

**STUDIES IN TROPICAL AFRICAN LACTARIUS SPECIES. 3.**  
**Lactarius melanogalus R. Heim and related species**

ANNEMIEKE VERBEKEN

Aspirant Nationaal Fonds voor Wetenschappelijk Onderzoek, Vakgroep Morfologie, Systematiek &amp; Ecologie, Groep Plantkunde, Universiteit Gent, Ledeganckstraat 35, B-9000 Gent, Belgium

The type-specimens of the African blackening *Lactarius*-species, *L. melanogalus* R. Heim, *L. baliophaeus* Pegler and *L. griseogalus* R. Heim are examined and compared to recent collections from Zaire, Cameroon, Burundi, Zambia and Tanzania. *Lactarius denigricans* spec. nov. and *L. baliophaeus* var. *orientalis* var. nov. are proposed.

In tropical Africa, some of the *Lactarius*-species in the section *Plinthogali* (as defined by Bon, 1983 and Hesler & Smith, 1979) are characterized by a remarkable colour-change of the latex and a strong staining of the context. The latex is first watery and transparent, then turns to grey or even black. The context is cream-coloured and becomes first greyish pink or greyish red, finally black. In dried condition, those species are easily recognized by the black colour of the context.

Heim (1955b, 1966, 1967) described two blackening species in the section *Plinthogali*: *L. melanogalus* from Ivory Coast, Cameroon, Gabon and Zaire and *L. griseogalus* from Central African Republic. Another blackening *Lactarius* is described by Pegler (1969) from Ghana: *Lactarius baliophaeus*.

**MATERIAL AND METHODS**

This study is based on herbarium material from the National Botanic Garden of Belgium (BR), the Royal Botanic Garden of Edinburgh (E), the University of Gent (GENT), the University of Helsinki (H), the Royal Botanic Gardens of Kew (K), the National Museum of Natural History of Paris (PC) and the personal herbarium of Bart Buyck (BUYCK).

Microscopic features are studied in congo-red in ammonia or L4 (Clemençon, 1972) (eventually after a short passage in KOH 10% solution). Spore ornamentation is described and illustrated as observed in Melzer's reagent. Terminology of cystidial elements is according to Buyck (1991). Line-drawings are made with the aid of a drawing tube at magnifications 6700× for spores, 3200× for individual elements and 1100× for sections and surface views. Stippling indicates refractive contents in cystidia and lactifers, intracellular pigmentation in the elements of pilei- and stipitipellis. Basidia length excludes sterigmata length.

Spores are measured in side view in Melzer's reagent, excluding the ornamentation, and measurements are given as (MINa) [AVa–2\*SD]–AVa–AVb–[AVb + 2\*SD] (MAXb) in which AVa = lowest mean value for the measured collections, AVb = greatest mean value and SD = standard deviation. Q stands for 'quotient length/width' and is given as (MINQa) Qa–Qb (MAXQb) in which Qa, resp. Qb, stand for the lowest, respectively the highest, mean quotient for the measured specimens.

Colour-codes are from Kornerup & Wanscher (1978). Colour of spore-prints is according to Romagnesi (1967). L + 1/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).

## RESULTS

In addition to the type-specimens, 40 more recent collections have been studied. Most of those collections could be identified as *L. baliophaeus*. Some represented *L. melanogalus*. When comparing all the collections of *L. baliophaeus*, it was striking that some of them had clearly longer spores than the type-specimen. I propose a new variety, *L. baliophaeus* var. *orientalis*.

Between the Tanzanian collections, gathered by Tiina Saarimäki et al., one blackening *Lactarius* that superficially resembles *L. baliophaeus*, was found. It shows exactly the same colour-changes, but has totally different microscopic features. The pileipellis consists of thick-walled cylindric elements on a pseudoparenchymatous layer; there are thick-walled and emergent macropleurocystidia; the ornamentation of the spores is always lower than 0.5 µm and is composed of warts and fine connective lines. The species is described as *L. denigricans*.

*Lactarius melanogalus*, *L. griseogalus* and *L. baliophaeus* are typical members of the section *Plinthogali*, because of their winged spores and hymeniderm-like pileipellis without thick-walled elements. Though superficially related with those species by the similar colour-changes, *L. denigricans* belongs to a different section. The closest affinities with other African *Lactarii* are found with *Lactarius rubroviolascens* R. Heim. The latex of *L. rubroviolascens* is water-like, almost translucent with a greyish tinge, the context becomes blackish, then reddish. Most of the microscopical features are more or less similar to those of *L. denigricans*: rather thick-walled elements in pilei- and stipitipellis, macropleurocystidia thick-walled and emergent; spores low ornamented.

## KEY TO THE BLACKENING LACTARIUS-SPECIES IN AFRICA

- 1a. Terminal elements of the pileipellis thick-walled; ornamentation of the spores never exceeding 0.5 µm height, composed of warts and fine connective lines . . . *L. denigricans*
- b. No thick-walled elements present in the pileipellis; ornamentation of the spores exceeding 1 µm height, composed of ridges forming a more or less complete reticulum . . . 2
- 2a. Spores ellipsoid; Q = 1.24–1.64 . . . . . 3
- b. Spores globose to subglobose, rarely ellipsoid; Q = 1.01–1.20 . . . . . 4
- 3a. Pileus and stipe greyish yellow to yellowish brown, without papilla; spores completely winged . . . . . *L. baliophaeus* var. *orientalis*
- b. Pileus and stipe dark brown, with a distinct papilla; spores partially winged, with conical warts and lower ridges present . . . . . *L. griseogalus*
- 4a. Ornamentation of the spores 1–2 µm high; spores 6.7–7.3–7.5–8.2 × 6.0–6.5–6.7–7.2 µm; latex finally bluish black . . . . . *L. melanogalus*
- b. Ornamentation of the spores up to 1(–1.3) µm high; spores 7.0–7.9–8.3–9.0 × 6.5–7.3–7.6–8.2 µm; latex finally beige to cream-colour . . . *L. baliophaeus* var. *baliophaeus*

# 1. *Lactarius melanogalus* R. Heim — Figs. 1, 2

*Lactarius melanogalus* R. Heim, Bull. Jard. Bot. Etat 25 (1955) 46; Boissiera 7 (1943) 268 (nom. nud., without Latin diagnosis).

Pileus (2.5) 3–4 (5.5) cm diam., thin, applanate, then slightly depressed; margin irregular, undulate, not incurved; pellis not dehiscent, smooth, mat, dry, strongly radially wrinkled, olivaceous ochraceous brown to dark brown (5E4-6, 5F4-6, 6EF6-7) with black spots. Stipe (1.5) 2.5–4 (7) × 0.4–1.0 cm, cylindric, curved near the base, smooth, longitudinally grooved, firm, dark cream-colour and greyish brown (4EF6-8, 6CD3-4), with black spots. Lamellae adnexed to adnate with decurrent tooth, unequal with lamellulae of different lengths, rather dense, 2–3 mm broad, thick, greasy, greyish, ochraceous, cream-colour, with black spots; edge slightly crenular, sometimes darker. Context thin, first transparent to cream-colour, then greyish pink, finally blackening; taste mild to acrid; smell not remarkable, sometimes sweet. Latex abundant, first watery, then cream to greyish, finally bluish black. Spore deposit not noticed.

