

Fungal diversity notes 491–602: taxonomic and phylogenetic contributions to fungal taxa

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Abstract This is a continuity of a series of taxonomic and phylogenetic papers on the fungi where materials were collected from many countries, examined and described. In addition to extensive morphological descriptions and appropriate asexual and sexual connections, DNA

sequence data are also analysed from concatenated datasets to infer phylogenetic relationships and substantiate systematic positions of taxa within appropriate ranks. Whenever new species or combinations are proposed, we apply an integrative approach using morphological and molecular

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data as well as ecological features wherever applicable. Notes on 112 fungal taxa are compiled in this paper including *Biatriosporaceae* and *Rousoellaceae*, *Didysimulans* gen. nov., 81 new species, 18 new host records and new country records, five reference specimens, two new combinations, and three sexual and asexual morph reports. The new species are *Amanita cornelii*, *A. emodotrygon*, *Angustimassarina alni*, *A. arezzoensis*, *A. italica*, *A. loniceriae*, *A. premilcurensis*, *Ascochyta italica*, *A. rosae*, *Austroboletus appendiculatus*, *Barriopsis thailandica*, *Berkleasium ariense*, *Calophoma petasitis*, *Camarosporium laburnicola*, *C. moricola*, *C. grisea*, *C. ossea*, *C. paraincrustata*, *Colletotrichum sambucicola*, *Coprinopsis cerkezii*, *Cytospora gelida*, *Dacrymyces chiangraiensis*, *Didysimulans italica*, *D. mezzanensis*, *Entodesmium italica*, *Entoloma magnum*, *Evlachovaea indica*, *Exophiala italica*, *Favolus gracilisporus*, *Femsjonina monospora*, *Fomitopsis flabellata*, *F. roseoalba*, *Gongronella brasiliensis*, *Helvella crispoides*, *Hermatomyces chiangmaiensis*, *H. chromolae-nae*, *Hysterium centramurum*, *Inflatospora caryotae*, *Inocybe brunneosquamulosa*, *I. luteobrunnea*, *I. rubrobrunnea*, *Keissleriella cirsii*, *Lepiota cylindrocystidia*, *L. flavocarpa*, *L. maerimensis*, *Lophiotrema guttulata*, *Marasmius luculentus*, *Morenoina calamicola*, *Moelleriella thanathonensis*, *Mucor stercorarius*, *Myrmecridium fluviae*, *Myrothecium*

septentrionale, *Neosetophoma Garethjonesii*, *Nigrograna cangshanensis*, *Nodulosphaeria guttulatum*, *N. multiseptata*, *N. sambuci*, *Panus subfasciatus*, *Paraleptosphaeria padi*, *Paraphaeosphaeria viciae*, *Parathyridaria robiniae*, *Penicillium punicae*, *Phaeosphaeria calamicola*, *Phaeosphaeriopsis yuccae*, *Pleurophoma italica*, *Polyporus brevibasidiosus*, *P. koreanus*, *P. orientivarius*, *P. parvovarius*, *P. subdictyopus*, *P. ulleungus*, *Pseudoasteromasaria spadicea*, *Rosellinia mearnsii*, *Rubroboletus demonensis*, *Russula yanheensis*, *Sigarispora muriformis*, *Sillia italica*, *Stagonosporopsis ailanthicola*, *Strobilomyces longistipitatus*, *Subplenodomus galicola* and *Wolfiporia pseudococos*. The new combinations are *Melanomma populina* and *Rubroboletus eastwoodiae*. The reference specimens are *Cookeina tricholoma*, *Gnomoniopsis sanguisorbae*, *Helvella costifera*, *Polythrincium trifolii* and *Russula virescens*. The new host records and country records are *Ascochyta medicaginicola*, *Boletellus emodensis*, *Cyptotrampa asprata*, *Cytospora ceratosperma*, *Favolaschia auriscalpium*, *F. manipularis*, *Hysterobrevium mori*, *Lentinus sajor-caju*, *L. squarrosulus*, *L. velutinus*, *Leucocoprinus cretaceus*, *Lophiotrema vagabundum*, *Nothophoma quercina*, *Platystomum rosae*, *Pseudodidymosphaeria phlei*, *Tremella fuciformis*, *Truncatella spartii* and *Vaginatispora appendiculata* and three sexual and

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Fig. 126 *Entoloma magnum* (CAL 1385, holotype). Scale bar 20 mm (photo by K. N. Anil Raj)

Entoloma myochroum Noordel. & E. Ludw., a species from Germany (Noordeloos 2004), is close to *E. magnum* in having almost similar-sized basidiocarps, a concave and glabrous pileus, adnate lamellae with concolorous edges, a solid stipe with a fibrillose surface, almost similar-sized basidiospores ($7\text{--}10 \times 6.5\text{--}8.5 \mu\text{m}$) with 4–6 angles, a fertile lamella-edge and clamped hyphae. However, that species has a mouse-grey-coloured pileus, a flexuous or irregularly shaped stipe, a cutis-type pileipellis made up of hyphae with intracellular pigment and lamellar and pileus trama with short inflated elements.

In a BLASTn search using the ITS sequence (628 bp) derived from *E. magnum*, the closest hit was *E. ochreoprunuloides* (GenBank Number KC710092; 92% identity). *Entoloma ochreoprunuloides* Morgado & Noordel., is a species from Germany (Noordeloos 2004; Morgado et al. 2013), resembles *E. magnum* in having a similar-shaped, brownish pileus with radially wrinkled and innately fibrillose surface, isodiametric basidiospores, a fertile-lamella edge, and clamped hyphae. However, *E. ochreoprunuloides* differs from *E. magnum* owing to its smaller-sized and differently-coloured basidiocarps, emarginate lamellae, smaller ($5.9\text{--}7.1 \times 5.7\text{--}7.2 \mu\text{m}$) basidiospores and hyphae of the pileipellis with intracellular pigment.

In the phylogram (Fig. 126) generated from the ML analysis, *E. magnum* nested within a clade, which represents the subgenus *Entoloma*. Within this clade, *E. magnum*, *E. luteobasis*, *E. ochreoprunuloides*, *E. madidum* and collections of *E. bloxamii* formed a subclade. Within this subclade, *E. magnum* was differentiated as an independent lineage separated from other species with significant (74%) bootstrap support.

Inocybaceae Jülich

The type genus of the Inocybaceae, *Inocybe*, had traditionally been placed within the *Cortinariaceae* family (Kirk et al. 2008, Singer 1986). Despite this, Jülich placed the genus in its own family, the Inocybaceae (Jülich 1982). Members of this family have a widespread distribution in tropical and temperate areas (Cannon & Kirk 2007).

Inocybe (Fr.) Fr.

The genus *Inocybe* (*Inocybaceae*) is a species-rich genus of *Agaricales* and is well-known for their ectomycorrhizal ecology and toxicity of most species (Matheny 2009). Matheny (2009) proposed seven major clades or lineages consisting of *Inocybe* and its allies within the family *Inocybaceae*. Of the seven clades or lineages (*Inocybe* s. str., *Nothocybe*, *Pseudosperma*, *Mallochybe*, *Inosperma*, *Auritella* and *Mallochybella*), *Auritella* and *Mallochybella* were formally recognised as distinct genera, *Auritella* and *Tubariomyces* (Matheny and Bougher 2006a, b; Alvarado et al. 2010). Species of *Inocybe* are characterised by mostly brownish or rarely whitish basidiomata occasionally with a purplish or lilac hue, a fibrillose-rimose or squamulose pileus, brownish lamellae, brown spore-print, a fibrillose-pruinose stipe at times with a distinct marginate-bulbous base, a characteristic odour, smooth, warty, nodulose or spinulose basidiospores and metuloidal cystidia often with crystalloid deposits at their apices. Several species are devoid of metuloidal cystidia and they are characterised by abundant, thin-walled cheilocystidia (Matheny 2005; Larsson et al. 2009). During the course of our studies on this genus in Kerala State, India, we discovered several new species of *Inocybe*. Three of these species belonging to the *Pseudosperma* clade (Fig. 128) are described here.

