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HYGROCYBE IN KERALA STATE, INDIA

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Twenty-five species of *Hygrocybe* are described, illustrated and discussed, including 10 new species, namely *H. globispora*, *H. keralensis*, *H. gregaria*, *H. griseoalbida*, *H. corallina*, *H. lobatospora*, *H. brunneosquamulosa*, *H. aurantiocephala*, *H. smaragdina* and *H. aurantioalba*. Two new varieties are proposed, viz. *H. nivosa* var. *pallidolutea* and *H. apala* var. *indica*. The new combination *Hygrocybe deceptiva* is proposed. A key is provided for all described taxa.

Many parts of the vast Indian subcontinent are still not fully explored for agarics. Most of the available literature on Indian agarics comprises isolated and sporadic records. Monographic treatments of particular genera from specific regions are very few. The situation in Kerala State corresponds with this general pattern. Revisons of only a few genera have been published, for instance *Hymenagaricus* (Heinemann & Little Flower, 1984), *Micropsalliota* (Heinemann & Leelavathy, 1991), *Entoloma* (Manimohan et al., 1995) and *Psilocybe* (Thomas et al., 2002). In this paper we present the results of our studies on the genus *Hygrocybe* (Fr.) Kumm. of Kerala State.

Physiography, climate and vegetation of Kerala

Kerala State is situated in the southwest of peninsular India. It lies between 74.8–77.5° longitude and 8.2–12.8° latitude. Kerala covers an area of 38,864 km^2, representing 1.18% of the total area of India. It is bordered by the Indian Ocean in the west and a mountain range, called the Western Ghats, in the east. The average height of this mountain range is about 900 m, with some peaks reaching 2680 m. The mountains slope away coastward to form the undulating midlands and the coastal areas.

The tropical humid climate of Kerala is associated with two monsoons. The south-west monsoon brings heavy rain during the period June–August. The north-east monsoon, lasting from October to the middle of December, brings comparatively less rain. Temperature ranges between 24°C and 37.5°C in the plains and between 10°C and 32°C in the hills.

The major vegetation types in Kerala include wet evergreen and semi-evergreen forests, tropical moist deciduous forests, tropical dry deciduous forests, montane subtropical and temperate shola forests, mangrove swamps and grasslands. Much of the natural forests have been cleared over the years for the planting of tea, coffee, rubber and cardamom. Coconut groves and rice paddies occupy much of the midlands and coastal areas. Level of endemism in the vegetation is very high with more than 400 species of flowering plants endemic to this region.

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Most of the specimens mentioned in this paper were collected from Calicut University campus, not because it is a particularly good habitat for *Hygrocybe*, but we were in the opportunity to carry out intensive collecting at this locality. Some species were also seen in other places outside the campus but usually not collected. Calicut is situated close to the coast of the Indian Ocean in the northern half of Kerala. The university campus occupies an undulating area of about 227 ha where the altitude ranges from 40–50 m above sea level. It consists of stretches of laterite soil, sparsely covered with grass, intermixed with groves of coconut, cashew, mango and other trees. There are isolated patches of gravel and red loamy soil. The coast is 3 km west of the campus.

MATERIAL AND METHODS

All descriptions in this paper are based exclusively on material collected from Kerala State, India. The collections were described in the laboratory and subsequently dried at 60°C. Most microscopic characters were studied on fresh material, using hand-cut sections in a 3% aqueous potassium hydroxide solution. Spore sizes are based on measurements of 20 spores, in most cases taken from a spore print. The hilar appendix was not included in the measurement of spore length. Characters that are similar in all species of *Hygrocybe*, such as a white spore print and inamyloid spores, are not mentioned in the descriptions. Colour codes are according to Kornerup & Wanscher (1978).

In addition to the Kerala collections, type collections of some species, obtained on loan from other herbaria, were examined for comparison. All the Kerala collections examined are deposited in the Nationaal Herbarium Nederland, Universiteit Leiden branch (L).

The descriptions are arranged according to the infrageneric classification, adopted by Boertmann (1995). A key is added to fascilitate identification of *Hygrocybe* collections from Kerala and adjacent regions.

KEY TO THE TAXA OF HYGROCYBE IN KERALA

1. Hymenophoral trama irregular, made up of short elements (< 200 μm long); lamellae decurrent (subgenus *Cuphophyllus*).
   2. Pileus white or at centre pale yellow; lamellae and stipe white.
      3. Pileus 5–18 mm, pure white; stipe 1–2(–3) mm wide
         20a. *H. nivosa* var. *nivosa*
      3. Pileus 15–45 mm, whitish with pale yellow centre; stipe 3–4 mm wide
         20b. *H. nivosa* var. *pallidolutea*
   2. Basidiomata with yellow, orange or brown tones.
      4. Pileus reddish brown; lamellae and stipe greyish brown; spores 4.5–6.0 × 4.0–5.5 μm . . . . . 24. *H. globispora*
      4. Basidiomata with yellow, orange or orange-brown colours; spores often larger.
         5. Spores 9.5–12.5(–13.0) × 4.5–6.5(–7.0) μm, Q = 1.7–2.5, ellipsoid-oblong to cylindrical, often constricted . . . . . 21. *H. keralensis*
         5. Spores 5.0–7.5 × 4.0–6.0 μm, Q = 1.1–1.5, broadly ellipsoid to ellipsoid.

6. Basidiomata solitary or scattered; pileus brownish orange; spores 6.0–7.5 × 5.0–6.0 µm; most hyphae of hymenophoral trama inflated, 3.0–18 µm wide . . . . . 22. *H. pratensis*
6. Basidiomata usually gregarious; pileus bright orange; spores 5.0–6.5 × 4.0–5.0 µm; hyphae of hymenophoral trama cylindrical, 3.0–8.0 µm wide . . . . . 23. *H. gregaria*

1. Hymenophoral trama regular or subregular; lamellae variously attached (subgenera *Hygrocybe* and *Pseudohygrocybe*).
7. Hymenophoral trama strictly regular, made up of very long, tubuliform elements, up to 2500 µm long; lamellae free or narrowly adnate (subgenus *Hygrocybe*).
8. Basidiomata blackening when bruised and with age.
9. Pileus and stipe greyish white with black fibrils . . . . 3. *H. griseoalbida*
9. Pileus and stipe with yellow to red colours.
10. Pileus and stipe with few to many black fibrils on a red, orange or brownish background, even when young; spores 7.0–9.0 × 5.5–7.0(–8.0) µm, Q = (1.0–)1.1–1.3, broadly ellipsoid, not constricted; basidiomata small to large with pileus 10–90 mm broad 2. *H. astatogala*
10. Pileus and stipe without black fibrils; spores 8.0–11.5 × 4.5–6.0 µm, Q = 1.6–2.2(–2.4), ellipsoid-oblong to cylindrical, often constricted; basidiomata small with pileus up to 15 mm broad 1a. *H. conica* var. *conicopalustris*
8. Basidiomata not blackening.
11. Pileus white, pale yellow or pale orange.
12. Basidiomata white to pale yellow; spores and basidia dimorphic; macrospores (7.0–)8.0–10.0(–10.5) × (6.0–)6.5–9.5(–10.0) µm, microspores 4.0–6.5 × 3.5–5.0 µm . . . . . 7. *H. alwisii*
12. Pileus pale orange with whitish umbo; stipe white; spores and basidia not dimorphic; spores 7.0–11.0 × 5.0–7.0 µm 6. *H. apala* var. *indica*
11. Pileus vividly yellow, orange or red.
13. Pileus orange, contrasting with white lamellae and whitish to pale yellow stipe; spores 8.0–10.0 × (5.5–)6.0–7.0 µm, Q = (1.2–)1.3–1.5, broadly ellipsoid to ellipsoid, not constricted . . 5. *H. aurantioalba*
13. Pileus and stipe orange-yellow to red; lamellae yellowish; spores 7.0–10.0(–10.5) × 4.5–6.5 µm, Q = 1.3–1.9, predominantly ellipsoid-oblong, some subcylindrical, often in part constricted.
14. Pileus 25–90 mm broad, orange-red to yellowish orange, slightly sticky when moist . . . . . 4a. *H. acutoconica* var. *acutoconica*
14. Pileus 20–40 mm, vividly red at first, viscid when moist 4b. *H. acutoconica* var. *cuspidata*
7. Hymenophoral trama subregular, made up of short to medium-sized elements, up to 500 µm long; lamellae variously attached, often adnate or decurrent (subgenus *Pseudohygrocybe*).
15. Pileus viscid to glutinous; pileipellis an ixotrichodermium.

16. Edge of lamellae gelatinous, hyaline, sterile, made up of slender, branched cheilocystidia; basidiomata pale pink to coral red .... 9. *H. corallina*
16. Edge of lamellae not gelatinous, concolorous with faces, fertile; basidiomata yellowish, orange or bright red.
17. Spores 7.5–9.5(–10.5) × 5.8–7.5 × 4.5–6.0 μm, distinctly flattened, in frontal view obpyriform with prominent median constriction (Q = 1.25–1.4), in side-view ellipsoid-oblong (Q = 1.6–1.9) 12. *H. lobatospora*
17. Spores 5.5–8.0 × 3.0–4.5 μm, not flattened, not or weakly constricted.
18. Pileus at first pale orange, soon turning pale yellow, glutinous; pileipellis and stipitipellis an ixotrichodermium .. 10. *H. ortoniana*
18. Pileus at first scarlet-red to orange-red, viscid; pileipellis and stipitipellis predominantly an ixocutis ..... 11. *H. insipida*

15. Pileus dry or at most slightly sticky when moist, smooth or squamulose; pileipellis a cutis or trichodermium.
19. Pileus and stipe with bright colours, yellow, orange or red, occasionally pileus with brown scales.
20. Pileus surface fibrillose to squamulose, at least at centre; pileipellis at pileus centre a trichodermium, towards margin a cutis with trichodermal tufts of erect hyphae, 5.0–15 μm wide, often constricted at septae.
21. Pileus orange-red to orange with concolorous scales; lamellae whitish to pale yellow; basidiomata not darkening on drying 18. *H. cantharellus*
21. Pileus yellowish brown with darker brown scales; lamellae yellowish brown; pileus and stipe darkening to dark brown or black in exsiccata ..... 19. *H. brunneosquamulosa*
20. Pileus surface smooth and glabrous; pileipellis a cutis of repent hyphae, 2.0–7.0(–10) μm wide.
22. Spores 7.5–9.5(–10.5) × 5.8–7.5 × 4.5–6.0 μm, distinctly flattened, in frontal view obpyriform with prominent median constriction (Q = 1.25–1.4), in side-view ellipsoid-oblong (Q = 1.6–1.9) ..... 12. *H. lobatospora*
22. Spores not flattened, not constricted.
23. Spores 4.5–6.5 × 4.0–5.5 μm, globose to subglobose 13. *H. aurantia*
23. Spores ellipsoid to oblong, often larger.
24. Spores 5.0–8.0 × 2.5–4.0(–4.5) μm; pileus and stipe yellow, lamellae pale yellow or white ..... 15. *H. parvula*
24. Spores 6.5–10.5 × 4.0–7.5 μm; pileus and stipe orange or red.
25. Pileus bright red, translucently striate when moist; lamellae reddish or orange with paler edge; spores 6.5–10.5 × 5.0–7.5 μm, broadly ellipsoid or ellipsoid; basidia 25–38 × 8.0–11 μm ..... 16. *H. mexicana*

25. Pileus orange, not striate; lamellae white to pale orange; spores 7.0–9.0 × 4.0–5.0 µm, ellipsoid to ellipsoid-oblong; basidia 33–50 × 6.0–7.5 µm
14. *H. aurantiocephala*

19. Pileus and stipe predominanty brownish, greyish or green.
26. Pileus and stipe dark to pale green . . . . . 17. *H. smaragdina*
26. Basidiomata without green colours, brownish or greyish.
27. Basidiomata small: pileus 5–15 mm broad, stipe 10–15 × 1–1.5 mm, entirely greyish brown; spores 3.5–5.0 × 3.0–4.5 µm; clamp-connections absent . . . . . 25. *H. deceptiva*
27. Basidiomata larger: pileus 10–65 mm broad, stipe 15–90 × 2–10 mm; spores (7.0–)7.5–10.5(–11.0) × (5.0–)5.5–6.5(–7.5) µm; clamp-connections present.
28. Pileus with olive-brown to dark brown scales on yellow-brown background, not becoming perforate; stipe yellow; pileus and stipe turning dark brown to black in exsiccata; smell not distinctive . . . . . 19. *H. brunneosquamulosa*
28. Pileus glabrous or slightly fibrillose, greyish brown, becoming perforate at centre; stipe whitish or brownish; pileus and stipe not darkening on drying; smell nitrous . . 8. *H. cinerascens*

DESCRIPTIONS OF THE SPECIES

SUBGENUS **HYGROCYBE**

Section **Hygrocybe**

Subsection **Nigrescentes** (Bataille) Arnolds

1. **Hygrocybe conica** (Schaeff.: Fr.) Kumm.

Agaricus conica Schaeff., Fungi Bavar. 4 (1774) 2; *Agarius conicus* Schaeff.: Fr., Syst. Mycol. 1 (1821) 103; *Hygrocybe conica* (Schaeff.: Fr.) Kumm., Führ. Pilzk. (1871) 111.

1a. **Hygrocybe conica** var. **conicopalustris** (R. Haller Aar.) ex Arnolds — Fig. 1

Hygrophorus conicopalustris R. Haller Aar., Schweiz. Z. Pilzk. 31 (1953) 141 (invalid); *Hygrocybe conica* var. *conicopalustris* (R. Haller Aar.) ex Arnolds, Persoonia 13 (1986) 143.

Basidiomata small. Pileus 5–15 mm, conical at first, with or without acute umbo, remaining so or becoming somewhat expanded with a conical umbo, brownish red (K. & W. 9C7, 8C7); surface slightly viscid, appressed fibrillose; margin straight, initially entire, becoming finely fissile to eroded. Lamellae free, whitish to cream, up to 4 mm wide, with entire, concolorous edge, crowded, with lamellulae of 1–2 lengths. Stipe 15–45 × 1–4.5 mm central, cylindrical or compressed, slightly broader towards base, hollow, somewhat translucent, light yellow (4A4), appressed fibrillose lengthwise. Odour not distinctive. Entire basidioma blackening on bruising and with age.

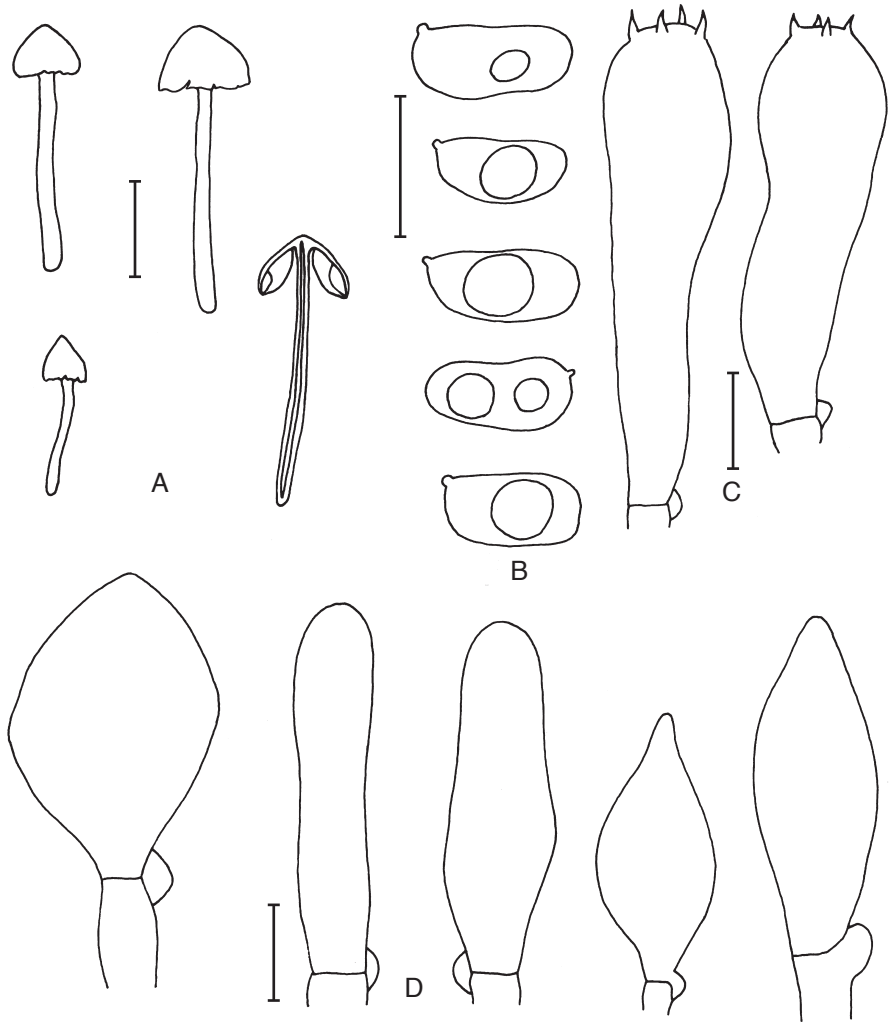

Fig. 1. *Hygrocybe conica* var. *conicopalustris*. A. Basidiomata; B. spores; C. basidia; D. pseudocystidia. Scale bars: resp. 1 cm, 10 μm.

Spores 8.0–11.5 × 4.5–6.0 μm, Q = 1.6–2.2(–2.4), Qav. = 2.0, ellipsoid-oblong or cylindrical, not or slightly constricted in the middle. Basidia 40–55 × 8.0–11.5 μm, clavate to narrowly clavate, thin-walled, hyaline, 2- or 4-spored with sterigmata up to 5 μm long; mature basidia quickly collapsing and then filled with dark brown contents. Lamella edge fertile, but in between basidia numerous basidioles present, measuring 20–30 × 8.0–15 μm, versiform, mostly fusoid or ventricose-rostrate, occasionally cylindrical, lageniform or clavate, thin-walled, hyaline. Pleurocystidia absent but similar basidioles present on faces of lamellae. Hymenophoral trama regular, made up of very

long (> 1000 μm) elements with tapering ends, 4.0–25 μm broad, thin-walled, hyaline or with yellowish brown to dark brown contents. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a cutis, made up of 1.5–10 μm broad, thin-walled hyphae, filled with yellowish brown to dark brown contents. Stipitipellis a cutis; hyphae 1.0–10 μm broad, thin-walled, filled with dark brown contents. Clamp-connections observed at the base of basidia and cheilocystidia.

Habitat & distribution — On the ground, scattered, amongst decaying leaf litter under cashew trees (*Anacardium occidentale* L.), not common, July.

Collections examined. INDIA: Kerala State, Calicut University Campus, 4.VII.1994, *Manimohan M602a* (L); 6.VII.1994, *Manimohan 602b* (L).

Our collections evidently belong to the *Hygrocybe conica* complex, regarded by some authors (e.g. Hesler & Smith, 1963; Boertmann, 1995) as a single, variable species, by others (e.g. Courtecuisse & Duhem, 1994) as a complex with many species. We follow a broad species concept since all characters seem to be intergrading. The small basidiomata suggest affinity to *H. conica* var. *conicopalustris*, described from mires and bogs in Europe. Also, spore size and other microscopical characters fit in with this taxon. However, our collections were not made in swampy areas.

2. **Hygrocybe astatogala** (R. Heim) Heinem. — Fig. 2, Plate 1

Bertrandia astatogala R. Heim, Rev. Mycol. 1 (1936) 224 (invalid); *Bertrandia astatogala* R. Heim ex Heim, Rev. Mycol. 31 (1966) 155; *Hygrocybe astatogala* (R. Heim) Heinem., Bull. Jard. Bot. Brux. 33 (1963) 436.