Spores globose to subglobose, sometimes ellipsoid, 6.7–7.3–7.5–8.2 × 6.0–6.5–6.7–7.2 µm ( $Q = 1.04\text{--}1.11\text{--}1.13\text{--}1.20$ ;  $n = 60$ ); ornamentation amyloid, composed of high ridges (1–2 µm), forming a winged reticulum, without isolated warts, denser on adaxial side; plage not amyloid. Basidia 30–45 × 9–11 µm, cylindric to narrowly utriform, 4-spored. Macroleurocystidia sparse, not emergent, 33–43 × 6–8 µm, cylindric to fusiform, sometimes irregular, with slightly thickened wall. Pseudoleurocystidia sparse; content dark brown. Lamella-edge sterile; cheilocystidia 18–28 × 4–6 µm, cylindric to fusiform and tapering upwards, wall slightly thickened; content brown. Lamella-trama irregular, composed of hyaline thin-walled hyphae; lactiferous hyphae abundant and with remarkable brown content. Pileipellis a hymeniderm; 40–70 µm thick, elements of the suprapellis 20–40 × 7–13 µm, thin-walled, subglobose to slightly clavate or clavate, with brown intracellular pigmentation; subpellis pseudoparenchymatous, thin. Stipitipellis a palissade; 40–90 µm thick; elements of the suprapellis (10) 15–30 (35) × 3–6 (10) µm, cylindric, slender, sometimes fusiform or irregular, with brown intracellular pigment; subpellis pseudoparenchymatous. Clamp-connections lacking.

Chemical reaction — Gaiac: intense blue-green (both *Goossens-Fontana* 979 and *Buyck* 1356). Phormol: ± 7BC7, reddish orange, greyish red. NH<sub>4</sub>OH: greyish yellow (4B4). Aniline: reddish, then 7E8 brown.

*Examined material and distribution.* CAMEROON: rain forest, South Western Prov., near Mundema, Korup National Park, transect P, 100–150 ft alt., 1984, *Alexander* '6' (E); *ibid.*, plot 10, March 1991, *Watling* 23140 (E); *ibid.*, plot 15–18, *Watling* 23141 (E); Amugebria, near Ebolowa, July 1946, *Heim* 'Q43' (PC: Heim, 1955b; lost?). — GABON: Drier Guineo-Congolian rain forest: road of Oyem, *Heim* (Heim, 1955b). — GHANA: West African dry coastal forest, Cape coast, Jukwa road, May 1973, *Rose* 7306 (K; Pegler & Young, 1982, not seen). — IVORY COAST: Drier Guineo-Congolian rainforest, near Gagnoa, April 1939, *Heim* A87 (PC: Heim, 1955b; lost?). — ZAIRE: Drier Guineo-Congolian rain forest with *Macrolobium dewevrei*, Equateur prov., Binga, 380 m alt., Dec. 1934, *Goossens-Fontana* 979 (lectotypus, BR). Guineo-Congolian lowland rain forest with *Gilbertiodendron* and *Scaphopetalum*, Tshopo prov., 5 km NNE of Batabongena, terrestrial amongst leaves, April 1984, *Buyck* 1356 (BR). — ZAMBIA: Wetter Zambezian miombo woodland, Luapala prov., Mansa, Kwanfumu, Jan. 1991, *Buyck* 3332 (BUYCK).

## Observations:

1) Heim first used the name *Lactarius melanogalus* (1943) for a specimen from Ivory Coast, without Latin diagnosis. In 1955b he redescribed the species, Latin diagnosis in-

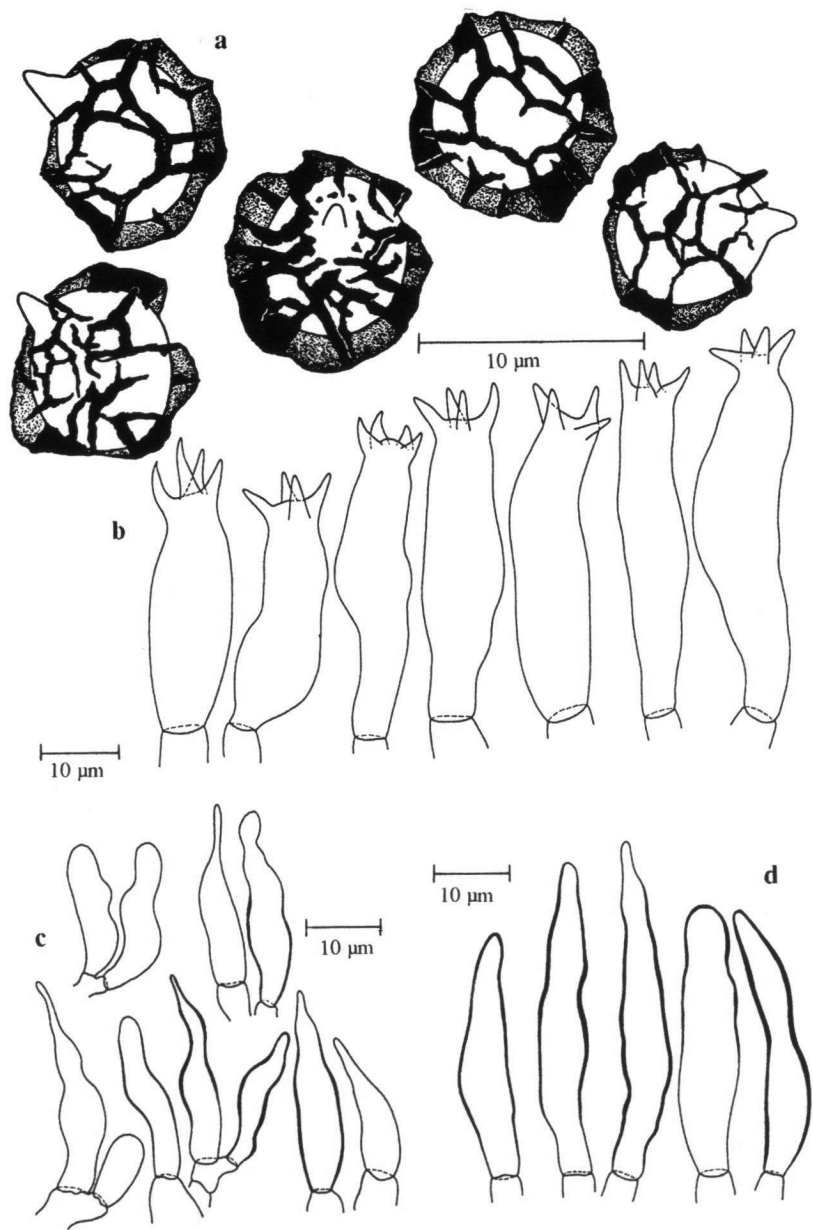


Fig. 1. *Lactarius melanogalus*. a. Spores; b. basidia; c. cheilocystidia; d. macropleurocystidia (a–d. *Goossens-Fontana* 979).

