STUDIES IN TROPICAL AFRICAN *LACTARIUS* SPECIES. 4. SPECIES DESCRIBED BY P. HENNINGS AND M. BEELI

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Type studies and illustrated descriptions are given of the tropical African *Lactarius* (Russulaceae) species described by Hennings (1902) and Beeli (1927–1936) which were not included in Heim's monographs (1938, 1955). *L. badius* Verbeken *nom. nov.*, *L. russulaeformis* (Beeli) Verbeken *comb. nov.* and *L. kalospermus* (Beeli) Verbeken & Walleyn *comb. nov.* are proposed. *L. congolensis* Beeli is shown to be an earlier name for both *L. craterelloides* R. Heim & Gooss.-Font. and *L. unicolor* Gooss.-Font. & R. Heim which are identical, *L. russulaeformis* is an earlier name for *L. pellicularis* R. Heim, *L. annulatoangustifolius* (Beeli) Buyck is an earlier name for *L. pandani* R. Heim, and both *L. pandani* f. *intermedius* and *L. pandani* f. *pallidus* are concluded to be synonyms of *L. pelliculatus* (Beeli) Buyck. *L. zenkeri* (Henn.) Singer is neotypified and *L. goossensiae* Beeli and *Lactarius sesemotani* (Beeli) Buyck are lectotypified. Finally, *Lentinus clitocyboides* Henn. is not based on *Lactarius*, as suggested by Pegler (1983), but on *Russula*.

Keywords. Agaricales, Russulaceae, taxonomy, typification.

INTRODUCTION

Except for some more recently described species, knowledge of the genus *Lactarius* Pers. in tropical Africa is almost completely based on the monographs of Heim (1938, Madagascar; 1955a, Zaire; 1955b, Zaire and former French colonies in Western Africa). However, before Heim some other authors described several species that have not received much attention. Eichelbaum (1906) and Walker (1931) mentioned some vernacular names of *Lactarius*-like fungi without giving full descriptions, whereas Bresadola (in De Wildeman, 1914) described *Lactarius velutinus*, although this species is referable to *Russula* (Buyck, 1988). Beeli (1928) described two species in the genus and Hennings (1902) created *Lactariopsis* in which he described the annulate *Lactariopsis zenkeri*, later placed in *Lactarius* by Singer (1942). The presence in the tropics of veiled *Lactarius* species, species fructifying on rotten wood and species with a very restricted presence of milk, together with his lack of field experience in the tropics, apparently confused Beeli (1927a, 1927b, 1928, 1933, 1936) as he described *Lactarius* specimens in the genera *Armillaria* (1), *Omphalia* (1), *Clitocybe* (1), *Russula* (2) and *Laccaria* (1).

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The previous paper in the *Studies in tropical African Lactarius species* series was: Verbeken, A. (1995). Studies in tropical African *Lactarius* species. 3. *Lactarius melanogalus* R. Heim and related species. *Persoonia* (in press).

The present study surveys the *Lactarius* species described by Hennings and Beeli and proposes the necessary nomenclatural changes. The species are treated in chronological order.

MATERIALS AND METHODS

The present study was based on collections from BR, E, FH, K, LY, PC and the private herbaria of Bart Buyck ('hb. Buyck', Kaprijke, Belgium) and Daniel Thoen ('hb. Thoen', Arlon, Belgium).

Microscopic features were studied in Congo red in ammonia (after a short pretreatment in 10% potassium hydroxide solution). Spore ornamentation was described and illustrated as observed in Melzer's reagent. Terminology of cystidial elements is according to Buyck (1991). Terminology concerning the different types of pileipellis and stipitipellis is according to Bon (1980). Line drawings were made with the aid of a drawing tube at magnifications of 6700× for spores, 3200× for individual elements and 1100× for sections and surface views. Stippling indicates refractive contents in cystidia and lactifers.

Spores were measured in side view in Melzer's reagent, excluding the ornamentation. The measurements are given as [AVa−2*SD]–*AVa*–*AVb*–[AVb+2*SD] in which AVa = lowest mean value for the measured collections, AVb = highest mean value and SD = standard deviation. In cases where the minimum value is less than the lowest mean value minus two times the standard deviation, the minimum value is given in parentheses. Similarly, where the maximum value is greater than the highest mean value plus two times the standard deviation, the maximum value is given in parentheses. Q stands for 'quotient length/width' and is given as MINQa–*Qa*–*Qb*–MAXQb in which Qa and Qb stand respectively for the lowest and the highest mean quotient for the measured specimens. Twenty or thirty spores per collection were measured (n = number of spores measured).

Colour codes are from Kornerup & Wanscher (1978). L+l/cm means number of lamellae (L) and lamellulae (l) per cm at pileus mid-radius. Names of phytogeographical regions and vegetation types are according to White (1983).

TAXONOMIC RESULTS

1. Lactarius zenkeri (Henn.) Singer in Ann. Mycol. 40: 111 (1942). **Figs 1, 2.**
Basionym: *Lactariopsis zenkeri* Henn. in Bot. Jahrb. Syst. 30: 51 (1902). Type: *Alexander* 16 (neo., designated here, E).
Misappl.: *Lactarius zenkeri* (Henn.) Singer sensu Singer (1946), = *L. annulato-angustifolius*.

Pileus 3–6cm diam., first convex, then applanate and infundibuliform; margin thin, incurved, then straight; velum submembranaceous, whitish or pruinose, rupturing towards margin and leaving small whitish flocks; pellis smooth and striate towards margin, yellowish brown to pale ochraceous, darker in the centre, paler towards

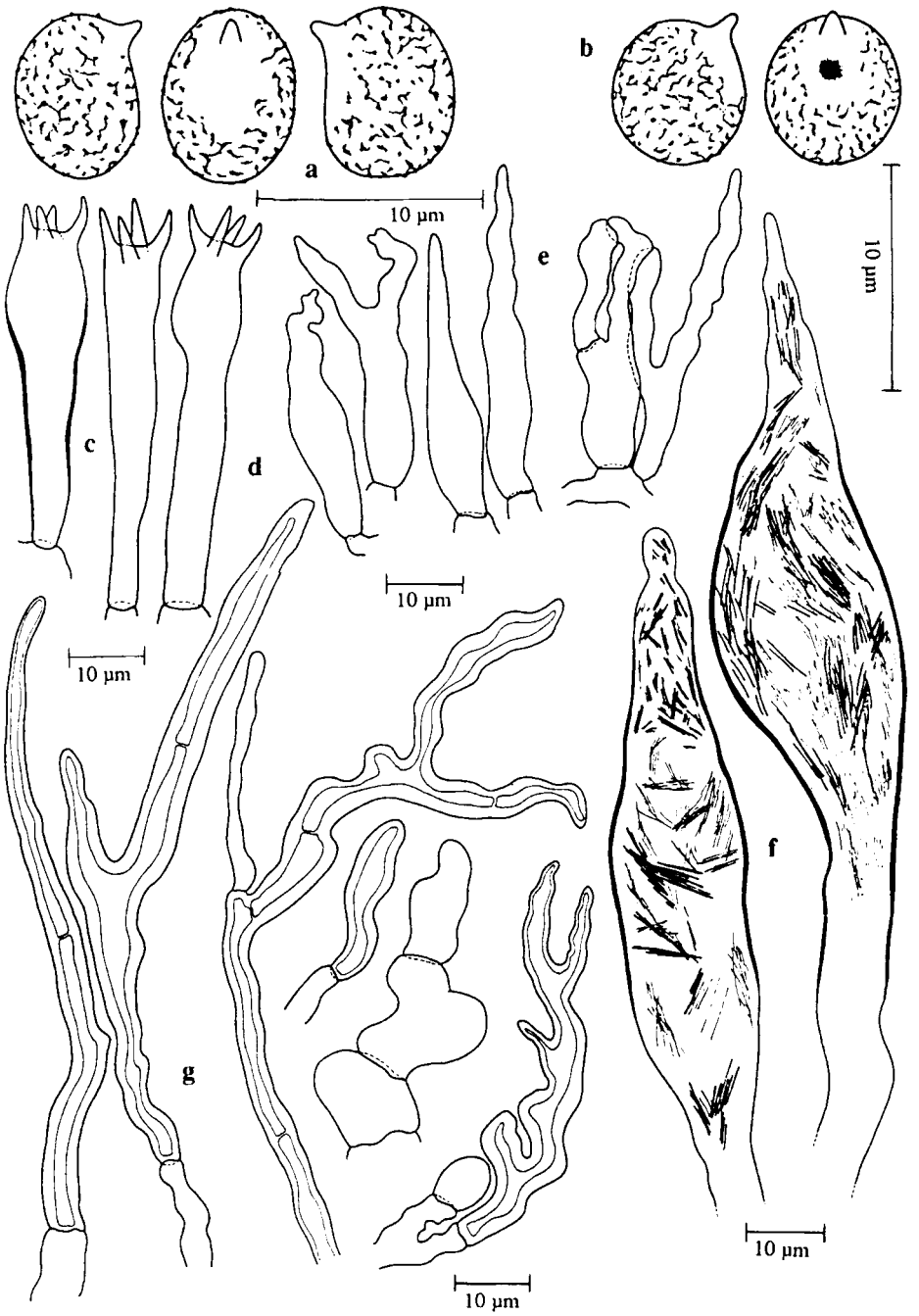

FIG. 1. *Lactarius zenkeri*. a, spores (*Alexander* 16); b, spores (*Thoen* 7885); c, basidia (*Alexander* 16); d, basidia (*Thoen* 7885); e, cheilocystidia (*Alexander* 16); f, pseudopleurocystidia (*Alexander* 16); g, elements of the pileipellis (*Alexander* 16).

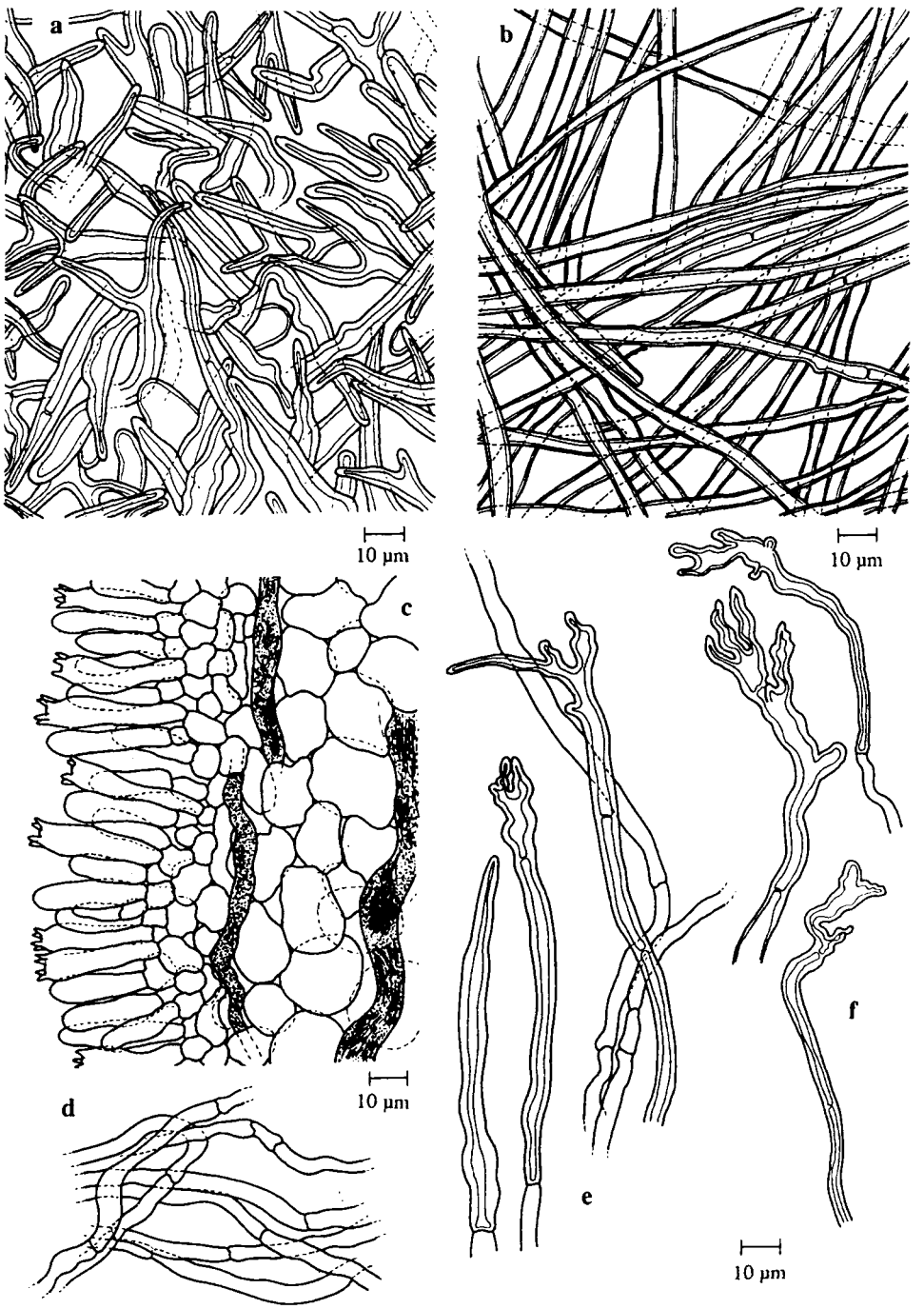

FIG. 2. *Lactarius zenkeri* (*Alexander* 16). a, surface view of the stipitipellis, halfway up the stipe; b, surface view of the stipitipellis, at the base; c, hymenium, subhymenium and lamella-trama; d, elements of the annulus, middle part; e, elements of the annulus, upper part; f,

margin. *Stipe* 2–4 × 0.5–2cm, cylindric to subclavate, ochraceous, dry, smooth, paler at the apex, solid, sometimes becoming fistulous. *Velum partiale* closed in the young basidiomes (velangiocarp development), then forming an annulus near the apex of the stipe, membranaceous, thin, whitish. *Lamellae* adnate to decurrent, crowded, narrow to medium broad (1–3mm), waxy, ochraceous, paler than pileus; edge entire, concolorous. *Context* firm, white, not changing; smell not remarkable. *Latex* quite abundant, white; taste unknown. *Spore deposit* white.