Basidiomata small to large. Pileus 10–90 mm, conical with an obtuse umbo at first, then expanding but retaining an umbonate centre, initially with black, appressed fibrils on a scarlet (K. & W. 9A8), reddish orange (7A8), yellowish orange (4A8) or reddish brown (9D8) background, soon becoming uniformly black, translucently striate and slightly viscid when moist; margin involute and entire when young, becoming straight and fissile. Lamellae free to narrowly adnexed, initially white with concolorous, finely eroded edge, soon blackening, up to 6 mm wide, crowded, with lamellulae of 1–3 lengths. Stipe 40–140 × 4–12 mm, cylindrical or slightly tapering towards apex, occasionally compressed, fistulose, at first with black, appressed fibrils on a reddish orange (7A8), deep orange (5A8) or yellowish orange (4A8) background, whitish towards base, soon becoming uniformly black, occasionally exuding a clear fluid when cut. Context red to yellowish orange. Odour absent.

Spores 7.0–9.0 × 5.5–7.0(–8.0) μm, Q = (1.0–)1.1–1.3, Qav. = 1.2, subglobose, broadly ellipsoid to ellipsoid, frequently with refractive contents. Basidia 27–45 × 7.0–11 μm, clavate, frequently with dark brown contents, mostly 4-spored, rarely 1- or 2-spored; sterigmata up to 7.0 μm long. Lamella edge heterogeneous, consisting of basidia, tips of hymenophoral tramal hyphae and isolated dense tufts of versiform cheilocystidia. Cheilocystidia 20–70 × 6.0–10 μm, filiform, fusiform, clavate, cylindrical or lageniform, often constricted, thin-walled, hyaline. Pleurocystidia absent; fusiform pseudocystidia with a terminal, filiform projection (projecting ends of trama hyphae) sometimes present but rare. Hymenophoral trama regular, made up of hyphae with very long (> 1000 μm), up to 25 μm broad elements with rounded or tapering ends.

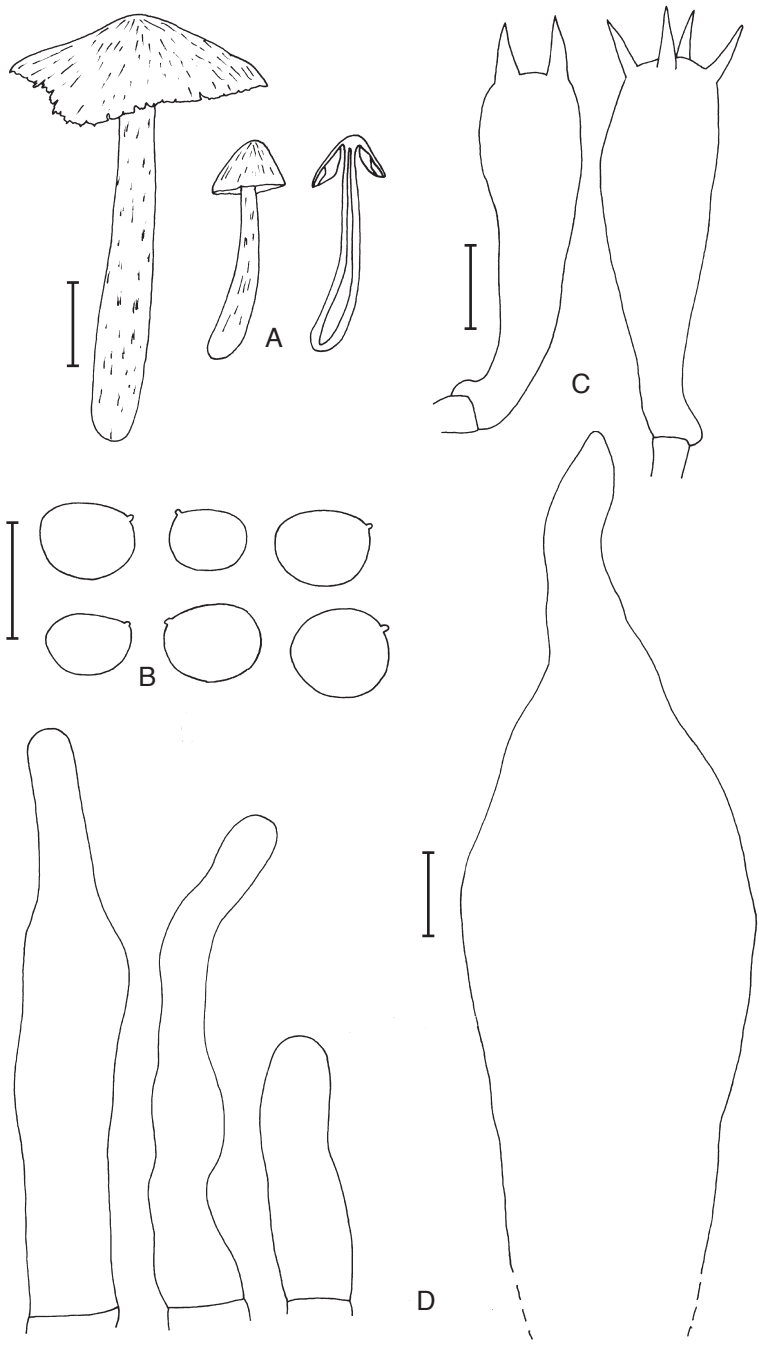

Fig. 2. *Hygrocybe astatogala*. A. Basidiomata; B. spores; C. basidia; D. pseudocystidia. Scale bars: resp. 1 cm, 10 μm.

Pileipellis a cutis, made up of repent, thin-walled, 3.0–15 μm wide hyphae with dark brown to black or rarely yellow or orange contents. Stipitipellis a cutis, made up of thin-walled, 5.0–25 μm wide hyphae with dark brown contents. Clamp-connections observed in trama hyphae and at the base of basidia.

Habitat & distribution — On the ground amongst decaying litter, solitary or scattered, locally common, June–July.

Collections examined. INDIA: Kerala State, Calicut University Campus, 22.VI.1994, *Manimohan M583* (L); ibid. 4.VII.1994, *Leelavathy F779* (L), *Leelavathy F780* (L); ibid. 26.VI.1995, *Leelavathy F804* (L); ibid. 30.VI.1997, *Leelavathy F882* (L).

This species was originally described as *Bertrandia astatogala* by Heim (1936) from Madagascar. It is now known to have a wide distribution in tropical and subtropical regions, extending from central Africa to New Zealand (Horak, 1990) and Australia (Young & Wood, 1997). *Hygrocybe astatogala* is one of the commonest *Hygrocybe* species in Kerala.

Hygrocybe astatogala has a similar habit as *H. conica*, which also turns black in age. The former differs in the presence of black fibrils on pileus and stipe from the beginning, in the shorter and broader ellipsoid spores, in the presence of true cheilocystidia (also described by Young & Wood, 1997) and in the excretion of fluid in moist conditions. *Hygrocybe astatogala* shows a remarkable variability in size and colour of the basidiomata. We do not see a reason to distinguish different taxa since all characteristics are intergrading. A similar variability is known in the *H. conica* complex, where, however, several species or varieties are distinguished by many authors (see description of *H. conica*).

3. **Hygrocybe griseoalbida** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 3

Pileus 28–40 mm latus, convexus vel conico-convexus, non-umbonatus, griseo-albidus, radialiter nigro-fibrillosus, vulnerato nigrescens, siccus. Lamellae liberae vel adnexae, albidae vel pallide griseae, nigrescentes. Stipes 40–60 × 3–4 mm, e pileo concolor. Odor nullus.

Sporae 9.0–12.0 × 4.0–6.0 μm, ellipsoideae-oblongae vel cylindraceae, frequenter strangulatae. Basidia 25–45 × 7.5–10 μm, clavata, 4-sporigera. Cheilocystidia et pleurocystidia nulla. Pseudocystidia 30–65 × 7.0–15 μm, versiformia. Trama hymenophoralis regularis. Hyphae cuticulae pilei repentes, 3.5–10 μm latae, pigmento nigro contentae. Hyphae omnes fibulatae.

Holotypus: India, Kerala State, Calicut University Campus, 28.VII.1993, *Leelavathy F746* (L).

Basidiomata small to medium-sized. Pileus 28–40 mm, convex, hemispherical to conico-convex without umbo, slate-grey (K. & W. 3F2) due to black fibrils on dull greyish white background, blackening on bruising; surface dry; margin straight, entire at first, becoming fissile. Lamellae free to narrowly adnexed, ventricose, up to 6 mm, crowded, with lamellulae of 2–3 lengths, white to pale grey, becoming blackish, at first at the edge, with entire, concolorous edge. Stipe 40–60 × 3–4 mm, central, cylindrical, equal, hollow, white with closely appressed black fibrils giving an overall slate-grey (3F2) appearance, becoming blackish on bruising. Context white to pale grey, in pileus 1.5 mm thick. Odour absent.

Spores 9.0–12.0 × 4.0–6.0 μm, Q = 1.8–2.5, Qav. = 2.0, ellipsoid-oblong to cylindrical, frequently slightly to strongly constricted. Basidia 25–45 × 7.5–10 μm, clavate, 4-spored, rarely 1- or 2-spored, with sterigmata up to 7.0 μm long, filled with blackish

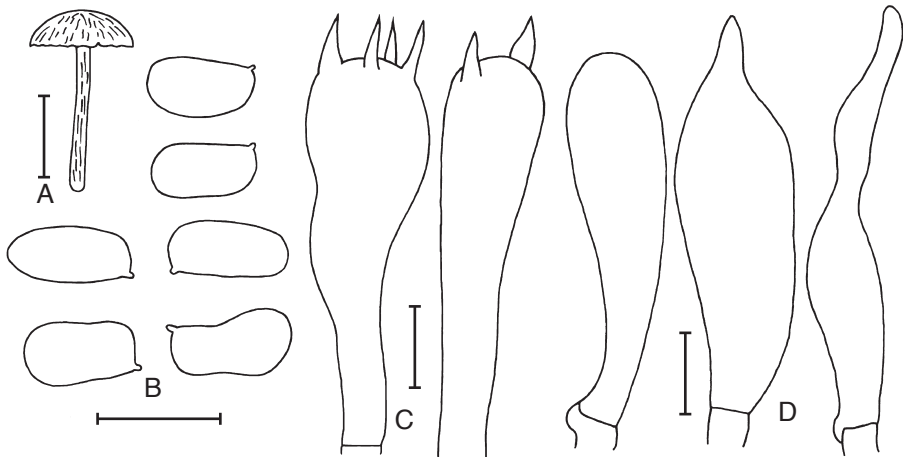

Fig. 3. *Hygrocybe griseoalbida*. A. Basidioma; B. spores; C. basidia; D. pseudocystidia. Scale bars: resp. 1 cm, 10 μm.

pigments when mature. Lamella edge fertile or with dense clusters of pseudocystidia in some regions. Pseudocystidia 30–65 × 7.0–15 μm, originating from the trama hyphae, versiform, mostly clavate, occasionally mucronate, ventricose-rostrate or with a very long, beak-like projection at the apex, thin-walled, hyaline or filled with blackish pigments. Pleurocystidia absent. Hymenophoral trama regular, made up of hyphae with very long (> 1000 μm) elements with tapering ends, 5.0–48 μm broad, thin-walled, hyaline. Hyphae of pileitrama similar to those of hymenophoral trama; oleiferous hyphae frequent. Pileipellis a cutis, made up of thin-walled hyphae, 3.5–10 μm broad, with greyish or blackish intracellular pigment. Stipitipellis a cutis with thin-walled hyphae, 1.5–25 μm wide, with greyish brown or blackish intracellular pigments. Clamp-connections present in all parts of the basidioma.

Habitat & distribution — On the ground, scattered or solitary, not common, July–August.

Collections examined. INDIA: Kerala State, Calicut University Campus, 8.VIII.1984, *Leelavathy F252* (L); ibid. 28.VII.1993, *Leelavathy F746* (L, holotype); ibid. 2.VIII.1995, *Leelavathy F817* (L).

Hygrocybe griseoalbida is a very characteristic species by the prominent, black, appressed fibrils on the white pileus and stipe and free, white lamellae. Bright colours are completely absent in the basidiomata that are entirely blackening on bruising or on drying. Another distinctive feature are the cylindrical to oblong-ellipsoid spores, frequently with a median constriction.

The regular hymenophoral trama, free lamellae and blackening of the entire basidiome are typical of subsection *Nigrescentes* (Bataille) Arnolds of section *Hygrocybe*. Among the blackening species of *Hygrocybe* reported so far, none seems to have the combination of characters described above. *Hygrocybe conica* var. *peradenyca* (Sacc.) Pegler, known from Sri Lanka (Pegler, 1986), is similar in having appressed fibrils on both pileus and stipe, but that taxon has a conico-campanulate pileus with an acute umbo, yellow basidiomata and broadly ovoid spores.

Subsection **Macrosporae** R. Haller ex Bon

4. **Hygrocybe acutoconica** (Clem.) Singer

Mycena acutoconica Clem., Bot. Survey Nebraska 2 (1893) 38; *Hygrophorus acutoconicus* (Clem.) A.H. Sm., N. Amer. Spec. Mycena (1947) 472; *Hygrocybe acutoconica* (Clem.) Singer, Lilloa 22 (1951) 153. — *Hygrocybe persistens* (Britzelm.) Singer, Rev. Mycol. 5 (1940) 8.

4a. **Hygrocybe acutoconica** var. **acutoconica** — Fig. 4

Basidiomata medium-sized to large. Pileus 25–90 mm, conico-convex at first, becoming plano-convex with an obtuse to conical umbo, orange-red (K. & W. 8A8) to reddish orange (7A8) at centre, yellowish orange (4A8) towards the margin, surface slightly sticky and translucently striate when moist, silky striate to smooth, glabrous; margin initially slightly involute, entire or lobate, becoming straight to revolute and deeply fissile. Lamellae free, up to 15 mm wide, subdistant, with lamellulae of 1–4 lengths, pastel-yellow (1A4, 2A4) with concolorous, somewhat eroded edge. Stipe 25–100 × 10–15 mm, central, cylindrical or slightly tapering towards apex, hollow, concolorous with pileus at apex, downwards yellowish orange (4A8) and whitish at base, twisted fibrillose-striate lengthwise. Context in pileus concolorous with surface. Odour and taste absent.

Spores (7.0–)7.5–9.5(–10.0) × (4.5–)5.0–6.0 μm, Q = (1.3–)1.5–1.6(–1.8), Qav. = 1.6, ellipsoid-oblong to slightly phaseoliform, some ellipsoid, sometimes constricted. Basidia 35–50 × 7.0–10 μm, clavate, mostly 4-spored, occasionally 2-spored with sterigmata up to 6.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama regular, made up of hyphae with very long (> 1000 μm), thin-walled, pale yellowish, 2.0–18 μm broad elements with tapering ends. Hyphae of pileitrama similar to those of hymenophoral trama but frequently inflated up to 30 μm. Pileipellis an ixocutis, made up of loosely entangled, thin-walled hyphae, 4.0–6.5 μm wide, with pale yellowish orange intracellular pigment. Stipitipellis a cutis with thin-walled, hyaline or pale yellowish hyphae, 1.0–8.0 μm wide. Clamp-connections present in all parts of the basidioma.

Habitat & distribution — On the ground, scattered to gregarious, amongst decaying leaf-litter under cashew trees (*Anacardium occidentale* L.), June–October.

Collections examined. INDIA: Kerala State, Calicut University Campus, 26.VI.1991, *Leelavathy F680* (L); ibid. 22.VI.1994, *Manimohan M580* (L); ibid. 25.VI.1995, *Leelavathy F807* (L); ibid. 27.VI.1997, *Leelavathy F880a* (L); ibid. 22.VI.1998, *Leelavathy F963* (L).

On the basis of non-blackening basidiomata with a conical pileus, free lamellae and a strictly regular trama, our collections belong to *Hygrocybe* subsection *Macrosporae*. In all essential characters it is identical to *H. persistens* as described by Arnolds (1990) from the Netherlands and to *H. acutoconica*, as described by Hesler & Smith (1963) from North America. These names are synonyms and *H. acutoconica* has priority (Candusso, 1997). The basidiomata from Kerala are robust and larger than those usually found in Europe (Arnolds, 1990; Boertmann, 1995), but Hesler & Smith (1963) described *H. acutoconica* from North America with a pileus up to 10 cm broad and stipe up to 12 mm thick. The spores of our collections are more slender than those of *H. aurantioalba* and *H. apala*, as described in this paper, but somewhat broader than those recorded from European collections (Arnolds, 1990; Boertmann, 1995).

Fig. 4. *Hygrocybe acutoconica* var. *acutoconica*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

4b. **Hygrocybe acutoconica** var. **cuspidata** (Peck) Arnolds — Fig. 5, Plate 2

Hygrophorus cuspidatus Peck, Bull. Torrey Bot. Club 24 (1897) 141; *Hygrocybe cuspidata* (Peck) Murrill, N. Amer. Fl. 9 (1916) 379; *Hygrocybe acutoconica* var. *cuspidata* (Peck) Arnolds, Persoonia 12 (1985) 475.

Basidiomata small to medium-sized. Pileus 20–40 mm, conical to conico-convex, at centre blood-red (K. & W. 10C8) to cherry-red (10B8), yellowish towards margin, viscid and translucently striate at margin when moist; surface glabrous; margin slightly involute, somewhat wavy, entire, becoming fissile. Lamellae free to narrowly adnexed,

up to 5 mm wide, crowded, with lamellulae of 1–3 lengths, white to light yellow (4A4) with finely crenulate, concolorous edge. Stipe 20–70 × 4–7 mm, central, cylindrical, broader towards base, hollow, orange (5A5) at apex, downwards yellowish and almost white at base, finely striate lengthwise, less viscid than pileus. Context concolorous with the pileus surface. Odour and taste not distinctive.

Spores 7.0–10.0(–10.5) × 4.5–6.5 μm, Q = 1.3–1.9, Qav. = 1.5, very variable in shape, ellipsoid, ellipsoid-oblong or subcylindrical, sometimes weakly to strongly constricted, with a large oil drop almost filling the lumen. Basidia 26–45 × 7.0–10(–12.5) μm, clavate, 4-spored, with sterigmata up to 6.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama regular, made up of hyphae with very long (> 1000 μm), thin-walled, hyaline, 16–26 μm wide elements with tapering ends. Hyphae of pileitrama 8.0–17 μm wide, thin-walled, hyaline. Pileipellis an ixocutis of parallel to slightly interwoven hyphae, made up of 2.0–7.0 μm

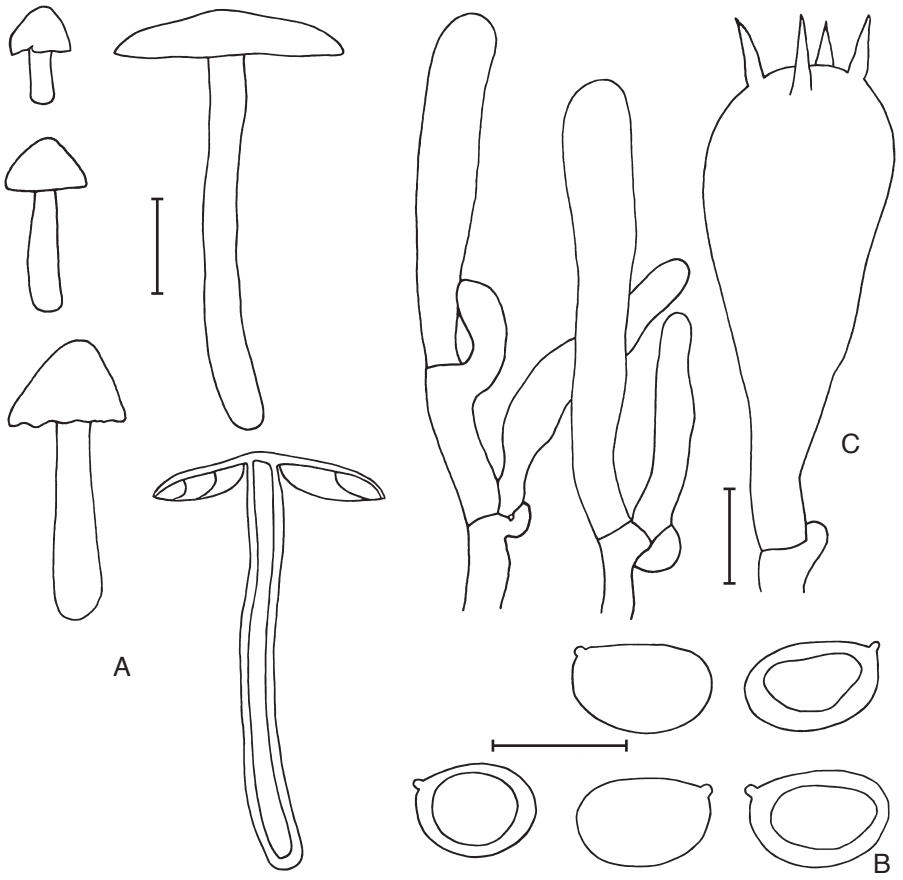

Fig. 5. *Hygrocybe acutoconica* var. *cuspidata*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

wide, thin-walled hyphae. Stipitipellis an ixocutis with thin-walled, hyaline or pale yellowish hyphae, 1.0–10 μm wide. Clamp-connections present in all parts of the basidioma.

