
Agarics from coffee plantations in Eastern Mexico: two new records

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The taxonomic study of two agarics gathered in coffee plantations in eastern Mexico (State of Veracruz) revealed the occurrence of a new species of *Stropharia*, proposed here as *S. cifuentesii*, as well as *Ripartitella alba*, this latter documented for the first time from coffee plantations in the area. Descriptions, illustrations, and discussions are provided for both taxa

Key words: *Agaricales*, *Ripartitella*, *Stropharia*, taxonomy, wood inhabiting fungi.

Introduction

Coffee plantations are an important component of vegetational landscape in central Veracruz (Eastern Mexico), maintaining often several remnant tree species of native woods (Escamilla *et al.*, 1995; Bandala *et al.*, 2004). The information available in Mexican literature about macrofungi diversity reports that agarics occurring in such agroecosystems on the east coast are scarcely documented (Bandala *et al.*, 2004). It would be expected that these agroecosystems provide shelter to several macrofungi, but that they are perhaps unsuitable for ectomycorrhizal species. While studying macrofungi in shaded coffee-plantations in Veracruz, two unreported agarics were encountered which are the subject of the present contribution, viz. *Stropharia cifuentesii*, a new species proposed here, as well as *Ripartitella alba* Halling & Franco-Mol.

Materials and methods

For methods employed in the microscopic study (SEM included) we refer to Bandala *et al.* (2004). Notation \bar{x} means the mean values of basidiospore length and width in n spores (35 spores measured per collection), and Q the

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mean of length/width ratio in n spores. Colour described for basidiomes was compared and coded (alphanumeric colour ranges in brackets) according to the Munsell colour chart (1994) (e.g. 10YR 7/6) and Kornerup and Wanscher (1967) (e.g. 4A3-4). Herbaria are abbreviated according to Holmgren *et al.* (1990).

Taxonomy

Ripartitella alba Halling & Franco-Mol., Mycologia 88: 669. 1996.

(Figs. 1, 3a-b, 4)

Pileus (10-)13-28 mm diam., at first obtusely conical to somewhat campanulate, soon broadly convex or plane-convex with a deflexed margin, finally plane-convex and centrally depressed or slightly depressed, dry, initially covered with a more or less compact (interrupted), brownish-orange (near 7.5 YR 6/6-8) or dull brownish-orange (somewhat lighter than 7.5 YR 7/6), tomentose-squamulose layer breaking after pileus expansion and the centre remaining matted-tomentose or in some specimens squamose (flat or more or less thick, patch-like scales) and towards the margin having moderately spaced, irregularly concentrically arranged, tiny, somewhat appressed, flat squamules, as they reach pileus edge they become smaller (at times freckle-like) and often less abundant, margin finally glabrous, in some specimens the scales of the pileus surface look like minute squares recalling a loosely tessellately-rimose pattern (to the naked eye), such vestiture varies in colour from more or less yellowish-brown or light yellowish-brown at centre (somewhat paler than 10YR 6/6 with yellowish tints) to light greyish-yellow (lighter than 10YR 7/6) or pinkish-buff (near 10YR 7/3-4 with yellowish tints) towards the margin, all on a white or whitish ground; margin incurved when young, becoming straight with age, smooth or variably wavy, appendiculate or irregularly appendiculate, bearing minute remnants of a white (brownish in their most outer extreme), fibrillose-membranous veil. *Lamellae* more or less adnexed to somewhat uncinata, subdistant, subclose in some less expanded pilei, moderately straight to subventricose, often slightly arcuate, more or less broad (2-2.5 mm deep), entire, some bifurcate, lamellulae of three different lengths, white to yellowish-white (3A2), margin concolourous, entire. *Stipe* 10-29(-34) × 2-5 mm, central to slightly eccentric, cylindric, some slightly tapered towards the base whilst others weakly broader, moderately straight, more often curved, white, pruinose near lamellae attachment, silky-fibrillose downwards then weakly striate; decorated with small, more or less abundant, scattered, fibrillose-membranous, white (brownish in their most outer extreme) squamules which often form a fragmented ring; the squamules are less abundant towards the base or with age;