Spores ellipsoid, sometimes subglobose, 6.4–*7.1–7.8*–8.6 × 4.9–*5.5–6.3*–6.9µm (Q = 1.09–*1.19–1.29*–1.45; *n* = 100); ornamentation amyloid, low, composed of irregular sized and shaped warts; warts less than 0.2µm high, isolated, connected by lines or aligned, sometimes forming a faint, partial reticulum; plage mostly not amyloid, sometimes with a centrally, slightly amyloid spot. *Basidia* 30–40(–50) × 9–10µm, cylindric to slightly clavate, 4-spored, rarely 2-spored. *Macropleurocystidia* absent. *Pseudopleurocystidia* rather scarce, 15–25µm diam. in the upper part, clavate to conical, tapering upwards, mucronate, very emergent, with needle-like to granular content. *Lamella-edge* sterile; cheilocystidia 15–40 × 5–10µm, narrowly utriform to conical, in some specimens tortuous and often dichotomously branched. *Hymenophoral trama* heteromerous, composed of sphaerocytes and numerous lactiferous hyphae; narrow, hyaline hyphae becoming more abundant near the edge. *Pileipellis* two-layered; elements of suprapellis very thick-walled (1–2µm), 50–110 × 4–8µm, long, slender, hair-shaped and tapering upwards, septate and sometimes branching; subpellis composed of irregular to rounded cells, 5–15(–20)µm, with some elements of the upper layer penetrating. *Stipitipellis* two-layered; elements of suprapellis 50–120 × 7–10µm, very often branched, thick-walled (2–3µm); with numerous lactifers. *Annulus* composed of narrow hyphae that are thin-walled, hyaline, septate and sometimes branched, (2–)3–5(–7)µm diam. *Clamp-connections* absent.

Distribution and ecology. Terrestrial or on rotten wood in rainforest and semi-evergreen forest. Known from Cameroon and Senegal.

Specimens examined. CAMEROON. South Western Prov., near Mundema, Korup National Park, transect P16–27, 100–150ft alt., i 1988, *I.J. Alexander* 16 (neotypus, E); ibid., transect P23, i 1989, *Watling* 21471; ibid., P23, *Watling* 21480; ibid., P18, v 1989, *Watling* 22185; ibid., trail to transect P, *Watling* 22186; ibid., P18, iii 1991, *Watling* 23135; ibid., P15, *Watling* 23136; ibid., transect before P, *Watling* 23137; ibid., P13, in huge troop, *Watling* 23139; ibid., P21, *Watling* 25312 (all at E). SENEGAL. Basse Casamance Prov., forêt des Bayotes, under *Afzelia africana*, 10m alt., ix 1987, legit A. Ba, *Thoen* 7885 (hb. Thoen).

Observations

1. The macroscopical description is based on the description of Hennings (1902) and the field-notes of Watling. The microscopical description is based on *Alexander* 16, *Watling* 23135 and *Thoen* 7885.

2. The original type material (*Zenker* 2230 et icon.) at Berlin is lost (Horak, 1968) and no isotype material could be traced at BR, PC, K, E, FH or S. Singer (in Singer et al., 1983) refers to 'the type' of *L. zenkeri* designating a collection from Liberia which he described as *L. zenkeri*, although this exsiccatum clearly represents *L. annulatoangustifolius* (q.v.), a species that differs especially in having more bright orange colours and larger spores with a more pronounced ornamentation. To avoid further misunderstanding of the identity of *L. zenkeri*, *Alexander* 16 (E) is proposed as the neotype for this species. This collection was made in Korup National Park (Cameroon) where several other fungi that were described by Hennings from Cameroon occur (Watling, pers. comm.).

2. Lactarius badius Verbeken, **nom. nov. Fig. 3.**
Basionym: *Clitocybe castanea* Beeli in Bull. Soc. Roy. Bot. Belgique 60: 79 (1927), non *Lactarius castaneus* W.F. Chiu in Lloydia 8: 34 (1945). Type: *Goossens-Fontana* 404 et icon. (holo. BR).

Pileus 8cm diam., firm, plano-convex, slightly depressed in centre; margin slightly incurved; pellis smooth, glabrous, chestnut-brown. *Stipe* 10 × 1.4–2cm, clavate, glabrous, smooth, whitish, with reddish brown shade, firm, solid. *Lamellae* adnate, unequal with lamellulae, moderately narrow (4mm), whitish. *Context* firm, rather thin in pileus (2mm), white. *Latex* not observed. *Spore deposit* not observed.

Spores ellipsoid to elongate, 5.9–*6.5*–7.0(–8.0) × 4.0–*4.7*–5.6µm (Q = 1.23–*1.40*–1.60, *n* = 20); ornamentation amyloid, composed of irregularly shaped and sized warts; warts sometimes aligned or forming ridges, never forming a complete reticulum, <0.3µm high; plage not amyloid. *Basidia* 32–40 × 6–8µm, cylindric to subclavate, 4-spored. *Macropleurocystidia* scarce, 40–55 × 6–9µm, clavate or fusiform, rounded on top or tapering upwards, rising deep in the subhymenium; content granular to needle-like. *Pseudopleurocystidia* rather abundant, 6–9µm diam., often emergent, clavate or fusiform, rounded on top or tapering upwards; content granular or needle-like. *Lamella-edge* fertile. *Hymenophoral trama* heteromerous, composed of sphaerocytes and lactifers. *Pileipellis* a trichoderm; ascending terminal elements 10–30 × 4–6µm, cylindric to fusiform, tapering upwards; content yellowish brown. *Stipitipellis* composed of interwoven, long and slender hyphae that are 3–6µm diam., thin-walled, sometimes branched; content locally yellowish brown. *Clamp-connections* absent.

Ethnomycological notes. Eaten by the local population. *Vernacular name.* Nsense (Gombe, Zaire).

Distribution and ecology. Known only from the type locality, in swamp forest in Zaire.

Specimens examined. ZAIRE. Equateur Prov., Bangala, valley of the Motima, iii 1924, *Goossens-Fontana* 404 et icon. (holotypus, BR).

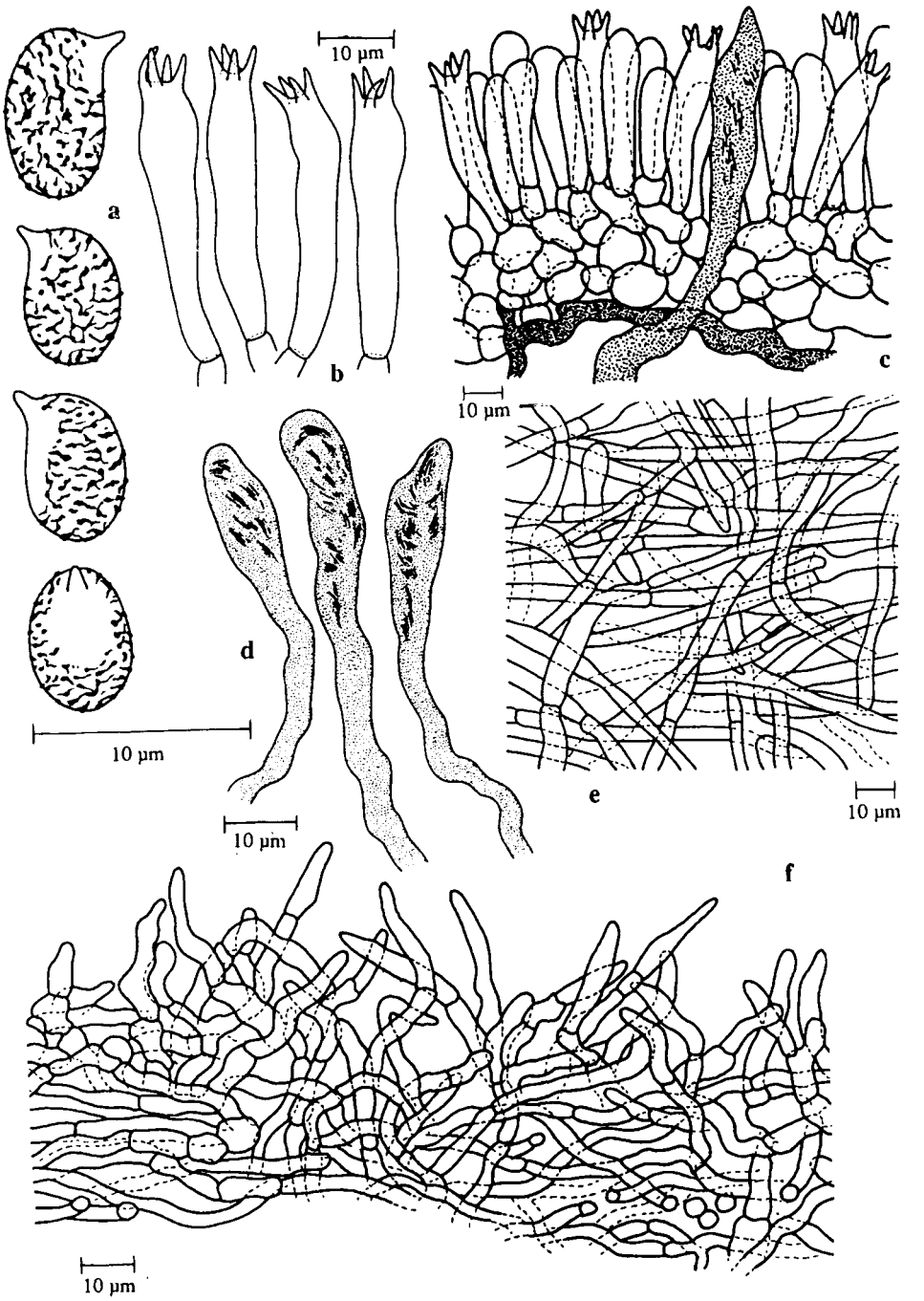

FIG. 3. *Lactarius badius* (*Goossens-Fontana* 404). a, spores; b, basidia; c, hymenium and subhymenium; d, pseudopleurocystidia; e, surface view of the stipe, halfway up the stipe; f, section through the pileipellis, halfway along the radius.

Observations

1. The macroscopical description is based on Beeli (1927b) and on the watercolour of Goossens-Fontana. The microscopical description is based on *Goossens-Fontana* 404.

2. The type specimen consists of one basidiome in good condition.

3. The species is particularly characterized by the very small and elongate spores.

4. It is remarkable that macrocystidia and pseudocystidia have the same size and shape. The macrocystidia arise rather deep in the subhymenium, but there is a septum and they are not connected with a lactifer, unlike the pseudocystidia. Is this common presence a sign of transition from one into another?

5. Beeli (1933) stated that *Clitocybe isolata* Beeli (1927b: 79) seemed identical with his *C. castanea* but the remains of the type specimen of that species do not belong to the Russulaceae.

3. Lactarius pelliculatus (Beeli) Buyck in Bull. Jard. Bot. Belg. 59: 242 (1989). **Figs 4, 5.**

Basionym: *Armillaria pelliculata* Beeli in Bull. Soc. Roy. Bot. Belgique 59: 111 (1927). Type: *Goossens-Fontana* 546 (holo. BR).

Syn.: *Lactarius pandani* R. Heim f. *intermedius* R. Heim in Bull. Jard. Bot. État 25: 20 (1955) ['var.' *intermedius* in Fl. Iconogr. Champ. Congo 4: 87 (1955), nom. nud.]. Type: *Goossens-Fontana* 3036 et icon. (holo. BR).

Lactarius pandani f. *pallidus* R. Heim in Bull. Jard. Bot. État 25: 17 (1955). Type: *Goossens-Fontana* 807 et icon. (holo. BR).

Coloured illustrations are given by Heim (1955a: pl. 13, figs 2ab, 3; 1955b: pl. 1, figs 2–4).

Pileus 4–8cm diam., fleshy, firm, convex, then applanate, infundibuliform when older; margin thin, striate, first incurved, then straight; velum viscous and with radial, gelatinized veins when wet, greyish and pellicular when dry, leaving fine, whitish flocks towards the margin; pellis dehiscent near the margin, slightly gelatinized, ferruginous red, yellowish ochre to pale yellowish. *Stipe* 3–5 × 0.9–1.4cm, cylindric, short, tapering downwards, smooth, with some longitudinal veins near the apex, ochraceous, paler than the pileus, fleshy, solid, then fistulous. *Velum partiale* closed in the young basidiomes (velangiocarp development), then forming an annulus near the apex of the stipe, membranaceous, thin, whitish. *Lamellae* adnate to decurrent, rather broad, rather thick, brittle, with some anastomosing veins near the margin, sometimes dichotomously branched, pale ochraceous. *Context* white to pale yellowish; taste acrid; smell pepper-like. *Latex* scarce, transparent, watery, not present in older basidiomes; taste acrid to very acrid. *Spore deposit* white.

