamellae as buff to creamy white (Dutta et al. 2015), and the stipe as reddish brown to cinnamon brown (Pegler 1983) or dark brown to black (Mata and Petersen 2003). Our São Tomé material is also similar to *G. allegetii* (De Seynes) A.W. Wilson, Desjardin & E. Horak, but the latter species has fewer lamellae with less ciliate edges, slightly smaller basidiospores with mean  $8 \times 4.3 \mu\text{m}$  (Java; Wilson et al. 2004) or  $7 \times 3.3 \mu\text{m}$  (Africa; Pegler 1977), and the pileus was described by De Seynes (1897) as "roseo isabellino pallescente 3 cent. lato".

Pairwise comparisons of aligned, overlapping ITS sequences of *Gymnopus* aff. *polygrammus* with the top ten BLAST results indicate closest similarity (96.6–97.4%) to five specimens of *G. polygrammus* (AY842954, AY256701, DQ450029 – Puerto Rico; KJ778752 – India; KJ609162 – Korea). Because of the slight morphological differences, geographic distinction, and about 3% difference with ITS sequences annotated as representing *G. polygrammus*, we recognize our material as *Gymnopus* aff. *polygrammus*. In the ITS phylogeny (Fig. 1), *Gymnopus* aff. *polygrammus* is sister to *G. polygrammus* with 100% BS and 1.0 PP support.



**Fig. 44** – Micromorphological features of *Gymnopus* aff. *polygrammus* (DED 8324, BAP 668). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. d. Pileocystidia and pileipellis terminal cells. e. Caulocystidia. Scale bar = 10  $\mu$ m

***Gymnopus rodhallii*** Desjardin & B.A. Perry, sp. nov.

Figs 45, 46a–d

Mycobank: MB821165; Facesoffungi number: FoF03751

Holotype – AFRICA. São Tomé, along main road EN1 at 33 km marker, N00°19.606', E06°30.667', 18 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 627 (SFSU).

Etymology – named in honor of Roderick C. M. "Rod" Hall who has supported this project since its inception.

Diagnosis – Pileus (8–) 16–40 mm diam, hemispherical to broadly convex, expanding to plano-convex, centrally depressed, when young margin decurved, in age uplifted in places, split and eroded, striate to sulcate to the disc; surface dull, dry, glabrous, slightly polished, disc pale brownish grey to cream, or beige to cream (4A3) overall. Context up to 1 mm thick, buff, soft. Lamellae adnate, close with 2–3 series of lamellulae, occasionally forked, narrow (1–2 mm), cream (4A3) with concolorous



edges. Stipe (30–) 45–70 × 2–3 mm, central, terete to compressed, cylindrical or with a slightly flared apex, tough, pliant, hollow, non-insititious; surface dull, dry, densely white-pruinose overall, dark greyish brown (6–7F3–4) to greyish brown (5–6E–F4) overall; arising from clusters of coarse white rhizomorphs. Odor somewhat sweet; taste indistinct.

Basidiospores 6.4–7.0 × 3.0–3.5 μm, only 6 observed in two specimens, ellipsoid to sublacrymoid, smooth, hyaline, inamyloid, thin-walled. Basidia not observed. Basidioles 18–25 × 4.5–6.5 μm, fusoid. Pleurocystidia absent. Cheilocystidia abundant, lamellar edge sterile; 38–66 × 7–11.5 μm, clavate to nearly sphaeropedunculate or irregular in outline, typically non-lobed, occasionally with one lobe, hyaline, inamyloid, thin-walled. Pileipellis a cutis of repent, radially arranged hyphae 3.5–7.5 μm diam, cylindrical, non-diverticulate, smooth or weakly incrustated, hyaline or with pale yellowish brown incrustations, inamyloid, non-gelatinous, thin-walled; terminal cells undifferentiated, repent. Pileus trama of interwoven hyphae similar to those in the pileipellis but with walls up to 1 μm thick. Lamellar trama regular; hyphae 2.5–6.5 μm diam, cylindrical, hyaline, inamyloid, non-gelatinous, thin-walled. Stipitipellis a cutis with erect caulocystidia; cortical hyphae 2.5–6 mm diam, parallel, cylindrical, non-diverticulate, smooth, hyaline, inamyloid, non-gelatinous, thin-walled or with walls up to 1 μm thick; medullary hyphae 3.5–15 μm diam, cylindrical, hyaline to pale brown, inamyloid, walls up to 1.5 μm thick. Caulocystidia 32–64 × 5–8 μm, cylindrical to irregularly cylindrical, subclavate or



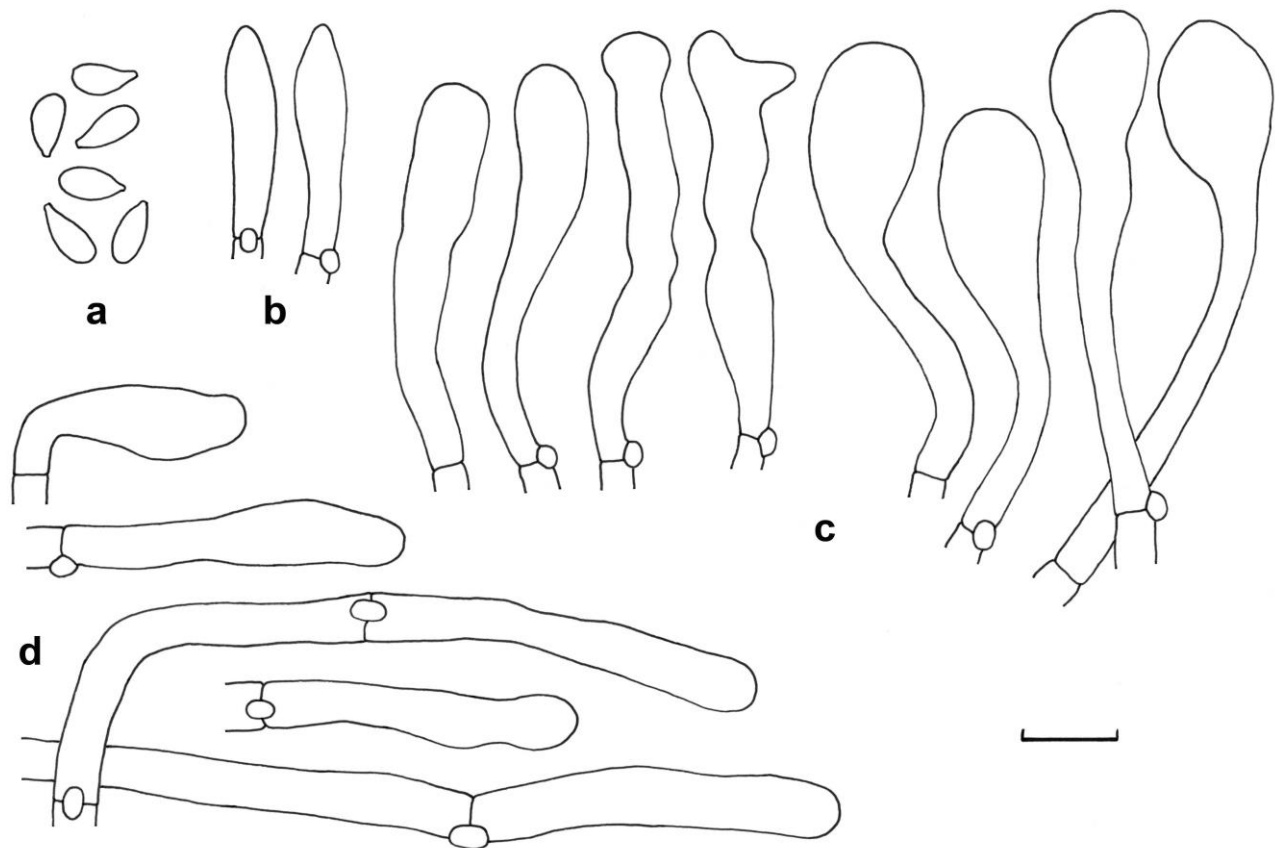
**Fig. 45** – Basidiomes of *Gymnopus rodhallii* (Holotype, BAP 627). Scale bar = 10 mm

rarely ventricose, often in chains, apex broadly obtuse, hyaline, inamyloid, thin-walled or with walls up to 0.5  $\mu\text{m}$  thick. Clamp connections present.

