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SHORT COMMUNICATION

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CONTRIBUTION TO THE MACROMYCETES OF WEST BENGAL, INDIA: 23–27

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Abstract: The present article reports five heterobasidiomycetous taxa, viz., *Dacryopinax spathularia* (Dacrymycetaceae), *Exidia glandulosa*, *Pseudohydnum gelatinosum* (Exidiaceae), *Tremella fuciformis*, and *T. mesenterica* (Tremellaceae), based on collections made from West Bengal, India, with their morpho-anatomical details. *Dacryopinax spathularia* is reported from Odisha and Uttar Pradesh while *Tremella fuciformis* and *T. mesenterica* are reported from Chhattisgarh.

Keywords: Heterobasidiomycetes, jelly fungi, taxonomy, West Bengal.

Five jelly fungi were collected from different corners of West Bengal, India, and are reported herein with detailed morpho-taxonomic details.

The state of West Bengal has a wide range of phytogeographic regions extending from the coastal areas (of Bay of Bengal) to the subalpine regions of the eastern Himalaya. Each of these regions is unique in terms of various ecological conditions such as temperature, humidity, salinity, rainfall, altitude, edaphic factors, etc. that provide a wide range of habitats for the luxuriant growth of different types of macromycetes.

The ‘jelly fungi’ belong to the class

Heterobasidiomycetes, characterized by the presence of greatly swollen gelatinous basidiocarps, basidia that lobed and often divided by transverse, oblique or longitudinal septa, and prominent sterigma (Webster & Weber 2007). Most of the jelly-fungi are saprotrophs that preferably grow on dead and decaying plant parts. The present manuscript reports five Heterobasidiomycetous fungi viz., *Dacryopinax spathularia* (Schwein.) G.W. Martin, *Exidia glandulosa* (Bull.) Fr., *Pseudohydnum gelatinosum* (Scop.) P. Karst., *Tremella fuciformis* Berk., and *Tremella mesenterica* Retz. with their morphological details. This is a series of our earlier works dealing with the exploration of macromycetes diversity of West Bengal (Acharya et al. 2017a,b,c; Tarafder et al. 2017).

MATERIALS AND METHODS

The specimens were collected during field trips in monsoon seasons (2010–2017) from corners of West Bengal, India. Macro-morphological and ecological features of each collection were noted in the field and subsequently photographed. The colour codes

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and terms used were in accordance with Kornerup & Wanscher (1978). Microscopic features were obtained from freehand sections of dried specimens by mounting with 10% KOH, Congo red and Melzer's reagent with the help of Carl Zeiss AX10 Imager A1 phase contrast microscope. Measurements of 30 basidiospores of each of the specimens were examined. Q value denotes length/breadth ratios of basidiospores and the mean value is underlined. Identification was done with the help of standard literature (Spears 1957; McNabb 1965; Ellis & Ellis 1990; Zhishu et al. 1993; Kuo 2006, 2007, 2008a,b; Pippola & Kotiranta 2008; Shirouzu et al. 2009). The voucher specimens were deposited in the Calcutta University Herbarium (CUH).

TAXONOMY

Dacryopinax spathularia (Schwein.) G.W. Martin

Lloydia 11: 116 (1948) (Fig. 1, Image 1a)

Fruit body 3–9 mm high. Pileus 1–5 mm diam., flabellate to petaloid, cartilaginous, brownish orange (6C8, 7C6) to reddish-orange (7B7) when fresh, turns reddish orange (7A8-B7-C7) all over on drying, surface covered with cortical hairs coloured white (1A1), margins sinuate to undulating. Stipe 1–1.5 mm broad, slender, cylindrical, white (1A1) to grey (7B1) when fresh, becoming grey (6B1) on drying, surface covered with cortical hairs coloured white (1A1). Odour mushroomy.