Spores ellipsoid, 7.1–*8.0–8.6*–9.1(–9.9) × 5.8–*6.4–7.0*–7.5(–8.3)µm (Q = 1.13–

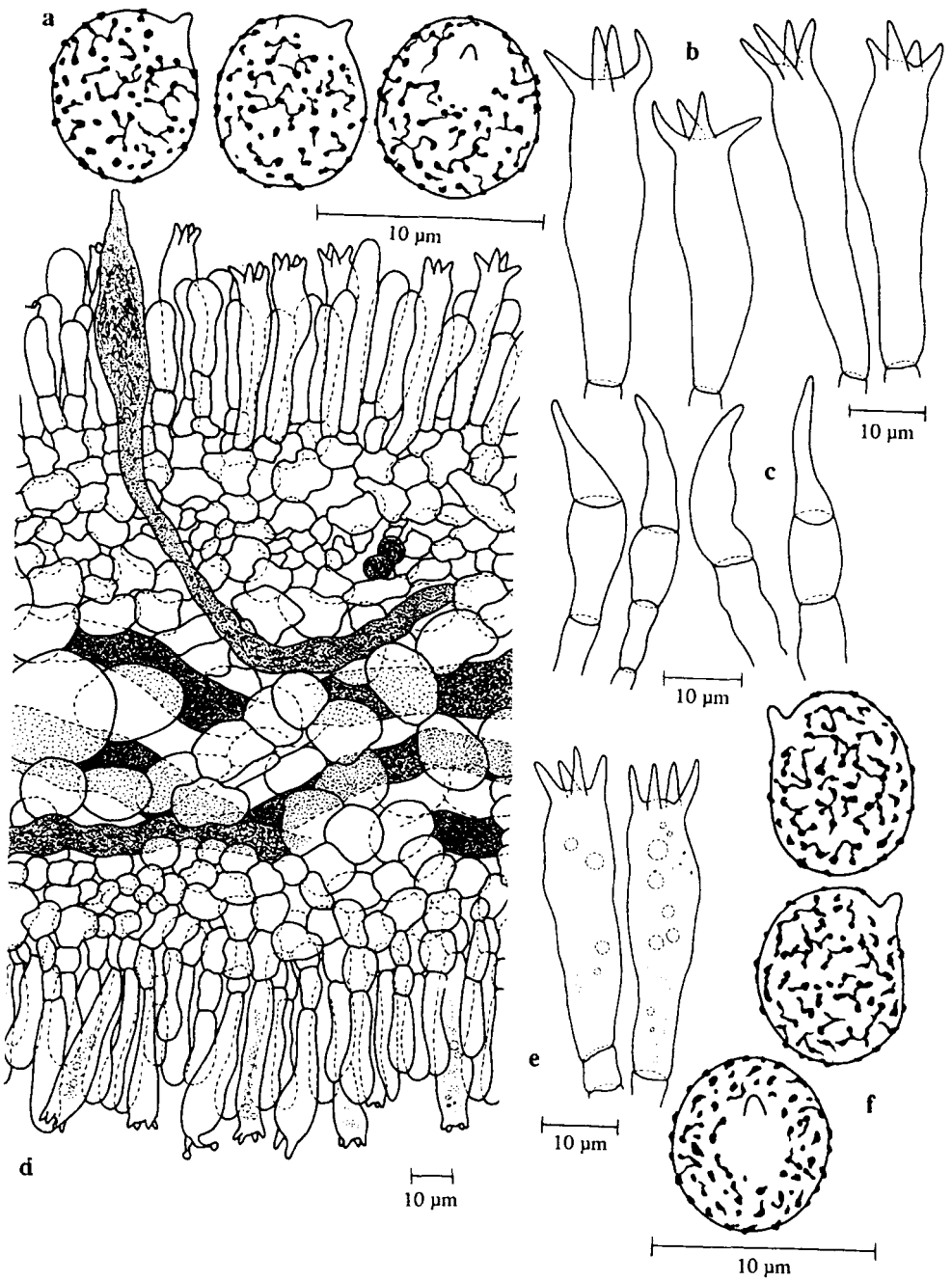

FIG. 4. *Lactarius pelliculatus*. a, spores (*Goossens-Fontana* 807); b, basidia (*Goossens-Fontana* 807); c, cheilocystidia (*Goossens-Fontana* 807); d, hymenium, subhymenium and lamella-trama (*Goossens-Fontana* 3036); e, basidia (*Goossens-Fontana* 3036); f, spores (*Goossens-Fontana* 3036).

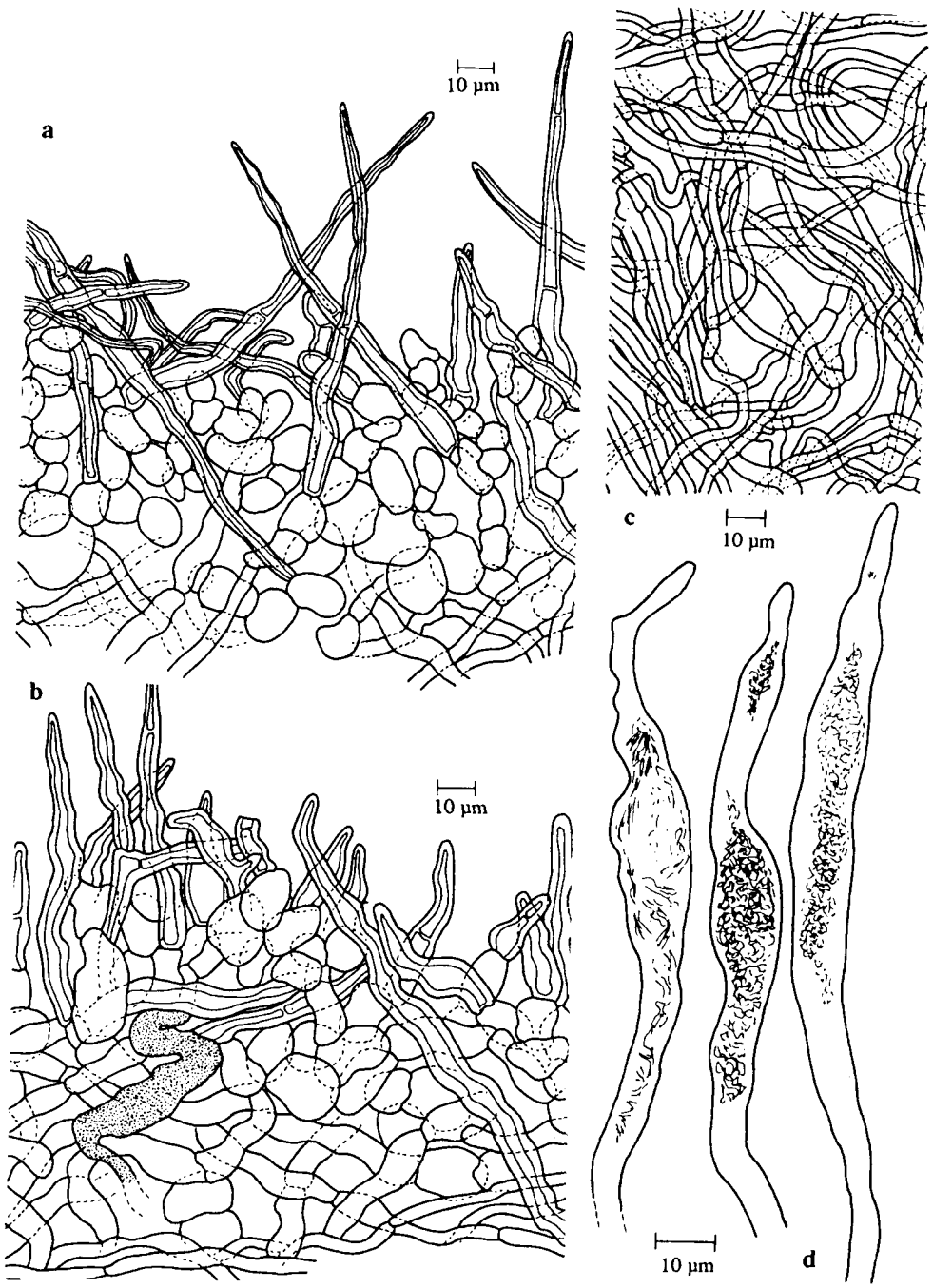

FIG. 5. *Lactarius pelliculatus*. a, section through the pileipellis, halfway along the radius (*Goossens-Fontana* 3036); b, section through the stipitipellis, halfway up the stipe (*Goossens-Fontana* 807); c, surface view of the annulus, middle part (*Goossens-Fontana* 807); d, pseudopleurocystidia (*Goossens-Fontana* 807).

1.23–1.24–1.35, $n=60$); ornamentation amyloid, composed of irregularly sized and shaped warts; warts less than 0.5μm high, isolated, connected by lines or aligned, sometimes forming a faint, partial reticulum, but always distinct; plage not amyloid. *Basidia* 40–50 × 9–10μm, cylindric to slightly clavate, 4-spored, rarely 2-spored. *Macropleurocystidia* absent. *Pseudopleurocystidia* rather scarce, 15–25μm diam. in the upper part, clavate to conical, tapering upwards, mucronate, very emergent, with needle-like to granular content. *Lamella-edge* sterile; cheilocystidia 15–40 × 5–10μm, narrowly utriform to conical. *Hymenophoral trama* heteromerous, composed of sphaerocytes and numerous lactiferous hyphae; narrow, hyaline hyphae becoming more abundant near the edge. *Pileipellis* two-layered; elements of suprapellis very thick-walled (1–2μm), 50–130 × 4–8μm, long, slender, hair-shaped and tapering upwards, septate and sometimes branched; subpellis composed of irregular to rounded cells, 5–15(–20)μm, with some elements of the upper layer penetrating. *Stipitipellis* with larger rounded cells than the pileipellis; elements of suprapellis 50–150 × 7–10μm, sometimes branched, with 2–3μm thick walls; with numerous lactifers. *Annulus* composed of narrow hyphae that are thin-walled, hyaline, septate and sometimes branched, (2–)3–5(–7)μm diam. *Clamp-connections* absent.

Distribution and ecology. Drier Guineo-Congolian rainforest with *Gilbertiodendron dewevrei*. Known only from Zaire.

Specimens examined. ZAIRE. Equateur Prov., Lisala, 350–400m alt., on the ground, xii 1925, *Goossens-Fontana* 546 (holotypus *Armillaria pelliculata*, BR); Binga, 380m alt., 08–1928, very numerous, on the ground, *Goossens-Fontana* 807 et icon. (holotypus *L. pandani* f. *pallidus*, BR); ibid., xii 1941, at the base of a stem of *M. dewevrei*, *Goossens-Fontana* 2069 et icon. (BR); ibid., x 1942, on the ground, *Goossens-Fontana* 3036 et icon. (holotypus *L. pandani* f. *intermedius*, BR).

Observations

1. *Lactarius pelliculatus* is very closely related to *L. zenkeri*, but differs in the somewhat larger basidiomes (pileus up to 8cm diam.) and the slightly larger spores. The cheilocystidia are not tortuous or branched, as is often the case in *L. zenkeri*. The ornamentation of the spores is more pronounced than in *L. zenkeri*, but is still very low and faint when compared to *L. annulatoangustifolius* (q.v.).

2. Buyck (1989) synonymized *Lactarius pandani* R. Heim with *Lactarius pelliculatus* (Beeli) Buyck, without any comment. The present detailed studies of the type specimens demonstrate that the specimens described as *L. pandani* clearly belong to different species (see also *L. annulatoangustifolius*).

3. Some authors (e.g. Redhead & Norvell, 1993) consider the presence of the annulus and the 'lignicolous' habit as arguments to maintain *Lactariopsis* Henn. as a separate genus, to 'make *Lactarius* more homogeneous'. With this the present author cannot agree. The lignicolous habit is not a constant feature in those species and there are

several other unveiled *Lactarius* species that grow on more or less rotten wood in the African rainforests. Moreover, several undescribed '*Lactariopsis*' species in woodland vegetation are always terrestrial. The presence of an annulus cannot be considered as an argument to maintain a separate genus. In tropical *Russula* species an annulus is present in species belonging to different sections (*Crassotunicatae*, *Ingratae*, *Fistulosae*; Buyck, pers. comm.). Finally, the microscopic features of those annulate *Lactarius* species are very similar to those of other groups: *L. gymnocarpus* R. Heim ex Singer and related species which have the same pileipellis and stipitipellis structure and similar low ornamented spores; *L. phlebonemus* R. Heim & Gooss.-Font. and related species which also have those thick-walled hair-shaped elements in their pellis.

4. The subgenus *Lactariopsis* (Henn.) Singer seems particularly well represented in tropical Africa. Besides the rainforest species *L. zenkeri*, *L. pelliculatus* and *L. annulatoangustifolius*, at least two other species occur in the miombo woodlands (Verbeken, in prep.).