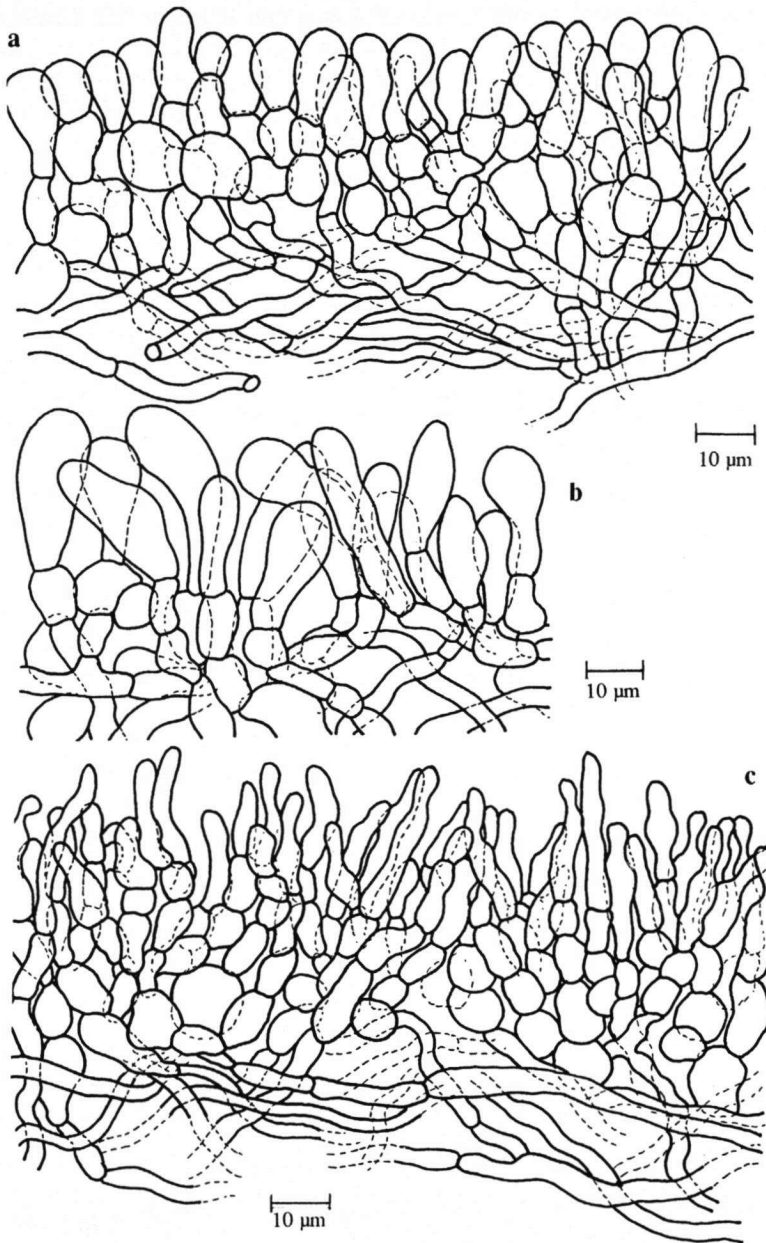


Fig. 2. *Lactarius melanogalus*. a. Section through the pileipellis near the margin; b. section through the pileipellis halfway the radius; c. longitudinal section through the stipitipellis near the top (a, c. Goossens-Fontana 979; b. Buyck 3332).

cluded, and cited specimens from Ivory Coast, Cameroon and Zaire. He did not indicate a type-specimen. *Heim A87* and *Heim Q43*<sup>1</sup> could not be traced at PC. Considering the water-colour of *Heim A87* and the drawings of the spores, they clearly represented the same species as *Goossens-Fontana 979*. I propose *Goossens-Fontana 979* as lectotypus. The type-specimen consists of two basidiomes in good condition.

2) The macroscopical description is based on the description of Heim (1955b) and completed with fieldnotes on *Buyck 3332* and *1356*. The microscopical description is based on *Goossens-Fontana 979*, including spore-measurements of *Buyck 1356* and *3332*.

3) Following the description of Heim, the colour of the pileus is ochraceous to olive-brown and the illustration of *Heim A87* shows indeed a rather pale mushroom. *Goossens-Fontana 979* is mentioned (Heim, 1955a) to be dark brown (bistre sombre), which is also the colour of the specimens of *Buyck* and *Watling*. The water-colour of *Heim A87*, which shows a very young specimen, proves that the pileus is ochraceous when young and becomes darker with age.

4) The taste of latex and context is very acrid in the specimens collected by Heim, very bitter in *Goossens-Fontana 979*, very acrid (but slow) in *Buyck 3332*, mild in *Buyck 1356*. There is a strong and sweetish smell in *Buyck 1356*, a fish-smell in *Heim Q43* and a smell of *Russula pectinata* (Foetentinae) in *Heim A87*.

5) The presence of aberrant spores is mentioned by Heim (1955b, fig. 15). Those spores can have the same size as the normal spores, but they have strongly amyloid droplet-like, globose warts, very irregular in size and number, and there is no sign of the normal reticulate ornamentation at all. I observed such spores in *Goossens-Fontana 979* and in the specimens of Cameroon, but they are certainly not characteristic for this species. Similar deviant spores were observed in collections of other African *Lactarius*- and *Russula*-species (*Buyck*, personal comment). An explication for their existence is unknown.

6) Coloured illustrations of *L. melanogalus* are provided by Heim (1955a: pl. 14.6; 1955b: pl. 5.1-2). Pegler & Young (1982) published a scanning electron microscopy-photograph of the spores of *L. melanogalus*.

7) *Lactarius melanogalus* is cited in Nzigidahera (1993), but those specimens represent *L. baliophaeus* var. *baliophaeus* (*Buyck 4062, 4063, 4338*) and *L. baliophaeus* var. *orientalis* (*Buyck 4375*).

## 2. *Lactarius griseogalus* R. Heim — Fig. 3a

*Lactarius griseogalus* R. Heim, Rev. Mycol. (Paris) 32 (1967) 204; Israel J. Bot. 15 (1966) 158, nom. nud., without Latin description.