Basidiospores (7–)8–8.7–9.5(–11) × 3.5–3.7–4.5 μm, Q=1.6–2.3–3.0, cylindrical, curved, thin-walled, greyish beige (4C2) to grey (4C1), inamyloid, 1-septate at maturity, short apiculate, oil granule present when viewed with KOH. Basidia 13–20 × 1.5–3.5 μm, bifurcate, having typical tuning-fork like structure, thin-walled, hyaline, 2-spored; sterigmata 7–22 × 2.5–3.5 μm, cylindrical. Pro-basidia 19.5–30.5 × 3.5–4.5 μm, clavate to cylindrical with basal septa, becoming bifurcate at maturity. Hymenium unilateral, smooth to slightly wavy. Marginal hyphae 11–27 × 4–6 μm, solitary or fasciculate, cylindrical, smooth, straight or flexuous, sometimes branched, thick-walled, septate, hyaline to brownish grey (5C2) with KOH. Internal hyphae 2.5–3.5 μm broad, cylindrical, smooth, thin-walled, branched, septate, hyaline to pale yellow (4A3) when viewed with KOH; clamp-connections absent.

Habit and habitat: Caespitose, gregarious or arranged in rows, on dead and decayed dicotyledonous woods.

Specimens examined: CUH AM175, 11.viii.2010, 22.44917°N & 88.18500°E, elevation 3m, Kakdwip, South 24-Pargana, West Bengal, India, coll. P. Pradhan & A.K. Dutta; CUH AM184, 18.viii.2011, 21.87611°N &

88.39138°E, elevation 8.5m, Sonarpur, South 24-Pargana, West Bengal, India, coll. A.K. Dutta & P. Pradhan; CUH AM187, 17.ix.2011, 22.36250°N & 88.87666°E, elevation 6m, Sandeshkhali, South 24-Pargana, West Bengal, India, coll. A.K. Dutta & P. Pradhan; CUH AM169, 31.vii.2010, 22.21472°N & 88.90555°E, elevation 4m, Chotomollakhali, Gosaba block, South 24-Pargana, West Bengal, India, coll. P. Pradhan; CUH AM172, 31.vii.2010, 22.22333°N & 88.91388°E, elevation 4m, Amtali, South 24-Pargana, West Bengal, India, coll. S. Chatterjee & S. Chandra; CUH AM168, 31.vii.2010, 22.19805°N & 88.71388°E, elevation 6m, Basanti, South 24-Pargana, West Bengal, India, coll. K. Acharya; CUH AM349, 09.vii.2015, 22.58666°N & 88.41472°E, elevation 4m, Central Park, Kolkata, West Bengal, India, coll. K. Acharya & A.K. Dutta & S. Paloi; CUH AM528, 14.viii.2017, 22.88305°N & 88.76361°E, elevation 6m, Gobardanga, North 24-Pargana, West Bengal, India, coll. K. Acharya; CUH AM544, 14.vii.2017, 26.32194°N & 88.43638°E, elevation 37m, Debi Bari, Cooch Behar, India, coll. K. Acharya; CUH AM 541, 16.vii.2017, 26.32194°N & 88.43638°E, elevation 37m, Debi Bari, Cooch Behar,

