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STUDIES OF LACTARIUS FROM MEXICO: A NEW SPECIES IN SUBGENUS PIPERITES

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Lactarius lacteolutescens is described as a new member in subgenus *Piperites* subsect. *Croceini*. It was found growing in a mixed forest of *Pinus* spp. and *Abies hickellii*, at Mt. Cofre de Perote, Central Region of the State of Veracruz (Gulf Area, Mexico).

The mycobiota ectotrophically associated with the Pinaceae of Mexico is of particular interest, since a great number of species of *Pinus*, at present known in the world, occur in this country, including several taxa restricted to its territory and neighbouring areas (Rzedowski, 1978; Perry, 1991). At present several species of *Lactarius* associated with these conifers in Mexico have been reported (Guevara et al., 1987; Montoya et al., 1990, 1996; Montoya & Bandala, 1996), including a new species (Kong-Luz & Estrada Torres, 1994). In the Cofre de Perote Region, in the central area of the State of Veracruz, an interesting species of *Lactarius* has been found growing in association with *Pinus* (*P. patula, P. pseudostrobus*, and *P. montezumae*). Because of its distinctive characters (yellow staining latex, size and shape of cystidia, and basidiospore ornamentation) it is considered a new species in the subgenus *Piperites* (Fr.) Kauffman subsect. *Croceini* (Burl.) Sing. sensu Hesler & Smith (1979).

Methods. This study is based on the analysis of fresh and dried specimens. Annotations of colours in brackets were codified according to Kornerup & Wanscher (1978) colour manual. Microscopic analysis was carried out on sections mounted in 5% KOH. The basidiospores were observed in Melzer's reagent and were measured in side view. The dimensions of the basidiospores do not include the ornamentation; their height is indicated separately.

The ranges of spore measurements correspond to the absolute values measured (25 basidiospores per collection) and the range of the means is mentioned in brackets. L (mean length) and W (mean width) correspond to the mean of means ± standard deviation (sd). The range of the means of quotient Q (= length/width) and the mean of means ± sd are also included.

Line drawings were made with the aid of a drawing tube and micrographs of the basidiospores were prepared with a scanning electron microscope.

Herbarium acronyms are according to Holmgren et al. (1990).

Lactarius lacteolutescens Montoya, Bandala & G. Moreno *spec. nov.* — Figs. 1–19

Pileus 17–63 mm latus, convexus vel plano-convexus, acuto- vel conico-papillatus, aurantiaco-brunneus. Stipes 40–120 × 6–17 mm, obclavatus, roseo-salmoneus, late e basi vinosus, basi villoso-strigosus. Latex lacteus, lutescens, superficio luteo-, late brunneotinctus. Sapor acer. Sporae in massa bubalinae vel luteolae roseotinctae. Basidiosporae 7.2–8.8(–9.6) × (4.8–)5.6–6.4(–7.2) µm, reticulatae vel subreticulatae, verrucae et cristae singularia praesentia, ornamentum 0.8–1.2 µm altum. Pleurocystidia

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76–106 × 8–12 µm, subfusiformes, frequente apicibus mucronatis, conspicua. Cheilocystidia similia, 40–64 × 8–12 µm. Pellicula ex ixocutis compositur. Hymeniotrama heteromera. Gregarius sub *Pinus*.

Holotypus: Mexico, Veracruz, Municipio de Xico, E Cofre de Perote, Los Gallos, 1.5 km ad septentriones ex Ingenio El Rosario, *Montoya 3222* (XAL).

Etymology: due to its white latex becoming yellow.

