

## Studies on *Lactarius* : a new species from the Gulf of Mexico area

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**ABSTRACT** – An undescribed *Lactarius* species in subgenus *Lactifluus*, subsect. *Volemi* has been found in the central region of the Gulf of Mexico area, viz. *L. pallidilamellatus*. The combination of features with regard to basidiome color, basidiospore size and ornamentation height, and hymenial cystidia (size and wall thickness) distinguish it from its close relative *Lactarius lamprocystidiatus* from New Guinea. The basidiomes of the new species described here were found growing under *Carpinus* in a subtropical (mesophytic) forest.

**Russulales / Taxonomy / Ectomycorrhizal fungi**

### INTRODUCTION

A monitoring program that we established in a mesophytic (subtropical) forest in the central area of the State of Veracruz (Gulf of Mexico area) is helping us to record the macrofungi associated with this ecosystem; periodical explorations in the area have been carried out between 1990 and 1995, and after 2001 (Bandala and Montoya 2002, Montoya and Bandala 2003a). The species here described was detected in 1990. The specimens (superficially) recalled basidiomes of *Lactarius volemus* Fr. and *L. austrovolemus* Hongo, but they were distinct macro- and microscopically, thus suggesting the existence of an undescribed taxon. Detailed observation of the characters of a recent fresh collection, gathered in a provided plot dominated by trees of *Carpinus caroliniana* Walter, enough information to interpret that the specimens represent an isolate species. This new taxon proposed here as *Lactarius pallidilamellatus*, is closely related to *Lactarius lamprocystidiatus* Verbeken and Horak (2000) described from New Guinea. Its possible association with other ectotrophs in the mesophytic forest such as *Quercus* spp. should be examined in future. We have not found it in other areas of the country, neither through field visits nor at Mexican herbaria.

Macroscopic features were recorded from fresh material, alphanumeric color designations are according to Kornerup and Wanscher (1978). For methods followed during microscopic study, measurements and SEM analysis, we refer to Montoya and Bandala (2003b). The range reported for the basidiospore measurements describes the variability within the collections (in brackets appear the extreme values  $\pm 2$  SD in the samples). The notation **RM** means the range of means of length x width in n collections (n = 5) (based on 30 basidiospore measurements in each collection); **QM** corresponds to the range of means of coef. Q (length/width ratio of spores). Herbarium acronyms are according to Holmgren *et al.* (1990).