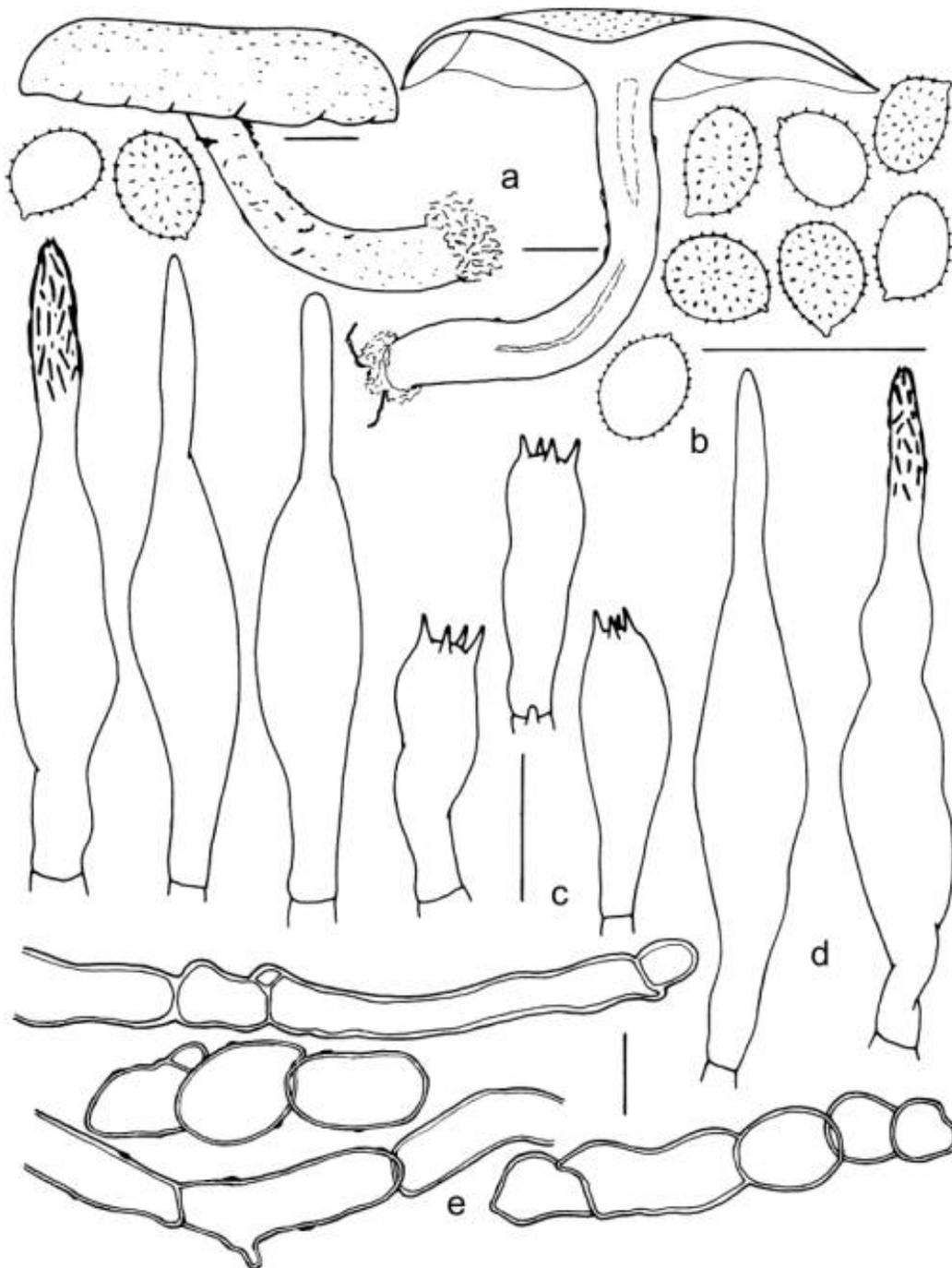


Fig. 1. *Ripartitella alba* (Jarvio 1476). **a.** Basidiomes. **b.** Basidiospores. **c.** Basidia. **d.** Pleurocystidia. **e.** Pileipellis hyphae (squamules). Bars: a= 4.3 mm; b-e = 10 μ m.

partially fistulose or fistulose, becoming hollow, fibrous; with scarce but conspicuous, more or less coarse, white rhizomorphs at base, others with scanty, white basal mycelium. *Context* white, unchangeable on exposure; *Smell* none; *Taste* weakly farinaceous. *Spore print* white.