Habitat & distribution — On the ground, solitary or scattered, in open places as well as in wooded areas, July–October.

Collections examined. INDIA: Kerala State, Calicut University Campus, 25.VIII.1994, *Manimohan M611* (L); ibid. 14.VII.1995, *Leelavathy F816b* (L); ibid. 27.VII.1995, *Leelavathy F816c* (L); ibid. 17.VIII.1996, *Leelavathy F849b* (L); Nilambur Teak Forest, 19.X.1994, *Manimohan M616* (L).

This taxon is identified by us as *H. cuspidata*, originally described from North America, in view of the viscid, red, conical pileus; free lamellae with regular trama; non-discolouring basidiomata and large, variable spores. *Hygrocybe cuspidata* is also known from Europe (Arnolds, 1990). Our collections seem to differ slightly from European and North American material in the paler, whitish lamellae, but this character is quite variable in the group of *H. acutoconica* (Boertmann, 1995).

Together with other authors, we regard *H. cuspidata* as a variety of *H. acutoconica* (Arnolds, 1986) since it differs only in the bright red colour of the pileus. Some authors consider it merely a variant of that species (Boertmann, 1995). The size of the basidiomata in our material of var. *cuspidata* is considerably smaller than in var. *acutoconica*, but this may be accidental. Other authors have not recorded substantial differences in size of pileus and stipe (Hesler & Smith, 1963; Arnolds, 1990).

Hygrocybe cystidiorubra A.M. Young & A.E. Wood, recently described from Australia (Young & Wood, 1997) is probably identical. According to the description it differs only in the presence of pseudocystidia, a feature observed occasionally in numerous species of subgenus *Hygrocybe* and considered by us a character without taxonomic significance (Arnolds, 1974).

5. **Hygrocybe aurantioalba** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 6

Pileus 10–40 mm latus, conicus, demum plano-convexus, umbonatus, centro rubro-aurantiacus, margine luteo-aurantiacus, viscidulus, pellucido-striatus. Lamellae liberae vel subliberae, albae. Stipes 25–60 × 2–5.5 mm, cylindraceus, fistulosus, translucens, albus, pallide luteus vel luteus, fibrilloso-striatus, siccus. Odor nullus.

Sporae 8.0–10.0 × (5.5–)6.0–7.0 μm, late ellipsoideae vel ellipsoideae. Basidia 26–62 × 7.0–11 μm, 4- vel (2-)sporigera. Cheilocystidia et pleurocystidia nulla. Pseudocystidia presentes, 10–15 μm lata, versiformia. Trama hymenophoralis regularis, elementis > 1000 × 10–40 μm. Pileipellis ixocutis, hyphae 3.0–15 μm latae. Fibulae presentes.

Holotypus: India, Kerala State, Calicut University Campus, 2.VI.1995, *Leelavathy F802* (L).

Basidiomata small to medium-sized, somewhat delicate. Pileus 10–40 mm, conical with an acute umbo at first, becoming plano-convex with umbo, reddish orange (K. & W. 7A8) at centre, deep orange (6A8) or yellowish orange (5A8 to 4A8) towards margin, fading to yellow except at the disk which remains reddish orange; surface slightly sticky and translucently striate when moist, silky striate or smooth, glabrous; margin slightly incurved and entire at first, becoming straight, fissile, and lobate. Lamellae free to narrowly adnexed, rather crowded, up to 4.5 mm wide, with lamellulae of 1–2 lengths, white, with entire or finely crenulate, concolorous edge. Stipe 25–60 × 2–5.5 mm,

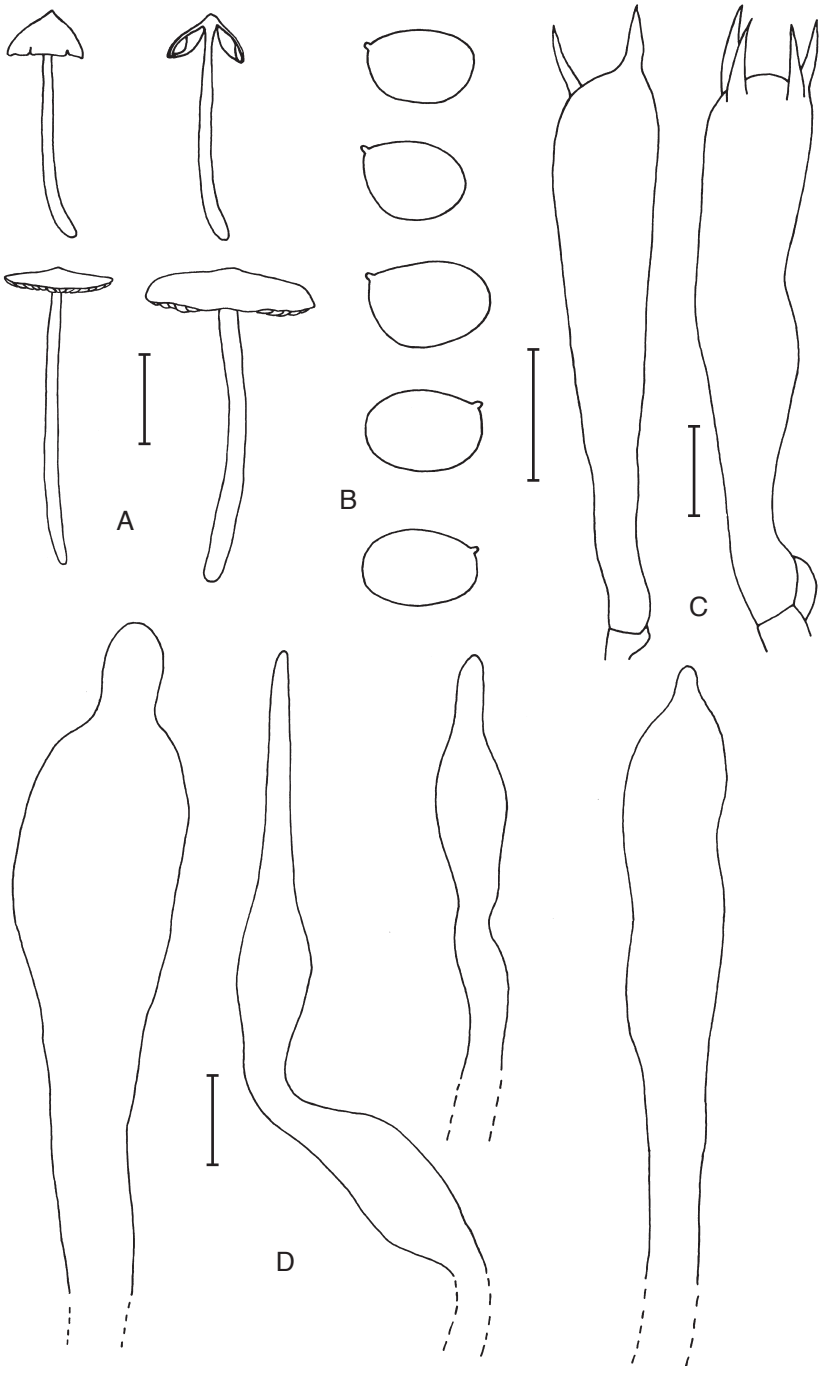

Fig. 6. *Hygrocybe aurantioalba*. A. Basidiomata; B. spores; C. basidia; D. pseudocystidia. Scale bars: resp. 1 cm, 10 μm.

central, cylindrical, almost equal, hollow, translucent, always paler than pileus, varying from yellow to pale yellow or white, silky-striate lengthwise. Context in pileus orange-yellow. Odour not distinctive.

Spores 8.0–10 × (5.5–)6.0–7.0 μm, Q = (1.2–)1.3–1.5, Qav. = 1.35–1.4, broadly ellipsoid to ellipsoid with large apiculus, not constricted. Basidia 26–62 × 7.0–11 μm, clavate, mostly 4-spored, rarely some 2-spored, with sterigmata up to 6.0 μm long. Lamella edge fertile. Cheilocystidia absent but edge with some pseudocystidia, originating from trama, 10–15 μm wide, versiform, mostly clavate, thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama regular, made up of very long (> 1000 μm), thin-walled, hyaline to yellowish elements, 10–40 μm wide, with tapering ends. Hyphae of pileitrama similar to those of hymenophoral trama, with lactifers. Pileipellis an ixocutis, made up of 3.0–15 μm wide, repent to ascending, thin-walled hyphae, constricted at the septa, with orange intracellular pigment. Stipitipellis a cutis with thin-walled, hyaline or pale yellowish hyphae, 2.0–10 μm wide. Clamp-connections present in all parts of the basidioma.

Habitat & distribution — On the ground, among litter, solitary or scattered, in the shade of trees, June–August.

Collections examined: INDIA: Kerala State, Calicut University Campus, 22.VI.1994, *Manimohan M582* (L); ibid. 27.VI.1994, *Manimohan M582c* (L); ibid. 2.VI.1995, *Leelavathy F802* (L, holotype); ibid. 28.VI.1997, *Leelavathy F879* (L); ibid. 13.VI.1998, *Leelavathy F949* (L).

Hygrocybe aurantioalba belongs to subsection *Macrosporae* of subgenus *Hygrocybe* in view of the very long elements in the trama, free lamellae, non-blackening basidioma and rather large spores. It differs from our collections of *H. acutoconica* in smaller, more delicate basidioma with a remarkable contrast between the bright orange pileus and much paler lamellae and stipe, as well as in broader spores. The spore size is rather similar to the European *H. konradii* R. Haller (Haller, 1955), but that species differs in the larger basidioma with almost uniform, orange-yellow to orange-red colours on pileus, lamellae and stipe. *Hygrocybe apala* has similar spores but the entire basidioma is much paler.

6. **Hygrocybe apala** (Berk. & Broome) Pegler & Rayner var. **indica** Leelav., Manim. & Arnolds, *var. nov.* — Fig. 7

Hygrocybe apala (Berk. & Broome) Pegler & Rayner, Kew Bull. 23 (1968) 382 var. *indica* Leelav., Manim. & Arnolds.

A typo differt: pileo pallido aurantiaco, cheilocystidibus nullis.
Holotypus: India, Kerala State, Nilambur Teak Forest, 19.X.1994, *Manimohan M614* (L).

Basidiomata medium-sized. Pileus 20–35 mm, conical at first, becoming conico-convex with an umbo, whitish at centre, towards the margin pale orange (K. & W. 6A3), slightly darker (6A5) translucently striate when moist; surface very viscid; margin initially slightly involute, becoming straight, lobate and fissile. Lamellae free, crowded, up to 5 mm wide, light yellow (4A4/4A5), with entire, concolorous edge. Stipe 60–80 × 4–8 mm, central, cylindrical, hollow, purely white, surface viscid, faintly striate lengthwise. Context thin, whitish. Odour absent.

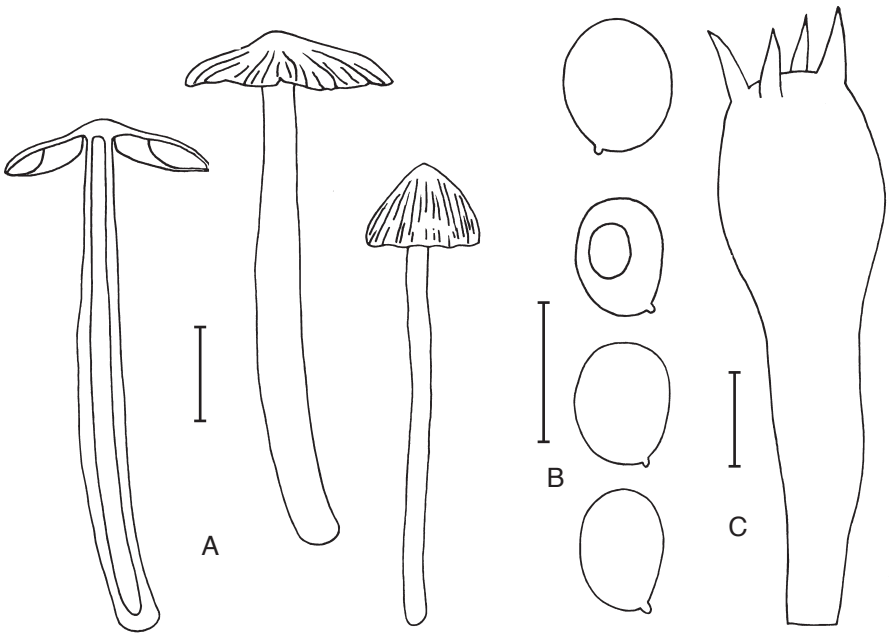

Fig. 7. *Hygrocybe apala* var. *indica*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

Spores 7.0–11.0 × 5.0–7.0 μm, Q = 1.2–1.7, Qav. = 1.35–1.5, broadly ellipsoid or ovoid with large apiculus. Basidia 27–50 × 8.0–12 μm, broadly clavate, thin-walled, 4-spored or some 3- or 2-spored, with sterigmata up to 4.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama regular; made up of very long (> 1000 μm) elements with tapering ends, 2.0–20 μm wide, thin-walled, hyaline. Hyphae of pileitrama 2.0–20 μm wide, thin-walled, hyaline. Pileipellis an ixocutis made up of 2.0–8.0 μm wide, thin-walled, slightly gelatinized hyphae, with yellowish intracellular pigment. Stipitipellis an ixocutis with thin-walled, hyaline, slightly gelatinized hyphae, 1.0–9.0 μm wide.

Collections examined. INDIA: Kerala State, Calicut University Campus, 16.VIII.1995, *Leelavathy F818* (L); Nilambur Teak Forest, 19.X.1994, *Manimohan M614* (L, holotype).

In view of the regular hymenophoral trama, non-blackening basidiomata, conical pileus and free lamellae, this taxon belongs to subgenus *Hygrocybe*, subsection *Macrosporae*. It has many characters in common with *H. konradii*, described from Europe (Haller, 1955; Arnolds, 1990), for instance the size and shape of the spores (although slightly smaller in our material) and general habit. However, *H. konradii* differs in much more intensely coloured basidiomata: pileus, lamellae and stipe are deep yellow to orange.

Our collections seem to be closely related to *H. apala* (Berk. & Broome) Pegler & Rayner, described from Sri Lanka (Berkeley & Broome, 1871; Pegler, 1986) and also reported from Kenya (Pegler, 1977). The basidiomata of this species are also pale and

the spore size is similar. However, the basidiomata of *H. apala* have a lemon-yellow to straw-yellow pileus without orange tones. Another difference may be the sterile edge of lamellae, according to Pegler lined with cheilocystidia in *H. apala* (Pegler, 1977, 1986). However, Pegler's line drawings (1977) strongly suggest the presence of pseudocystidia, a feature occasionally found in most species of section *Hygrocybe* and without diagnostic value. In the same publication, Pegler reported similar cheilocystidia for *H. nigrescens* (Quel.) Kuhner (= *H. conica* f. *pseudoconica* (J.E. Lange) Arnolds). In this widespread species other authors observed only pseudocystidia in variable quantities (e.g. Arnolds, 1974). Renewed study of the type collection may prove whether true cystidia are present in *H. apala*.

Since the intensity of yellow and red pigments is quite variable in many species of *Hygrocybe*, we consider our collections a variety of *H. apala* for the time being.

7. **Hygrocybe alwisii** (Berk. & Broome) Pegler — Fig. 8, Plate 3

Hygrophorus alwisii Berk. & Broome, J. Linn. Soc. Bot. 11 (1871) 565; *Hygrocybe alwisii* (Berk. & Broome) Pegler, Kew Bull., Addit. Ser. 12 (1986) 66.

Basidiomata medium-sized to large. Pileus 40–90 mm, conico-convex at first, becoming applanate with a subumbonate centre, mostly entirely white, occasionally pale yellowish, often with a more distinct yellowish tinge towards the disc; surface somewhat sticky when moist, smooth and glabrous; margin at first straight and entire, becoming recurved and fissile. Lamellae adnexed to almost free, crowded, with lamellulae of 1–4 lengths, up to 7 mm wide, white or occasionally pale yellowish, with concolorous eroded, finely pruinose edge. Stipe 65–120 × 6–10 mm, central, cylindrical, slightly tapering towards apex, hollow; white or rarely pale yellowish, faintly striate lengthwise, occasionally with loose, somewhat recurved fibrils, especially in the lower half. Odour indistinct.

Spores dimorphic; macrospores (7.0–)8.0–10.0(–10.5) × (6.0–)6.5–9.5(–10.0) μm, Q = 1.1–1.3, Qav. = 1.2; microspores 4.0–6.5 × 3.0–5.5 μm, Q = 1.1–1.3, Qav. = 1.2; both types broadly ellipsoid, ovoid or subglobose. Basidia dimorphic; macrobasidia 48–66 × 11–13 μm; microbasidia 24–30 × 4.0–6.0 μm; both types clavate to narrowly clavate, thin-walled, hyaline, 4-spored with sterigmata up to 7.0 μm long. Lamella edge sterile. Cheilocystidia 35–60 × 6.0–12 μm, clavate, fusiform or cylindrical, thin-walled, hyaline. Pleurocystidia absent, but pseudocystidia on faces of lamellae present, 50–100 × 12–18 μm, fusiform-lanceolate to ventricose-rostrate, thin-walled, hyaline, originating from hyphae of the hymenophoral trama. Hymenophoral trama regular, made up of thin-walled, hyaline hyphae with very long (> 1000 μm) elements with tapering ends, 21–42 μm wide. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a trichodermium, made up of loosely entangled, ascending and almost erect, 5.0–18 μm wide, thin-walled, hyaline hyphae. Stipitipellis a cutis with thin-walled hyphae, 3.0–20 μm wide. Clamp-connections present in all parts of the basidioma, including the base of basidia.

Habitat & distribution — On the ground, amongst decaying leaves, in the shade of cashew trees (*Anacardium occidentale* L.), solitary, scattered or in small groups, June–August.