## DESCRIPTION OF THE SPECIES

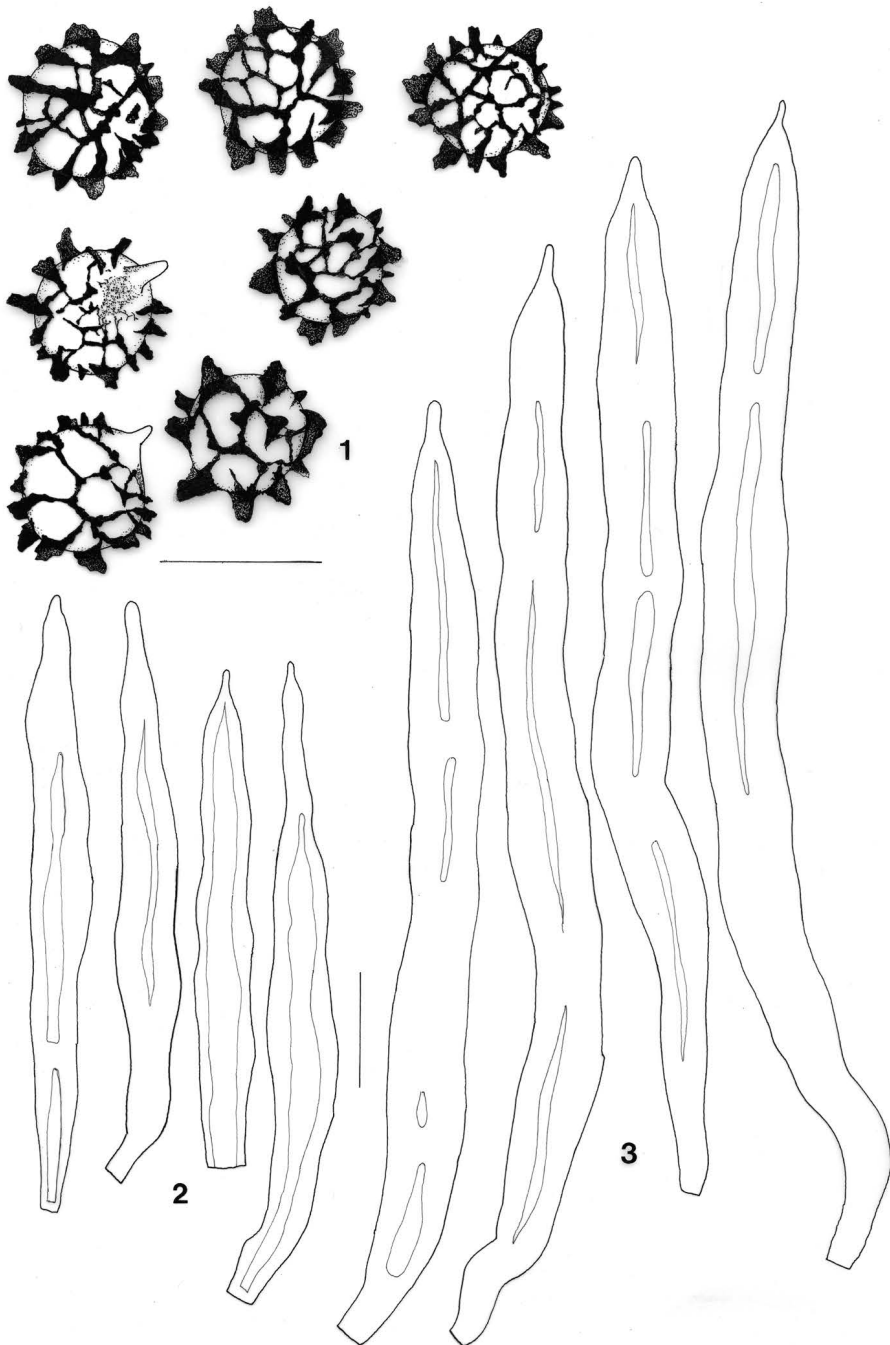
***Lactarius pallidilamellatus* Montoya et Bandala sp. nov.**