Inocybe brunneosquamulosa K.P.D. Latha & Manim., sp. nov.

Mycobank number: MB 816735; *Facesoffungi number*: FoF: 2176, Figs. 129, 130

Etymology: referring to the brown squamules on the pileus surface.

Holotype: CAL 1308

Basidiocarps small. *Pileus* 7–11 mm diam., convex with a small umbo when young, becoming broadly convex still with a small umbo at maturity; surface initially dark brown (6F8/OAC636) on the squamules and brownish-orange (6C4/OAC653) elsewhere, becoming dark brown (6F7/OAC637) on the squamules, greyish-orange (6B3/OAC633) on the fibrils and brownish-grey (6C2/OAC662) elsewhere at maturity, appressed- to recurved-squamulose all over when young, becoming appressed- to recurved-squamulose on and around the umbo and appressed-fibrillose and rimose towards the margin; margin incurved, becoming decurved, crenate or wavy. *Lamellae* sinuate,

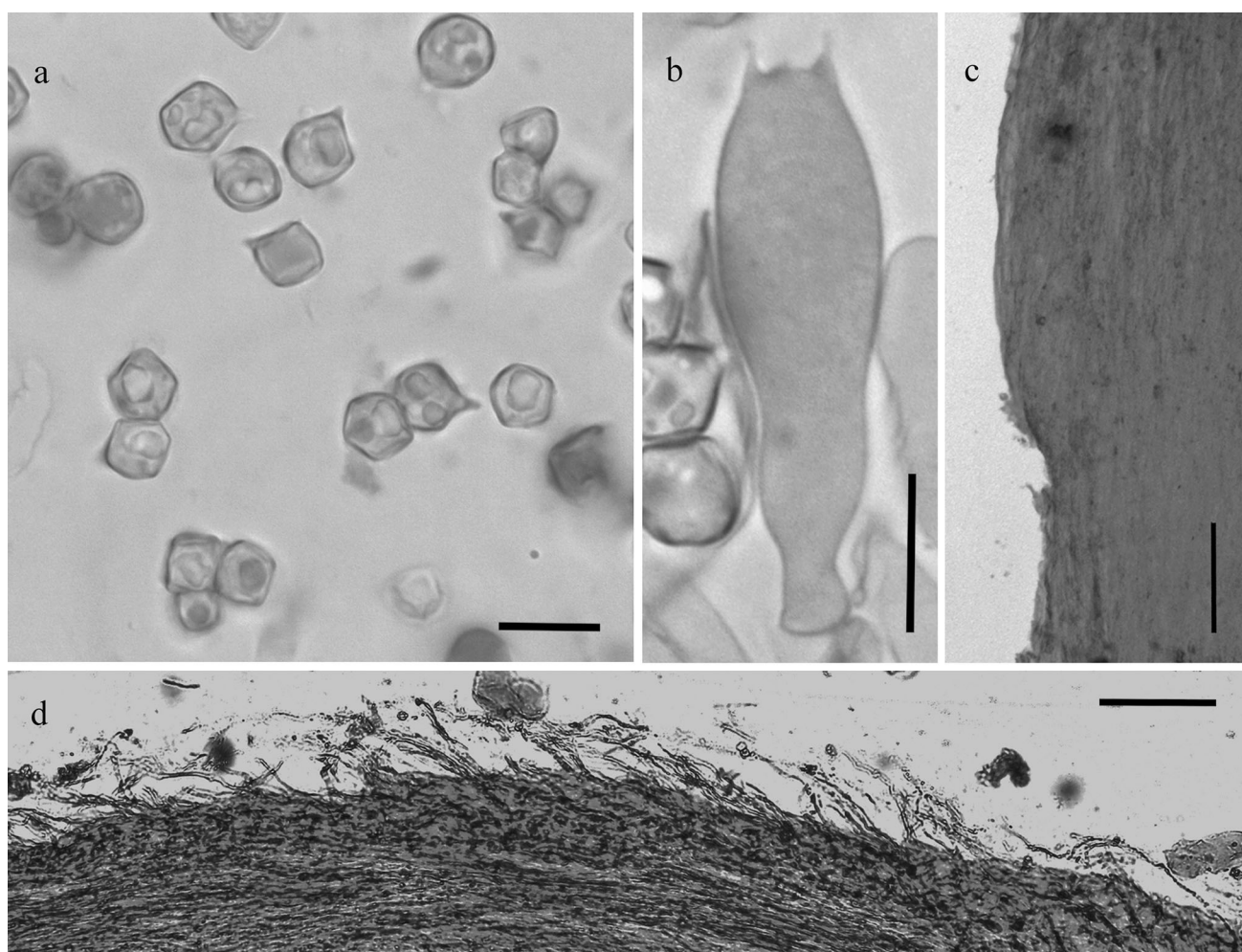


Fig. 127 *Entoloma magnum* (CAL 1385, holotype). **a** Basidiospores. **b** Basidium. **c** Stiptipellis. **d** Pileipellis. Scale bars a, b = 10 μ m; c, d = 100 μ m (photos by K. N. Anil Raj)

close, initially orange grey (6B2/OAC634), becoming brownish-orange (6C4/OAC655) or light brown (6D4/OAC686) at maturity, up to 1.5 mm wide, with lamellulae of 1 length; edges fimbriate, whitish. *Stipe* 17–19 \times 1–2 mm, central, terete, equal, cartilaginous, solid; surface brownish-orange (6C3/OAC633) all over, appressed-fibrillose in most parts, slightly-recurved fibrillose and finely pruinose towards the apex; base not enlarged. *Odour* and *taste* not distinctive. *Basidiospores* 8–10 \times 5–6.5 ($9 \pm 0.6 \times 5.9 \pm 0.4$) μ m, $Q = 1.3$ –1.9, $Q_m = 1.5$, smooth, ellipsoid to subphaseoliform, slightly thick-walled, yellowish-brown. *Basidia* 21–30 \times 11–13 μ m, clavate, thin-walled, hyaline, 4-spored; sterigmata up to 4.5 μ m long. *Pleurocystidia* absent. *Lamella-edge* heterogeneous. *Cheilocystidia* 17–39 \times 11–18 μ m, versiform: clavate, utriform, fusiform, cylindrical with an obtuse apex, occasionally subglobose or rarely pedicellate or septate, hyaline with faint hyaline encrustations, thin- to slightly thick-walled. *Lamellar trama* subregular; hyphae 6–15 μ m wide, thin-

walled, hyaline or pale yellow. *Subhymenium* pseudo-parenchymatous. *Pileus trama* subregular, composed of both narrow and inflated hyphae; hyphae 3–30 μ m wide, pale yellow, thin-walled. *Pileipellis* a cutis frequently disrupted with trichodermal patches, often a perfect trichoderm at the centre; hyphae 8–16 μ m wide, thin- to slightly thick-walled, with a brown wall pigment and dense, yellowish-brown or brown spiral encrustations; terminal cells 25–52 \times 7–11 μ m, clavate or cylindrical with an obtuse apex, thin- to slightly thick-walled. *Stiptipellis* a cutis often disrupted by loose hyphal projections scattered over the entire surface of the stipe and with bunches of caulocystidia confined to the extreme stipe apex; hyphae 5–11 μ m wide, thin- to slightly thick-walled, with a pale yellowish-brown wall pigment and faint hyaline encrustations; terminal cells, 21–49 \times 5–7 μ m, cylindrical or flexuous-cylindric, slightly thick-walled, with a pale yellowish-brown wall pigment and faint hyaline encrustations. *Caulocystidia* 22–50 \times 11–14 μ m, catenulate,

