

Tanzanian mushrooms and their uses 6. *Lactarius*

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Seventy-two specimens of *Lactarius* were collected in Tanzania between 1990–1995. The material contained 27 species of which 15 had not been described. Two of these, *Lactarius denigricans* Verbeke & Karhula and *L. densifolius* Verbeke & Karhula have been described since then and three more species, *L. xerampelinus* Karhula & Verbeke, *L. tanzanicus* Karhula & Verbeke and *L. volemoides* Karhula are described here. In addition, all the identified species of *Lactarius* in Tanzania are listed and annotated. Many *Lactarius* species are considered edible in Tanzania although there are a range of opinions among the different tribes some of which are contradictory.

Key words: Africa, Agaricales, *Lactarius*, Tanzania, taxonomy.

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Introduction

This article is a part of a series of studies dealing with Tanzanian edible mushrooms. For the background, methods (collecting and interviews), research area of the project and habitats see Härkönen et al. (1993a). The first results on *Russula*, *Coprinus*, *Amanita*, *Termitomyces* and *Gasteromycetes* species were published in Härkönen et al. (1993a–b, 1994b), Saarimäki et al. (1994), Härkönen (1995), Calonge et al. (1997) and about edible and poisonous species in general in Härkönen et al. (1994a, 1995).

Until recently (Verbeke 1995a–1996d) *Lactarius* has been poorly studied and collected in tropical East Africa. *Lactarius* species are, however, frequently found in the open *Brachystegia*

woodland (miombo) of Southern and Western Tanzania. Apart from the Tanzanian collections studied here and gathered by Härkönen, Karhula and Saarimäki between 1990 and 1995, many *Lactarius* have also been collected between 1991 and 1996 from the neighbouring miombo woodlands of Burundi, Malawi and Zambia, principally by Buyck (priv. herb.) but also by Pearce and Morris. For the present state of knowledge concerning *Lactarius* in the neighbouring countries, we refer to Verbeke (1995a–1996d) and Buyck & Verbeke (1995) and Buyck (1994).

As far as Tanzania is concerned, the only published records of *Lactarius* species concern *L. gymnocarpus* (Pegler 1977), *L. pseudogymnocarpus* (Verbeke 1995b), *L. chromospermus* (Munyanziza 1994), *L. kabansus* (Härkönen et al.

1995), *L. edulis* (Härkönen et al. 1995), *L. aff. phlebophyllus* sensu Härkönen et al. (1994a, 1995 = *L. xerampelinus* Karhula & Verbeken sp. nov.) and *L. aff. pseudovolemus* sensu Härkönen et al. (1994a, 1995 = *L. volemoides* Karhula sp. nov.).

Material and methods

The authors collected 72 *Lactarius* specimens during their five collecting trips 1990–1995. All the specimens are deposited at the Botanical Museum of the University of Helsinki (H) and some representative specimens in the herbario of Gent (GENT) and Dar es Salaam (DSM). All the collection numbers concern the specimens gathered by us (*Saarimäki et al.*) if not mentioned otherwise. Härkönen and Saarimäki collected and photographed the specimens, wrote the field notes and interviewed the local people. The microscopical details were studied and drawn by Karhula except for some spore ornamentations that were drawn by Verbeken (Figs. 3 and 16).

The spore ornamentation is described and illustrated as observed in Melzer's reagent. Line-drawings of the spores were made with a Leitz microscope and a camera lucida at $\times 6700$ magnification. Spores were measured in side view in Melzer's reagent, excluding the ornamentation. Measures are given as lowest – average – highest value for length and width. Q stands for length / width ratio. Measurements were made with the aid of a measuring-ocular connected with a Leitz microscope. Other microscopic structures were studied in Cotton Blue. The structure of pileipellis, basidia and cystidia were drawn with the aid of a camera lucida at $\times 1000$ magnification. The terminology used for elements of lamellae is adopted from Buyck (1991), for the structure of pileipellis and stipitipellis from Verbeken (1996c).

Tanzanian species of *Lactarius*

Among the 72 specimens there were 27 species of *Lactarius* of which 15 species are most probably new to science. Two species; *L. densifolius* and *L. denigricans*, had been described earlier by Verbeken and Karhula, based on material from Tanzania and Burundi in Verbeken (1996a,b). In this contribution *L. tanzanicus* sp. nov., *L. volemoides* sp. nov. and *L. xerampelinus* sp. nov. are described. Due to either lack of sufficient material or extensive macroscopical descriptions, the other species have not been described. All identified species are annotated, treated in systematic order (Verbeken 1996c) and illustrated.

Lactarius luteopus Verbeken, Mycotaxon 55:536. 1995. – Fig. 1

Vernacular names: Wunyamalagata (Bena-language); Unguyuu (Ndendeuli); Lai, Hajuli (Matengo).

Edibility: The information gathered is very variable. Some Bena people consider it inedible, some parboil and dry it before use. The Ndendeuli think it is delicious.

Ecology: Miombo woodland or degraded woodland with *Uapaca*, *Brachystegia*, *Parinari*, *Ochna*, *Rothmannia*, *Combretum molle*, *Garcinia*, *Gardenia*, *Eriosema*, *Faurea*, *Bridelia* and *Protea*.

Specimens examined: **Tanzania.** Southern Prov., Songea Distr., ca. 25 km N of Songea along the main road, ca. 5 km from the main road, Mawa village (10 35 BC), 1000 m, 27.I.1993 1415, 1424; About 40 km N of Songea, Hanga, Nyamagoma village (10 35 BC), 990 m, 27.I.1993 1432. Southern Highlands Prov., Njombe Distr., Ngaramiro, 2 km N of Kidugala (09 34 BA), on hill slope, red soil, 1550 m, 31.I.1993 1486; Mbalali village 11 km S of Kidugala, red soil, 1650 m, 1.II.1993 1504.

Observations: *L. luteopus*, *L. tanzanicus*, *L. medusae*, *L. gymnocarpoides*, *L. volemoides*, *L. pumilus* and *L. denigricans* have a lampropalisade-like pileipellis (Fig. 4 and 8). *L. luteopus* is easy to recognize by the bright yellow fruit bodies. *L. luteopus* has been collected by Buyck from Zambia and was later described by Verbeken (1995b). The colour photograph in the present publication is the first one published of this species.