4. Lactarius russulaeformis (Beeli) Verbeken, **comb. nov. Figs 6, 7.**
Basionym: *Omphalia russulaeformis* Beeli in Bull. Soc. Roy. Bot. Belgique 60: 83 (1927). Type: *Goossens-Fontana* 136 et icon. (holo. BR).
Syn.: *Lactarius pellicularis* R. Heim in Bull. Jard. Bot. État 25: 85 (1955). Type: *Goossens-Fontana* 926 et icon. (holo. BR).

Coloured illustrations of *L. russulaeformis* (as *L. pellicularis*) are provided by Heim (1955a: pl. 15, fig. 9; 1955b: pl. 6, fig. 1a–d).

Pileus (1.8–)2.5–3.5cm diam., very thin, plano-convex to depressed and infundibuliform; centre with papilla; margin striate to grooved; pellis not dehiscent, pellicular, smooth, cupreous red with a lilac tint. *Stipe* 2–3 × 0.4–0.7cm, long, slender, cylindric to subfusiform, sometimes curved, smooth, cupreous red with a lilac tint, paler on top, fragile, often fistulous. *Lamellae* decurrent (sometimes adnate-decurrent), unequal with lamellulae, distant (5+4/cm), medium broad (<6mm), rather thick, brittle, yellowish white, with a pink tint. *Context* granulate, brittle, ochraceous pink, more intense pink near the base; taste bitter and very acrid; smell bitter. *Latex* white to yellowish; taste acrid. *Spore deposit* white.

$FeSO_4$: pileus greenish. *Guaiac*: pileus brown.

Spores ellipsoid, 7.9–*9.2–9.8*–10.9 × 7.3–*7.8–8.4*–9.0μm (Q = 1.07–*1.16–1.19*–1.26, *n* = 60); ornamentation amyloid, composed of slender spines, (1.0–)1.5–2.0μm high, fairly regularly connected by fine connective lines; wall with slightly amyloid spots; plage distinct, not amyloid. *Basidia* 36–55 × 10–14μm, cylindric to clavate, 4-spored; content slightly granular; sterigmata 6–10 × 1–2.5μm. *Macropleurocystidia* absent. *Pseudopleurocystidia* fairly abundant, 6–7(–9)μm diam., cylindric to moniliform; content densely oleiferic, sometimes slightly granular. *Lamella-edge* sterile; cheilocystidia 10–15(–20) × 4–6μm, shortly cylindric to clavate, often septate. *Hymenophoral trama* irregular, composed of hyaline, thin-walled hyphae, 3–4μm diam.; oleiferic and lactiferous hyphae abundant, <9μm diam. *Pileipellis* subcellular to hymeniderm-

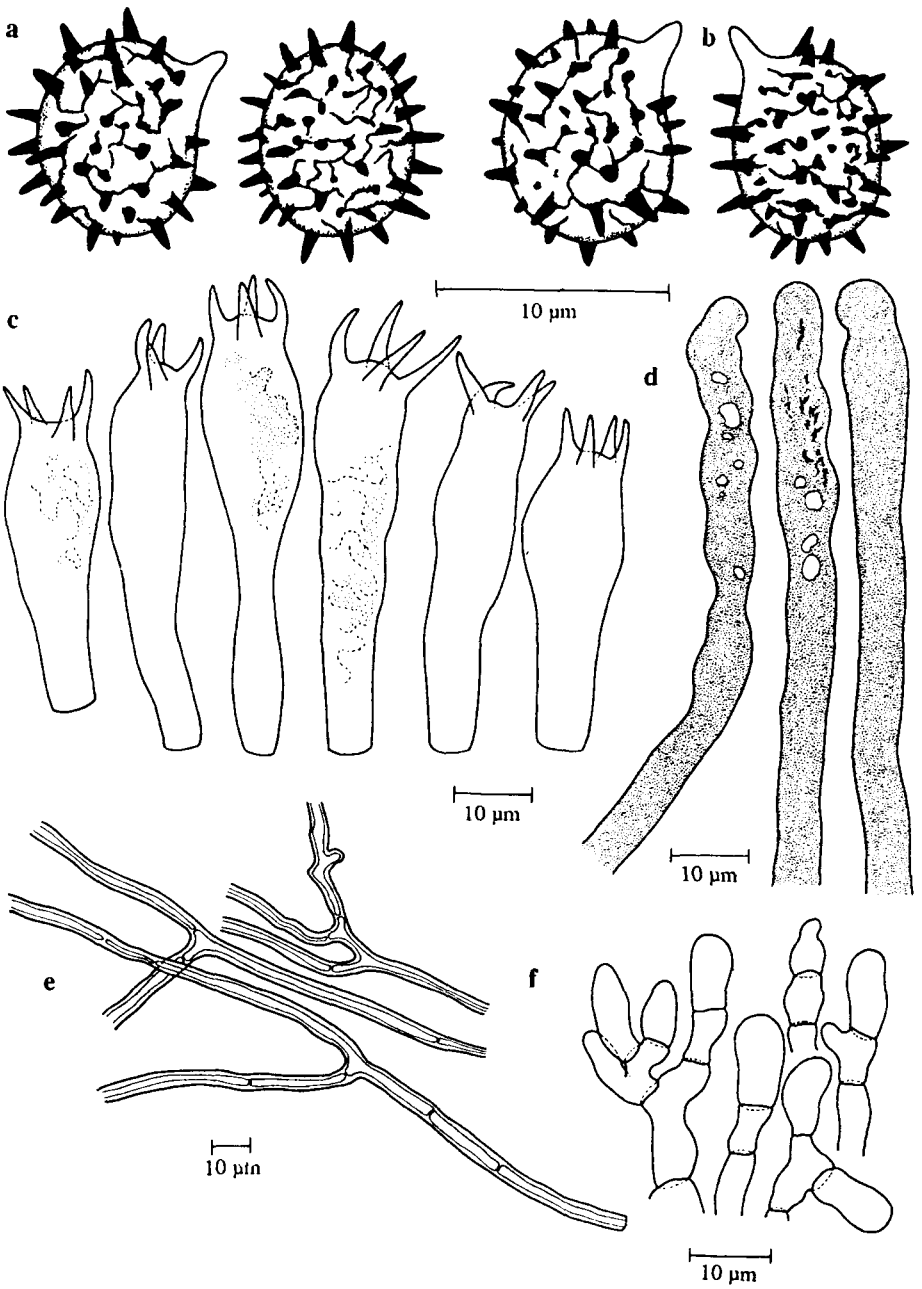

FIG. 6. *Lactarius russulaeformis*. a, spores (*Goossens-Fontana* 926); b, spores (*Buyck* 1589); c, basidia (*Goossens-Fontana* 926); d, pseudopleurocystidia (*Buyck* 1589); e, elements of the base of the stipe (*Buyck* 1589); f, cheilocystidia (*Buyck* 1589).

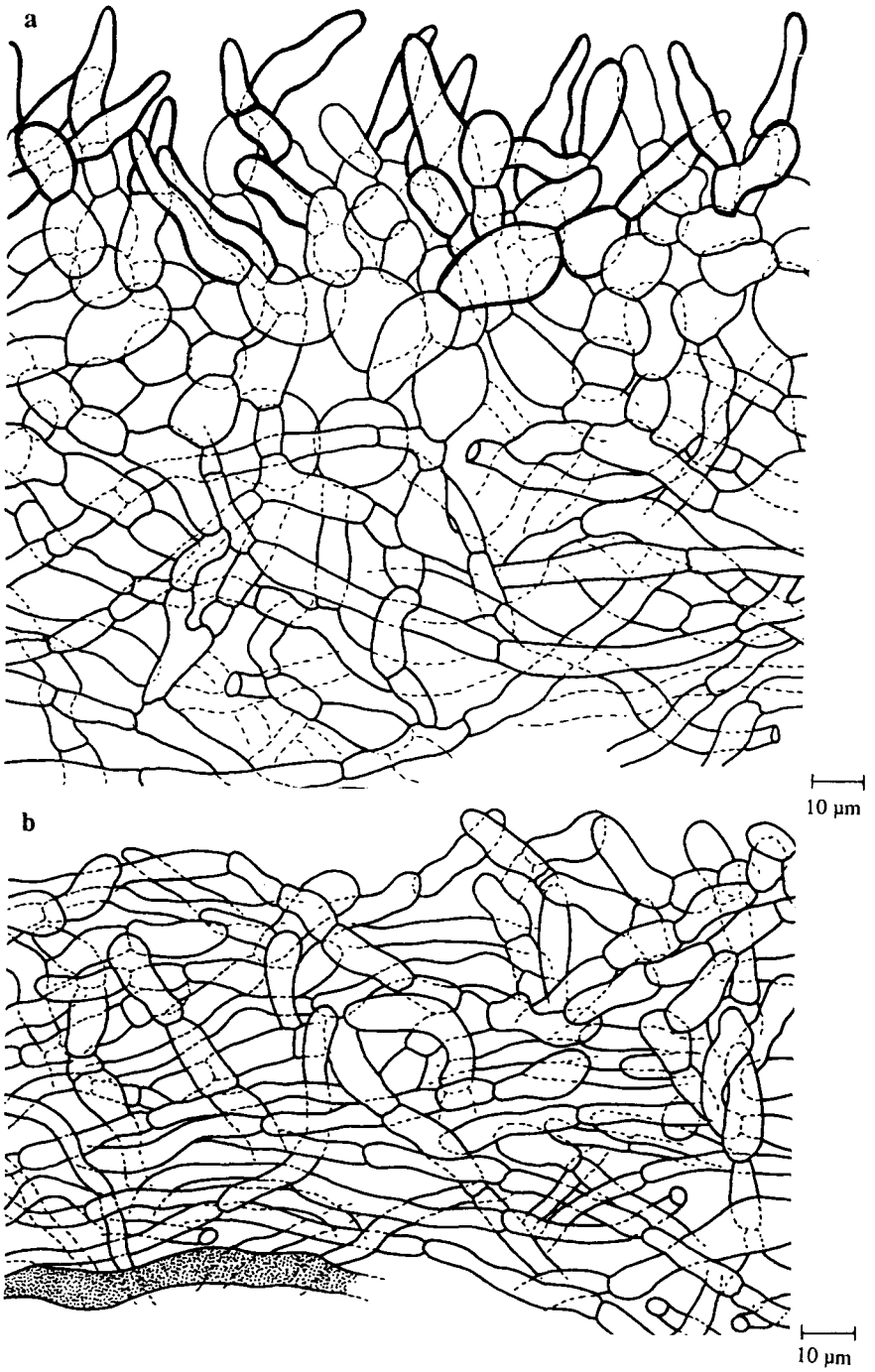

FIG. 7. *Lactarius russulaeformis* (*Buyck* 1589). a, section through the pileipellis, halfway along the radius; b, section through the stipitipellis, halfway up the stipe.

like, 60–100μm thick; elements of the suprapellis 15–35 × 7–10μm, cylindric to fusiform and tapering upwards, slightly thick-walled (<0.5μm), sometimes branched and septate. *Stipitipellis* one-layered, with more recumbent hyphae than in the pileipellis; hyphae long and slender, often septate; terminal elements 10–20 × 5–8μm, rounded to cylindric or fusiform, thin-walled. *Clamp-connections* absent.

Distribution and ecology. Drier Guineo-Congolian rainforest with *Gilbertiodendron dewevrei*. Known only from Zaire.

Specimens examined. ZAIRE. Equateur Prov., Binga, 380m alt., on the ground, vii 1931, *Goossens-Fontana* 926 et icon. (holotypus *Lactarius pellicularis*, BR). Swamp forest: Equateur Prov., Eala, on dead wood, vi 1923, *Goossens-Fontana* 136 et icon. (holotypus *Omphalia russulaeformis*, BR). Tshopo Prov., 5km NNE of Batiabongena, terrestrial, iv 1984, *Buyck* 1589 et icon. phot. (BR).

Observations

1. The type specimen (*Goossens-Fontana* 136) is in a poor condition but both spore ornamentation and size, as well as the watercoloured illustration, agree with the type of *L. pellicularis* (except that on the spores of *Goossens-Fontana* 136 some shorter and more rounded warts are also observed). The lignicolous habit of *Goossens-Fontana* 136 is not a valuable character by which to distinguish it from the other collections because a facultative fructifying of ectomycorrhizal fungi on (mostly rotten) wood in tropical rainforests is a phenomenon that is frequently observed in other African *Lactarius* species (see also *L. pelliculatus*).

2. The description is based on *Goossens-Fontana* 926 and *Buyck* 1589 (but spore measurements are based on all three available collections). The colour of the context in *Buyck* 1589 is brownish, the taste is acrid; its pileus measures 1.8cm diam. and is brown with a reddish tint (6–7E8) in the centre and light orange to greyish orange (5A4–5B5) near the margin; some lamellae are forked.

5. Lactarius congolensis Beeli in Bull. Soc. Roy. Bot. Belgique 60: 164 (1928). Type: *Goossens-Fontana* 528 et icon. (holo. BR). **Fig. 8.**
Syn.: *Lactarius craterelloides* R. Heim & Gooss.-Font. in Heim in Bull. Jard. Bot. État 25: 52 (1955). Type: *Goossens-Fontana* 2081 et icon. (holo. BR).
Lactarius unicolor Gooss.-Font. & R. Heim in Heim in Bull. Jard. Bot. État 25: 77 (1955). Type: *Goossens-Fontana* 881 et icon. (holo. BR).

