

## Studies in *Lactarius* sect. *Tabidi*

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**Key words:** *Basidiomycetes*, *Russulales*, *Lactarius*, *L. chrysorrheus*, *L. isabellinus*, *L. lacunarum*, *L. oedohyphosus*, *L. tabidus*, *L. theiogalus*. - Taxonomy, systematics, new species, key.

**Abstract:** An extensive study of the group of *Lactarius theiogalus* sensu NEUHOFF revealed that within this complex a new species could be defined: *Lactarius oedohyphosus*. This species can be distinguished from both *L. theiogalus* and *L. lacunarum* by the structure of pileipellis and stiptipellis, and spore ornamentation. In the field it differs from *L. theiogalus* sensu NEUHOFF by the non-wrinkled, reddish brown pileus, and a poorly to slowly yellowing latex. An attempt is also made to clarify the nomenclatorial confusion surrounding the epitheton *thiogalus*. It is shown that *Agaricus theiogalus* in its original sense represents *Lactarius chrysorrheus* and cannot be used in the current concept of *Lactarius theiogalus* sensu NEUHOFF. *Lactarius tabidus* is accepted here as the correct name for *Lactarius theiogalus* sensu NEUHOFF and follows the current interpretation of this name by various contemporary authors. The fact that the original diagnosis could also be interpreted as describing *Lactarius omphaliformis*, *L. obscuratus* and possibly also *L. oedohyphosus*, is discussed. A provisional key is given to the species of sect. *Tabidi* in Europe with full descriptions of *L. tabidus*, *L. oedohyphosus* and *L. lacunarum*.

**Zusammenfassung:** Eine gründliche Untersuchung der Sippen um *Lactarius theiogalus* sensu NEUHOFF ergab, daß innerhalb dieses Komplexes eine neue Art abgegrenzt werden kann: *Lactarius oedohyphosus*. Diese Art unterscheidet sich sowohl von *L. theiogalus* als auch von *L. lacunarum* durch Hutstruktur, Stielbekleidung und Sporenornamentation. Im Gelände unterscheidet sie sich von *L. theiogalus* sensu NEUHOFF durch den nicht runzeligen, rotbraunen Hut und durch schwach bis langsam gilbende Milch. Es wird der Versuch unternommen, die nomenklatorische Konfusion um das Epitheton *thiogalus* zu klären. Es wird gezeigt, daß *L. theiogalus* im ursprünglichen Sinn *L. chrysorrheus* ist und daher nicht für das gegenwärtig gebräuchliche Konzept von *L. theiogalus* sensu NEUHOFF verwendet werden kann. *Lactarius tabidus* wird hier als der korrekte Name für *L. theiogalus* sensu NEUHOFF akzeptiert gemäß der gegenwärtigen Interpretation dieses Namens durch verschiedene zeitgenössische Autoren. Die Tatsache, daß die Originaldiagnose auch als *L. omphaliformis*, *L. obscuratus* und möglicherweise als *L. oedohyphosus* interpretiert werden könnte, wird diskutiert. Ein vorläufiger Schlüssel zu den Arten der Sektion *Tabidi* in Europa und ausführliche Beschreibungen von *L. tabidus*, *L. oedohyphosus* und *L. lacunarum* sind eingeschlossen.

JALINK & NAUTA (1984) studying the mycosociology of wet *Betula* woodland in the province Drenthe, The Netherlands, found it often difficult to distinguish between *Lactarius theiogalus* sensu NEUHOFF, *L. hepaticus* PLOWRIGHT, and *L. lacunarum* ROMAGN. ex HORA with the existing literature. A fourth taxon, with apparently more or less intermediate characters seemed to exist. NOORDELOOS (unpubl.), in his prelim-

inary studies for a revision of *Lactarius* in The Netherlands, confirmed this supposition. He stimulated his student IDZERDA to make a critical study of this species complex as part of her course in biology at Leiden University.

The present paper is based on this study of the complex of *Lactarius theiogalus* sensu NEUHOFF, *L. lacunarum*, and *L. hepaticus*, supplemented by data obtained by the second author from his own observations and literature studies. The key is only preliminary, awaiting further studies in the rather complex group of reddish brown or yellow-brown *Lactarius* species.

### Material and methods

The macro- and micromorphology of herbarium collections and fresh basidiocarps were studied using the standard techniques described in *Flora agaricina neerlandica* (BAS & al. 1988). Spores were observed in Melzer's reagent at a magnification of x 1000, in oil immersion, to study their ornamentation and in a selected number of collections they were also examined with scanning electron microscopy. Covering layers of pileipellis and stiptipellis were studied using hand and cryotome sections. All line drawings were made using a drawing tube.

### Taxonomic part

Key to the species of *Lactarius* sect. *Tabidi* in Europe

1. Spores with a distinct reticulum of (sometimes interrupted) ridges, warts and lines 2.
1. Spores with isolated warts or wart connected by (fine) lines and connectives, but never forming a complete reticulum 4.
2. Pileus dark purple-brown to red-brown; in boreal and mountainous *Picea* forest
 

***L. badiosanguineus* KÜHNER & ROMAGN.**
2. Pileus paler without purple tinges; in other habitats 3.
3. Pileus dull brown, often with distinctly paler, crenulate margin; latex quickly staining yellow, acrid; pleurocystidia 61-85 µm long; in *Pinus* forest
 

***L. hepaticus* PLOWRIGHT**
3. Pileus vivid red-brown or orange-brown, uniformly coloured; latex slowly staining yellow, mild to adstringent or subacid; pleurocystidia 33-65 µm long; in moist places near deciduous trees (e.g., *Betula*, *Salix*, *Populus*)
 

***L. lacunarum* ROMAGN. ex HORA**
4. Pileus dark brown-red to blackish-red; associated with *Alnus viridis* in mountainous areas
 

***L. brunneohepaticus* MOSER**
4. Pileus red-brown, orange, yellow-brown to yellow-ochre; not associated with *Alnus viridis* 5.
5. Pileus usually distinctly wrinkled when fresh; pileipellis a palisade of rounded to angular-isodiametrical elements, without a distinct suprapellis of narrow hyphae; spores with isolated warts, at most a few connected with fine lines; latex usually quickly yellowing; pleurocystidia distinctly larger than cheilocystidia
 

***L. tabidus* FR. (= *L. theiogalus* sensu NEUHOFF)**

5. Pileus not or only slightly wrinkled, even when dry; pileipellis a trichopalisade of rather wide, thin-walled hyphae; spores with warts which are often found in rows, often connected by fine lines, sometimes forming a very incomplete reticulum; latex slowly yellowing; pleurocystidia similar in size to cheilocystidia

***L. oedohyphosus* IDZERDA & NOORDEL.**

**Species descriptions**

**1. *Lactarius oedohyphosus* IDZERDA & NOORDEL., spec. nova** (Colour Fig. VII b; Figs. 1, 2, 7 d)

Misapplied name: *Lactarius theiogalus* sensu MARCHAND 1980, pl. 578; *Lactarius taibidus* sensu BLUM 1976: 265, pro parte?

**Latin diagnosis:** Pileus 10-42(-57) mm latus, plano-convexus demum infundibuliformis, interdum papillatus, margine inflexus demum rectus vel reflexus, paulisper hygrophanus, haud striatus, pallide vel obscure testaceus, glaber vel leviter rugulosus. Lamellae adnatae vel subdecurrentes, arcuatae vel segmentiformes, pallide roseae vel testaceae acie concolori. Stipes 10-45 x 3-8(-13) mm, cylindraceus vel fusiformis, pallide testaceus versus basim obscurior, glaber. Latex albus, tarde lutescens. Odore nulla. Sapore miti vel subacre vix subamara. Sporae 6,0-7,5 x 5,0-6,5(-7,5)  $\mu\text{m}$ , Q = 1,1-1,4, subgloboasae vel ellipsoideae verrucis lineis connexis amyloideis ornatae. Basidia (19-)30-42 x (6,0-)7,0-11  $\mu\text{m}$ , clavata, 4-sporigera. Cheilocystidia 22-48 x 4,5-8,0(-9,0)  $\mu\text{m}$ , lageniformia vel fusiformia. Pleurocystidia (macrocystidia) 35-56 x 6,0-9,0  $\mu\text{m}$ . Pseudocystidia 2,5-3,5  $\mu\text{m}$  lata, cylindracea vel filiformia. Pileipellis trichopalisaderma, 100-250  $\mu\text{m}$  lata hyphis 3,0-7,0 latis formata. Stipitipellis: suprapellis cutis ad 25  $\mu\text{m}$  lata hyphis cylindraceis, 2,0-3,5  $\mu\text{m}$  latis; subpellis e sphaerocystis globosis 13-30 x 13-24  $\mu\text{m}$  formata. Fibulae absentes. Gregarius, locis paludosis sub *Betula*.