Habitat and known distribution – Cespitose on soil and debris of cacao in coastal cacao-banana groves under secondary forest, and on palm debris in coastal forest. Africa (Príncipe, São Tomé).

Material examined – AFRICA. Príncipe, Bom Bom Resort area on Bom Bom Island, 20 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 630 (MF100981, SFSU); São Tomé, along main road EN1 at 33 km marker, N00°19.606', E06°30.667', 18 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 627 (Holotype, MF100982, SFSU).

Notes – *Gymnopus rodhallii* is distinguished by a striate, glabrous, beige-cream pileus, close and narrow cream-colored lamellae, a dark greyish brown stipe covered with white pruinae that arises from clusters of coarse white rhizomorphs, small basidiospores (6.4–7  $\times$  3.0–3.5  $\mu\text{m}$ ), clavate-pedicellate to



**Fig. 46** – Micromorphological features of *Gymnopus rodhallii* (Holotype, BAP 627). a. Basidiospores. b. Basidioles. c. Cheilocystidia (left–BAP 630, right–BAP 627). d. Caulocystidia. Scale bar = 10  $\mu\text{m}$

irregularly cylindrical cheilocystidia, and rather broad, cylindrical, obtuse caulocystidia that often occur in chains. *Gymnopus rodhallii* is similar to a number of members of Sect. *Vestipedes*, including *G. menehune* Desjardin, Halling & Hemmes, *G. johnstonii* (Murrill) Dennis, *G. subpruinosis* (Murrill) Desjardin, Halling & Hemmes, *G. omphalodes* (Berk.) Halling & J.L. Mata, and *G. coracicolor* (Berk. & M.A. Curtis) J.L. Mata. *Gymnopus menehune*, described from Hawaii, differs in a darker brown pileus, larger basidiospores (7.5–9.5  $\times$  3.5–4.2  $\mu\text{m}$ ), cylindrical-lobed cheilocystidia, and nodulose pileipellis terminal cells (Desjardin et al. 1999). *Gymnopus johnstonii*, described from Puerto Rico, has a darker brown pileus, distant and broader lamellae (2–3 mm), larger basidiospores (8–10  $\times$  3–5  $\mu\text{m}$ ),

shorter cheilocystidia (–35 µm long), and more strongly brown-incrusted pileipellis hyphae (Dennis 1951, Pegler 1983). *Gymnopus subpruinus* has a darker brown to greyish brown pileus, distant and broader lamellae (1–4 mm), a paler stipe with greyish orange apex, larger basidiospores (8–10 × 4.5–5.2 µm), and conspicuous pileocystidia for which the species is named (Desjardin et al. 1999). Basidiomes of *Gymnopus rodhallii* look very similar to those of *G. omphalodes* reported from Trinidad by Dennis (1951; Pl. 21, Fig. 10), but the latter species forms a paler pileus (nearly white), conspicuous pleurocystidia, narrower basidiospores (2.5–3 µm), and more hair-like caulocystidia (–140 × –5 µm). *Gymnopus coracicolor*, described from Cuba, differs in forming a smaller (8–22 mm diam), cinnamon brown to chestnut brown pileus, distant and broader lamellae (2–3 mm), a smaller (15–45 × 1–2 mm), paler stipe, and lacks white rhizomorphs (Dennis 1951, Pegler 1983). Mata and Ovrebo (2009) reported *G. coracicolor* as having scattered pleurocystidia, absent in *G. rodhallii*.

Pairwise comparisons of aligned, overlapping ITS sequences of *Gymnopus rodhallii* with the top ten BLAST results indicate closest similarity (92.2–92.4%) to four specimens of *Gymnopus menehune* (AY263426–Holotype, KJ855237, KJ778753, JN182864). Comparisons with ITS sequences of *G. johnstonii* (AY822014), *G. subpruinus* (AY842952, DQ450025, DQ450026, DQ450027) and *G. omphalodes* (KJ609160, AF505761, DQ450011, AY256700, DQ450010) show 87%, 84.6–85.9% and 80.1–81.9% similarity, respectively. No ITS sequences of *G. coracicolor* are available for comparison. In the ITS phylogeny (Fig. 1), *G. rodhallii* belongs in a well-supported clade (93% BS, 1.0 PP) with eight other *Gymnopus* species, including *G. hirtellus* and *G. hirtelloides* reported herein from Príncipe.

***Gymnopus* aff. *brunneigracilis*** (Corner) A.W. Wilson & Desjardin, Sydowia 56(1): 171. 2004.

Figs 47, 48a–c

Basionym: *Marasmius brunneigracilis* Corner, Beih. Nova Hedwigia 111: 39. 1996.

Facesoffungi number: FoF03752

Pileus 30–70 mm diam, broadly convex to plano-convex, sometimes with a shallow central depression; margin striate to pellucid-striate, eroded and seldom uplifted in age; surface dull, dry to moist, glabrous, hygrophanous, disc brown (7D6–8) to dark brown (5–6F7–8), margin cream (3–4A2), in age. Context thin, pliant, white. Lamellae adnexed to adnate, occasionally with a short decurrent tooth, subdistant with 2–3 series of lamellulae, thin, broad (2–5 mm), cream (4A3) with concolorous edge. Stipe 40–80 × 2.5–6 mm, central, terete, cylindrical or with slightly enlarged base, sometimes twisted, solid to stuffed, non-insititious; surface dull, dry, minutely white-pruinose, fibrous-striate, apex cream (4A2–3), base brown (7D6–8) to dark greyish brown (5–6E–F4–5); base with white tomentum. Odor and taste not distinctive, pleasant.

Basidiospores not observed, material sterile. Basidioles 24–33 × 4.0–6.5 µm, clavate to fusoid. Lamellar edge sterile. Cheilocystidia 24–30 × 4.8–7 µm, irregularly cylindrical to subclavate, occasionally with a few apical lobes or knobs, hyaline, inamyloid, thin-walled. Pleurocystidia absent. Pileipellis a cutis of repent, radially arranged hyphae 3–7 µm diam, cylindrical, branched, non-diverticulate, non-incrusted, hyaline to pale yellow, inamyloid, non-gelatinous, thin-walled; terminal cells undifferentiated, repent. Pileus trama of interwoven hyphae similar to those in the pileipellis but up to 12 µm diam. Lamellar trama regular; hyphae 3–10 µm diam, cylindrical, hyaline, inamyloid, non-gelatinous, thin-walled. Stipitipellis a trichodermium of erect caulocystidia; cortical hyphae 3–5 µm diam, parallel, cylindrical, non-diverticulate, smooth, hyaline, inamyloid or weakly dextrinoid, non-gelatinous, thin-walled; medullary hyphae 5–12 µm diam, cylindrical, hyaline, inamyloid, thin-walled. Caulocystidia 24–64 × 3–5 µm, irregularly cylindrical, flexuous, seldom with one or more knob-like outgrowths, hyaline, inamyloid, thin-walled. Clamp connections common.

Habitat and known distribution – Scattered on decaying wood in secondary coastal forest. Africa (São Tomé), Indonesia (Java), Singapore.