Basidiospores 4-5(-5.5) × 3-4 μm, \bar{x} = 4.7 × 3.5 μm, Q = 1.35, broadly ellipsoid to more or less subglobose, finely echinulate to punctate, thin-walled, lacking germ pore, hyaline, inamyloid; under SEM they look distinctly verrucose, with moderately broad, low, hemispheric or weakly conic verrucae. *Basidia* 17-26 × 5.5-7(-7.5) μm, clavate to narrowly clavate, 4-spored, thin-walled, hyaline, commonly clamped. *Pleurocystidia* 38-60 × 5.6-10.4 μm, narrowly lageniform, rarely subutriform, moderately thick-walled (< 1 μm thick), with a tapered apex, this latter incrustated, rough with short and thin, anastomosed fragments of a crystal-like material seen in Melzer solution or water, vanishing in KOH and then the walls appear smooth; hyaline, inamyloid, clamped, dispersed along the lamellae surfaces, occasionally reaching the lamellae edge. *Cheilocystidia* none, lamellae edge bearing basidia and basidioles. *Pileipellis* a cutis composed of hyphae (4-)5-9(-10) μm diam., cylindric, interwoven, with more or less scattered, prostrated or semierect clusters of short-cylindric or cylindric to somewhat ventricose hyphae (5-)6-12(-13) μm diam., these hyphae are septate, compactly arranged, more or less aligned in a subcatenulate pattern forming the squamules, in mass at times resembling an epithelial layer, occasionally some segments bearing a short, simple or more rarely bifurcate, lateral outgrowth, moderately thick-walled (< 1 μm thick), yellowish, in mass yellowish-brown or pale brown, with more or less coarse, scattered incrustations. *Pileus trama* with interwoven hyphae 4-12 μm diam., cylindric to slightly ventricose, moderately thick-walled (< 1 μm thick), hyaline, often with a slightly refringent intraparietal pigment. *Hymenophoral trama* regular to more or less irregular, hyphae 4.8-13.6 μm diam., cylindric to more or less ventricose, slightly thick-walled (< 1 μm thick), hyaline, often with yellowish intraparietal pigment. *Subhymenial layer* poorly developed, with short hyphae, often bifurcate, thin-walled, hyaline. *Clamp connections* present.

Habitat: Gregarious, caespitose, on dead wood (almost rotten-wood), in a shaded coffee plantation with trees of *Inga* spp., *Ficus calyculata* Miller and *Spondias mombin* L., remnants of a tropical deciduous forest, 1070 m.a.s.l.

Known distribution: Colombia, Costa Rica, Hawaii, Mexico, Puerto Rico.

Material examined: MEXICO. Veracruz: Coatepec Co., El Grande, 2 October 2003, D. Jarvio 1476 (XAL).

Notes: The lamellae disposition and basidiome colour exhibited by the Mexican specimen are two distinctive features that lead us to consider it as *R. alba*. The studied collection is composed of basidiomes in different stages of

development which in the field resembled a medium sized, white species of *Lepiota*. The minute scales on a white ground decorating pileus surface are not as pale as those described by Halling and Franco-Molano (1996). As a whole, the pileus in Mexican material showed a dull or pale pinkish-brown colour lacking orange or reddish tints. The ornamentation on pileus surface presented a characteristic arrangement, with spaced or loosely disposed, mostly appressed squamules. Among the basidiomes of the collection examined, some showed almost close lamellae, but in most cases the lamellae were clearly subdistant mainly in those with more expanded pileus. Reports of its close relative *R. brasiliensis* (Speg.) Singer (synonyms included), described the lamellae as somewhat narrower, crowded or very crowded to close or very close, and the pileus with brown, cinnamon, ferruginous, rusty, reddish, reddish-brown or brownish-orange colour due to the presence of squamules (Murrill, 1940; Singer, 1946; Rick, 1961; Hongo, 1977; Pegler, 1977, 1983, 1990; Imazeki and Hongo, 1987; Ovrebo, 1988).