**Holotypus:** The Netherlands, prov. Drenthe, Kliploo, Dwingeloo, 2. Oct. 1983, M. NAUTA & L. JALINK (L).

**Pileus:** 10-42(-57) mm, plano-convex with depressed centre to infundibuliform, sometimes with small umbo, with inflexed then deflexed, finally sometimes reflexed margin, slightly hygrophanous, not or hardly translucently striate at margin only, pale to dark red-brown [MUNSELL 1975: 75 YR 5/6-8-4/6; 5YR 3/3-4; 4/3-6, 6/6; 5/6-8; 2.5 YR 5/8, 4-3/6-8; 10 R 3-4/6; KORNERUP & WANSCHER 1967: 5CD7-5, 7(C7) D7-6-E6-8 (8C7, E8)], dry, glabrous to slightly wrinkled when old.

**Lamellae:** L = 40-50, l = 1-7, adnate-subdecurrent, arcuate to segmentiform, normally thick, 1-5.5 mm broad, pale pink to reddish brown (10YR 8/3-7/4; 7.5 YR 7/6; 5 YR 8/4-7/8; 4B4-3, 5B4-5) with entire, concolorous or slightly paler edge.

**Stipe:** 10-45 x 3-8(-13) mm, cylindrical, sometimes attenuated towards apex and/or base to fusiform, sometimes broadened at base, pale orange-brown to red-brown at apex, pale orange-brown to fairly dark red-brown below (apex 10 YR 8/6-7/8; 5A7-6, 4A8-6, downwards 7.5 YR 6-5/6; 5 YR 4/6-5/6-8; 2.5 YR 4/4-8, 3/4-6; 5-6B8-7, 7D7, 8D8-E8), dry, glabrous or appearing finely rimed; with distinct white to orange-brown basal tomentum.

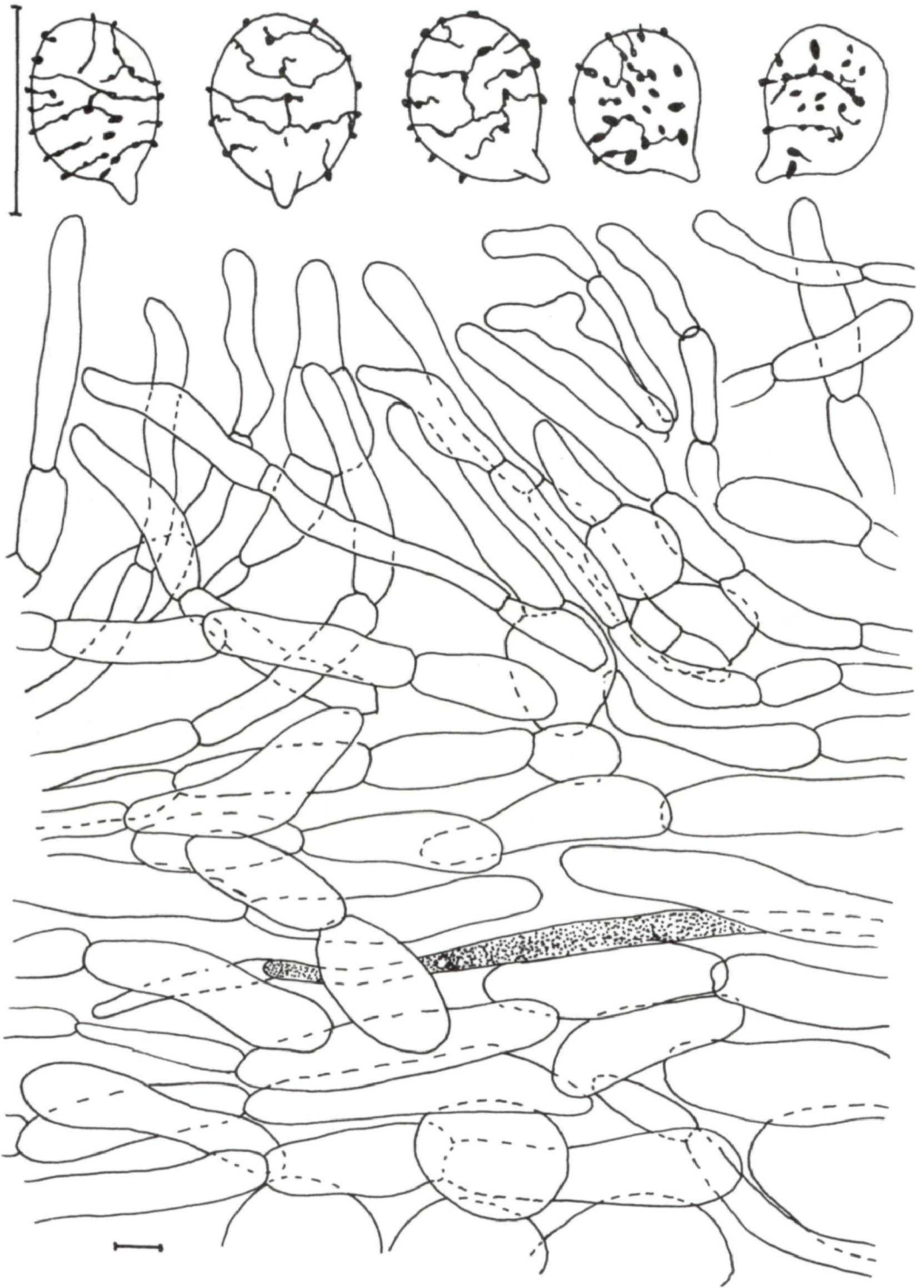


Fig. 1. *Lactarius oedohyphosus*. - Spores (bar: 10  $\mu$ m) and pileipellis (bar: 5  $\mu$ m).

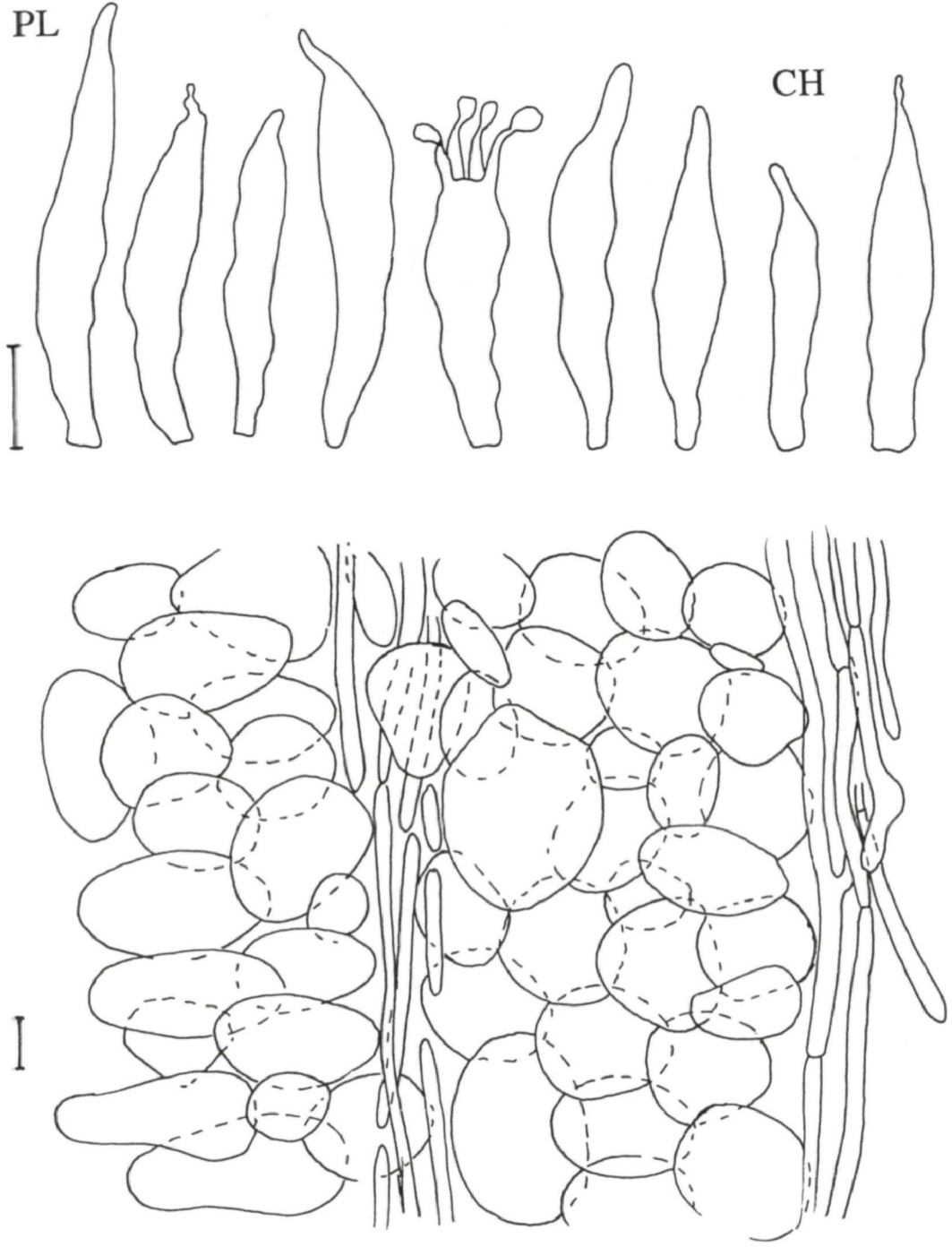


Fig. 2. *Lactarius oedohyphosus*. - Cheilocystidia (CH), basidium, pleurocystidia (PL) (bar: 10  $\mu$ m) and stipitipellis (bar: 5  $\mu$ m).

