

## ***Bolbitiaceae* of Kerala State, India: New species and new and noteworthy records**

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**Abstract:** 13 species of *Bolbitiaceae*, representing the five genera, *Bolbitius*, *Conocybe*, *Descolea*, *Galerella* and *Pholiotina*, are described, illustrated and discussed. Six species, namely *Conocybe brunneaurantiaca*, *C. pseudopubescens*, *C. radicans*, *C. solitaria*, *C. volvata* and *Pholiotina indica*, are new to science. *Bolbitius coprophilus*, *Descolea maculata*, *Galerella plicatella* and *Pholiotina utricystidiata* are recorded for the first time from India. One species is tentatively recorded as *Conocybe* aff. *velutipes*, *Conocybe sienophylla* and *C. zeylanica* are rerecorded. *Conocybe africana* and *C. bicolor* are considered as synonyms of *C. zeylanica*.

**Zusammenfassung:** 13 Arten der *Bolbitiaceae* aus den Gattungen *Bolbitius*, *Conocybe*, *Descolea*, *Galerella* und *Pholiotina* werden beschrieben, illustriert und diskutiert. Sechs Arten, nämlich *Conocybe brunneaurantiaca*, *C. pseudopubescens*, *C. radicans*, *C. solitaria*, *C. volvata* und *Pholiotina indica* sind neu für die Wissenschaft. *Bolbitius coprophilus*, *Descolea maculata*, *Galerella plicatella* und *Pholiotina utricystidiata* wurden erstmals in Indien gefunden. Eine Art wird vorläufig als *Conocybe* aff. *velutipes* bezeichnet, *Conocybe sienophylla* und *C. zeylandica* wurden wiedergefunden. *Conocybe africana* und *C. bicolor* werden als Synonyme von *C. zeylanica* aufgefaßt.

While studying the agaric family *Bolbitiaceae* of Kerala State, India, we came across some species belonging to the genera *Bolbitius*, *Conocybe*, *Descolea*, *Galerella* and *Pholiotina*, most of which were found to be either new species or new records from India. They are described, illustrated and discussed here. Colour notations used in the description of species are from KORNERUP & WANSCHER (1978). Unless otherwise stated, all the specimens examined are deposited in the herbarium WU.

*Bolbitius coprophilus* (PECK) HONGO 1959, Mem. Fac. Lib. Arts. Educ., Shiga University Nat. Sci. 9: 82 (Fig. 1 a-d)

**Characters:**

**Pileus:** 30-65 mm diam., conico-campanulate to conico-convex, becoming plane, finally uplifted, with a central obtuse umbo, often on a central shallow depression; surface light orange (KORNERUP & WANSCHER 1978: 6A4) to pastel red (7A4) at the centre, fading centrifugally, hygrophanous and becoming greyish orange (6B3) all over, glabrous, sulcate-striate to the centre, glutinous when moist especially towards the centre; margin appanate to reflexed, entire, becoming fissile or eroded. Context up to 2 mm thick at the centre, white.

**Lamellae:** adnexed to almost free, initially pinkish (7A2), becoming brownish orange (6C5) to light brown (7D6), close, up to 5 mm wide, with lamellulae of three lengths; lamellar edge pale, fimbriate under a lens.

**Stipe:** 40-100 x 2.5-9 mm, central, terete, attenuated towards apex, fragile, hollow; surface white or pinkish white (7A2), faintly pruinose; base slightly swollen.

**Context:** with unpleasant smell when mature.

**Spore-print:** not obtained.

**Spores:** 9.5-13.5 x 6.5-9 x 6-8 ( $11.67 \pm 1.22 \times 7.81 \pm 0.69 \times 6.84 \pm 0.56$ )  $\mu\text{m}$ ,  $Q = 1.35-1.65$ ,  $Q_m = 1.49$ , lenticular, ovoid to oviform-ellipsoid in face-view, ellipsoid in side-view, reddish brown in KOH, smooth, thick-walled, truncated by an apical germ-pore.

**Basidia:** 20-26.5 x 10.5-14  $\mu\text{m}$ , pyriform, 4-spored; sterigmata up to 3  $\mu\text{m}$  long.

**Cheilocystidia:** 16.5-49 x 7.5-16.5  $\mu\text{m}$ , lageniform to utriform, scattered, thin-walled, hyaline. Lamellar edge heteromorphous.

**Pleurocystidia:** absent.

**Hymenophoral trama:** subregular, hyphae 2-17.5  $\mu\text{m}$  wide, inflated, thin-walled, hyaline. Pileal trama interwoven; hyphae 2-26.5  $\mu\text{m}$  wide, narrower towards upper part, inflated towards lower region, thin to slightly thick-walled, pale yellowish brown.

**Pileipellis:** composed of loosely arranged hymeniform elements, 19-57.5 x 8-17  $\mu\text{m}$ , clavate to sphaeropedunculate, dispersed in a gelatinous matrix, thin-walled, hyaline to pale yellow or pinkish.

**Stipe trama:** composed of 2-9  $\mu\text{m}$  wide hyphae, thin- to slightly thick-walled, hyaline. Stipitipellis of parallel hyphae 2-12.5  $\mu\text{m}$  wide, thin- to slightly thick-walled, almost hyaline.

**Caulocystidia:** 5.5-12.5  $\mu\text{m}$  wide, arising as modified terminal parts of lateral hyphae, irregularly branched or diverticulate, septate, thin-walled, hyaline, in clusters or scattered.

**Clamp-connections:** not observed.

**Habitat:** on elephant dung, scattered, June-September.

**Specimens examined:** India: Kerala State, Thrissur District, Guruvayoor, 11. 6. 1999, K. A. THOMAS T312 (WU 20883); - 17. 6. 1999, K. A. THOMAS T312b (WU 20884); - Kasargod District, Adhoor, 16. 9. 2000, K. A. THOMAS T312c (WU 20885).

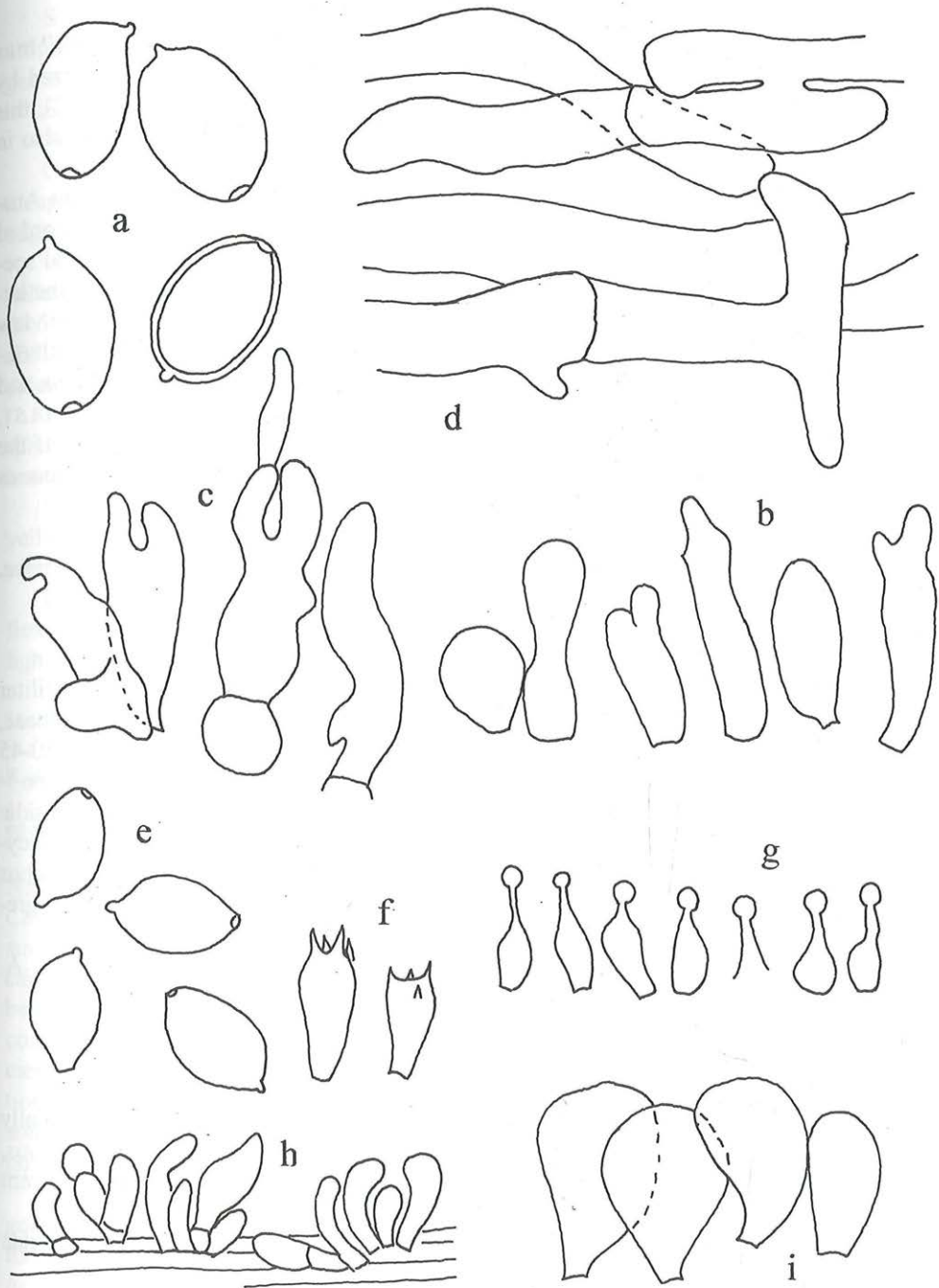


Fig. 1 a-d *Bolbitius coprophilus* (a, b, d WU 20884, c WU 20885). a spores, x 2000; b cheilocystidia, x 800; c caulocystidia, x 800; d hyphae of the hymenophoral trama, x 800. e-i *Conocybe brunneo-aurantiaca* (WU 20913, holotypus). e spores, x 2000; f basidia, x 800; g cheilocystidia, x 800; h caulocystidia, x 800; i pileipellis, x 800.

**Notes:**

Except for the smaller spores, the present collections are inseparable from *Bolbitius coprophilus* known from North temperate regions. This species is characterized by pinkish basidiomata growing on dung and straw. According to WATLING (1982), this species is widely distributed in glasshouses in The Netherlands, but it occurs also in the open in C Europe (ENDERLE & al. 1985, HÜBSCH 1985, TÄGLICH 1991).

Apart from the North temperate regions, *B. coprophilus* is also known from Australia (HONGO 1959) and Singapore (WATLING 1994). This is the first Indian record of this species. It is very close to *B. vitellinus* (PERS.: FR.) FR., a widely distributed species usually associated with dung including elephant dung (PEGLER 1977), but the latter species has bright lemon-chrome basidiomata. WATLING (1994) expressed the view that *B. variicolor* ATK. might be considered conspecific with *B. coprophilus*. KRIEGLSTEINER (1991), however, considered *B. variicolor* as a variety of *B. vitellinus* and proposed the new combination *Bolbitius vitellinus* var. *variicolor* (ATK.) KRIEGLST. According to our actual state of knowledge and contrary to earlier statements of the second author (HAUSKNECHT & RÜCKER 1989: 107), we consider the three taxa as closely related, but independent species.

***Conocybe brunneoaurantiaca* K. A. THOMAS, HAUSKNECHT & MANIMOHAN, spec. nova** (Fig. 1 e-i)

**Latin description:**

Pileus 4-8 mm latus, convexus, conico-convexus vel plano-convexus, raro subtiliter umbonatus, brunneo-aurantiacus, hygrophanus, glaber. Lamellae adnexae, brunneae, subconfertae, lamellulis intermixtae, marginibus concoloratae et integrae. Stipes 20-45 x <1 mm, pileo concolor, glaber. Sporae 6,5-11 x 4,5-6,5 µm, Q = 1,22-1,78, Qm = 1,5, ellipsoideae, laeves, crassitunicatae, truncato poro germinativo praeditae. Basidia 14,5-22 x 7,5-10,5 µm, clavata, 4-sporigera. Cheilocystidia 18-30 x 6,5-10 µm, lecythiformia. Pileipellis hymeniformis, cellulis sphaero-pedunculatis vel pyriformibus composita. Caulocystidia 10-29 x 4,5-7,5 µm, clavata vel cylindrico-flexuosa, gregaria. Hyphae fibulatae. Ad lignum putrefactum vel humum.