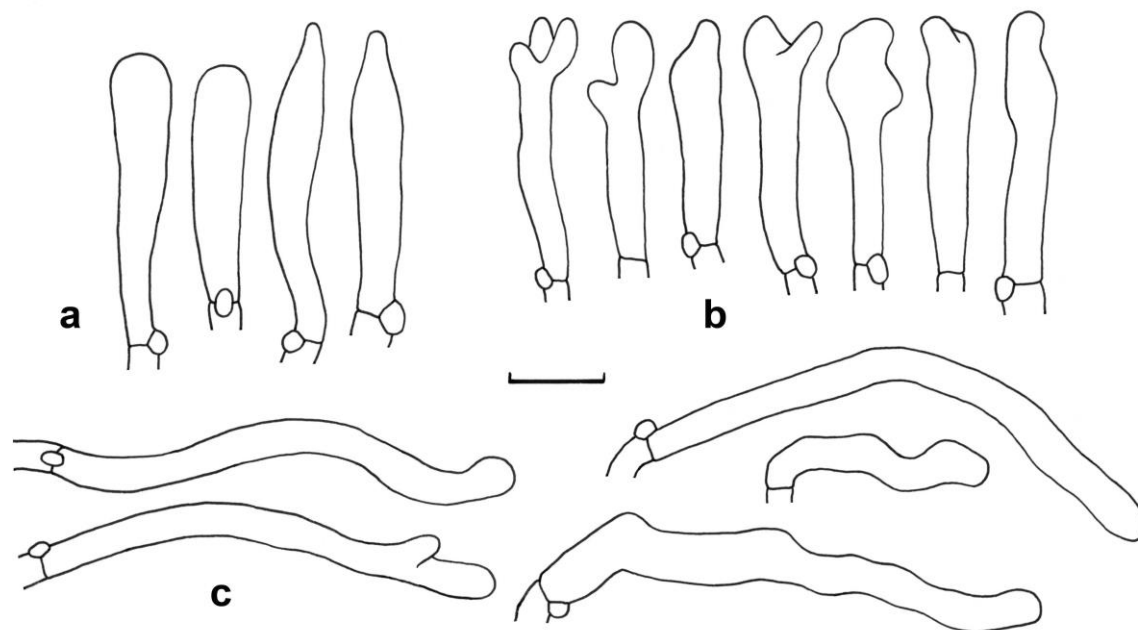


**Fig. 47** – Basidiomes of *Gymnopus* aff. *brunneigracilis* (BAP 621). Scale bar = 10 mm

Material examined – AFRICA. São Tomé, along road EN-1 on north side of island at 18.25 km marker, N00°23.687', E06°36.302', 17 April 2008, coll. by D.E. Desjardin and B.A. Perry, BAP 621 (MF100983, SFSU).

Notes – *Gymnopus* aff. *brunneigracilis* is characterized by a rather large, striate pileus with brown disc and cream margin, subdistant, cream-colored lamellae, a non-insititious, white-pruinose stipe with cream-colored apex and dark greyish brown base, irregularly cylindrical cheilocystidia and caulocystidia with or without a few knob-like projections, non-diverticulate pileipellis hyphae, and growth on decaying wood. The São Tomé specimen reported here is sterile and yielded no basidiospores or mature basidia. Material from Java (Wilson et al. 2004) differs slightly in forming a more evenly brown to reddish brown pileus and a less pruinose stipe with fewer caulocystidia. Type material from Singapore differs in forming smaller basidiomes (pileus 10–28 mm diam, stipe 8–16 × 1–1.5 mm; Corner 1996).

Pairwise comparisons of aligned, overlapping ITS sequences of *Gymnopus* aff. *brunneigracilis* with the top ten BLAST results indicate closest similarity (98.4%) to a Java specimen of *G. brunneigracilis* (AY263434), and show 96.3–96.7% similarity to nine specimens of *G. luxurians* (Peck) Murrill. *Gymnopus* aff. *brunneigracilis* forms a clade (78% BS, 1.0 PP) with *G. brunneigracilis* and *G. gibbosus* (Fig. 1).



**Fig. 48** – Micromorphological features of *Gymnopus* aff. *brunneigracilis* (BAP 621). a. Basidioles. b. Cheilocystidia. c. Caulocystidia. Scale bar = 10  $\mu$ m

*Gymnopus cervinus* (Henn.) Desjardin & B.A. Perry, comb. nov.

Figs 49, 50a–e

Basionym: *Marasmius cervinus* Henn., Bot. Jb. 23: 551. 1897.

Holotype – Cameroon, Lolodorf, on dead wood and leaves, 8 Sept. 1895, Staudt 437 (not found).

Mycobank: MB821167; Facesoffungi number: FoF03753

Pileus 10–25 mm diam, convex becoming plano-convex, centrally depressed in age, sulcate to rugulose-sulcate; margin decurved to uplifted, sometimes undulate; surface dull, moist to dry, glabrous, disc and sulcae dark brown (6–7F5–8), brown (6–7E4–8) elsewhere. Context very thin (0.5 mm), concolorous with surface. Lamellae horizontal, adnexed, sometimes with a thin pseudocollarium, distant (12–15) or subdistant (15–18) with 2 series of lamellulae, narrow (1–1.5 mm), seldom slightly intervenose, brown (7E6–8) to greyish brown (7D–E3) with paler edges, non-marginate. Stipe 8–20  $\times$  0.5–1.5 mm, central, terete, cylindrical or narrowed downward, tough, pliant, hollow, insititious; surface dull, dry, velutinous to pubescent overall; apex brown (7E5–8), base dark brown (7–8F6–8); rhizomorphs absent.

Basidiospores 6.4–8.3  $\times$  3.5–4.2  $\mu$ m [ $x_m = 7.3 \pm 0.60 \times 3.8 \pm 0.27 \mu$ m,  $Q = 1.8–2.1$ ,  $Q_m = 1.93 \pm 0.08$ ,  $n = 20$ ,  $s = 1$ ], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia 15–26  $\times$  5–7  $\mu$ m, clavate, 4-spored, clamped. Basidioles clavate to subfusoid. Pleurocystidia absent. Cheilocystidia abundant, main body 13–26  $\times$  5–8  $\mu$ m, clavate or irregularly cylindrical, sometimes lobed, with few to numerous finger-like projections 2–11  $\times$  1.5–3.5  $\mu$ m, hyaline, inamyloid, thin-walled. Pileipellis a cutis of radially arranged, slightly interwoven, repent hyphae (2.5–) 4–10 (–12)  $\mu$ m diam, cylindrical or irregular in outline, with few scattered, broad, knob-like projections (not a *Rameales*-structure), with walls up to 2.0  $\mu$ m thick coarsely incrustated with dark brown pigments, inamyloid, non-gelatinous; terminal cells undifferentiated or with coarse, knob-like projections. Pileus and lamellar trama of hyphae 2–10 (–12)  $\mu$ m diam, cylindrical or irregular in outline, thin-walled or with walls up to 2  $\mu$ m thick, hyaline, smooth or pale brown-incrustated, non-gelatinous. Stipitipellis composed of numerous, erect caulocystidia. Stipe cortical hyphae 3–8  $\mu$ m diam, parallel, cylindrical, smooth or with pale

brown incrustations, hyaline or pale brown, inamyloid, thick-walled ( $\approx 3 \mu\text{m}$ ), non-gelatinous; medullary hyphae  $3\text{--}22 \mu\text{m}$  diam, cylindrical, smooth, hyaline or pale brown, thin-walled or with walls up to  $3 \mu\text{m}$  thick, non-gelatinous. Caulocystidia  $30\text{--}160 \times 5\text{--}10 \mu\text{m}$ , subcylindrical to acicular or lanceolate, obtuse to subacute, smooth, hyaline (stipe apex) to brown (stipe base), inamyloid, thick-walled ( $1\text{--}3 \mu\text{m}$ ). Clamp connections common in all tissues.



**Fig. 49** – Basidiomes of *Gymnopus cervinus* (BAP 623). Scale bar = 10 mm

Habitat and known distribution – scattered to gregarious on decaying woody debris in secondary forest. Africa (Príncipe, São Tomé).