Considering that *R. alba* shares most features with *R. brasiliensis*, a careful comparison should be made when studying fresh and herbarium collections. *Lepiota armillarioides* Dennis (1952) as depicted by Dennis (1970, pl. 15,5) under *Ripartitella brasiliensis*, macroscopically resembles our collection and we found that the collection illustrated by Dennis and Mexican specimens are similar to the collection of *R. alba* recently reported by T.J. Baroni from Puerto Rico (<http://www.cortland.edu/nsf/8243ripa.HTML>). Dennis in his concept of *R. brasiliensis* distinguished it from *R. sipariana* (Dennis) Dennis [according to Pegler (1983) a species of *Cystoderma*] because *R. sipariana* has a more notably pigmented pileus surface (dark red-brown). Hongo (1977) reported under *R. brasiliensis* specimens with "... small, brownish orange, granular-flocculose scales, crowded together, especially toward the center ...", disposed on a yellowish white to pale yellow ground, referring them to the colour plate of *R. sipariana* (Dennis, 1970, pl. 10, 8). *Agaricus exsanguis* Mont., according to Pegler (1990) a synonym of *Ripartitella brasiliensis*, was described with crowded lamellae and pileus bearing ochraceous squamules, these latter structures similar to those described by Halling and Franco-Molano (1996) for *R. alba*.

While variation of size and shape of basidiospores, cystidia and pileipellis elements among specimens of *R. alba* and *R. brasiliensis* overlaps, the macroscopic pileal characteristics in combination with lamellae disposition seem to be constant enough to separate *R. alba* from *R. brasiliensis* (Halling and Franco-Molano, 1996). It would be interesting to examine geographically isolated specimens and analyze critically whether these macroscopic differences separate phenotypically similar, intersterile taxa.

Stropharia cifuentesii Bandala, Montoya et Jarvio, **sp. nov.** (Fig. 2, 3c-d, 5)

Etymology: In recognition of Dr. Joaquin Cifuentes (FCME Herbarium) for his 30 years of mycological work at UNAM.

Pileus (8-)17-30 mm latus, primo subglobosus, demum convexus vel subumbonatus, siccus, subglaber vel innate minute squamulosus, primo rubidus, demum rubidobrunneus, pallescens dein opaque aurantiobrunneus vel ochraceobrunneus, ad marginem frequenter appendiculatus, velo albido, membranoso-flocculosus, subcrasso. *Lamellae* adnatae, confertae vel subconfertae, sublatae, primo pallidae dein pallide fuscae vel pallide flavobrunneae. *Stipes* (9-)17-37 × (1-)2-6(-7) mm, cylindricus, raro base subbulbosa, albo vel pallide flavidoalbo, subglaber dein laevi striatus, exannulatus, siccus, ad basim interdum rhizomorphis albis observatis. *Caro* albida, immutabilis, odore nullo, sapore miti. *Basidiosporae* 5.5-7 × 3.5-4.5(-5) μm, ellipsoideae, leves, crasse tunicatae, poro germinativo nullo, ochraceobrunneae. *Basidia* 18.5-25.6 × 5.5-8 μm, clavata, tetrasporigera. *Pleurocystidia* 28-55 × (8-)9-15 μm, numerosis, chrysocystidiis similia, clavata vel clavata pedicellata, subventricosa, apice rotundato vel mucronato, tenui-tunicata, corpusculo interno oleoso, flavo, prope apicem. *Cheilocystidia* nulla. *Pileipellis* ex hyphis cylindraceis cutem formantibus, hyalinis vel luteobrunneis, incrustatis. *Trama lamellarum* regularis. *Fibulae* presentes. *Acanthocytae* numerosae. MEXICO, Veracruz, Coatepec Co., Puerto Rico, 6 July 2001, V.M. Bandala 3365 (XAL, Holotypus hic designatus).