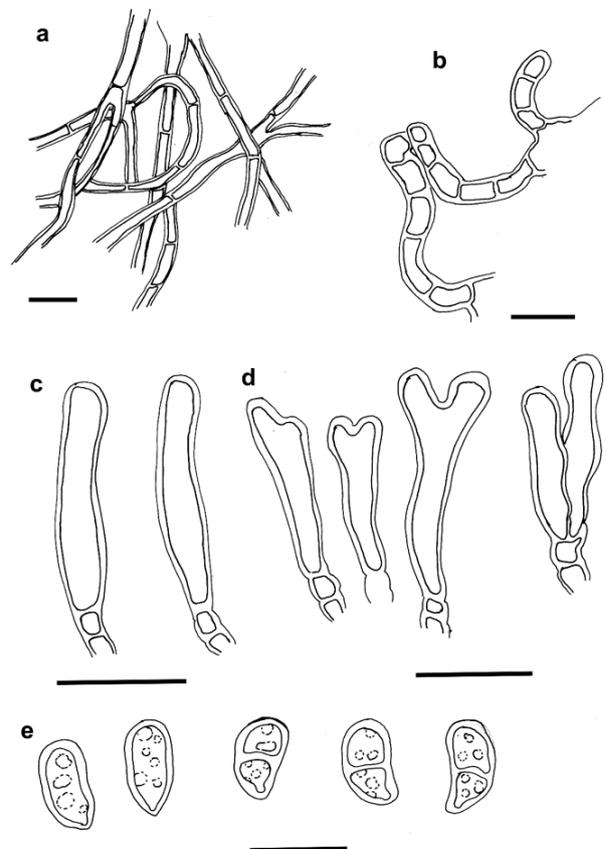


Figure 1. *Dacryopinax spathularia*: a - Internal hyphae, b - Marginal hyphae, c - Pro-basidia, d - Basidia, e - Basidiospores. Scale = 10 μm.

India, coll. K. Acharya.

Remarks: *Dacryopinax spathularia* is well characterised by its spatulate fruit body coloured yellow-orange; presence of thick-walled, cylindrical marginal hyphae; absence of inflated vesicles and hyphal pegs in the abhymenium; and presence of 0–1 septate basidiospores (McNabb 1965; Shirouzu et al. 2009). This is a widely distributed taxon and previously been reported from Japan, North America, and China etc. (McNabb 1965; Zhishu et al. 1993; Shirouzu et al. 2009). It was reported from Rajamunda, Odisha, growing on logs of *Shorea robusta* (Tiwari et al. 2013). The species was also recorded on wood from Saharanpur, Uttar Pradesh (Butler & Bisby 1931). The present collection matches well with the description made from North America (McNabb 1965); however, according to Shirouzu et al. (2009), basidiospores of the specimen from Japan were found to be sub-globose to reniform, while the Indian specimen showed mostly cylindrical basidiospores with the range varying from oblong to bacilliform ($Q=1.6–3.0$). The specimen reported from China was found to have 1–2 septate basidiospores at maturity, but the basidiospores of our collection showed one septation at maturity.

Among morphologically similar taxa: *Dacryopinax indacocheae* has foliose fruit body coloured tan and presence of inflated vesicles (McNabb 1965); *Dacryopinax formosus* primarily differs by the presence of hyphal pegs in abhymenium layer; *Dacryopinax aurantiaca* differs by its dingy white to cream or pallid tan-coloured stipe and abhymenial surface, and considerably longer basidiospores (up to $13.5 \times 5 \mu\text{m}$); *Dacryopinax elegans* has larger fruitbody (12–50 mm) coloured deep amber-brown to black-brown, thick-walled basidiospores with 3-septations at maturity. *Dacryopinax yungensis* differs by the presence of inflated vesicle-like cells in cortical layer, and comparatively larger ($11–14 \times 4.5–6.5 \mu\text{m}$), 3-septate basidiospores.

***Exidia glandulosa* (Bull.) Fr.**

Syst. mycol. (Lundae) 2(1): 224 (1822) (Fig. 2, Image 1b)

Fruit body 22–25 mm long, 10–16 mm broad, turbinate, fleshy, gelatinous, irregularly folded to cerebriform, reddish brown (8E5) to dark brown (8F4) to black when fresh, becoming greyish brown (8F3) to black, hard, crust-like when dry, surface with dot-like glands. Odour mushroomy.