**Context:** white to pale orange-brown in pileus and stipe, sometimes dark orange-brown in basal part of stipe. Latex white, usually very slowly yellowing on white paper, sometimes also yellowing on lamellae, mild to slightly bitter. Smell indistinct. Taste mild, sometimes slightly acrid in the throat, sometimes slightly bitter on the tongue.

**Spores:** 6.0-7.5 x 5.0-7.0(-7.5)  $\mu\text{m}$ ,  $Q = 1.1-1.4$ , mean values 6.74-7.01 x 5.84-6.52  $\mu\text{m}$ ,  $Q = 1.15-1.2$ , subglobose to ellipsoid; ornamentation amyloid, composed of up to 1  $\mu\text{m}$  high, irregularly shaped and sized, rounded warts, aligned or connected by fine connective lines, sometimes isolated, never forming a true net (PEGLER & YOUNG 1982, type C), plage not amyloid.

**Basidia:** (19-)30-42 x (6.0-)7.0-11  $\mu\text{m}$ , clavate, 4-spored. Lamella edge sterile.

**Cheilocystidia:** 22-48 x 4.5-8.0(-9.0)  $\mu\text{m}$ , lageniform to fusiform with long tapering, sometimes slightly moniliform neck, thin-walled.

**Pleurocystidia:** (macrocystidia) 35-56 x 6.0-9.0  $\mu\text{m}$ , similar to cheilocystidia. Pseudocystidia 2.5-3.5  $\mu\text{m}$  wide, slender, cylindrical to filiform.

**Pileipellis:** a trichopalisade, 100-250  $\mu\text{m}$  thick, consisting of erect chains of 3.0-7.0(-9.0)  $\mu\text{m}$  wide, inflated, thin-walled elements with irregularly cylindrical to clavate or lobed, thin- or rarely slightly thick-walled terminal elements, 12-30 x 3.0-9.0  $\mu\text{m}$ ; sphaerocysts present in deeper pileipellis and trama, 12-35 x 10-35  $\mu\text{m}$ , never forming a distinct layer.

**Stipitipellis:** multilayered: suprapellis a thin cutis of 2.0-3.5  $\mu\text{m}$  wide cylindrical hyphae, subpellis composed of rounded, subisodiametrical cells, 13-30 x 13-24  $\mu\text{m}$ , separated from deeper layers of sphaerocysts by a narrow lower layer of narrow hyphae, 1.0-3.5  $\mu\text{m}$  wide.

**Clamp-connections:** absent.

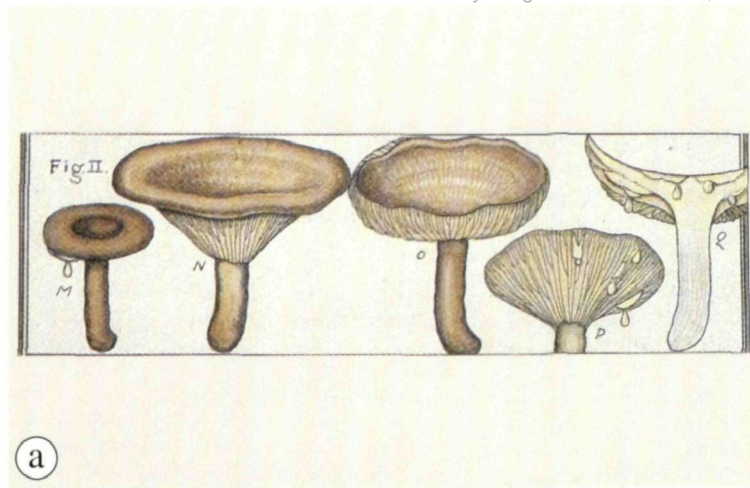
**Ecology:** Gregarious in moist deciduous woods, often among *Sphagnum*, associated with *Betula* and probably also other deciduous trees.

**Distribution:** Probably wide-spread, so far known only from a few localities in The Netherlands.

**Collections examined: The Netherlands:** prov. Drenthe, Dwingeloo, Kliploo, 2. Oct. 1983, M. NAUTA & L. JALINK (holotype, L); - - 4. Oct. and 2. Nov. 1983, L. JALINK & M. NAUTA LM 231 (WBS); - Assen, Witterveld, 5. Sept. 1982, L. JALINK & M. NAUTA LM 7 (WBS); prov. Zuid Holland, Alphen aan den Rijn, "De Put", 30. Oct. 1996, M. E. NOORDELOOS 967 and 968 (L); - Nieuwkoop, de Haack, 15. Oct. 1994, M. E. NOORDELOOS 94150, 94151 (L).

As is shown in the key to the species, *Lactarius oedohyphosus* can be differentiated from *L. tabidus* by the slow yellowing of the latex, not or scarcely wrinkled, not distinctly translucently striate pileus, the more vivid red colour of the pileus, and microscopically by the trichopalisadic nature of the pileipellis, slightly smaller spores with connected warts, and small pleurocystidia, which have the same size as the cheilocystidia. *Lactarius lacunarum* has about the same colour, but differs by having a pileipellis with abundant sphaerocysts in the subpellis, almost forming a complete layer; a stipitipellis with well developed suprapellis of narrow hyphae, spores with heavier ornamentation forming a distinct reticulum, and pleurocystidia which are definitely longer than the cheilocystidia. Also the latex is often more clearly yellowing in *L. lacunarum*.

MARCHAND (1980: pl. 578, fig. 578) clearly refers to our species. His spore drawings are very accurate and give the typical subreticulate pattern of *L. oedohyphosus*. In



Colour Fig. VII. a *Agaricus theiogalus*, iconotype from BULLIARD, Hist. Champ. France, pl. 567, fig. 2. 1791. b *Lactarius oedophosus*, holotype. c *Lactarius lacunarum*, NOORDELOOS 9691. d *Lactarius tabidus*, NOORDELOOS 94139.





his description he also indicates that his *Lactarius theiogalus* has a pileus that is almost glabrous, only vaguely wrinkled in contrast with the distinctly wrinkled pileus of *Lactarius tabidus*. The slow yellowing of the latex and the habitat clearly refer to *L. oedohyphosus*.

Although most of the description of *Lactarius tabidus* sensu BLUM (1976) refers to *L. theiogalus* sensu NEUHOFF, the drawings of the spores (BLUM 1976: 64, fig. 61) clearly refer to *L. oedohyphosus*.

In the key of M. BON (1980) our species cannot be determined with certainty, although in his description of *Lactarius theiogalus* spores are mentioned that sometimes have a fine reticulum. It is clear that BON's interpretation of *Lactarius tabidus* has nothing to do with *L. oedohyphosus* nor *L. theiogalus* sensu NEUHOFF (see also below).

## 2. *Lactarius lacunarum* ROMAGN. ex HORA, Trans. Brit. Mycol. Soc. **43**: 444. 1960 (Colour Fig. VII c; Figs. 3, 4, 7 c).

*Lactarius decipiens* var. *lacunarum* ROMAGN., Bull. Soc. Mycol. France **54**: 223. 1938.

Excl.: *L. lacunarum* sensu GULDEN & LANGE, Norw. J. Bot. **18**: 32. 1971 (= *L. lapponicus*).

**Iconography:** BON (1979: pl. 82,3), CETTO (1983: pl. 1507), JAMONI (1994: pl. 312), KORHONEN (1984: 196-197), LALLI & PACIONI (1981: 11), MARCHAND (1980: pl. 580), ROMAGNESI (1939: pl. 82).