Lactarius tanzanicus Karhula & Verbeken sp. nov. – Figs. 2–4

Pileus 6–13 cm diam., primo convexus tum sursum reflexo, pileipellis vivide aurantiaca, impolita. *Lamellae* decurrentes, distantes, cremeae, maculis brunneis. *Stipes* 3–8 cm longus, 1.5–3 cm crassus, albidus vel cremeus, irregulariter brunnescens. *Contextus* albidus, gustu mitis, odore dilute piscis similis. Latex albidus. *Sporae* ellipsoideae, 6.9–7.3–8 \times 5.0–5.4–6.3 μ m, incomplete reticulatae, verrucis parvis cristis paucisque ornatae, macula suprahilaris interdum distale amyloidea. *Basidia* 60–70 \times 7–10 μ m, cylindrata ad clavata. *Pleurocystidia* vera absentia. *Pileipellis* bistrata, elementa suprapellis 20–110 5–10 μ m, clavata vel irregulariter cylindrata, saepe ramosa, pariete in-crassato, subpellis pseudoparenchymata.

Holotype: **Tanzania.** Southern Prov., Kilwa Distr., Mavuji village, 78 km S of Kilwa Masoko, specimen purchased, 18.I.1993 *Saarimäki et al.* 1277 (H, isotypus DSM).

Pileus 6–13 cm in diameter, first convex then uplifted, margin wavy and uneven, pellis bright



Fig. 1. Bright yellow fruit bodies of *Lactarius luteopus* (1432).



Fig. 2. Fruit bodies of *Lactarius tanzanicus* (holotype).

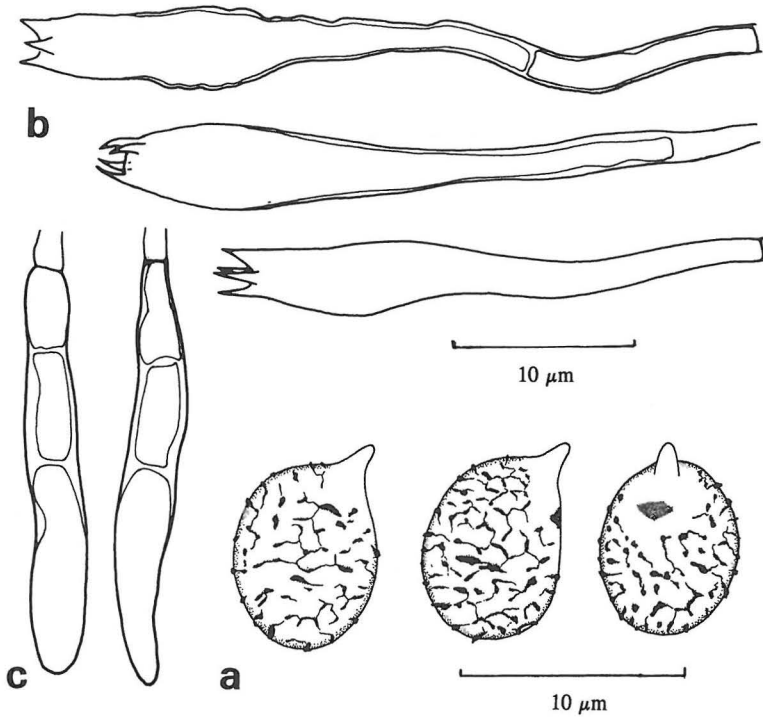


Fig. 3. *Lactarius tanzanicus*. – a) spores (holotype), b) basidia (1115), c) marginal cells (holotype).

orange, matted, slightly warted. *Lamellae* decurrent, distant, fairly thick, up to 7 mm broad, spaced with several lamellulae, cream with brown spots, lamella edge smooth. *Stipe* 3–8 × 1.5–3 cm, equal or slightly tapering, sometimes eccentric, striate, matted, white or cream, damaged areas turning brown, veil absent. *Context* in cap and stipe white, hard, brittle, milk latex white. *Smell* faint, fishy. *Taste* mild.

Spores ellipsoid, 6.9–7.3–8.0 × 5.0–5.4–6.3 µm, (Q = 1.14–1.37–1.50; n = 60), ornamentation amyloid, very fine, with small warts and few fine connective lines, plage sometimes with distal amyloid area. *Basidia* 4-spored, 60–70 × 7–10 µm, cylindrical to clavate, often thick-walled at the base. True *pleurocystidia* absent. Pseudopleurocystidia not abundant, 3–5 µm in diameter, cylindrical, obtuse. *Lamella-edge* sterile, marginal cells 45–53 × 5–6 µm, cylindrical, rounded or sharp pointed, thick-walled at base and septate. *Pileipellis* a lampropalisade; elements of the suprapellis 20–120 × 5–10 µm, clavate to irregularly cylindrical, some narrowly cylindrical, often branched, thick-walled (1–3 µm), subpellis pseudoparenchymatous, cells rounded, 10–25 µm in

diameter. *Stipitipellis* a lampropalisade; elements of the suprapellis 30–45 × 8–10–(15) µm, broadly clavate to lanceolate and cylindrical, thick-walled, subpellis pseudoparenchymatous.

Vernacular names: Imbohu nankuta (Makonde); Uyoga mchenga (Yao).

Edibility: The Makonde people consider it edible after parboiling, The Ngindo believe it is inedible.

Ecology: *Acacia–Combretum* woodland.

Additional specimens examined: **Tanzania**. Western Prov., Tabora Distr., ca. 20 km of Tabora, Lulanguru village (05 32 BA), 1100 m, 14.XII.1991 1115.

Observations: This species differs from *L. gymnocarpus* by its white or whitish stipe and clearly denser lamellae. The elements of the suprapellis of the pileipellis are less irregular and somewhat narrower (up to 10 µm) than those of *L. gymnocarpus*. Furthermore, the elements of the stipitipellis are up to 45 µm long, whereas in *L. gymnocarpus* they may be 120 µm long.

L. tanzanicus could be placed in the subgenus *Lactifluus* (Burl.) Hesler & A.H. Sm., section *Caperati* R. Heim.

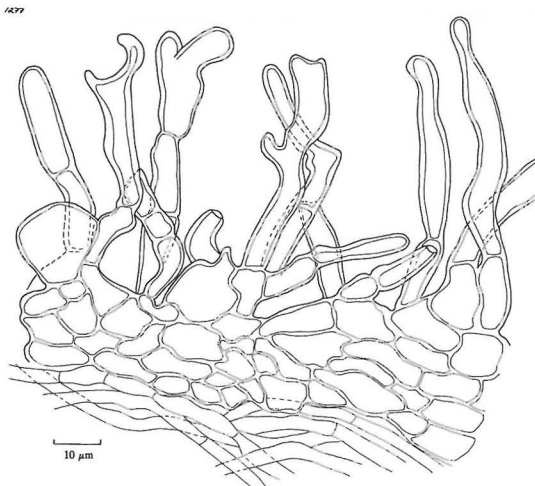


Fig. 4. The structure of pileipellis in *Lactarius tanzanicus* (holotype).

Härkönen et al. (1994a) described *L. tanzanicus* as *L. gymnocarpus* sensu lato in their article about the edible and poisonous mushrooms of Tanzania.