Because the type-specimen (1 basidiome) is in very bad condition and no other specimens of this species are known yet, no complete description can be given here. Before he gave a Latin diagnosis in 1967, Heim described the species extensively in 1966. According to Heim, this species is very closely related to *L. melanogalus*, but differs from it by the very dark brown pileus and a very pronounced papilla. The latex becomes greyish, but

<sup>1</sup>) There exists another specimen labeled *Heim Q43*, which represents *Lactarius gymnocarpus*. As there is no confusion possible between those species and as Heim cited *Heim Q43* also under *L. gymnocarpus*, I suppose that there were two specimens with the same number. Despite a long search, this *Heim Q43* could not be traced in the National Museum of Natural History of Paris.

never black and the taste is mild and sometimes a bit astringent. He also mentions that the spores are smaller. As in the present concept of *L. melanogalus* the pileus becomes darker with age and the taste of the context and latex appears rather variable, the noted differences are of low significance. Although the type is in very poor condition, it was possible to take a careful look at the spores. They proved to be very different indeed from those of *L. melanogalus*. The spores are ellipsoid and measure  $7.0\text{--}8.2\text{--}9.3 \times 5.5\text{--}6.0\text{--}6.5 \mu\text{m}$  ( $Q = 1.24\text{--}1.36\text{--}1.55$ ;  $n = 20$ ). The winged aspect of the ornamentation of the spores is not as obvious as in *L. melanogalus*. The ornamentation is up to  $1.5 \mu\text{m}$  high. Beside the normal 4-spored basidia, 2-spored basidia were frequently observed. For these reasons *L. griseogalus* is nevertheless considered as a good species.

*Examined material and distribution.* CENTRAL AFRICAN REPUBLIC: Sudanian woodland, Savanne de Bébé, close to Filifi river, associated with *Lophira alata* and *Uapaca guineensis* (the latter is likely to be the ectomycorrhizal host), Aug. 1966, Heim LM2189 (holotypus PC).

### 3. *Lactarius baliophaeus* var. *baliophaeus* Pegler — Figs. 3b, 4, 5a

*Lactarius baliophaeus* var. *baliophaeus* Pegler, Kew Bull. 23 (1969) 237.

Pileus 3–7 (9) cm diam., plano-concave, applanate to slightly depressed, infundibuliform when older; margin slightly incurved when young, then crenulate to undulate, striate when dry; pellis not dehiscent, smooth, dry, mat, quite thick, greyish yellow to brownish orange (4AB3–5–5C4) to dark blond and yellowish brown (5DE4–5), staining dark brown and black. Stipe central to excentric, (1.5) 2.5–5  $\times$  0.5–1.0 cm, cylindric, clavate towards the base, greyish yellow to brownish orange or dark blond, sometimes dark grey, staining black and dark brown, firm, smooth, dry. Lamellae broadly adnate to decurrent, very dense (4 + 12 to 3 + 6/cm), unequal with lamellulae (3–5 (7) between 2 lamellae, regular pattern), thin, paper-like, broad (3) 5–7 mm, cream, pale greyish, staining reddish then black; edge entire, sometimes black brown. Context firm, white to cream-colour, changing immediately to orange-red, greyish red and finally black; taste mild, sometimes slightly bitter (AV 94.283) or even first mild but then acrid (AV 94.438). Latex very abundant, water-like, transparent-brownish, changing to beige and cream-colour, taste mild (acrid in AV 94.438). Spore deposit cream-colour (IIa).

Spores globose to subglobose,  $7.0\text{--}7.9\text{--}8.3\text{--}9.0 \times 6.5\text{--}7.3\text{--}7.6\text{--}8.2 \mu\text{m}$  ( $Q = 1.01\text{--}1.07\text{--}1.09\text{--}1.15$ ,  $n = 80$ ); ornamentation strongly amyloid, composed of ridges, up to  $1.0$  ( $1.3$ )  $\mu\text{m}$  high, forming a complete reticulum, isolated warts very scarce; plage distal amyloid. Basidia 38–48  $\times$  10–12  $\mu\text{m}$ , clavate to utriform, tapering downwards, 4-spored; sterigmata 3–6  $\times$  1–2  $\mu\text{m}$ ; content granular or guttate. Macroleurocystidia scarce to abundant, not emergent but often arising deep in the hymenium, 40–55  $\times$  9–11, fusiform, wall slightly thickened and brown pigmented. Pseudopleurocystidia (2) 3–6  $\mu\text{m}$  diam., cylindric, rarely tortuous, top rounded, tapering or mucronate; content oleiferous, yellowish brown; sometimes emergent, quite abundant. Lamella-edge sterile; cheilocystidia 21–40  $\times$  (2) 3–6  $\mu\text{m}$ , tortuous to cylindric, fusiform, top rounded, mucronate or tapering, sometimes septate, sometimes slightly thick-walled, hyaline. Lamella-trama irregular, composed of thin-walled, hyaline hyphae and quite abundant lactifers with a brown content. Pileipellis a palisade; 30–80  $\mu\text{m}$  thick; elements of the pileipellis 10–25  $\times$  3–5  $\mu\text{m}$ , cylindric, slender, some fusiform, thin-walled, with brown intracellular pigment; subpellis pseudo-