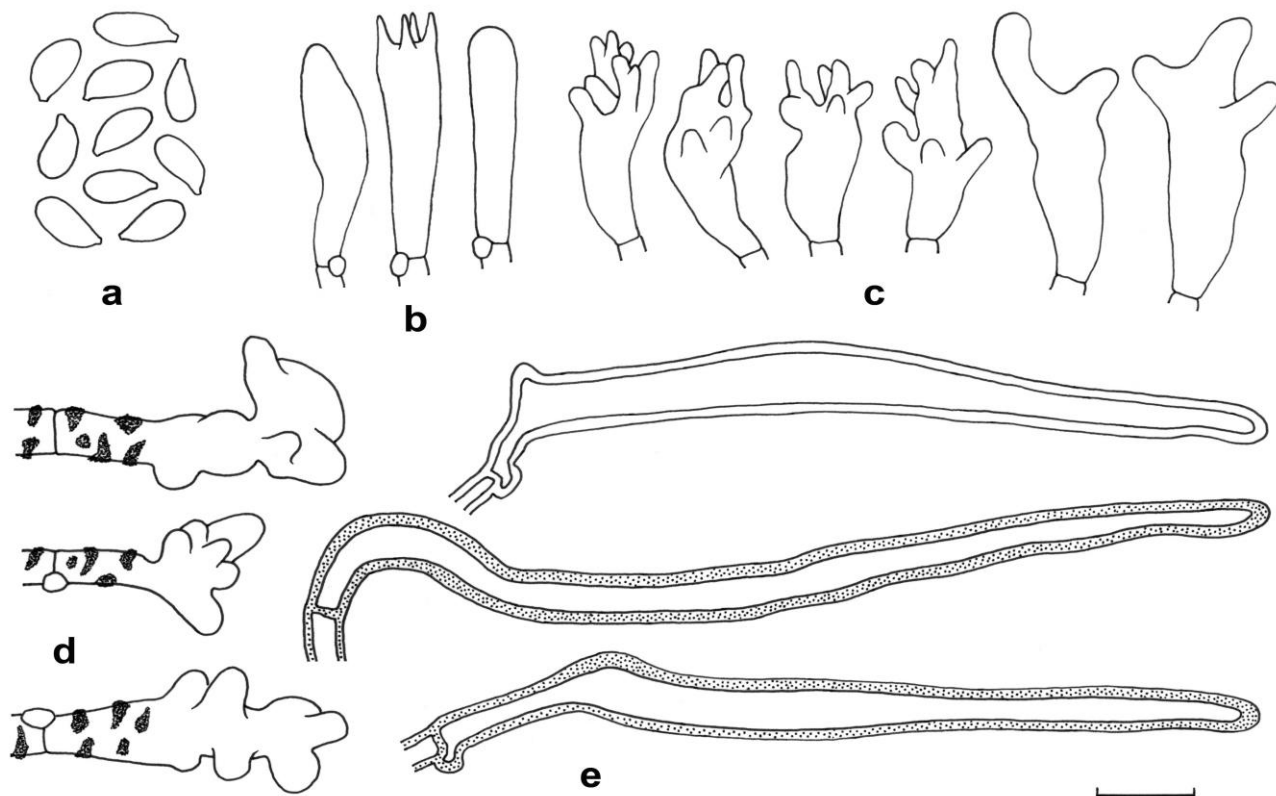
Material examined – AFRICA. Príncipe, Roça Pico Papagaio,  $N01^{\circ}37.182'$ ,  $E07^{\circ}23.474'$ , 21 April 2008, coll. by D.E. Desjardin, DED 8298 (MF100984, SFSU). São Tomé, along main road (EN1) on north side of island at 18.25 km marker,  $N00^{\circ}23.687'$ ,  $E06^{\circ}36.302'$ , 17 April 2008, coll. by B.A. Perry and D.E. Desjardin, BAP 623 (MF100985, SFSU).

Notes – *Marasmius cervinus* Henn. was described from material collected on dead wood in Lolodorf, Cameroon. According to Antonín (2007: 147), the type specimen is no longer available. The protologue, reproduced below, matches quite nicely with the specimens collected from São Tomé and Príncipe, and the epithet is herein accepted as representing that material.

Protologue (Hennings 1897): "Pileo tenui membranaceo, pellucido-cervino, convexo-explanato, medio depresso, subumbilicato atrobrunneo, radiatim sulcato subplicatoque obscuriore, 9–12 mm diametro, stipite corneo, fistuloso, brunneo velutino tomentoso ad basim atro, 12–15 mm longo vix 1 mm crasso; lamellis rotundato-adnatis, subdistantibus, inaequilongis, subventricosis. Sporis non visis."

Distinctive features of *Gymnopus cervinus* include a brown to dark brown, rugulose-sulcate pileus, distant to subdistant, brown lamellae, a velutinous, brown to dark brown, insititious stipe, basidiospores with mean  $7.3 \times 3.8 \mu\text{m}$ , cheilocystidia with few to numerous broad finger-like projections, a cutis-type pileipellis of coarsely brown-incrusted hyphae with a few knob-like projections, non-gelatinous, inamyloid tissues, numerous thick-walled, acicular caulocystidia, and growth on woody debris. In prior taxonomic constructs, this taxon would belong in *Marasmiellus* sect. *Dealbati*, subsect. *Quercini sensu* Singer (1973), where it would key closest to *Marasmiellus pandoensis* Singer. The latter species, described from Bolivia, differs in forming a deep rusty ochraceous brown pileus with cinnamon striae, close lamellae, narrower basidiospores ( $2.5\text{--}3.5 \mu\text{m}$ ), and more broadly rounded caulocystidia (Singer 1973). *Gymnopus cervinus* also show similarities to

*Collybia njalensis* (Beeli) Pegler, described from Sierra Leone, but the latter has an amber brown pileus, crowded, ochraceous tawny lamellae, a much longer stipe (25–60 mm), narrower basidiospores (2.5–3.5 µm), and pointed-fusiform cheilocystidia that lack apical projections (Pegler 1968).



**Fig. 50** – Micromorphological features of *Gymnopus cervinus* (BAP 623, DED 8298). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. d. Pileipellis terminal cells. e. Caulocystidia. Scale bar = 10 µm

Pairwise comparisons of aligned, overlapping ITS sequences of *G. cervinus* with the top ten BLAST results indicate closest similarity (90.9–93.4%) to uncultured Marasmiaceae isolates (LC013358, LC013361). In the ITS phylogeny (Fig. 1), *G. cervinus* forms a well-supported clade (100% BS, 1.0 PP) with *G. mustachius*, sister to *G. omphalodes*, *G. ocellus*, *G. peronatus* and *G. subnudus*.

***Gymnopus ugandensis*** (Pegler) Desjardin & B.A. Perry, comb. nov.

Figs 51, 52a–e

Basionym: *Marasmiellus ugandensis* Pegler, Kew Bull., Addit. Ser. 6: 120. 1977.

Lectotype *hic designari* – AFRICA. Uganda, Buganda Province, Mengo District, Mpanga Res. For., on fallen debris, alt. 1241 m, 8 June 1968, Pegler 1323 (K).

Mycobank: MB821169; Facesoffungi number: FoF03754

Pileus 3–13 mm diam, convex to subcampanulate; smooth to rugulose, short-striate; surface dull, dry, glabrous; disc pale brownish grey (6C3) to orangish white (5A2–3); margin buff to off-white with a hint of pink or orangish white. Context <1 mm thick, soft, white. Lamellae adnate, close to subdistant with 1–2 series of lamellulae, narrow, white to buff. Stipe 5–13 × 0.5–1 mm, central, terete, cylindrical,

tough, insititious; surface dull, dry, covered with white pruinae; apex white to buff, base greyish red (8C4–5) to reddish brown (8E4–5) or dark brown (8F4–5). Odor not distinctive.

Basidiospores  $6.5\text{--}8 \times 3.5\text{--}4 \mu\text{m}$  [ $x_m = 7.05 \pm 0.52 \times 3.7 \pm 0.19 \mu\text{m}$ ,  $Q = 1.7\text{--}2.1$ ,  $Q_m = 1.91 \pm 0.12$ ,  $n = 20$ ,  $s = 1$ ], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia  $24\text{--}28 \times 6\text{--}7 \mu\text{m}$ , clavate, 4-spored. Basidioles cylindrical to subclavate. Pleurocystidia absent. Lamellar edge sterile. Cheilocystidia  $24\text{--}42 \times 11\text{--}20$  ( $\text{--}22$ )  $\mu\text{m}$ , broadly clavate, apically diverticulate, hyaline, thin-walled; diverticula  $1.5\text{--}5 \times 1\text{--}3 \mu\text{m}$ , cylindrical to irregular in outline, sometimes branched, hyaline. Pileipellis a *Rameales*-structure; hyphae  $2.2\text{--}5 \mu\text{m}$  diam, cylindrical, diverticulate, hyaline, inamyloid, smooth or weakly incrustated, non-gelatinous, thin-walled; diverticula  $1.5\text{--}15 \times 1.5\text{--}3.2 \mu\text{m}$ , cylindrical to irregular in outline, hyaline. Pileus trama interwoven; lamellar trama regular; hyphae  $3\text{--}10 \mu\text{m}$  diam, cylindrical, hyaline, inamyloid, smooth, non-gelatinous, thin-walled. Stipitipellis a cutis with numerous erect caulocystidia; stipe cortical hyphae  $3\text{--}8 \mu\text{m}$  diam, cylindrical, parallel, hyaline to pale brown, inamyloid, smooth, non-gelatinous, thin-walled; medullary hyphae  $3.5\text{--}10 \mu\text{m}$  diam, hyaline, inamyloid, non-gelatinous, thin-walled. Caulocystidia  $12\text{--}64 \times 6.5\text{--}10 \mu\text{m}$ , cylindrical to fusoid or irregular in outline, sometimes lobed, apex broadly obtuse, hyaline, inamyloid, thin-walled. Clamp connections present.