**Typus:** India: Kerala State, Malappuram District, Nilambur, 14. 11. 1997, K. A. THOMAS T210 (WU 20913, holotypus).

**Characters:**

**Basidiomata:** small, slender.

**Pileus:** 4-8 mm diam., conico-convex, convex or plano-convex, occasionally with an indistinct umbo; surface brownish orange (6C5, 6C6, 7C5, 7C6), unicolorous, hygrophanous, smooth, glabrous, dry; margin decurved, entire. Context up to 0.5 mm at the centre.

**Lamellae:** adnexed, brown (6D7, 7D7), close, up to 2 mm wide, with lamellulae of three lengths; lamellar edge concolorous with the sides, entire.

**Stipe:** 20-45 x <1 mm, central, terete, slightly tapering apically, hollow; surface concolorous with the pileus surface, glabrous.

**Context:** thin, smell none.

**Spore-print:** not obtained.

Spores: 6.5-11 x 4.5-6.5 ( $8.58 \pm 1.28 \times 5.64 \pm 0.62$ )  $\mu\text{m}$ ,  $Q = 1.22-1.78$ ,  $Q_m = 1.5$ , ellipsoid, smooth, brownish orange in KOH, thick-walled, apically truncated by a germ-pore.

Basidia: 14.5-22 x 7.5-10.5  $\mu\text{m}$ , clavate, 4-spored; sterigmata up to 3  $\mu\text{m}$  long.

Ammoniacal reaction: negative.

Cheilocystidia: 18-30 x 6.5-10  $\mu\text{m}$ , lecythiform, with a long slender neck and a capitulum of 3-5  $\mu\text{m}$  diam., thin-walled, hyaline to light brownish yellow. Lamellar edge heteromorphous to almost sterile with sparse or crowded cheilocystidia.

Hymenophoral trama: subregular, with a narrow mediostatum of narrow, yellowish brown hyphae and broad lateral strata of inflated, paler hyphae; hyphae 2-24.5  $\mu\text{m}$  wide, thin-walled. Pileal trama interwoven; hyphae 1.5-35  $\mu\text{m}$  wide, narrow and densely brown encrusted towards hypodermial region, inflated and hyaline or paler towards lower region of the pileal trama, thin-walled.

Pileipellis: hymeniform, elements 19-41.5 x 11.5-27.5  $\mu\text{m}$ , pear-shaped to sphaeropedunculate, thin-walled, pale brown or hyaline towards apex, brown towards base. Pileocystidia evidently absent.

Stipe trama: composed of 1.5-27.5  $\mu\text{m}$  wide hyphae, parallel, thin-walled, light yellowish brown. Stipitipellis of parallel hyphae 2-9.5  $\mu\text{m}$  wide, thin-walled, light yellowish brown.

Caulocystidia: 10-29 x 4.5-7.5  $\mu\text{m}$ , in fascicles, mostly clavate or cylindrical-flexuose; sometimes with a beak-like projection at the apex, thin-walled, hyaline to light yellowish brown.

Clamp-connections: present in all parts of the basidiomata.

**Habitat:** on decaying twigs and humus-rich soil, scattered, November.

**Specimen examined** (besides type): **India:** Kerala State, Malappuram District, 18. 11. 1997, K. A. THOMAS T210b (WU 20914).

**Additional material examined:** *Conocybe lentispora* SINGER: **Argentina:** Tucumán, San Pablo, on naked earth, 27. 3. 1949, R. SINGER (LIL, holotype).

#### Notes:

*Conocybe brunneoaurantiaca* is characterised by small, vividly coloured basidiomata; small, slightly lentiform, lemon-shaped spores; lecythiform cheilocystidia with small capitula and long necks; and caulocystidia that are neither lecythiform nor filiform. It belongs to subg. *Conocybe* sect. *Pilosellae* (WATLING 1982), where, owing to the combination of characters listed above, it occupies a rather isolated position. The species coming closest to it seems to be *Conocybe lentispora* from Argentina. Examination of the type material of *C. lentispora* revealed that the latter species has much smaller, more lentiform spores (5.5-6.5 x 4.2-5.2 x 3.6-4.2  $\mu\text{m}$ ) with a smaller germ-pore.

In shape and size of spores, the new species resembles the European *C. hexagonospora* HAUSKN. & ENDERLE, but the latter grows in montane to subalpine spruce forests and has totally different colours and much larger basidiomata. *Conocybe lenticulospora* WATLING, another European species with lentiform spores, has larger spores and grows on dung or in manured meadows. In Europe in glass houses there has been found a quite similar up to now unnamed species with stipe covering typical of sect. *Pilosellae*, small basidiomata and similar hexagonal-lentiform spores (see PIDLICH-AIGNER & HAUSKNECHT 2001), but this is clearly different because of its brown

to dark brown, cuspidate pileus, white to whitish stipe and somewhat larger, darker coloured spores.

***Conocybe pseudopubescens* K. A. THOMAS, HAUSKNECHT & MANIMOHAN, spec. nova** (Fig. 2 a-e)

**Latin description:**

Pileus 5-14 mm latus, conico-convexus vel conico-campanulatus, hygrophanus, primo brunneo-aurantiacus, postea aurantio-albus, in statu humecto pellucido-striatus, glaber. Lamellae anguste adnatae, pallide brunneae, subconfertae, lamellis intermixtae, marginibus dilutae et integrae. Stipes 30-60 x 1-2 mm, primo pileo concolor, postea pallide aurantiacus, subtiliter pruinosis. Sporae 11,5-17,5 x 7,5-12 x 7-10  $\mu\text{m}$ , Q = 1,29-1,69, Qm = 1,52, ellipsoideae, lentiformes, laeves, crassitunicatae, truncato poro germinativo praeditae. Basidia 18-30 x 10,5-16,5  $\mu\text{m}$ , clavata vel pedicellato-clavata, 4-sporigera. Cheilocystidia copiosa, 12,5-27 x 6,5-12  $\mu\text{m}$ , lecythiformia. Pileipellis hymeniformis, cellulis sphaero-pedunculatis composita. Caulocystidia 7,5-56,5 x 5-12,5  $\mu\text{m}$ , versiformia, haud lecythiformia, gregaria vel dispersa. Hyphae fibulatae. Ad fimum *Elephas maximus*.

**Typus:** India: Kerala State, Wayanad District, Muthanga, 25. 6. 1994, K. A. THOMAS T84 (WU 20919, holotypus).

**Characters:**

Basidiomata: small.

Pileus: 5-14 mm diam., conico-convex to conico-campanulate; surface almost brownish orange (6C5, 6C6), hygrophanous and becoming orange-white (5A2), smooth, glabrous, dull, translucent-striate when moist; margin decurved, entire to slightly eroded. Context less than 1 mm thick at the centre, orange-white.

Lamellae: narrowly adnate, light brown (7D6), close, up to 2.5 mm wide, with lamellulae of three lengths; lamellar edge paler, entire.

Stipe: 30-60 x 1-2 mm, central, terete, equal or slightly attenuated towards apex, hollow; surface initially colorous with pileus surface, later pale orange (5A3), faintly pruinose, glabrescent.

Context: smell none.

Spore-print: not obtained.

Spores: 11.5-17.5 x 7.5-12 x 7-10 ( $14.39 \pm 1.79 \times 9.44 \pm 0.98 \times 8.74 \pm 0.87$ )  $\mu\text{m}$ , Q = 1.29-1.69, Qm = 1.52, lenticular, oviform-ellipsoid to oblong-ellipsoid in face-view, ellipsoid in side-view, smooth, reddish brown in KOH, thick-walled, apically truncated by a broad germ-pore.

Basidia: 18-30 x 10.5-16.5  $\mu\text{m}$ , clavate or pedicellate-clavate, 4-spored; sterigmata up to 3  $\mu\text{m}$  long.

Ammoniacal reaction: negative.

Cheilocystidia: 12.5-27 x 6.5-12  $\mu\text{m}$ , lecythiform with a capitulum of 2.5-5  $\mu\text{m}$  diam., subtended by a small neck, thin-walled, hyaline to pale brownish yellow. Lamellar edge sterile with crowded cheilocystidia.

Pleurocystidia: none.

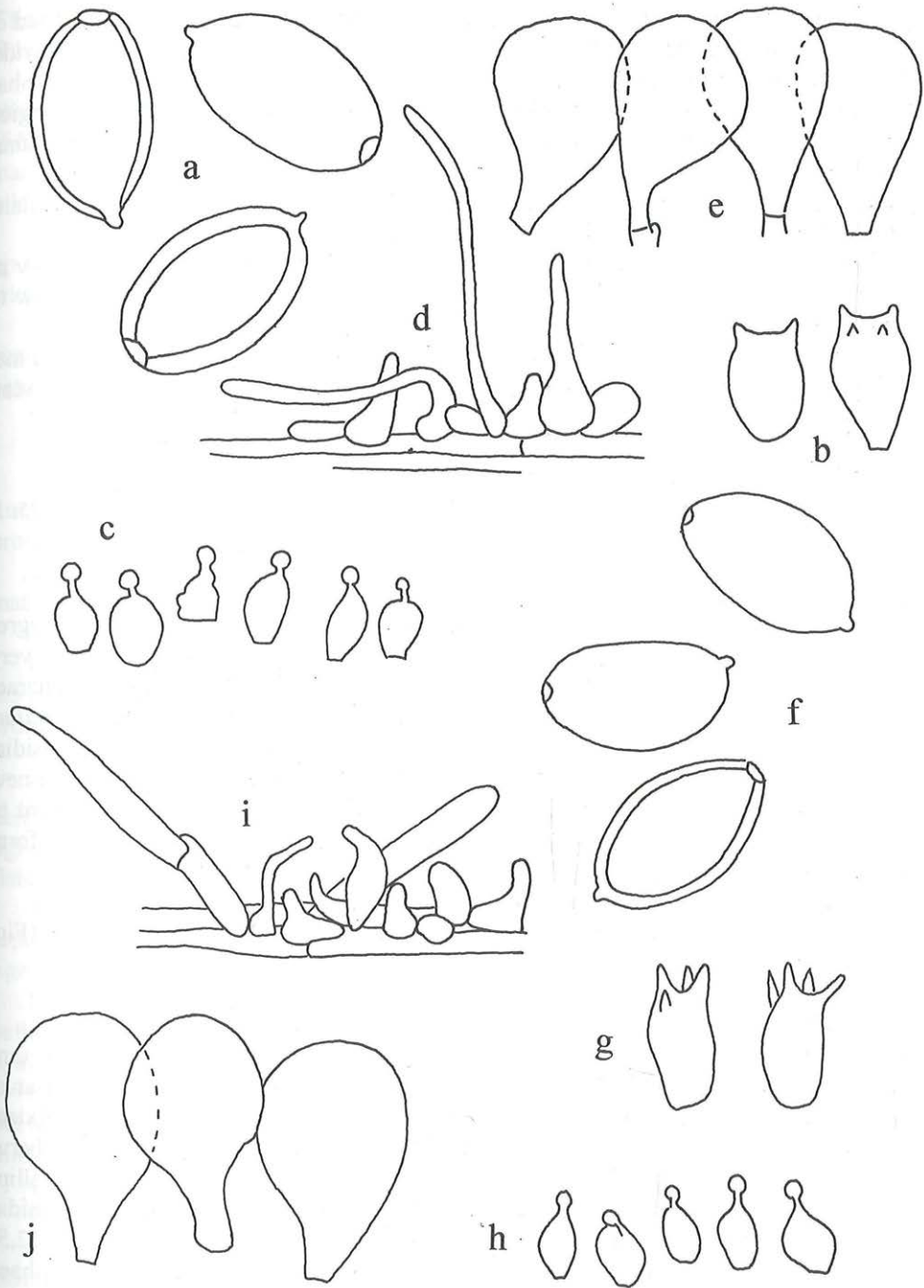


Fig. 2 a-e *Conocybe pseudopubescens* (WU 20919, holotypus). a spores, x 2000; b basidia, x 800; c cheilocystidia, x 800; d caulocystidia, x 800; e pileipellis, x 800. f-j *Conocybe radicans* (WU 20915, holotypus). f spores, x 2000; g basidia, x 800; h cheilocystidia, x 800; i caulocystidia, x 800; j pileipellis, x 800.