Lactarius gymnocarpoides Verbeken, Mycotaxon 55:530. 1995. – Fig. 5

Vernacular names: Witsiba, Wunyidziva (Bena).

Edibility: These fungi have to be parboiled before cooking to avoid bitterness (Bena).

Ecology: Degraded *Uapaca* woodland, few *Brachystegia*, *Garcinia*, *Eriosema*, *Ochna*, *Faurea*, *Bridelia* and *Protea*.

Specimens examined: Tanzania. Southern Highlands Prov., Njombe Distr., Mbalali village 11 km S of Kidugala, red soil, 1650 m, 1.II.1993 1508.

Observations: *L. gymnocarpoides* is very closely related to *L. tanzanicus*; both have lampropalisade-like pileipellis and very low ornamentated spores. However, *L. gymnocarpoides* has a lighter coloured pileus and stipe and clearly bigger spores than *L. tanzanicus*.

Lactarius volemoides Karhula sp. nov. – Figs. 6–8

Pileus 4.5–9 cm diam., convexus ad umbilicatus, margine incurvato tum ad sursum reflexo, pileipellis tomentosa, leviter rimosa, aurantiaca vel aurantiobrunnea. **Lamellae** decurrentes, distantes, al-

bidae ad cremeae. **Stipes** 2–3 cm longus, 0.6–2 cm crassus, aurantiobrunneus, stipitipellis tomentosa. **Contextus** albus, gustu mitis, odore piscis similis. **Latex** abundans, albidus. **Sporae** ellipsoideae, 8.5–9.2–10.5 × 6.0–7.1–8.2 μm, incomplete ad irregulariter reticulatae, verrucis sublaevibus interdum connexis ornatae; macula suprahilaris non amyloidea. **Basidia** 53–90 × 9.5–11 μm, clavata. **Pleurocystidia** vera absentia. **Pileipellis** bistrata, elementa suprapellis 10–75 × 3–6 μm, cylindrata, 2- vel 3-septata, pariete incrassato, subpellis pseudoparenchymata.

Holotype: Tanzania. Southern Highlands Prov., Mbeya Distr., Mbozi (09 32 BB), 1650 m, 24.III.1991 Saarimäki et al. 705 (H).

Pileus 4.5–9 cm in diameter, first convex, then umbilicate, margin incurved then uplifted. **Pellis** orange or orange-brown, darker at centre, tomentose, slightly wrinkled. **Lamellae** decurrent, distant, thick, up to 7 mm broad, white or cream, lamella-edge smooth, some forked near margin, few short lamellulae irregularly. **Stipe** 2–3 × 0.6–2 cm, tapering downwards, orange-brown, tomentose. **Context** white, brittle. **Milk** latex white and abundant. **Smell** weak, fishy (like *L. volemus*). **Taste** mild.

Spores 8.5–9.2–10.5 × 6.0–7.1–8.2 μm, (Q = 1.16–1.37–1.50, n = 60) ellipsoid, ornamentation amyloid, composed of small warts and thin ridges forming an irregularly interconnected reticulum, plage inamyloid. **Basidia** 4-spored, 53–90 × 9.5–11 μm, clavate, thin-walled. Lamella-edge fertile. True **pleurocystidia** absent. Pseudopleurocystidia 5–7 μm in diameter. **Subhymenium** and hymenophoral trama composed of sphaerocytes, 12–15 μm in diameter and lactifers, 6–10 μm in diameter. **Pileipellis** a lampropalisade, elements of suprapellis 10–75 × 3–6 μm, cylindrical, 2- or 3-septate, thick-walled (1–2 μm), subpellis pseudoparenchymatous, composed of rounded, thick-walled cells, 15–20 μm in diameter. **Stipitipellis** consists of repent hyphae, the hyphal tips projecting outwards. **Clamp connections** absent.

Vernacular names: Ufanyi, Wunyamagulu (Bena), Mpofu (Nyiha), Uselele, Utundulu (Safwa).

Edibility: Hunters may eat it as raw in the field. It is easy to preserve by drying in the sun.

Ecology: Miombo woodland planted with *Cupressus* or dominated by *Uapaca*, *Brachystegia* and *Parinari*.



Fig. 5. Fruit bodies of *Lactarius gymnocarpoides* (1508).



Fig. 6. Fruit bodies of *Lactarius volemoides* (holotype). *L. volemoides* resembles *L. pseudovolemus* and *L. volemus*.

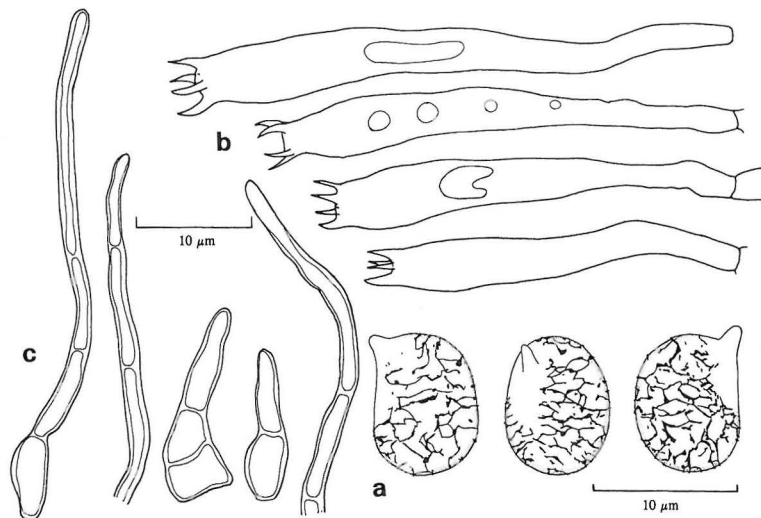


Fig. 7. *Lactarius volemoides*. – a) spores, b) basidia, c) marginal cells of pileipellis (holotype).

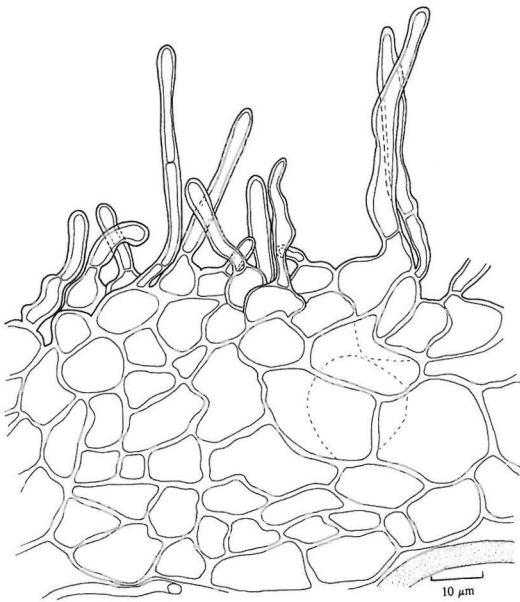


Fig. 8. The structure of pileipellis of *Lactarius volemoides* (holotype).