figs. 1-10

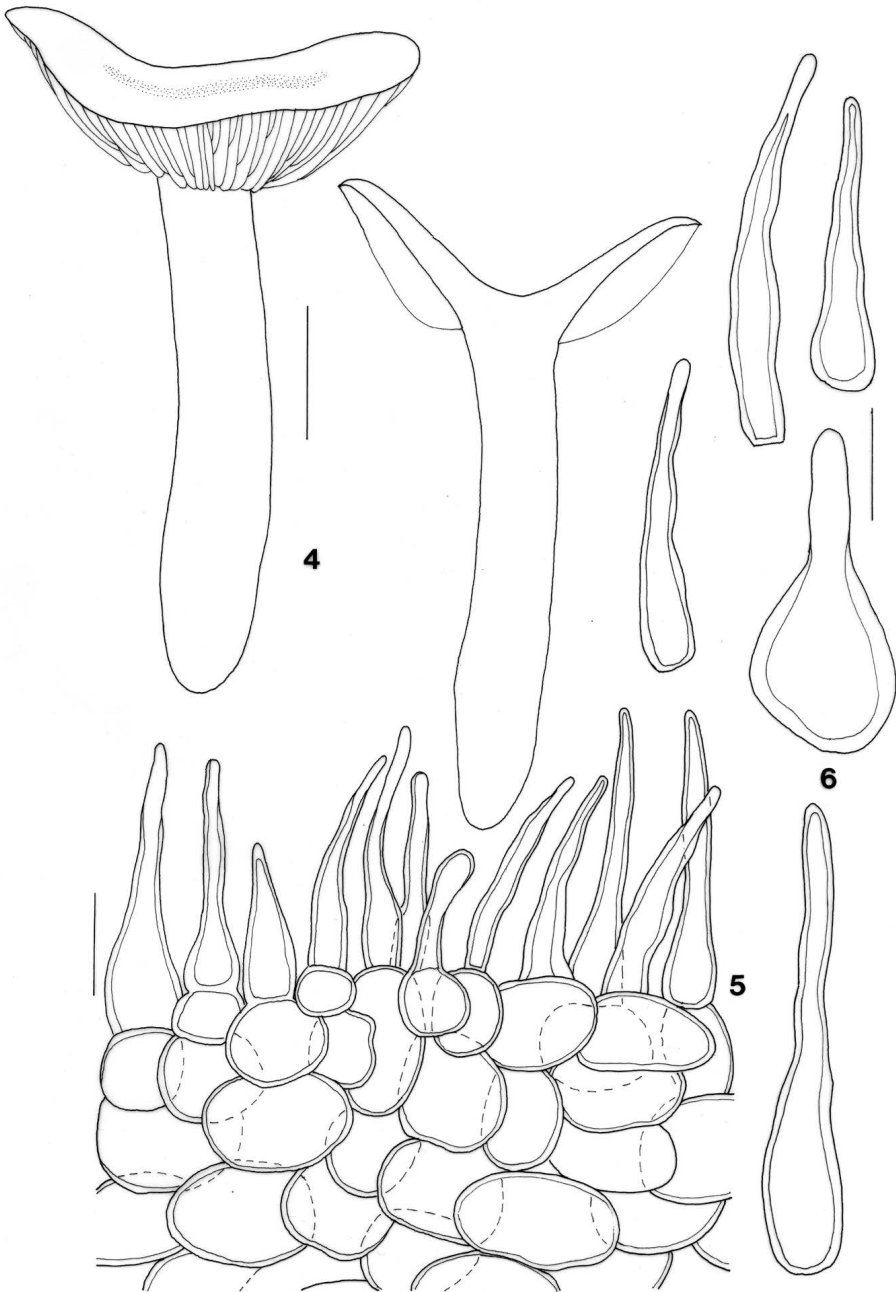
*Pileus* 35-63 mm *latus*, *convexus vel planus*, *aurantius*, *in medio obscurior*, *siccus*, *minute velutinus*; *marginē incurvo*, *minute ruguloso*. *Lamellae adnatae*, *subdecurrentes*, *densae*, 4-6 mm *latae*, *cremeae*. *Stipes* 45-90 × 5-16 mm, *cilindricus*, *solidus*, *pallide aurantio luteus*, *siccus*, *subvelutinus*. *Caro alba dein luteo-alba*, *brunnescens*, *odore forte piscis simili*. *Latex albidus*, *abundans*, *sapores nullo*. *Sporae* (6.4-) 7.2-8.8 × (5.6-) 6.4-7.2 (-8) μm, *subgloboseae*, *reticulatae*, *cristis usque ad 1-2 (-2.4) μm altis*. *Cystidia subfusiformia*, *crassetunicata*, *abundantia*; *pleurocystidia* 64-120 × 6.4-9.6 μm, *pariete 1.6-4 (-4.8) μm crasso*; *cheilocystidia* 32-80 × 3.2-6.4 μm, *pariete 0.8-2.4 μm crasso*. *Pileipellis trichodermis*; *pileocystidia* 16-40.8 × 2.4-10.8 μm, *versiformia*, *subfusiformia*, *abundantia*, *crassetunicata*, *pariete 0.8-1.8 μm crasso*; *cellulae subpellis inflatae et subgloboseae*. *Holotypus: lectus prope Mexico: Veracruz, Mpio. Xalapa, km 2.5 old road Xalapa-Coatepec, Parque Ecológico Francisco J. Clavijero, 27.II.2003, Montoya 3970 (XAL)*.