Hymenophoral trama: subregular, with a narrow mediostratum composed of narrow hyphae, and broad lateral strata of inflated hyphae; hyphae 2-27.5  $\mu\text{m}$  wide, thin-walled, pale brownish yellow to almost hyaline. Pileal trama interwoven; hyphae 2-30  $\mu\text{m}$  wide, narrow and with light yellow encrustation towards hypodermial region and inflated, with hyaline to pale yellow pigment towards lower region of the trama, thin-walled.

Pileipellis: hymeniform, elements 22.5-55 x 17-44  $\mu\text{m}$ , sphaeropedunculate, thin-walled, hyaline towards distal end, light yellow towards base.

Stipe trama: composed of 2-34  $\mu\text{m}$  wide hyphae, thin-walled, pale yellow or hyaline. Stipitipellis of parallel hyphae 2-11.5  $\mu\text{m}$  wide, thin-walled, pale yellow to almost hyaline.

Caulocystidia: 7.5-56.5 x 5-12.5  $\mu\text{m}$ , very variable, never lecythiform, sometimes with a swollen base and a very long, flexuose upper part, in fascicles or scattered, thin-walled, pale yellow to hyaline.

Clamp-connections: present in all parts of basidiomata.

Habitat: on elephant dung, scattered, May-June.

Specimen examined (besides type): India: Kerala State, Wayanad District, Muthanga, 25. 5. 1999, K. A. THOMAS T84b (WU 20920).

#### Notes:

Small, coprophilous basidiomata, total absence of velar remnants, brownish, hygrophanus and pellucid-striate pileus, large (>11  $\mu\text{m}$  long), lentiform spores with very thick wall, and very variable caulocystidia that are never lecythiform are the characteristic features of this species which belongs to subg. *Conocybe*, sect. *Pilosellae*. Size and shape of spores, stipe covering, 4-spored or occasionally 2-spored basidia, and coprophilous habitat are similar to those of *C. singeriana* HAUSKN., but the new species has (1) distinctly smaller, thin-fleshed basidiomata, (2) strongly pallescent to orange-white, non-hairy pileus, (3) a stipe base without bulb, and (4) more lentiform spores with thicker (up to 2  $\mu\text{m}$ ) wall.

***Conocybe radicans* K. A. THOMAS, HAUSKNECHT & MANIMOHAN, spec. nova** (Fig. 2 f-j)

#### Latin description:

Pileus 6-14 mm latus, conico-campanulatus, conico-convexus vel convexus, raro umbonatus, pallide aurantiacus, hygrophanus, glaber, in statu humecto pellucido-striatus. Lamellae adnatae, pallide brunneae vel brunneae, subconfertae, lamellis intermixtae, marginibus concoloratae et integrae. Stipes 60-90 x 1-2 mm, pileo concolor, puberulus, radicans. Sporae 11,5-15,5 x 7-9,5 x 6,5-8,5  $\mu\text{m}$ , Q = 1,42-1,79, Qm = 1,6, ellipsoideae vel ovato-ellipsoideae, laeves, truncato poro germinativo praeditae. Basidia 22,5-36,5 x 11,5-15,5  $\mu\text{m}$ , clavata, 4-sporigera, raro 2-sporigera. Cheilocystidia 12,5-22,5 x 5,5-11  $\mu\text{m}$ , lecythiformia. Pileipellis hymeniformis, cellulis globosis vel sphaeropedunculatis composita. Caulocystidia 24-122,5 x 4,5-25  $\mu\text{m}$ , versiformia, haud lecythiformia, gregaria vel dispersa. Hyphae fibulatae. Ad terram in pratis.

Typus: India: Kerala State, Wayanad District, Ponkuzhy, 29. 4. 1998, K. A. THOMAS T252 (WU 20915, holotypus).



**Characters:**

**Basidiomata:** small, fragile, radicating.

**Pileus:** 6-14 mm diam., 6-12 mm high, conico-campanulate to conico-convex to convex, sometimes with a small umbo; surface pale orange (5A3) or light orange (5A4, 5A5), hygrophanous, smooth, glabrous, dull, translucent-striate when moist; margin decurved, entire. Context up to 2 mm wide at the centre, concolorous with the pileus surface.

**Lamellae:** adnate to adnate-adnexed, light brown (6D6) or brown (6D7), close, up to 3 mm wide, with lamellulae of three lengths; lamellar edge entire, concolorous with the sides.

**Stipe:** 60-90 x 1-2 mm, central, cylindrical, slightly tapering apically, hollow; surface concolorous with the pileus surface, slightly pubescent; base distinctly radicating.

**Context:** smell not distinctive.

**Spore-print:** not obtained.

**Spores:** 11.5-15.5 x 7-9.5 x 6.5-8.5 ( $13.92 \pm 1.02 \times 8.73 \pm 0.76 \times 7.52 \pm 0.63$ )  $\mu\text{m}$ ,  $Q = 1.42-1.79$ ,  $Q_m = 1.6$ , lenticular, ellipsoid to oviform-ellipsoid, smooth, red brown in KOH, apically truncated by a germ-pore.

**Basidia:** 22.5-36.5 x 11.5-15.5  $\mu\text{m}$ , clavate, 4-spored, rarely 2-spored; sterigmata up to 10  $\mu\text{m}$  long.

**Ammoniacal reaction:** negative.

**Cheilocystidia:** 12.5-22.5 x 5.5-11  $\mu\text{m}$ , lecythiform, with a small capitulum of 2.5-5  $\mu\text{m}$  diam., subtended by a short neck, thin-walled, hyaline. Lamellar edge heteromorphous to almost sterile.

**Pleurocystidia:** none.

**Hymenophoral trama:** subregular, composed of a narrow mediostratum of narrow hyphae and lateral strata of inflated cells; hyphae 3-37.5  $\mu\text{m}$  wide, thin-walled, light brownish yellow to hyaline. Pileal trama composed of 2-39  $\mu\text{m}$  wide hyphae, inflated, thin-walled, almost hyaline or often with light brownish yellow encrustation.

**Pileipellis:** hymeniform, elements 17.5-46.5 x 12.5-36.5  $\mu\text{m}$ , globose to sphaeropedunculate, thin-walled, sometimes faintly encrusted, hyaline towards distal end, light brownish yellow towards base.

**Stipe trama:** composed of 2-26.5  $\mu\text{m}$  wide hyphae, thin-walled, hyaline to pale yellow. Stipitipellis of parallel hyphae 2-11.5  $\mu\text{m}$  wide, thin-walled, pale yellow to hyaline.

**Caulocystidia:** 24-122.5 x 4.5-25  $\mu\text{m}$ , variable, mostly somewhat lageniform but never lecythiform, seen at the upper part of the stipe, either in clusters or scattered, thin-walled, hyaline.

**Clamp-connections:** present on all hyphae.

**Habitat:** on the ground, amongst grass, scattered, April.

**Notes:**

The most distinctive feature of this new species, which belongs to subg. *Conocybe* sect. *Pilosellae*, is the strongly radicating base of the stipe. Among the radicating species of *Conocybe*, it comes close to *Conocybe fiorii* (SACC.) WATLING, owing to some microscopical similarities. Macroscopically, the latter species differs by more robust basidiomata, red-brown, rugulose, non-striate pileus, habitat on sand and presence of

lecythiform caulocystidia. *Conocybe cettoiana* HAUSKN. & ENDERLE, a dung-inhabiting species has smaller, more thin-walled spores and filiform elements amongst caulocystidia. *Conocybe microrrhiza* HAUSKN. var. *tetraspora* (SINGER & HAUSKN.) HAUSKN., growing on the ground, also comes close, but it has a reddish brown pileus and much smaller spores with thinner walls (for comparison, see HAUSKNECHT 1996).

***Conocybe sienophylla* (BERK. & BR.) SINGER 1962, Sydowia 15: 68 (Fig. 3 a-d)**

**Characters:**

**Pileus:** 7-20 diam., 4-8 mm high, conical, conico-campanulate, or conico-convex; surface orange-white (5A2), pale orange (5A3), or light orange (5A4), mostly with a light brown tint, hygrophanous, glabrous, dry, dull, faintly translucent striate when moist; margin decurved, almost entire to slightly undulating. Context up to 1 mm thick at the centre, concolorous with the pileus surface.

**Lamellae:** narrowly adnate, pale orange (5A3) or with a brown tint, subclose, up to 3.5 mm wide, with lamellulae of two lengths; lamellar edge pale, almost entire.

**Stipe:** 35-52 x 0.7-1.5 mm, central, cylindrical, equal or slightly tapering apically, hollow; surface orange-white (5A2) to greyish orange (5B3), faintly pruinose.

**Context:** no smell.

**Spore-print:** not obtained.

**Spores:** 7.5-11.5 x 5.5-8 x 4.5-7 ( $9.60 \pm 1.01 \times 6.50 \pm 0.53 \times 5.92 \pm 0.65$ )  $\mu\text{m}$ ,  $Q = 1.26-1.70$ ,  $Q_m = 1.48$ , lenticular, oviform-ellipsoid in face-view, subamygdali-form in side-view, pale orange yellow to yellow in KOH, slightly thick-walled, apically truncated by a germ-pore.

**Basidia:** 16.5-29 x 9-12.5  $\mu\text{m}$ , short clavate to vesiculose, 4-spored; sterigmata up to 5  $\mu\text{m}$  long.

**Ammoniacal reaction:** negative.

**Cheilocystidia:** 15-27 x 6.5-12.5  $\mu\text{m}$ , lecythiform, with a capitulum of 3-5  $\mu\text{m}$  diam., subtended by a narrow neck, thin-walled, pale yellow to hyaline. Lamellar edge sterile with crowded cheilocystidia.

**Pleurocystidia:** none.

**Hymenophoral trama:** subregular, with a narrow mediostatum having narrow hyphae and broad lateral strata of inflated hyphae; hyphae 2-30  $\mu\text{m}$  wide, thin-walled, pale brownish yellow to hyaline. Pileal trama interwoven; hyphae 2-34  $\mu\text{m}$  wide, thin-walled, narrower and encrusted by a brownish yellow pigment towards hypodermal region, more inflated and pale brownish yellow to almost hyaline without encrustation towards lower region of the trama.

**Pileipellis:** hymeniform, elements 17.5-41.5 x 12.5-32.5  $\mu\text{m}$ , sphaeropedunculate, thin-walled, pale yellow to hyaline towards apex, brownish yellow towards base. Pileal margin with numerous cystidia alike the cheilocystidia.

**Stipe trama:** of 2-26.5  $\mu\text{m}$  wide hyphae, parallel, thin-walled, pale brownish yellow to almost hyaline. Stipitipellis of parallel to repent hyphae 2-9.5  $\mu\text{m}$  wide, thin-walled, pale brownish yellow to almost hyaline.

**Caulocystidia:** 7-28 x 4.5-10.5  $\mu\text{m}$ , variable in shape, very rarely lecythiform or with a filiform apical part, thin-walled, pale yellow to hyaline.