Additional specimens examined: **Tanzania.** Southern Highlands Prov., Mbeya Distr., a few km E of Mbeya, Ipembe Hill (08 33 CD), 1600 m, 28.III.1991 Saari-mäki *et al.* 749. *L. pseudovolemus*. **Madagascar.** Bet-simarka Prov., S of Maningory, Malagasy lowland rain-forest, 12–1934, *Heim G61* (holotype, PC).

Observations: In the book 'Edible mushrooms of Tanzania' (Härkönen *et al.* 1995) this species is illustrated and described as *Lactarius* sp. aff. *pseudovolemus*. The type locality of *L. pseudovolemus* is Malagasy lowland rainforest. *L. volemoides* differs from *L. pseudovolemus* in having paler, white to cream lamellae, by its smell which is similar to that of *L. volemus*, by its larger spores with lower ornamentation, by its longer basidia with lower ornamentation, by its longer spores and longer elements of the suprapellis and by its habitat being miombo woodland.

Lactarius volemoides belongs in the subgenus *Lactifluus* (Burl.) Hesler & A.H. Sm. because of the structure of pileipellis and spore ornamentation. It fits well in subsect. *Rugati* Pacioni & Lalli, by the long and slender basidia and the absence of true pleurocystidia.

This mushroom is said to be common at the end of rainy seasons.

Lactarius pumilus Verbeken, Bull. Jard. Bot. Nat. Belg. 65:205. 1996. – Fig. 9

Vernacular names: Wikese, (Nyamwezi); Unyakuvemba (Hehe).

Edibility: Tasty edible mushroom, has to be dried before cooking (Nyamwezi); edible (Hehe).

Ecology: Degraded woodland with *Agave sisalana*, *Brachystegia*, *Julbernardia*, *Terminalia*, *Parinari* and *Albizia*.

Specimens examined: **Tanzania.** Western Prov., Tabora Distr., ca. 20 km W of Tabora, Lulanguru village (05 32 BA), 1100 m, 14.XII.1991 1109. Southern Highlands Prov., Iringa Dist., 40 km NE of Iringa, Itagutwa village (07 35 DA), 1300 m, 08.II.1993 1603. **Burundi.** Bururi Prov., Nkayamba, just N of Rumonge, 850–950 m, III.1993 Buyck 5000 (Priv. herb. Buyck).

Observations: *L. pumilus* is described by Verbeken (1996b). *L. pumilus* is very small: diameter of pileus is only 1–3.5 cm and the length of its stipe 1–2.5 cm. This is the only *Lactarius* species studied from Tanzania where no sphaerocytes were observed in the trama. The microscopical details are illustrated in Verbeken (1996c).

Lactarius medusae Verbeken, Mycotaxon 55:532. 1995. – Fig. 10

Vernacular names: Widziva (Bena), Unyakuvemba (Hehe).

Edibility: Eaten after parboiling and cooking (Hehe).

Ecology: Miombo woodland with *Uapaca*, few *Brachystegia*, *Garcinia*, *Eriosema*, *Ochna*, *Faurea*, *Bridelia* and *Protea*.

Specimens examined: **Tanzania.** Southern Highlands Prov., Iringa Dist., Sao Hill Sawmills (08 35 AC), 1900 m, 29.III.1991 763; Njombe Distr., 11 km S of Kidugala, Mbalali village (09 34 BA), 1650 m, 01.II.1993 1502; Iringa Distr., Mafinga, Sao Hill Misitu (08 35 AD), purchased from a woman who had collected the specimen from nearby miombo woodland, 1800 m, 06.II.1993 1589.

Observations: The microscopical details are illustrated by Verbeken (1995b) based on the material collected by Buyck from Burundi. Verbeken's description agrees with that of our Tanzanian specimens. Before Verbeken published the description of *L. medusae*, our specimens were misidentified as *L. rubroviolascens* (Härkönen et al. 1994a). *L. medusae* differs from *L. rubroviolascens* in having stronger ornamentation on its spores and much longer elements of suprapellis. Context of *L. medusae* becomes violet and context of *L. rubroviolascens* becomes first blackish then reddish (Verbeken 1996c).

Lactarius denigricans Verbeken & Karhula, Persoonia 16:219. 1996. – Fig. 11

Vernacular names: Unknown.

Edibility: Local people ignore this peculiar species with rapid colour changes.

Ecology: Degraded miombo woodland growing mainly *Uapaca* with some *Brachystegia*.

Specimens examined: **Tanzania.** Southern Prov., Songea distr., Lirondo village, 120 km N of Songea, 1250 m, 30.I.1993 1467 (holotype, H).

Observations: The microscopical details are illustrated by Verbeken (1996a). The name of this *Lactarius* species refers to its milk latex which is first white, watery, then bright red and finally turns black. *L. denigricans* resembles *L. medusae* and *L. rubroviolascens* in the colour changes of its milk latex and context and the very emergent and abundant true pleurocystidia but *L. denigricans* differs from these species in its spore ornamentation and pileipellis structure. All the colour changes can be seen in Fig. 11.

Lactarius annulatoangustifolius Verbeken, Edinb. J. Bot. 53:72. 1996. – Fig. 12

Vernacular names and edibility: Not known.

Ecology: Lower montane forest with *Dracaena afromontana*, *Craibia brevecaudata*, *Isobertia* and *Syzygium*.

Specimens examined: **Tanzania.** Tanga Prov., Lushoto Distr., West Usambara Mts., Mazumbai, Forest Reserve, near the Tanner's house, (04 38 DC), on ground, 1700 m, 17.XII.1995 1700, 1720.

Observations: All other macroscopical and microscopical characters of our specimens are in good agreement with the type specimen of *L. annulatoangustifolius*, but the spores of our specimens are not quite as high-ornamentated as the spores of the type specimen of *L. annulatoangustifolius*. According to Verbeken's drawings (1996d) there is, however, some variation in the ornamentation of the spores of *L. annulatoangustifolius*.

The three species, *L. annulatoangustifolius*, *L. heimii* and *L. velutissimus* have an annulus around the stipe. *L. annulatoangustifolius* is easy to recognize by the up to 1 µm high warts on the spores. The other two species have very low ornamentation on the spores.

Lactarius heimii Verbeken, Bull. Jard. Bot. Belg. 65:201. 1996. – Fig. 13

Vernacular names: Kansalaghe (common name for inedible mushrooms) (Sukuma); Wikese, (Nyamwezi); Unyakuvemba (Hehe).



Fig. 9. Fruit bodies of *Lactarius pumilus* (1109).



Fig. 10. Fruit bodies of *Lactarius medusae* (1589).