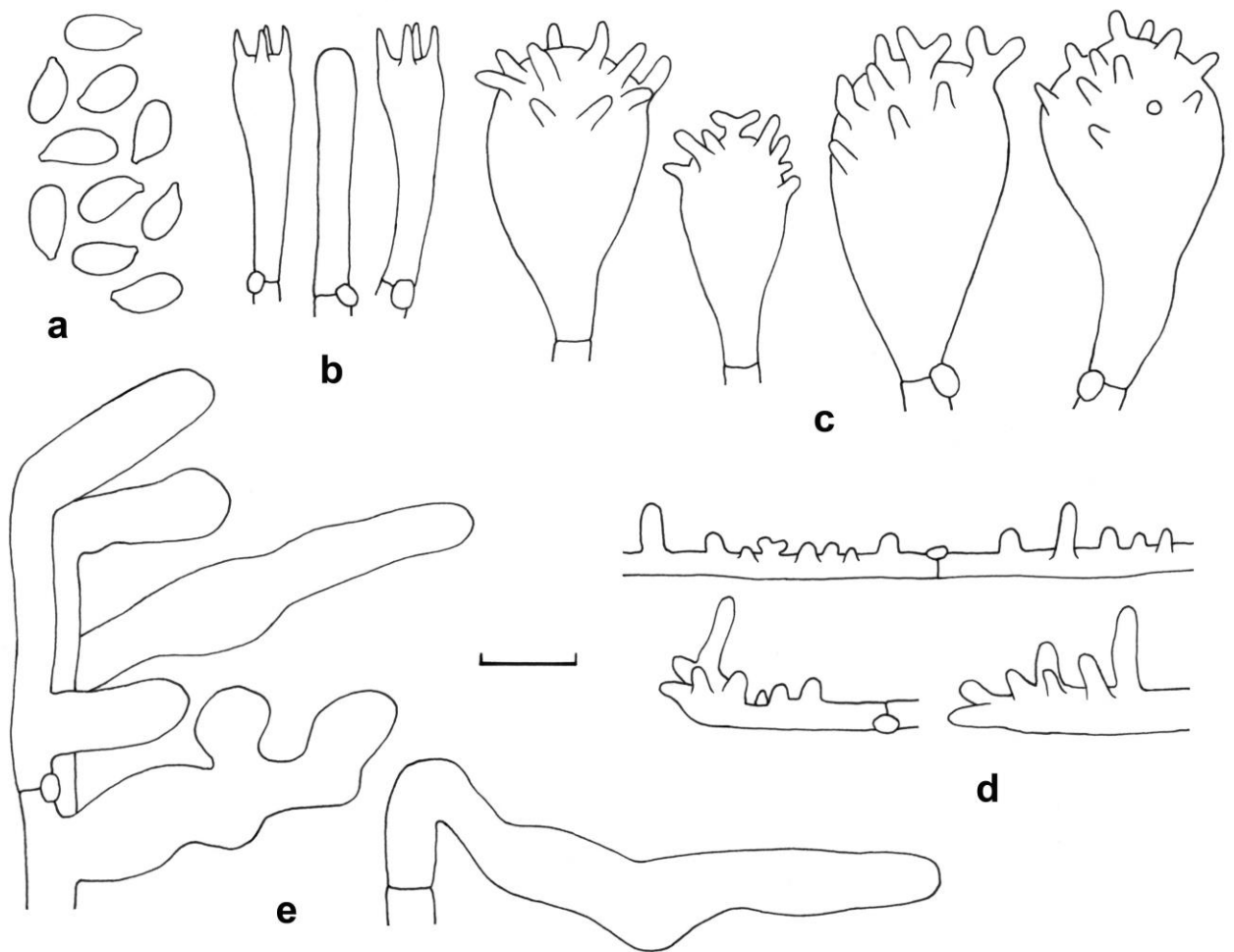
**Fig. 51** – Basidiomes of *Gymnopus ugandensis* (BAP 614). Scale bar = 10 mm



Habitat and known distribution – Scattered to gregarious on undetermined dicotyledonous twigs in primary forest. Africa (São Tomé, Tanzania, Uganda).

Material examined – AFRICA. São Tomé, Parque Nacional Obo, along trail from Bom Sucesso to Lagoa Amelia, between N00°17.112', E06°35.967' and N00°16.922', E06°36.062', 14 April 2008, coll. by B.A. Perry, BAP 614 (MF100986, SFSU).

Notes – *Gymnopus ugandensis* is distinguished by a small pileus with greyish brown to orangish white disc and off-white margin, close to subdistant white lamellae, a short, insititious, brown to reddish brown stipe covered with white pruinae, relatively small basidiospores with mean  $7 \times 3.7 \mu\text{m}$ , broadly clavate cheilocystidia (11–20  $\mu\text{m}$  diam) with short apical diverticula, a *Rameales*-type pileipellis, broadly obtuse, clavate, thin-walled caulocystidia, and growth on twigs. The São Tomé material differs slightly from the east African specimens, which have more crowded lamellae, slightly smaller basidiospores (mean  $6.5 \times 3 \mu\text{m}$ ), and narrower cheilocystidia (8–12  $\mu\text{m}$ ) (Pegler 1977). However, the unusual cheilocystidia and thin-walled caulocystidia are diagnostic.



**Fig. 52** – Micromorphological features of *Gymnopus ugandensis* (BAP 614). a. Basidiospores. b. Basidia and basidiole. c. Cheilocystidia. d. Pileipellis hyphae and terminal cells. e. Caulocystidia. Scale bar = 10  $\mu\text{m}$

Pairwise comparisons of aligned, overlapping ITS sequences of *G. ugandensis* with the top ten

BLAST results indicate closest similarity (92.9–96%) to uncultured Agaricales clones, and 91.9% similarity to *Marasmiellus foliophilus* A.K. Dutta, K. Acharya & Antonín. The latter species, described recently from India, differs from *G. ugandensis* in forming more distant lamellae, a longer (15–29 mm), greyish yellow to buff-brown stipe, slightly longer basidiospores (mean  $7.8 \times 3.7 \mu\text{m}$ ), narrower (9–12  $\mu\text{m}$ ) cheilocystidia with much longer (up to 18  $\mu\text{m}$ ) and broader apical diverticula, thick-walled caulocystidia, and growth on leaves (Dutta et al. 2015). In the ITS phylogeny (Fig. 1), *G. ugandensis* belongs in a supported clade (76% BS, 1.0 PP) with *G. ramealis* (Bull.) Gray, *M. foliophilus* and *G. pleurocystidiatus*.

*Gymnopus ugandensis* may represent what was reported from São Tomé by Bresadola and Roumeguère (1890) and Coutinho (1925) as *Marasmius amadelphus* (Bull.) Fr., the latter recognized as a synonym of *G. ramealis*.

***Gymnopus mustachius*** Desjardin & B.A. Perry, sp. nov.

Fig. 53a–d

MycoBank: MB821162; Facesoffungi number: FoF03755

Holotype – AFRICA. São Tomé, Parque Nacional Obo, on trail to Lagoa Amelia, between N00°17.122', E06K35.967' and N00°16.922', E06°36.062', 28 Apr. 2008, coll. by B.A. Perry and D.E. Desjardin, BAP 670 (SFSU).