**Descriptions:** BLUM (1976: 268-269), GRÖGER (1981: 22), BUYCK & SCHONACKERS (1987: 11-25), HESLER & SMITH (1979: 555-556), JALINK & NAUTA (1984: 136), KÜHNER (1957: 107, 1975: 57), NATHORST-WINDAHL (1966: 24-25), RAMM & WEHOLT (1982: 36), WALLEYN & VERBEKEN (1997: 33-34).

**Pileus:** 10-80 mm, convex to plano-convex with slight central depression, expanding to plano-concave to infundibuliform, sometimes with small umbo, with involute then deflexed, finally straight margin, sometimes with crenulate margin, slightly hygrophanous, not translucently striate or at outermost margin only, red-brown to red-yellow, more or less uniformly coloured or outermost margin paler orange-yellow (young 2.5 YR 3/4 then 2.5 YR 3-4/6-8; 5 YR 6-5/6-8, 4.4, 3/3-4; 10 YR 3/6-4/8, margin 5 YR 5/7-8), smooth, glabrous, dry or very slightly viscid when wet.

**Lamellae:** L = 30-90, l = 3-9, crowded to fairly distant, adnate-subdecurrent to deeply decurrent, arcuate to segmentiform or subventricose, up to 5 mm broad, pale pink to reddish yellow or reddish brown (10 YR 8/3, 5-6.5 YR 8/4-6, 7/6, 6/6) with entire, concolorous edge.

**Stipe:** 15-50(-65) x 4-11 mm (middle), often narrowed at apex and tapering towards base, pale ochre-orange to orange-brown or red-brown (7.5 7/6, 5YR 4-6/6-8; 5 YR 3/4), very dark red-brown at base (2.5 YR 4-3/6), smooth, glabrous, often somewhat marbled.

**Context:** concolorous with surface in cortex, pinkish white to pinkish brown in inner parts of pileus and stipe. Latex white, slowly to quickly yellowing (within

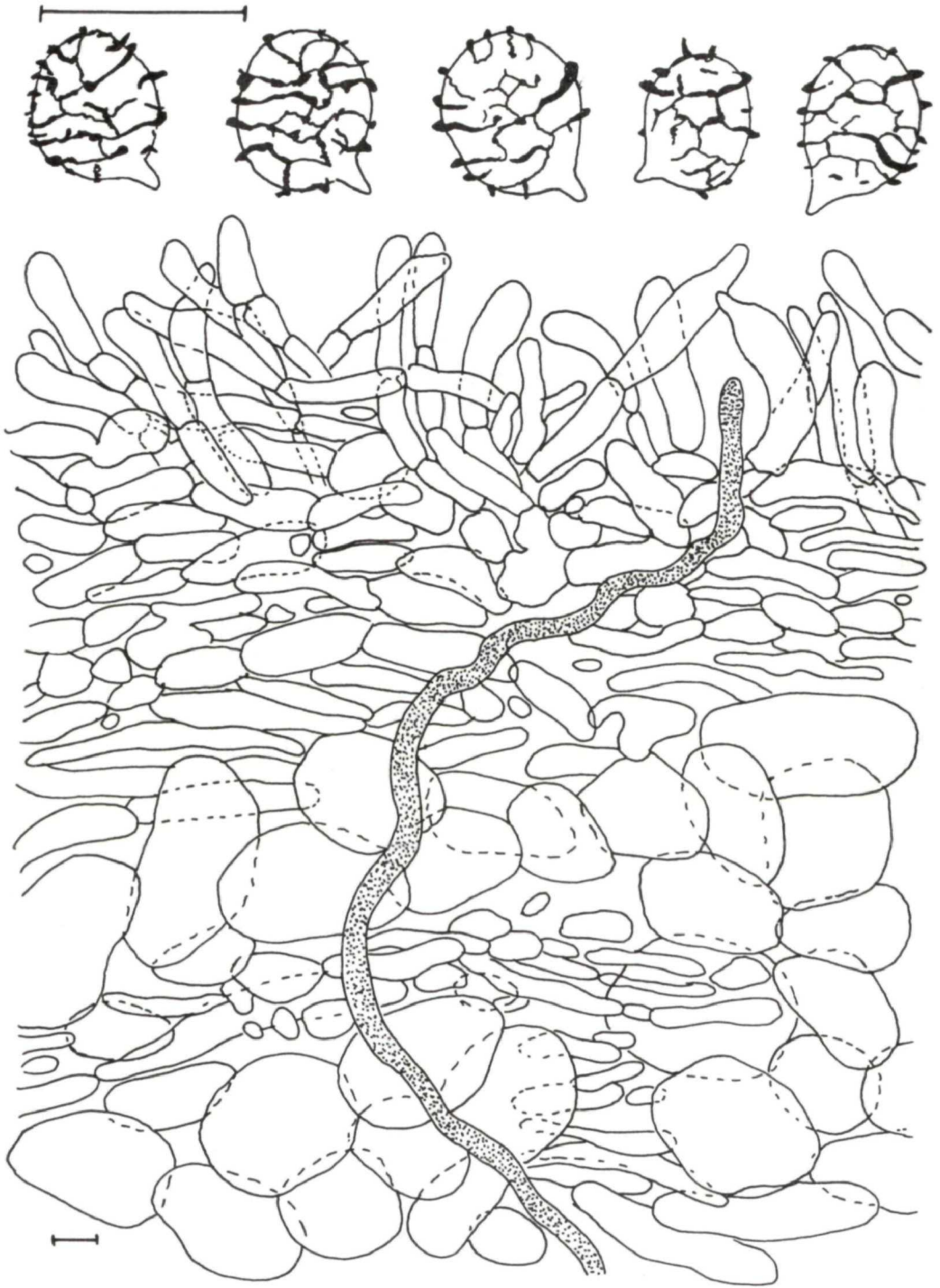


Fig. 3. *Lactarius lacunarum*. - Spores (bar: 10  $\mu$ m) and pileipellis (bar: 5  $\mu$ m).