**Clamp-connections:** present on all hyphae.

**Habitat:** on the ground, scattered, June.

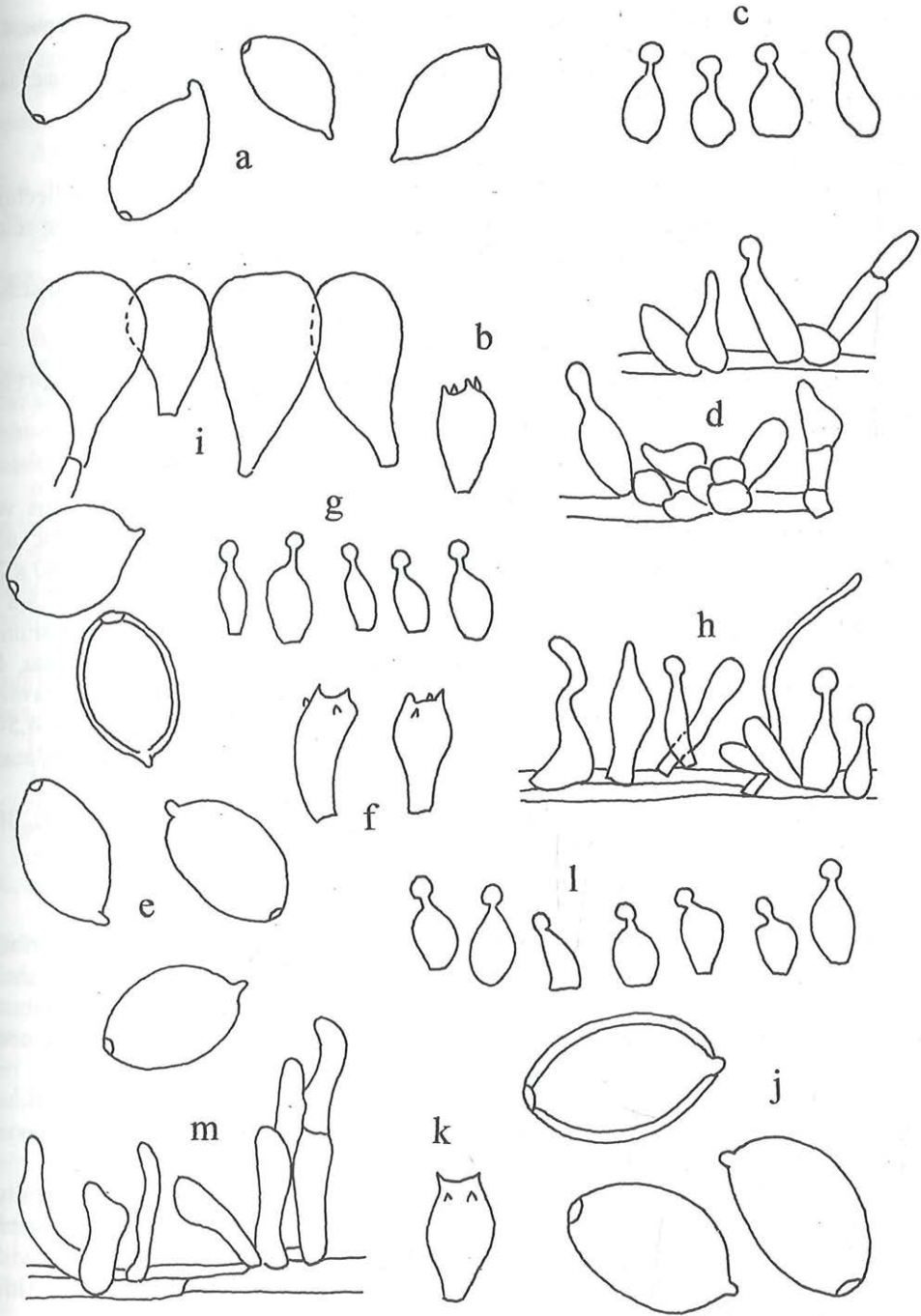


Fig. 3 a-d *Conocybe sienophylla* (WU 20905). a spores, x 2000; b basidium, x 800; c cheilocystidia, x 800; d caulocystidia, x 800. e-i *Conocybe solitaria* (e-h WU 20903, i WU 20902). e spores, x 2000; f basidia, x 800; g cheilocystidia, x 800; h caulocystidia, x 800; i pileipellis, x 800. j-m *Conocybe* aff. *velutipes* (WU 20916). j spores, x 2000; k basidium, x 800; l cheilocystidia, x 800; m caulocystidia, x 800.

**Specimen examined:** India: Kerala State, Malappuram District, Calicut University Campus, 15. 6. 1998, K. A. THOMAS T265 (WU 20905).

**Additional material examined:** Sri Lanka: Peradeniya, Botanical Garden, on the ground, Jan. 1869, THWAITES No. 933 (K, holotype).

### Notes:

Except for the somewhat smaller and more thick-walled spores, the Kerala collection is identical to the type material of *Conocybe sienophylla* from Sri Lanka. This species has already been recorded from India (MANJULA 1983; WATLING & al. 1988).

The European collections identified as *C. sienophylla* seem to represent a distinct species with larger carpophores and paler spores with thinner walls.

***Conocybe solitaria* K. A. THOMAS, HAUSKNECHT & MANIMOHAN, spec. nova** (Fig. 3 e-i)

### Latin description:

Pileus 12-40 mm latus, conico-convexus vel campanulatus, pallide aurantiacus vel griseo-aurantiacus, glaber, ad marginem subtiliter pellucido-striatus. Lamellae adnexae, brunneae, subconfertae, marginibus concoloratae et integrae. Stipes 60-140 x 2-3,5 mm, radicans, ad apicem fimbriatus, ad basim pruinosis. Sporae 8,5-13 x 5,5-8 x 5-7  $\mu\text{m}$ , Q = 1,30-1,75, Qm = 1,51, ellipsoideae vel subangulatae, laeves, crassitunicatae, truncato poro germinativo praeditae. Basidia 21,5-29 x 7,5-11  $\mu\text{m}$ , clavata, 4-sporigera. Cheilocystidia 14-26,5 x 4-10  $\mu\text{m}$ , lecythiformia. Pileipellis hymeniformis, cellulis sphaeropedunculatis vel vesiculososis composita. Caulocystidia 10-28 x 4,5-8  $\mu\text{m}$ , lecythiformia, raro ad apicem filiformia, gregaria vel dispersa. Hyphae fibulatae. Ad terram in pratis.

**Typus:** India: Kerala State, Malappuram District, Calicut University Campus, 30. 10. 1999, K. A. THOMAS T28c (WU 20904, holotypus).

### Characters:

**Pileus:** 12-40 mm diam., conico-convex to campanulate, hardly expanding; surface pale orange (5A3), light orange (5A4) or greyish orange (5B4, 5B5), with small, shallow, scattered pits, glabrous with faint radial striations towards margin when moist; margin decurved, entire, at times turning fissile. Context up to 2 mm thick at the centre, white to orange white (5A2).

**Lamellae:** adnexed, pale orange (5A3) turning to brown (6E7), subcrowded, up to 5.5 mm wide with lamellulae of 4-5 lengths; lamellar edge slightly pale or concolorous with the sides, entire.

**Stipe:** 60-140 x 2-3.5 mm, central, cylindrical, equal or slightly tapering apically, solid, becoming fistulose; surface pale yellow (4A3) or pale orange (5A3) towards apex and underground part, brownish orange (6C4) elsewhere, sometimes yellowish white (4A2) all over, fimbriate towards apex, rest faintly pruinose, sometimes minutely longitudinally-fibrillose; base distinctly radicating.

**Context:** smell not distinctive.

**Spore-print:** brown (6D7).

**Spores:** 8.5-13 x 5.5-8 x 5-7 (10.36  $\pm$  1.11 x 6.95  $\pm$  0.56 x 6.0  $\pm$  0.46)  $\mu\text{m}$ , Q = 1.30-1.75, Qm = 1.51, lenticular, oviform-ellipsoid, ellipsoid or subhexagonal in face-

view, ellipsoid in side-view, orange brown in KOH, smooth, thick-walled with a truncate apical germ-pore.

**Basidia:** 21.5-29 x 7.5-11  $\mu\text{m}$ , clavate, sometimes with a median constriction, 4-spored; sterigmata up to 4.5  $\mu\text{m}$  long.

**Ammoniacal reaction:** needle-like crystals not formed but small, sand-grain like crystals observed in plenty with Ammonia solution (no positive reaction, see HAUSKNECHT 1999).

**Cheilocystidia:** 14-26.5 x 4-10  $\mu\text{m}$ , lecythiform, with a capitulum of 3-4.5  $\mu\text{m}$  diam., thin-walled, hyaline. Lamellar edge sterile with crowded cheilocystidia.

**Pleurocystidia:** none.

**Hymenophoral trama:** regular to subregular, with a mediostratum of comparatively narrow hyphae and broad lateral strata of inflated hyphae; hyphae 2-31.5  $\mu\text{m}$  wide, thin-walled, pale yellow. Pileal trama interwoven; hyphae 1.5-35  $\mu\text{m}$  wide, thin-walled, pale yellow to hyaline, those towards hypodermal region narrow, yellowish and encrusted, and those towards lower region inflated and non-encrusted.

**Pileipellis:** hymeniform, elements 16.5-54 x 11.5-30  $\mu\text{m}$ , sphaeropedunculate to vesiculose, thin-walled, pale yellow, faintly encrusted.

**Stipe trama:** composed of 2-24  $\mu\text{m}$  wide hyphae, thin-walled, pale yellow to yellowish brown. Stipitipellis of parallel hyphae 1.5-9.5  $\mu\text{m}$  wide, thin-walled, pale yellow.

**Caulocystidia:** 10-28 x 4.5-8  $\mu\text{m}$ , mostly lecythiform, at times the neck becoming much elongated and filamentous without developing a capitulum, at the upper part of the stipe, in clusters or scattered as modified peripheral hyphal tips, hyaline.

**Clamp-connections:** present.

**Habitat:** on the ground, amongst grass, scattered or mostly solitary, July-October.

**Specimens examined:** **India:** Kerala State, Malappuram District, Calicut University Campus, 12. 7. 1996, K. A. THOMAS T28 (WU 20902); - - 11. 8. 1999, K. A. THOMAS T28b (WU 20903).

**Additional material examined:** **Pakistan:** Changa Manga, 11. 9. 1975, SULTAN AHMED 24924 (K, as *Conocybe tenera*).

#### Notes:

Large basidiomata, radicating stipe, total absence of velar remnants, wrinkled pileus, slightly angular spores, and a stipe covering composed of both lecythiform and filiform elements are the characteristics of this species which is a member of sect. *Mixtae* (in the restricted sense of WATLING, see HAUSKNECHT 1996: 162). *Conocybe cettoiana* and *C. fiorii* also have radicating stipes and the same type of stipe covering. *Conocybe cettoiana*, however, has smaller, often caespitose basidiomata with shorter stipes that always remain whitish, abundant lecythiform caulocystidia, and coprophilous habitat. *Conocybe fiorii*, on the other hand, has reddish brown, wrinkled, non-striate pilei, longer stipes and larger spores.

A collection from Pakistan, named *Conocybe tenera* in Kew herbarium [K(M) 60068], on examination was found to be conspecific with our new species.

**Conocybe aff. *velutipes* (VELEN.) HAUSKNECHT & SVRČEK 1999**, Czech Mycol. 51: 68 (Fig. 3 j-m)

**Characters:**

**Pileus:** 4-15 mm diam., convex, conico-convex, or companulate; surface almost pale orange (5A3), greyish orange (5B3) or brownish orange (5C3), hygrophanous and becoming orange white (5A2), smooth to slightly atomate, dull, faintly translucent-striate when moist; margin decurved, entire. Context up to 1.5 mm thick at the centre, concolorous with pileus surface.

**Lamellae:** narrowly adnate, almost pale orange (5A3) when young, later turning light brown (6D6), close, up to 3 mm wide, with lamellulae of 2-3 lengths; lamellar edge slightly lighter than the sides, entire.

**Stipe:** 25-65 x 0.7-1.5 mm, central, almost equal or slightly attenuated towards apex, fistulose; surface concolorous with the pileus surface, initially finely pruinose, becoming glabrous.

**Context:** smell none.

**Spore-print:** rust-brown (6E8) to brownish grey (6F8).

**Spores:** 10-15 x 7-9.5 x 6.5-8.5 ( $13.19 \pm 1.26 \times 7.78 \pm 1.91 \times 7.58 \pm 0.52$ )  $\mu\text{m}$ ,  $Q = 1.39-1.81$ ,  $Q_m = 1.60$ , slightly lenticular, ellipsoid to faintly subhexagonal in face-view, ellipsoidal in side-view, smooth, orange brown to reddish brown in KOH, thick-walled, with a broad, truncate apical germ-pore.