Basidiospores $11–13.1–13.5(–15) \times (4.5–)5–5.6(–6.5) \mu\text{m}$, $Q=1.5–2.4–3.2$, oblong to cylindrical, allantoid, dark brown (7F5) at maturity, smooth, inamyloid, oil granules present with KOH. Phragmobasidia $11–17 \times 8–12 \mu\text{m}$,

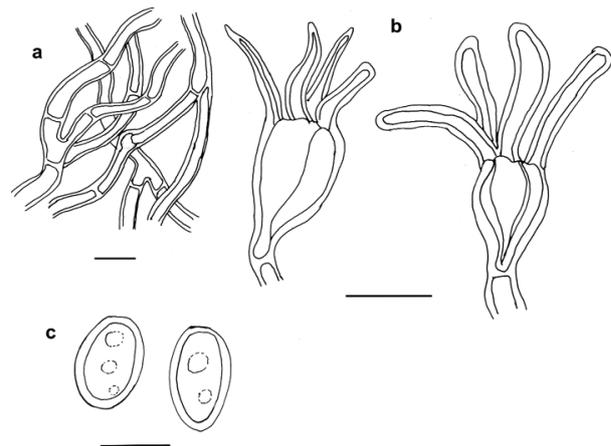


Figure 2. *Exidia glandulosa*: a - Hyphae, b - Basidia, c - Basidiospores. Scale = 10 μm .

globose to ellipsoid, hyaline, smooth, longitudinal, cruciate septate, 2–4 spored, basally stalked; stalk of basidia $7–14.5 \times 1.8–3.5 \mu\text{m}$, septate, hyaline, smooth; sterigmata $14–54 \times 3.5–5.5 \mu\text{m}$, hyaline. Hyphae $2–5.5 \mu\text{m}$ broad, smooth, with clamp-connections.

Habit and habitat: Gregarious to confluent, growing on dead and decayed dicotyledonous woods.

Specimen examined: CUH AM 219, 10.viii.2013, 22.27972°N & 88.45472°E, elevation 8m, Gocharan, South 24-Parganas, West Bengal, India, coll. A.K. Dutta & P. Pradhan.

Remarks: Characteristic features of *Exidia glandulosa* includes the presence of brown to black turbinate, gelatinous fruit bodies that often coalescing together to form masses, dotted by minute glandular structures, cruciate septate, stalked basidia and allantoid basidiospores. The Indian collection nicely matches with the description of Ellis & Ellis (1990); however, the habitat of our collection was other dead dicotyledonous wood as compared to the Britain collection that was reported to be oak and hazel. It was reported from Nilgiris, Tamil Nadu (Montagne 1842). Among morphologically similar taxa: *Exidia plana* differs by its effused fruit body (Roberts 2001) that lacks dot-like glands on its surface. *Exidia truncata* Fr. has fruit bodies that are not confluent and remain largely free from the substrate, and larger basidiospores ($14–22 \times 5–7 \mu\text{m}$; Ellis & Ellis 1990). *Exidia saccharina* differs in having caramel to dark brown fruit bodies lying flat on the substrate (Ellis & Ellis 1990). *Exidia recisa* differs by its amber to dark brown coloured fruit bodies that are not confluent and becomes flabby and drooping when old (Ellis & Ellis 1990).

***Pseudohydnum gelatinosum* (Scop.) P. Karst**

Not. Sällsk. Fauna et Fl. Fenn. Förh. 9: 374 (1868)

(Fig. 3, Image 1c)

Fruit body 21–39 mm high. Pileus 14–28 mm, fan-shaped, glossy, gelatinous, dull red (8C3) to reddish-brown (9D4) when fresh, becoming dark brown (8F4) when dry, hard, cartilaginous; lower hymenial surface covered with dense, soft teeth or spines, teeth 1–3 mm long, white (9A1). Stipe 15–18 × 7–13 mm, lateral, reddish brown (9D4) when fresh, becoming dark brown (8F4) on drying.