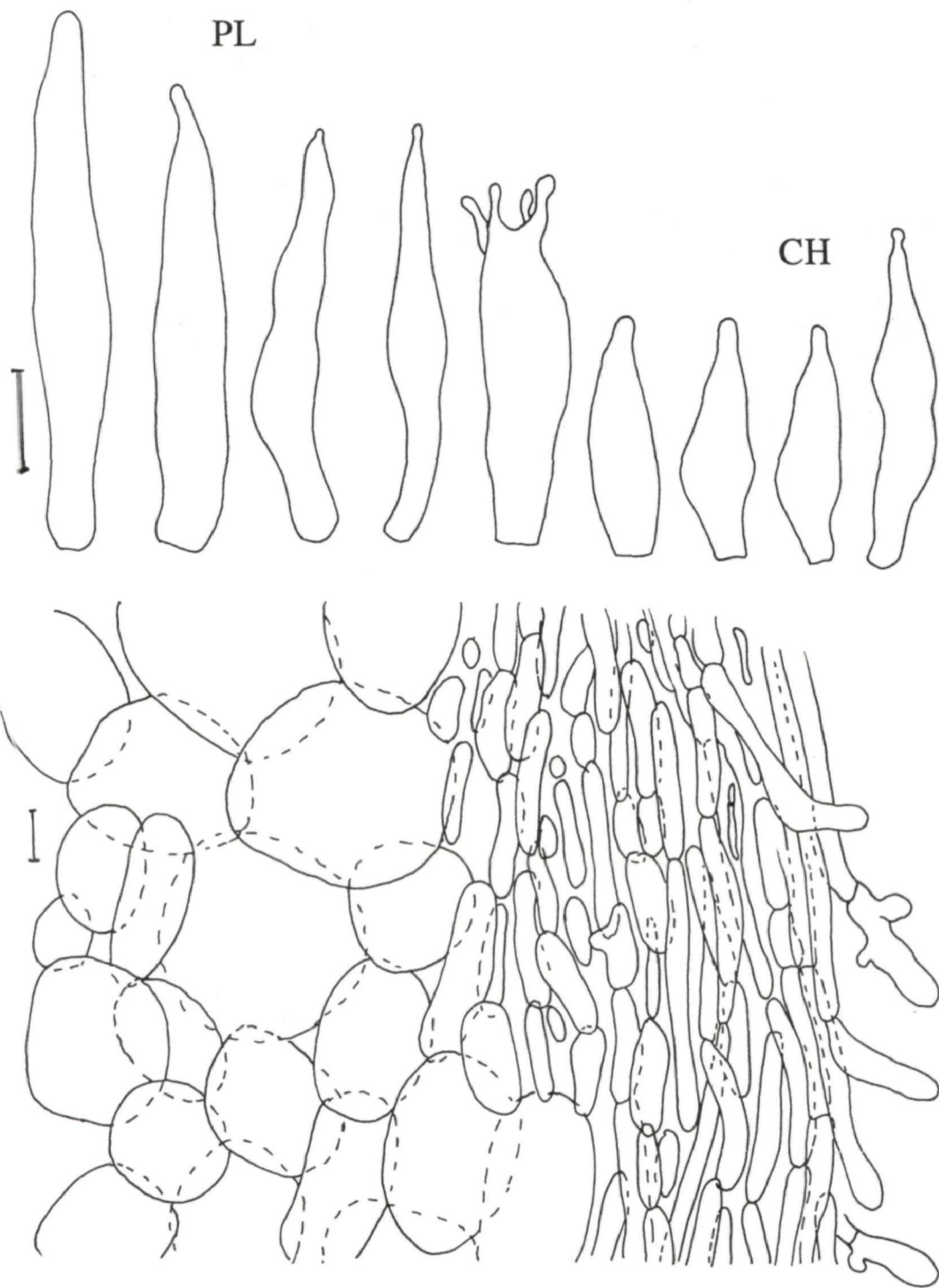


Fig. 4. *Lactarius lacunarum*. - Cheilocystidia (CH), basidium, pleurocystidia (PL) (bar: 10  $\mu$ m) and stipitipellis (bar: 5  $\mu$ m).

5 min.) on white handkerchief, mild or somewhat acrid in the throat. Smell none or weak, reminiscent of fruit similar to *Lactarius quietus* FR. Taste mild or subacid in the throat.

**Spores:** 6.0-8.5 x 5.0-7.5  $\mu\text{m}$ , Q = 1.0-1.4, mean values 6.87-7.25 x 5.85-6.21  $\mu\text{m}$ , Q = 1.08-1.2, globose to broadly ellipsoid; ornamentation amyloid, composed of up to 1  $\mu\text{m}$  high, irregularly shaped and sized warts and ridges, forming an incomplete reticulum, up to 1  $\mu\text{m}$  high (PEGLER & YOUNG 1983, Type D), plage not amyloid.

**Basidia:** 28-43 x 7-11  $\mu\text{m}$ , clavate, 4-spored. Lamella edge sterile.

**Cheilocystidia:** (17-)23-40(-48) x (4.0-)5.0-8.0  $\mu\text{m}$ , fusiform to lageniform with broadest part below middle, with long, acute, sometimes moniliform neck, thin-walled.

**Pleurocystidia:** (macrocystidia) 33-54(-74) x 4.5-8.5  $\mu\text{m}$ , cylindrical or fusi-form-lageniform with long, tapering neck. Pseudocystidia filiform to subcylindrical, 3.0(-6.0)  $\mu\text{m}$  wide.

**Pileipellis:** 150-250  $\mu\text{m}$  thick, a trichoderm or palisade, consisting of 2.0-5.0  $\mu\text{m}$  wide, cylindrical hyphae with cylindrical to clavate terminal elements, based on a layer of sphaerocysts, 15-35 x 10-20  $\mu\text{m}$ .

**Stipitipellis:** up to 50  $\mu\text{m}$  thick, a cutis with transition to a trichoderm of narrow, cylindrical, 2.0-6.0  $\mu\text{m}$  wide hyphae, with scattered trichodermal tufts of terminal elements ("caulocystidia"), subpellis consisting of a dense layer of sphaerocysts, 10-40 x 10-30  $\mu\text{m}$ .

**Caulocystidia:** scattered, but always present, 9.0-25 x 3.0-6.0  $\mu\text{m}$ , variably shaped, cylindrical-clavate with finger-like appendages or somewhat coralloid.

**Clamp-connections:** absent.

**Ecology:** gregarious in damp places, such as nearly dry ditches, in black soil, among rotten leaves, also in grassy places, such as open woodland and road-sides planted with trees, forming ectomycorrhiza with various deciduous trees, such as *Alnus incana*, *Corylus*, *Betula*, *Populus tremula* L., *P. alba* L., *P. canescens* (AIT.) SM., *Quercus*, and *Salix* on a wide range of soil types, such as fertile clay and acidic, peaty soil, also found among *Sphagnum*.

**Distribution:** widespread all over temperate Europe, but rarely recorded.

**Collections examined:** **France:** Alsace, Winkel, 17. Oct. 1990, M. WILHELM (L). **Italy:** Trento, Levico, Colle di Tenna, 10. Sept. 1995, A. HAUSKNECHT (L). **The Netherlands:** prov. Groningen, Tjuchem, Weereweg, 26. July 1993, R. A. F. SULLOCK-ENZLIN (L); - Breede Borg, 2. Oct. 1996, M. E. NOORDELOOS 96202 (L); prov. Drenthe, Smilde, 29. Okt. 1986, A. E. JANSEN & B. DE VRIES (WBS); prov. Overijssel, Diepenveen, 27. Aug. 1972, Mr. & Mrs. PIEPENBROEK 501 (L); prov. Flevoland, Abbertsbos, 13. Nov. 1991, G. VAN ZANEN (L); prov. Noord Brabant, Bergen op Zoom, Zoomland, 6. Okt. 1996, M. E. NOORDELOOS 96215 (L); - Moergestel, Hildersven, 7. Oct. 1980, C. BAS 7700 (L); Ginneken, Ulvenhoutse bos, 19. July 1960, C. BAS 1973a (L); - Best, 1. Aug. 1962, C. P. VERSCHUUREN (L); prov. Limburg, Griendsveen, 8. Oct. 1994, M. E. NOORDELOOS 94128 and 94129 (L); - Gronsveld, Savelsbos, 26. Oct. 1958, C. BAS 1642 (L). **United Kingdom:** Scotland, Inverness-shire, Newtonmore, 27. Aug. 1996, M. E. NOORDELOOS (L).

The ecological range of *Lactarius lacunarum* is rather wide. Earlier records came from wet places such as nearly dry ditches and marshes, often associated with *Betula*, *Salix* or even *Pinus*, but more recently records have been made from somewhat drier spots, such as road-sides and open woodland, often associated with *Populus* spp. (Compare also GRÖGER 1981). It can be distinguished from *Lactarius tabidus* by its more vividly coloured, not wrinkled pileus. Often the stipe is rather short in compar-

ison with the diameter of the pileus. Microscopically the caulocystidia are distinctive for *L. lacunarum*.

### 3. *Lactarius tabidus* FR., Epicr.: 346. 1838. (Colour Fig. VII d; Figs. 5, 6, 7 a, b)

Synonym: *Lactarius isabellinus* BURL., Bull. Torrey Bot. Club **34**: 88. 1907.

Excluded: *Lactarius tabidus* sensu NEUHOFF (= *L. omphaliformis* ROMAGN.); sensu BOUDIER (= *L. obscuratus*).

Misapplied names: *Lactarius theiogalus* (BULL.: FR.) S. F. GRAY sensu NEUHOFF, Milchlinge, pl. 14, fig. 57. 1956; non sensu BULL., QUÉL., BRES. (= *L. chrysorrhoeus* FR.); nec sensu REA, British Basidiomycetes: 489. 1922 (= *L. hepaticus*); nec sensu KONRAD & MAUBLANC, Icon. sel. fung. **10**: pl. 340. 1937 (= mixture of *L. hepaticus* and *L. rubescens*); nec sensu KÜHNER, Bull. Soc. Mycol. France **91**: 57-59. 1975 (= *L. lapponicus*); nec sensu RICKEN, NÜESCH (= *L. decipiens*).

**Iconography:** KORHONEN (1984: 195-196, as *L. theiogalus*), LANGE 1940: pl. 176), NEUHOFF (1956: pl. 14, as *L. theiogalus*), PHILLIPS (1981: 89), RYMAN & HOLMÅSEN (1992: 575, as *L. theiogalus*).

**Descriptions:** KONRAD (1935: 176-177), KONRAD & FAVRE (1935: 152-154), KÜHNER (1975: 64-66), NEUHOFF (1956: 211-213, as *L. theiogalus*), NÜESCH (1933: 107-109, PEARSON (1950: 81-99), ROMAGNESI (1938: 220).

**Neotype** (selected here): Sweden, Medelpad, Ånge, Julåsen, 26. Aug. 1993, M. E. NOORDELOOS 9386 (L).

**Pileus:** (5-)10-55 mm, plano-convex with slightly depressed centre soon expanding to applanate to concave or infundibuliform, sometimes with small central umbo, with slightly involute to deflexed, finally straight margin, strongly hygrophanous, when moist reddish yellow to reddish brown, uniformly coloured or with paler marginal zone [5 YR 7-5(-4)/6-8, 7.5 YR 7-4/6-8; 7D8-F7-8, 6C6-8 to 6D6-8, or 5C7-6], strongly pallescent on drying to pale pinkish yellow or sordid yellow brown (7.5 YR 7-8/6-8), not or slightly translucently striate at margin, glabrous or more frequently slightly to distinctly wrinkled, particularly at centre, but frequently also in marginal zone.