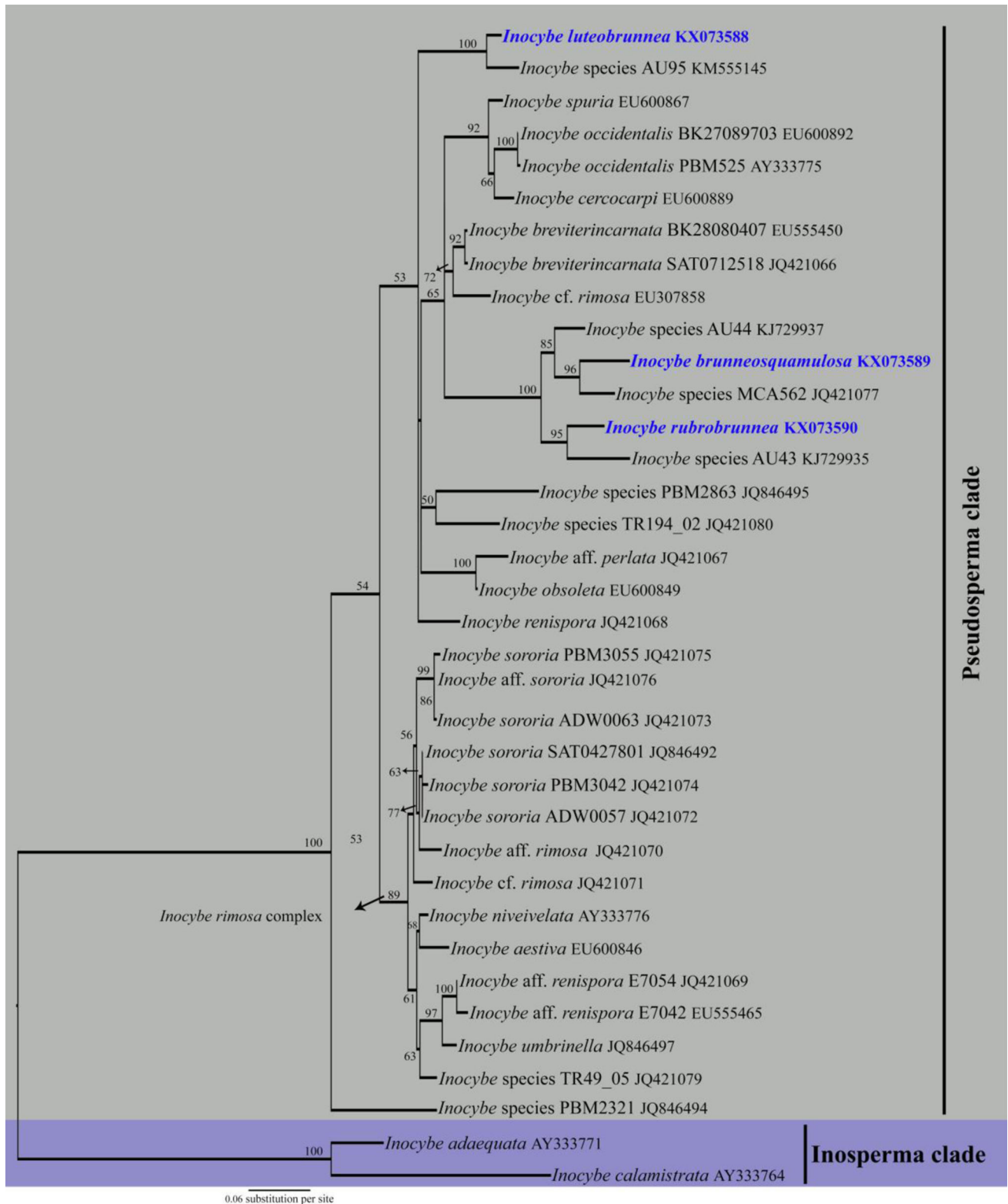


Fig. 128 Phylogram generated from maximum likelihood (RAXML) analysis based on RPB2 sequence data matrix for 34 *Inocybe* species. Sequences of *Inocybe* species belonging to the *Pseudosperma* clade used in this study have been selected from a previous analysis of Kropp et al. (2013). Values at nodes indicate bootstrap support. BS

values $\geq 50\%$ are shown. *Inocybe luteobrunnea*, *I. brunneosquamulosa* and *I. rubrobrunnea* are in pink to highlight its phylogenetic position in the tree. The tree is rooted with *I. adaequata* and *I. calamistrata* of Inosperma clade

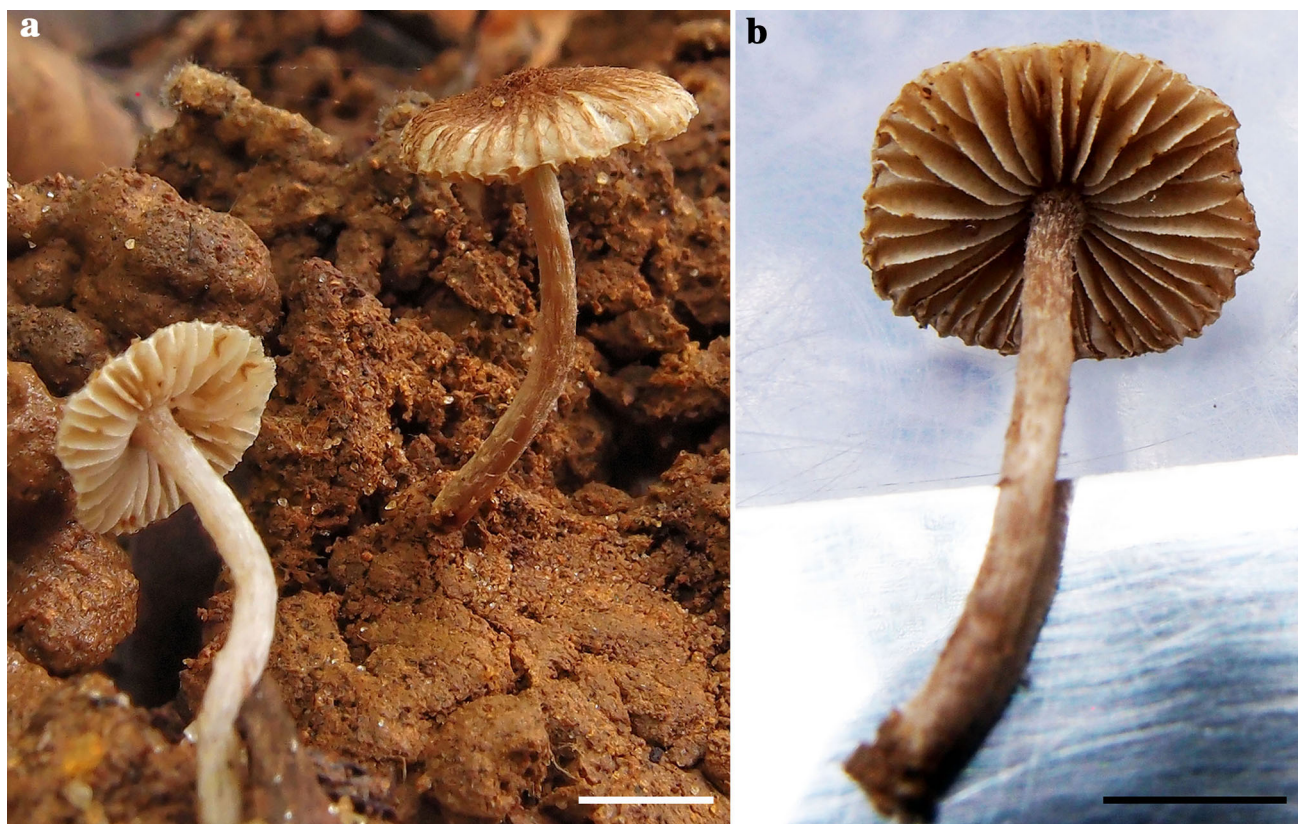


Fig. 129 *Inocybe brunneosquamulosa* (CAL 1308, holotype). **a, b** Basidiocarps. Scale bars a, b = 5 mm (photos by K. P. Deepna Latha)

clavate, inflated clavate or obovoid, rarely septate, hyaline, occasionally with faint, hyaline encrustations, thin- to slightly thick-walled. *Stipe trama* hyphae with dense, yellowish-brown oleaginous contents. *Clamp connections* seen on all hyphae.