Basidiospores (5–)6–7.2(–9) × (5–)6–6.8(–7.5) μm, Q=1–1.1–1.3, globose to sub-globose, hyaline, apiculate, smooth, thin-walled, oil granules present when viewed with KOH. Basidia 11–15 × 7–11 μm, globose to sub-globose or ellipsoid, hyaline, thin-walled, inamyloid, smooth, 2–4 septate (cruciate), oil granules present when viewed with KOH, basally stalked, stalk 5–29 × 2–3.5 μm, 2–4 spored; sterigmata 5–25 × 2–4 μm, 1-septate, sometimes bearing bifurcation near the tip, smooth. Hyphae 2.5–4.5 μm broad, smooth, hyaline, branched, thin-walled, clamp-connections present. Hymenium unilateral, wavy due to the presence of teeth.

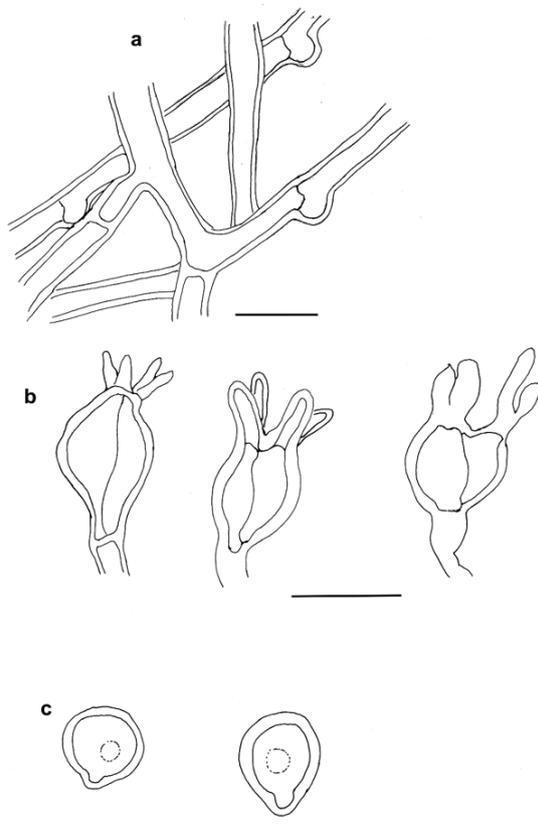


Figure 3. *Pseudohydnum gelatinosum*: a - Hyphae, b - Basidia, c - Basidiospores. Scale = 10 μm.

Habit and habitat: Solitary to scattered, on humus mixed soil.

Specimen examined: CUH AM197, 22.viii.2012, 27.01805°N & 88.56472°E, elevation 1697m, Lolaygaon, Darjeeling District, West Bengal, India, coll. A.K. Dutta & P. Pradhan.

Remarks: The presence of characters like a glossy, fan-shaped, gelatinous pileus with the lower (hymenial) fertile surface covered with dense, white soft teeth or spines can easily identify *Pseudohydnum gelatinosum* in the field (Ellis & Ellis 1990). It is distinct from other taxa in being the only toothed member of the jelly fungi (Emberger 2008).

Pseudohydnum gelatinosum has been previously reported from India (Das 2009). The present collection shows little smaller cap (14–28 mm vs. 40–90 mm) and larger basidiospores (5–9 × 5–7.5 μm vs. 5–6 × 4–5.5 μm). Apparently, *Dacryopinax elegans* resembles the present taxon with regard to colour, structure, and texture but is easily distinguished from it when the lower part of pileus is examined (Kuo 2015).

***Tremella fuciformis* Berk.**

Hooker's J. Bot. Kew Gard. Misc. 8: 277 (1856)

(Fig. 4, Image 1d)

Fruit body 43–63 mm long and 35–42 mm broad, white (1A1), firm gelatinous, translucent, mucilaginous when fresh, becoming horny, thin, grey (3B1) to yellowish-grey (3B2) coloured when dry, repeatedly lobed or forked with margins flexuous to folded, sessile. Odour slightly fishy.