**Basidia:** 20-32.5 x 12.5-17  $\mu\text{m}$ , vesiculose to pedicellate-clavate, 4-spored, sterigmata up to 3.5  $\mu\text{m}$  long.

**Ammoniacal reaction:** needle-like crystals not formed but sand-grain like crystals.

**Cheilocystidia:** 15-25 x 5.5-12  $\mu\text{m}$ , lecythiform, with a globose capitulum of 2.5-4.5  $\mu\text{m}$  diam., thin-walled, hyaline. Lamellar edge heteromorphous to almost sterile.

**Pleurocystidia:** none.

**Hymenophoral trama:** subregular, with a narrow mediostratum of narrow hyphae and broad lateral strata of inflated hyphae; hyphae 2.5-32.5  $\mu\text{m}$  wide, pale yellowish brown. Pileal trama interwoven; hyphae 1.5-30  $\mu\text{m}$  wide, inflated, thin-walled, yellowish brown, sometimes encrusted with yellowish brown pigment especially at hypodermal region.

**Pileipellis:** hymeniform, elements 20-45 x 12.5-37.5  $\mu\text{m}$ , sphaeropedunculate, thin-walled, hyaline towards distal end, yellowish brown towards base.

**Stipe trama:** consisting of 2-28  $\mu\text{m}$  wide hyphae, thin-walled, pale yellow. Stipitipellis made of parallel hyphae 2-9  $\mu\text{m}$  wide, thin-walled, pale yellow.

**Caulocystidia:** 11.5-99 x 4.5-17  $\mu\text{m}$ , very variable in shape but never lecythiform, mostly cylindrical-flexuose, in clusters to scattered throughout stipe surface, thin-walled, hyaline.

**Clamp-connections:** present.

**Habitat:** on dung-manured pots, scattered, September-October.

**Specimens examined: India:** Kerala State, Malappuram District, Calicut University Campus, 5. 9. 1999, K. A. THOMAS T326 (WU 20916); - - 7. 9. 1999, K. A. THOMAS T326b (WU 20917); - - 6. 10. 1999, K. A. THOMAS T326c (WU 20918).

**Notes:**

Small basidiomata growing on manured soil, large, ellipsoid or faintly hexagonal, thick-walled spores, lecythiform cheilocystidia, and very variable caulocystidia that are never lecythiform are typical of the present Indian collections which belong to subg. *Conocybe* sect. *Pilosellae*. These collections come close to the European *Conocybe velutipes*, a member of the *C. sienophylla* complex, differing from the type by somewhat larger, occasionally faintly hexagonal and non-lentiform spores with thicker walls. The species around *C. velutipes* (= *C. kuehneriana* SINGER) and *C. sienophylla* need further investigations and only then one can say with certainty whether the Indian collections are conspecific with *C. velutipes* or not.

*Conocybe lenticulospora*, also dung inhabiting and quite common in Europe, has smaller, distinctly lentiform and often more angular spores and duller colours of the pileus.

***Conocybe volvata* K. A. THOMAS, HAUSKNECHT & MANIMOHAN, spec. nova** (Fig. 4 a-e)

**Latin description:**

Pileus 15-55 mm latus, membranaceus, campanulatus vel conicus, raro umbonatus, ad discum brunneus vel rubro-brunneus, ad marginem pallide brunneus, hygrophanus, glaber, in statu humecto pellucido-striatus. Lamellae adnexae vel anguste adnatae, brunneae, confertae, marginibus concoloratae et integrae. Stipes 50-140 x 1,5-6 mm, volvatus, ad apicem striato-pruinosis. Sporae 9,5-14,5 x 7-9 x 6-8  $\mu\text{m}$ ,  $Q = 1,28-1,64$ ,  $Q_m = 1,44$ , ovato-ellipsoideae vel ellipsoideae, lentiformes, crassitunicatae, laeves, proprio poro germinativo praeditae. Basidia 19-26,5 x 11,5-15,5  $\mu\text{m}$ , pedicellato-clavata, 4-sporigera. Cheilocystidia 18-29 x 7,5-14  $\mu\text{m}$ , lecythiformia. Pileipellis hymeniformis, cellulis sphaeropedunculatis composita. Caulocystidia 9-31,5 x 6,5-13  $\mu\text{m}$ , versiformia, gregaria. Hyphae fibulatae. Ad fimum *Elephas maximus*.

**Typus:** India: Kerala State, Thrissur District, Guruvayoor, 21. 8. 2000, K. A. THOMAS T302e (WU 20901, holotypus).

**Characters:**

Pileus: 15-55 mm diam., membranous, campanulate to conical to conico-convex, sometimes with an obtuse umbo; surface, in most specimens, brown (7D7, 7E8) or reddish brown (8E7, 9E6) towards disc and light brown (7D5, 7D6) towards margin, sometimes light brown (7D5, 7D6) or brown (7E6) all over, hygrophanous and becoming greyish orange (6B3), glabrous, smooth, finely translucent-striate when moist; margin decurved, entire or finely crisped. Context up to 1.5 mm thick at the centre, brownish white.

Lamellae: adnexed to narrowly adnate, light brown (7D5, 7D6) or sometimes brown (6D7), close to subcrowded to crowded, up to 3.5 mm wide, with lamellulae of different lengths; lamellar edge pale when young, later concolorous with the sides, entire.

Stipe: 50-140 x 1.5-6 mm, central, terete, attenuated towards apex, hollow; surface white towards apex, greyish red (7B3, 8B3) or reddish brown (8E4, 9E5) towards base, finely longitudinally striate, faintly pruinose towards apex under a lens; base volvate; volva bifid, whitish, firmly appressed, with a cottony interior and exterior.

Context: smell not distinctive.

Spore-print: not obtained.

Spores:  $9.5\text{-}14.5 \times 7\text{-}9 \times 6\text{-}8$  ( $11.53 \pm 1.10 \times 7.98 \pm 0.60 \times 6.84 \pm 0.46$ )  $\mu\text{m}$ ,  $Q = 1.28\text{-}1.64$ ,  $Q_m = 1.44$ , oviform-ellipsoid to ellipsoid or frequently subhexagonal in face-view, ellipsoid in side-view, smooth, pale orange brown to brown in KOH, thick-walled, apically truncated by a broad germ-pore.

Basidia:  $19\text{-}26.5 \times 11.5\text{-}15.5$   $\mu\text{m}$ , inflated-clavate or pedicellate-clavate, 4-spored; sterigmata up to 3  $\mu\text{m}$  long.

Pavement cells: distinctly present in hymenium.

Ammoniacal reaction: negative.

Cheilocystidia:  $18\text{-}29 \times 7.5\text{-}14$   $\mu\text{m}$ , lecythiform, with a capitulum of 6  $\mu\text{m}$  diam., thin-walled, hyaline. Lamellar edge sterile.

Pleurocystidia: none.

Hymenophoral trama: regular, with a mediostatum of comparatively narrow hyphae and lateral strata of inflated hyphae; hyphae 3.5-17  $\mu\text{m}$  wide, thin-walled, hyaline. Pileal trama composed of 1.5-17.5  $\mu\text{m}$  wide hyphae, thin-walled, hyaline to pale yellow, with a hypodermial region of narrow, pale yellowish brown and sometimes faintly encrusted hyphae.

Pileipellis: hymeniform, elements 27.5-60  $\times$  19-37.5  $\mu\text{m}$ , thin-walled, hyaline towards distal end, pale yellowish brown and sometimes inconspicuously encrusted towards base.

Stipe trama: formed of 2-29  $\mu\text{m}$  wide hyphae, thin-walled, hyaline. Stipitipellis of parallel hyphae 2-15  $\mu\text{m}$  wide, thin-walled, hyaline to pale yellowish brown.

Caulocystidia: seen towards the upper part of the stipe, in small clusters, 9-31.5  $\times$  6.5-13  $\mu\text{m}$ , variable: clavate, oblong, lageniform, obclavate, or irregular, thin-walled, hyaline.

Clamp-connections: present on all hyphae.

Habitat: on elephant dung, scattered, May-August.

Specimens examined: India: Kerala State, Thrissur District, Guruvayoor, 11. 6. 1999, K. A. THOMAS T302b (WU 20899); - 17. 6. 1999, K. A. THOMAS T302c (WU 20900).

### Notes:

Only five species of *Conocybe* with volvate stipe base are known to this date and all of them belong to sect. *Singerella* WATLING. With the key of WATLING & HAUSKNECHT (1997) to the volvate species of *Conocybe*, one arrives at *C. hornana* SINGER & HAUSKN. which has similar spore-size, caulocystidia and cheilocystidia. The new species, however, differs from *C. hornana* in colours, striation, umbo and surface of pileus, velar remnants on the pileus, non-fragile, membranous volva and distinct pavement cells in the hymenium.

*Conocybe locellina* (MURRILL) WATLING is also very close but it has more dirty yellowish or isabelline pileus, thicker stipe, spores with much thinner walls and it was reported as growing on sawdust mixed with horse dung.

*Conocybe zeylanica* (PETCH) BOEDIJN 1951, Sydowia 5: 223 (Fig. 4 f-j)

### Characters:

Basidiomata: delicate.



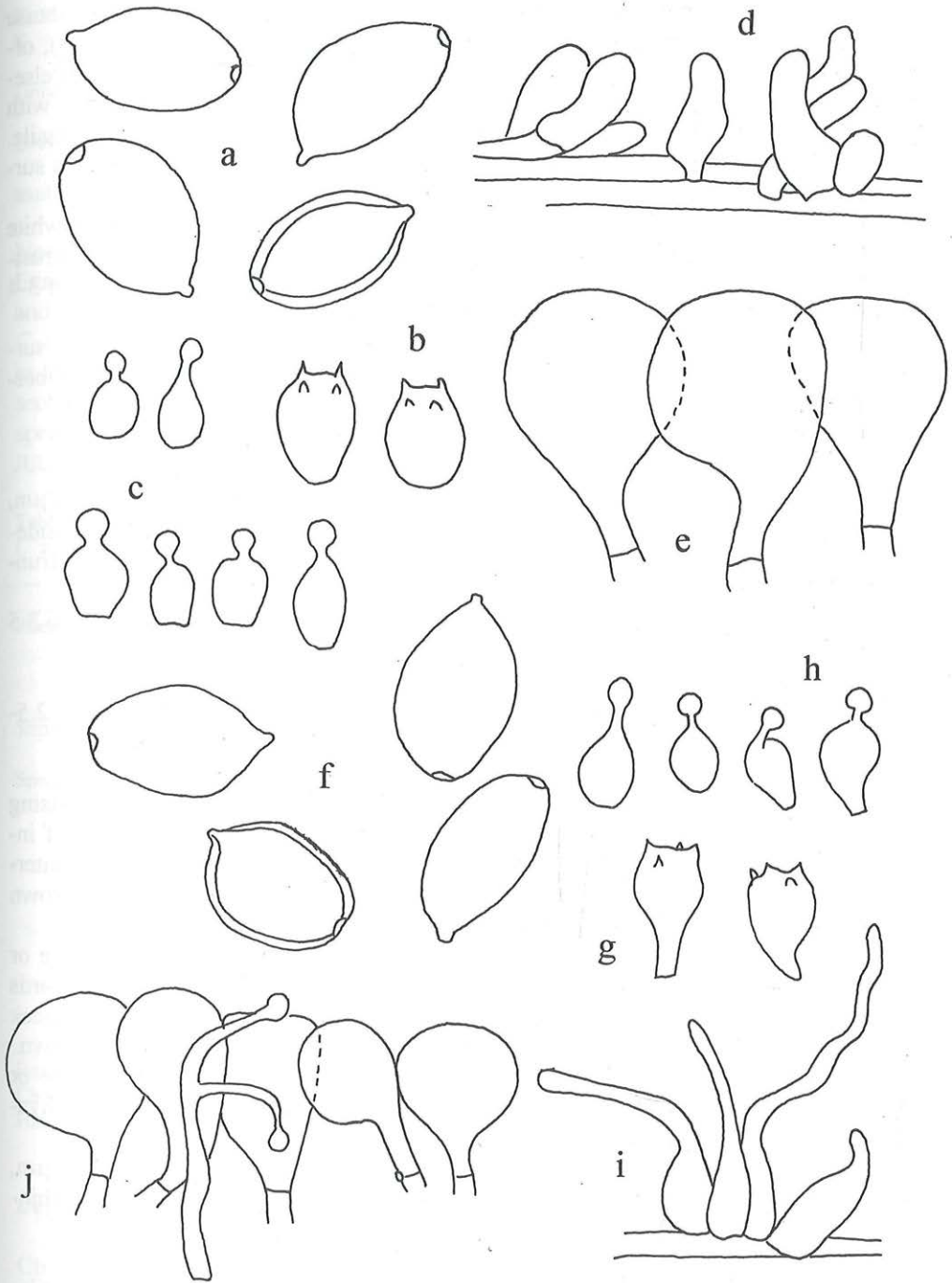


Fig. 4 a-e *Conocybe volvata* (WU 20901, holotypus). a spores, x 2000; b basidia, x 800; c cheilocystidia, x 800; d caulocystidia, x 800; e pileipellis, x 800. f-j *Conocybe zeylanica* (f-i WU 20908, j WU 20912). f spores, x 2000; g basidia, x 800; h cheilocystidia, x 800; i caulocystidia, x 800; j pileipellis, x 800.