Coloured illustrations of *L. congolensis* (as *L. craterelloides* and *L. unicolor*) are provided by Heim (1955a: pl. 14, fig. 9 & pl. 15, fig. 8; 1955b: pl. 3, fig. 4 & pl. 5, fig. 4ab).

Pileus 4–12cm diam., firm, convex, then deeply depressed; margin incurved when young, not striate; pellis not dehiscent, smooth to finely velutinate, fuliginous brown to dark brown with locally blackish tint. *Stipe* 4–8 × 1–2cm, cylindric to subfusiform,

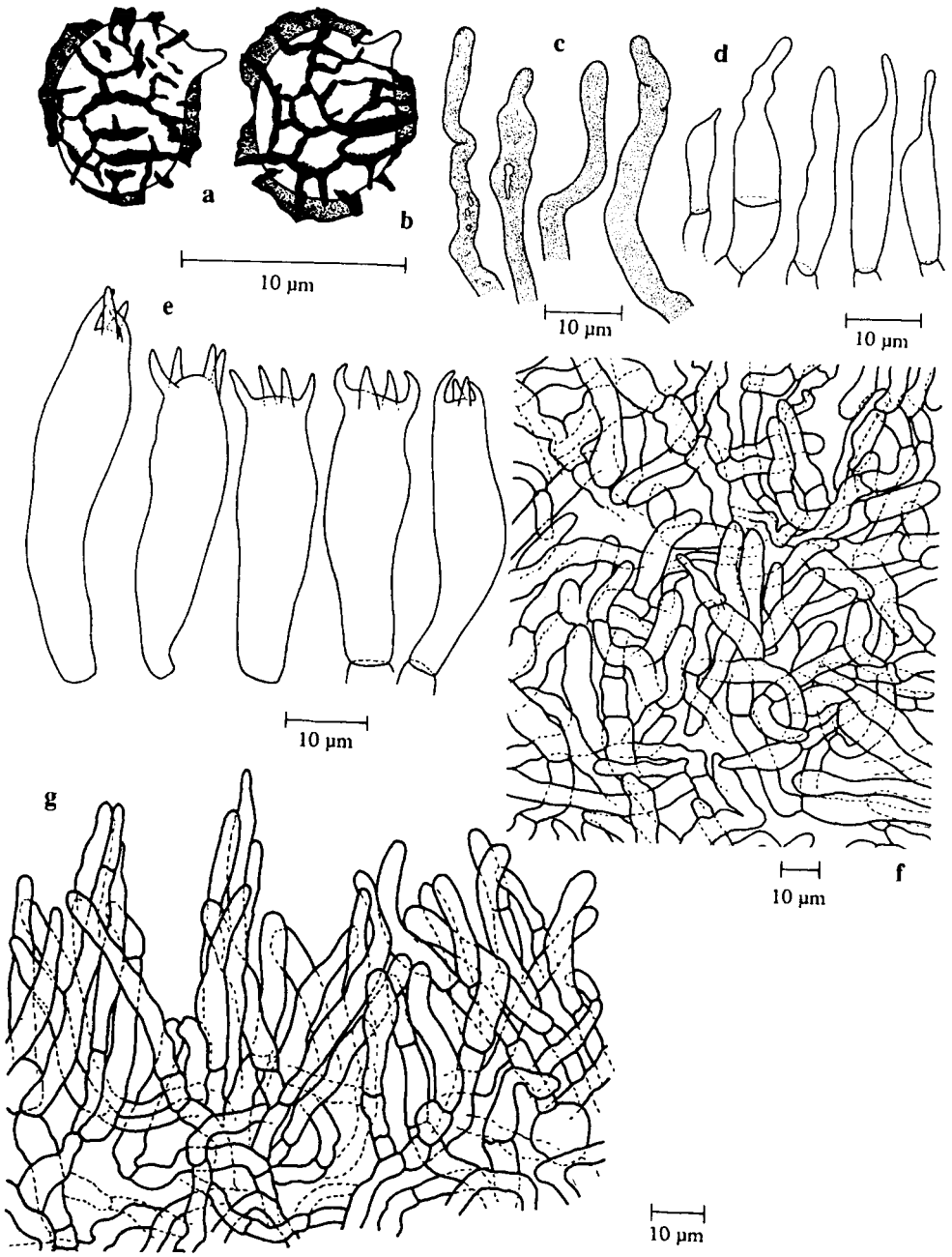

FIG. 8. *Lactarius congolensis*. a, spore (*Goossens-Fontana* 2081); b, spore (*Goossens-Fontana* 528); c, pseudocystidia, towards the edge of the lamella (*Goossens-Fontana* 2081); d, cheilocystidia (*Goossens-Fontana* 528); e, basidia (*Goossens-Fontana* 528); f, surface view of the stipe, halfway up the stipe (*Goossens-Fontana* 528); g, section through the pileipellis, halfway along the radius (*Goossens-Fontana* 2081).

smooth to finely velutinate, dark fuliginous ochre to brown. *Lamellae* subdecurrent, unequal with irregular lamellulae, crowded (20/cm), narrow, thin, white to cream-coloured; edge brownish. *Context* thick, white, changing reddish to brownish; taste mild. *Latex* abundant, opaque, white, unchanging; taste mild. *Spore deposit* white.

Guaiac: slowly greyish blue. *Phenol*: brown-purple. $FeSO_4$, NH_3, *aniline, α-naphthol*: negative.

Spores subglobose to ellipsoid, 6.9–*8.1*–9.3 × 5.6–*6.4*–7.4μm (Q = 1.10–*1.26*–1.51; *n* = 30); ornamentation amyloid, composed of a reticulum, without distinct isolated warts; ridges 1–2μm high; plage not amyloid. *Basidia* 35–45 × 10–11μm, cylindric to clavate, 4-spored. *Macropleurocystidia* absent. *Pseudopleurocystidia* moderately abundant, 2–4(–5)μm diam., cylindric to irregular tortuous. *Lamella-edge* sterile; cheilocystidia 25–40 × 4–9μm, irregularly tortuous, often capitate, sometimes obtuse; content brownish; pseudocystidia moderately abundant. *Hymenophoral trama* irregular, composed of hyaline hyphae and abundant lactifers, no sphaerocytes. *Pileipellis* a trichoderm, one-layered; terminal elements 25–40 × 3–4(–7)μm, narrowly cylindric to slightly tapering upwards, with intracellular brownish pigmentation. *Stipitipellis* with larger cells than the pileipellis, 15–35 × 6–8μm. *Clamp-connections* absent.

Ethnomycological notes. Eaten by the local population of Diobo Akuba, Zaire. *Vernacular name.* Nsutu na muntu (type locality, Zaire).

Distribution and ecology. Drier Guineo-Congolian rainforest with *Gilbertiodendron dewevrei*. Known only from Zaire.

Specimens examined. ZAIRE. Equateur Prov., Diobo Akuba, vii 1925, terrestrial, *Goossens-Fontana* 528 et icon. (holotypus *L. congolensis*, BR); Binga, 380m alt., viii 1929, *Goossens-Fontana* 837 et icon. (BR); ibid., *Goossens-Fontana* 881 et icon. (holotypus *L. unicolor*, BR); ibid., 1942, terrestrial, isolated or in twos, *Goossens-Fontana* 2081 et icon. (holotypus *L. craterelloides*, BR).

Observations

1. The synonymy of *L. craterelloides* with *L. congolensis* was already suggested by Heim himself. The type material consists of two specimens in rather poor condition. *Goossens-Fontana* 2081 consists of four rather poorly preserved specimens (mixed with two different *Russula* specimens) agreeing in all characters with the material of *L. congolensis*. The description is based on both collections.

2. The velvety, dry and brown pileus, the staining reddish to brownish of the context, the trichodermal structure of the pileipellis and stipitipellis, and the winged aspect of the spore ornamentation argue in favour of placing this species in subgen. *Plinthogali* (Burl.) Hesler & A.H. Sm. [syn. sect. *Plinthogali* (Burl.) Singer], a group which seems well represented in tropical Africa.

3. Misidentifications: Degreef (1990, = *L. kabansus*); Nzigidahera (1993, = *Lactarius* sp.).

6. Lactarius goossensiae Beeli in Bull. Soc. Roy. Bot. Belgique 60: 165 (1928). Type: *Goossens-Fontana* 268 (lecto., selected here, BR).

When Beeli described this species, he cited two specimens: *Goossens-Fontana* 213 and 268. The first represents *L. gymnocarpus* R. Heim ex Singer. The latter is treated in an earlier paper (Verbeken, 1995) as *Lactarius* sp. 1. The author considered *L. goossensiae* as a nomen dubium, as the name was based on two different collections, but proposes here to maintain the name with *Goossens-Fontana* 268 as a lectotype.

7. Lactarius sesemotani (Beeli) Buyck in Bull. Jard. Bot. Belg. 59: 241 (1989). **Figs 9, 10.**
Basionym: *Russula sesemotani* Beeli in Bull. Soc. Roy. Bot. Belgique 60: 169 (1928). Type: *Goossens-Fontana* 505a et icon. (lecto., selected here, BR).

The original description is based on mixed material. Both 'type collections', *Goossens-Fontana* 143 and 505, are a mixture of *Russula* and *Lactarius* material. One watercolour of *Goossens-Fontana* 505 clearly represents the *Lactarius*; the watercolour of *Goossens-Fontana* 143 represents a smaller *Russula*. The author separated the collections, renumbering the material as *Goossens-Fontana* 143a and 143b and *Goossens-Fontana* 505a and 505b. *Goossens-Fontana* 505a is designated here as lectotype. The specimens are in fact in rather good condition and agree perfectly with more recently collected material from Zaire and Zambia.

Pileus 5–10 (or more) cm diam., thick, fleshy, hemispherical to convex when young, then applanate and infundibuliform; margin incurved when young, straight when older, strongly and deeply sulcate; pellis dehiscent, smooth, shiny, viscose, finely fibrous in the centre, yellowish ochre, then ochraceous brown (4A4–7), paler towards the margin (3A2), greyish when older. *Stipe* (2.5–)4–10 × 1.5–2.5cm, cylindric, subbulbous, faintly striate, faintly velvety, whitish, pale ochre, firm, solid, sometimes becoming fistulous. *Lamellae* adnate, decurrent when older, unequal with a few lamellulae (0–1 between 2 lamellae), fairly distant (3+1 to 5/cm), rather broad (7–9mm), rather thick, sometimes forked, cream colour to pale yellowish (4A4); edge entire, concolorous. *Context* firm, white to cream colour, unchanging, but becoming pale orange under the pileipellis; taste mild, but becoming acrid by the latex; smell not remarkable, agreeable. *Latex* scarce, white, fluid; taste acrid. *Spore deposit* pale, but not purely white.

$FeSO_4$: negative or faintly greyish brown. *HCl*, *NaOH*, *NH_4OH*: all negative.

Spores mostly ellipsoid, sometimes subglobose, 7.2–*8.2–8.6*–9.7 × 5.6–*6.7–7.2*–7.9µm (Q = 1.09–*1.19–1.24*–1.43; *n* = 80); ornamentation amyloid, composed of irregularly shaped and sized warts, aligned or connected by fine lines, never forming a reticulum, not exceeding 0.2µm height; plage sometimes with a faintly