**Lamellae:** L = 40-80, l = 1-9, moderately to fairly crowded, broadly adnate to subdecurrent or arcuate-decurrent, segmentiform, rarely subventricose with broadest part near stipe, 2-6 mm broad, very pale brown or pinkish yellow (10 YR 8-7/3-6, 7.5 YR 8-7/4 to 7-6/6, 5A5-4, 5B6-3 to C6/5, 6C7-5), darker when old and often spotted with darker reddish brown spots, with entire, concolorous edge.

**Stipe:** 15-60 x 3-11 mm, cylindrical or compressed, sometimes tapering towards apex, sometimes broadened or tapering towards base and more or less fusiform, dark reddish yellow to red-brown, often darker with age, especially towards base (2.5 YR 2.5/4-4/6, 5 YR 3/3-4/6 or 5-6/8-6, 7C8-6, 7E8-6, 6C8-5, F7), often paler at apex [7.5-4/6-8, 10 YR 8/6-6/8 or 7/4, 6(B7)C8-7-D8, 5A7-5-C7-5], dry, glabrous, often appearing somewhat rimed with fine, appressed aeriferous fibrils, often with white to deep orange-brown basal tomentum.

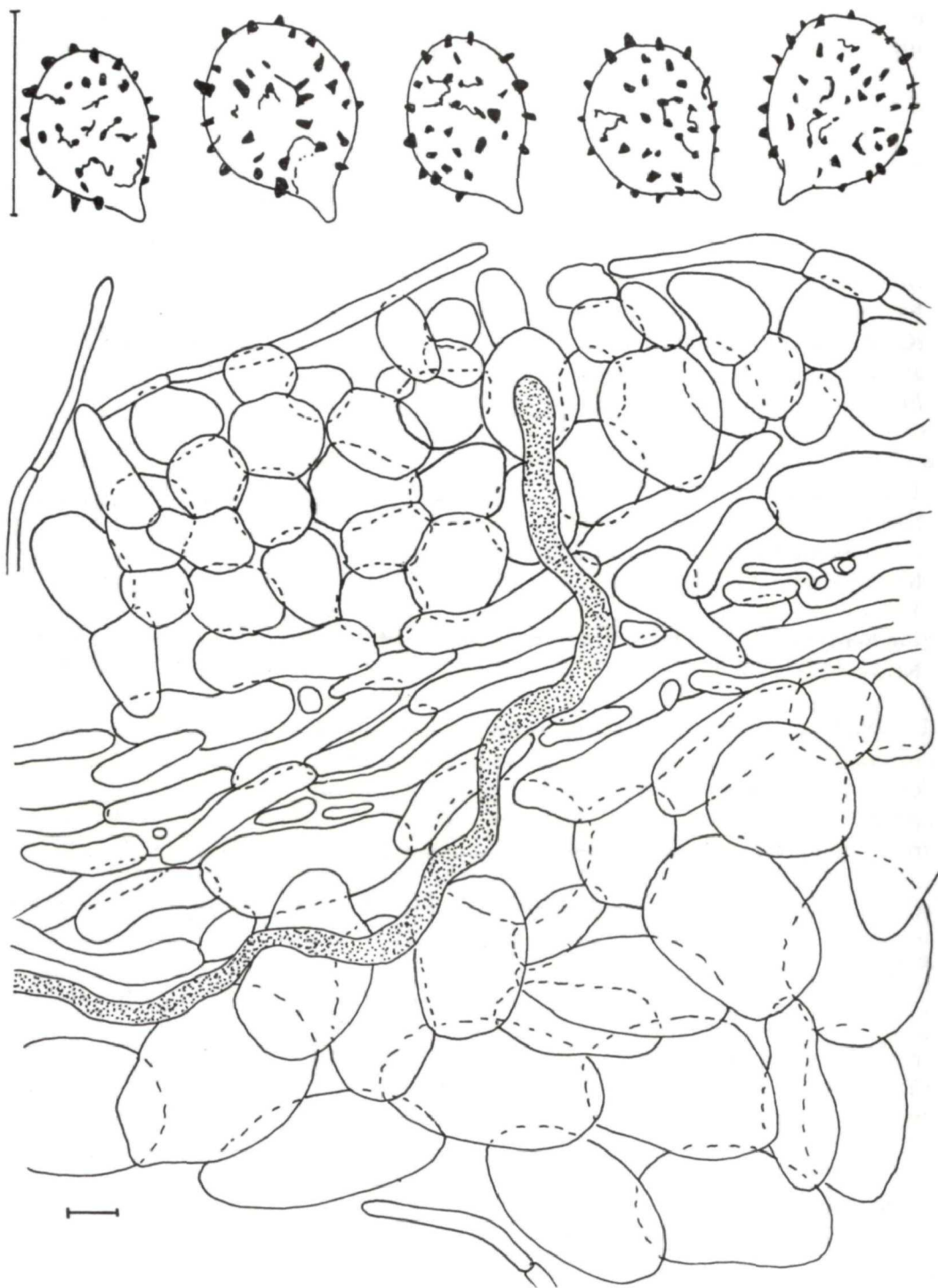


Fig. 5. *Lactarius tabidus*. - Spores (bar: 10  $\mu$ m) and pileipellis (bar: 5  $\mu$ m).

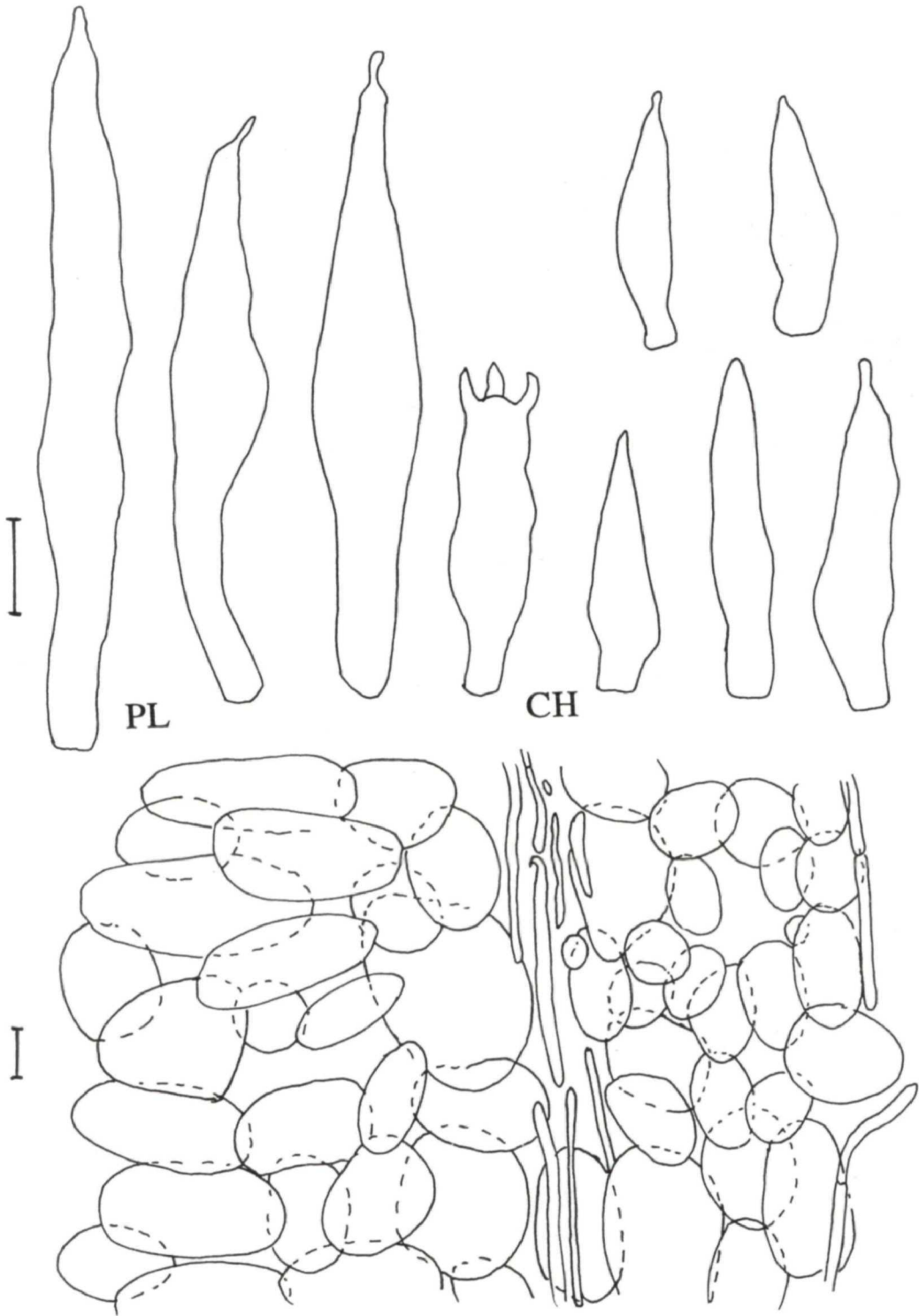


Fig. 6. *Lactarius tabidus*. - Cheilocystidia (CH), basidium, pleurocystidia (PL) (bar: 10  $\mu$ m) and stipe pellis (bar: 5  $\mu$ m).