Pileus (8-)17-30 mm diam., at first subglobose, becoming more or less pulvinate to convex, some slightly umbonate, hygrophorous, dry to weakly lubricous, tomentose when young, when expanded disrupted and becoming covered with fine, appressed fibrils which form minute scales (under lens), then more or less innately subsquamulose or scurfy to the naked eye, such vestiture is more conspicuous towards pileus margin; red to reddish when young, gradually becoming reddish-brown (7E8) to orange-brown (7C7, 7D7-8) over a cream-yellowish (4A3-4) ground, in some the centre remaining very pale reddish; margin more or less involute to inflexed, rather straight in the more expanded specimens, appendiculate or irregularly appendiculate in most stages of development, margin bearing remnants of a white, membranous-floccose, somewhat thick and soft veil. *Lamellae* adnate to slightly emarginate, close to subdistant, subventricose, moderately broad (3-5 mm deep), thinner towards pileus edge, lamellulae of 2-3 different lengths, whitish or white-yellowish when young, becoming yellowish-grey (near 2.5Y 6/4) or yellowish-brown (somewhat darker than 2.5Y 7/6), margin concolourous, entire. *Stipe* (9-)17-37 × (1-)2-6(-7) mm, cylindric or slightly tapered upwards (2-4 mm broad), some with a more or less subbulbous base 4-7 mm broad, whitish, pale yellowish or white-yellowish, slightly fibrillose then weakly striate (under lens); without ring, at times obscurely covered with fine, scattered fibrils near the annular zone; solid, fibrous-fleshy; with some, whitish, more or less coarse rhizomorphs at base. *Context* whitish, unchangeable on exposure; *Smell* none; *Taste* mild, weakly bitter.