Habitat: on the ground, scattered around *Vateria indica* (*Dipterocarpaceae*) trees.

Specimen examined: INDIA, Kerala State, Ernakulam District, Kochi, Thevakkal, Ponnakkudam Kavu sacred grove, 25 August 2014, K.P.D Latha DKP264 (CAL 1308, holotype).

GenBank Numbers ITS: KX073582; LSU: KX073586; RPB2: KX073589.

Notes: Small basidiocarps with a dark brown, squamulose and fibrillose-rimose pileus; a fibrillose stipe with a finely pruinose apex and an abruptly ending base; smooth, ellipsoid to subphaseoliform basidiospores; a hymenium devoid of pleurocystidia; versiform cheilocystidia with occasional, faint, hyaline encrustations; a cutis-type pileipellis which is disrupted with trichodermal patches and a cutis-type stipitipellis disrupted by loose, hyphal projections and often with caulocystidia at the extreme stipe apex are the salient features of *I. brunneosquamulosa*. *Inocybe fuscospinulosa*, a species originally described from Indonesia (Horak 1980b) and also reported from Sri Lanka

(Pegler 1986), seems to be somewhat similar to *I. brunneosquamulosa* in having a pileus of rather similar colour and surface features, a fimbriate lamella-edge, a fibrillose stipe, a hymenium devoid of pleurocystidia, a trichoderm-type pileipellis and the presence of cheilocystidia. *Inocybe fuscospinulosa*, however, is distinguished from the *I. brunneosquamulosa* in having larger basidiocarps with a densely squamulose pileus, crowded, adnexed, tobacco brown lamellae, a reddish-brown tinted stipe with occasional scales, smaller ($6.5\text{--}8 \times 4\text{--}5 \mu\text{m}$) and ovoid basidiospores, cylindrical to subfusoid cheilocystidia devoid of encrustations and a stipitipellis lacking caulocystidia. *Inocybe brunneosquamulosa* is also somewhat similar to *I. umbrinovirens* E. Horak, a species so far known only from Papua New Guinea (Horak 1980b), in having a somewhat similar-coloured pileus with almost similar surface features, a fibrillose stipe, smooth basidiospores, a hymenium devoid of pleurocystidia, the presence of cheilocystidia with encrusting pigment and a trichoderm-type pileipellis. However, the characters such as the larger basidiocarps with differently-shaped pileus, chocolate brown, adnexed, crowded lamellae, a hollow stipe with a greenish base, larger ($10\text{--}12.5 \times 7\text{--}8.5 \mu\text{m}$) and ovoid basidiospores, larger basidia, cheilocystidia that are terminal elements of lamellar trama, the absence of

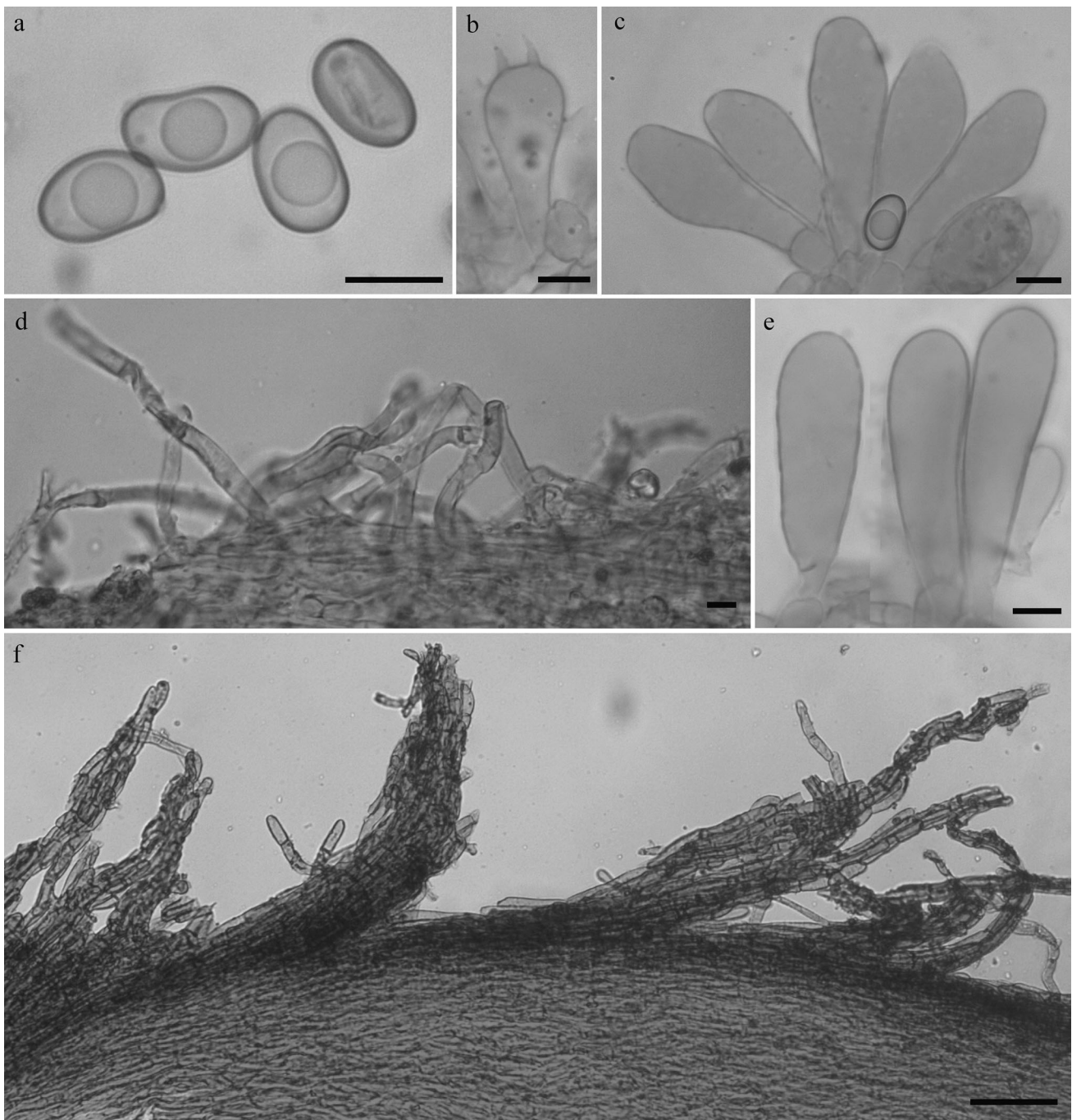


Fig. 130 *Inocybe brunneosquamulosa* (CAL 1308, holotype). **a** Basidiospores. **b** Basidium. **c** Cheilocystidia. **d** Stipitipellis. **e** Caulocystidia. **f** Pileipellis. Scale bars a–e = 10 μ m, f = 100 μ m (photos by K. P. Deepna Latha)

caulocystidia and a strong odour make *I. umbrinovirens* different from *I. brunneosquamulosa*.

Inocybe squamata J.E. Lange, a species widespread in Europe and USA (Cripps 1997) and also reported from Kerala (Pradeep and Vrinda 2010; Mohanan 2011) is similar to *I. brunneosquamulosa* in having a pileus of somewhat similar texture, rather similarly attached lamellae, a fibrillose stipe, subphaseoliform basidiospores,

a hymenium devoid of pleurocystidia, the presence of cheilo- and caulocystidia and similar type of pileipellis. However, *I. squamata* has larger basidiocarps with a differently-coloured pileus, thick, broad, yellow brown lamellae, a longer, white stipe, larger basidiospores (9–11.5 (13) \times (5) 5.5–6.5 μ m), occasional 2-spored basidia and narrowly clavate cheilo- and caulocystidia lacking encrustations.