Basidiospores (6–) 6.5–8.4–9(–10) × (5–)5.5–6(–7) μm, Q=1.1–1.3–1.5, subglobose to broadly ellipsoid, smooth, hyaline, inamyloid, apiculate, with 1 oil guttule. Phragmobasidia 11–14 × 6.5–10 μm, subglobose, becoming longitudinally cruciate septate, 2–4 septate at maturity, thin-walled, hyaline, oil granules visible when mounted with KOH, 4-spored; sterigmata 10–33 × 2–4 μm, cylindrical. Conidia 8–15 × 6–9 μm, subglobose to broadly ellipsoid, smooth, hyaline. Swollen cells 11–20 × 6–11 μm, globose to subglobose to ellipsoid, abundant, hyaline, oil granules present when viewed with KOH. Hyphae 2.5–5.5 μm broad, hyaline, thin walled, branched, clamp-connections present.

Habit and habitat: Solitary, on dead and decayed dicotyledonous wood.

Specimens examined: CUH AM536, 14.viii.2017, 22.88305°N & 88.76361°E, elevation 6m, Gobardanga, North 24 Parganas, West Bengal, India, coll. K. Acharya; CUH AM543, 14.vii.2017, 26.32194°N & 88.43638°E, elevation 37m, Debi Bari, Cooch Behar, India, coll. K.



Image 1. Habit of mature fruit bodies of a - *Dacryopinax spathularia*, b - *Exidia glandulosa*, c - *Pseudohydnum gelatinosum*, d - *Tremella fuciformis*, e - *Tremella mesenterica*.

Acharya.

Remarks: *Tremella fuciformis* is characterised by its pure white, translucent, gelatinous fruit bodies with lobed margins, and the presence of cruciate-septate phragmobasidia (Spears 1957). It has previously been reported from several countries such as China, Brazil, and North America (Burt 1921; Olive et al. 1948; Spears 1957; Zhishu et al. 1993). The Chinese specimen differs from the present collection in having slightly smaller basidiospore (5–7 μm diam.); however, the present specimen was found to be identical to the description made from Brazil and North America (Burt

1921; Olive et al. 1948; Spears 1957). From India it was reported growing on logs of *Shorea robusta* from West Bengal (Banerjee 1947) and Jagdalpur, Chhattisgarh; on *Pterocarpus marsupium* and from Keshkalghat, Chhattisgarh (Tiwari et al. 2013).

Tremella fuciformis is morphologically similar to *T. reticulata*; however, *T. reticulata* grows on the ground or on very rotten stumps and it differs by having a larger (up to 80mm long and 150mm broad), erect, reticulated fruit body that is irregularly forked upwards giving rise to tapered tips (Spears 1957; Kuo 2008a).

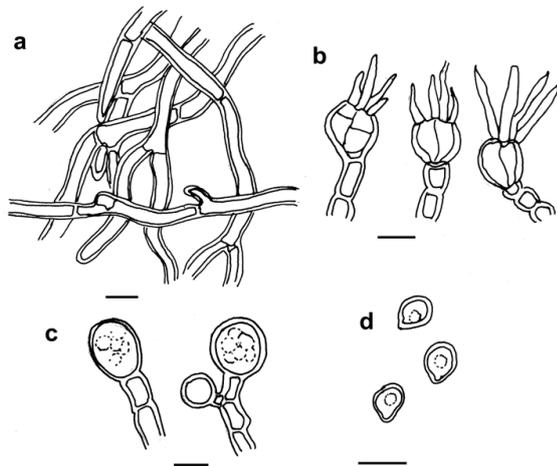


Figure 4. *Tremella fuciformis*: a - Hyphae, b, - Basidia, c - Swollen cells, d - Basidiospores. Scale = 10µm.

Tremella mesenterica Retz.

K. svenska Vetensk-Akad. Handl., ser. 1 30: 249 (1769)
(Fig. 5, Image 1e)

Fruit body 18–33 × 13–30 mm, folded into lobes, cerebriform, gelatinous, light yellow (4A5) when fresh, becoming orange (5A6) to greyish orange (5B6), horny and crust-like when dry. Sessile. Odour mushroomy.