**Context:** somewhat spongy, white to pale pink in inner part of pileus and stipe; brown to red-brown in cortex of pileus and stipe. Latex white, usually quickly (within 1-2 minutes) staining sulphur yellow, especially on a white cloth, sometimes also the context turns quickly sulphur-yellow when bruised, mild or subacid, sometimes slightly bitter. Smell indistinct. Taste mild.

**Spores:** 6.0-8.5(-9.0) x 5.0-7.5  $\mu\text{m}$ , Q = 1.0-1.4, mean values 6.99-7.94 x 6.06-6.5  $\mu\text{m}$ , Q = 1.13-1.26, globose to ellipsoid, ornamentation amyloid, composed of up to 1  $\mu\text{m}$  high, irregularly shaped and sized isolated warts, at most two warts are connected by a fine line (PEGLER & YOUNG 1982, type A, B), plage not amyloid.

**Basidia:** 26-40 x 7-10  $\mu\text{m}$ , clavate, 4-spored. Lamella edge sterile.

**Cheilocystidia:** 24-51 x 4.0-8.0  $\mu\text{m}$ , fusiform to lageniform with broadest part below middle, with long, often (sub)capitate neck, thin-walled.

**Pleurocystidia:** (macrocystidia) (37-)46-90(-111) x 5.0-10(-13)  $\mu\text{m}$ , fusiform-lageniform with long, tapering neck. Pseudocystidia filiform to subcylindrical, 2.0-3.5(-5.0)  $\mu\text{m}$  wide.

**Pileipellis:** 150-250  $\mu\text{m}$  thick, a palisade of rounded, subglobose elements, 15-30 x 10-25  $\mu\text{m}$  without or with a few, scattered thin-walled hyphae; subpellis of slightly smaller, subglobose elements, 5.0-11 x 6.0-14  $\mu\text{m}$ .

**Stipitipellis:** 100-200  $\mu\text{m}$  thick, a palisade of subglobose elements, 15-25 x 6.0-14  $\mu\text{m}$ , separated from the stipititrama by a layer of narrow, thin-walled hyphae and small rounded to elongate elements.

**Clamp-connections:** absent.

**Ecology:** Ectomycorrhizal, often associated with *Betula* and possibly also *Salix* in damp places, such as among *Sphagnum* in marshy forests, but frequently also in drier areas, such as *Pinus* and *Pseudotsuga* plantations on rather poor, sandy or peaty soil, in boreal *Picea* forests, but then may be always (?) with *Betula* in vicinity.

**Distribution:** Widespread in the Northern Hemisphere, from subarctic through boreal, temperate to mediterranean climate zones. Summer-Autumn.

**Collections examined:** **Finland:** Inari Lapland, Utsjoki, Kevo, Jesnavaaralle, 16. Aug. 1995, M. E. NOORDELOOS 95076 (L); - Kevo, Tshieskuljoki, 17. Aug. 1995, M. E. NOORDELOOS 95080 (L); Rovaniemi, Kaihuanvaara, Kylmäohja, 23. Aug. 1992, M. E. NOORDELOOS 9284 (L). **The Netherlands:** prov. Friesland, Weststellingwerf, Rottige Meente, 29. Aug. 1982, P. B. JANSEN 82328 (L); prov. Gelderland, Ede, Planken Wambuis, 4. Oct. 1996, M. E. NOORDELOOS 96208 (L); - Ede, Ginkelse Zand, 20. Oct. 1994, M. E. NOORDELOOS 94106, 94107 (L); - Otterlo, Hoge Veluwe, 20. Sept. 1992, M. E. NOORDELOOS 92155 (L); prov. Utrecht, Hilversum, Craailo, 12. Aug. 1973, P. VAN WINDEN (L); prov. Noord Holland, Vogelenzang, Eiland van Rolvers, 28. Oct. 1996, S. IDZERDA 981-6 (L); - Bergen aan Zee, Verbrande Pan, 4. Nov. 1996, S. IDZERDA 966-16 (L); prov. Zuid Holland, Gouderak, Veerstaalblok, 16. Nov. 1980, P. B. JANSEN 80244 (L); - Nieuwkoop, de Haeck, 11. Nov. 1996, S. IDZERDA 9618, 9619-26 (L); - Rockanje, Strijpemonde, 17. Oct. 1981, C. BAS 7838 (L); prov. Limburg, Helden, Scherliet, 11. Oct. 1994, M. E. NOORDELOOS 94139 (L); - Wijlre, in der Elzer Stond, 21. Aug. 1979, P. B. JANSEN (L); - Griendsveen, 8. Oct. 1994, M. E. NOORDELOOS 94130, 94131, 94132, 94139 (L); Mariapeel, 8. Oct. 1994, M. E. NOORDELOOS 94127 (L). **Norway:** Troms, Storfjord, Signaldalen, 20. Aug. 1992, M. E. NOORDELOOS 9270 (L). **Sweden:** Medelpad, Ämge, Julåsen, 26. Aug. 1993, M. E. NOORDELOOS 9386 (L). **United Kingdom:** Scotland, Dunkeld, The Hermitage, 25. Aug. 1996, M. E. NOORDELOOS 9672 (L).