Comparison of the ITS (679 bp), LSU (935 bp) and RPB2 (699 bp) sequences derived from *I. brunneosquamulosa* with the nucleotide sequences available in GenBank Numbers showed that *I. brunneosquamulosa* has distinct sequences. *Inocybe* species MCA562 resulted as the closest hit in megablast searches with ITS (GenBank Numbers JQ408785; Identities = 630/682 (92%)), LSU (GenBank Numbers JN975016; Identities = 921/936 (98%)) and RPB2 (GenBank Numbers JQ421077; Identities = 673/699 (96%)) sequences. *Inocybe* species MCA562 is a collection from Japan, but its morphological features are unavailable for comparison as it remains unpublished.

The phylogenetic placement of *I. brunneosquamulosa* is shown in the phylogram (Fig. 128) generated from the ML analysis of RPB2 sequence data matrix. In the ML analysis, *I. brunneosquamulosa* nested in the Pseudosperma clade with maximum support (100% ML) where it paired with *Inocybe* species MCA562 and had a strong support (96% ML).

Inocybe luteobrunnea K.P.D. Latha & Manim., *sp. nov.*

Mycobank number: MB 816734; *Facesoffungi number*: FoF 2177; Figs. 131, 132

Etymology: referring to the yellowish-brown pileus.

Holotype: CAL 1260

Basidiocarp small. *Pileus* 6–14 mm diam., narrowly conical when very young, becoming conico-convex and finally convex with a small umbo; surface brown (6F6/OAC636) on the squamules and yellowish-brown (5D8/OAC775) elsewhere when young, becoming dark brown (6F7/OAC639) at the centre and on the squamules and brownish-orange (5C4, 5C5/OAC806) elsewhere at maturity, with appressed- to slightly recurved, minute squamules on and around the umbo, appressed-fibrillose towards the margin; margin incurved when young, becoming decurved to somewhat straight with age, crenate or somewhat wavy, finely fissile. *Lamellae* emarginate, subventricose, rarely furcate, close, greyish-orange (5B3, 5B4/OAC793), up to 2 mm wide, with lamellulae of 3 lengths; edges fimbriate, rather whitish. *Stipe* 13–22 × 2–2.5 mm, central, equal, fistulose; surface initially orange grey (6B2/OAC634), becoming greyish-orange (5B2/OAC675) at maturity, appressed-fibrillose all over, finely pruinose towards the apex; base somewhat bulbous, not marginate-bulbous. *Odour* and *taste* not distinctive.

Basidiospores 7–8 (9) × 5–6 (6.5) (7.9 ± 0.7 × 5.9 ± 0.5) μm, Q = 1.2–1.6, Qm = 1.4, smooth, ovoid to amygdaliform, slightly thick-walled, pale yellowish-brown. *Basidia* 23–34 × 8–10 μm, clavate, thin-walled,

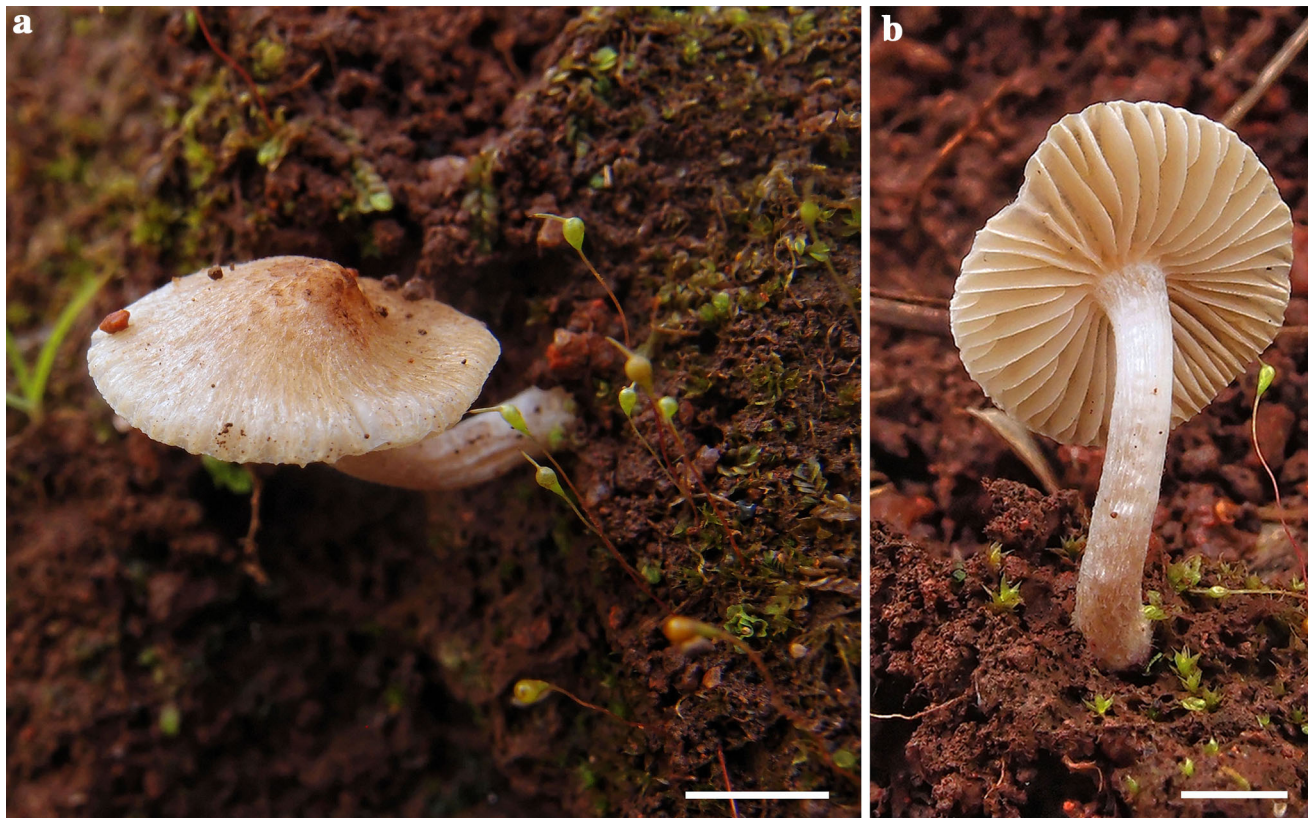


Fig. 131 *Inocybe luteobrunnea* (CAL 1260, holotype). **a, b** Basidiocarp in the field. Scale bars a, b = 5 mm (photos by K. P. Deepna Latha)