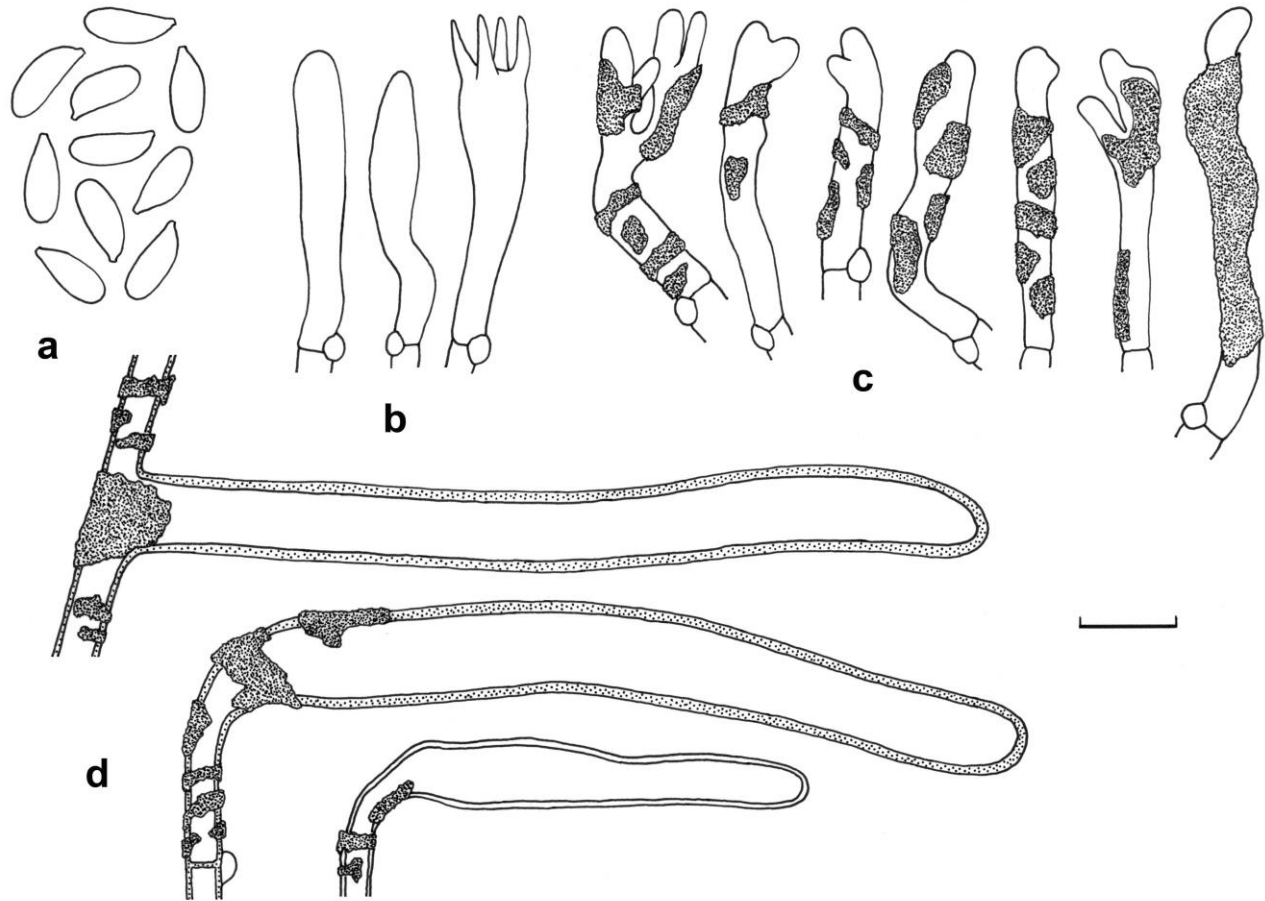
Etymology – *mustachius*, referring to the cells on the lamellar edge looking like a brown mustache.

Diagnosis – Pileus 3–13 mm diam, convex to plano-convex, centrally depressed in age, striate; surface dull, dry, minutely appressed-fibrillose to furfuraceous, dark reddish brown (7–8F7–8) with darker ornamentation. Context 0.5 mm thick, pale brownish grey. Lamellae horizontal, adnate to a pseudocollarium, subdistant with 1 series of lamellulae, moderately broad, pale brownish grey with dark brown edges. Stipe 14–32  $\times$  0.5–1 mm, central, cylindrical, terete or compressed, base twisted-striate, tough, hollow, insititious; surface dull, dry, densely hispid with brownish black ornamentation, brownish black overall; associated with narrower, wiry, brownish black rhizomorphs but not arising from them. Odor indistinct.

Basidiospores 8.5–10  $\times$  3.5–4  $\mu\text{m}$  [ $x_m = 9.2 \pm 0.37 \times 3.7 \pm 0.17 \mu\text{m}$ ,  $Q = 2.4\text{--}2.6$ ,  $Q_m = 2.47 \pm 0.05$ ,  $n = 20$ ,  $s = 1$ ], elongate-ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia 30–37  $\times$  6.5–8  $\mu\text{m}$ , clavate, 4-spored. Basidioles 28–36  $\times$  5–6.5  $\mu\text{m}$ , subfusoid to fusoid. Pleurocystidia absent. Lamellar edge sterile, composed of repent to erect, irregularly cylindrical cheilocystidia 25–48  $\times$  3.8–6.5  $\mu\text{m}$ , often lobed or with a few knob-like outgrowths, strongly incrustated with granular to annular or plaque-like dark brown pigments; walls thin or up to 0.5  $\mu\text{m}$  thick, hyaline to brown, non-gelatinous. Pileipellis a cutis of radially arranged, slightly interwoven hyphae 3–8  $\mu\text{m}$  diam, cylindrical, non-diverticulate, very coarsely and strongly incrustated with granular to annular or plaque-like dark brown pigments (up to 0.6  $\mu\text{m}$  thick), brown, inamyloid, non-gelatinous; terminal cells undifferentiated, cylindrical to subclavate, non-diverticulate (not *Siccus*-type), coarsely brown-incrustated. Pileus trama interwoven; lamellar trama regular; hyphae 2.2–7  $\mu\text{m}$  diam, cylindrical, much-branched, smooth or incrustated, hyaline, inamyloid, non-gelatinous, thin-walled or with walls up to 0.5  $\mu\text{m}$  thick. Stipe cortical hyphae 2.2–6  $\mu\text{m}$  diam, cylindrical, non-diverticulate, very coarsely and strongly incrustated with granular to annular or plaque-like dark brown pigments, hyaline to brown, inamyloid, non-gelatinous, thin-walled; medullary hyphae similar but hyaline, non-incrustated. Caulocystidia abundant, 32–85  $\times$  6.5–12  $\mu\text{m}$ , cylindrical to subfusoid, obtuse, hyaline to brown, smooth or brown-incrustated, non-gelatinous, walls 0.5–1.3  $\mu\text{m}$  thick. Clamp connections present.

Habitat and known distribution – Gregarious on woody sticks in primary forest. Africa (São Tomé).

Material examined – AFRICA. São Tomé, Parque Nacional Obo, on trail to Lagoa Amelia, between N00°17.122', E06K35.967' and N00°16.922', E06°36.062', 28 Apr. 2008, coll. by B.A.



**Fig. 53** – Micromorphological features of *Gymnopus mustachius* (Holotype, BAP 670). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. d. Caulocystidia. Scale bar = 10  $\mu\text{m}$

Notes – *Gymnopus mustachius* is characterized by rather small, dark reddish brown, appressed-fibrillose pileus, subdistant, pale brownish grey lamellae with dark brown edges, a densely hispid, insititious, brownish black stipe, basidiospores with mean  $9.2 \times 3.7 \mu\text{m}$ , irregularly cylindrical, brown pigmented-incrusted cheilocystidia, a cutis-type pileipellis of non-diverticulate, coarsely and strongly incrusted brown hyphae, cylindrical, obtuse, brown, thick-walled caulocystidia, and growth on woody sticks. *Marasmius brunneimarginatus* Corner, described from Singapore, is similar, but has a pale brown pileus, pale pink lamellae, no rhizomorphs, smaller basidiospores ( $6\text{--}7 \times 3 \mu\text{m}$ ), broader ( $9\text{--}20 \mu\text{m}$ ), subglobose to broadly clavate cheilocystidia, tufts of erect pileocystidia, and grows on leaves (Corner 1996). *Marasmiellus pandoensis* Singer, described from Bolivia, shares pileipellis and stipitipellis morphologies with *G. mustachius*, but forms a deep rusty brown pileus, non-marginate lamellae, smaller basidiospores (mean  $7\text{--}7.5 \times 3\text{--}3.5 \mu\text{m}$ ), and broadly clavate cheilocystidia with apical diverticula (Singer 1973).

Pairwise comparisons of aligned, overlapping ITS sequences of *Gymnopus mustachius* with the top ten BLAST results indicate closest similarity (91.2%) to several *Gymnopus dichrous* (Berk. & M.A. Curtis) Halling sequences (JF313694, DQ480115) from North Carolina, USA. *Gymnopus mustachius* forms a well-supported clade (100% BS, 1.0 PP) with *G. cervinus* (Fig. 1).

*Gymnopus melanopus* A.W. Wilson, Desjardin & E. Horak, Sydowia 56: 181. 2004.