*Pileus* 35-63 mm wide, *plano-convex* and finally centrally depressed, orange to yellow-orange (6B8-C8-D8, 7C8-D8) with somewhat intense (8E8) tinges at the central area of the disc, *subvelvety*, *dry*, somewhat *rugose*; margin weakly *decurved* at the edge, *rugose*, at times somewhat *striate*. *Lamellae* crowded to close, *adnate to subdecurrent*, although some *subfree*, some *dichotomic* near the *pileus border*, moderately broad (4-6 mm wide), cream color to pale yellowish (3A2, 4A3-A2, 5A5-A4), staining brown (6F8) when bruised, with *lamellulae* of different sizes, surfaces at times *rugose-venose*. *Stipe* 45-90 × 5-16 mm, more or less *cylindric*, yellow-orange or paler (5A6, 5A7, 6B7-C7) than the *pileus*, paler towards the apex, *subvelvety*, *dry*, surface *longitudinally rugose*. *Context* compact, cream-white to yellowish (4A2) or cream yellowish, staining brown after exposed; *stipe base* pinkish-brown to reddish; odor strong, somewhat fish like, taste mild. *Latex* white, copious, sticky, staining brown or reddish brown, but finally brown on white paper and on the cut surfaces; taste mild. The latex, context, *pileus* and *stipe* surfaces staining green with FeSO<sub>4</sub>.