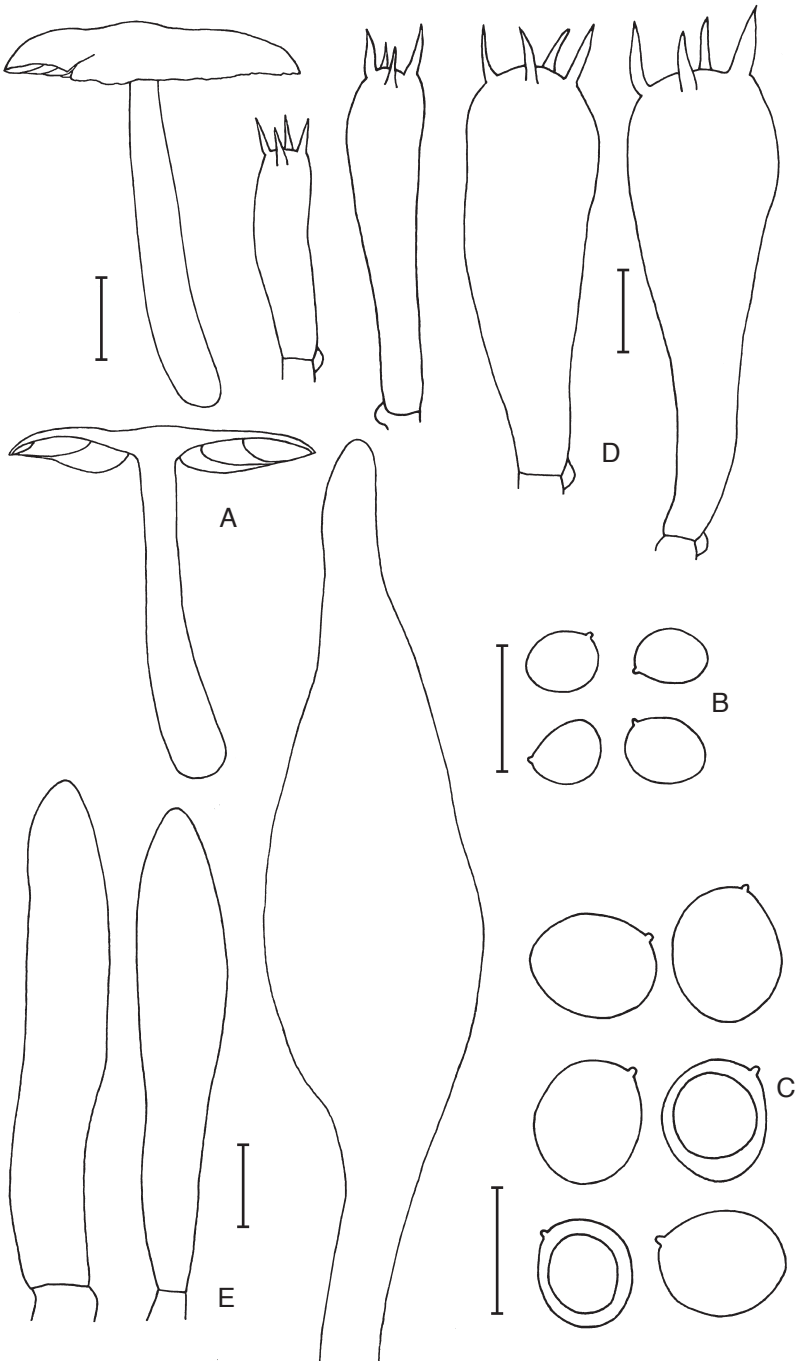

Fig. 8. *Hygrocybe alwisii*. A. Basidiomata; B. microspores; C. macrospores; D. basidia; E. pseudocystidia. Scale bars: resp. 1 cm, 10 μm.

Plate 1. *Hygrocybe astatogala*.

Plate 2. *Hygrocybe acutoconica* var. *cuspidata*.

Plate 3. *Hygrocybe alwisii*.

Plate 4. *Hygrocybe smaragdina*.

Collections examined. INDIA: Kerala State, Calicut University Campus, 17.VI.1993, *Leelavathy F743* (L); ibid. 23.VI.1994, *Manimohan M579b* (L); ibid. 30.VI.1994, *Manimohan M579d* (L); ibid. 29.VI.1995, *Leelavathy F809* (L); ibid. 30.VI.1997, *Leelavathy F881* (L). — SRI LANKA, Central Province, Kandy District, Peradeniya, XI.1868, *Thwaites 814* (K, holotype).

Hygrocybe alwisii is a characteristic species with its large whitish basidiomata. This species was originally described from Sri Lanka by Berkeley & Broome (1871). The type collection was redescribed by Pegler (1986). He could not recover the edge of the lamellae and did not observe cystidia-like structures on the faces of the lamellae. However, in our examination of the type, we found similar cheilocystidia and pseudocystidia on the lamellae as in the Kerala collections. Pegler (1986) keyed this species out in the group of species with subregular trama, made up of short elements. However, the trama is in fact made up of very long, broad elements and is typically regular.

Although the basidiomata of *H. alwisii* are mostly whitish, occasionally specimens occur with a pale yellow colour. The colour difference is striking in the field, but they are otherwise indistinguishable from the whitish ones.

The taxonomic position of *H. alwisii* within *Hygrocybe* is ambiguous. The almost free lamellae, regular trama structure and presence of pseudocystidia suggest close affinity with section *Hygrocybe*. On the other hand, the dimorphic spores and basidia are a typical feature of section *Firmae*. However, species in that section differ in basidiomata with bright red to yellow colours and adnate to decurrent lamellae with a subregular trama. It is quite possible that dimorphic basidia and spores have independently evolved in different groups of *Hygrocybe*. For the time being we place *H. alwisii* in section *Hygrocybe*, subsection *Macrosporae*.

SUBGENUS **PSEUDOHYGROPHORUS** Bon

Section **Neohygrocybe** Herink

8. **Hygrocybe cinerascens** (Berk. & Broome) Pegler — Fig. 9

Hygrophorus cinerascens Berk. & Broome, J. Linn. Soc. Bot. 11 (1871) 562; *Hygrocybe cinerascens* (Berk. & Broome) Pegler, Kew Bull., Addit. Ser. 6 (1977) 50.

Basidiomata small to medium-sized. Pileus 10–55 mm, convex to parabolic at first with flattened or slightly depressed centre, becoming applanate, often with a perforate centre continuous with the stipe lumen, hygrophanous, greyish brown (K. & W. 6E4) when moist with darker translucently striate margin, becoming opaque and orange-grey (5B2) or golden brown (5C5) on drying, surface appearing smooth and glabrous when moist, finely squamulose when dry (under a lens); margin straight, mostly entire, occasionally fissile. Lamellae emarginate with decurrent tooth, subdistant, with lamellulae of 2–3 lengths, up to 8 mm wide, white to greyish yellow (4B3), with entire, concolorous edge. Stipe 30–80 × 3–10 mm, central, cylindrical, often irregularly compressed, equal or tapering towards both ends, hollow, whitish to pale brown, surface smooth and glabrous. Odour distinctly nitrous. No part of the basidiomata changes colour on bruising. Exsiccata dark brown to black.

Spores (7.0–)7.5–9.0(–9.5) × (5.0–)5.5–6.5(–7.0) μm, Q = (1.2–)1.3–1.5, Qav. = 1.4, ellipsoid. Basidia 24–42 × 6.0–9.0 μm, clavate, 4-spored with sterigmata up to

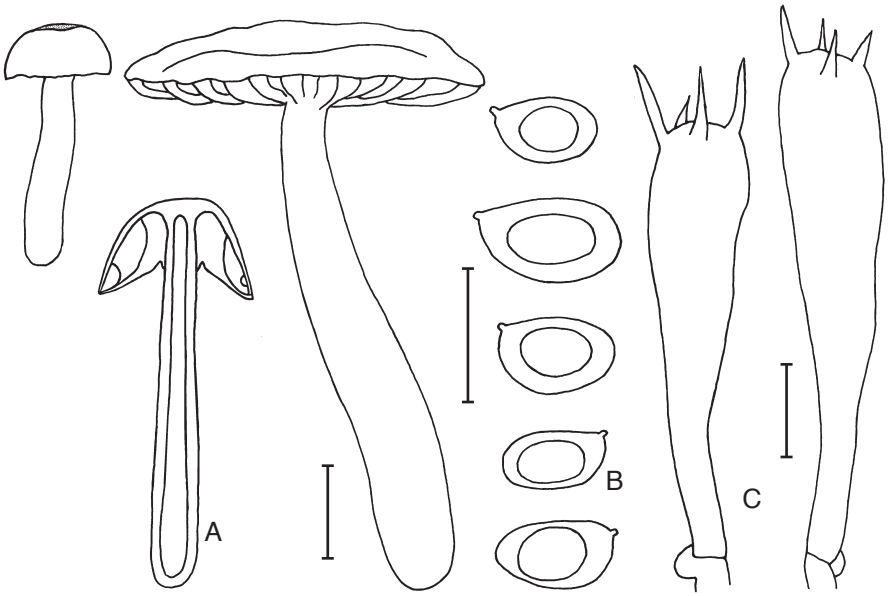

Fig. 9. *Hygrocybe cinerascens*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

9.0 μm long. Lamella edge fertile. Cheilocystidia and pleurocystidia absent. Hymenophoral trama subregular, made up of long chains of short to medium-sized elements with rounded ends, 20–300 × 5.0–38 μm. Hyphae of pileitrama 12–18 μm broad, thin-walled, with a brown intracellular pigment. Pileipellis an undifferentiated cutis, made up of 3.0–9.0 μm wide, thin-walled hyphae, with brown intracellular pigment. Stipe trama made up of subregular chains of short to medium-sized elements with rounded ends, 20–200 × 3.0–15 μm. Stipitipellis an undifferentiated cutis with thin-walled, hyaline hyphae 2.0–10 μm wide. Clamp-connections present in all parts of the basidiomata.

Habitat & distribution — On the ground, amongst decaying leaves, scattered or in caespitose groups, locally abundant, June–October.

Collections examined. INDIA: Kerala State, Calicut University Campus, 1.IX.1992, *Leelavathy F738* (L); ibid. 22.VI.1994, *Manimohan M581* (L); ibid. 27.VI.1994, *Manimohan M581b* (L); ibid. 27.VI.1997, *Leelavathy F878* (L); ibid. 31.X.1997, *Leelavathy F923* (L). — SRI LANKA, Central Province, VII.1869, *Thwaites 1198* (K, type).

Hygrocybe cinerascens is characterized by the dull colours, the distinct nitrous odour and the perforate pileus. However, the nitrous smell seems not to be a constant character (Hesler & Smith, 1963). Originally described from Sri Lanka, it is now known to be a pantropical species, with records from Tanzania (Pegler, 1977), Trinidad (Dennis, 1953) and Martinique (Pegler, 1983). The Kerala collections resemble the type collection in all characters except for the slightly narrower spores.

Hygrocybe cinerascens belongs to sect. *Neohygrocybe* (= subsect. *Ovinae*, Arnolds, 1990), characterized by a subregular trama in combination with a dry pileus with dull, brownish colours. It is close to *H. nitrata* (Pers.) Wünsche (= *H. murinacea* sensu auct.) from Europe and North America which also has the characteristic nitrous smell. The

Plate 5. *Hygrocybe gregaria*.

Plate 6. *Hygrocybe globispora*.

pileus in *H. nitrata* is darker, more distinctly squamulose and not depressed. The pileipellis in that species has clear trichodermial tufts, whereas it is a cutis in *H. cinerascens*. The perforate pileus centre, continuous with the lumen of the stipe, is often considered as a quite characteristic feature of *H. cinerascens*, but the photograph of *H. nitrata*, published by Boertmann (1995: 75), also shows one basidioma with perforated pileus centre. However, this phenomenon is apparently rather exceptional in *H. nitrata*.

Pegler (1977) described *H. cinerascens* from Tanzania and pointed to the affinity with *H. ingrata* J.P. Jensen & F.H. Møller. The latter species is very close to *H. nitrata*, but the context is reddening when bruised.

Section **Glutinosae** Kühner

9. **Hygrocybe corallina** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 10

Basidiocarpus delicatus, translucidus, copioso viscidus. Pileus 8–32 mm latus, conico-convexus vel applanatus, albus vel incarnatus, translucidus, corallino-striatus. Lamellae adnatae, corallinae. Stipes 20–35 × 1–3 mm, primo corallinus, postea translucido-albus. Odor nullus.

Sporae 7.0–10.0 × 4.5–6.5 μm, ellipsoideae vel oblongae. Basidia 20–50 × 5.0–14 μm clavata, 1-, 2-, vel 4-sporigera. Cheilocystidia et pleurocystidia nulla. Trama hymenophoralis regularis. Cutis pilei ixotrichodermialis efformata.

Holotypus: India, Kerala State, Calicut University Campus, 7.VII.1994, *Manimohan 601d* (L).

Basidiomata small to medium-sized, delicate, translucent, copiously viscid. Pileus 8–32 mm, conico-convex, becoming applanate without umbo or depression at the centre, hygrophanous, translucently white, pinkish white (K. & W. 7A2, 7A3) or pale red (8B3, 8B4), darker coral-red (9B4, 9B6) translucently striate when moist, glutinous, glabrous, with margin slightly involute and entire at first, becoming revolute and fissile. Lamellae adnate, soon seceding, subdistant, without or with lamellulae of 1–2 lengths, sometimes slightly intervenose towards margin, up to 2 mm wide, coral red (9B4, 9B6), with hyaline, glutinous, entire edge. Stipe 20–30 × 1–3 mm, central, cylindrical, almost equal, hollow, initially coral-red, becoming pinkish white (7A2, 7A3) to translucently white except at the apex which remains red, glutinous, glabrous. Odour absent. Spore print white. Entire basidioma turning orange-yellow in exsiccata.

Spores 7.0–10.0(–11.0) × 4.5–6.5 μm, Q = 1.4–1.8(–2.1), Qav. = 1.5–1.7, ellipsoid or ellipsoid-oblong, occasionally slightly constricted. Basidia 20–50 × 5.0–14 μm, clavate, with refractive contents, 1-, 2-, or 4-spored with sterigmata up to 10 μm long. Lamella edge sterile, made up of slender, erect, branched hyphae, with terminal cells 15–31 × 2.0–4.5 μm, mostly cylindrical, occasionally fusiform, clavate or irregularly constricted, thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama regular, made up of medium-sized to long, thin-walled elements, 100–500 × 3.0–20 μm, occasionally inflated up to 42 μm, often with tapering ends, with pale red, intracellular pigment. Pileitrama made up of 9.0–12.5 μm wide, thin-walled, hyaline hyphae. Pileipellis an ixotrichodermium made up of 1.0–9.0 μm broad, sparsely branched, ascending to erect, thin-walled, hyaline hyphae, embedded in a thick layer of gluten, up to 500 μm thick. Stipitipellis an ixotrichodermium, made up of 1.0–5.0 μm wide, sparsely branched, thin-walled, hyaline hyphae, embedded in gluten. Clamp-connections observed in all parts of the basidioma.

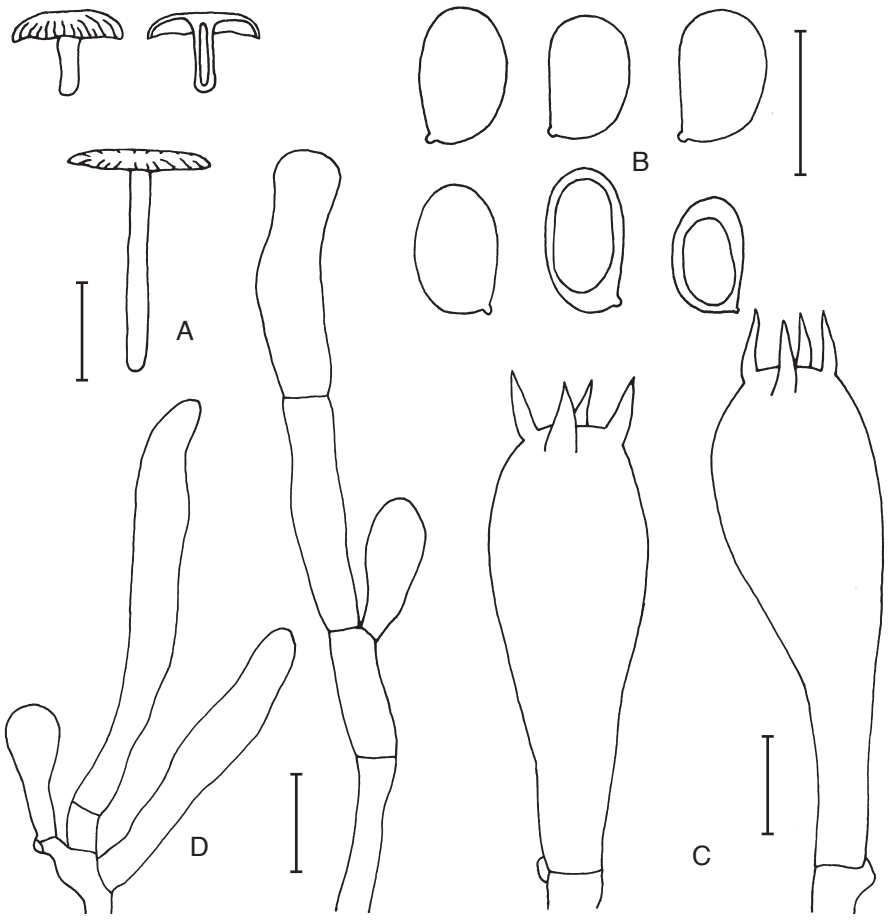

Fig. 10. *Hygrocybe corallina*. A. Basidiomata; B. spores; C. basidia; D. tips of hyphae on edge of lamellae. Scale bars: resp. 1 cm, 10 μm.

Habitat & distribution — On the ground, amongst decaying leaves under cashew trees, solitary or gregarious, not very common or abundant, June–October.

Collections examined. INDIA: Kerala State, Calicut University Campus, 14.VIII.1992, *Gouri G29* (L); ibid. 1.VII.1994, *Manimohan M601* (L); ibid. 7.VII.1994, *Manimohan 601d* (L, holotype); ibid. 19.X.1994, *Manimohan 615* (L); ibid. 23.VI.1995, *Leelavathy F801* (L).

Hygrocybe corallina is easily distinguished in the field on the small, very viscid, pale red to coral-red basidiomata with bright red lamellae having a hyaline, glutinous edge. Under the microscope, this edge is sterile and made up of branched hyphae embedded in a glutinous matrix. *Hygrocybe corallina* is therefore obviously related to *H. laeta*, a species widespread in the northern hemisphere with a similar sterile lamella edge and glutinous pileus and stipe. However, the latter species has larger basidiomata with duller colours, smaller spores and shorter elements in the hymenophoral trama (Hesler & Smith, 1963; Arnolds, 1990).

A few other species have glutinous basidiomata with a sterile lamella edge, lined with branched cheilocystidia. The European species *H. luteolaeta* Arnolds (= *H. vitellina* sensu Boertmann, 1995) has entirely egg-yellow basidiomata (Arnolds, 1990). In Australia, *H. graminicolor* (E. Horak) T.W. May & A.E. Wood and *H. pseudograminicolor* A.M. Young have green coloured basidiomes and *H. chromolimonea* (G. Stev.) T.W. May & A.E. Wood has bright yellow basidiomes (Young & Wood, 1997).

Hygrocybe laeta and the other species mentioned above have a subregular hymenophoral trama with elements up to 120 μm long. In *H. corallina* the trama is regular with much longer elements, often with tapering ends. In this respect it is more or less intermediate between subgenus *Hygrocybe* and subgenus *Pseudohygrocybe*. However, all other characteristics indicate that this species belongs to the latter subgenus, section *Glutinosae*. Our observations suggest that elongation of elements on the trama has taken place several times during the evolution of *Hygrocybe* species.

Section **Coccineae** Fayod

Subsection **Coccineae** (Bat.) Singer

10. **Hygrocybe ortoniana** Bon — Fig. 11

Hygrocybe ortoniana Bon, Doc. mycol. 19 (75) (1989) 55.
Misapplied name: *Hygrocybe glutinipes* sensu R. Haller, Schweiz. Z. Pilzk. 34 (1956) 179; sensu Arnolds, Fl. agar. neerl. 2 (1990) 110.