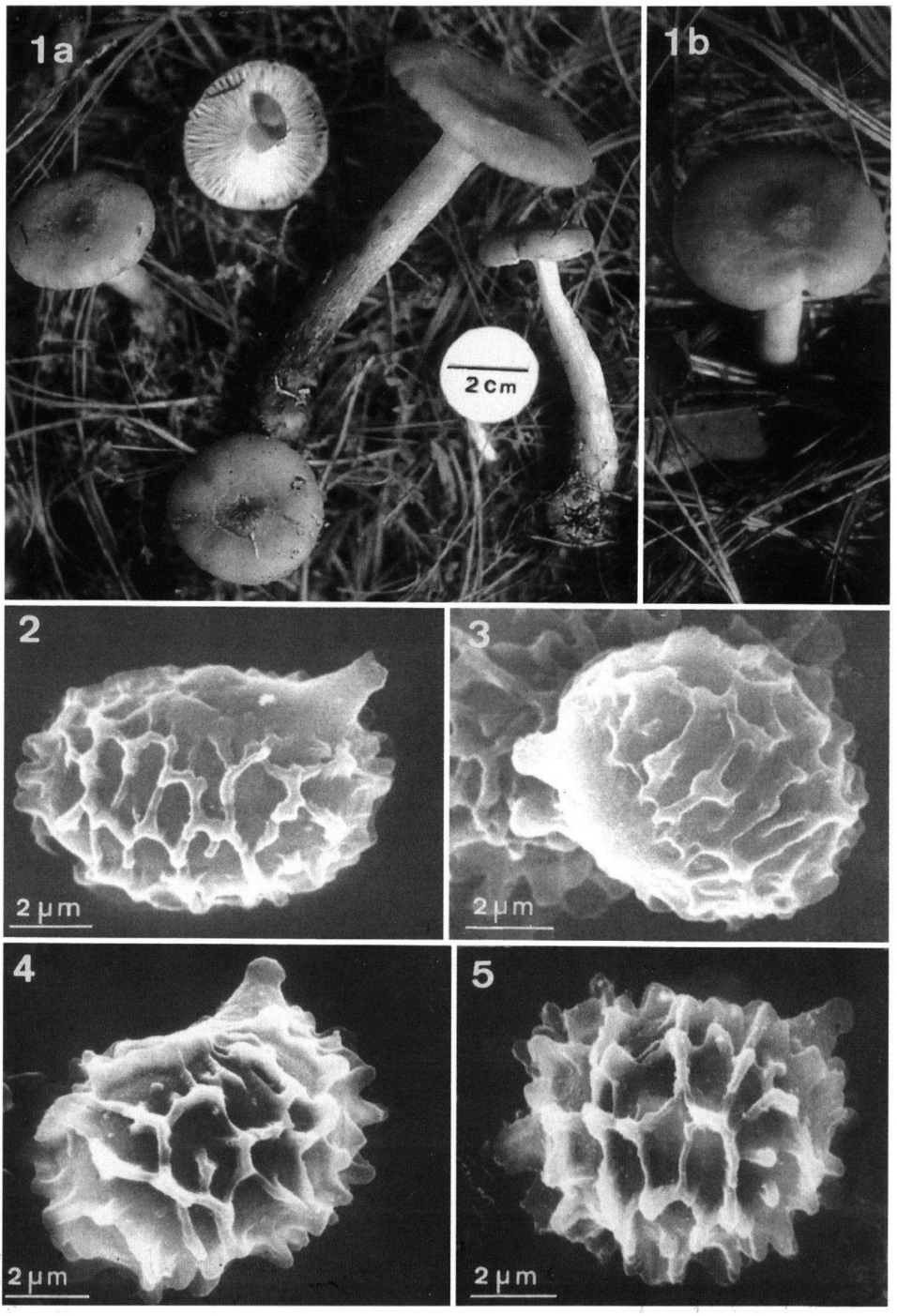
Pileus 17–63 mm in diam., convex when young to plano-convex, at times undulated, depressed in age, with an acute or conic papilla, glabrous, viscid to subviscid in dry weather, hygrophanous, azonate or at times with obscure zonations due to the loss of humidity and hence appearing canescent areas, orange brown, dark ochraceous salmon to cinnamon brown (6B6, 6C8, 6-8D7) with vinaceous tinges (7E7, 8E8-F8) in wet portions, generally yellowish orange at margin and dark orange brown to vinaceous brown (8E6) at the disc when loosing humidity; margin at times incurved, somewhat striate. Lamellae dense, arcuate, medium broad, adnate, pale pinkish buff to yellowish orange (5A2-3, 6A3), becoming vinaceous (9E6-7) or dark vinaceous (pale 10E7), finally ferruginous brown; edge continuous to slightly irregular; lamellulae numerous and of different length. Stipe 40–120 × 6–17 mm, obclavate to subcylindric sinuous and broadened towards the base, dry to slightly sticky, fibrillose, fistulose, pinkish buff (5A2), pinkish salmon to orange, vinaceous at the base in young specimens, upwards darkening to vinaceous (8E6) when mature, then with almost 3/4 of the stipe in dark vinaceous brown (10F5) and only the apex remaining pinkish buff; base villose-strigose, villosity whitish to pinkish brown (7-8B3) with greyish vinaceous tinges. Latex milky, after 3–5 seconds changing to yellow (4A5-B6), staining the cut areas yellow and later brown; taste astringent to slightly acrid. Context pale flesh colour to pale pinkish buff at pileus and above the stipe, pinkish brown in most of the stipe, vinaceous brown (8E6) in wet conditions, staining yellow; odour agreeable; taste slightly bitter. KOH on latex orange and on pileus olivaceous. Phenol on context negative, yellowish on latex. Spore print buff to yellowish (4A2-3) with pinkish tinges.