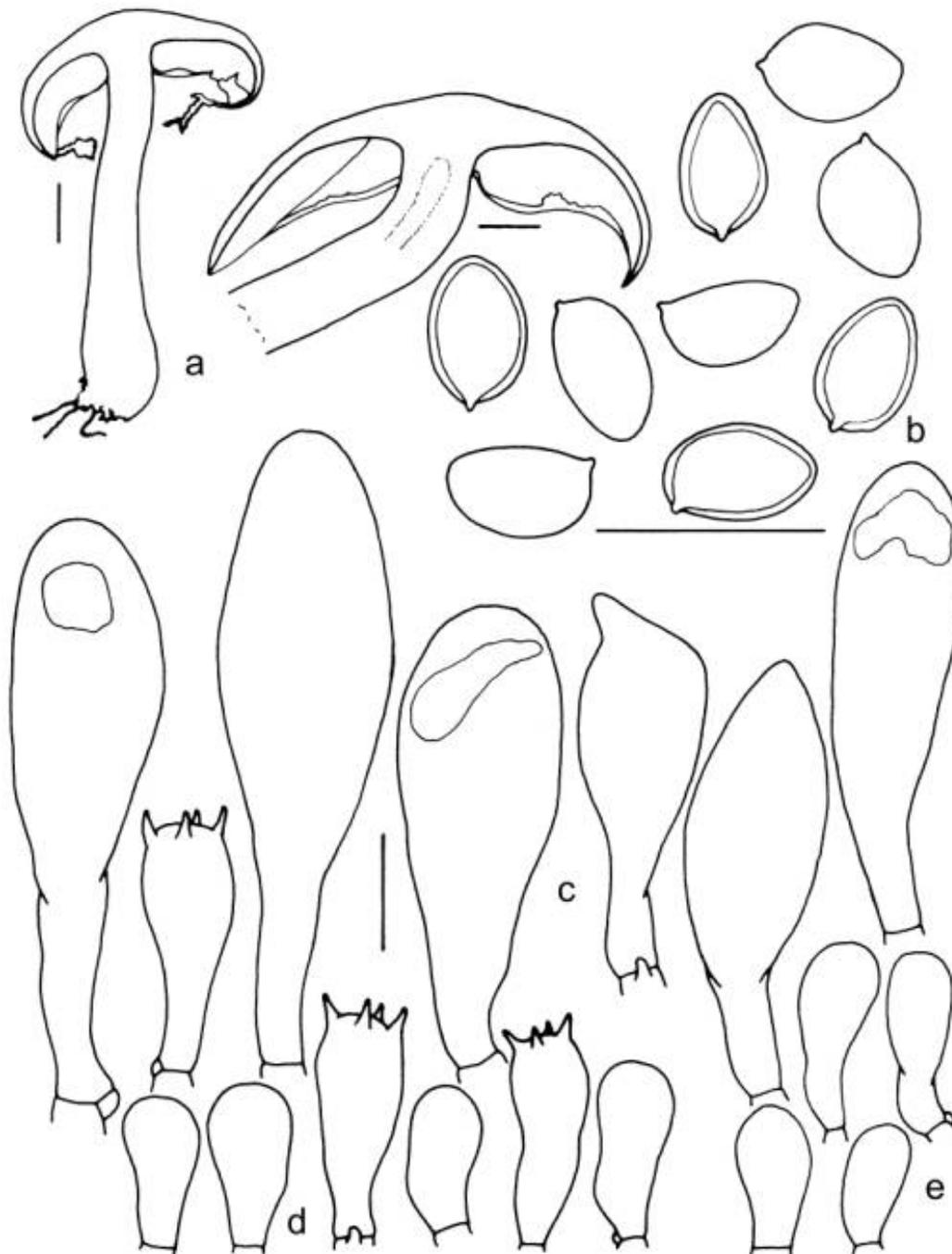


Fig. 2. *Stropharia cifuentesii* (Bandala 3365). **a.** Basidiomes. **b.** Basidiospores. **c.** Chrysocystidia (pleurocystidia). **d.** Basidia and basidiolate-like elements. **e.** Basidiolate-like elements from lamellae edge. Bars: a= 5 mm; b-e = 10 μ m.

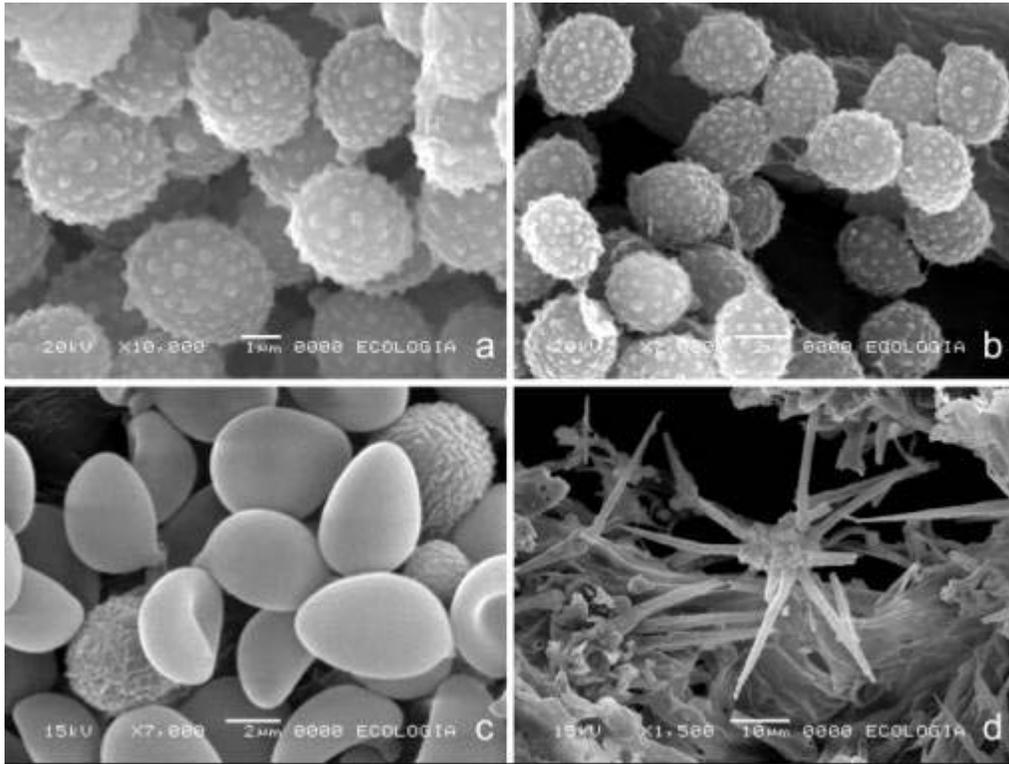


Fig. 3. Scanning Electron Micrographs of basidiospores and acanthocytes. **a-b.** *Ripartitella alba* (Jarvio 1476). **c-d.** *Stropharia cifuentesii* (Bandala 3365).