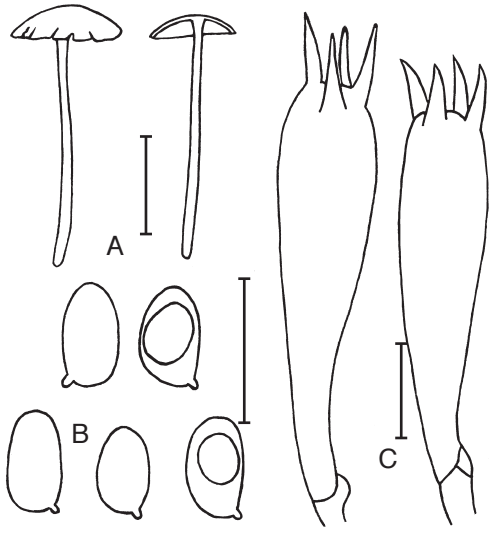

Fig. 11. *Hygrocybe ortoniana*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

Basidiomata small, delicate, translucent, entirely viscid. Pileus 10–25 mm, convex at first, becoming planoconvex, strongly hygrophanous, light orange (K. & W. 5A4, 5A5) at first, then light yellow (3A5), finally very pale yellow (3A2, 3A3) with more distinctly yellow or orange-like tint near centre, translucently striate and viscid when moist; margin straight, entire or finely fissile. Lamella adnate to subdecurrent, subdistant, with lamellulae of 1–3 lengths, up to 2 mm wide, white to pale yellow, with entire, concolorous edge. Stipe 30–40 × 1.5–4 mm, cylindrical, equal, fistulose, light orange (5A4, 5A5) at first, becoming light yellow (3A5, 3A3) with an orange tinge towards apex, translucent, viscid. Context white, thin. Odour and taste absent.

Spores 5.5–7.5(–8.0) × 3.5–4.5(–5.0) μm, Q = 1.5–2.0, Qav. = 1.7–1.8, ellipsoid-oblong to ovoid-oblong, with small apiculus, occasionally weakly constricted. Basidia 30–50 × 7.5–10 μm, clavate, 2- and 4-spored. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama subregular, made up of thin-walled, hyaline hyphae with short (< 250 μm), 3.0–20 μm broad elements. Hyphae of pileitrama similar to those of hymenophoral trama, with laticifers. Pileipellis an ixotrichoderm of very loosely interwoven, narrow hyphae, 2.0–7.5 μm wide, thin-walled, hyaline. Stipitipellis an ixotrichoderm of loosely entangled, narrow hyphae, 1.5–4.0 μm wide, thin-walled, hyaline. Clamp-connections present.

Habitat — On the ground, amongst decaying leaves in the shade of trees, rare, June.

Collections examined. INDIA: Kerala State, Calicut University Campus, 24.VI.1994, *Manimohan M591* (L); ibid. 20.VI.1995, *Leelavathy F798* (L); ibid. 21.VI.1995, *Manimohan M629* (L).

This fungus is characterized by strongly hygrophanous basidiomata that are initially entirely light orange but rapidly become pale yellow, a glutinous pileus and stipe, broadly adnate lamellae and subregular hymenophoral trama. Therefore it belongs to *Hygrocybe* section *Coccineae*. Our material fits in well with the descriptions of *H. glutinipes* (J.E. Lange) R. Haller Aar. by Orton (1960) and Arnolds (1990). Arnolds (1990) described the colours of the pileus as lemon- or chrome-yellow. The colour in our collection is light orange at first, and soon becomes pale yellow.

Recently, Boertmann (1995) has established that the original description of *H. glutinipes* by Lange (1940, as *H. citrina* var. *glutinipes*) concerns a species with regular hymenophoral trama. The valid name of *H. glutinipes* sensu Orton and Arnolds is *H. ortoniana* Bon.

Hygrophorus westii Murrill, described from Florida, is somewhat similar in having whitish, glutinous basidiomata, but the size is much larger than in our collection (pileus 2.5–4 cm, stipe 5–10 mm thick), the lamellae are adnexed and arcuate and the stipe is white with a floccose apex.

11. **Hygrocybe insipida** (J.E. Lange) M.M. Moser — Fig. 12

Hygrocybe reai (Maire) J.E. Lange var. *insipida* J.E. Lange, Dansk bot. Ark. 4 (4) (1923) 26; *Hygrocybe insipida* (J.E. Lange) M.M. Moser, Röhrl.-Blätterp. 3. Aufl. (1967) 65.

Basidiomata small, fragile, viscid. Pileus 4–24 mm, convex to hemispherical at first, becoming applanate, with or without depressed centre, hygrophanous, orange-red (K. & W. 8B8), scarlet (9B8, 10B8, 10A8) or deep red (10C8), paler towards margin, translucently striate when moist; margin slightly involute, becoming straight to revolute, entire, becoming fissile. Lamellae adnate to subdecurrent, subdistant to fairly crowded at first, up to 2 mm wide, with lamellulae of 1–3 lengths, pastel red (8A4) to light orange (5A4, 5A5) or almost white, with entire, concolorous edge. Stipe 10–30 × 1–2.5 mm, central, cylindrical, sometimes compressed, hollow, yellowish white (3A2, 4A2), occasionally melon-yellow (5A4) or pale red, viscid. Context concolorous with the pileus. Taste and odour indistinct. On drying all parts of the basidioma become orange-yellow.

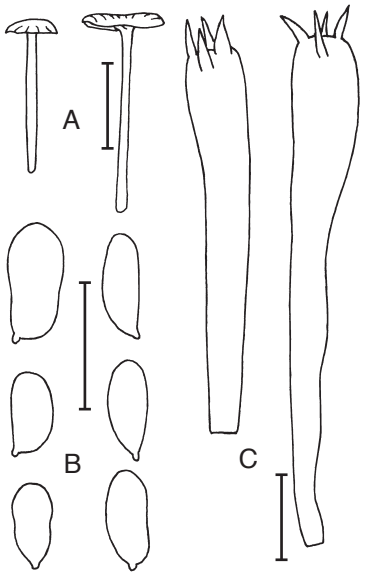

Fig. 12. *Hygrocybe insipida*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

Spores 5.5–8.0 × 3.0–4.5 μm, Q = 1.5–2.3, Qav. = 1.65–2.0, ellipsoid-oblong or subcylindrical, often a considerable part (> 20 %) constricted. Basidia 27.5–44 × 5.5–7.5 μm, narrowly clavate, 2- to 4-spored, with sterigmata up to 7.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama subregular, made up of hyphae with swollen cells up to 300 μm long and 25 μm broad. Pileitrama made up of swollen cells almost similar to those of hymenophoral trama, with orange intracellular pigment. Pileipellis an ixocutis or ixotrichodermium, made up of loosely entangled, ascending to erect, gelatinized, hyaline hyphae, 2.0–5.0 μm broad. Stipitipellis an ixocutis of loosely entangled, repent and ascending or almost erect, thin-walled, hyaline hyphae, 1.5–4.0 μm wide. Clamp-connections present.

Habitat — On the ground, scattered amongst litter in shaded places, August–September.

Collections examined. INDIA: Kerala State, Calicut University Campus, 6.VIII.1993, *Leelavathy F748* (L); ibid. 1.VII.1994, *Manimohan M600* (L); ibid. 4.VII.1994, *Manimohan M600b* (L); ibid. 8.VII.1994, *Manimohan 600c* (L); ibid. 3.VIII.1997, *Leelavathy F892b* (L); ibid. 18.VIII.1997, *Leelavathy F905* (L); ibid. 26.VIII.1997, *Leelavathy F 905d* (L); ibid. 1.IX.1997, *Leelavathy F 913* (L).

Hygrocybe insipida is characterized by small basidiomata with red, viscid pileus, yellow, viscid stipe and small, often constricted spores. There seem to be no essential differences with European *H. insipida*. Arnolds (1990) described the spores of *H. insipida* as (5.5–)6.0–9.5(–11.5) × 3.0–5.0(–6.5) μm, usually with a small proportion constricted. Boertmann (1995) measured (5.0–)6.0–7.5(–9.0) × 3.0–4.0(–5.0) μm. The pileipellis was described as an ixocutis to ixotrichodermium and the stipitipellis as an ixocutis, as is the case in our collections.

A closely related or identical species is *H. similis* (Petch) Pegler, described from Sri Lanka. Pegler (1986) described the spores as 6.5–9.0 × 3.5–5.0 μm, consequently slightly larger than in our collections. Besides, all spores are said to be constricted and the basidia are slightly larger (40–50 × 5.0–7.0 μm). Possibly *H. similis* is a synonym, in which case this name has priority over *H. insipida*. However, we did not check the type to confirm the observations by Pegler.

Another possible synonym is *H. minutula* (Peck) Murrill, described from North America. The macroscopic appearance and characters of pileipellis and stipitipellis are similar according to Hesler & Smith (1963), but the spores are reported to be larger: 7–10.3 × 4–5(–6) μm, in the type 8–10 × 4–5 μm.

12. **Hygrocybe lobatospora** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 13

Pileus 25 mm latus, convexus vel plano-convexus, primo depressus, postea perforatus, rufo-aurantius vel aurantius, viscidus, pellucido-striatus. Lamellae adnatae vel decurrentes, atro-aurantiae. Stipes 30 × 2.5 mm, aurantius. Odor nullus.

Sporae 7.5–9.5(–10.5) × 5.8–7.5 × 4.5–6.0 μm, applanatae, ellipsoideae vel obpyriformiae, constrictae. Basidia 37.5–50 × 7.5–9.0 μm, clavata, 4-sporigera. Cheilocystidia et pleurocystidia nulla. Trama hymenophoralis subregularis. Hyphae cuticulae pilei repentes 1.0–5.0 μm latae, gelatinosae. Hyphae fibulatae.

Holotypus: India, Kerala State, Wayanad District, Meppadi Forest, 29.XII.1997, *Leelavathy F943* (L).

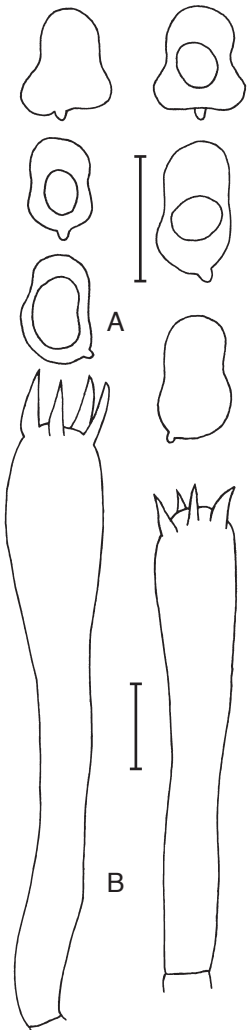

Fig. 13. *Hygrocybe lobatospora*. A. Spores; B. basidia. Scale bars: 10 μm.

Basidiomata medium-sized. Pileus c. 25 mm, convex to plano-convex, slightly depressed at centre, becoming perforate when mature, hygrophanous, bright orange-red (K. & W. 8A8) when moist, fading to orange (6A7–5A7) or light orange (5A4–5A5) on drying, viscid and translucently striate when moist, becoming dry and glabrous; margin straight, entire, becoming fissile. Lamellae adnate to subdecurrent, up to 4 mm wide, subdistant, with lamellulae, light orange to orange (5A5–5A6) with paler edge. Stipe c. 30 × 2.5 mm, cylindrical, slightly broader towards apex, fistulose, bright orange (5A7); surface dry, smooth. Context thin, almost translucent, light orange. Odour and taste indistinct.

Spores 7.5–9.5(–10.5) × 5.8–7.5 × 4.5–6.0 μm, distinctly flattened, in frontal view obpyriform with prominent median constriction, some appearing almost nodulose (Q = 1.25–1.4, Qav. = 1.3), in side-view ellipsoid-oblong (Q = 1.6–1.9, Qav. = 1.7), with one or two prominent guttules. Basidia 37.5–47.5(–50) × 7.5–8.5(–9.0) μm, clavate, 4-spored, with sterigmata up to 8.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama subregular, made up of subcylindrical and inflated thin-walled, hyaline cells up to 120 × 38 μm. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis an ixocutis of repent, thin-walled, hyaline hyphae, 1.0–5.0 μm broad. Clamp-connections present.

Habitat — On the ground, on forest floor, solitary, December.

Collection examined. INDIA: Kerala State, Wayanad District, Meppadi Forest, 29.XII.1997, *Leelavathy F943* (L, holotype).

The subregular hymenophoral trama and the adnate lamellae place *H. lobatospora* in the subgenus *Pseudohygrocybe*. In view of the weakly viscid pileus and the structure of the pileipellis, it is best placed in subsection

Coccineae. It is easily distinguished from other species treated in this paper by the strongly constricted spores which are broader to the adapical end in frontal view and often have a trilobate appearance. This type of spore is found in several other species, e. g. in *H. miniata* (Fr.: Fr.) Kumm. from the northern hemisphere and *H. rubrocarnosa* (G. Stev.) E. Horak from New Zealand (Horak, 1990), both of them different in having a fibrillose to squamulose pileus and spores that are not so strongly constricted.

The closest related species seems to be *H. mucronella* (Fr.) P. Karst. (= *H. reai* (Maire) J.E. Lange), a widespread taxon from the northern hemisphere, also with weakly viscid, reddish pileus. The spores in that species are also often constricted and broader in front-view, but the side-lobes are less developed (see e. g. drawings by Boertmann, 1995). Therefore the spores are not as broad as in our species. Spore size is given as (6–)7–8.5(–10) × (4–)5–6(–7) μm by Boertmann and (6.5–)7.0–9.5(–10.0) × 4.0–5.5(–6.0) μm by Arnolds (1990). Besides, *H. mucronella* is characterized by a bitter taste which is lacking in our collection. However, Kühner (1977) described a variety *mite* Kühner with a mild taste. This variety comes close to our material, but we think that the shape and size of spores are distinctive.

Subsection **Siccae** Boertm.

13. **Hygrocybe aurantia** Murrill — Fig. 14

Hygrophorus aurantius (Murrill) Murrill, Mycologia 4 (1912) 332; *Hygrocybe aurantia* Murrill, Mycologia 3 (1911)195.

Basidiomata small. Pileus 12–32 mm, convex to plano-convex, sometimes sligthly depressed at centre, strongly hygrophanous, when moist orange-red (8B8) to reddish orange (K. & W. 7A8), not striate, fading to pale red or almost yellowish white; surface smooth and dry; margin straight, becoming revolute, sometimes irregular, incised. Lamellae adnate to subdecurrent or decurrent, subdistant, up to 3.5 mm wide, with lamellulae, reddish orange to pastel-red (7A4–7A5), with entire, concolorous edge. Stipe 20–35 × 1.5–4 mm, subcylindrical, occasionally compressed, hollow, slightly wider at apex, reddish orange (7A8) with pinkish orange (7A5, 7A6) base at first, becoming pale red to almost yellowish white, smooth and dry. Context in pileus concolorous to surface, up to 1 mm thick. Odour and taste not distinctive.

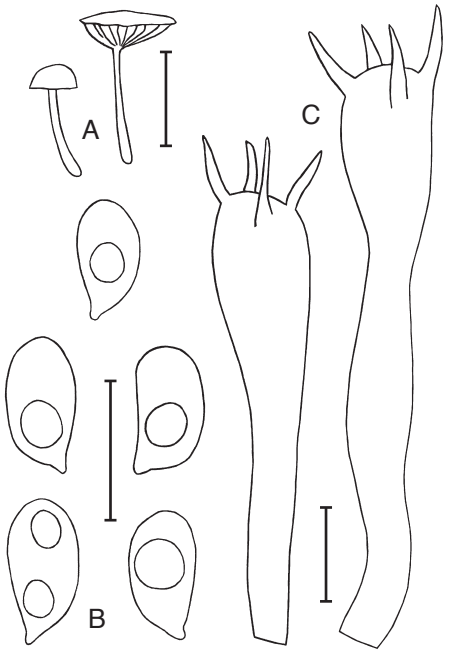

Fig. 14. *Hygrocybe aurantia*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

Spores 4.5–6.0(–6.5) × 4.0–5.0(–5.5) μm, Q = 1.1–1.3, Qav. = 1.1–1.2, globose to subglobose, some broadly ellipsoid, with a single large guttule. Basidia 31–48 × 6.0–7.5 μm, narrowly clavate, 4-spored. Lamella edge fertile or sometimes heterogeneous. Cheilocystidia absent or scattered, 45–65 × 4.5–10 μm, versiform, mostly cylindrical to constricted, thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama subregular, made up of thin-walled hyphae with short cells up to 150 μm long and 20 μm broad, with pale orange intracellular pigment. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a cutis of repent hyphae, 3.5–9.5 μm wide, with a few scattered, free-ending, undifferentiated hyphae, sometimes in small tufts and a little ascending. Stipitipellis similar to pileipellis. Clamp-connections present in all parts of the basidioma, including the base of basidia.

Habitat — On the ground, solitary to gregarious, June–September.

Collections examined. INDIA: Kerala State, Calicut University Campus, 24.VII.1992, *Leelavathy F718b* (L); ibid. 27.VI.1995, *Leelavathy F805* (L); ibid. 24.VII.1997, *Leelavathy F893* (L); ibid. 3.IX. 1997, *Leelavathy F914* (L).

This species is unique among the bright coloured *Hygrocybe*-species of our region in the small globose to subglobose spores. Furthermore, it is characterized by the small basidiomata with dry, smooth, orange-red pileus and adnate to decurrent lamellae. We could not find any significant difference between our material and *H. aurantia*, originally described from Jamaica (Murrill, 1911) and later also described from Japan (Hongo, 1952) and England (Reid, 1972). In some of our collections, some poorly differentiated cystidia-like cells were seen along the edge of the lamellae, but we do not regard this as a distinctive character.

A related taxon is *H. tricoloroides* Pegler, described from Sri Lanka (Pegler, 1986). However, the pileus of that species is often yellow at the centre with a sharply delimited red marginal zone. We did not observe this contrasting colour pattern in our collections.

14. **Hygrocybe aurantiocephala** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 15

Pileus 7–20 mm, plano-convexus, centro depressus, aurantius vel pallide aurantius, glaber, siccus, non striatus. Lamellae adnatae vel subdecurrentes, albidae vel pallide aurantiae. Stipes 20–28 × 1–2.5 mm, e pileo concolor. Odor nullus.

Sporae 7.0–9.0 × 4.0–5.0 μm, ellipsoideae-oblongae. Basidia 33–50 × 6.0–7.5 μm, clavata, 1-, 2-, vel 4-sporigera. Cheilocystidia et pleurocystidia nulla. Trama hymenophoralis subregularis. Pileipellis cutiformis, hyphae repentes, 2.0–5.0 μm latae, hyalinae. Hyphae omnes fibulatae.

Holotypus: India, Kerala State, Calicut University Campus, 11.VII.1997, *Leelavathy F887A* (L).

Basidiomata small. Pileus 7–20 mm, hemispherical to convex at first, then plano-convex with a central depression, not hygrophanous, bright orange to light orange (K. & W. 5A6, 5A7, 5A8), dry, smooth, not translucently striate; margin initially involute, becoming straight. Lamellae adnate to subdecurrent, subdistant, narrow, occasionally slightly intervenose near margin, intermixed with lamellulae, white to very pale orange (5A2), with entire, concolorous edge. Stipe 20–28 × 1–2.5 mm, cylindrical, slightly broader towards apex in some specimens, occasionally compressed, hollow, concolorous to pileus; surface dry, smooth. Context pale orange to whitish, thin. Odour and taste indistinct.

Spores 7.0–9.0 × 4.0–5.0 μm, Q = (1.4–)1.5–1.8, Qav. = 1.6–1.7, ellipsoid-oblong, some ellipsoid, not constricted. Basidia 33–50 × 6.0–7.5 μm, clavate, 1-, 2- or 4-spored,

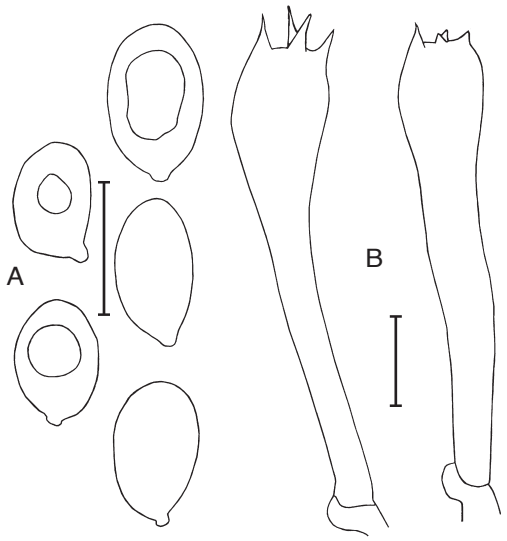

Fig. 15. *Hygrocybe aurantiocephala*. A. Spores; B. basidia. Scale bars: 10 μm.

with sterigmata up to 9.5 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama subregular, made up of hyphae with short, thin-walled, hyaline elements up to 150 × 10 μm. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a dry, poorly differentiated cutis of repent, thin-walled, hyaline hyphae, 2.0–5.0 μm wide. Stipitipellis a cutis with thin-walled, hyaline hyphae, 2.0–6.0 μm wide. Clamp-connections present in all parts of the basidioma.