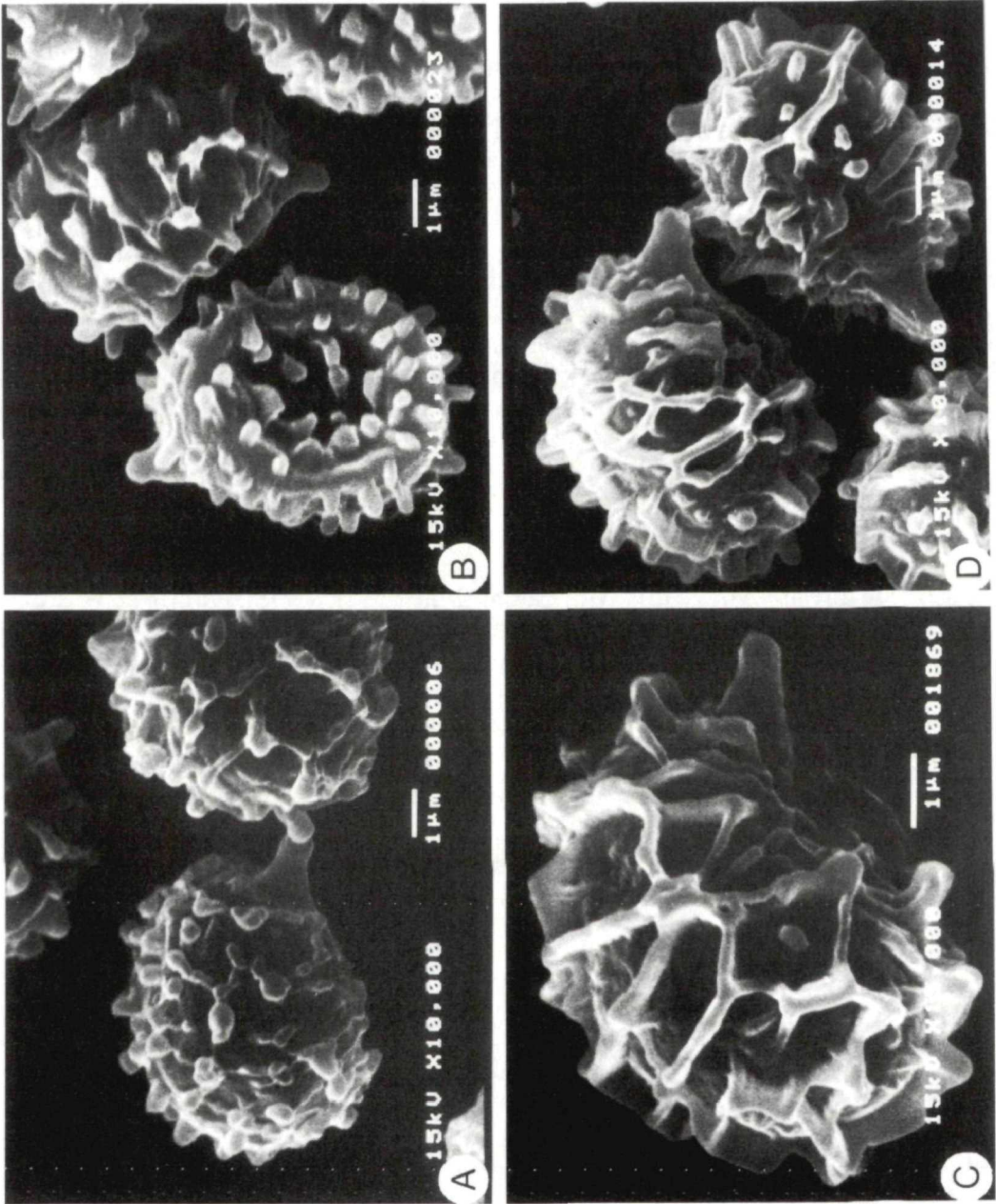


Fig. 7 a-d. SEM-pictures of spores. a *Lactarius tabidus*, M. E. NOORDELOOS 95080. b *L. tabidus*, S. IDZERDA 9616. c *L. lacunarum*, M. E. NOORDELOOS 9691. d *L. oedohyphosus*, holotype.

## Nomenclatural remarks

### How to interpret the name *Agaricus theiogalus* BULL.?

Looking at the iconotype of the name *Agaricus theiogalus* in BULLIARD (1791: pl. 567, fig. 2) it is obvious that BULLIARD depicts here the *Lactarius* species nowadays currently named *Lactarius chrysorrheus* FR. The clearly zonated pileus and bright yellow latex allows no other interpretation (see colour fig. VII a). No wonder that QUÉLET (1886) and BRESADOLA (1929: pl. 378) correctly interpreted *Lactarius theiogalus* as such. It is strange that FRIES, who first adopted BULLIARD's species in this sense (FRIES 1821) later described a new species as *Lactarius chrysorrheus* (FRIES 1838: 342). QUÉLET (1886) considered both taxa conspecific, but distinguished them at varietal level, var. *thiogalus* with reddish tinged pileus and latex becoming sulphur-yellow, and var. *chrysorrheus* with more yellow tinged pileus and latex becoming golden-yellow.

The epithet *thiogalus* has also been interpreted in various other ways:  
*Lactarius theiogalus* sensu RICKEN, NÜESCH, BRITZELM. = *L. decipiens* QUÉL.  
*Lactarius theiogalus* sensu REA = *L. hepaticus* PLOWRIGHT  
*Lactarius theiogalus* sensu KÜHNER 1975 = *L. lapponicus* HARMAJA  
*Lactarius theiogalus* sensu KONRAD & MAUBL. p.p. = *L. rubescens* BRES.

The interpretation of NEUHOFF (1956: pl. 14, fig. 57) is interesting as he bases his concept of *Lactarius theiogalus* sensu FRIES on an unpublished plate in the collection of the Natural History Museum in Stockholm. This shows a species with wrinkled pileus and latex that clearly turns yellow. NEUHOFF's interpretation got wide acceptance, among other, in the works of MOSER (1985) and KORHONEN (1984).

From the above discussion it will be clear, however, that the epithet *thiogalus* cannot be applied to NEUHOFF's taxon. It should be used in its original sense, i.e. that of BULLIARD, which would mean that it should replace the widely accepted name *Lactarius chrysorrheus* FR.! This rather unfortunate situation can possibly be solved by conservation of the last mentioned name. A proposal will be written at a later date.

### Is the name *Lactarius tabidus* available to replace *L. theiogalus* sensu NEUHOFF?

Translation of the original diagnosis (FRIES 1838: 346):

*Lactarius tabidus*: Pileus thin-fleshed, flattened with acute umbo, pallescent and wrinkled on drying; stipe narrowly fistulose, glabrous; lamellae rather distant, thin, pallescent. Latex white, mild. In shady deciduous woods. Pileus translucently striate when moist, red-brown when young, later on pallescent to flesh-colour, finally pale yellow.

FRIES described here a new species, which he earlier (FRIES 1821) included in *Agaricus subdulcis*. There is no indication whatsoever that the latex changes yellow, which is typically the case in *L. theiogalus* sensu NEUHOFF.

Later authors paid much attention to the fact that FRIES mentioned a wrinkled surface of the pileus in his original description. Two interpretations are possible: in one *Lactarius tabidus* is a small omphaloid species growing in marshy places with indistinctly or not yellowing latex: *Lactarius tabidus* sensu BOUDIER (1905: pl. 57) (= *L. obscuratus*) or *Lactarius tabidus* sensu NEUHOFF (= *L. omphaliformis* RO-

MAGN.), while in the other, more or less identical with *Lactarius theiogalus* sensu NEUHOFF, it is a somewhat more robust fungus with latex usually clearly staining yellow: *Lactarius tabidus* sensu PEARSON, KONRAD & MAUBL., KÜHNER & ROMAGNESI, KÜHNER, R. PHILLIPS.

Considering the fact that FRIES in one of his later works (1874: tab. 171, fig. 3) depicted as *Lactarius tabidus* a species with the habit of *L. vietus* (FR.: RR.) FR., it seems likely that the second interpretation of the epithet *tabidus* is more justified than the first one. We doubt whether the original *Lactarius tabidus* really stands for *Lactarius theiogalus* sensu NEUHOFF, especially because of the fact that FRIES never mentioned the yellowing of the latex, and pointed to the great similarity with *Lactarius vietus*.

BON (1980) who intensively studied the genus *Lactarius*, presents in his key another problem by distinguishing two different species: *Lactarius theiogalus* and *L. tabidus*. They can be distinguished as follows:

Slender species with depressed pileus which may be clearly translucently striate at the margin; latex quickly discolouring; smell similar to *Lactarius quietus*; Lamellae rather crowded; spores 6.0-8.5 x 5.5-7.0 µm with isolated warts or a fine reticulum; in acid, moist places, often between *Sphagnum*. Icones: KONR. & MAUBL. 339-2, upper figs; LANGE 176B, MARCHAND 578

***L. theiogalus* sensu NEUHOFF**

Medium sized species with slightly more fleshy pileus, not translucently striate or if so in young specimens only; latex slowly turning yellow; smell distinctly like that of *L. quietus*; spores larger, (8-)9-10(-11) x 6-8 µm, with more or less complete reticulum; in neutral habitats, frequently under *Fagus*. Icones: CETTO 1058; FRIES 171, fig. 3; KONRAD & MAUBLANC 339, fig.2; MARCHAND 579; MICHAEL HENNIG 5, 52 upper figs.

***L. tabidus***

For us it is clear that *Lactarius theiogalus* sensu BON is the same as NEUHOFF's species, although it is possible that elements of *L. oedohyphosus* are included (e.g. spores with fine reticulum). The interpretation of *Lactarius tabidus* sensu BON is unknown to us, as it has spores with a more or less complete reticulum. It may represent an as yet unnamed taxon, or a variant of *L. subdulcis*. The latter species is also in critical need of revision. The plates cited do not give a solution: CETTO (1983: 1058) depicts rather red specimens, which maybe identical with *L. rubescens* BRES., KONRAD & MAUBL. (1937: 339 upper figs.) and MARCHAND (1980: 579) give a yellow-brown form of what we may call *L. theiogalus* sensu NEUHOFF, and the plate of FRIES (1874: 171, fig. 3) is not very much like our fungus.

In conclusion we may state that the various interpretations of the name *Lactarius tabidus* are confusing. This leaves us two options:

To consider the name *Lactarius tabidus* a nomen confusum. So far, the oldest available name that covers *Lactarius theiogalus* sensu NEUHOFF and *L. tabidus* sensu PEARSON, KONRAD & MAUBL., KÜHNER & RAMAGNESI, KÜHNER, R. PHILLIPS is *Lactarius isabellinus* described from North America by BURLINGHAM (1907), which should consequently be reintroduced.

To accept the epithet *tabidus* in the sense of PEARSON, KONRAD & MAUBL., KÜHNER & ROMAGNESI, KÜHNER, R. PHILLIPS and designate a neotype. This is probably more acceptable than the introduction of the forgotten name *isabellinus*.

After discussions with fellow mycologists, it has been decided to accept the second option, and to provide a full description and neotype for our interpretations of *Lactarius tabidus* FR.

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