Basidiospores 7.2–8.8(–9.6) × (4.8–)5.6–6.4(–7.2) µm (8.03–8.32 × 5.95–6.43; L = 8.20 ± 0.06; W = 6.24 ± 0.09); Q = 1.27–1.36; 1.32 ± 0.02 (n = 25 spor es per 5 specimens), ellipsoid, yellowish, more or less densely ornamented; reticulum 0.8–1.2 µm high, more or less complete; warts and crests joined by low and high bands, forming continuous reticulations; isolated verrucae and crests also present; suprahilar plage conspicuous, inamyloid. Basidia 40–50 × 4.8–6.4 µm, clavate, tetrasporic, hyaline; sterigma 4.8–6.4 µm long. Macropleurocystidia 76–106 × 8–12 µm, subfusiform, frequently mucronate at apex, thin-walled or with wall up to 0.8 µm thick, numerous and conspicuous, projecting (beyond the hymenial layer), hyaline to yellowish. Cheilocystidia 40–64 × 8–12 µm, subfusiform, frequent, conspicuous, thin-walled, similar in shape to pleurocystidia, hyaline to yellowish. Pileipellis an ixocutis, 70–96 µm thick; hyphae 2.4–4 µm in diam., compactly arranged,

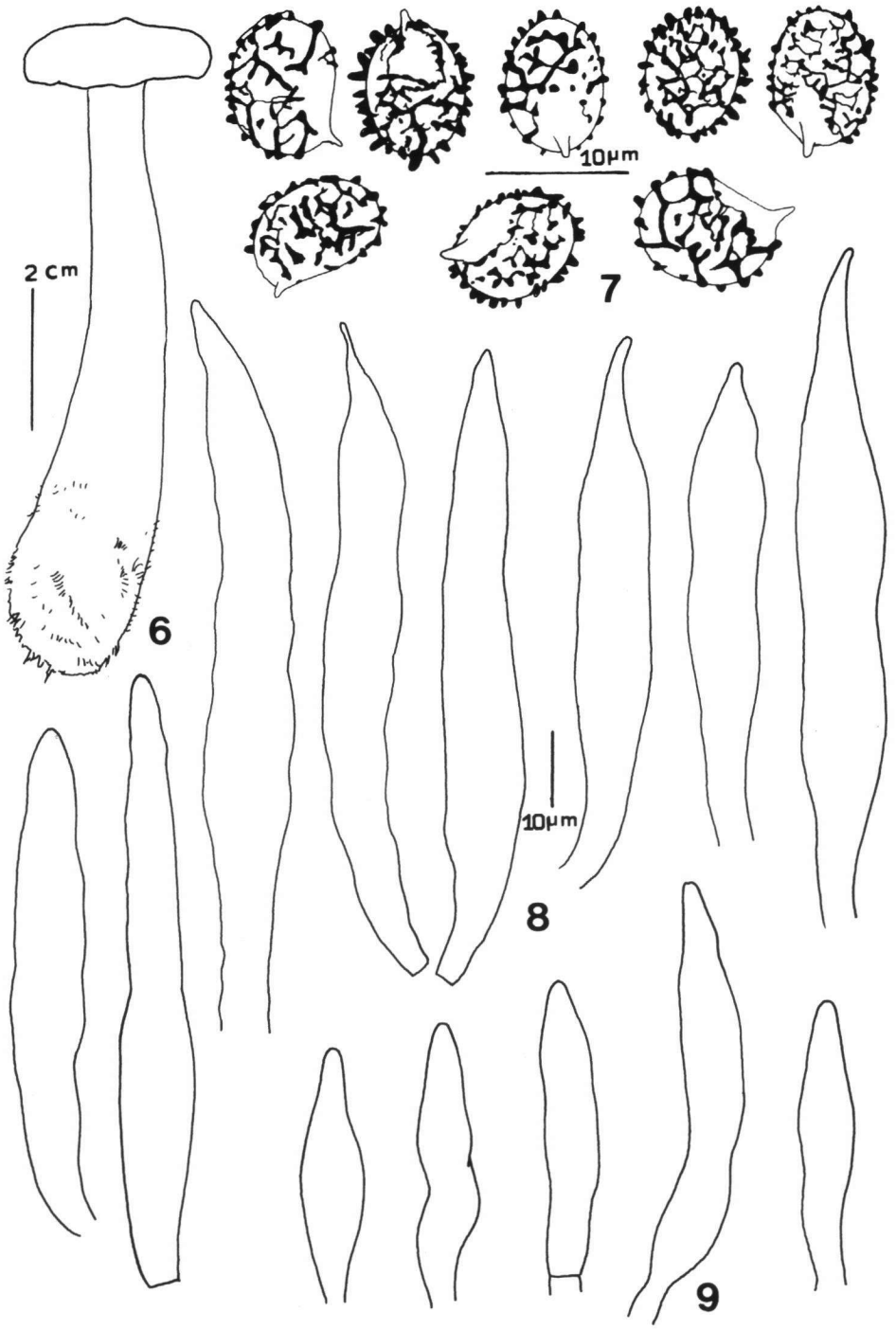
Figs. 1–5. *Lactarius lacteolutescens*. 1a. Basidiomata; 1b. detail of the pileus papilla; 2–5. basidiospores with SEM (*Montoya 3222*, holotype).

Figs. 6–9. *Lactarius lacteolutescens*. 6. Basidiome; 7. basidiospores; 8. pleurocystidia; 9. cheilocystidia (*Montoya 3222*, holotype).