Fig. 11. Fruit bodies of *Lactarius denigricans* (1467).



Fig. 12. Fruit bodies of *L. annulatoangustifolius* (1700). Photo T. Niemelä.

Edibility: Opinions about its edibility varies a lot. Some Hehe consider it edible, the Nyamwezi think it is edible after drying and boiling, whereas the Sukuma find it inedible.

Ecology: Woodland with *Brachystegia*, *Terminalia*, *Combretum*, *Rothmannia*, *Catunaregam*, *Psoropteryx*, *Hyphaene*, *Agave sisalana*, *Parinari*, *Albizia*, *Euphorbia spinosa* and *Julbernardia*.

Specimens examined: **Tanzania.** Western Prov., Kahama Distr., ca. 40 km SW of Kahama, Mpunze, Forest Reserve (03 32 CD), 1150 m, 10.XII.1991 1034; ca. 45 km SW of Kahama, Mpunze, Forest Reserve (03 32 CD), 1150 m, 10.XII.1991 1042; Tabora Distr., ca. 20 km W of Tabora, Lulanguru village (05 32 BA), 1100 m, 14.XII.1991 1111. Southern Highlands Prov., Iringa Distr., 40 km NE of Iringa, Itagutwa village (07 35 DA), 1300 m, 08.II.1993 1600, 1607.

Observations: *Lactarius heimii* macroscopically resembles *L. neotropicus* described from the Lesser Antilles (Pegler & Fiard 1979). *L. heimii*, however, has larger, more elongate ($Q = 1.29$ for *L. heimii* vs. $Q = 1.12$ for *L. neotropicus*) and lower ornamentated spores.

Misappl.: *L. pelliculatus* (Beeli) Buyck in Härkönen et al. (1994a) = *L. heimii*.

Lactarius velutissimus Verbeke, Bull. Jard. Bot. Belg. 65:212. 1996. – Fig. 14

Vernacular names: Unknown.

Edibility: Inedible (Bena); edible (Ngoni).

Ecology: Degraded miombo woodland with *Brachystegia*, *Julbernardia*, *Uapaca*, *Syzygium*, *Combretum*, *Uapaca*, *Garcinia*, *Eriosema*, *Ochna*, *Faurea*, *Bridelia* and *Protea*.

Specimens examined: **Tanzania.** Southern Prov., Songea Distr., 29 km from Songea towards Mbinga, Matomondo (10 35 CB), 800 m, 29.I.1993 1454. Southern Highlands Prov., Njombe Distr., Mbalali village 11 km south of Kidugala (09 34 BA) red soil, 1650 m, 01.II.1993 1515.

Observations: The pileipellis of *L. velutissimus* is thicker, paler coloured and clearly stellately rupturing while in *L. heimii* the pileipellis is darker, more cracked and irregularly rupturing towards the margin. Microscopically *L. heimii* is easily recognized by its longer spores (Verbeke 1996c).

Lactarius xerampelinus Karhula & Verbeke sp. nov. – Figs. 15–18

Pileus 5–12 cm diam., primo convexus et in centro leviter depressus, deinde infundibuliformis, pileipellis xerampelina, impolita, marginem versus pruinosa. **Lamellae** subdecurrentes, subdistantes, pallide cremeae. **Stipes** 2–6 cm longus, 1–3 cm crassus, pallide ochraceus, subtiliter scrobiculatus. **Contextus** albidus, ochraceus, gustu mitis. **Latex** abundans, albidus. **Sporae** ellipsoidae, $7.5\text{--}8.7\text{--}10 \times 5\text{--}5.9\text{--}7 \mu\text{m}$, verrucis saepe isolatis interdum connectis ornatae, macula suprahilaris in parte amyloidea. **Basidia** $60\text{--}70 \times 7\text{--}9 \mu\text{m}$. **Pleurocystidia** vera absentia. **Pileipellis** ex catenis elementorum elongatorum, elementa terminalis $20\text{--}35 \times 6\text{--}10 \mu\text{m}$, clavata vel cylindrata.

Holotype: **Tanzania.** Western Prov., Tabora distr., ca. 20 km w of Tabora, Lulanguru village (05 32 BA), 1100 m, 14.XII. 1991 *Saarimäki et al. 1116* (H, isotype GENT and DSM).

Pileus 5–12 cm in diameter, at first convex with central depression, then depressed to funnel-shaped, margin in old specimens irregular, wavy. **Surface** dark red-brown, matted, at margin pruinose, in old specimens finely areolate. **Gills** shortly decurrent, sub-distant with several lamellulae, fairly thick, up to 5 mm broad, pale cream, margin entire. **Stipe** 2–6 \times 1–3 cm, variable in shape, cylindrical to tapering, pale ochraceous, matted, weakly scrobiculate. **Context** in cap up to 13 mm thick, white, turning ochraceous on bruising; in stipe similar to cap, solid, milk latex white, abundant. **Smell** fresh, fruity. **Taste** mild, pleasant. **Spore print** pale cream.

Spores $7.5\text{--}8.7\text{--}10 \times 5\text{--}5.9\text{--}7 \mu\text{m}$, ($Q = 1.29\text{--}1.48\text{--}1.67$; $n = 152$), ellipsoid, ornamentation amyloid, punctate with few very fine connective lines, plage partly amyloid. **Basidia** 4-spored, $60\text{--}70 \times 7\text{--}9 \mu\text{m}$. True *pleurocystidia* absent. Pseudopleurocystidia abundant, 3–5 μm in diameter. **Lamella-edge** sterile, marginal cells thin-walled, cylindrical, tapering upwards, $70\text{--}80 \times 10 \mu\text{m}$. **Hymenophoral trama** composed of sphaerocytes, lactifers 4 μm in diameter. **Pileipellis** trichopalisade, composed of elongate, thin-walled cells forming chains, terminal cells $20\text{--}35 \times 6\text{--}10 \mu\text{m}$, clavate or cylindrical. **Stipitipellis** trichoderm-like composed of repent, thin-walled hyphae, the hyphal tips projecting outwards. **Clamp connections** absent.



Fig. 13. Fruit bodies of *Lactarius heimii* (1034).



Fig. 14. Fruit bodies of *Lactarius velutissimus* (1515) are paler than fruit bodies of *L. heimii*. Photo T. Niemelä.



Fig. 15. Fruit bodies of *Lactarius xerampelinus* (holotype). Xerampelinus means dull red with a strong mixture of brown.