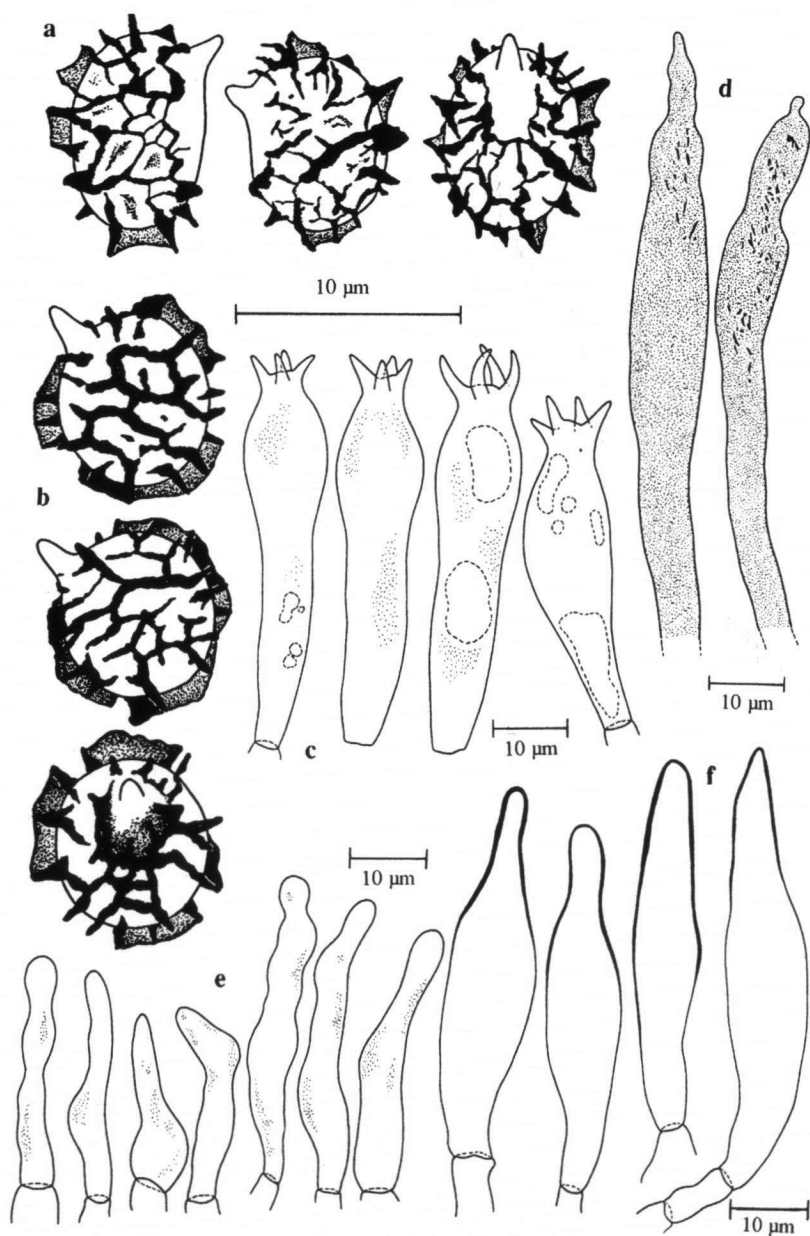


Fig. 3. *Lactarius griseogalus*. a. Spores (Heim LM 2189). — *Lactarius baliophaeus* var. *baliophaeus*. b. Spores; c. basidia; d. pseudopleurocystidia; e. cheilocystidia; f. macropleurocystidia (b, c. Holden GC 66; c–f. Verbeken 94.153).



parenchymatous. Stipitipellis trichoderm-like; hyphae interwoven and ascending in suprapellis, no spherical cells; terminal elements cylindric to slightly tortuous,  $20\text{--}30 \times 3\text{--}5\ \mu\text{m}$ , thin-walled, with brown intracellular pigment; lactifers in the underlayer abundant. Clamp-connections lacking.

Chemical reactions —  $\text{FeSO}_4$ : nihil.  $\text{HCl}$ : nihil.  $\text{NH}_4\text{OH}$ : nihil.  $\text{NaOH}$ : pileipellis intense red.

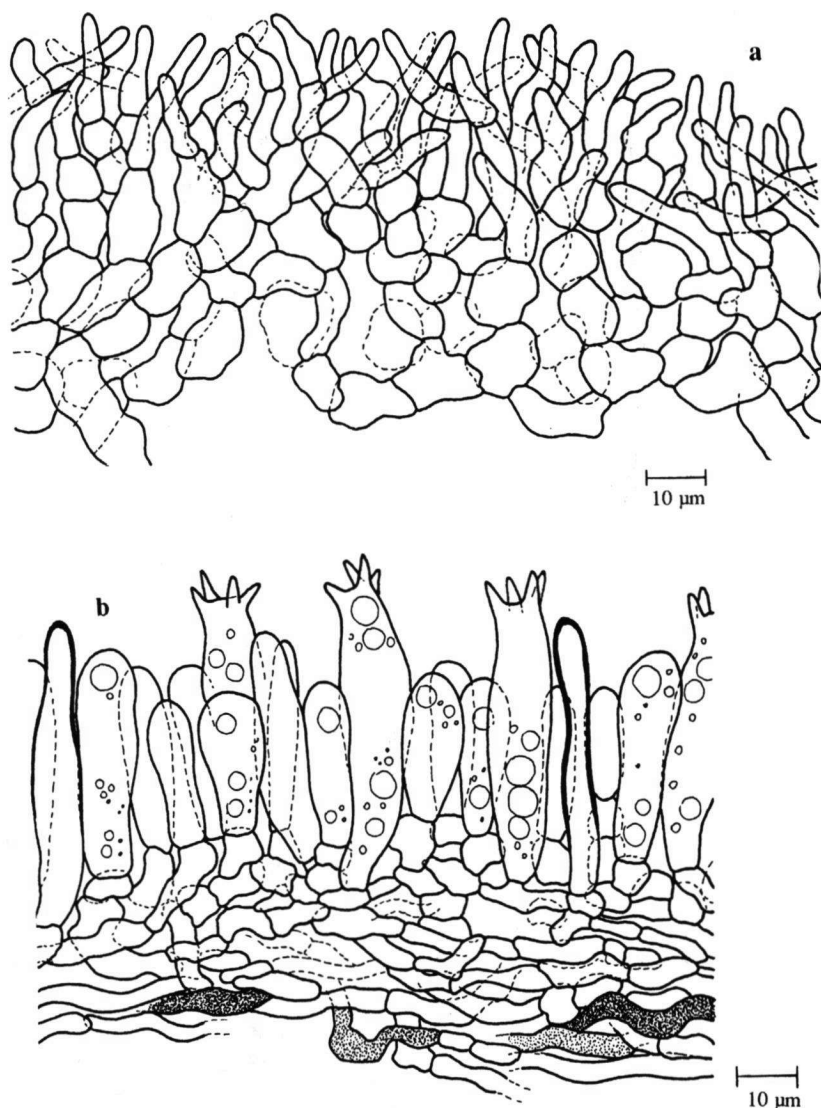


Fig. 4. *Lactarius baliophaeus* var. *baliophaeus*. a. Section through the pileipellis near the margin; b. part of the hymenium halfway a lamella (a. Holden GC 66; b. Verbeken 94.153).