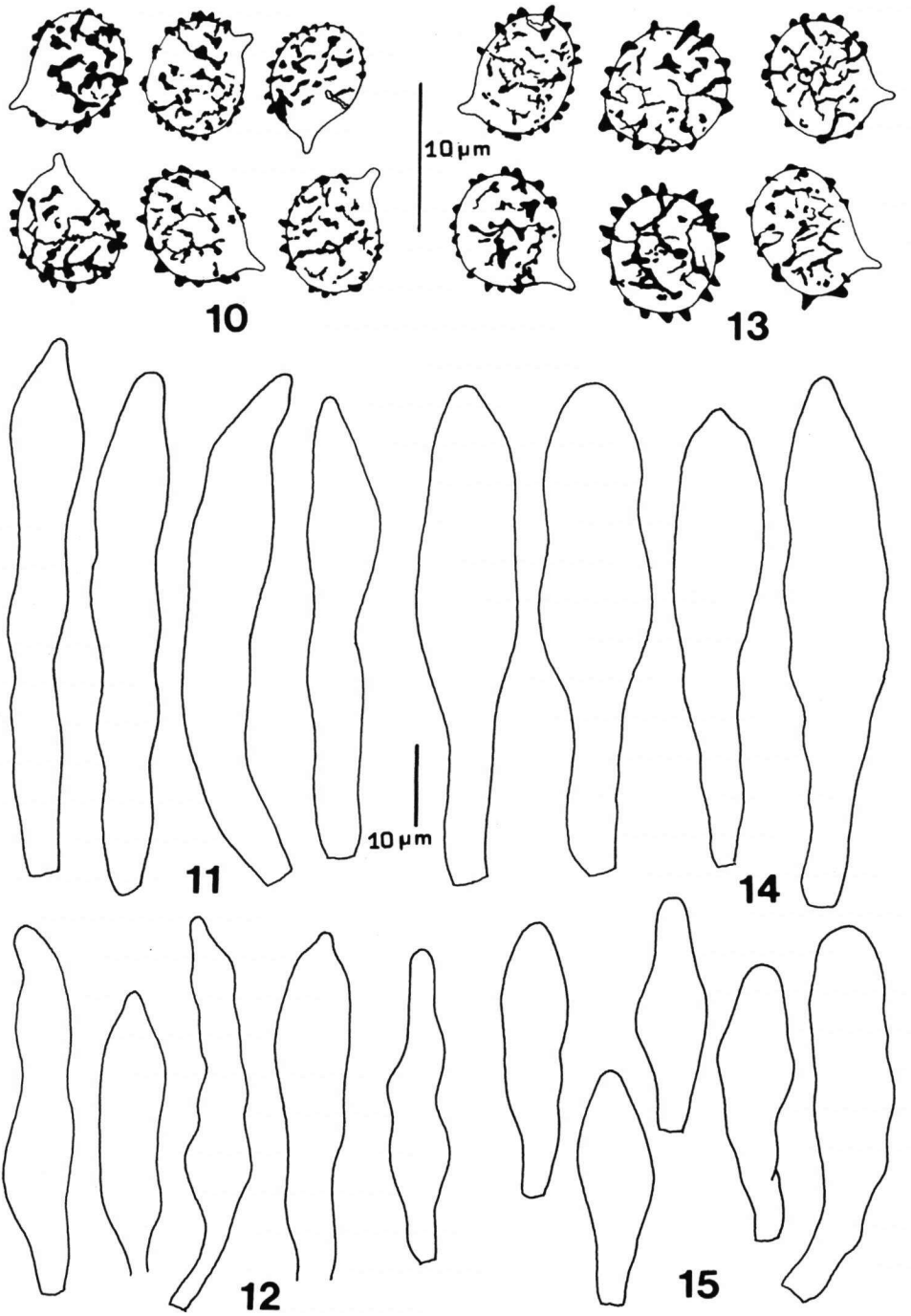
Figs. 10–12. *Lactarius colorascens*. 10. Basidiospores; 11. pleurocystidia; 12. cheilocystidia (*Atkinson s.n.*, holotype). — Figs. 13–15. *Lactarius vinaceorufescens*. 13. Basidiospores; 14. pleurocystidia; 15. cheilocystidia (*Smith 6020*, holotype).