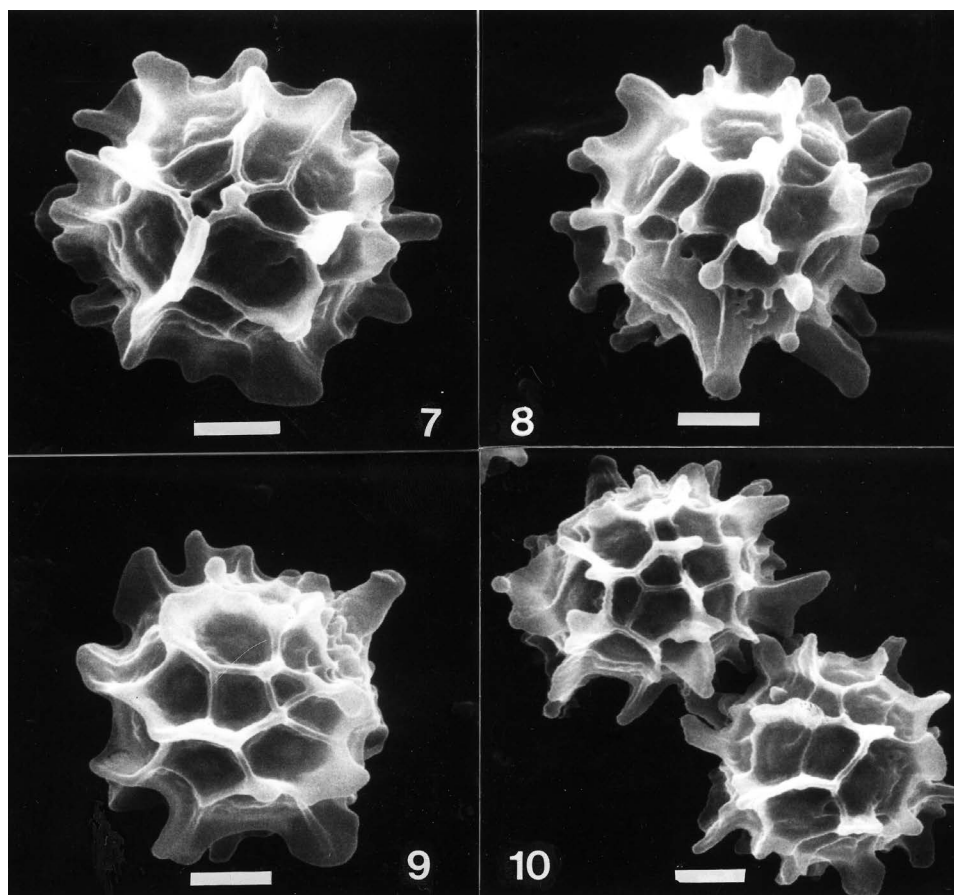
*Basidiospores* (6.4-) 7.2-8.8 × (5.6-) 6.4-7.2 (-8) μm; **RM** = 7.1-8 × 6.5-7 μm; **QM** = 1.10-1.14; *subglobose*, with *amyloid* *plage*; *ornamentation* 1-2 (-2.4) μm high, as a complete *reticulum* with broad bands, arranged in a dense mesh net; under SEM the ornamentation appears continued into bands forming a more or less complete *reticulum*, the ridges present an *irregular wavy margin*, some are higher than others, inclusive with *winged appearance*. *Basidia* 46-80 × 8-9 μm, *tetrasporic* or *bisporic*, at times the *sterigmata* in a same *basidia* unequal in size. *Pleurocystidia* 64-120 × 6.4-9.6 μm, *thick walled*, with wall 1.6-4 (-4.8) μm thick, *subfusiform*, *sinuous*, at times with *constricted apex*, abundant. *Cheilocystidia* similar to *pleurocystidia*, 32-80 × 3.2-6.4 μm, *thick walled* (0.8-2.4 μm thick), abundant. *Pleuropseudocystidia* 3.2-4 μm diam., *subcylindric*, *sinuous*, not projected beyond *hymenium*. *Pileipellis* a *trichodermis*, *pileocystidia* 16-40.8 × 2.4-12.8 μm, *fusiform*, apex *elongated*, *subacute to rounded*, some *subcylindric*, commonly *widened at base*, *thick walled* (0.8-1.8 μm thick); *subpellis* composed of *subisodiametric cells*, with the elements 4.8-28 μm diam., with *thickened walls*, 0.8-1.6 μm thick. *Context hyphae* 4-7.2 μm diam., *laticifers* 5.6-16 μm diam., *sphaerocytes* 16-32 μm diam. *Hymenophoral trama hyphae* 5.6-6.4 μm diam., *laticifers* 2.4-10.4 μm diam., *sphaerocytes* 13.6-20 μm diam.



Figs 1-3. *Lactarius pallidilamellatus*. 1: basidiospores. 2: cheilocystidia. 3: pleurocystidia (holotype) (scale bar = 10  $\mu$ m).



Figs 4-6. *Lactarius pallidilamellatus*. 4: basidiomes. 5: section of pileipellis. 6: pileocystidia (holotype) (scale bar = 10  $\mu$ m, except for 4 = 20 mm).



Figs 7-10. *Lactarius pallidilamellatus*. Basidiospores under SEM (*Montoya-Castillo s.n.*) (scale bar = 2  $\mu$ m).

**HABITAT:** Solitary or subgregarious, on soil, under *Carpinus caroliniana*, at 1300 m.a.s.l. in a mesophytic (subtropical) forest.

**MATERIAL STUDIED.** MEXICO. Veracruz: Mpio. Xalapa, km 2.5 old road Xalapa-Coatepec, Parque Ecológico Francisco J. Clavijero, 13.VI.1986, *Anell 417*; 12.X.1997, *Montoya-Castillo s.n.*; 27.II.2003, *Montoya 3970* (holotype); around Instituto de Ecología, 7.V.1990, *Bandala 1906*; near Coapexpan River, 11.VII.1992, *Bandala 2109* (all at XAL).