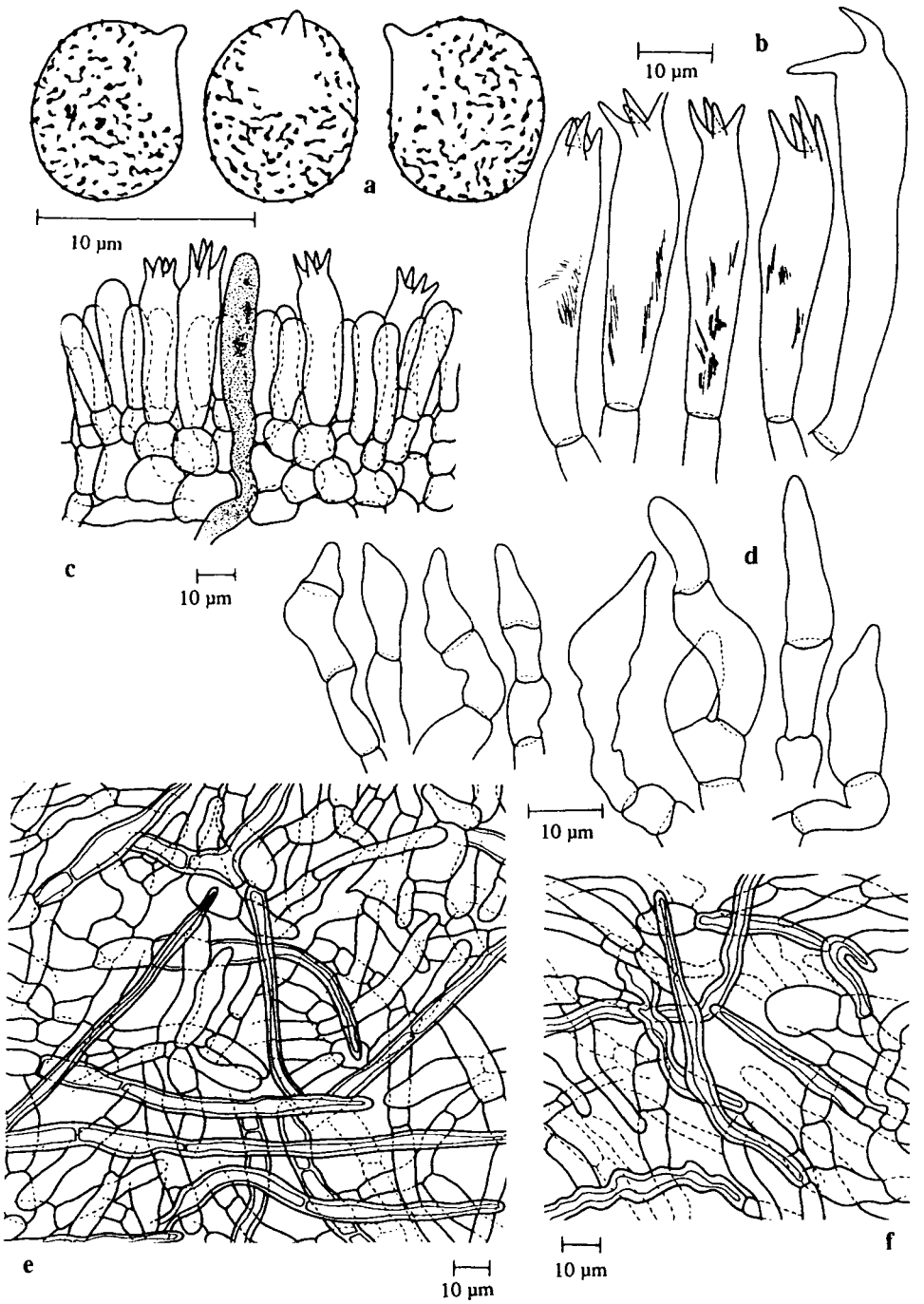

FIG. 9. *Lactarius sesemotani*. a, spores (*Goossens-Fontana* 505); b, basidia (*Goossens-Fontana* 143); c, hymenium and subhymenium (*Buyck* 3471); d, cheilocystidia (*Buyck* 3471); e, surface view of the stipe, halfway up the stipe (*Buyck* 3471); f, surface view of the pileipellis, halfway along the radius (*Goossens-Fontana* 143).

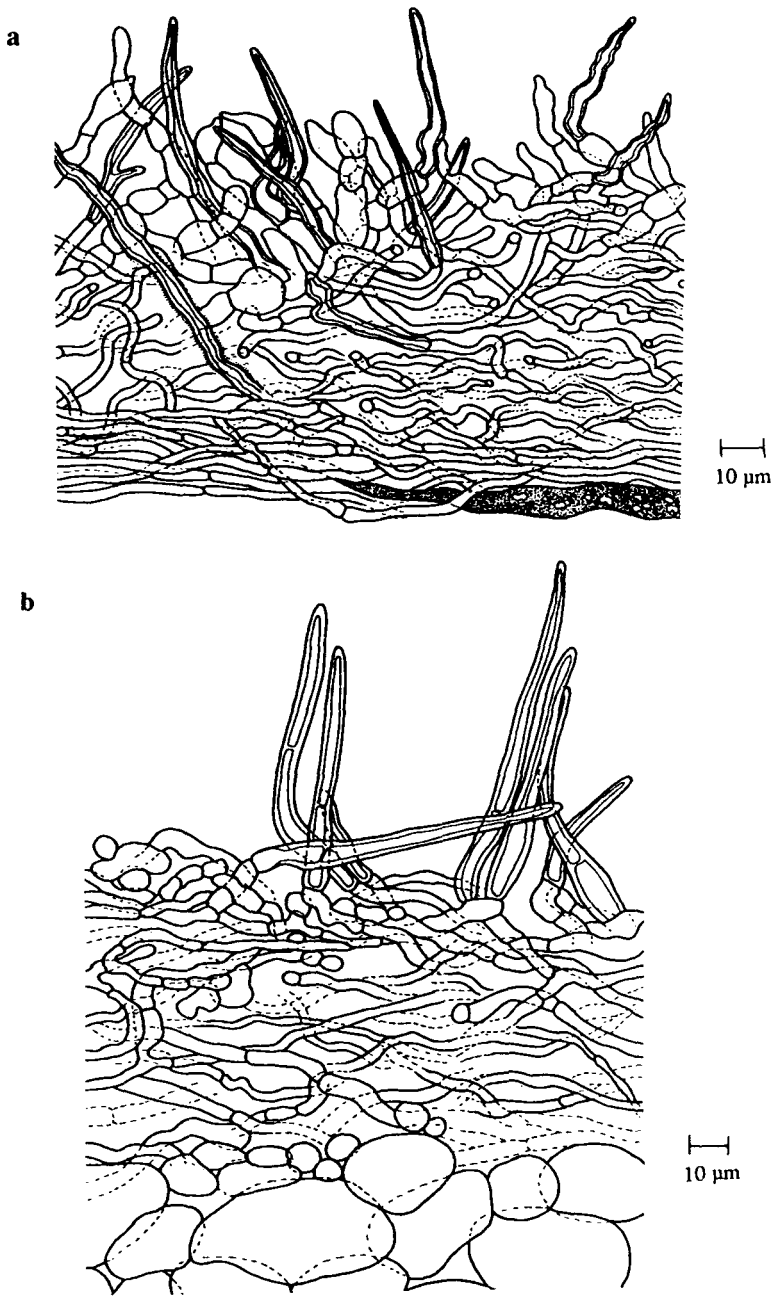

FIG. 10. *Lactarius sesemotani*. a, section through the pileipellis, halfway along the radius (*Goossens-Fontana* 143); b, section through the stipitipellis, halfway up the stipe (*Buyck* 3471).

amyloid spot in centre. *Basidia* 35–40 × 8–10μm, cylindric to subclavate, 4-spored, sometimes 2-spored. *Macropleurocystidia* absent. *Pseudopleurocystidia* rather scarce, 8–12μm diam., cylindric to fusiform, rounded or tapering on top, emergent up to 30μm; content oleiferic or granular and needle-like. *Lamella-edge* sterile; cheilocystidia 15–40 × 5–8μm, fusiform, tapering upwards, often septate, sometimes branched. *Hymenophoral trama* heteromerous, composed of sphaerocytes and lactifers. *Pileipellis* two-layered; suprapellis composed of cylindric or rounded to fusiform hyaline elements, 10–20 × 5–8μm, and hair-shaped, slender, long, slightly tortuous elements with thickened wall (1μm), 50–120 × 4–8μm, sometimes branched; subpellis composed of loosely interwoven, hyaline hyphae (1–)2–3μm diam., forming an ixocutis. *Stipitipellis* with less rounded or cylindric cells than the pileipellis. *Clamp-connections* absent.

Ethnomycological notes. Eaten by the local population of Djongo Akuba, Zaire. *Vernacular name.* Sese motani (Zaire).

Distribution and ecology. Wetter Zambezian miombo woodland dominated by *Brachystegia utilis* and *B. bussei*, swamp forest and drier Guineo-Congolian rainforest with *Gilbertiodendron dewevrei*.

Specimens examined. BURUNDI. Nyamirambo, near Rumonge, iii 1994, *Verbeken* 94.082, 94.154, 94.155, 94.471, 94.476 (BR). ZAIRE. Equateur Prov., Eala, v 1923, terrestrial, *Goossens-Fontana* 143a (BR). Djongo Akuba, terrestrial, xii 1925, *Goossens-Fontana* 505a et icon. (lectotypus, BR). Shaba Prov., Mengé, among mosses in roadside, 04-1986, *Schreurs* 1592 (BR). ZAMBIA. Copperbelt Prov., Chati-forest, under *Albizia*, i 1991, *Buyck* 3471 (hb. Buyck). Western Prov., Mwinilunga, road to Solwezi km 50, i 1991, *Buyck* 3531 et icon. phot. (hb. Buyck).

Observations

The macroscopical description is based on the field-notes of Goossens-Fontana, Buyck and Verbeken. The microscopical description is based on *Goossens-Fontana* 143a, 505a, *Buyck* 3471 and *Verbeken* 94.082.

8. Lactarius kalospermus (Beeli) Verbeken & Walleyn, **comb. nov. Figs 11, 12.**
Basionym: *Laccaria kalosperma* Beeli in Bull. Soc. Roy. Bot. Belgique 66: 22 (1933).
Type: *Goossens-Fontana* 859 et icon. (holo. BR).

Pileus 4.5–6.5cm diam., firm, fleshy, convex, then applanate, with papilla when young, depressed in centre when older; margin striate; pellis not dehiscent, smooth, radially plicate, with reticulate pattern between the grooves, fuliginous brown. *Stipe* 5 × 0.5cm, cylindric, fuliginous brown, paler at the base. *Lamellae* adnate to decurrent, unequal with lamellulae of different length, distant, yellowish orange to ferruginous brown; edge entire, concolorous. *Context* firm, solid, whitish, yellowish in stipe. *Latex* not observed. *Spore deposit* not observed.

Guaiac: immediately blue-green. *Phenol*: slowly brown. *$FeSO_4$, NH_3, SV, Pyrol, α-naphthol*: all negative.

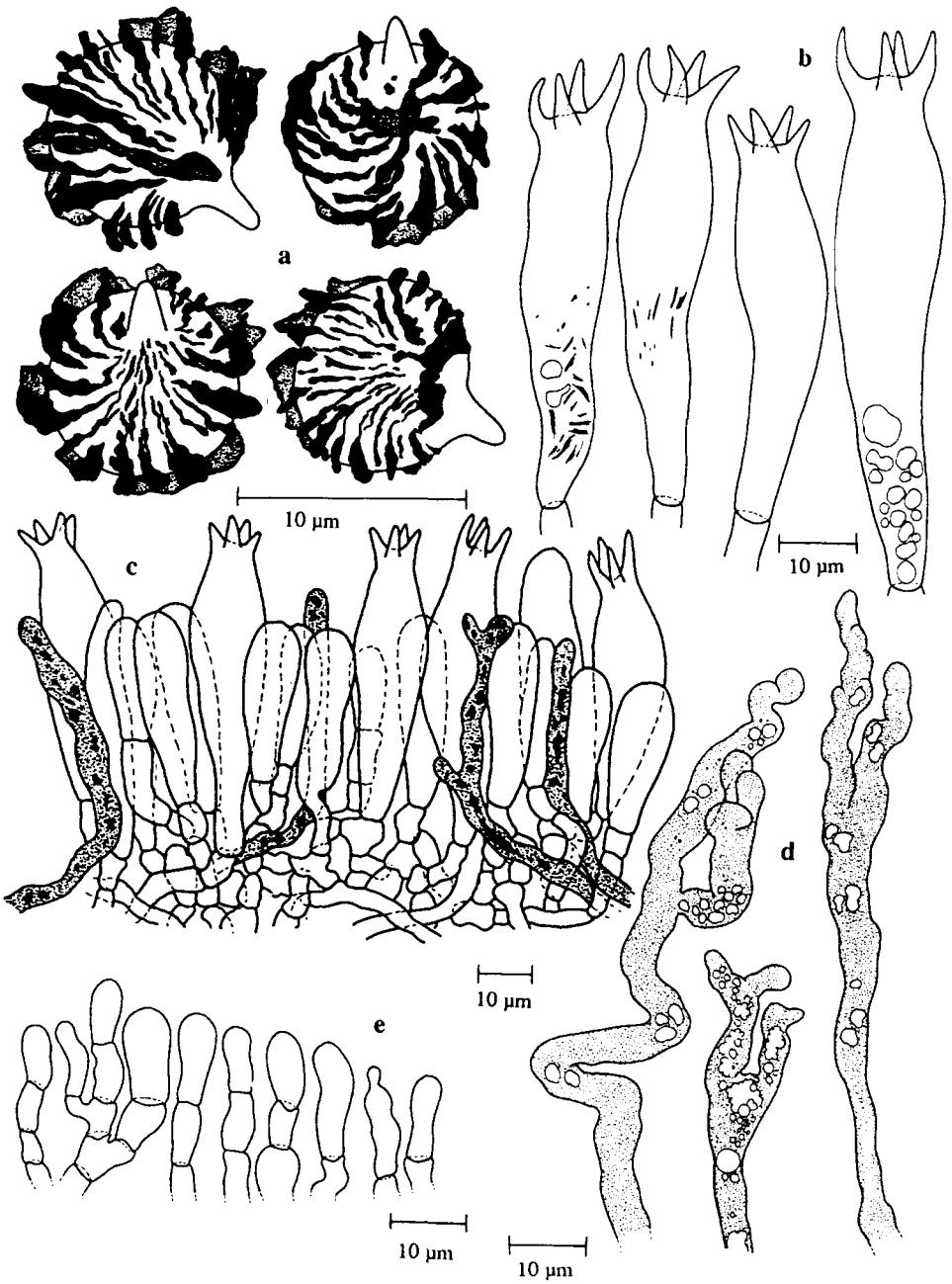

FIG. 11. *Lactarius kalospermus* (*Goossens-Fontana* 859). a, spores; b, basidia; c, hymenium and subhymenium; d, pseudopleurocystidia; e, cheilocystidia.