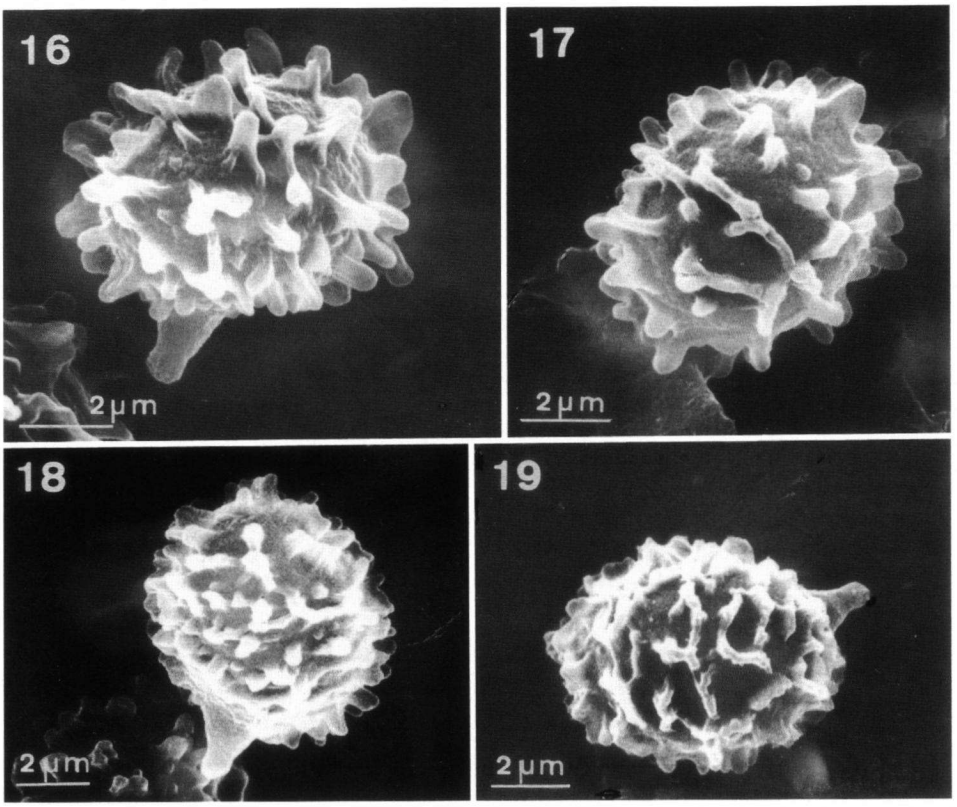
Figs. 1–5 (legend on p. 128).



Figs. 6–9 (legend on p. 128).



Figs. 10–15 (legend on p. 128).



Figs. 16–19. Basidiospores with SEM. — 16 & 17. *Lactarius vinaceorufescens* (*Smith 6020*, holotype). — 18 & 19. *Lactarius colorascens* (*Atkinson s.n.*, holotype).

scarcely gelatinized; elements hyaline to yellowish. Pileus context heteromerous; sphaerocytes 12–36 µm in diam., yellowish, numerous, with walls up to 2.4 µm thick; hyphae 4–9.6 µm in diam., hyaline to yellowish, infrequent; laticiferous hyphae 5.6–9.6 µm in diam., honey yellow. Hymenophoral trama heteromerous; sphaerocytes 6.4–24 µm in diam., yellowish, conspicuous, in rosettes; hyphae 3.2–6.4(–9.6) µm in diam., intermixed, tightly arranged, hyaline to yellowish; laticiferous hyphae 5.6–8 µm in diam., yellowish, scarce.

Habitat – Gregarious, in a *Pinus–Abies* forest (*Abies hickellii* Flous & Gaussen, *P. ayacahuite* Ehrenb., *P. montezumae* Lambert, *P. patula* Schlecht. & Cham., and *P. pseudostrobus* Lindl.), always collected under associations of *P. patula, P. pseudostrobus*, and *P. montezumae*, also nearby *P. patula*.

Material studied. MEXICO: Veracruz, Municipio de Xico, E Cofre de Perote, Los Gallos, 1.5 km al N de Ingenio El Rosario, *Bandala 1865, 2565, 3019, 3023, 3032 & 3036; Castillo 870, 873, 874, 878, 879, 880 & 881; Montoya 1057, 1402, 2172, 2274, 2360, 3222* (holotype, XAL), *3223, 3234, 3272, 3273, 3311, 3414, 3422 & 3428; Ochoa 155; Peralta 23; Nieves 598, 665, 666, 902 & 930* (all at XAL).

Other collections examined. Lactarius vinaceorufescens, USA: Michigan, Muskegon Co., *A. H. Smith 6020* (holotype, MICH). *Lactarius colorascens*, USA: New York, Port Jefferson, Aug. 1904, *G. F. Atkinson* (holotype, NYS).