**Pileus:** 20-45 mm diam., conical or campanulate, sometimes with an obtuse umbo; surface brown (6D7, 6E7) to rust-brown (6E8) at disc, pale yellow (4A3), orange-white (5A2), pale orange (5A3), light orange (5A4) or light brown (6D4) elsewhere, hygrophanous, glabrous, finely translucent-striate when moist, sometimes with fine, longitudinal subsulcate striations; margin decurved, entire, sometimes fissile. Context up to 2 mm thick at the centre, off-white or concolorous with the pileus surface.

**Lamellae:** adnexed to narrowly adnate, yellowish white (4A2), orange white (5A2), brownish orange (6C6) or light brown (6D6) when young, later turning rust-brown (6E8) or brown (7D7, 7E6), close, up to 3.5 mm wide, with lamellulae of 3-4 lengths; lamellar edge concolorous with the sides, entire.

**Stipe:** 65-135 x 2-6 mm, fragile, central, terete, tapering apically, hollow; surface yellowish white (4A2), pale orange (5A3) or orange-white (5A2), densely pubescent, glabrescent.

**Context:** delicate, deliquescent when old. Smell not distinctive.

**Spore-print:** not obtained.

**Spores:** 10-15.5 x 7.5-11 x 7-9.5 ( $12.97 \pm 1.59 \times 9.05 \pm 1.07 \times 8.27 \pm 0.51$ )  $\mu\text{m}$ ,  $Q = 1.23-1.62$ ,  $Q_m = 1.44$ , lenticular, oviform-ellipsoid in face-view, ellipsoid in side-view, smooth, yellowish brown to orange brown in -KOH, thick-walled, apically truncated by a broad germ-pore.

**Basidia:** 17.5-29 x 9.5-14  $\mu\text{m}$ , pedicellate-clavate, 4-spored, sterigmata up to 3.5  $\mu\text{m}$  long.

**Ammoniacal reaction:** negative.

**Cheilocystidia:** 16.5-27.5 x 7-10.5  $\mu\text{m}$ , lecythiform with a capitulum of 2.5-4.5  $\mu\text{m}$  diam., thin-walled, hyaline. Lamellar edge heteromorphous to sterile.

**Pleurocystidia:** none.

**Hymenophoral trama:** subregular, with a narrow mediostratum comprising narrow, (1.5-9  $\mu\text{m}$  wide) pale yellowish brown hyphae and broad lateral strata of inflated (up to 25  $\mu\text{m}$  wide), thin-walled, hyaline hyphae. Pileal trama loosely interwoven; hyphae 1.5-29  $\mu\text{m}$  wide, narrow and densely encrusted with a yellowish brown pigment towards hypodermial region, inflated and hyaline towards basal region.

**Pileipellis:** hymeniform, elements 20.5-56.5 x 11.5-25  $\mu\text{m}$ , inflated-clavate or sphaeropedunculate, thin-walled, hyaline towards distal end, yellowish brown towards base. Pileocystidia 24-48 x 4-6.5  $\mu\text{m}$ , elongated lageniform with a long tapering neck and a capitulum of 3.5-5  $\mu\text{m}$  diam., scattered, thin-walled, hyaline or yellowish brown.

**Stipe trama:** composed of 1.5-27.5  $\mu\text{m}$  wide hyphae, thin-walled, hyaline or pale yellowish brown. Stipitipellis of parallel hyphae 2-9.5  $\mu\text{m}$  wide, thin-walled, hyaline or pale yellowish brown.

**Caulocystidia:** present throughout the surface in fascicles, 11.5-45 x 3-9  $\mu\text{m}$ , clavate, cylindrical or lageniform, some with long, filiform apical appendage, all thin-walled and hyaline.

**Clamp-connections:** present in all parts of the basidiomata.

**Habitat:** on a heap of dried cow dung as well as on decaying pith of the palm *Corypha umbraculifera* L., scattered, July-October.

**Specimens examined: India:** Kerala State, Kannur District, Pulukurumba, 14. 9. 1997, K. A. THOMAS T147 (WU 20908) - - 15. 9. 1997, K. A. THOMAS T147b (WU 20909); - - 16. 9. 1997, K. A. THOMAS T147c (WU 20910); - - 28. 9. 1997, K. A. THOMAS T147d (WU 20911); - - 26. 10. 1997,

K. A. THOMAS T147e (WU 20912); - Malappuram District, Calicut University Campus, 9. 7. 1999, K. A. THOMAS T318 (WU 20906); - - 16. 7. 1999, K. A. THOMAS T318b (WU 20907).

**Additional materials examined:** *Conocybe africana* (PEGLER) WATLING: **Uganda:** Makerere University Campus, on open grass, 1. 6. 1964, leg. A. OJONG, det. N. PEGLER (K, holotype).

*Conocybe bicolor* WATLING: **Zaire:** Lacs Edouard et Kivu, Panzi, on the ground in plantation of *Grevillea*, February, 1948, leg. GOOSENS-FONTANA (BR, holotype).

*Conocybe zeylanica*: **Sri Lanka:** Peradeniya, on the ground on decaying vegetable refuse, September, 1868, leg. THWAITES 711 (K, holotype).

### Notes:

Examination and comparison of the type materials of *Conocybe africana*, *C. bicolor* and *C. zeylanica* (Table 1) convinced us that the first two species are synonymous to *C. zeylanica*. There are no real differentiating characters available to treat these species as distinct. The present Kerala collections as well as recent collections made by the second author from La Réunion and Mauritius (Africa) also were found to be conspecific with *C. zeylanica*. There are previous reports of this species from India (MANJULA 1983, WATLING & al. 1988).

Table 1. Comparison of macro- and microscopical characters of *Conocybe bicolor*, *C. africana* and *C. zeylanica*.

	<i>C. bicolor</i>	<i>C. africana</i>	<i>C. zeylanica</i>
Pileus	26-38 mm vividly yellowish ochre, more yellow near the margin	12-30 mm deep ochre in centre, paler near the margin	30-50 mm centre yellow to orange, margin paler
Stipe	54-94 x 3(-7) mm white, hollow	50-110 x 1-4 mm white, hollow	160-230 x 4-6 mm white, hollow
Spores	Ø 12.6 x 7.6 x 6.9 µm Qm = 1.7	Ø 13.5 x 8.7 x 7.7 µm (PEGLER: 9-12.5 x 6-8! µm) Qm = 1.55	Ø 11.9 x 8.2 x 7.7 µm (PEGLER for African material: 12-16 x 7.5-9.5 µm; for material of Sri Lanka: 9-14 x 8.5-9.5 µm) Qm = 1.45
	somewhat lentiform, an- gular, wall ~1.2 µm, germ-pore ~1.5 µm	somewhat lentiform, hardly angular, wall more than 1 µm, germ- pore up to 2 µm	somewhat lentiform, an- gular, wall up to 1-1.2 µm, germ-pore ~1.5 µm
Basidia	no differences	no differences	no differences
Cheilocyst.	no differences	no differences	no differences
Habitat	in plantation with Gre- villeas	on open grass	on ground, decaying vegetable refuse

*Descolea maculata* BOUGHER 1985, Austral. J. Bot. 33: 619 (Fig. 5 a-d)

### Characters:

Pileus: 20-40 mm diam., initially conico-convex, turning to convex, eventually plano-convex, usually with a ± distinct obtuse umbo, at times with a small depression at the disc; surface uniformly dark brown (7F4, 7F5) when young, when mature dark brown (7F8) towards the disc, fading to brown (6E7, 7E7) towards margin, hygrophalous and becoming uniformly light orange (5A4, 6A4), moist sometimes with fine ra-

dial wrinkles, translucent-striate towards margin, with powdery velar remnants; margin decurved to plane, sometimes slightly upturned, entire or at times fissile or eroded. Context up to 3 mm wide at the centre, whitish.

Lamellae: adnexed to almost free, light orange (5A4) or greyish orange (5B6), frequently with a brown tint, close, up to 5 mm wide, with lamellulae of 3-4 lengths; lamellar edge pale, entire to slightly eroded, finely pruinose under a lens.

Stipe: 25-65 x 3.5-8 mm, central, terete, sometimes slightly compressed, slightly attenuated towards apex, hollow; surface pale orange (5A3), sometimes brownish towards base, glabrous, at times fibrillose towards base, annulate; annulus central to almost superior, pendant, radially grooved.

Context: smell not distinctive.

Spore-print: not obtained.

Spores: 9-14 x 5-8.5 ( $10.88 \pm 1.45$  x  $6.77 \pm 0.85$ )  $\mu\text{m}$ ,  $Q = 1.44-1.80$ ,  $Q_m = 1.62$ , amygdaliform to subamygdaliform, faintly verruculose, yellowish brown, thick-walled, with an apical callus, germ-pore absent.

Basidia: 29-50 x 9-14.5  $\mu\text{m}$ , clavate, mostly with hyaline to yellowish brown granular contents, 1-, 2-, or 4-spored; sterigmata very long, up to 14.5  $\mu\text{m}$  long.

Cheilocystidia: 12.5-60 x 5-20.5  $\mu\text{m}$ , clavate or flexuous, thin-walled, hyaline. Lamellar edge heteromorphous with crowded cheilocystidia.

Pleurocystidia: none.

Hymenophoral trama: subregular with a mediostratum of 3-27  $\mu\text{m}$  wide, inflated, thin-walled, light brown hyphae, flanked on either side by 2-10  $\mu\text{m}$  wide, narrow, thin-walled, brown hyphae. Pileal trama parallel-interwoven; hyphae 2-26.5  $\mu\text{m}$  wide, thin-walled, with brown encrusting pigment; hyphae of the hypodermial region bearing copious dark brown encrusting pigment.

Pileipellis: hymeniform, elements 12.5-56.5 x 7.5-25  $\mu\text{m}$ , vesiculose, clavate or pedicellate-clavate, thin-walled, hyaline towards the distal end, brown encrusted towards base.

Stipe trama: composed of 2-25  $\mu\text{m}$  wide hyphae, parallel, thin-walled, with pale brown pigment. Stipitipellis of parallel hyphae 2-14  $\mu\text{m}$  wide, thin-walled, coarsely encrusted by a brown pigment. Velar elements 4-20  $\mu\text{m}$  wide, slightly thick-walled, encrusted by a dark brown pigment.

Clamp-connections: present in all parts of the basidiomata.

**Habitat:** on soil, around or attached to buried roots and trunks of *Eucalyptus*, scattered, August-October.

**Specimens examined:** India: Kerala State, Idukki District, Munnar, 29. 8. 1997, K. A. THOMAS T162 (WU 21151); - - 8. 8. 1999, K. A. THOMAS T321 (WU 21152); - - 12. 10. 1999, K. A. THOMAS T321b (WU 21153).

#### Notes:

The Kerala collections are indistinguishable from those described from Australia (BOUGHER & MALAJCZUK 1985). The Australian collections also were mostly associated with *Eucalyptus* trees and BOUGHER & MALAJCZUK (1985) experimentally proved the ectomycorrhizal association of *Descolea maculata* with *Eucalyptus*.