Basidiospores 14–16–18 × 14–15–16.5 µm, Q=1–1.1–1.2, globose to sub-globose, smooth, hyaline to pale yellowish (3A3), apiculate, oil granules visible with KOH. Phragmobasidia 25–29 × 22–27 µm, globose to sub-globose, 2–4 celled, longitudinally or obliquely (cruciate) 4-septate at maturity, thin-walled, hyaline to pale yellowish (3A3), inamyloid, smooth, oil granules present when viewed with KOH, 4-spored; sterigmata 18–144 × 4.5–6.5 µm. Conidia not observed. Swollen cells 14–33 × 11–27 µm, sub-globose to ellipsoid to oblong, terminal or sub-terminal, stalked, smooth, hyaline. Hyphae 2–5 µm broad, thin-walled, branched, hyaline to pale yellow (3A3), clamp-connections present.

Habit and habitat: Solitary to caespitose, on dead and decayed dicotyledonous wood.

Specimens examined: CUH AM538, 10.viii.2017, 22.78638°N & 88.35500°E, elevation 17m, Barrackpore, North 24-Pargana, West Bengal, India, coll. K. Acharya; CUH AM545, 16.vii.2016, 23.40083°N & 88.50138°E, elevation 20m, Krishnanagar, Nadia, West Bengal, India, coll. K. Acharya.

Remarks: Distinguishing features of *Tremella mesenterica* includes a bright yellow, lobed, cerebriform fruit body, presence of cruciate septate phragmobasidia with much longer sterigmata (Ellis & Ellis 1990; Pippola & Kotiranta 2008). The specimen of our collection

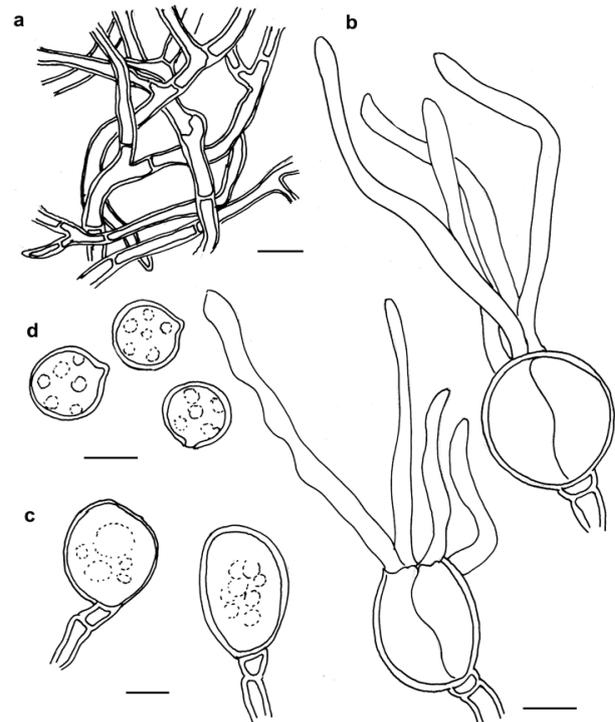


Figure 5. *Tremella mesenterica*: a - Hyphae, b - Basidia, c - Swollen cells, d - Basidiospores. Scale = 10µm.

is similar in characters with the one described from Finland (Pippola & Kotiranta 2008) except having slightly longer sterigmata and presence of distinct oil droplets in basidia and sterigmata. From India, it was reported from Jagdalpur, Chhattisgarh, growing on logs of *Shorea robusta* (Tiwari et al. 2013).

With regard to the colouration and size of the fruit body, *Tremella mesenterica* is similar to *T. aurantia* (Pippola & Kotiranta 2008). However, *T. aurantia* differs from *T. mesenterica* in having rather smaller basidiospores (5.5–9 × 4.5–7 µm) and basidia (ca. 9–13 µm wide) (Pippola & Kotiranta 2008).

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