Distinguishing features of this species are the size of the basidiomata, the colour change of latex on exposure, and the darkening of the stipe and lamellae surfaces with age. Microscopically the size and shape of cystidia which are abundant and conspicuous and the basidiospore ornamentation are diagnostic. The presence of rosettes in the hymenophoral trama is also noticeable. The distinctive and immediate yellow staining of the latex, combined with the pileipellis structure support the position of *Lactarius lacteolutescens* in the subgenus *Piperites* subsect. *Croceini* sensu Hesler & Smith (1979). In this group, the species keys out close with *L. colorascens* Peck and *L. vinaceorufescens* A.H. Sm.

According to descriptions by Hesler & Smith (1960, 1979) and the re-examination of the type material, in *Lactarius vinaceorufescens* and *L. colorascens* the basidiomata have a pileus diameter more or less equal to the stipe length (or larger), while in *L. lacteolutescens* the stipe is twice as long as the pileus diameter. *Lactarius vinaceorufescens* has a pileus of 40–120 mm diam. and a stipe of 40–70 × 10–25 mm, and *L. colorascens* a pileus of 25–50 mm diam. and stipe 25–35 × 3–5 mm. Moreover, *L. vinaceorufescens* was reported with paler basidiomata and (apparently) without papillate pileus. On the other hand, microscopic analysis showed that *L. colorascens* (Figs. 10–12 and 18–19) has smaller basidiospores 6–7.2(–8) × 4.8–5.6 µm (L = 7.04 ± 0.10; W = 5.30 ± 0.08; Q = 1.34 ± 0.02), with a less reticulate ornamentation, having more isolated ridges and verrucae, which at times are combined with discontinuous low bands. It has infrequent and shorter cystidia (44–66 × 6.4–8 µm) and scattered isolated sphaerocytes in the lamellae trama. *Lactarius vinaceorufescens* (Figs. 13–15 and 16–17) presents slightly smaller and more globose basidiospores (6.4–)7.2–8 × 5.6–6.4 µm (L = 7.42 ± 0.11; W = 6.08 ± 0.08; Q = 1.22 ± 0.02) bearing isolated ridges and verrucae; cystidia 36–60 × 8.8–12(–13.6) µm, clavate or rarely mucronate and scattered; hymenophoral trama lacking rosettes. Table I shows a comparison of spore dimensions of the three taxa.

Table I. Comparison of the spore dimensions of three different species of *Lactarius* studied.

taxon	dimensions	L ± sd	W ± sd	Q ± sd	n	specimen
L. lacteolutescens	7.2–9.6 × 5.6–6.4	8.27 ± 0.12	6.11 ± 0.07	1.36 ± 0.02	25	holotype
	7.2–8.8 × (5.6–)6.4	8.09 ± 0.12	6.37 ± 0.03	1.27 ± 0.02	25	*Bandala 3036*
	7.2–8.8(–9.6) × 5.6–6.4	8.29 ± 0.13	6.34 ± 0.04	1.31 ± 0.02	25	*Castillo 870*
	8–8.8(–9.6) × 5.6–6.4(–7.2)	8.32 ± 0.09	6.43 ± 0.07	1.30 ± 0.02	25	*Nieves 902*
	7.2–8.8 × (4.8–)5.6–6.4	8.03 ± 0.09	5.95 ± 0.09	1.35 ± 0.02	25	*Montoya 2172*
	7.2–8.8(–9.6) × (4.8–)5.6–6.4(–7.2)	8.20 ± 0.06	6.24 ± 0.09	1.32 ± 0.02		
L. vinaceorufescens	(6.4–)7.2–8 × 5.6–6.4	7.42 ± 0.11	6.08 ± 0.08	1.22 ± 0.02	25	*Smith 6020*
L. colorascens	6.4–7.2(–8) × 4.8–5.6	7.04 ± 0.10	5.30 ± 0.08	1.34 ± 0.02	25	*Atkinson s.n.*

L = mean length; W = mean width; sd = standard deviation; Q = mean of quotient; n = spore number.

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