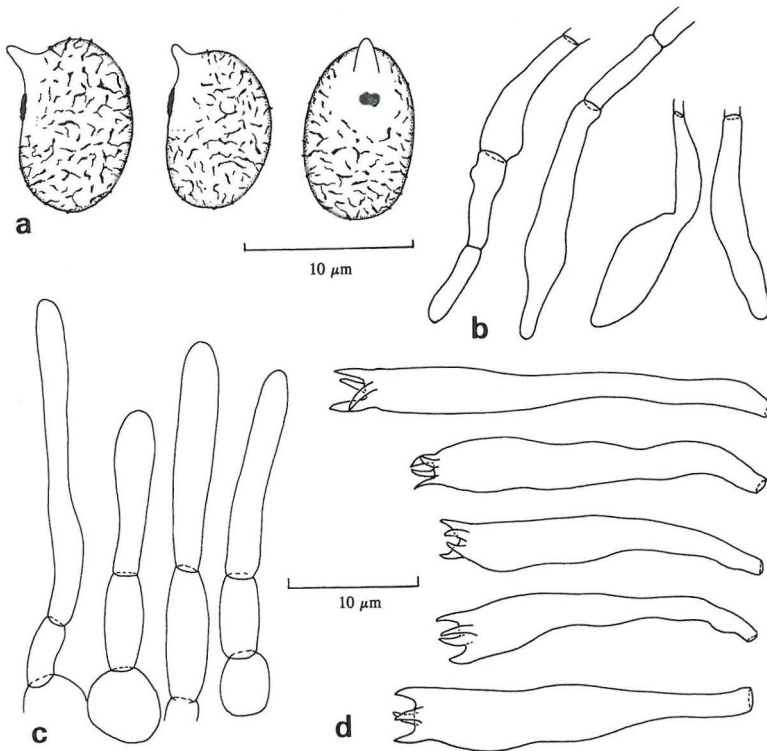


Fig. 16. *Lactarius xerampelinus*. – a) spores, b) basidia, c) marginal cells, d) marginal cells of pileipellis (holotype).

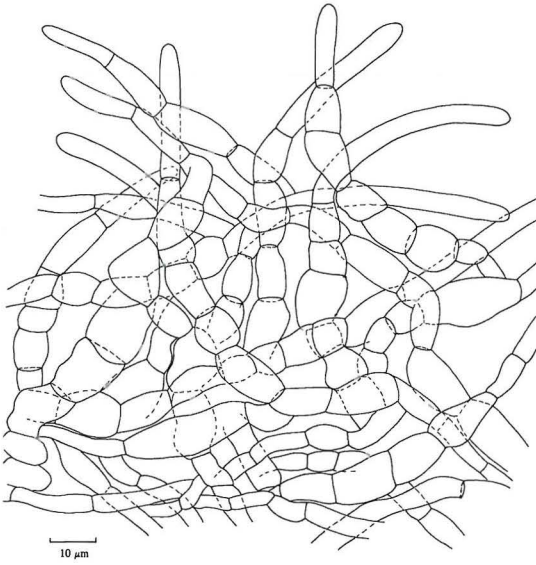


Fig. 17. The structure of pileipellis of *Lactarius xerampelinus* (1604).

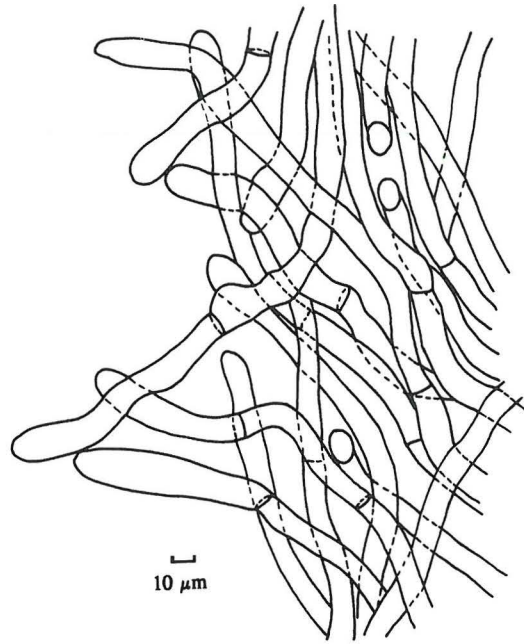


Fig. 18. The structure of stipitipellis of *Lactarius xerampelinus* (holotype).



Fig. 19. Fruit bodies of *Lactarius laevigatus* (1485).

Vernacular names: Wimenda (Hehe), Kikoba (Nyamwezi), Bushikoba (Sukuma).

Edibility: Edible, can be cooked without par-boiling or drying. Often sold at market places.

Ecology: Degraded woodland with *Agave sisalana*, *Brachystegia*, *Terminalia*, *Parinari*, *Albizia* and *Julbernardia*.

Additional specimens examined: **Tanzania.** Western Prov., Tabora Distr., Urambo, purchased in Urambo market (05 32 AA), ca. 1070 m, 13.XII.1991 1090; ca. 20 km W of Tabora, Lulanguru village (05 32 BA), 1100 m, 14.XII.1991 1114, 1121. Southern Highlands Prov., Iringa Distr., 40 km NE of Iringa, Itagutwa village (07 35 DA), 1300 m, 8.II.1993 1604. *Lactarius phlebophyllus:* **Madagascar.** Betsimisarakava Prov., Anosibé, S of Soanierana, Malagasy lowland rainforest, XII-1934, Heim G87 (holotype, PC).

Observations: This species microscopically resembles *Lactarius phlebophyllus* R. Heim, having similar type of pileipellis and lacking true pleurocystidia. *L. xerampelinus* differs from *L. phlebophyllus* having lower spore ornamentation and trichoderm-like stipitipellis whereas *L. phlebophyllus* has trichopalisade-like stipitipellis. According to Verbeken (1996c) the microscopic characters of *L. phlebophyllus* are very similar to those of *L. latifolius* Verbeken. *L. xerampelinus* differs from *L. latifolius* having clearly ellipsoid spores whereas *L. latifolius* has almost globose spores. The three species have a somewhat reddish brown pileus. The habitat of *L. latifolius* and *L. gymnocarpus* is rainforest whereas *L. xerampelinus* grows on miombo woodland.

Xerampelinus means dull red with a strong mixture of brown. *L. xerampelinus* is related to *L. edulis* Verbeken and *L. densifolius* Verbeken & Karhula because of the dry, slightly tomentose pileipellis, trichopalisade-type structure of pileipellis and very low spore ornamentation (Verbeken 1996c).

Lactarius xerampelinus is included in the book on Tanzanian mushrooms (Härkönen et al. 1995) as *L. sp. aff. phlebophyllus*. Härkönen et al. (1994a) mention *L. xerampelinus* as *L. cf. phlebophyllus*.

Lactarius laevigatus Verbeken, Bull. Jard. Bot. Belg. 65: 203. 1996. – Fig. 19

Vernacular names: Wunyamalagata (Bena); Ungujuu (Ndendeuli).

Edibility: Has to be boiled first then dried (Bena); edible (Ndendeuli).