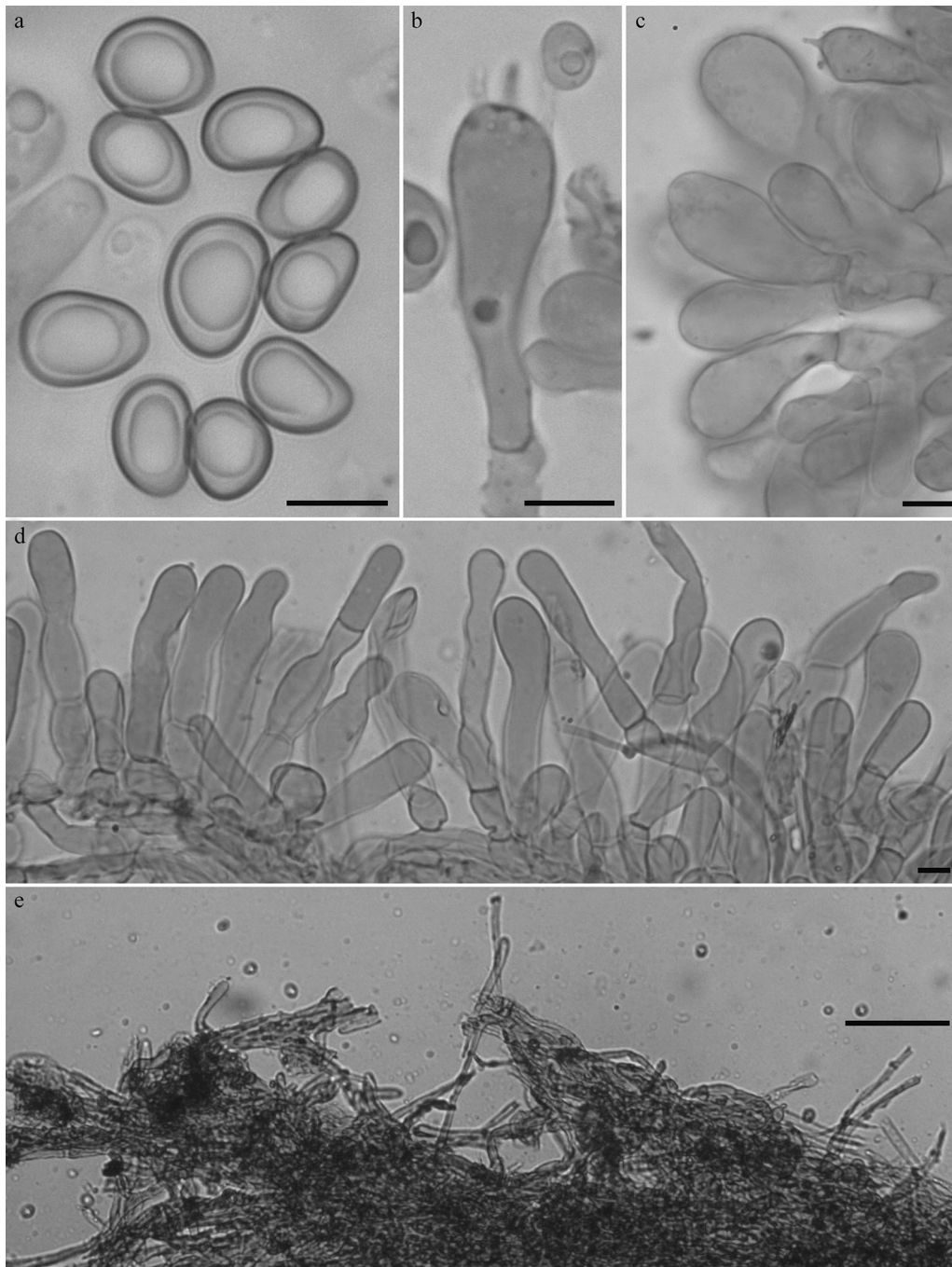


Fig. 132 *Inocybe luteobrunnea* (CAL 1260, holotype). **a** Basidiospores. **b** Basidium. **c** Cheilocystidia. **d** Caulocystidia. **e** Pileipellis. Scale bars a–d = 10 μ m, e = 100 μ m (photos by K. P. Deepna Latha)

hyaline, 4-spored or rarely 2-spored; sterigmata up to 5 μ m long. Mature basidia slightly projecting beyond the hymenial surface. *Pleurocystidia* absent. *Lamella-edge* sterile with abundant cheilocystidia. *Cheilocystidia* 17–52 \times 9–15 μ m, versiform: clavate, inflated clavate, cylindrical or cylindrical with apical constriction, cylindro-flexuose, cylindrical with irregular constriction, narrowly utriform, utriform with a median constriction, ovoid, fusiform,

submoniliform or short-pedicellate, often septate, thin- to slightly thick-walled, hyaline. *Lamellar trama* subregular, composed of both narrow and inflated hyphae; hyphae 3–25 μ m wide, thin- to slightly thick-walled, hyaline, at times with faint, hyaline encrustations especially towards the edge of the hymenium. *Subhymenium* poorly developed. *Pileus trama* subregular; hyphae 9–28 μ m wide, pale yellow, thin- to slightly thick-walled. *Pileipellis* a cutis

often transitioning to a trichoderm towards the centre; hyphae 4–11 μm wide, tangled, slightly thick-walled, with a pale-yellow wall pigment and brown spiral encrustations. *Stipitipellis* a cutis frequently disrupted with bunches of caulocystidia towards the apex; hyphae 5–12 μm wide, thin-to slightly thick-walled, with a pale-yellow wall pigment and hyaline encrustations, some hyphae with dense, yellowish-brown, amorphous contents towards the base. *Caulocystidia* 13–74 \times 7–13 μm , versiform: clavate, narrowly clavate, moniliform, submoniliform, cylindricoflexuous, cylindrical with an obtuse apex, utriform with a median constriction, cylindrical or ovoid with a rostrate apex, often septate, thin- to slightly thick-walled, hyaline. *Clamp connections* observed on all hyphae.

Habitat: scattered among bryophytes, on a mud wall.

Material examined: INDIA, Kerala State, Idukki District, Munnar, on the way to Mattupetti top hill station, 31 August 2013, K. P. Deepna Latha DKP167 (CAL 1260, **holotype**); GenBank Numbers ITS: KX073580; LSU: KX073584; RPB2: KX073588; INDIA, Kerala State, Idukki District, Munnar, on the way to Mattupetti top hill station, 9 November 2013, K. P. Deepna Latha DKP251 (CAL 1260, **holotype**; CAL 1261, **paratype**).

GenBank Numbers ITS: KX073581; LSU: KX073585.

Notes: *Inocybe luteobrunnea* is characterised by a yellowish-brown pileus with a fibrillose to minutely squamulose surface; a fibrillose stipe with a finely pruinose apex and a bulbous base; smooth, ovoid to amygdaliform basidiospores; a hymenium lacking pleurocystidia; abundant, versiform cheilocystidia; subregular lamellar trama with faint hyaline encrustations; a pileipellis that is a cutis with a transition to a trichoderm towards the centre and a cutis-type stipitipellis frequently disrupted with bunches of caulocystidia confined to the stipe apex. *Inocybe palaeotropica* E. Turnbull & Watling, a widespread species reported from Singapore, Malaysia, Sabah, Papua New Guinea, Solomon Islands (Horak 1980b) and also recorded from Kerala by Vrinda et al. (1997, as *I. umbrina* Masee), shares a few characters with *I. luteobrunnea* such as a similar-shaped pileus, similar-sized basidiospores (7.5–10.5 \times 4.5–6 μm), a sterile lamella-edge and caulocystidia on the stipe apex. *Inocybe palaeotropica*, however, has larger basidiocarps with dissimilar colour and surface features, adnexed lamellae, a fibrillose stipe devoid of apical pruinosity, ovoid to short ellipsoid basidiospores, only 4-spored basidia, clavate to cylindro-clavate cheilocystidia, hyphae of lamellar trama lacking encrustations, a cutis-type pileipellis and smaller, cylindro-clavate caulocystidia. *Inocybe luteobrunnea* is somewhat similar to *I. fuscospinulosa* Corner & E. Horak, an Indonesian species (Horak 1980b) and also reported from Sri Lanka (Pegler 1986), in having a somewhat similar-shaped pileus, a fibrillose stipe, almost similar-sized basidiospores (6.5–8 \times

4–5 μm), cheilocystidia, a hymenium devoid of pleurocystidia and an almost similar pileipellis structure. However, *I. fuscospinulosa* differs from *I. luteobrunnea* owing to its larger basidiocarps with conspicuous, erect, spiny squamules on the pileus, crowded, adnexed, tobacco-brown lamellae, a red-brown tinged stipe with occasional brown squamules and without a distinct bulbous base, ovoid basidiospores, consistently 4-spored basidia, larger, differently-shaped cheilocystidia and a stipitipellis devoid of caulocystidia.

The distinctive status of (CAL 1260: 675 bp; CAL 1261: 674 bp), LSU (CAL 1260: 838 bp; CAL 1261: 746 bp) and RPB2 (CAL 1260: 651 bp) sequences of *I. luteobrunnea* was confirmed in the BLASTn searches. An unnamed Australian species, *Inocybe* species AU95 was the closest hit in a megablast search for ITS (GenBank Numbers KP636851; Identities = 540/588 (92%)), LSU (GenBank Number KP171053; Identities = 831/839 (99%)) and RPB2 (GenBank Number KM555145; Identities = 638/651 (98%)) sequences.