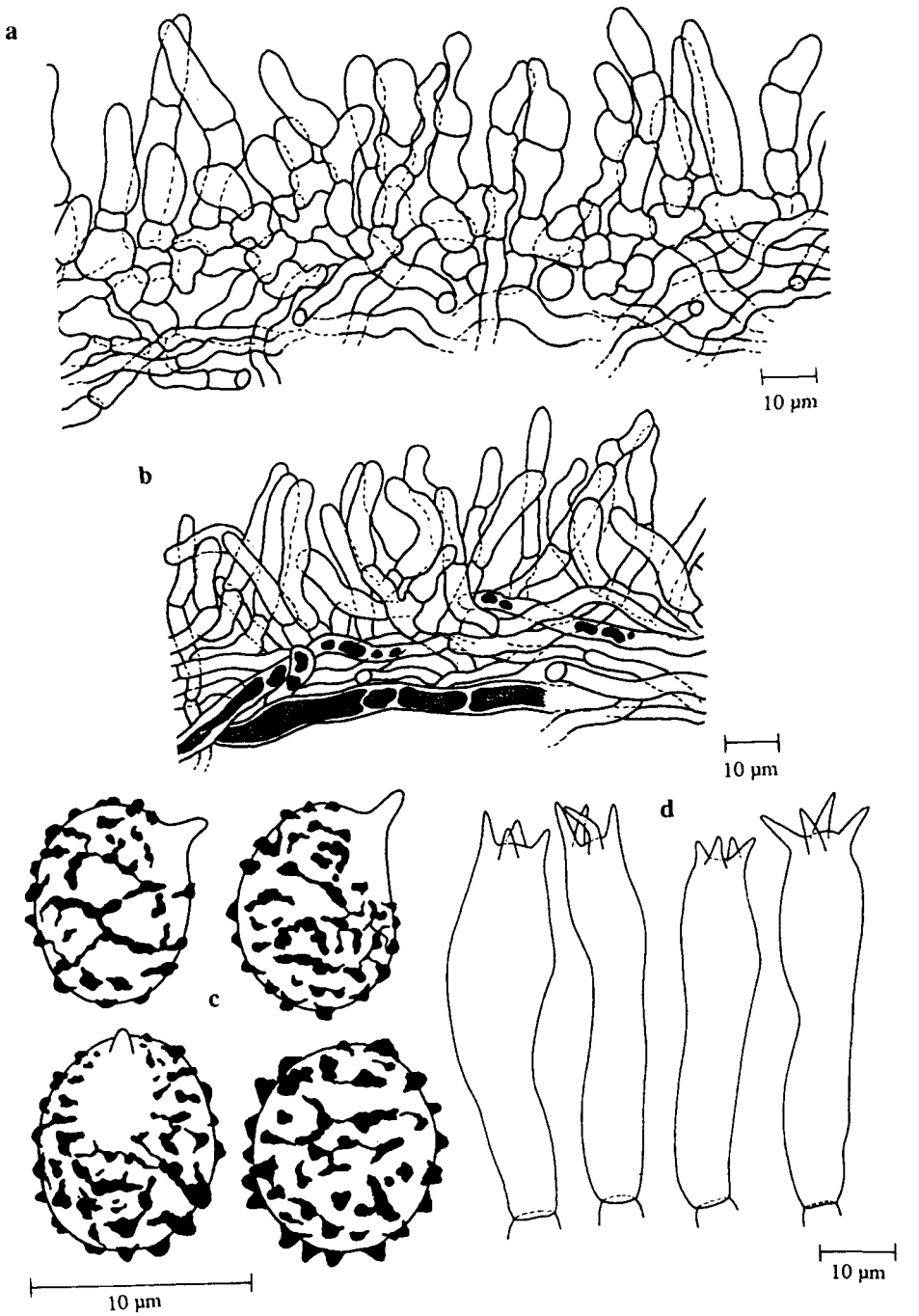

FIG. 12. *Lactarius kalospermus* (*Goossens-Fontana* 859). a, section through the pileipellis, halfway along the radius; b, section through the stipitipellis, halfway up the stipe. *Lactarius annulatoangustifolius* (*Goossens-Fontana* 2038). c, spores; d, basidia.

Spores globose to subglobose, 7.7–*8.3*–8.9(–9.0) × 7.4–*7.9*–8.4(–8.5)µm (Q = 1.00–*1.04*–1.12; *n* = 20); ornamentation amyloid, composed of coarse and parallel ridges forming a zebroid pattern, sometimes even spiral-like; ridges <2µm high, narrow or broader but then often splitting; isolated fine lines also present; plage sometimes distally amyloid, sometimes verrucose. *Basidia* 50–65 × 10–14µm, clavate, 4-spored; content needle-like or slightly granular. *Macropleurocystidia* absent. *Pseudopleurocystidia* very abundant, cylindric to irregularly tortuous towards the top, often branched; content oleiferic, guttate. *Lamella-edge* sterile; cheilocystidia 10–20 × 3–5µm, cylindric, sometimes fusiform and mucronate; pseudopleurocystidia also present. *Hymenophoral trama* subregular, composed of hyaline hyphae and abundant lactiferous hyphae. *Pileipellis* subcellular to hymeniderm-like, two-layered; terminal elements 14–40 × 5–9µm, cylindric to clavate or fusiform, often septate, content brown; with a rudimentary pseudoparenchymatic layer. *Stipitipellis* with longer, narrower and more regularly cylindric elements than the pileipellis, 15–30 × 4–5µm; without a pseudoparenchymatic layer. *Clamp-connections* absent.

Distribution and ecology. Drier Guineo-Congolian rainforest with *Gilbertiodendron dewevrei*. Known only from Zaire.

Specimens examined. ZAIRE. Equateur Prov., Binga, 380m alt., xii 1929, *Goossens-Fontana* 859 et icon. (holotypus, BR); ibid., on the ground, i 1936, *Goossens-Fontana* 1031 et icon. (BR).

Observations

1. Heinemann (1946) first indicated that *Laccaria kalosperma* is based on a *Lactarius* species belonging to the '*pterospori*' (sect. *Plinthogali*, sic). It was, however, not included in Heim's survey (1955a, b) of tropical African *Lactarius* species.

2. The type material consists of a single basidiome and is, although crumbled, in rather good condition. *Goossens-Fontana* 1031 is in very poor condition but the striking resemblance of the watercolour and the spore characteristics with those of the type remove any doubt that they are conspecific.

3. The description is based on the type material, completed with field-notes and macrochemical observations based on *Goossens-Fontana* 1031.

4. Similar characteristic very high and dense, zebroid spore ornamentation is rare in the genus and described only for *Lactarius arachnisporus* R. Heim & Perr.-Bertr. from New Guinea.

9. Lactarius annulatoangustifolius (Beeli) Buyck in Bull. Jard. Bot. Belg. 59: 241 (1989). **Figs 12–15.**
Basionym: *Russula annulatoangustifolia* Beeli in Bull. Jard. Bot. État 14: 87 (1936).
Type: *Goossens-Fontana* 834 (holo. BR).
Syn.: *Lactarius pandani* R. Heim in Candollea 7: 376 (1938); Prodr. Fl. Mycol.

Madagascar 1: 37 (1938), *nom. prov.* (without Latin diagnosis). *Lactariopsis pandani* R. Heim in Rev. Mycol. (Paris) 2: 7 (1937), *nom. prov.* (without Latin diagnosis). Type: *Heim* G89bis (holo. PC).

Lactarius pandani R. Heim f. *aurantiacus* R. Heim in Bull. Jard. Bot. État 25: 18 (1955). Type: *Goossens-Fontana* 2038 et icon. (holo. BR).

Misappl.: *Lactarius zenkeri* (Henn.) Singer sensu Singer 1946 non Henn.

Coloured illustrations of *L. annulatoangustifolius* (as *L. pandani*) are provided by Heim (1938: pl. 1, fig. A; 1955a: pl. 13, fig. 4; 1955b: pl. 1, fig. 1a–e).

Pileus (1–)3–5(–7.5)cm diam., fleshy and fairly thick when young, fragile and thin when older, convex with a papilla, then applanate and slightly depressed; margin thin, incurved, then straight; velum thick, gelatinized but not glutinous, with characteristic radial to sinuous veins when young, rupturing and leaving whitish fine flocks, showing the underlying striate margin; pellis dehiscent near the margin, yellow to brownish orange, darker in centre, light tan at margin. *Stipe* (2.5–)3.5–5 × (0.3–)0.6–1.2cm, cylindric, tapering downwards, slightly sinuous or curved, wrinkled when young, then smooth, with gelatinized veins in the upper part, spongy solid, then fistulous, subconcolorous to pileus, but paler cream-coloured at the apex, yellowish at the base; with whitish and abundant mycelium at the base. *Velum partiale* closed in the young basidiomes (velangiocarp development), then forming a submembranaceous annulus, whitish to cream colour, not mobile, ring-shaped. *Lamellae* adnate to decurrent, prolonging into veins on the stipe, unequal with lamellulae of different lengths, narrow (1–3mm), crowded, yellow to cream colour, then tan, dirtier when bruised; edge entire, concolorous. *Context* white to cream colour, first solid then granulose and fragile in pileus, fibrillose in stipe; taste (very) acrid; smell disagreeable, acrid. *Latex* abundant when young, then scarce, white, taste acrid. *Spore deposit* white.

Spores ellipsoid, 7.6–*8.7–9.5*–10.1(–10.7) × 6.3–*7.0–7.6*–8.1(–8.7)µm (Q = 1.14–*1.24–1.28*–1.42; *n* = 100); ornamentation amyloid, composed of conical to irregular warts and short ridges, < 1µm high, often connected by fine and lower lines, forming an incomplete reticulum; wall rugose between the ornamentation; plage not amyloid. *Basidia* (30–)35–50 × 9–13µm, cylindric to narrowly clavate, 4-spored, rarely 2-spored. *Macropleurocystidia* absent. *Pseudopleurocystidia* quite abundant, 12–20µm diam., emergent < 50µm, clavate to tortuous towards, tapering upwards, capitate, mucronate to rostrate; wall slightly thickened; content needle-like to granular. *Lamella-edge* sterile; cheilocystidia 12–30 × 5–10µm, irregularly fusiform to utriform, often septate, thin-walled. *Hymenophoral trama* heteromerous; composed of sphaerocytes in the upper part; lactiferous hyphae present, narrow; subregular and composed of narrow hyaline hyphae towards the edge of lamellae. *Pileipellis* two-layered, elements of suprapellis 30–110 × 4–8µm, long, slender, hair-shaped and tapering upwards, very thick-walled (1–2µm), sometimes septate and branched; subpellis composed of narrow cells, 5–20µm, slightly thick-walled to thin-walled, with some elements of the upper layer penetrating the subpellis. *Stipitipellis*

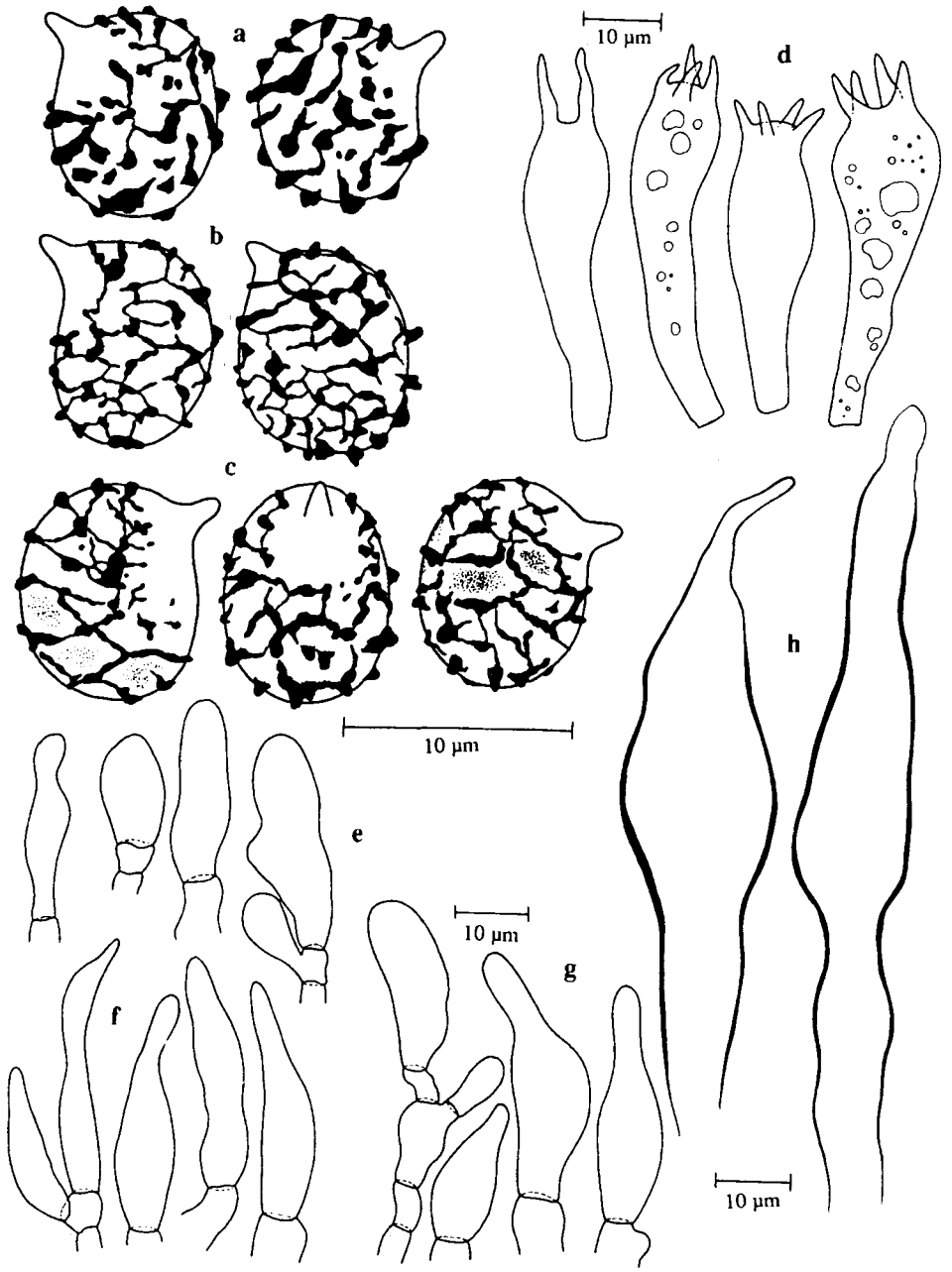

FIG. 13. *Lactarius annulatoangustifolius*. a, spores (*Heim* G89); b, spores (*Harley* 57); c, spores (*Thoen* 5137); d, basidia (*Heim* G89); e, cheilocystidia (*Thoen* 5137); f, cheilocystidia (*Goossens-Fontana* 2038); g, cheilocystidia (*Harley* 57); h, pseudopleurocystidia (*Goossens-Fontana* 2038).