Ecology: Miombo woodland with *Brachystegia*, *Julbernardia*, *Combretum*, *Albizia*, *Pterocarpus*, *Protea*, *Faurea*, *Parinari*, *Uapaca*, *Rothmannia*, *Combretum molle*, *Garcinia* and *Gardenia*.

Specimens examined: **Tanzania.** Lake Prov., Mwanza Distr. Geita, a few km W of Geita (02 32 CD), ca. 1250 m, 5.XII.1991 1006a. Southern Prov., Masasi Distr., Rukohe village (10 39 AC), 550 m, 22.I.1993 1326; Songea Distr., about 40 km N of Songea, Hanga, Nyamagoma village (10 35 BC), 990 m, 27.I.1993 1428. Southern Highlands Prov., Njombe Distr., Ngaramiro, 2 km N of Kidugala (09 34 BA), on hill slope, red soil, 1550 m, 31.I.1993 1485. **Zambia.** Copperbelt Prov., Chati-forest, near Kitwe, degraded miombo woodland, under *Albizia adantifolia*, 1274 m, 12-1990 Buyck 3211 (Priv. herb. Buyck).

Observations: We compared the Tanzanian specimens to the specimen *Buyck 3211* collected from Zambia. The structure of pileipellis, marginal cells, basidia, pseudopleurocystidia, and structure of hymenophoral trama are similar in all of the five specimens. We could not find any difference in spore ornamentation either, but specimen 3211 has spores which are a bit more rounded than those of our specimens (3211: Q = 1.29, n = 20; specimens 1006a, 1326, 1428 and 1485: Q = 1.39, n = 80). Because the shape of the spores is the only difference we concluded, these specimens are conspecific. *L. laevigatus* has strongly striate, smooth, light orange to greyish orange pileus and an ixocutis-like to trichoderm-like pileipellis (Verbeken 1996c).

Lactarius edulis Verbeken & Buyck, Publications Agricoles 34: 103. 1994. – Fig. 20

Vernacular name: Wisimba (Hehe)

Ecology: Miombo woodland.

Specimens examined: **Tanzania.** Western Prov., Tabora Distr., Tabora, purchased in the dried form at Tabora market (05 32 BB), 12.XII.1991 1057a. Southern Highlands Prov., Iringa Distr., Mafinga, Sao Hill Misitu (08 35 AD), purchased from a woman who had collected specimen from nearby miombo woodland, 6.II.1993 1588.

Observations: *L. edulis* has fleshy and firm context and trichopalisade-like pileipellis. The microscopic details were illustrated by Verbeken (1995a). Härkönen et al. (1995) have published the first record of *L. edulis* for Tanzania.



Fig. 20. *Lactarius edulis* (1588).



Fig. 21. Fruit bodies *Lactarius densifolius* (1479). *Lactarius densifolius* resembles *L. inversus* but has much denser lamellae.



Fig. 22. Fruit bodies of *Lactarius kabansus* (1089).

Lactarius densifolius Verbeke & Karhula Bull. Jard. Bot. Nat. Belg. 65: 200. 1996. – Fig. 21

Vernacular names: Wifwimi = ‘eagerly hunted’, Ulyafwimi, Wifimi, Vulwafwimi, Widziwa (Bena).

Edibility: can be eaten without parboiling, some interviewees consider this as the best of all mushrooms (Bena).

Ecology: Degraded miombo woodland with *Brachystegia*, *Julbernardia*, *Uapaca*, *Syzygium*, *Ochna*, *Parinari*, *Rothmannia*, *Combretum molle*, *Garcinia* and *Gardenia*.

Specimens examined: **Tanzania.** Southern Prov., Songea Distr., 29 km from Songea towards Mbinga, Matomondo (10 35 CB), 800 m, 29.I.1993 1449; Lirondo village, 120 km N of Songea (09 35 CD), 1250 m, 30.I.1993 1468. Southern Highlands Prov., Njombe Distr., Kidugala (09 34 BA), specimens were brought to us by some small children, 1550 m, 30.I.1993 1474; Ngaramiro, 2 km N of Kidugala (09 34 BA), on hill slope, red soil, 1550 m, 31.I.1993 1479, 1489; N of Kidugala, between the villages of Sengele and Masaulwa, (09 34 BA), 1500 m, 2.II.1993 1524; N of Kidugala, Masaulwa village, (09 34 BA), purchased from a woman who was preparing mushrooms for drying, 1500 m, 2.II.1993 1543.

Observations: *Lactarius densifolius* resembles *L. inversus* Gooss.-Font. & R. Heim.

L. densifolius has, however, clearly denser lamellae and lower spore ornamentation than *L. inversus*. According to Verbeke (1996c) the pileipellis is trichopalisade in *L. inversus* and trichoderm in *L. densifolius*. A colour picture has also been published by Buyck (1994) under the name ‘*L. inversus*’.

Lactarius kabansus Pegler & Pearce, Kew Bull. 35: 487. 1980. – Fig. 22

Vernacular names: Wisigisa (Hehe), Umpalala (Nyamwezi)

Edibility: Edible and popular, does not need to be parboiled. Sold in market places.

Ecology: Miombo woodland.

Specimens examined: **Tanzania.** Western Prov., Tabora Distr., Urambo, purchased from Urambo market (05 32 AA), 13.XII.1991 1089. Southern Highlands Prov., Iringa Distr., Mafinga, Sao Hill Misitu, purchased from a woman who had collected the specimen from nearby miombo woodland (08 35 AD), 6.II.1993 1590.

Observations: *L. kabansus* is easily recognized by its dark coloured, small fruit bodies and hymeniderm-like pileipellis. The first record of *Lactarius kabansus* from Tanzania was published by Härkönen et al. (1995).

Lactarius chromospermus Pegler, Kew Bull. 37: 269. 1982.

Vernacular names: no given names.

Edibility: inedible (Bena).

Ecology: Miombo woodland with *Brachystegia* and *Uapaca*.

Specimens examined: **Tanzania.** Southern Highlands Prov., Njombe Distr., between the villages of Sengele and Masaulwa, (09 34 BA), 1500 m, 2.II.1993 1539.

Observations: The name refers to its dark brown spores. Buyck and Verbeken (1995) discussed the microscopical features and the ecology of *L. chromospermus* in detail. We found similar differences between our measurements and Pegler's description as did Buyck and Verbeken.

Lactarius cyanovirescens Verbeken, Bull. Jard. Bot. Belg. 65:199. 1996.

Vernacular names: Unknown.

Edibility: Woman, who had been hospitalized because of mushroom poisoning, said that this fungus is inedible (Hehe).

Ecology: Degraded miombo woodland dominated by *Uapaca*.