Habitat — On the ground, gregarious to scattered, in the shade of trees, July–August.

Collections examined. INDIA: Kerala State, Calicut University Campus, 5.VIII.1992, *Leelavathy F724* (L); ibid. 29.VI.1994, *Manimohan M592b* (L); ibid. 11.VII.1997, *Leelavathy F887a* (L, holotype); ibid. 25.VII.1997, *Leelavathy F895* (L); ibid. 7.VIII.1997, *Leelavathy F887C* (L).

In view of the dry pileus without scales (pileipellis being a simple cutis), the adnate lamellae and the subregular trama, this species belongs to subgenus *Pseudohygrocybe* subsection *Siccae*. Macroscopically it is rather similar to *H. aurantia*, but it differs in the non-hygrophanous pileus and pale lamellae, contrasting with bright orange pileus and stipe. More importantly, the spores are much larger and not globose.

Among European species, *H. reidii* Kühner seems to be related, but that species has larger basidiomata with a characteristic, honey-like smell, slightly smaller spores and a slightly rugulose pileus, corresponding with a trichodermial pileipellis at the pileus centre (Kühner, 1976; Arnolds, 1990).

15. **Hygrocybe parvula** (Peck) Murrill — Fig. 16

Hygrophorus parvulus Peck, N.Y. State Mus. ann. Rept. 28 (1879) 50; *Hygrocybe parvula* (Peck) Murrill, N. Amer. Fl. 9 (1916) 378.

Basidiomata small, delicate. Pileus 10–30 mm, convex with a weak central depression, hygrophanous, bright yellow (K. & W. 3A5, 3A6, 3A7) at first, becoming pale yellow (3A2, 3A3), translucently striate when moist; surface dry, smooth and glabrous; margin straight. Lamellae decurrent, subdistant, up to 2 mm wide, with lamellulae of 1–3 lengths, pale yellow to white, with entire, concolorous edge. Stipe 20–25 × 2 mm, central, cylindrical, hollow, concolorous with the pileus; surface smooth. Context thin, pale yellow to white. Odour and taste indistinct.

Spores 5.0–8.0 × 2.5–4.0(–4.5) μm, Q = (1.4–)1.7–2.3(–2.7), Qav. = 1.7–2.0, ellipsoid-oblong to cylindrical, a variable proportion constricted in some collections, rarely irregular in shape. Basidia (25–)34–43 × 5.5–6.5 μm, clavate, 4-spored with sterigmata up to 5.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama subregular, made up of hyphae with short, cylindrical or swollen cells up to 65 × 3.0–24 μm. Pileitrama similar to hymenophoral trama; laticifers abundant. Pileipellis an undifferentiated cutis, made up of repent, thin-walled, hyaline hyphae 2.5–6.5 μm wide. Stipitipellis a cutis with thin-walled, hyaline hyphae, 2.0–7.0 μm wide. Clamp-connections present.

Habitat — On the ground, in deciduous forest, gregarious to scattered, June.

Collection examined. INDIA: Kerala State, Wayanad District, Muthanga Forest, 25.VI.1997, *Leelavathy F872* (L).

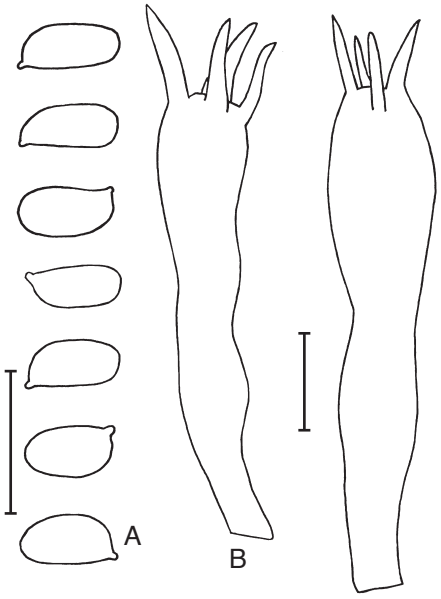

Fig. 16. *Hygrocybe parvula*. A. Spores; B. basidia. Scale bars: 10 μm.

The present collection agrees with the description of *Hygrophorus parvulus* by Hesler & Smith (1963) in almost all respects. In the Kerala collection, the stipe was uniformly yellow from base to apex without any reddish or salmon tinge, as is often the case in North America (Hesler & Smith, 1963). The cells of the hymenophoral trama are very broad in our collection, a feature noticed by Hesler & Smith (1963) on the type collection of *H. parvula*.

Pegler (1983) described *H. parvula* from Martinique with a distinctly umbonate pileus and an orange-yellow colour of the basidiomata. These features were absent in the Kerala collection. However, the constriction of spores, observed by Pegler (1983) in the Martinique collection, could be seen in our collection as well.

16. **Hygrocybe mexicana** Singer — Fig. 17

Hygrocybe mexicana Singer, Sydowia 12 (1958) 225; *Hygrophorus mexicanus* (Singer) Hesler & A.H. Sm., North Amer. Species of Hygrophorus (1963) 181.

Basidiomata small and delicate. Pileus 3–20 mm, convex with a small, shallow depression at the centre, hygrophanous, when moist initially scarlet-red (K. & W. 10A8), strongly orange (6A8, 5A8) translucently striate, becoming uniformly deep orange (5A8) in age; surface smooth and glabrous, slightly sticky when moist; margin straight, crenulate or wavy, becoming fissile. Lamellae adnate to subdecurrent, subdistant to rather crowded, up to 4 mm wide, without or with lamellulae of 1–2 lengths, concolorous to pileus, paler towards entire edge. Stipe 15–45 × 1–1.5 mm, central, cylindrical

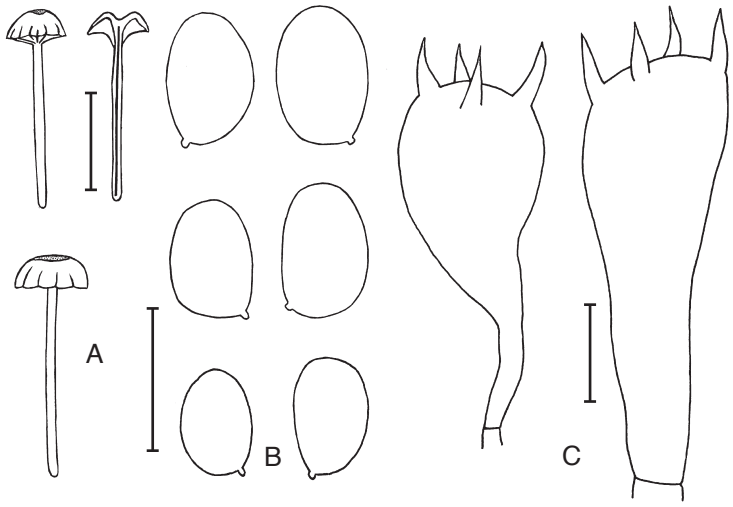

Fig. 17. *Hygrocybe mexicana*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

or broader towards apex, hollow, concolorous to pileus, translucent; surface dry, smooth and glabrous. Context in pileus concolorous to surface. Odour not distinctive.

Spores (6.5–)7.5–10.5 × (5.0–)5.5–7.5 μm, Q = (1.2–)1.3–1.6, Qav. = 1.3–1.4, ellipsoid with rather large apiculus. Basidia 25–38(–45) × 8.0–11 μm, clavate, 2- and 4-spored; with sterigmata up to 7.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama subregular to almost regular, made up of hyphae with small to medium-sized elements, 60–500 × 5.0–30 μm, with either round or tapering ends, thin-walled, with yellowish contents. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a poorly differentiated cutis of repent, 2.0–7.5 μm wide, thin-walled hyphae. Stipitipellis a cutis with hyphae similar to those of pileipellis. Clamp-connections observed in all parts of the basidioma but not frequent.

Habitat — On the ground, gregarious to scattered amongst decaying leaves under cashew trees, not abundant, June–July.

Collections examined. INDIA: Kerala State, Calicut University Campus, 22.VI.1983, *Leelavathy F962* (L); ibid 25.VI.1991, *Leelavathy F668* (L); ibid. 24.VII.1992, *Gouri G17d* (L); ibid. 22.VI.1994, *Manimohan M585* (L); ibid. 19.VI.1995, *Leelavathy F793* (L).

This fungus is characterized by tiny basidiomata with deep red colours, a dry, smooth pileus and adnate to subdecurrent lamellae. At first sight it is rather similar to *Hygrocybe cantharellus* (Schwein.) Murrill, a well-known species from Eurasia and North America. That species differs in somewhat larger sporocarps, a squamulose pileus and corresponding trichodermial pileipellis, and larger spores (see description of *H. cantharellus* below). In view of the combination of characters the described fungus does not belong to *Hygrocybe* subsection *Squamulosae*, but to subsection *Siccae*.

We could not find any decisive difference between our collections and *H. mexicana* described by Singer (1958) from Oaxaca, Mexico, on the basis of a single collection.

The same collection was described by Hesler & Smith (1963). The pileus of *H. mexicana* is scarlet-red, glabrous, umbilicate and about 10 mm broad, the lamellae are very broadly adnate to subdecurrent, the stipe is scarlet-red and about 21 × 1.5 mm and the spores measure 7–9.5 × 4–7 μm. Hesler & Smith (1963) pointed to the remarkably short basidia, measuring 25–35 × 7.2–9.2 μm. This agrees quite well with the collections from Kerala. Nevertheless some doubt remains about our identification since we did not study the type collection ourselves.

17. **Hygrocybe smaragdina** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 18, Plate 4

Pileus 4–17 mm latus, convexus, subumbilicatus, hygrophanus, in udo ad dicsum atrovirens, ad marginem flavovirens, pellucido-striatus, transeuns albidus, glaber, viscidulus. Lamellae adnatae vel subdecurrentes, albidae vel viriditinctae. Stipes 10–40 × 1–2 mm, ad apicem pallide viridis, ad basim luteus. Caro pilei concolor, tenuis. Odor nullus.

Sporae 6.0–11.0(–11.5) × 4.5–7.5 μm, ellipsoideae, raro strangulatae. Basidia 32–52 × 5.0–10 μm, clavata, 1-, 2- vel 4-sporigera. Cystidia nulla. Trama hymenophoralis regularis. Hyphae culticulae pilei repentes, 7.0–12 μm latae, pigmento pallido virido contentae. Hyphae fibulatae.

Holotypus: India, Kerala State, Calicut University Campus, 22.VI.1991, *Gouri 24* (L).

Basidiomata small. Pileus 4–17 mm, convex, often slightly depressed at centre, hygrophanous, when moist dark green (K. & W. 27F8) at centre, towards margin deep green (27D8), at margin yellowish green (30A8), translucently striate and slightly sticky, translucent, soon fading to white with some green tinge near centre, finally opaque and dry; surface smooth or becoming cracked at centre; margin straight, somewhat uneven. Lamellae adnate to subdecurrent, up to 4 mm wide, rather crowded to subdistant, with lamellulae of different lengths, whitish with a pale green tinge, with entire, occasionally wavy, concolorous lamella edge. Stipe 10–40 × 1–2 mm, central, cylindrical or slightly broader towards apex, hollow, pale green (27A3) or greenish white (27A2), yellowish towards base, translucent; surface faintly striate lengthwise, slightly sticky when moist. Context in pileus concolorous to surface, very brittle. Odour and taste absent.

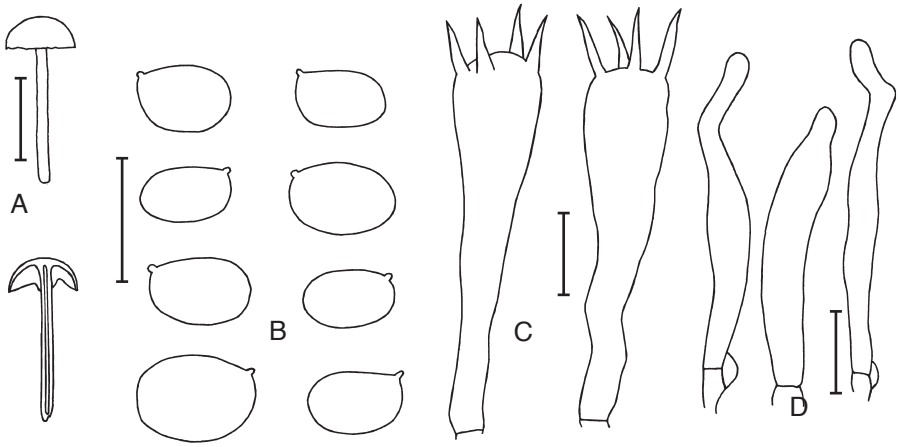

Fig. 18. *Hygrocybe smaragdina*. A. Basidiomata; B. spores; C. basidia; D. basidioles. Scale bars: resp. 1 cm, 10 μm.

Spores 6.0–11.0(–11.5) × 4.5–7.5 μm, Q = (1.2–)1.3–1.7(–1.8), Qav. = 1.4–1.5, very variable, broadly ellipsoid to ellipsoid-oblong, exceptionally slightly constricted. Basidia 32–52 × 5.0–10 μm, clavate, 1-, 2- and 4-spored intermixed, with sterigmata up to 8.0 μm long. Lamella edge heterogeneous, the fertile basidia being intermixed with few cylindrical to slightly ventricose-rostrate basidioles, 30–75 × 3.5–9.0 μm. Pleurocystidia absent, but basidioles scattered everywhere. Hymenophoral trama subregular to regular, made up of hyphae with cylindrical to strongly inflated elements, 12–600 μm long, mostly longer than 150 μm, 3.0–20(–40) μm wide, often with tapering ends; hyphae in mediostratum with a greenish intracellular pigment. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a cutis of radially arranged, repent, 7.0–12 μm wide, thin-walled hyphae, hyaline or with pale green contents. Stipitipellis a cutis with 3.0–8.0 μm wide, thin-walled hyphae, almost hyaline or very pale green. Clamp-connections present.

Habitat — On the ground, scattered, in open areas, June–August.

Collections examined. INDIA: Kerala State, Calicut University Campus, 22.VI.1991, *Gouri 24* (L, holotype); ibid. 25.VI.1991, *Leelavathy F669* (L); ibid. 17.VIII.1992, *Leelavathy F721* (L); ibid. 31.VIII.1995, *Manimohan M644b* (L); ibid. 3.VII.1997, *Leelavathy F900* (L).

Hygrocybe smaragdina is characterized by small basidiomata with a hemispherical to convex, green pileus, concolorous stipe and whitish, adnate to subdecurrent lamellae. The basidiomata are strongly hygrophanous. On drying the dark green colour is fading through light green to almost dirty white. The shallow depression at the centre of the pileus becomes cracked in some specimens, but this character is not constant. There is also not a clear-cut perforation. The context consists mainly of strongly inflated cells up to 40 μm broad, making the pileus quite brittle.

Though there is large variation in the size of spores, they cannot be called dimorphic as it is not possible to segregate them into two distinct groups. The variation in spore size can be explained by presence of 1-, 2- and 4-spored basidia in a single basidioma.

In some aspects *H. smaragdina* resembles *H. viridis* Capelari & Maziero from Brazil (Capelari & Maziero, 1988), whose spores and basidia are described as dimorphic. The two species differ in size of basidiomata which are consistently smaller in *H. viridis* and *H. viridis* lacks a conspicuous depression in the pileus. Other differences are the white colour of the lamellae, yellowish green pigmentation of the pileus and yellow colour at the base of the stipe in *H. smaragdina*.

Recently, Young & Wood (1997) described some green species of *Hygrocybe* from Australia. *Hygrocybe stevensoniae* May & A.E. Wood has basidiomata with similar colours and stature as our collections, but the pilei- and stipitipellis were described as an ixotrichodermium, quite different from *H. smaragdina*.

Subsection **Squamulosae** (Bat.) Singer

18. **Hygrocybe cantharellus** (Schwein.) Murrill — Fig. 19

Agaricus cantharellus Schwein., Schr. Nat. Ges. Leipzig 1 (1822) 88; *Hygrophorus cantharellus* (Schwein.) Fr., Epicr. Mycol (1838) 329; *Hygrocybe cantharellus* (Schwein.) Murrill, Mycologia 3 (1911) 196; *Camarophyllus cantharellus* (Schwein.) Murrill, N. Amer. Fl. 9 (1916) 388. — *Hygrocybe lepida* Arnolds, Persoonia 13 (1986) 139.

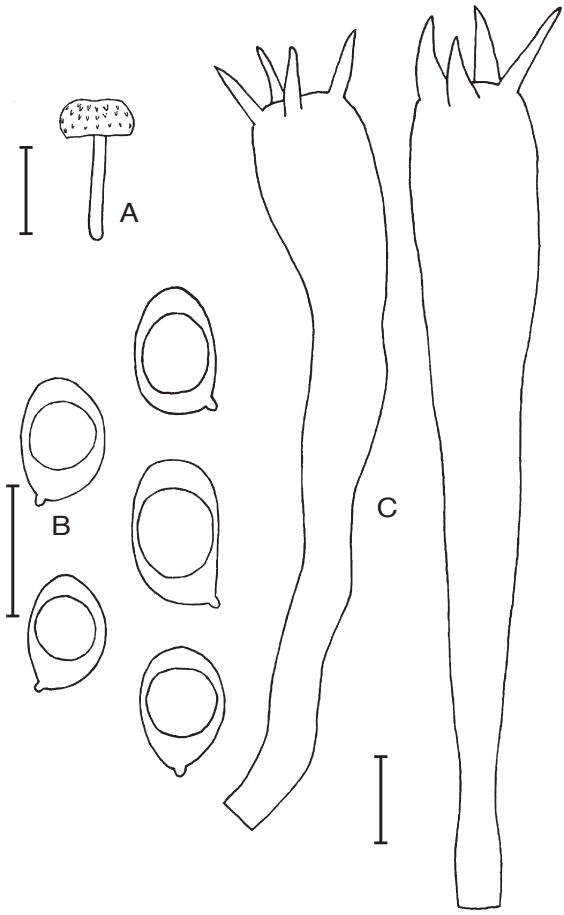

Fig. 19. *Hygrocybe cantharellus*. A. Basidioma; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

Basidiomata small. Pileus 8–14 mm, convex to hemispherical with a central depression, hygrophanus, when moist at first orange-red (K. & W. 8B8), becoming deep orange (6A8), not striate; surface fibrillose, squamose to squarrulose, in particular at centre, with scales concolorous to pileus; margin involute at first, becoming straight, entire. Lamellae adnate to subdecurrent or arcuate decurrent, subdistant, with lamellulae in 3 or 4 tiers, pale yellow to orange-white (4A3–5A2), with even, concolorous edge. Stipe 13–28 × 2–3 mm, cylindrical, equal, hollow, almost concolorous to pileus (6A7–5A8), at base paler (5A5), smooth. Context in pileus pale orange (5A3, 5A4), more yellowish towards lamellae, 1–1.5 mm thick. Odour and taste indistinct.