The phylogram generated from the Maximum Likelihood (ML) analysis (Fig. 129) depicts the relative placement of *I. luteobrunnea*. The ML analysis placed *I. luteobrunnea* in the Pseudosperma clade with full support (100% ML) based on RPB2 sequence data matrix. Within this clade, *I. luteobrunnea* clustered with an unnamed Australian species, *Inocybe* species AU95 (KM555145) with maximum support (100% ML). The macro-morphological and microscopic data of that species are not available for comparison.

Inocybe rubrobrunnea K.P.D. Latha & Manim., *sp. nov.*

Mycobank number: MB 816736; *Facesoffungi number*: FoF: 2175; Figs. 133, 134

Etymology: referring to the reddish-brown colour of the pileus.

Holotype: CAL 1307

Basidiocarps small. *Pileus* 6–12 mm diam., somewhat hemispherical or paraboloid when young, becoming convex or plano-convex with a small umbo; surface reddish-brown (8E5, 8E6/OAC609, OAC610) when young, becoming dark brown (7F7/OAC621) at the centre and on the squamules, orange grey (6B2) elsewhere, appressed- to slightly recurved squamulose and appressed-fibrillose all over when young, becoming appressed- to recurved squamulose on and around the centre, appressed-fibrillose and rimulose towards the margin; margin initially incurved, becoming decurved to somewhat straight with age, crenate. *Lamellae* sinuate or emarginate, close, initially greyish-orange (6B3/OAC654), becoming brownish-orange (6C4/OAC695), up to 1.5 mm wide, with lamellulae of 3 lengths; edges fimbriate, whitish. *Stipe* 11–20 \times 1–2 mm, central, terete, equal or slightly tapered towards the base,



Fig. 133 *Inocybe rubrobrunnea* (CAL 1307, holotype). **a, b** Basidiocarp in the field. Scale bars a, b = 5 mm (photos by K. P. Deepna Latha)

cartilaginous, solid; surface brownish-orange (6C3/OAC633), fading towards the apex, appressed-fibrillose all over, slightly pruinose at the apex; base slightly enlarged. *Odour* and *taste* not distinctive.

Basidiospores $7\text{--}9 \times 5\text{--}6$ ($8.32 \pm 0.63 \times 5.57 \pm 0.43$) μm , $Q = 1.2\text{--}1.7$, $Q_m = 1.4$, smooth, ellipsoid to slightly phaseoliform, slightly thick-walled, pale yellowish-brown. *Basidia* $18\text{--}27 \times 9\text{--}12$ μm , clavate, thin-walled, hyaline, 4-spored; sterigmata up to 3 μm long. *Pleurocystidia* absent. *Lamella-edge* heterogeneous. *Cheilocystidia* $17\text{--}44 \times 6\text{--}15$ μm , abundant, versiform: narrowly clavate, clavate, cylindrical, oblong, ellipsoid, fusiform, obovoid, cylindrical with a median constriction or with a subcapitate apex, occasionally septate, exuding some amorphous material at the apex, slightly thick-walled (up to 1 μm thick), hyaline or rarely with pale yellowish-brown, amorphous contents, occasionally with faint, hyaline encrustations. *Lamellar trama* subregular, composed of both narrow and inflated hyphae; hyphae 3–23 μm wide, thin- to slightly thick-walled, hyaline. *Subhymenium* pseudoparenchymatous. *Pileus trama* subregular; hyphae 6–27 μm wide, hyaline or pale yellow, thin-walled. *Pileipellis* a cutis often disrupted with bundles of tangled ascending hyphae towards the centre; hyphae 5–10 μm wide, with a pale brownish-yellow wall

pigment and brown spiral encrustations. *Stipitipellis* a cutis composed of hyaline or pale yellow hyphae (3–10 μm wide), devoid of encrustations, frequently disrupted by bundles of loose, tangled hyphae towards the apex (2–6 μm wide), with a pale-yellow wall pigment and pale yellow spiral encrustations, thin- to slightly thick-walled, occasionally with yellowish-brown amorphous contents. *Caulocystidia* absent. *Clamp connections* observed on all hyphae.

Habitat: on soil, solitary or in small groups, near *Hopea ponga* (*Dipterocarpaceae*) trees.

Specimen examined: INDIA, Kerala State, Wayanad District, Muthanga, Muthanga Wildlife Sanctuary, 21 August 2013, K. P. Deepna Latha DKP142 (CAL 1307, holotype).

GenBank Numbers ITS:KX073583; LSU:KX073587; RPB2:KX073590.

Notes: Small basidiocarps with an appressed-fibrillose to squamulose pileus; a stipe with a slightly enlarged base and a fibrillose surface; smooth, ellipsoid to slightly phaseoliform basidiospores; a hymenium devoid of pleurocystidia; versiform cheilocystidia exuding some amorphous material at the apex; a cutis-type pileipellis disrupted with bundles of tangled ascending hyphae; and a cutis-type stipitipellis often disrupted by bundles of loose, tangled

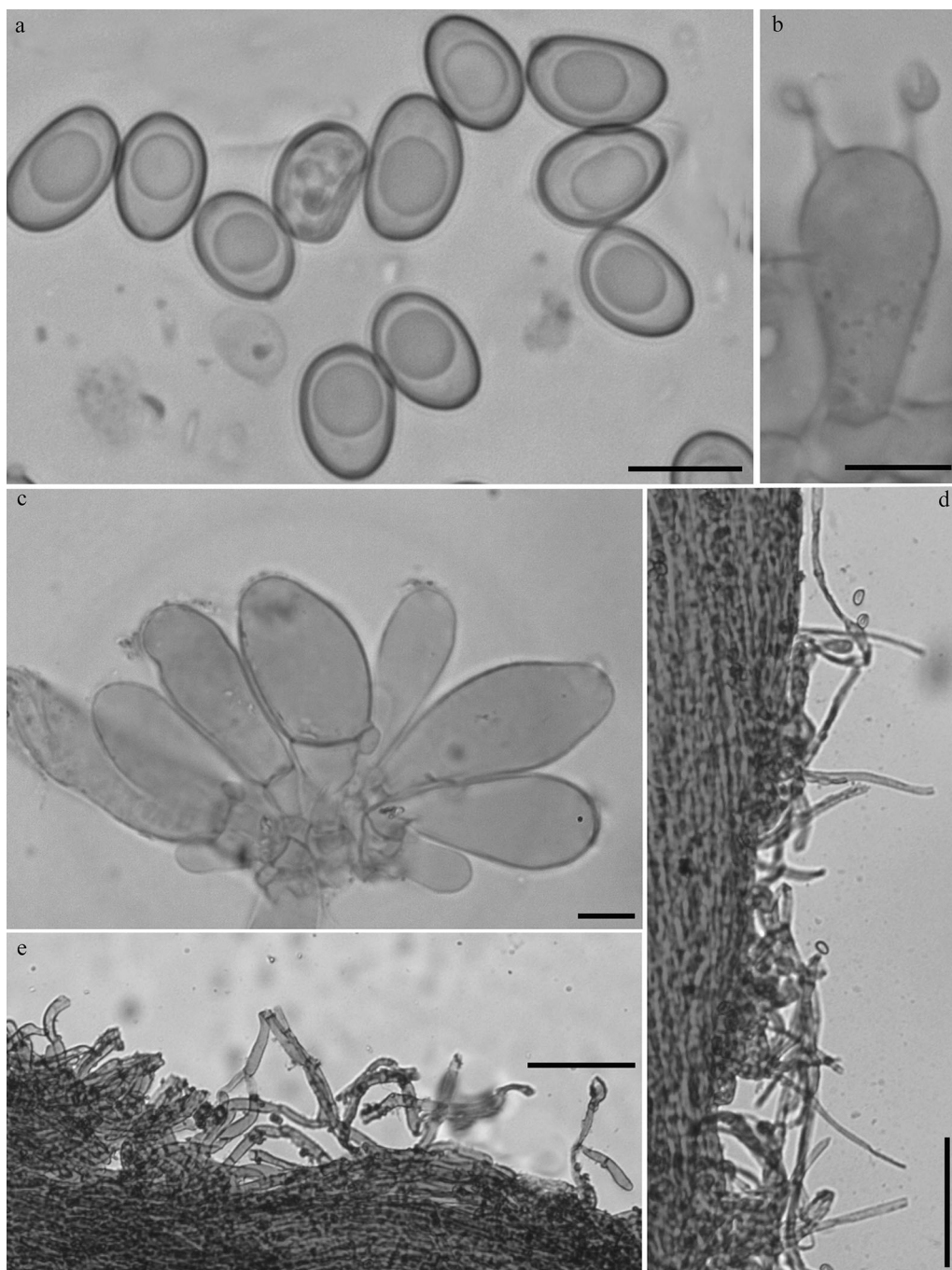


Fig. 134 *Inocybe rubrobrunnea* (CAL 1307, holotype). **a** Basidiospores. **b** Basidium. **c** Cheilocystidia. **d** Stipitipellis. **e** Caulocystidia. **f** Pileipellis. Scale bars a–c = 10 μm , d, e = 100 μm (photos by K. P. Deepna Latha)