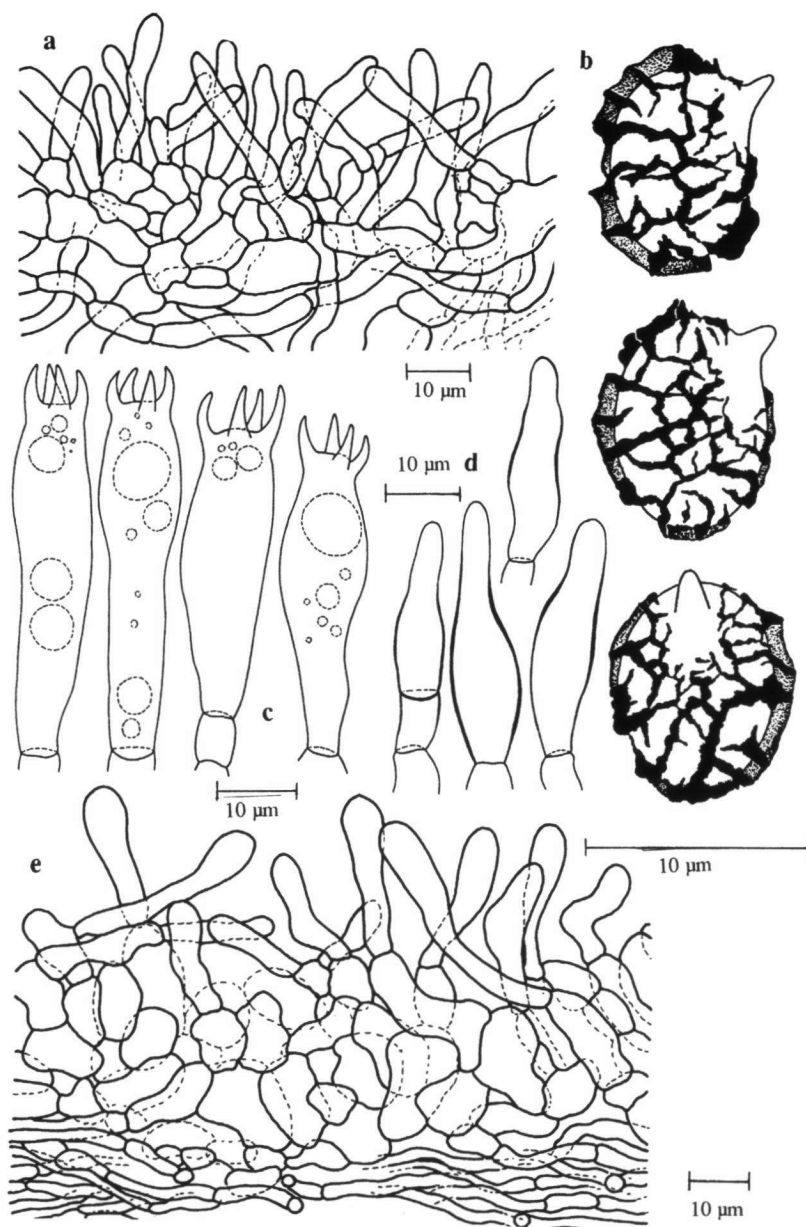


Fig. 5. *Lactarius baliophaeus* var. *baliophaeus*. a. Section through the pileipellis halfway the radius (Verbeken 94.153). – *Lactarius baliophaeus* var. *orientalis*. b. Spores; c. basidia; d. cheilocystidia; e. section through the pileipellis halfway the radius (b–e. Verbeken 94.472).

**Examined material and distribution.** BURUNDI: Miombo woodland dominated by *Brachystegia utilis*: Bururi prov., Nyamirambo, Rumonge Forest Reserve, 850–950 m alt., May 1993, *Buyck* 5091 (et icon. phot.), 5092, 5137 (BUYCK); March 1994, *Verbeken* 94.012, 94.028, 94.069, 94.283 (et icon. phot.), 94.386, 94.438, 94.472 (et icon. phot.) (BR); Nkayamba, just N of Rumonge, 850–950 m alt., Dec. 1991, under *B. microphylla*, *Buyck* 4062, 4063 (BUYCK); April 1992, under *B. spiciformis*, *Buyck* 4338 (BUYCK); Dec. 1992, under *B. microphylla*, *Buyck* 4641, 4642 (BUYCK); March 1993, *Verbeken* 94.153 (et icon. phot.), 94.165 (et icon. phot.) (BR). — GHANA: Guineo-Congolian rain forest: Tafo, under *Cassia*, July 1955, Holden GC66 (holotypus K). — ZAMBIA: Miombo woodland, Luapala prov., near Kawambwa, Jan. 1991, *Buyck* 3446 (BUYCK).

#### Observations:

The macroscopical description is compiled from the description of Pegler (1969) and the fieldnotes of Verbeken. The microscopical description is based on *Holden GC66*, *Verbeken* 94.153 and *Verbeken* 94.283.

#### 4. *Lactarius baliophaeus* Pegler var. *orientalis* Verbeken, var. nov. — Fig. 5b–e

A varietate typica differt sporae forma atque sporae dimensionibus, sporis ellipsoideis,  $7.4\text{--}8.7\text{--}9.4\text{--}10.3 \times 5.8\text{--}6.4\text{--}7.0\text{--}7.4$  (7.7)  $\mu\text{m}$  ( $Q = 1.21\text{--}1.34\text{--}1.36\text{--}1.64$ ;  $n = 60$ ).

Holotypus: *Verbeken* 94.472, Burundi, March 1994 (BR, isotypus GENT).

*Lactarius baliophaeus* var. *orientalis* differs from *L. baliophaeus* var. *baliophaeus* only by the spore shape and dimensions. The spores are ellipsoid,  $7.4\text{--}8.7\text{--}9.4\text{--}10.3 \times 5.8\text{--}6.4\text{--}7.0\text{--}7.4$  (7.7)  $\mu\text{m}$  ( $Q = 1.21\text{--}1.34\text{--}1.36\text{--}1.64$ ;  $n = 60$ ).

**Examined material and distribution.** BURUNDI: Miombo woodland dominated by *Brachystegia utilis*: Bururi prov., Nyamirambo, Rumonge Forest Reserve, 850–950 m alt., Jan. 1993, *Buyck* 5232 (BUYCK), Nov. 1993, *Buyck* 5229 (BUYCK); March 1994, *Verbeken* 94.215, 94.472 (holotypus BR, isotypus GENT), 94.523 (BR); Nkayamba, just N of Rumonge, 850–950 m alt., April 1992, associated with *B. microphylla*, *Buyck* 4375 (BUYCK). — ZAMBIA: Miombo woodland with *Baphia bequartii*, *Isoberlinia angolensis*, *Uapaca kirkiana*, *Brachystegia spiciformis* and *Albizia antunesiana*: Copperbelt prov., Chatiforest, near Kitwe, alt. 1270 m, under *Brachystegia spiciformis*, Dec. 1990, *Buyck* 3115, 3132, 3225, 3227 (et icon. phot.) (BUYCK), under *Anisophyllea boehmii*, *Buyck* 3214 (BUYCK), under *Afzelia quanzensis* and *Brachystegia spiciformis*. Miombo woodland with *Brachystegia boehmii*: Luapala prov., Mansa, Kwanfumuwe, Jan. 1991, *Buyck* 3322 (BUYCK).

#### 5. *Lactarius denigricans* Verbeken & Karhula, spec. nov. — Figs. 6–8

Pileus 6–8 cm diam., convexus ad leviter depressus; margine irregulari; pileipellis pallide ochracea, dein badio vel nigro maculata. Stipes 4.5–6 cm longus, 1.5–2 cm crassus, cylindricus, pileo concoloratus, dein badio vel nigro maculatus, in longitudine rugosus ad sulcatus. Lamellae decurrentes, modice confertae, albo-cremaeae, denigrantes. Latex abundans, translucido-albus, rubescens, dein niger, guttu mitis. Contextus albus, rubescens, postremo lilacinus ad niger. Sporae  $6.8\text{--}7.7\text{--}8.4$  (8.7)  $\times$   $5.6\text{--}6.3\text{--}7.1$   $\mu\text{m}$ , subglobose ad ellipsoideae, irregulariter verrucosae ad incomplete reticulatae; macula suprahilaris centrale amyloidea. Macropleurocystidia absentia. Pileipellis bistrata; elementa suprapellis  $15\text{--}55 \times 7\text{--}8$  (10)  $\mu\text{m}$ , cylindrata ad clavata, pariete incrassato (0–1  $\mu\text{m}$ ); subpellis pseudoparenchymata.

Holotypus: *Saarimäki et al.* 1467, Tanzania, Jan. 1993 (H).