Basidiospores $5.5-7 \times 3.5-4.5(-5) \mu\text{m}$, $\bar{x} = 6.2 \times 4 \mu\text{m}$, $Q = 1.55$, ellipsoid, slightly attenuated towards apex, then more or less amygdaliform in side view or slightly ovoid in frontal view, smooth, thick-walled (up to $1 \mu\text{m}$ thick), yellowish-brown, apically rounded, often bearing a germ porelike discontinuity of the wall; under SEM smooth and with a smooth rounded apex lacking a true germ pore. *Basidia* $18-26 \times 5.5-8 \mu\text{m}$, clavate, 4-spored, some 1- or 2-spored, thin-walled, hyaline, clamped. *Pleurocystidia* $28-55 \times (8-9)-15 \mu\text{m}$, as *chrysocystidia*, clavate or more or less clavate-pedicellate, some with a somewhat tapered apex, other mucronate, hyaline-yellowish, often containing an irregular or rounded, central or apically located, refractive, yellow, floating body; thin-walled, sometimes clamped, arising on or below hymenium level, abundant. *Cheilocystidia* none, the lamellae edge bearing basidia and basidiole-like elements $(10-11)-20 \times (5-5.5)-7(-8) \mu\text{m}$, hyaline, thin-walled, clamped, at times the chysocystidia reach the lamellae tip (tangential section). *Pileipellis* a cutis composed of hyphae $3-8 \mu\text{m}$ diam., cylindrical to slightly ventricose, prostrated, thin-walled, smooth or punctate, then somewhat granulose in aspect, hyaline to yellowish, more or less golden-yellow in mass, with scattered hyphae having a dense, refringent, yellowish content, obscurely



Fig. 4. Basidiomes of *Ripartitella alba* (Jarvio 1476). Bar = 10 mm.



Fig. 5. Basidiomes of *Stropharia cipientesii* (Bandala 3365). Bar = 10 mm.

gelatinized. *Veil* (at pileus margin) with hyphae 5.6-13(-14) μm diam., cylindrical to ventricose, compactly arranged, thin or thick-walled ($< 1 \mu\text{m}$ thick), hyaline-yellowish, pale yellow in mass, slightly gelatinized, with minute incrustations, then more or less granulose in aspect, with scattered hyphae having a dense, refringent, yellowish content, often some kind of crystal-like, colourless granules scattered among the hyphae. *Pileus trama* with hyphae 5.6-12(-15) μm diam., ventricose, thin- or thick-walled ($< 1 \mu\text{m}$ thick), hyaline, with a somewhat refringent, intraparietal, yellowish pigment, then pale yellow in mass, compactly and radially oriented, somewhat irregularly arranged towards the pileipellis, weakly gelatinized, with scattered hyphae having a dense, refringent, yellowish content. *Hymenophoral trama* subregular to regular, hyphae 4-6.5 μm diam., cylindrical to more or less ventricose, thin- or slightly thick-walled ($< 1 \mu\text{m}$ thick), hyaline, with a somewhat refringent, intraparietal, yellowish pigment, then pale yellow in mass. *Subhymenium layer* poorly differentiated, with short, single or bifurcate, compactly arranged, hyaline, thin-walled hyphae 3-5 μm diam. *Rhizomorphs* bearing numerous acanthocytes with elongated outgrowths $20-74 \times 2.5-5 \mu\text{m}$, fusoid, thick-walled (1-1.5 μm thick), arising from a crystal-like, anastomosed or rosette-like base, hyaline, refringent. *Clamp connections* present.

Habitat: Subgregarious, on decomposing litter of herbs and grasses (a more or less loose, straw-like mass), near coffee plants and *Enterolobium cyclocarpum* (Jacq.) Griseb trees, remnants of a tropical deciduous forest, 1070 m.a.s.l.

Known distribution: Mexico (type locality).

Material examined: MEXICO, Veracruz, Coatepec Co., Puerto Rico, 6 July 2001, V.M. Bandala 3365 (XAL, **holotype here designated**).