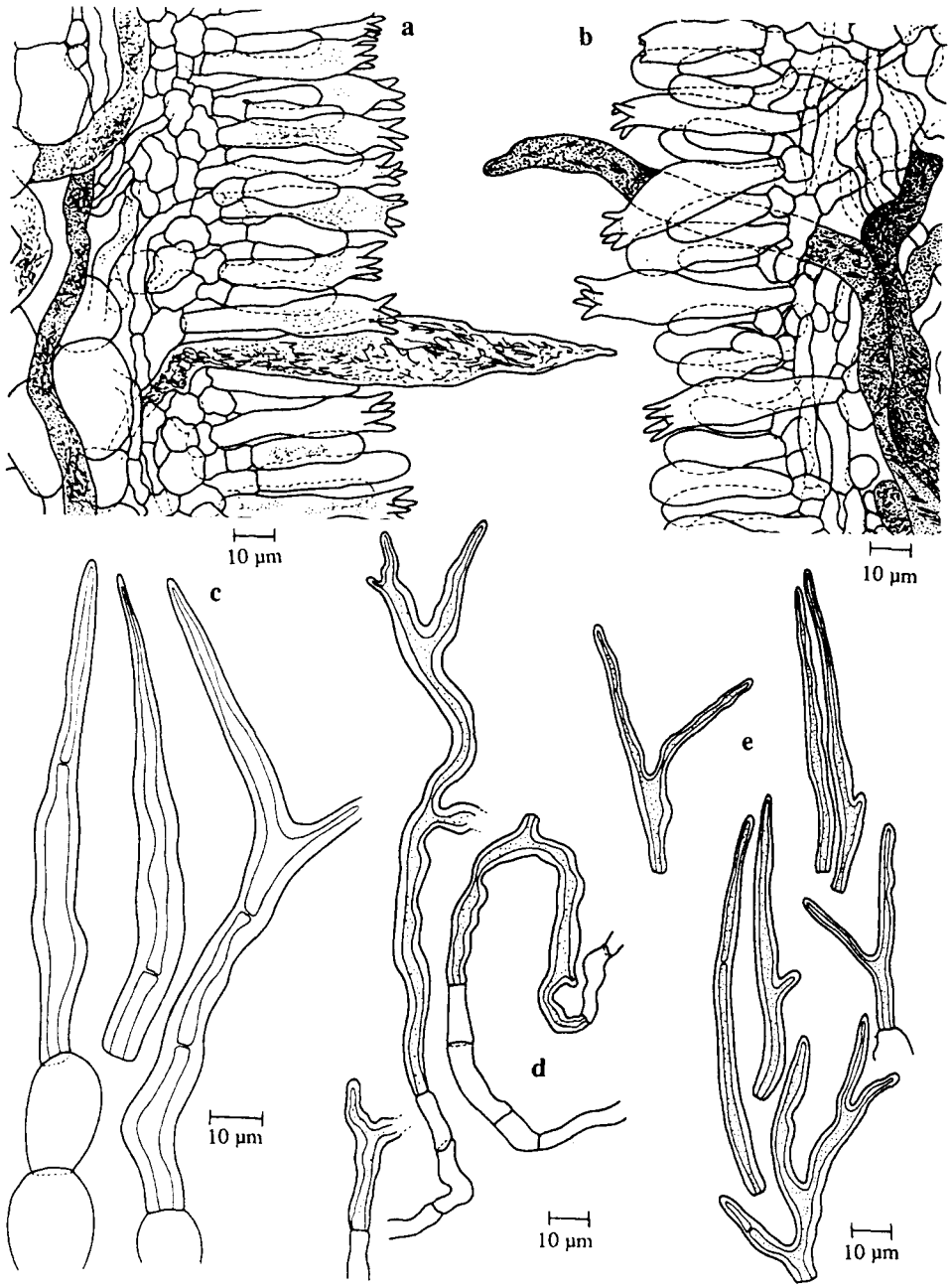

FIG. 14. *Lactarius annulatoangustifolius*. a, hymenium and subhymenium (*Harley* 57); b, hymenium and subhymenium (*Thoen* 5137); c, elements of the pileipellis (*Heim* G89); d, elements of the annulus, lower part (*Thoen* 5137); e, elements of the stipitipellis, halfway up the stipe (*Heim* G89).

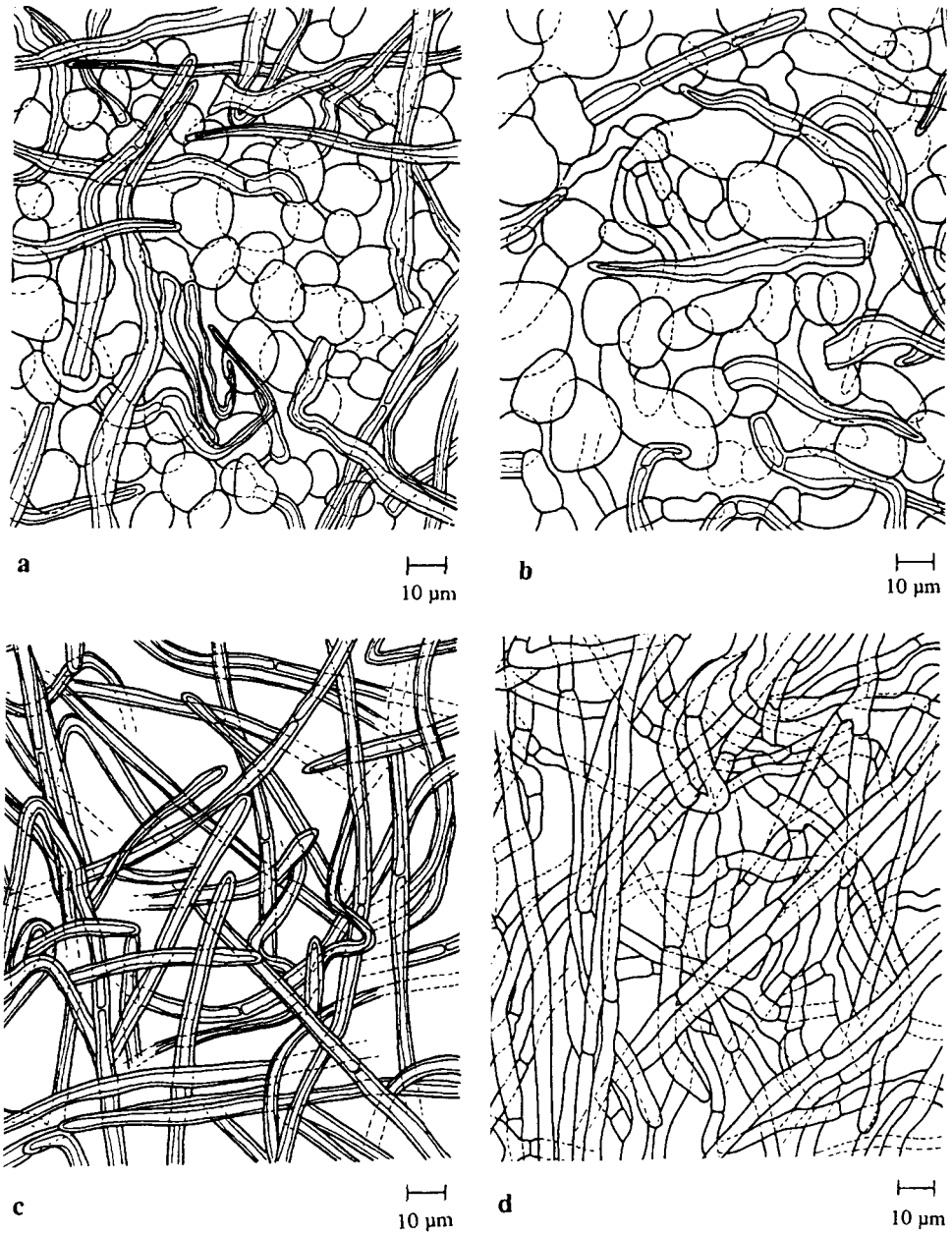

FIG. 15. *Lactarius annulatoangustifolius*. a, surface view of the pileipellis, halfway along the radius (*Goossens-Fontana* 2038); b, surface view of the stipitipellis, halfway up the stipe (*Goossens-Fontana* 2038); c, surface view of the stipitipellis, at the base of the stipe (*Thoen* 5137); d, surface view of the annulus (*Thoen* 5137).

as pileipellis but at the base of the stipe consisting of narrower and longer thick-walled, unbranched hyphae. *Annulus* composed of thin-walled, hyaline hyphae, that are densely interwoven, often septate, sometimes branched and 2–5μm diam. *Clamp-connections* absent.

Distribution and ecology. Drier Guineo-Congolian rainforest (often with *Gilbertiodendron dewevrei*), Guineo-Congolian lowland rainforest with *G. dewevrei* and *Scaphopetalum*, dry evergreen forest (muhulu), wetter Zambezian miombo woodland and Malagasy lowland rainforest. In humus or on rotten wood. Known from Liberia, Cameroon, Madagascar, Zaire and Zambia.

Specimens examined. LIBERIA. Near Nengbe, on humus and well-rotted wood, iv 1939, *Harley* 57 (FH). CAMEROON. South Western Prov., near Mundema, Korup National Park, transect P, 100–150ft alt., on wood but connected to white mycelium and mycorrhizal roots, i 1989, *Watling* 21466 (E); ibid., i 1988, *Alexander* 16b (E); surroundings of Douala, on sandy soil, viii 1959, *Berthet* 314 (LY) (Berthet & Boidin, 1966). MADAGASCAR. Betsimisaraka Prov., S of Soanierana Gagnoa, on rotten wood, xii 1934, *Heim* G89 (PC); ibid., subgregarious on rotten wood of *Pandanus*, *Heim* G89bis (holotypus *L. pandani*, PC); ibid.?, *Heim* s.n. (PC). ZAIRE. Equateur Prov., Binga, 380m alt., xi 1928, *Goossens-Fontana* 834 (holotypus *Russula annulatoangustifolia*, BR); ibid., ix 1940, *Goossens-Fontana* 2038 et icon. (holotypus *L. pandani* f. *aurantiacus*, BR). Tshopo distr., 5km NNE of Batabongena, in humus, iv 1984, *Buyck* 1344 et icon. phot. (BR); ibid., v 1984, *Buyck* 1656 et icon. phot. (BR); Yanero, v 1984, *Buyck* 1730 et icon. phot. (BR). Shaba, Muhulu de la Luiswishi, 1210m alt., xii 1971, *Thoen* 5137 (BR). ZAMBIA. Western prov., Mwinilunga, road to Solwezi km 50, i 1991, *Buyck* 3516 et icon. phot., 3567 et icon. phot., 3568 et icon. phot., 3569 et icon. phot., 3595 (hb. Buyck).

Observations

The macroscopical description is based on Heim (1938, 1955b), Singer (1946) and field-notes of Thoen. The microscopical description is based on *Goossens-Fontana* 2038, *Heim* G89 and *Thoen* 5137.

10. Excluded species

Lentinus clitocyboides Henn. in Bot. Jahrb. Syst. 30: 45 (1902).

This species was described from the rainforest of Cameroon. The type material at Berlin (B) is lost but Pegler (1983) studied the isotype collections available at Kew (K) and Paris (PC), and mentioned that *Lentinus clitocyboides* represents a *Lactarius* species. However, a closer study of the material, which is in a rather bad condition, shows that this is actually a *Russula* species of the subsection *Fistulosinae* R. Heim ex Singer. It will be treated in a forthcoming paper (Verbeken, Buyck & Walleyn, in prep.).

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