Figs 54, 55a–d

Facesoffungi number: FoF03756

Pileus 5–20 mm diam, convex to campanulate, expanding to plano-convex, rugulose-striate to the disc; surface dull, dry, glabrous, disc greyish brown (6–7C4–5), margin paler to greyish orange (6B3–4) to beige (5A3). Context <1 mm thick, soft, buff. Lamellae adnate, close to subdistant with 2–3 series of lamellulae, narrow, pale cream (<4A3), darkening to greyish orange (6–7B–C4). Stipe 8–30 × 1–2 mm, central, cylindrical above a slightly enlarged base, terete or compressed, fistulose-stuffed, tough, subinsititious; surface dull, dry, white-pruinose overall, apex brownish grey (5–6C3), base dark brown to black; rhizomorphs absent. Odor and taste indistinct.

Basidiospores 7–8.5 × 3.5–4.2 μm, only 7 seen [ $x_m = 7.7 \times 3.9 \mu\text{m}$ ,  $Q_m = 1.95$ ], ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia not observed. Basidioles 21–29 × 5–6.5 μm, clavate to subfusoid. Pleurocystidia absent. Lamellar edge sterile. Cheilocystidia 28–57 × 8–16 μm, clavate, often with one or more lobes or broad knob-like outgrowths, broadly obtuse, hyaline, inamyloid, thin-walled. Pileipellis a cutis of radially arranged, repent hyphae 2.5–7 μm diam, cylindrical, non-diverticulate, smooth or brown-incrusted, hyaline, inamyloid, non-gelatinous, thin-walled; terminal cells undifferentiated. Pileus trama radially arranged to interwoven; hyphae similar to pileipellis but up to 10 μm diam. Lamellar trama regular; hyphae 3.5–16 μm diam, cylindrical to inflated, hyaline, inamyloid, thin-walled. Stipitipellis a cutis with numerous clustered caulocystidia; cortical hyphae 2.5–8 μm diam, cylindrical, non-diverticulate, smooth or weakly brown-incrusted, hyaline to brown, inamyloid, thin-walled; medullary hyphae 4–16 μm diam, cylindrical to inflated, smooth, hyaline, inamyloid, thin-walled. Caulocystidia 28–57 × 5.7–11.5 μm, irregularly cylindrical to clavate, often lobed, broadly obtuse, hyaline, inamyloid, thin-walled. Clamp connections present.

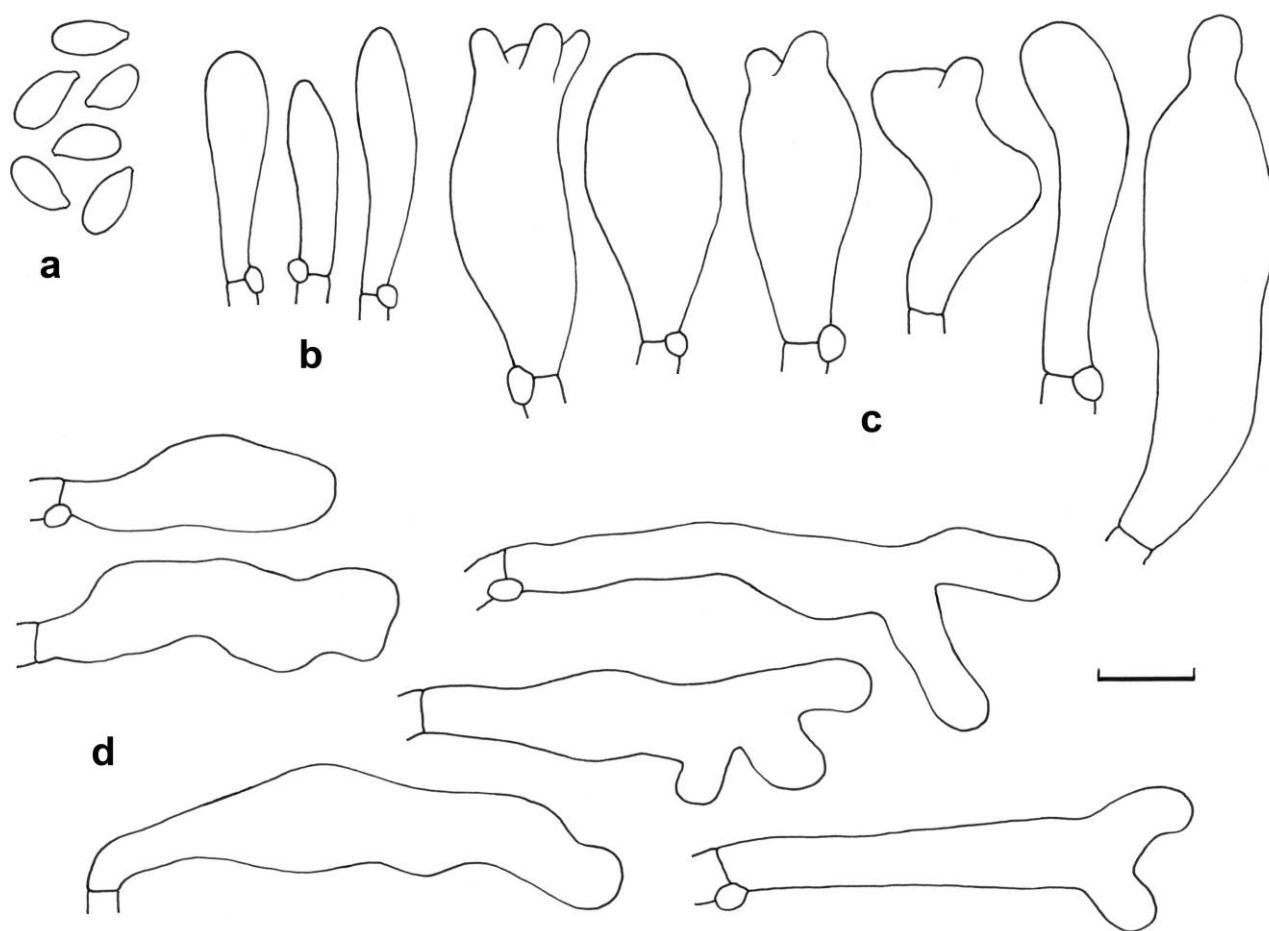


**Fig. 54** – Basidiomes of *Gymnopus melanopus* (BAP 607). Scale bar = 10 mm

Habitat and known distribution – Gregarious on coconut fruit hulls in coastal coconut-cacao grove. Africa (São Tomé), India, Indonesia (Java).

Material examined – AFRICA. São Tomé, along main road (EN2) on south side of island approx. 200 m east of 38 km marker, N00°08.500', E06°39.650', 13 Apr. 2008, coll. by B.A. Perry, BAP 607 (MF100988, SFSU).

Notes – *Gymnopus melanopus* was described from material collected in the Bogor Botanical Garden in Java (Wilson et al. 2004) and reported subsequently from India (Dutta et al. 2015). Distinctive features include a small, rugulose-striate, greyish brown to cream pileus, close to subdistant, narrow lamellae, a subsinistitious, black stipe covered with white pruinae, basidiospores with mean range 7.7–8.5 × 3.8–4.0 μm, broadly clavate, often knobby cheilocystidia, irregularly cylindrical caulocystidia, and growth on woody debris. An ITS sequence of BAP 607 was 99.7–99.8% similar to four GenBank sequences determined as *Gymnopus melanopus* (AY263442 [Holotype], AY263425, KR348866, KM896875) in pairwise comparisons of aligned, overlapping sequences. In the ITS phylogeny (Fig. 1), *G. melanopus* is sister to *G. juniperinus* (type species of *Marasmiellus*) with 70% BS and 0.96 PP support.



**Fig. 55** – Micromorphological features of *Gymnopus melanopus* (BAP 607). a. Basidiospores. b. Basidioles. c. Cheilocystidia. d. Caulocystidia. Scale bar = 10 μm

*Gymnopus billbowski* Desjardin & B.A. Perry, sp. nov.

Figs 56, 57a–d

Mycobank MB 821172; Facesoffungi number: FoF 03757

Holotype – AFRICA. São Tomé, along main road (EN-1) on north side of island at 16.5 km marker, N00°24.374', E06°37.092', 17 April 2008, collected by D.E. Desjardin, DED 8250 (SFSU).