**OTHER MATERIAL STUDIED.** *Lactarius lamprocystidiatus*: Papua New Guinea. Morobe: Bulolo, Heads Hump, 9.III.1972, *Horak 72-195* (isotype GENT). *Lactarius austrovolemus*: Papua New Guinea. Morobe: Bulolo, Manki, 30.IV.1973, *Horak 73-192* (GENT). *Lactarius volemus*: México. Michoacán: Pontezuelas, km 219-220 road Morelia-Toluca, 28.VII.1980, *leg. Cifuentes 747* (FCME 10606).

This new taxon can be recognized by the combination of the following set of characters: slender habit, pileus and stipe orange; crowded, cream to yellowish lamellae; white context changing to brown when exposed; copious white latex; basidiospores (6.4-) 7.2-8.8  $\times$  (5.6-) 6.4-7.2 (-8)  $\mu\text{m}$ , with a heavy reticulum and prominent thick walled hymenial cystidia.

*Lactarius pallidilamellatus* is closely related to *L. lamprocystidiatus* Verbeken & Horak, described from New Guinea (Verbeken and Horak 2000). Both species share basidiospores with a strong reticulum and similar lamellae arrangement. According to Verbeken and Horak (2000) *Lactarius lamprocystidiatus* occurs under *Castanopsis acuminatissima* (Bl.) A. DC. and differs from *L. pallidilamellatus* because its basidiomes present pileus in deep orange to (fox) red-brown color, orange-brown stipe, orange lamellae and orange-brown context (unchanging on exposure). The latex was recorded as watery white. The range of basidiospore size reported is somewhat larger, 9  $\times$  8.5  $\mu\text{m}$  in average (9  $\times$  8.4  $\mu\text{m}$  in our revision of the isotype). The hymenial cystidia are shorter and with thinner walls: pleurocystidia 50-70  $\times$  5-6  $\mu\text{m}$ , with wall up to 2  $\mu\text{m}$  thick (in our revision of the isotype: 35.4-66  $\times$  3-6  $\mu\text{m}$ , with wall up to 1.6  $\mu\text{m}$ ), cheilocystidia 25-35  $\times$  5-7  $\mu\text{m}$  with wall up to 1.5  $\mu\text{m}$  thick (21-37.8  $\times$  2.4-6  $\mu\text{m}$ , with wall up to 1.6  $\mu\text{m}$  seen in the isotype). The pileocystidia shape in *Lactarius pallidilamellatus* is versiform, however frequently the elements present a widened or even ampullaceous base.

*Lactarius lamprocystidiatus*, *L. pallidilamellatus* and *L. austrovolemus* Hongo constitute a homogeneous group of species in sect. *Lactifluus* (Burl.) Hesler & A.H. Sm., subsect. *Volemi* Pacioni & Lalli, characterized by globose to subglobose spores bearing a conspicuous heavy ornamentation. The lamellae arrangement mainly segregates the two former species from *Lactarius austrovolemus*, this latter exhibiting distant lamellae (Hongo, 1973; Lalli and Pacioni 1992; Verbeken and Horak 2000). This feature is even observed in dry condition, as shown by the specimen *Horak 73-192*.

*Lactarius volemus* is another species of subsection *Volemi* known to occur in North America (Hesler and Smith 1979), including Mexico (Montoya *et al.* 1996). Macroscopically it differs from *L. pallidilamellatus* by its more robust basidiomes, close lamellae, somewhat darker colors, and microscopically it can be distinguished by its basidiospores with a fine and lower ornamentation [0.5-0.8  $\mu\text{m}$  high in the collection from Michoacan; 1  $\mu\text{m}$ , high according to Basso (1999) or 0.5 (-1)  $\mu\text{m}$  high after Heilmann-Claussen *et al.* (1998)] and arranged in a wider mesh net.

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