Spores 7.0–10.0(–10.5) × 5.0–6.0(–6.5) μm, Q = (1.3–)1.4–1.7(–1.8), Qav. = 1.5, ellipsoid to ellipsoid-oblong, not constricted. Basidia 48–60 × 6.0–7.5 μm, narrowly clavate, 4-spored with sterigmata up to 7.5 μm long. Lamella edge fertile; cheilocystidia

and pleurocystidia absent. Hymenophoral trama subregular, made up of hyphae with short cells, up to 150 × 21 μm; laticifers present. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a cutis of repent hyphae, in places with trichodermial tufts of ascending and erect hyphae, constricted at septa, with clavate, 12.5–17.5 μm wide terminal cells. Stipitipellis a cutis, made up of thin-walled, 2.0–10 μm wide hyphae with yellowish to reddish contents. Clamp-connections present.

Habitat — On the ground, scattered in small groups, September.

Collection examined. INDIA: Kerala State, Nilambur Teak Forests, 18.XII.1997, *Leelavathy F935* (L).

This collection agrees well with *H. cantharellus*, a species widely distributed in North America and Europe, although the spores in our collection are a little shorter. The spore size in *H. cantharellus* was reported by various authors as follows: (7.0–) 8.0–11.5(–12.5) × (4.5–)5.0–7.0(–7.5) μm (Arnolds, 1990); (7.5–)9–10.5(–11.5) × (5–)5.5–7(–9) μm (Boertmann, 1995); 7–12 × 4–6 μm (Hesler & Smith, 1963). Other characteristic features of *H. cantharellus* are the slender basidiomata with orange-red, depressed, finely squamulose pileus and pale, decurrent lamallae. These characters are also found in the Kerala collection.

Hygrocybe miniata (Fr.: Fr.) Kumm., another closely related species, differs in a number of characters: 1) the spores are smaller and constricted in frontal view (Arnolds, 1990; Boertman, 1995); 2) the lamellae are never decurrent; 3) the lamellae have orange, red, or pink colours.

19. **Hygrocybe brunneosquamulosa** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 20

Pileus 10–65 mm latus, convexus, primo subumbilicatus, postea perforatus, squamulosus, olivaceo-brunneus. Lamellae adnatae, citrinae vel olivaceo-brunneae. Stipes 15–90 × 2–8 mm, luteus. Odor nullus. Exsiccatae nigrescentes.

Sporae 7.0–10.5(–11.0) × 4.5–6.5(–7.5) μm, ellipsoideae, ovoideae vel subamygdaliformiae. Basidia 37–69 × 7.5–12 μm, cylindrico-clavata, pigmento luteo-brunneo contenta, 4- vel 2-sporigera. Cystidia nulla. Trama hymenophoralis subregularis. Pileipellis trichodermiformis. Hyphae cuticulae pilei 2.0–15 μm latae, fasciculatae, pigmento luteo-brunneo contentae. Hyphae omnes fibulatae.

Holotypus: India, Kerala State, Calicut University Campus, 7.VIII.1997, *Leelavathy F901* (L).

Basidiomata small to medium-sized. Pileus 10–65 mm, convex or hemispherical with a central depression which in mature specimens becomes perforated and continuous with the stipe lumen, on yellowish brown (K. & W. 5E 8) background olive brown (4E8) to dark brown (5F8) squamulose with squamules larger and erect at the disc, smaller and appressed towards margin, often partly evanescent, exposing the yellow context; margin involute and entire in the beginning, becoming straight, fissile and irregularly lobate. Lamellae adnate with decurrent tooth, up to 10 mm wide, subdistant, with lamellulae of 1–4 lengths, occasionally forked near margin, bright yellow (4A5), greyish brown (5D3) or olive-brown (4D4, 4D5) with entire, concolorous edge. Stipe 15–90 × 2–8 mm, central, almost cylindrical, often irregularly compressed, hollow, light yellow (3A5), amber-yellow (4B6) or egg-yellow (4B8), faintly striate lengthwise, glabrous, sometimes darkening on bruising. Odour absent. Entire basidiomata becoming blackish on drying; lamellae occasionally retaining yellow colour.

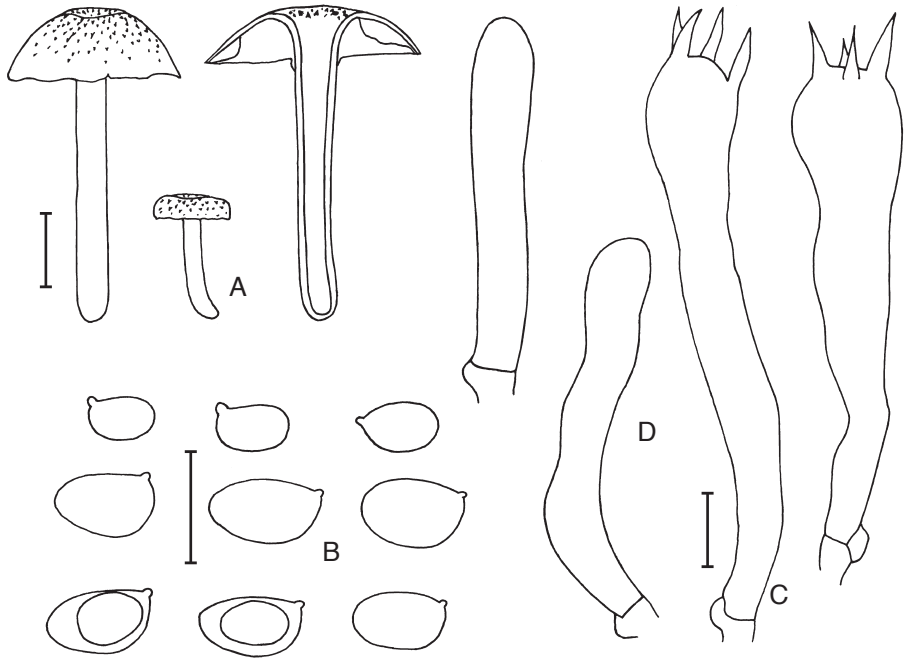

Fig. 20. *Hygrocybe brunneosquamulosa*. A. Basidiomata; B. spores; C. basidia; D. basidioles. Scale bars: resp. 1 cm, 10 μm.

Spores 7.0–10.5(–11.0) × 4.5–6.5(–7.5) μm, Q = (1.3–)1.4–1.7, Qav. = 1.45–1.6, ellipsoid to ellipsoid-oblong, ovoid or subamygdaliform, with rather large apiculus. Basidia 37–69 × 7.5–12 μm, narrowly clavate, 4-spored or rarely 2-spored, frequently with yellowish brown intracellular pigment and a somewhat refractive, easily collapsing wall and with sterigmata up to 7.0 μm long. Lamella edge fertile or occasionally heterogeneous to almost sterile by presence of basidioles. Basidioles 30–48 × 4.5–7.5 μm, narrowly clavate or irregularly constricted, thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama subregular, made up of hyphae with long chains of short to medium-sized, thin-walled, elements, 30–125 × 2.0–47.5 μm, with pale yellowish to hyaline content. Hyphae of the pileitrama similar to those of hymenophoral trama, occasionally inflated up to 25 μm. Pileipellis a cutis, made up of repent, 2.0–15 μm wide, thin-walled hyphae, with yellowish brown intracellular pigment, disrupted by trichodermial tufts of semi-erect hyphae with 7.5–15 μm wide, cylindrical terminal cells. Stipitipellis a cutis with thin-walled hyphae, 1.5–10 μm wide, with yellowish brown intracellular pigment. Clamp-connections present in all parts of the basidioma.

Habitat — On the ground, solitary, scattered or caespitose, amongst decaying leaf litter, June–August.

Collections examined. INDIA: Kerala State, Calicut University Campus, 23.VI.1994, *Manimohan M587b* (L); ibid. 30.VI.1994, *Manimohan M587c* (L); ibid. 11.VII.1997, *Leelavathy F886d* (L); ibid. 22.VII.1997, *Leelavathy F886e* (L); ibid. 7.VIII.1997, *Leelavathy F901* (L, holotype).

Hygrocybe brunneosquamulosa is easily distinguished in the field by the often subcaespitose basidiomata with a dark yellow-brown, squamulose pileus, having a central depression or perforation, and the bright yellow to olive-yellow stipe and lamellae. After heavy rains, the pileus surface in some of the mature basidiomata appears to be dull yellow due to partial removal of the dark brown scales.

In some collections, the stipe surface and lamellae become slightly darker olive-brown on handling. On drying the pileus and stipe in most basidiomata become very dark, almost black, while the lamellae of some specimens retain the yellow colour, though paler than in fresh condition. This darkening of exsiccata, together with the presence of abundant dark yellow-brown pigment in all parts of the basidiomata, is a striking and unique character of this species.

In the Calicut University Campus, *H. brunneosquamulosa* has been collected mainly from two different locations year after year. Those from the first location are mostly squatty in habit with a short stipe, thickened towards the apex. The specimens from the second location are taller, with a longer, cylindrical stipe and the colour of stipe is brighter yellow than on the first location. All collections are almost identical in microscopic characters, except that in some collections some pyriform spores are present in addition to normal spores. Though *H. brunneosquamulosa* is a locally common species, it is often overlooked because of the dull pileus colour, which makes it difficult to distinguish it from the background of decaying litter.

Hygrocybe caespitosa Murrill, described from North America, seems to be closely related to *H. brunneosquamulosa*. It also has a squatty appearance, a pileus with darker scales and it often grows caespitose (Hesler & Smith, 1963: 165). It differs mainly in the paler yellowish pileus without olivaceous tones that does not become perforated nor blackish on drying. In addition, the terminal cells of hyphae of the pileipellis in *H. caespitosa* are enlarged to clavate, ovoid or ellipsoid, and clamp-connections in that species are rare or absent on the hyphae of both pileipellis and hymenophoral trama (Hesler & Smith, 1963).

SUBGENUS **CUPHOPHYLLUS** Donk

Section **Cuphophyllus** Donk

20. **Hygrocybe nivosa** (Berk. & Broome) Leelav., Manim. & Arnolds, *comb. nov.*

Basionym: *Hygrophorus nivosus* Berk. & Broome, J. Linn. Soc. Bot. 11 (1871) 563.

Synonym: *Camarophyllus nivosus* (Berk. & Broome) Pegler, Kew Bull., Addit. Ser. 12 (1986) 53.

20a. **Hygrocybe nivosa** var. **nivosa** — Fig. 21

Basidiomata small and delicate. Pileus 5–18 mm, convex to plano-convex with a slight depression at the centre, sometimes becoming depressed when mature, purely white, smooth, when moist with a translucent appearance, translucently striate; margin involute. Lamellae subdecurrent to decurrent, narrow, subdistant to distant, with lamellulae of different lengths, intervenose, white. Stipe 15–25 × 1–2(–3) mm, cylindrical or

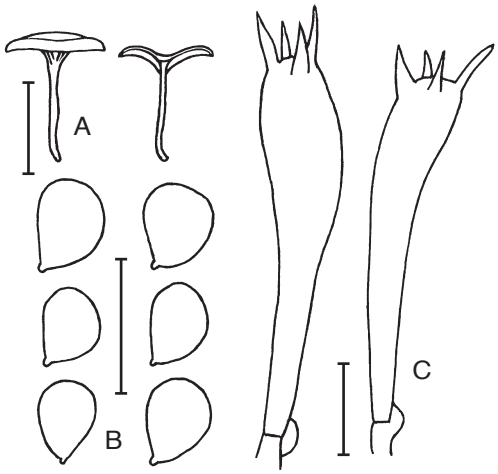

Fig. 21. *Hygrocybe nivosa* var. *nivosa*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

slightly thicker towards apex, occasionally compressed, flexuous or straight, hollow; white, smooth. Context very thin, translucent, white. Odour and taste indistinct. Basidiomata darkening on drying.

Spores 6.0–7.0 × 3.5–4.5(–5.0) μm, Q = 1.3–1.7, Qav. = 1.5, ovoid to lacrymoid. Basidia 31–37 × 5.5–6.0 μm, clavate, 4-spored, with sterigmata up to 5.5 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama interwoven, made up of hyphae 6.0–15.5 μm broad, with short cells less than 150 μm long. Pileitrama interwoven, made up of hyphae 1.5–8.0 μm wide, thin-walled, hyaline. Pileipellis an undifferentiated cutis of narrow, thin-walled, mostly repent, sometimes ascending hyphae. Stipitipellis a cutis with hyphae 1.5–8.0 μm wide, thin-walled, hyaline. Clamp-connections present in entire basidioma.

Habitat — On the ground, gregarious to scattered, in large numbers in the shade of trees, mostly in the woods, July.

Collections examined. INDIA: Kerala State, Calicut University Campus, 14.VIII.1992, *Gouri G31* (L); ibid. 30.VII.1997, *Leelavathy F899* (L); ibid. 25.VIII.1997, *Leelavathy F907* (L).

The described collections were identified as *H. nivosa*, originally described from Sri Lanka (Berkeley & Broome, 1871), in spite of some minor differences. The lamellae of our collections are intervenose, a feature not mentioned by Pegler (1986). However, this character may have been neglected by him since it is a widespread feature in the subgenus *Cuphophyllus* (Arnolds, 1990; Boertmann, 1995) and of little diagnostic value. The size of spores in our collections is similar to that described by Pegler (1986) as 5.5–7 × 4.7 μm.

Hygrocybe nivosa shows some similarity to *H. virginea* (Wulfen: Fr.) Orton & Watling, a species widely distributed in the northern hemisphere. However, the basidiomata of the former species are smaller, more delicate with an almost translucent pileus; the spores are much smaller and the basidia shorter. The spore size is rather similar in *Camarophyllus angustifolius* Murrill, originally described from New Jersey, USA (Murrill, 1916). However, that species has much larger basidiomata with a fleshy, non-striate pileus.

20b. **Hygrocybe nivosa** var. **pallidolutea** Leelav., Manim. & Arnolds, *var. nov.* — Fig. 22

A typo differt: basidiomata majis robustae, ad disco luteae.

Holotypus: India, Kerala State, Calicut University Campus, 4.VII.1997, *Leelavathy F889* (L).

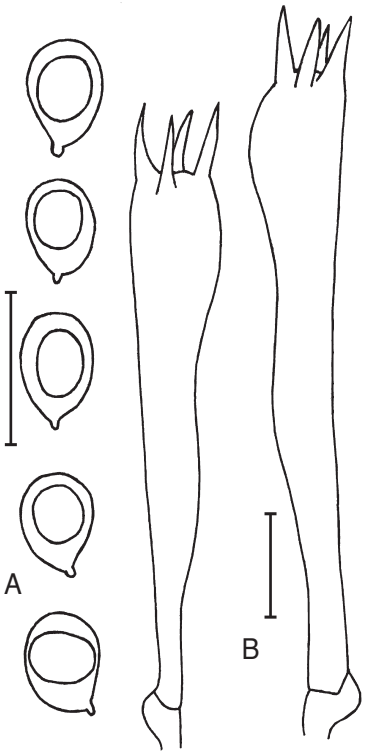

Fig. 22. *Hygrocybe nivosa* var. *pallidolutea*. A. Spores; B. basidia. Scale bars: 10 μm.

Basidiomata omphalinoid, small to medium-sized. Pileus 15–45 mm, convex to plano-convex with depressed centre, orange white (K. & W. 5A2) to pale yellow (4A4) at centre and almost white elsewhere, smooth, glabrous, slightly sticky, translucently striate; margin involute at first, becoming straight. Lamellae decurrent, up to 4 mm wide, distant to subdistant, with lamellulae, intervenose, white, with entire concolorous edge. Stipe 25–35 × 3–4 mm, subcylindrical, slightly broader towards apex, stuffed, smooth, white. Context white, up to 1 mm thick in pileus. Odour and taste indistinct.

Spores 5.5–6.5(–7.0) × 4.0–4.5(–5.0) μm, Q = 1.2–1.5, Qav. = 1.3–1.4, broadly ellipsoid to ellipsoid or ovoid. Basidia 40–50 × 6.0–7.5 μm, narrowly clavate, 4-spored, with sterigmata up to 5.5 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama interwoven, made up of hyphae 5.0–10.5 μm broad. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a cutis of narrow hyphae, 2.0–4.5 μm broad, slightly gelatinized, thin-walled, hyaline, without differentiated terminal cells. Stipitipellis similar to pileipellis. Clamp-connections observed in all parts of the basidioma.

Habitat — On the ground, in the shade of shrubs, solitary, July.

Collection examined. INDIA: Kerala State, Calicut University Campus, Botanical Garden, 4.VII.1997, *Leelavathy F889* (L, holotype).

This taxon differs from *H. nivosa*, as described here, by slightly larger and stouter basidiomata and by the pileus centre being not purely white. However, it may fit within the variation of this species. According to Pegler (1986), the pileus of *H. nivosa* measures 10–30 mm and the stipe 15–40 × 2–5 mm. Spore size and shape are in good accordance with this species. For the time being, it is considered as a more robust and stronger coloured variety of *H. nivosa*. More collections are needed to study the constancy of these characters.

21. **Hygrocybe keralensis** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 23

Pileus 45–70 mm latus, convexus vel plano-convexus, aurantius, adpresso-fibrillosus, transeuns glaber. Lamellae decurrentes, aurantiae vel pallide aurantiae. Stipes 30–70 × 15–18 mm, pileo concolor. Odor subaromaticus.

Sporae 9.5–12.5(–13.0) × 4.5–6.5(–7.0) μm, ellipsoideae-oblongae, ovoido-oblongae vel cylindricae, frequenter strangulatae. Basidia 62–80 × 9.0–10 μm, cylindrico-clavata, 2- vel 4-sporigera. Cheilocystidia et pleurocystidia nulla. Trama hymenophoralis irregularis. Hyphae cuticulae pilei repentes, 4.5–12.5 μm latus; raro cutis pilei trichodermialis efformata. Hyphae raro fibulatae.

Holotypus: India, Kerala State, Muthanga Forests, 20.VII.1998, *Leelavathy F972* (L).

Basidiomata medium-sized to large, robust. Pileus 45–70 mm, convex to planoconvex, margin becoming revolute, bright orange to brownish orange (K. & W. 5A6, 5A7, 5A8, 5B8, 5C8), surface adpressed fibrillose in places, becoming smooth and glabrous; margin involute at first, becoming crenate to wavy. Lamellae decurrent, up to 3.5 mm broad, subdistant, with lamellulae, sometimes forked near margin, not intervenose; almost concolorous to pileus or paler (5A5, 5A3), with entire concolorous edge. Stipe 30–70 × 5–18 mm, central, subcylindrical, tapering towards base, solid, pale orange (5A3–5A4), smooth. Context in pileus up to 4 mm thick, brittle, concolorous to surface or paler, in stipe white in the middle, pale orange near surface. Odour distinctive, pleasant; taste not distinctive.

Spores 9.5–12.5(–13.0) × 4.5–6.5 (–7.0) μm, Q = 1.7–2.5, Qav. = 1.85–2.1, ellipsoid-oblong, ovoid-oblong or cylindrical, with or without a central constriction. Basidia 62–80 × 9.0–10 μm, narrowly clavate, 2- or 4-spored, with sterigmata up to 9.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama interwoven, made up of cylindrical and inflated hyphae, 4.5–33.5 μm wide; subhymenium almost pseudoparenchymatous. Pileitrama made up of mostly inflated cells, 4.5–40 μm broad, thin-walled, hyaline. Pileipellis a cutis, trichodermial in places, made up of thin-walled, hyaline hyphae, 4.5–12.5 μm broad, without differentiated terminal cells. Stipitipellis a cutis of thin-walled, almost hyaline hyphae, 1.0–5.0 μm wide. Clamp-connections rare.

Habitat — On the ground, solitary or scattered, November.

Collections examined. INDIA: Kerala State, Wayanad District, Muthanga Forests, 20.XII.1997, *Leelavathy F940* (L); ibid. 20.VII.1998, *Leelavathy F972* (L, holotype).