hyphae towards the apex are the diagnostic features of *I. rubrobrunnea*.

Following the key of Kobayashi (2002), *I. rubrobrunnea* keys out close to *I. quercina* Hongo, a species known from Japan, because of its reddish-brown pileus with almost similar size, shape and surface features, a whitish lamella-edge, a solid stipe with a fibrillose surface, almost similar-shaped basidiospores, the absence of pleurocystidia and the

presence of cheilocystidia. However, the characters such as the adnexed lamellae that become red when cut, a longer stipe, larger basidiospores ($8.2\text{--}10.8 \times 4.8\text{--}5.5 \mu\text{m}$) and basidia, smaller cheilocystidia devoid of encrustations, a cutis-type pileipellis lacking encrustations, the presence of caulocystidia and a strong odour of that species make it different from *I. rubrobrunnea*. *Inocybe fuscospinulosa*, a species originally described from Indonesia (Horak 1980b)

and also reported from Sri Lanka (Pegler 1986), has a pileus with dark brown squamules, a whitish lamella-edge, basidiospores of similar size ($7\text{--}9 \times 4.2\text{--}5.5 \mu\text{m}$) and shape and the absence of pleuro- and caulocystidia. However, that species differs in having larger basidiocarps with a campanulate to applanate pileus, a white context discolouring purplish-red on exposure, cheilocystidia devoid of encrustations and a trichoderm-type pileipellis.

Comparison of the ITS (676 bp), LSU (924 bp) and RPB2 (702 bp) sequences of *I. rubrobrunnea* with the nucleotide sequences of taxa available in GenBank Numbers suggests that it has distinct sequences. In a megablast search of the GenBank Numbers database using ITS sequence of *I. rubrobrunnea*, the closest hit was *Inocybe* species MCA562 (GenBank Numbers JQ408785; Identities = 616/668 (92%)) followed by *Inocybe* species AU43 (GenBank Numbers KJ729878; Identities = 605/659 (92%)). An undescribed *Inocybe* species, *Inocybe* species AU44 was the closest hit in BLASTn search with LSU (GenBank Numbers KJ729906; Identities = 896/925 (97%)) sequence. *Inocybe* species AU43 (GenBank Numbers KJ729935; Identities = 670/702 (95%)) resulted as the closest hit in BLASTn search with RPB2 sequences. But, the details of *Inocybe* species MCA562, an unnamed *Inocybe* collection from Japan and *Inocybe* species AU43 and *Inocybe* species AU44, another unnamed collection from Australia, are not available for comparison.

The RPB2-based ML phylogeny (Fig. 128) placed *Inocybe rubrobrunnea* in the Pseudosperma clade with full support (100% ML). Within this clade, *I. rubrobrunnea* clustered with *Inocybe* species AU43 with a significant support (95% ML).

Marasmiaceae Roze ex Kühner.

The family *Marasmiaceae* is characterized by white spores. The members of this family mostly have tough stems and the capability of shrivelling up during a dry period and later recovering. According to Kirk et al. (2008), the family contains 54 genera and 1590 species.

Marasmius Fr.

Marasmius is a genus of mushroom-forming fungi in the family *Marasmiaceae*. It contains about 500 species (Kirk et al. 2008) of which a few, such as *Marasmius oreades*, are edible. However, most members of this genus are small, unimpressive, brown mushrooms. Their humble appearance contributes to them not being readily noticeable to the layman, and therefore these mushrooms are seldom collected by mushroom hunters. Quite a few of the species are known to grow in the characteristic fairy ring pattern (Fig. 135).

Marasmius luculentus A.K. Dutta, K. Acharya & Antonín, *sp. nov.*

Mycobank number: MB 816959; *Facesoffungi number*: FoF 2192, Figs. 136, 137

Etymology: referring to the beautiful (*luculentus*) appearance of the pileus.

Holotype: CUH AM120

Pileus 5–10 mm in diam., conic to hemispherical when very young, becoming convex in age, with a small conic to convex papilla that ranges from reddish-brown (8D6) to violet brown (10E5–6, 11E6–7) when young, but later turning brown (7D7, 7E8) to dark brown (7F7) at maturity, very rarely forming a central dot, often with a depression around the papilla; striate to plicate up to center, margin often crenate; surface dry, glabrous, hygrophanous, brownish-orange (7C4) to light brown (7D5–6) when very young, later reddish-grey (7–8B2) and finally turning white (1A1) to off-white at maturity, greyish-yellow (1–2B4, 4B4–5) on drying; context very thin, white to cream. *Lamellae* adnexed or adnate to a collarium, distant to subdistant ($L = 12\text{--}14$, $l = 0$), white (1A1), regular, slightly intervenose, edge concolorous. *Stipe* 5–9(–12) \times 0.1–0.3 mm, central, glabrous, wiry, pliant, cylindrical, equal, simple and insititious on the substratum, dark brownish-black to black overall, often accompanied by black rhizomorphs, 30–42 mm long. *Odour* and *taste* indistinct. *Spore print* white.

Basidiospores (9.3–)10–10.3–10.5(–11) \times (3.9–)4.3–4.8–5.4(–5.8) μm , $Q = 1.7\text{--}2.2\text{--}2.6$, ellipsoid to ellipsoid-fusoid, smooth, hyaline, IKI-, thin-walled. *Basidia* not observed. *Basidioles* 24–25 \times 5.5–7 μm , fusoid to clavate, hyaline, thin-walled. *Lamellae edge* sterile. *Pleurocystidia* absent. *Cheilocystidia* composed of *Siccus*-type broom cells; main body 14–18 \times 4–6(–7.5) μm , sphaeropedunculate to (broadly) clavate or irregular in outline, hyaline, apically thick-walled; apical setulae 2–3.5(–5.5) μm long, cylindrical or irregular in outline, obtuse, pale yellow to light brown in KOH, thick-walled. *Pileipellis* a hymeniform layer, composed of *Siccus*-type broom cells; main body (17–)19–23(–25) \times (7–)8–11(–14.5) μm , sphaeropedunculate to clavate, broadly clavate, often branched, pale yellow to light brownish in KOH, thick-walled; apical setulae (1.5–)3–4(–5.5) μm long, cylindrical, obtuse, thick-walled. *Pileus trama* composed of 4.5–7.5 μm broad, interwoven, cylindrical, hyaline, inamyloid, thin-walled hyphae. *Lamellar trama* hyphae 4–6.5 μm broad, interwoven, cylindrical, hyaline, inamyloid, thin-walled. *Stipitipellis* hyphae 5.5–6.5 μm broad, parallel to subparallel, cylindrical, smooth, non-gelatinous, hyaline to pale yellow in KOH, non-dextrinoid to weakly dextrinoid, thick-walled. *Stipe trama* hyphae 6.8–7.5 μm broad, parallel to subparallel, cylindrical,

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