Pileus 6–8 cm diam., convex to slightly depressed; margin irregular; pellis mat, slightly wrinkled, pale beige, becoming brownish grey to black when bruised. Stipe 4.5–6  $\times$  1.5–2 cm, cylindric, round to applanate on section, mat, longitudinally wrinkled to groov-

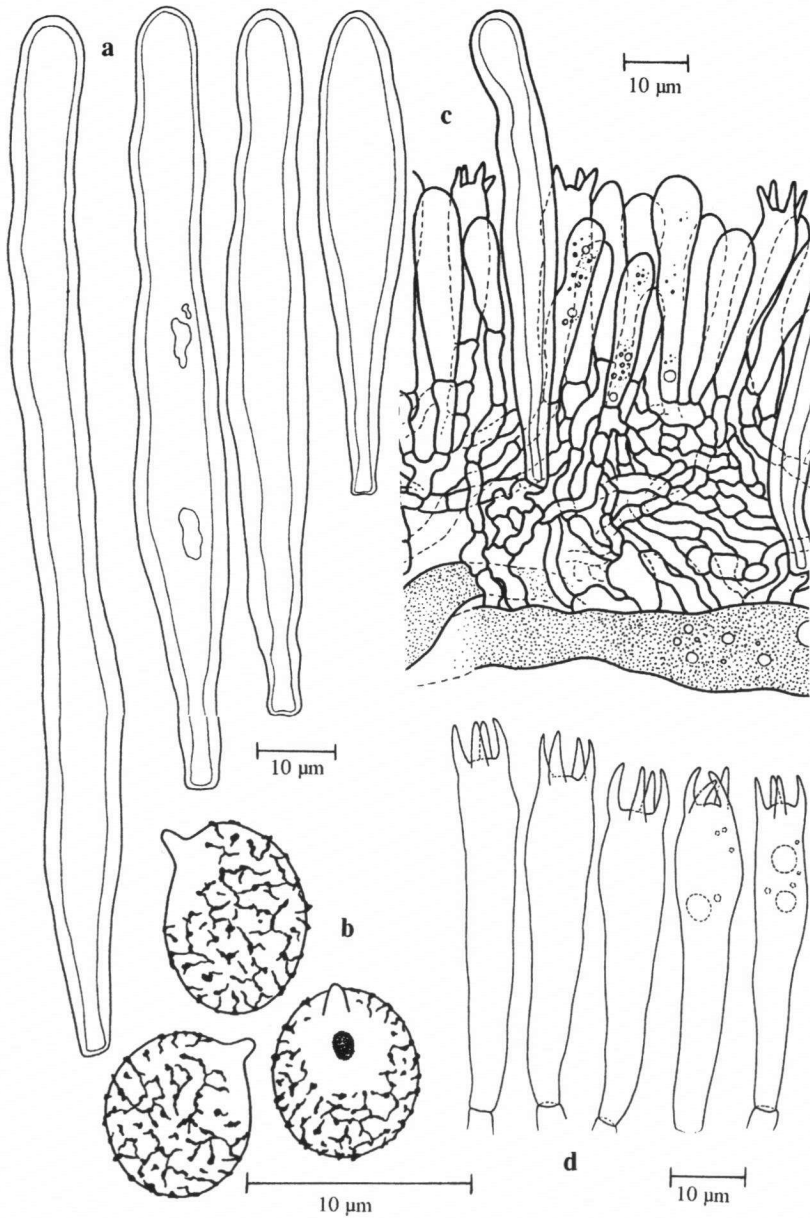


Fig. 6. *Lactarius denigricans*. a. Macropleurocystidia; b. spores; c. part of the hymenium halfway the lamella; d. basidia (a–d. Saarimäki *et al.* 1967).

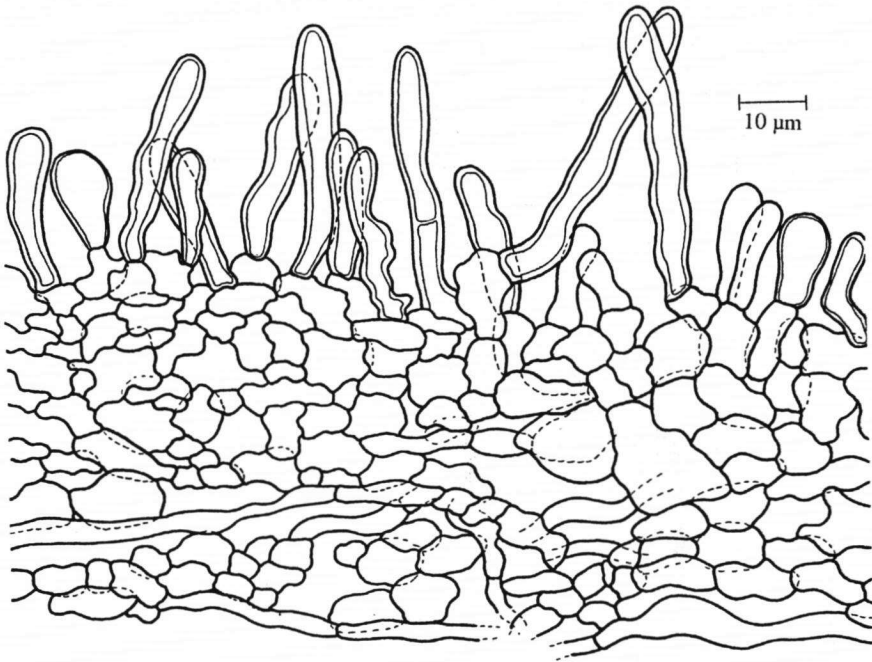


Fig. 7. *Lactarius denigricans*. Section through the pileipellis halfway the radius (Saarimäki et al. 1467).

ed, pale beige, becoming brownish grey when bruised. Lamellae decurrent, unequal with mostly short lamellulae, close, broad (8 mm), rather thick, ivory coloured, blackening when bruised; edge entire and concolorous. Context in the pileus white, becoming red, then lilac and finally black by the latex; in the stipe white, then yellow, red under the surface; taste mild, smell absent. Latex abundant, transparent-whitish, changing red on the air, finally black; taste mild. Spore deposit not noticed.

Spores subglobose to ellipsoid,  $6.8-7.7-8.4$  ( $8.7$ )  $\times$   $5.6-6.3-7.1$   $\mu\text{m}$  ( $Q = 1.12-1.21-1.32$ ;  $n = 50$ ); ornamentation amyloid, low, up to  $0.5$   $\mu\text{m}$  high, composed of irregular knotty warts and fine connective lines, never forming a complete reticulum; plage distinct, with a central amyloid spot. Basidia (38)  $40-45$  ( $47$ )  $\times$   $7-9$  ( $10$ )  $\mu\text{m}$ , cylindric to slightly clavate, 4-spored. Macropleurocystidia abundant, emergent,  $60-135 \times 10-11$   $\mu\text{m}$ , cylindric to narrowly fusiform, rounded with thickened wall ( $1-2$   $\mu\text{m}$ ). Pseudopleurocystidia not abundant, cylindric,  $7-8$   $\mu\text{m}$  diam., content brownish oleiferic. Lamella-edge fertile, macrocystidia, basidioles and basidia present. Lamella-trama composed of sphaerocytes and abundant broad lactiferous hyphae. Pileipellis a palissade;  $70-100$   $\mu\text{m}$  thick; elements of suprapellis  $15-55 \times 7-8$  ( $10$ )  $\mu\text{m}$ , cylindric, sometimes clavate, sometimes septate, thick-walled ( $0-1$   $\mu\text{m}$ ); subpellis thin, pseudoparenchymatous, spherical cells  $5-15$   $\mu\text{m}$ . Stipitipellis a trichoderm,  $90-140$   $\mu\text{m}$  thick; terminal elements cylindric to slightly tortuous, ( $10$ )  $25-60$  ( $80$ )  $\times$   $6-8$  ( $10$ )  $\mu\text{m}$ , thick-walled ( $1-2$   $\mu\text{m}$ ). Clamp-connections absent.