Notes: This taxon is readily recognized due to its pileus colour, the appendiculate pileus margin with veil remnants, non-annulate stipe, as well as basidiospore size and lamellae edge lacking cheilocystidia. The medium size of its basidiomes combining the macroscopic features mentioned could also be distinctive of this species in the field. Phenotypically *S. cifuentesii* is similar to some members of sect. *Mundae* (Fr.) Konrand & Maublanc (Singer, 1986) around *S. rugosoannulata* Farlow ex Murrill and *S. aurantiaca* (Cooke) Imai, as well as *S. variicolor* Desjardin & Hemmes which possess red or reddish pilei. In this group *S. cifuentesii* and *S. variicolor* are superficially similar sharing a more or less similar habit, similar range of pileus colour (cf. Hemmes and Desjardin, 2002), rhizomorphs with acanthocytes (as those reported by Farr, 1980), and a veil as appendiculate remnants on pileus margin. They can be separated, however, by differences in microscopic characters such as cystidia and basidiospores. *Stropharia variicolor* differs by its lageniform pleurocystidia (chrysocystidia), presence of cheilocystidia ($17.5-26 \times 9-15 \mu\text{m}$, abundant, clavate to sphaeropenduculate), and basidiospores ($6.5-7-8(-9) \times$

4.5-5.0(-5.7) μm (Desjardin and Hemmes, 2001). The basidiome size could be also distinctive, in *S. variicolor* being somewhat stouter [pileus: (25-)40-90 mm; stipe 40-80 \times 8-14(-20) mm], this latter, indeed, more or less similar to that of *S. rugosoannulata*, a very striking species recognizable by its larger basidiomes, stipe with a persistent, firm or pendent annulus, and larger basidiospores ($> 11 \mu\text{m}$) (Stuntz and Isaacs, 1962; Watling and Gregory, 1987; Courtecuisse and Duhem, 1994; Breitenbach and Kränzlin, 1995). The pileus of *S. aurantiaca* is persistently red or reddish-orange, which in combination with other macro- (more or less slender and tall basidiomes) and microscopic characters (apically truncate basidiospores $> 10 \mu\text{m}$ length; somewhat fusoid chrysocystidia; moderately long and slender cheilocystidia) separate it from *S. cipientesii*. In the same locality where *Ripartitella alba* (discussed above) was collected, we recorded one collection (Coatepec Co., El Grande, 17 November 2001, Jarvio 1112, XAL) that matches those characteristics and agrees well with *Stropharia aurantiaca* as reported by several authors (Reid, 1966; Moser, 1983; Watling and Gregory, 1987; Pegler and Legon, 1998). This latter taxon in fact has been cited (under *Naematoloma*) from different localities throughout Mexico (Bandala *et al.*, 1988).

Individual basidiomes of *S. cipientesii* with less markedly reddish cap, superficially could recall those of *S. albosulfurea* (Pat.) Zhu L. Yang, *S. hardii* G.F. Atk. and *S. squamulosa* (Masse) Masee. The pileus of *Stropharia albosulfurea* as described by Patouillard (1891, under *Hypholoma*) show some reddish shades (“... jaune roussâtre au center,...”) but differs from *S. cipientesii* by its more robust basidiomes (pileus up to 100 mm diam.; stipe 8-12 mm wide), pileus with violet tints (specially towards margin), reddish to blackish lamellae and stipe bearing a membranous annulus (Patouillard, 1891; Yang, 2000). Although collections of *S. hardii* occasionally seem to have an exannulate stipe (c.f. Hesler, 1975, fig. 28b), this taxon is recognized by its more or less robust basidiomes, commonly with the veil persisting as a membranous annulus, the floccose-scaly stipe and the pileus surface notably yellow-ochre or brownish-ochre (Atkinson, 1906; Morgan, 1908; Bessette *et al.*, 1997). *Stropharia squamulosa* does not develop reddish tints on the pileus instead it exhibits blue-green shades which are absent in *S. cipientesii*. Further, *S. squamulosa* has a distinctly appressed scaly pileus surface (Reid, 1972; Watling and Gregory, 1987).

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