The genus *Descolea* is considered to have migrated from its endemic habitat in the Southern hemisphere to the Northern hemisphere. *Descolea maculata* has also been recorded from Europe (MORENO & al. 1994; ESTEVE-RAVENTÓS & al. 1997) where it

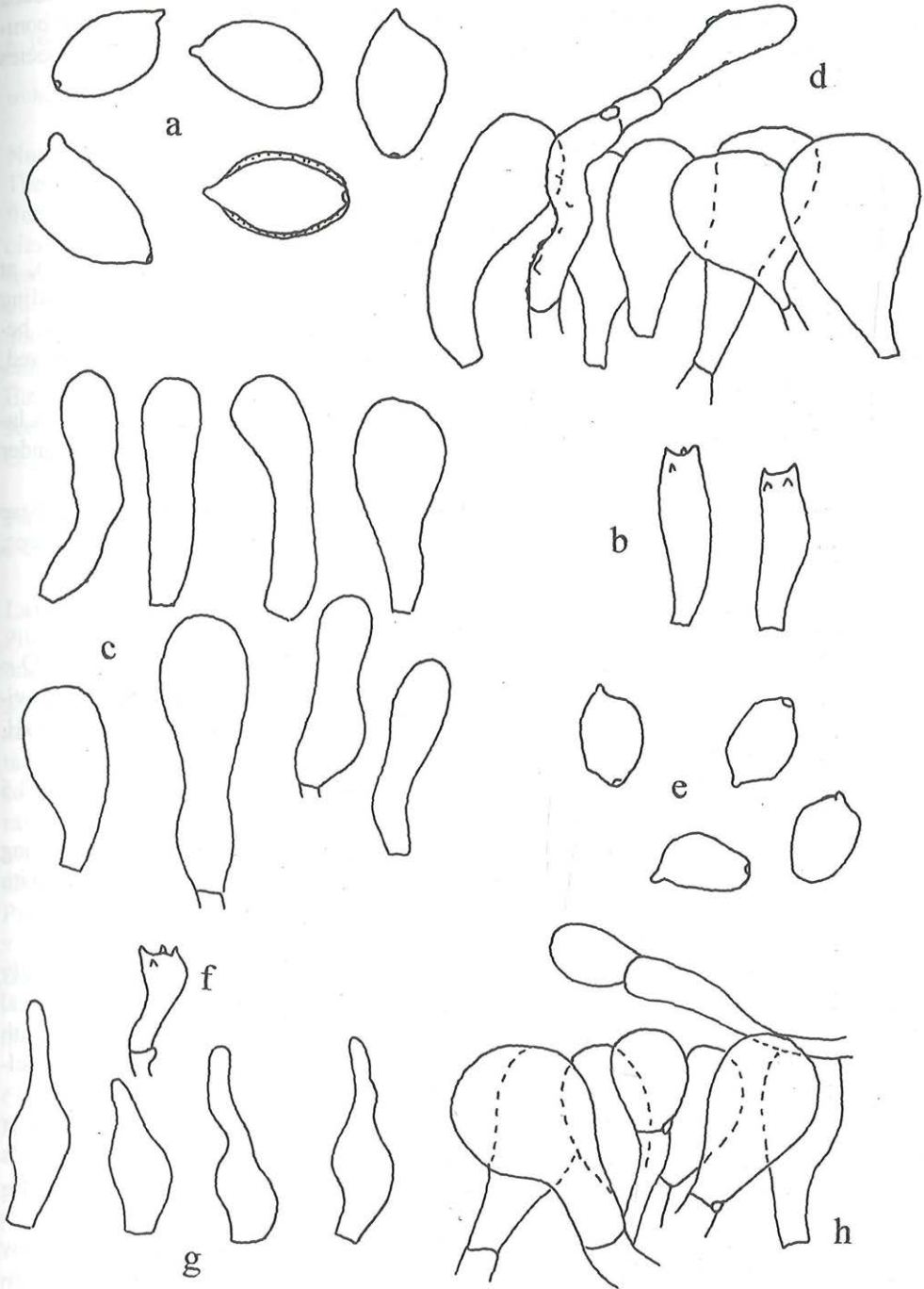


Fig. 5 a-d *Descolea maculata* (a, d WU 21153; b, c WU 21152). a spores, x 2000; b basidia, x 800; c cheilocystidia, x 800; d pileipellis, x 800. e-h *Galerella plicatella* (WU 20897). e spores, x 2000; f basidium, x 800; g cheilocystidia, x 800; h pileipellis, x 800.

also seems to be associated with the *Eucalyptus* forests and probably introduced (ESTEVE-RAVENTÓS & al. 1997). *Descolea pretiosa* HORAK, described from the coniferous forest in the State of Himachal Pradesh (HORAK 1971), is the only species known previously from India.

***Galerella plicatella* (PECK) SINGER 1951, Lilloa 22: 490 (Fig. 5 e-h)**

**Characters:**

Basidiomata: small, delicate.

Pileus: 4-8 mm diam., convex to plano-convex with a central depression, at times with a small umbo in the depression; surface brown (7E6, 7E7) at centre, fading towards margin as radial, parallel strips, intervening regions pale orange (5A3), becoming brownish on drying, dull, dry, plicate-striate to the centre; margin decurved, crenate. Context up to 0.5 mm thick at the centre.

Lamellae: adnexed, pale orange (5A3) or light orange (5A4), subclose, with lamellae of 2-3 lengths, up to 1.5 mm wide; lamellar edge slightly pale, fimbriate under a lens.

Stipe: 12-25 x 0.4-0.8 mm, central, terete, slightly tapering apically, hollow, base slightly swollen; surface orange white (5A2), finely pubescent in some specimens, glabrescent.

Context: smell none.

Spore-print: not obtained.

Spores: 6-9.5 x 4.5-7 x 4-5 ( $7.44 \pm 0.94 \times 5.34 \pm 0.79 \times 4.23 \pm 0.40$ )  $\mu\text{m}$ ,  $Q = 1.20-1.58$ ,  $Q_m = 1.40$ , lenticular, subrhomboid to subhexagonal or occasionally ovoid-ellipsoid in face-view, ellipsoid in side-view, smooth, yellowish brown in KOH, slightly thick-walled, apically truncated by a germ-pore.

Basidia: 13-19 x 7-10  $\mu\text{m}$ , sphaeropedunculate, 4-spored; sterigmata up to 2.5  $\mu\text{m}$  long.

Cheilocystidia: 16.5-54 x 8-16.5  $\mu\text{m}$ , ventricose or lageniform with a long neck and obtuse apex, thin-walled, pale yellow to hyaline. Lamellar edge sterile with crowded cheilocystidia.

Pleurocystidia: none.

Hymenophoral trama: almost regular with a mediostrium of comparatively narrow hyphae; hyphae 2-14  $\mu\text{m}$  wide, thin-walled, pale yellow to hyaline. Pileal trama interwoven; hyphae 2-12.5  $\mu\text{m}$  wide, thin-walled, narrower and encrusted with yellowish brown pigment towards hypodermial region, slightly inflated and pale yellow or hyaline towards lower region of the trama.

Pileipellis: hymeniform, elements 12-34 x 9-21.5  $\mu\text{m}$ , subglobose, pyriform or clavate, thin-walled, pale yellow to hyaline towards apex, yellowish brown towards base. Pileal rim with numerous cystidia, 17.5-81.5 x 7.5-17.5  $\mu\text{m}$ , similar to cheilocystidia.

Stipe trama: composed of 1.5-21.5  $\mu\text{m}$  wide hyphae, thin-walled, pale yellow to hyaline. Stipitipellis of parallel to slightly repent hyphae 1.5-9.5  $\mu\text{m}$  wide, thin-walled, sometimes faintly encrusted, pale yellow to hyaline.

Caulocystidia: 17.5-85 x 5-13  $\mu\text{m}$ , narrowly lageniform with long neck, scattered, thin-walled, pale yellow to hyaline.

Clamp-connections: present in all parts of the basidiomata.

**Habitat:** on the ground, scattered, June.

**Specimens examined:** India: Kerala State, Malappuram District, Calicut University Campus, 22. 6. 1997, K. A. THOMAS T82 (WU 20897); - - 23. 6. 1997, K. A. THOMAS T82b (WU 20898).

**Additional material examined:** USA: New York, Cayuga County, Sterling, on grassy ground, without date, C. H. PECK (NYS, holotype of *Agaricus coprinoides* PECK).

#### Notes:

The present Indian collections agree well with the type material of *Galerella plicatella* from North America in all essential features. This is the first Indian record of this species. The European materials usually referred to as *G. plicatella* represent a totally different fungus with more fleshy fruit bodies, darker, more uniformly coloured pilei, thicker stipes, and larger, strictly ellipsoidal spores that are darker in KOH, have thick, double walls and are never lentiform. WATLING, when he examined the type of *G. plicatella* (no date), made the following note on the herbarium voucher: "after examining European material attributed to this species I doubt whether this fungus has ever been seen in Europe". We are convinced that the Indian collections are conspecific with *G. plicatella*. It is now necessary to find another name for the European collections.

*Pholiotina indica* K. A. THOMAS, HAUSKNECHT & MANIMOHAN, spec. nova (Fig. 6 a-c)

#### Latin description:

Pileus 7-30 mm latus, convexus vel plano-convexus, in statu humecto aurantiacus, rubro-brunneus vel pallide brunneus, in sicco pallide aurantiacus vel griseo-aurantiacus, glaber, ad marginem subtiliter pellucido-striatus. Lamellae adnexae, primo pallide aurantiacae, postea brunneo-aurantiacae vel brunneae, confertae, lamellulis intermixtae, marginibus albidae et subtiliter lacerae. Stipes 15-50 x 1,5-7 mm, pileo concolor, subtiliter pruinosis, annulatus. Annulus centralis vel superus, movens, persistens. Sporae 7-9 x 4,5-6 x 4-5,5  $\mu\text{m}$ , Q = 1,42-1,75, Qm = 1,55, ellipsoideae, subtiliter lentiformes, laeves, crassitunicatae, proprio poro germinativo praeditae. Basidia 19-25 x 8-10  $\mu\text{m}$ , clavata, 4-sporigera. Cheilocystidia copiosa, 14-36,5 x 8-17  $\mu\text{m}$ , versiformia. Pileipellis hymeniformis, cellulis sphaeropedunculatis composita. Caulocystidia 14-40 x 5,5-16,5  $\mu\text{m}$ , gregaria vel dispersa, cheilocystidiis similia. Hyphae fibulatae. Ad fimum *Elephas maximus*.

**Typus:** India: Kerala State, Wayanad District, Muthanga, 9. 6. 1999, K. A. THOMAS T179f (WU 20890, holotypus).

#### Characters:

Basidiomata: small.

Pileus: 7-30 mm diam., convex to plano-convex; surface orange (6B7), reddish golden (6C7) or light brown (6D7, 7D6, 7D7) when moist, later fading to light orange (5A4, 5A5, 6A4, 6A5), greyish orange (5B4, 5B5) or pale orange (5A3) on drying, smooth, glabrous, occasionally with fine wrinkles, faintly striate towards margin when moist; margin decurved, entire. Context up to 2.5 mm thick at the centre, pale orange (5A3) or off-white with a brown tint.

Lamellae: adnexed, initially pale orange (5B3) or light orange (5B4), later brownish orange (6C6, 6C7), light brown (7D6) or brown (6D8, 7D7, 7E6), crowded

to subcrowded, up to 4 mm wide, with lamellulae of 3-5 lengths; lamellar edge whitish, finely torn under a lens.

**Stipe:** 15-50 x 1.5-7 mm, central, terete, almost equal or slightly tapering apically with a slightly swollen base, fistulose; surface concolorous with the pileus, pale orange (5A3) or greyish orange (5B4), usually paler towards apex, becoming brownish towards base, finely pruinose with fine longitudinal striations, annulate; annulus central to superior, movable, with fine striations, not evanescent.