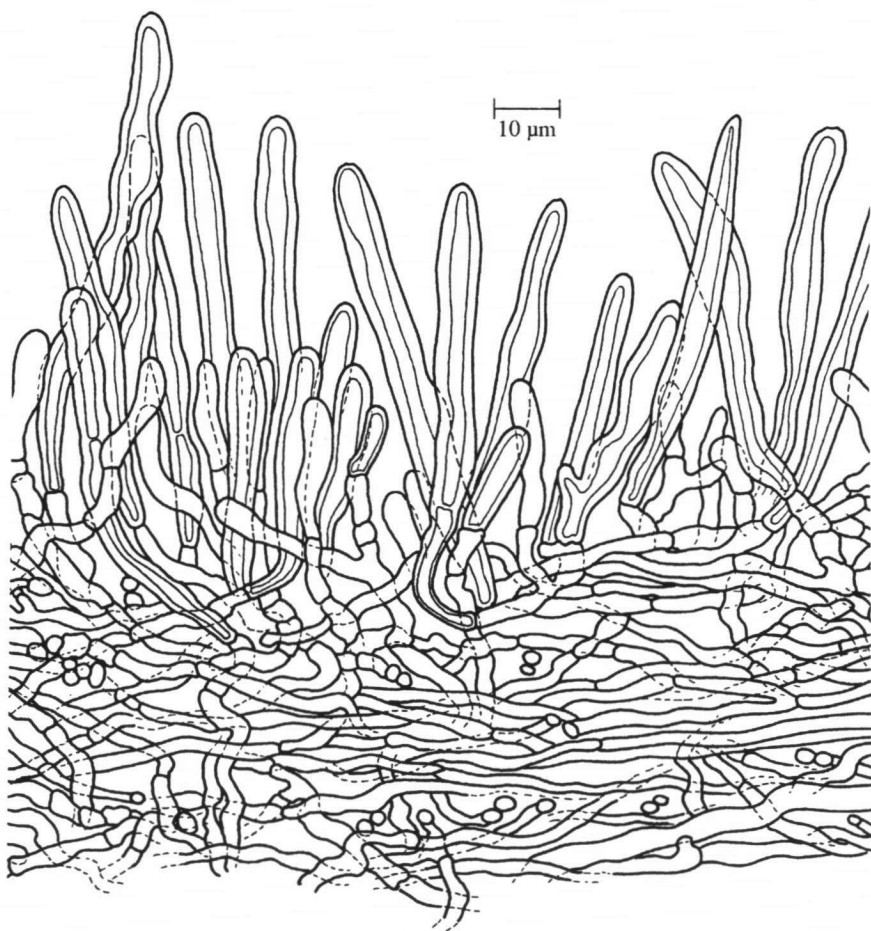


Fig. 8. *Lactarius denigricans*. Section through the stipitipellis near the top (Saarimäki *et al.* 1967).

*Examined material and distribution.* TANZANIA: Miombo woodland with mainly *Uapaca* and some *Brachystegia*, Southern prov., Songea distr., Lirondo, 1250 m, Jan. 1993, Saarimäki *et al.* 1967 (icon. phot.) (holotypus H).

#### ACKNOWLEDGEMENTS

I wish to express my gratitude to the directors and curators of the Herbaria referred to above, to Bart Buyck who kindly lent me his private collection, to Machiel Noordeloos for reviewing this paper, to Ruben Walley and Bart Buyck for the critical remarks and useful comments, to Paul Goetghebeur for checking and improving the Latin description and to Päivi Karhula for the pleasant cooperation during her stay in Belgium.

The National Foundation for Scientific Research (N.F.W.O., Belgium) is acknowledged for founding this research and for the financial support of my collecting-trip to Burundi.

## REFERENCES

- Beeli, M. 1928. Contribution à l'étude de la flore mycologique de Congo. Fungi Goossensiani V. Bull. Soc. Roy. Bot. Belgique 60: 153–174.
- Bon, M. 1983. Notes sur la systématique du genre *Lactarius*. Doc. Mycol. 13 (50): 15–26.
- Buyck, B. 1991. The study of microscopic features in *Russula*. 2. Sterile cells of the hymenium. *Russulales News* 1 (2): 62–85.
- Cléménçon, H. 1972. Zwei verbesserte Präparierlösungen für die mikroskopische Untersuchung von Pilze. *Z. Pilzk.* 38: 49–53.
- Heim, R. 1943. Remarques sur les formes primitives ou dégradées de *Lactario-Russulés* tropicaux. *Boissiera* 7: 266–280.
- Heim, R. 1955a. *Lactarius*. Fl. Iconogr. Champignons Congo 4: 81–97, pl. 13–15.
- Heim, R. 1955b. Les lactaires d'Afrique intertropicale (Congo belge et Afrique noire française). Bull. Jard. Bot. Etat 25: 1–91, pl. 1–6.
- Heim, R. 1966. Sur un lactaire hygroporoïde tropical à lait grisonnant *Lactarius griseogalus* Heim sp. nov. *Israel J. Bot.* 15: 158–162.
- Heim, R. 1967. Breves diagnoses latinae novitatum genericarum specificarumque nuper descriptarum. *Rev. Mycol. (Paris)* 32: 201–210.
- Hesler, L.R. & A.H. Smith. 1979. North American species of *Lactarius*. Ann Arbor, Univ. Michigan Press.
- Kornerup, A. & J.H. Wanscher. 1978. Methuen handbook of colour. London, Eyre Methuen.
- Nzigidahera, B. 1993. Contribution à l'étude systématique et écologique des champignons ectomycorrhiziques de la forêt claire de Nkayamba. Thesis (unpubl.), Univ. Burundi, Faculty of Science.
- Pegler, D.N. 1969. Studies on African Agaricales. II. *Kew Bull.* 23: 219–249.
- Pegler, D.N. & T.W.K. Young. '1981' 1982. *Russulaceae* Roze. *World Pollen Spore Fl.* 10: 1–35.
- Romagnesi, H. 1967. Les Russules d'Europe et d'Afrique du Nord. Paris, Bordas.
- White, F. 1983. The vegetation of Africa. A descriptive memoir to accompany the Unesco/AETFAT/UNSO vegetation map of Africa. Paris, Unesco.