Etymology – named in honor of William K. "Bill" Bowes Jr. who has supported this project since its inception.

Diagnosis – Pileus 3–15 mm diam, convex, margin striate to striatulate; surface dull, moist to dry, sometimes rugulose, glabrous to felted, subhygrophanous, disc brown (7–8E5–6) to pale greyish orange (<6B3), margin cream (4A3) to buff or white, in age buff overall or with a small greyish orange disc, often bruising reddish brown. Context <1 mm thick, soft, white. Lamellae adnexed to ascending-adnate with a very short decurrent tooth, distant with 2 series of lamellulae, broad (2–4 mm), white, non-marginate. Stipe 15–25 × 0.5–1.5 mm, central, terete, cylindrical or narrowed downward, tough, hollow, insititious to subsititious; surface dull, dry, pruinose, apex white to greyish orange or pale brownish grey (6C2), base brown (6–7E4–5) to dark reddish brown (7–8F6–8). Odor and taste raphanoid.

Basidiospores 5–7 × 3.8–5 μm [ $x_m = 5.8 \pm 0.43 \times 4.4 \pm 0.33$  μm,  $Q = 1.2–1.4$ ,  $Q_m = 1.33 \pm 0.05$ ,  $n = 25$ ,  $s = 1$ ], ovoid to broadly ellipsoid, smooth, hyaline, inamyloid, thin-walled. Basidia 23–32 × 5.7–8.0 μm, clavate, 4-spored. Basidioles clavate to subcylindrical. Pleurocystidia absent. Lamellar edge fertile. Cheilocystidia scattered, 22–36 × 8–12 (–20) μm, broadly clavate to irregular, with



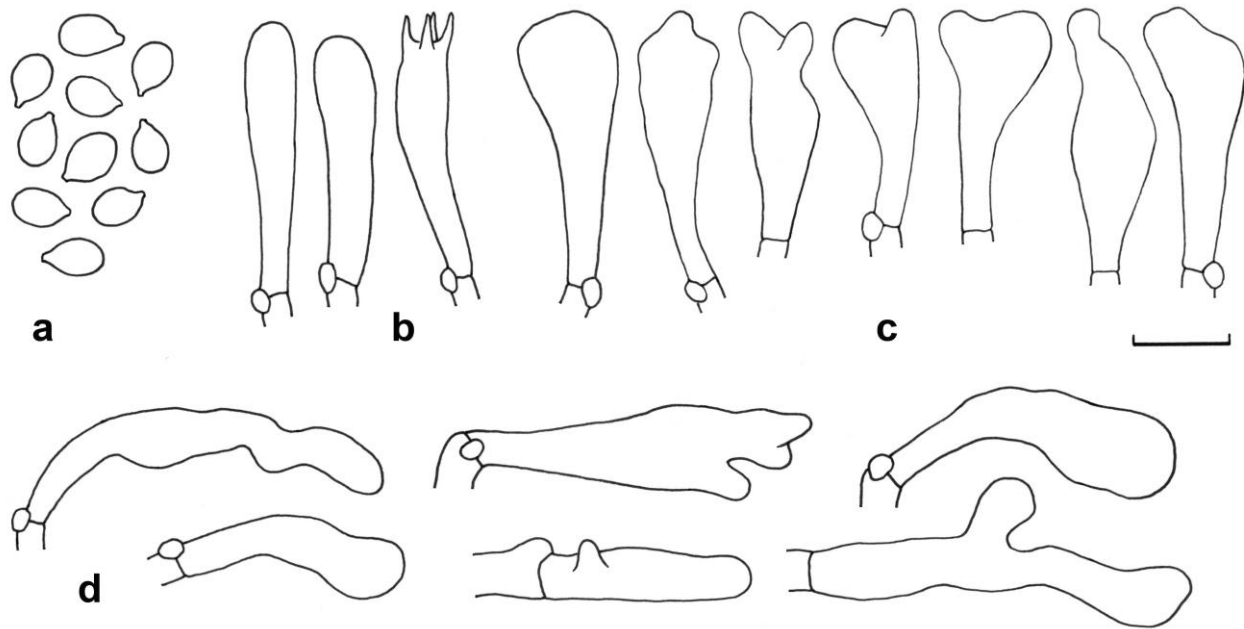
**Fig. 56** – Basidiomes of *Gymnopos billbowesii* (Holotype, DED 8250). Scale bar = 10 mm

or without a few apical knobs, hyaline, inamyloid, thin-walled. Pileipellis a cutis of repent, interwoven hyphae 3–12 μm diam, cylindrical or irregular, branched, non-diverticulate or with broad, knob-like

outgrowths, non-incrusted or with thin hyaline to pale brown incrustations, hyaline, inamyloid, non-gelatinous, thin-walled; terminal cells undifferentiated. Pileus trama interwoven, hyphae 2.5–8  $\mu\text{m}$  diam; lamellar trama regular, hyphae 2–5  $\mu\text{m}$  diam; hyaline, inamyloid, non-incrusted, non-gelatinous, thin-walled. Stipitipellis a cutis with numerous clustered caulocystidia; cortical hyphae 2–6.5  $\mu\text{m}$  diam, cylindrical, non-diverticulate, hyaline to pale brown, inamyloid, thin-walled or with walls up to 0.5  $\mu\text{m}$  thick, non-incrusted, non-gelatinous; medullary hyphae 2–9  $\mu\text{m}$  diam, hyaline, inamyloid, thin-walled. Caulocystidia 20–70  $\times$  3.5–10  $\mu\text{m}$ , irregularly cylindrical to clavate, sometimes lobed or with a few broad knobs, hyaline to pale brown, inamyloid, thin-walled or with walls up to 0.5  $\mu\text{m}$  thick. Clamp connections present in all tissues.

Habitat and known distribution – Solitary on woody debris under baobab trees and mesquite in coastal xerophytic habitat, or on trunk of standing palm in coastal secondary forest. Africa (São Tomé).

Material examined – AFRICA. São Tomé, along main road (EN-1) on north side of island at 16.5 km marker, N00°24.374', E06°37.092', 17 April 2008, collected by D.E. Desjardin, DED 8250 (Holotype, MF100989, SFSU); São Tomé, along main road (EN1) on north side of island at 18.25 km marker, N00°23.687', E06°36.302', 17 Apr. 2008, coll. by B.A. Perry and D.E. Desjardin, BAP 624 (MF100990, SFSU).



**Fig. 57** – Micromorphological features of *Gymnopus billbosesii* (Holotype, DED 8250). a. Basidiospores. b. Basidium and basidioles. c. Cheilocystidia. d. Caulocystidia. Scale bar = 10  $\mu\text{m}$

Notes – *Gymnopus billbosesii* is characterized by a small white pileus with brown to greyish orange disc that bruises reddish brown, distant white lamellae, a tough, pruinose stipe white at the apex and reddish brown at the base, raphanoid odor and taste, small ovoid basidiospores (mean 5.8  $\times$  4.4  $\mu\text{m}$ ), irregularly clavate cheilocystidia and caulocystidia, a cutis-type pileipellis, non-dextrinoid tissues with clamp connections, and growth on woody debris. *Gymnopus billbosesii* shows features similar to *Gymnopus diminutus* (Berk. & Br.) A.W. Wilson & Desjardin and its variety *G. diminutus* var. *clavatus* A.W. Wilson & Desjardin, but the latter form a non-striate pileus, close narrow lamellae, indistinct odor and taste, and narrower basidiospores (mean width 2.7–3.3  $\mu\text{m}$ ) (Pegler 1977, 1986; Wilson and Desjardin 2004). *Gymnopus indoctus* (Corner) A.W. Wilson, Desjardin & E. Horak,

known from Indonesia and Singapore, is also similar to *G. billbowski* but forms a larger (10–45 mm diam) pileus, closer lamellae, larger basidiospores ( $x_{\text{mm}} = 8.6 \times 4.1 \mu\text{m}$ ), and distinct, erect pileocystidia (Wilson et al. 2004).

Pairwise comparisons of aligned, overlapping ITS sequences of *Gymnopus billbowski* with the top ten BLAST results indicate closest similarity (87.5–90.2%) to uncultured, undetermined Agaricales clones. In the ITS phylogeny (Fig. 1), *G. billbowski* is on a long branch in a rather isolated position sister to *G. ramealis*, *G. ugandensis*, *M. foliophilus* and *G. pleurocystidiatus*.

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