**Context:** smell not distinctive.

**Spore-print:** dark brown (7F5).

**Spores:** 7-9 x 4.5-6 x 4-5.5 ( $8.22 \pm 0.44 \times 5.30 \pm 0.37 \times 4.73 \pm 0.32$ )  $\mu\text{m}$ ,  $Q = 1.42-1.75$ ,  $Q_m = 1.55$ , slightly lenticular, ellipsoid, yellowish brown to orange brown in KOH, smooth, thick-walled, truncated by an apical germ-pore.

**Basidia:** 19-25 x 8-10  $\mu\text{m}$ , clavate, 4-spored; sterigmata up to 3  $\mu\text{m}$  long.

**Cheilocystidia:** 14-36.5 x 8-17  $\mu\text{m}$ , variable: utriform, clavate, oblong, ventricose-fusoid or vesiculose, thin-walled, hyaline. Lamellar edge sterile with crowded cheilocystidia.

**Pleurocystidia:** none.

**Hymenophoral trama:** regular, with a broad mediostratum composed of short, comparatively more inflated cells; hyphae 2-12  $\mu\text{m}$  wide, thin-walled, hyaline. Pileal trama interwoven; hyphae 2-10.5  $\mu\text{m}$ , thin-walled, with a yellowish brown wall pigment, encrusted.

**Pileipellis:** hymeniform, elements 21.5-60 x 10-26.5  $\mu\text{m}$ , sphaeropedunculate, thin-walled, with a yellowish brown encrusting pigment towards base.

**Stipe trama:** composed of 2-21.5  $\mu\text{m}$  wide hyphae, thin-walled, with or without a light yellow wall pigment. Stipitipellis of parallel or slightly repent hyphae 2-10.5  $\mu\text{m}$  wide, thin-walled, encrusted with a light brownish yellow pigment.

**Caulocystidia:** 14-40 x 5.5-16.5  $\mu\text{m}$ , either in clusters, or scattered as recurved peripheral hyphal tips of the stipitipellis, similar to cheilocystidia in shape, thin-walled, hyaline.

**Clamp-connections:** present.

**Habitat:** on elephant dung, scattered, June-November.

**Specimens examined** (besides type): **India:** Kerala State, Wayanad District, Muthanga, 1. 10. 1997, K. A. THOMAS T179 (WU 20888); - - 30. 6. 1998, K. A. THOMAS T179b (WU 20889); - - 4. 7. 1997, K. A. THOMAS T96 (WU 20891); - - 18. 8. 1997, K. A. THOMAS T96c (WU 20892); - Wayanad District, Ponkuzhy, 13. 10. 1998, K. A. THOMAS T179c (WU 20893); - - 27. 10. 1998, K. A. THOMAS T179d (WU 20894); - - 19. 11. 1998, K. A. THOMAS T179e (WU 20895); - Idukki District, Munnar, 12. 10. 1999, K. A. THOMAS T179i (WU 20896).

**Additional material examined:** *Pholiotina stercoraria* (WATLING) ENDERLE: **USA:** Washington State, Hok river, near Spruce Olympia National Park, scattered on horse dung, 17. 5. 1939, A. H. SMITH (MICH, holotype).

## Notes:

This species is characterized by the following combination of features: (1) basidiomata that are always associated with elephant dung; (2) reddish brown to pale orange pileus; (3) stipe with a distinct, movable annulus; (4) spores that are less than 10  $\mu\text{m}$  long and with a distinct germ-pore; and (5) variable cheilo- and caulocystidia that are never capitate. This combination of features makes it distinct from all other previously described species of sect. *Pholiotina*.



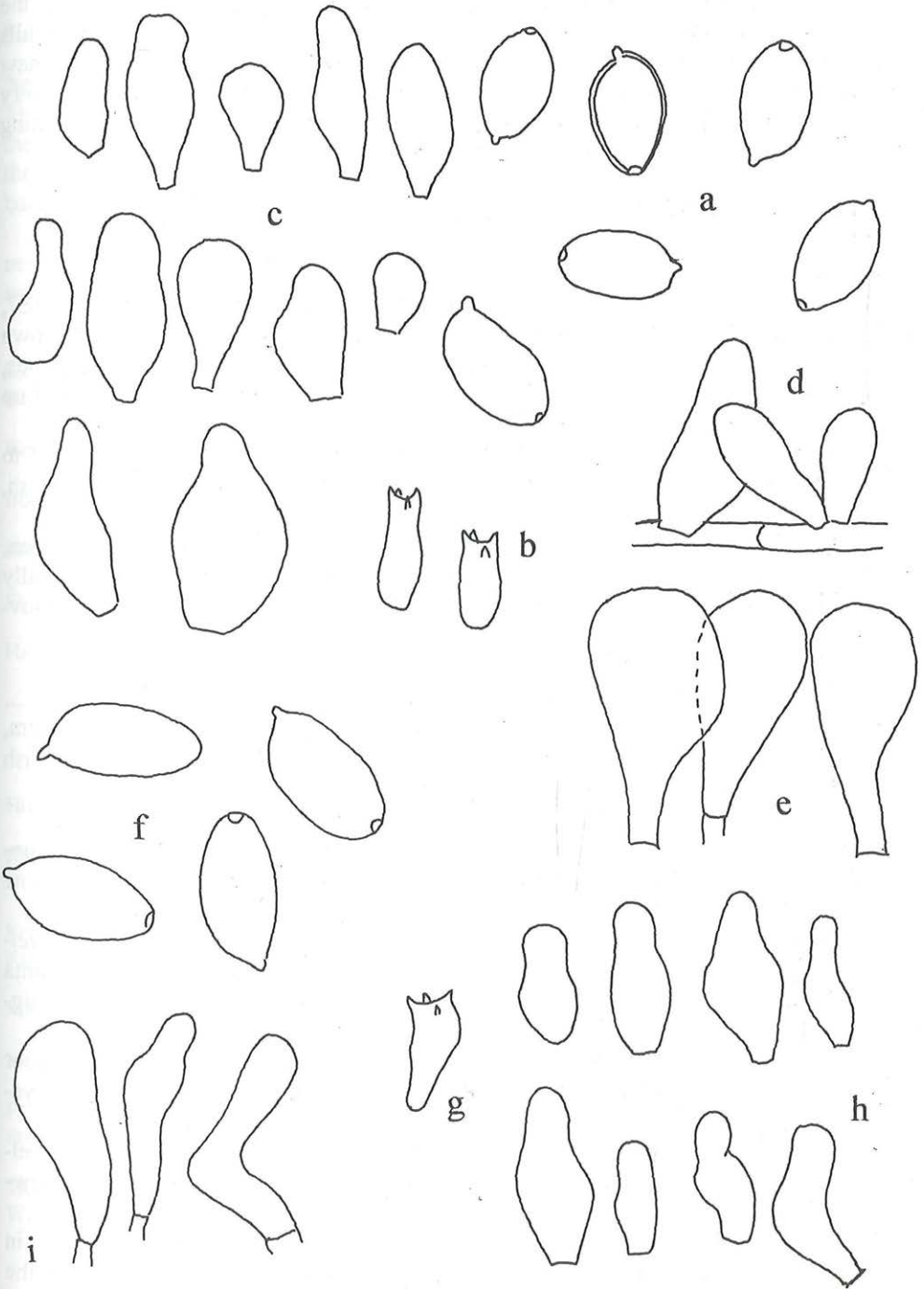


Fig. 6 a-e *Pholiotina indica* (a-c WU 20891, d, e WU 20895). a spores, x 2000; b basidia, x 800; c cheilocystidia, x 800; d caulocystidia, x 800; e pileipellis, x 800. f-i *Pholiotina utricystidiata* (WU 20887). f spores, x 2000; g basidium, x 800; h cheilocystidia, x 800; i caulocystidia, x 800.

Annulate species of *Pholiotina* growing on dung are quite rare. One of them, the North-American *Pholiotina stercoraria*, has larger spores with somewhat thicker walls and exclusively utriform cystidia, while utriform cystidia are intermixed in our new species with prominent vesiculose elements. Macroscopically the new species is very similar to *P. utricystidiata* ENDERLE & HÜBNER, but the latter is not dung-inhabiting and has larger spores and different cystidial morphology.

*Pholiotina utricystidiata* ENDERLE & HÜBNER 1999, Z. Mykol. 65: 17 (Fig. 6 f-i)

**Characters:**

**Pileus:** 7-27 mm diam., convex becoming plano-convex; surface brown (7E8, 7E7, 7E6) or reddish brown (8E6) towards centre, fading towards margin to light brown (6D6, 7D6), rapidly hygrophanous, turning to pale orange (5A3), smooth, glabrous, faintly pellucid-striate towards margin when moist; margin straight, entire. Context up to 1.5 mm thick at the centre, off-white with a brown tint.

**Lamellae:** adnate to adnexed, light brown (7D6) to brown (7E7), crowded to subcrowded, up to 4.5 mm wide, with lamellulae of 3 lengths; lamellar edge whitish, entire.

**Stipe:** 30-55 x 1-3.5 mm, central, terete, equal or slightly tapering towards apex, fistulose; surface concolorous with the pileus, sometimes becoming darker especially towards base, pruinose at apex, glabrescent below, annulate; annulus superior, movable.

**Context:** smell indistinct.

**Spore-print:** light brown (6D6).

**Spores:** 9.5-12 x 5.5-6.5 x 4.5-6 ( $10.70 \pm 0.65 \times 6.02 \pm 0.38 \times 5.33 \pm 0.34$ )  $\mu\text{m}$ ,  $Q = 1.52-2.00$ ,  $Q_m = 1.78$ , slightly lenticular, ellipsoid to oblong-ellipsoid, yellowish brown in KOH, thick-walled, truncated by an apical germ-pore.

**Basidia:** 20-25.5 x 7-10  $\mu\text{m}$ , clavate, 4-spored; sterigmata up to 3.5  $\mu\text{m}$  long.

**Cheilocystidia:** 14-45 x 5-15  $\mu\text{m}$ , mostly utriform, occasionally clavate, thin-walled, hyaline. Lamellar edge sterile with crowded cheilocystidia.

**Pleurocystidia:** none.

**Hymenophoral trama:** regular, hyphae 2-15.5  $\mu\text{m}$  wide, with a well-developed mediostatum consisting of short, comparatively more inflated cells. Pileal trama interwoven; hyphae 2-12.5  $\mu\text{m}$  wide, thin-walled, with a brownish yellow wall pigment, encrusted.

**Pileipellis:** hymeniform, elements 20-60 x 14-22  $\mu\text{m}$ , sphaeropedunculate or inflated-clavate, thin-walled, with brownish yellow wall pigment towards base, hyaline.

**Stipe trama:** composed of 2-17  $\mu\text{m}$  wide hyphae, thin-walled, with a light yellow wall pigment. Stipitipellis of parallel hyphae 2-10  $\mu\text{m}$  wide, with a thin, yellow-pigmented wall.

**Caulocystidia:** 16.5-47.5 x 7.5-15  $\mu\text{m}$ , mostly similar to cheilocystidia in shape, but occasionally capitate or subcapitate, seen towards the upper part of the stipe, in clusters, thin-walled, hyaline.

**Clamp-connections:** present in all parts of the basidiomata.

**Habitat:** on the ground, amongst grass, scattered, August.

**Specimens examined:** India: Kerala State, Idukki District, Munnar, 29. 8. 1997, K. A. THOMAS T158 (WU 20886); - - 30. 8. 1997, K. A. THOMAS T158b (WU 20887).

**Additional material examined: Germany:** Bavaria, Kaufbeuren-Neugablonz (type locality), 4. 9. 1998, H.-J. HÜBNER (WU 20164); -- 9. 7. 1999, H.-J. HÜBNER (WU 20165).

### Notes:

The Indian collections fit very well in all macro- and microscopical characters with materials of *Pholiotina utricystidiata* from the type locality, kindly made available to the second author by MANFRED ENDERLE and which are now incorporated in the herbarium WU and also with an Austrian collection (WU 20932) made in 1999.

This is the first record of *P. utricystidiata* outside of Europe where it is found on newly seeded lawns with soil intermixed with pieces of wood (type collection) as well as on grasslands with somewhat peaty soil.

For loan of materials the second author is thankful to MANFRED ENDERLE, Germany, and the keepers of following herbaria: BR, K, LIL, MICH, NYS, and WU. MONIKA KÖBERL is thanked for the artwork.

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