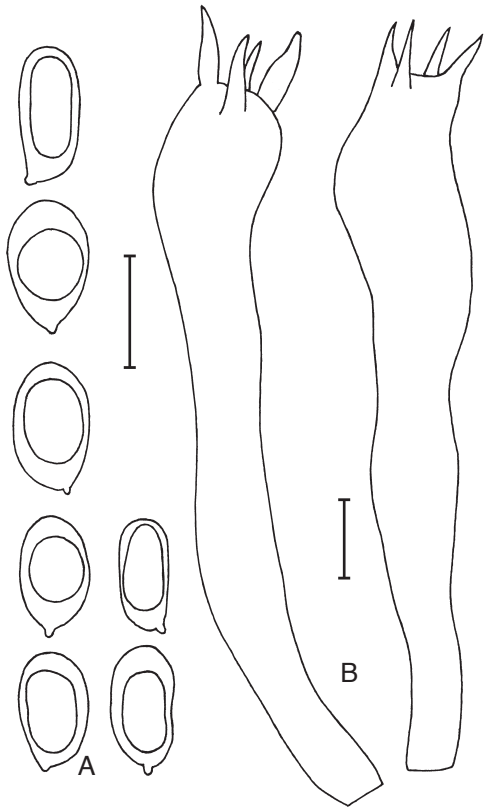

Fig. 23. *Hygrocybe keralensis*. A. Spores; B. basidia. Scale bars: 10 μm.

The appearance of *Hygrocybe keralensis* is rather similar to *H. pratensis* (Pers.: Fr.) Murrill var. *pratensis*, a widespread taxon in the northern hemisphere (Arnolds, 1990; Boertmann, 1995; Hesler & Smith, 1963). It shares the robust habit, decurrent lamellae and orange colours. However, the orange colours of *H. keralensis* are brighter and more yellowish than the brownish orange colours of *H. pratensis*. *Hygrocybe keralensis* can immediately be distinguished from the latter species by the much larger spores. Spore size and shape in *H. keralensis* are remarkably variable, always with a large proportion of constricted spores. A similar variability has been described in *Cuphophyllus* for some European collections of the white *H. virginea* (Wulfen: Fr.) Orton & Watling with mixed 4- and 2-spored basidia (Arnolds, 1974). The North American *Hygrophorus niveicolor* (Murrill) A.H. Sm. & Hesler, also with white basidiomata, has even larger spores than *H. keralensis*.

22. **Hygrocybe pratensis** (Pers.: Fr.) Murrill — Fig. 24

Agaricus pratensis Pers., Syn. Meth. Fung. (1801) 304; *Agaricus pratensis* Pers.: Fr., Syst. Mycol.1 (1821) 99; *Hygrophorus pratensis* (Pers.: Fr.) Fr., Epicr. Myc. (1838) 326; *Camarophyllus pratensis* (Pers.: Fr.) P. Kumm., Führ. Pilzk. (1871) 117; *Hygrocybe pratensis* (Pers.: Fr.) Murrill, Mycologia 6 (1914) 2; *Cuphophyllus pratensis* (Pers.: Fr.) Bon, Doc. Mycol. 14 (56) (1984) 10.

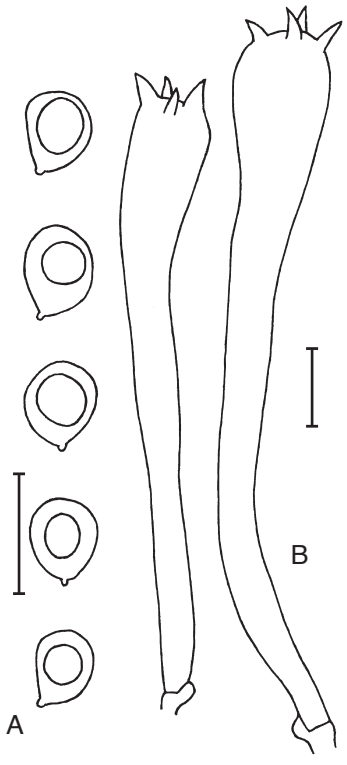

Fig. 24. *Hygrocybe pratensis*. A. Spores; B. basidia. Scale bars: 10 μm.

Basidiomata medium-sized to large, robust. Pileus 22–82 mm, convex to plano-convex, rarely subumbonate or shallowly depressed, deep orange or brownish orange (K. & W. 6B8, 6A6) at first, becoming light orange (6A4) or pale orange (6A3) in age, not striate; surface smooth; margin involute, becoming straight, occasionally revolute when mature. Lamellae subdecurrent to decurrent, subdistant, with lamellulae and some interveining, orange (6A7) to pale orange (6A3) or orange-white (5A2) when young, becoming almost yellowish white in age, with entire, concolorous edge. Stipe 20–50 × 2–15 mm, subcylindrical, tapering towards base, hollow; pale orange (6A3) or orange white (6A2); surface smooth. Context in pileus thick, almost concolorous to the surface or paler. Odour and taste indistinct. Spore print white.

Spores 6.0–7.5 × 5.0–6.0 μm, Q = 1.1–1.3, Qav. = 1.2, subglobose to ovoid, sometimes almost lacrymoid. Basidia 48–65 × 6.0–6.5 μm, narrowly clavate, 2- and 4-spored, with sterigmata up to 5.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama interwoven, made up of thin-walled, hyaline, closely septate hyphae, 3.0–18.0 μm broad. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis

a cutis of narrow, repent hyphae, 3.5–6.5 μm broad. Stipitipellis a cutis, made up of thin-walled, hyaline or pale yellowish hyphae, 1.0–4.0 μm wide. Clamp-connections present in entire basidioma.

Habitat — On the ground, scattered on the forest floor, November.

Collection examined. INDIA: Kerala State, Wayanad District, Muthanga forest, 20.XI.1997, *Leelavathy F941* (L).

The present collection agrees well with descriptions of *H. pratensis* (Pers.: Fr.) Murrill var. *pratensis* from other countries. In Europe, *H. pratensis* is usually found in pastures (Arnolds, 1990), but in North America it is widespread in forests (Hesler & Smith, 1963). The habitat in Kerala is also forest. This species has also been reported from Japan and South America.

In Kerala *H. pratensis* may be confused at first sight with two other species: *H. keralensis* and *H. gregaria*. For a comparison, see the descriptions of these species.

23. **Hygrocybe gregaria** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 25, Plate 5

Pileus 15–55 mm latus, convexus vel applanatus, depresses, ad discum rufoaurantius, ad marginem luteoaurantius, siccus, glaber, estriatus. Lamellae adnatae vel decurrentes, luteae. Stipes 15–35 × 4–10 mm, pallide aurantius. Odor nullus.

Sporae 5.0–6.5 × 4.0–5.0 μm, late ellipsoideae vel ovoideae. Basidia 35–62 × 5.5–6.5 μm, cylindrico-clavata, 4-sporigera. Cheilocystidia et pleurocystidia nulla. Trama hymenophoralis irregularis. Hyphae cuticulae pilei repentes, 3.5–7.0 μm latae, hyalinae. Hyphae fibulatae.

Holotypus: India, Kerala State, Calicut University Campus, 8.XII. 1979, *Leelavathy F250* (L).

Basidiomata small to medium-sized, robust. Pileus 15–55 mm, initially convex, becoming applanate and soon depressed at centre, at first deep orange (K. & W. 6A8) to reddish orange (7A8) at centre, yellowish orange towards margin, then paler yellowish orange, smooth, glabrous, not striate; surface initially lubricous, becoming dry; margin initially involute and entire, becoming undulate when mature. Lamellae adnate, subdecurrent or decurrent, subdistant, with lamellulae in 2 or 3 tiers, some forked near margin, up to 4 mm wide, yellow (4A6, 4A5), with entire concolorous edge. Stipe 15–35 × 4–10 mm, cylindrical or slightly narrower towards base, occasionally compressed, solid at first, becoming stuffed, light orange (5A4), smooth, glabrous. Context in pileus concolorous with surface, up to 3 mm thick near centre. Odour and taste indistinct.

Spores 5.0–6.5 × 4.0–5.0 μm, Q = (1.1–)1.2–1.4(–1.5), Qav. = 1.3, broadly ellipsoid to ellipsoid or ovoid. Basidia 35–62 × 5.5–6.5 μm, narrowly clavate, mostly 4-spored, rarely 1- or 2-spored, with sterigmata up to 7.5 μm long.

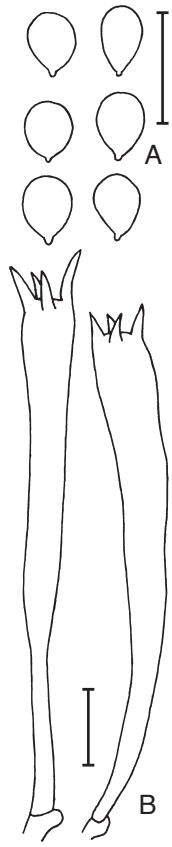

Fig. 25. *Hygrocybe gregaria*. A. Spores; B. basidia. Scale bars: 10 μm.

Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama irregular, made up of closely interwoven, thin-walled, hyaline hyphae, 3.0–8.0 μm wide, with elements up to 150 μm long. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a cutis of repent, thin-walled, hyaline hyphae, 3.5–7.0 μm broad. Stipitipellis a cutis with thin-walled, hyaline hyphae, 1.0–5.0 μm wide. Clamp-connections present in all tissues of basidioma.

Habitat — Gregarious to scattered among litter on the ground, in the woods, July–December.

Collections examined. INDIA: Kerala State, Calicut University Campus, 8.XII.1979, *Leelavathy F250* (L, holotype); ibid. 27.VII.1991, *Gouri G3C*; Nilambur Teak Forest; 8.VII.1994, *Manimohan M610* (L).

Hygrocybe gregaria is locally quite common and a large number of specimens could be collected year after year in the same area at Calicut University Campus. The basidiomata persist without decaying for a long time and therefore old, faded specimens could be collected along with young ones at the same time.

This species shows superficial resemblance to *H. pratensis* but differs in 1) bright orange pileus without brown tones; 2) slightly smaller spores; 3) narrower hyphae in the trama; and 4) the often gregarious occurrence. In view of the spore size and the structure of the trama it might be placed in section *Microsporae*, although the colours of basidiomata in that section are usually darker and duller. No description could be found in the literature fitting this fungus. Hence it is described as a new species.

Section **Microsporae** (A.H. Sm. & Hesler) Leelav. Manim. & Arnolds, *comb. nov.*

Basionym: *Hygrophorus* sect. *Microspori* A.H. Sm. & Hesler, Lloydia 5 (1942) 7.

24. **Hygrocybe globispora** Leelav., Manim. & Arnolds, *spec. nov.* — Fig. 26, Plate 6

Pileus 15–37 mm latus, convexus vel plano-convexus, depressus, rufo-brunneus, siccus, pellucido-striatus. Lamellae decurrentes, griseo-brunneae. Stipes 20–35 × 2–3 mm, griseo-brunneus. Odor nullus.

Sporae 4.5–6.0 × 4.0–5.5 μm, subglobosae vel globosae. Basidia 43–74 × 5.5–6.5 μm, cylindrico-clavata, 2- vel 4-sporigera. Cheilocystidia et pleurocystidia nulla. Trama hymenophoralis irregularis. Hyphae cuticulae pilei repentes, 1.0–6.0 μm latae; ad discum cutis pilei trichodermialis efformata. Fibulae nullae.

Holotypus: India, Kerala State, Calicut University Campus, 30.VII.1997, *Leelavathy F898* (L).

Basidiomata small to medium-sized. Pileus 15–37 mm, convex to plano-convex becoming depressed, hygrophanous, when moist initially dark reddish brown (K. & W. 8F8–8F7) at centre and slightly paler red-brown (8E8) towards margin, becoming red-brown ('Mahogany') (8E7) at centre and paler (8D8) towards margin on drying, translucently striate when moist, surface appearing smooth and dry, but finely squamulose under a lens; margin involute at first, remaining so or becoming straight or revolute, initially entire, becoming fissile. Lamellae decurrent, subdistant, with lamellulae, up to 3 mm wide, grey-brown to greyish red (8D4–8C4), with entire, concolorous edge. Stipe 20–35 × 2–3 mm, subcylindrical, slightly broader towards apex, occasionally compressed, straight or often curved, hollow; grey-brown to greyish red (8D4–8C4),

surface smooth, dry. Context pale grey-brown, up to 2 mm thick. Odour not distinctive.

Spores 4.5–6.0 × 4.0–5.5 μm, Q = 1.0–1.2, Qav. = 1.1, subglobose to globose, with refractive contents giving a punctate appearance. Basidia 43–74 × 5.5–6.5 μm, narrowly clavate, 2- to 4-spored; sterigmata up to 4.5 μm long. Lamella edge fertile. Cheilocystidia and pleurocystidia absent. Hymenophoral trama interwoven, made up of narrow hyphae, 3.0–8.0 μm broad, thin-walled, hyaline, inamyloid. Hyphae of pileitrama similar to those of hymenophoral trama. Pileipellis a cutis with transitions to a trichodermium at centre, made up of thin-walled hyphae, 1.0–6.0 μm wide, frequently with faint, spiral encrustations. Stipitipellis a cutis, made up of thin-walled, hyaline hyphae, 1.0–4.0 μm wide. Clamp-connections absent.

Habitat — Scattered or in small groups among leaf litter on the ground, June–August.

Collections examined. INDIA: Kerala State, Calicut University Campus, 21.VII.1979, *Leelavathy F252* (L); ibid. 13.VIII. 1992, *Leelavathy F752* (L); ibid. 27.VI.1994, *Manimohan M598* (L); ibid. 30.VI.1997, *Leelavathy F898* (L, holotype); ibid. 17.VI.1998, *Leelavathy F968* (L).

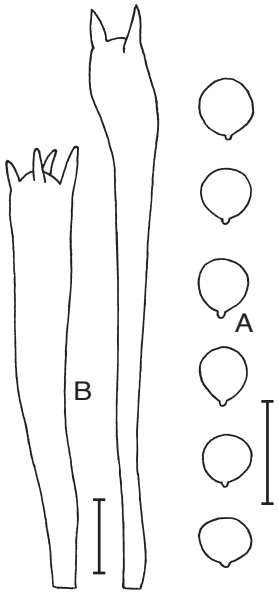

Fig. 26. *Hygrocybe globispora*. A. Spores; B. basidia. Scale bars: 10 μm.

Hygrocybe globispora is characterized by small to medium-sized basidiomata with reddish brown pileus, concolorous or paler stipe, and decurrent lamellae; intricately interwoven hymenophoral trama of narrow hyphae; small, globose to subglobose spores; long basidia; absence of clamp-connections and a trichodermial pileipellis at centre of pileus with some of the hyphae having encrustations on the wall.

This species belongs to subsection *Microspori* of *Hygrophorus* section *Camarophyllopsis* according to the classification by Hesler & Smith (1963). This subsection unites dull-coloured species with decurrent lamellae and irregular hymenophoral trama with remarkably narrow hyphae (usually 3.0–6.0 μm), small spores (up to 7.0 μm long) and absence of clamp-connections. We recognize this group of species as a separate section, *Microsporae*, of *Hygrocybe* subgenus *Cuphophyllus*.

Hygrocybe globispora is related to *Camarophyllus singularis* (Höhn.) Singer, described from Java and Sri Lanka (von Höhnel, 1908; Pegler, 1986), with similar spore size and trama structure. However, that species has a more brownish grey pileus, contrasting with whitish lamellae and stipe. *Hygrophorus umbrinus* Dennis from Trinidad and Martinique is also rather similar but differs in white lamellae and stipe, as well as subregular mediostratum in the hymenophoral trama (Dennis, 1953; Hesler & Smith, 1963).

SPECIES OF UNCERTAIN TAXONOMIC POSITION

25. **Hygrocybe deceptiva** (A.H. Sm. & Hesler) Leelav., Manim. & Arnolds, *comb. nov*. — Fig. 27

Basionym: *Hygrophorus deceptivus* A.H. Sm. & Hesler, Loydia 5 (1942) 45.
Synonym: *Armillariella deceptiva* (A.H. Sm. & Hesler) Singer, Lilloa 22 (1951) 216.

Basidiomata small. Pileus 5–15 mm, convex to applanate, hygrophanous, when moist greyish brown (K. & W. 6E3) at centre, paler towards the margin, translucently striate, on drying fading to pinkish buff and finally pale grey; surface silky smooth; margin straight to plane, becoming fissile. Lamellae broadly adnate to subdecurrent, moderately crowded, up to 2 mm wide, with lamellulae of different lengths, dull white to pale grey with entire, concolorous edge. Stipe 10–15 × 1–1.5 mm, central, cylindrical, stuffed or hollow, greyish brown (6D3), paler than the pileus, glabrous and dry. Context pale grey. Taste absent; odour slightly unpleasant.

Spores 3.5–5.0 × 3.0–4.5 μm, Q = 1.0–1.25, Qav. = 1.1–1.15, globose, subglobose or broadly ellipsoid, with a prominent oil drop. Basidia 15–21 × 3.0–6.0 μm, clavate, 4-spored with sterigmata up to 5.0 μm long. Lamella edge fertile; cheilocystidia and pleurocystidia absent. Hymenophoral trama subregular, made up of thin-walled hyphae with cylindrical to swollen cells, up to 24 μm wide and less than 200 μm long, with brown contents. Hyphae of pileitrama similar to those of hymenophoral trama, up to 18 μm broad. Pileipellis an undifferentiated cutis, made up of 3.0–8.0 μm broad, thin-walled hyphae with brown contents and in addition minutely encrusted pigment. Stipitipellis a cutis with 2.0–8.0 μm wide, thin-walled, hyaline or pale brown hyphae. Clamp-connections absent.

Habitat — On the ground, scattered to gregarious, in the shade of trees along roadside, July–August.

Collections examined. INDIA: Kerala State, Calicut University Campus, 9.VIII.1984, *Leelavathy F262* (L); ibid. 23.VII.1987, *Leelavathy F894* (L); ibid. 3.VII.1995, *Leelavathy F811* (L); ibid. 25.VII.1997, *Leelavathy F896* (L). — USA: North Carolina, 30.VII.1939, *Hesler 10247* (TENN, Holotype).

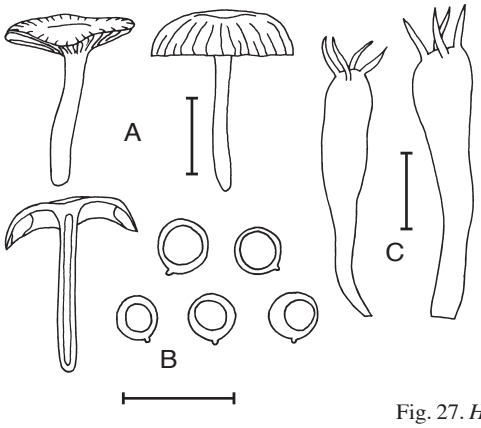

Fig. 27. *Hygrocybe deceptiva*. A. Basidiomata; B. spores; C. basidia. Scale bars: resp. 1 cm, 10 μm.

Except for the small size of the basidiomata, the Kerala collections agree well with the description of *H. deceptivus* by Hesler & Smith (1963) from North America. Our study of the type collection confirmed the similarity.

Hygrocybe deceptiva is well-characterized by the combination of small, brownish basidiomata with smooth pileus and the very small, subglobose spores. The species is difficult to place within any of the sections of *Hygrocybe*. It has many characters in

common with species of section *Microsporae*, e.g. the dull-coloured basidiomata with decurrent lamellae, small spores and absence of clamp-connections. However, the structure of the hymenophoral trama in *H. deceptiva* seems to be fundamentally different with parallel instead of interwoven hyphae, with swollen cells instead of narrow, cylindrical elements. The position within the genus *Hygrocybe* is not entirely sure in view of the short basidia and the presence of some encrusted pigment in the pileipellis. The latter character was not mentioned by Hesler & Smith (1963).

Most characters of *H. deceptiva* also fit in with the genus *Camarophyllopsis*, but representatives of that genus have a pileipellis made up of erect, more or less swollen elements.

ACKNOWLEDGEMENTS

We thank the curators of the herbaria of Royal Botanic Gardens Kew (K), New York State Museum (NYS), University of Michigan (MICH) and University of Tennessee (TENN) for the loan of type and authentic collections. Thanks are also due to Dr. K.A. Thomas, who brought several collections to our attention.

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