Specimens examined: **Tanzania.** Southern Highlands Prov., Iringa Distr., Mafinga, Changarawe village (08 35 AD), 1750 m, 5.II.1993 1578. **Burundi.** Bururi Prov., Rumonge Forest Reserve, Nyamirambo, dominated by *Brachystegia utilis*, 850–950 m, III–1994 Verbeken 94.156 (BR).

Observations: *L. cyanovirens* has smooth, dry, brownish orange to light brown, or greyish red pileus and cutis-like pileipellis.

Edibility of *Lactarius* in Tanzania

Tanzanians have hundreds of vernacular names for mushrooms and it seems to us they have no logical system for classifying them. During the interviews it was noteworthy that the genus *Lactarius*, however, is recognized by many people. At least the Bena even have a collective name for

Lactarius species, Unyamaziwa, which means 'fungi which exude milk'.

When people collect mushrooms for food they identify them with the same method many researchers use. After picking a mushroom, they break a bit of it to see if it is brittle or tough. Then they smell it and taste it. Some people reject all bitter or acrid species but others have made the same discovery used by people as far north as Finland. Before cooking the bitter *Lactarius* species for food they boil them for a short time and then throw the water away. We ourselves tasted all the specimens in the fresh form and found out that among the Tanzanian *Lactarius* there are many more mild species than among the *Lactarius* of the boreal zone. Some, for instance, *L. kabansus* and *L. volemoides* are eaten raw in the field.

Only four tribes, the Arusha, Chagga, Maasai and Meru, of the interviewed 35 tribes do not use mushrooms for food. At least among members of the Bena, Mwera and Ndendeuli tribes there are contradictory opinions about *Lactarius*, some eat them, others ignore them and assume that they are inedible or even poisonous. The same member of the Bena tribe claimed that mushrooms that exude milk latex were poisonous, but considered *Lactarius volemoides* to be the best edible fungus. The *Lactarius* species which have a veil around the stipe, *L. heimii* and *L. velutissimus*, are unpopular. These fungi are considered inedible or edible but never delicious. In miombo woodland *Lactarius* is considered the fourth best fungus group after *Termitomyces*, *Amanita* and *Cantharellus*. Tribes that at least once mentioned some *Lactarius* to be the best edible fungi are the Bena, Hehe, Makonde and Nyamwezi. In mountain areas people consider *Lactarius* to be inedible, even if some species are found also in mountain forests. Wood-rotting fungi are preferred there.

Tanzanians dry the fruit bodies of *Lactarius* for storage. The mushrooms are cut into pieces and spread on a mat or an iron sheet in the sunshine. Some, at least the acrid species, are parboiled before drying. In that case the dried mushrooms become very hard and need a long soaking or even grinding before use. Dried mushrooms are also offered for sale in the market places. Dried *Lactarius* are often sold mixed with dried *Cantharellus*.

Comparison of *Lactarius* and *Russula*

According to the classic division the fruit bodies of the genus *Russula* contain sphaerocytes in the hymenophoral trama whereas they are lacking in the hymenophoral trama of the genus *Lactarius* (Pegler 1977, Ryvarden et al. 1994). However, Singer (1986) found sphaerocytes in the hymenophoral trama of some tropical *Lactarius* species. We noticed that all the Tanzanian *Lactarius* specimens which Härkönen and Saarimäki collected, except *L. pumilus*, had sphaerocytes in their hymenophoral trama. According to Verbeken (1996c), in some tropical African *Lactarius* species, the hymenophoral trama looks exactly like the hymenophoral trama of *Russula*: completely composed of clusters of sphaerocytes. Lactifers are present between the sphaerocytes, but they may also occur in the hymenophoral trama of *Russula*. The only true microscopic difference between the genera is the presence (in *Lactarius*) or absence (in *Russula*) of pseudocystidia, tips of lactifers without septae, in the hymenium as observed by Buyck (1989, 1995).

Lactarius in Tanzania

Härkönen and Saarimäki collected the biggest amount of *Lactarius* specimens from Southern Highland Province (39 collections). According to Pegler (1977) and White (1983) the vegetation in southern and western Tanzania is similar to the vegetation in Malawi. Therefore we supposed to find also in Tanzania the five *Lactarius* species (*L. luteopus*, *L. densifolius*, *L. kabansus* var. *pallidus*, *L. gymnocarpoides* and *L. medusae*) which Morris had collected from Malawi (Morris 1990, Verbeken 1996c). We found all of them, except *L. kabansus* var. *pallidus*, in our material.

Verbeken (1996c) has described *L. urens* and *L. subamarus* from Burundi and *L. rubiginosus* and *L. kabansus* var. *pallidus* from Zambia, which have been found from Tanzania, too. Together with our specimens 20 species and one variety of *Lactarius* have been reported from Tanzania. Together with the still undescribed species we found 27 species of *Lactarius*. Because of the big amount of species among only 72 collections we assume that there is a large diversity of *Lactarius* species in Tanzania. According to Buyck (1995) before the year 2000 at least another 200 new Russulales species will be described from tropical areas only.

Edibility of *Lactarius* in other African countries

We found information about the edibility of *Lactarius* only in Burundi, Malawi, Zambia, Zaire and South Africa (Williamson 1975, Parent & Thoen 1977, Pearce 1981a–b, Buyck 1994, van der Westhuizen & Eicker 1994, Verbeken 1996c). *L. edulis* is eagerly sought after both in Burundi and Tanzania (Buyck 1994, Verbeken 1995a, 1996c). According to Pearce (1981a) there is a wide variety of *Russula* and *Lactarius* in Zambia, however, many of them are considered inedible because of a peppery or otherwise unpleasant taste. Most of the edible and commercial species belong to the genus *Lactarius*. According to Pegler & Pearce (1980) and Pearce (1981a) *L. kabansus* is gathered in vast quantities from the woodlands of Zambia and it is one of the first mushrooms to appear at roadside markets in November or December. *L. kabansus* is commonly eaten raw in Zambia and also in Tanzania. Some of the *Lactarius* and certain *Russula* are eaten in Zaire, whilst others, such as *L. velutissimus* and *Russula annulata* are rejected. *Lactarius* are preserved in the same way in Tanzania, Malawi, Zambia and Zaire; they are sun-dried (Williamson 1975, Parent & Thoen 1977, Pearce 1981a). Some *Lactarius* are parboiled before drying in Tanzania, Zambia and Zaire (Parent & Thoen 1977, Pearce 1981b). In some parts of Zambia *Russula* and *Lactarius* in particular are smoked before storage (Pearce 1981a).

In the book 'Mushrooms of Southern Africa' (van der Westhuizen & Eicker 1994) only two *Lactarius* species, *L. deliciosus* and *L. hepaticus* are mentioned. Both the species grow on pine plantations and are of northern temperate origin. The native *Lactarius* species and their edibility in South Africa have probably not yet been studied.

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