

---

## New species and records of *Crepidotus* from Costa Rica and Mexico

---

Bandala, V.M.<sup>1\*</sup>, Montoya, L.<sup>1</sup> and Mata, M.<sup>2</sup>

<sup>1</sup>Dept. Biodiversidad y Sistemática, Instituto de Ecología, A.C., P.O. Box 63, Xalapa, Veracruz 91000, Mexico

<sup>2</sup>Instituto Nacional de Biodiversidad, P.O. Box 22-3100, Santo Domingo de Heredia, Costa Rica

Bandala, V.M., Montoya, L. and Mata, M. (2008). New species and records of *Crepidotus* from Costa Rica and Mexico. *Fungal Diversity* 32: 9-29.

The new species *C. pseudoantillarum* and *C. herrerae* are described from Costa Rica and Mexico respectively. Records of *C. pseudoantillarum* from different localities in Mexico are presented, as well as the first report of *C. albescens* from Costa Rica. The newly described species, related to the taxa with smooth spores, gelatinous tissues and clamped hyphae, prompted us to make a reexamination of type specimens of *C. albescens*, *C. antillarum*, *C. betulae*, *C. cinchonensis* and *C. phaseoliformis*. On account of the morphological features are recognized: *C. albescens* (= *C. betulae*, *C. phaseoliformis*) and *C. cinchonensis*. The type of *Tremellopsis antillarum* is found to be a member of *Crepidotus uber* but under the name of *C. antillarum s. auct.* a distinct taxon has been obscured, which is being described here as *C. pseudoantillarum*. Descriptions, illustrations of microscopic features and discussions are provided.

**Key words:** *Crepidotaceae*, taxonomy, tropical fungi, wood-inhabiting fungi

---

### Article Information

Received 6 June 2007

Accepted 19 January 2008

Published online 30 September 2008

\*Corresponding author: V.M. Bandala; e-mail: victor.bandala@inecol.edu.mx

---

### Introduction

There has been an increment in studying the macrofungi of Central and South America (Capelari *et al.*, 2006; Lechner *et al.*, 2006; Ovrebo and Baroni, 2007; Ortiz-Santara *et al.*, 2007). In this paper we report new records and new species of *Crepidotus* from Mexico and Coast Rica. *Crepidotus* includes several species of lamellate, often sessile, small, brown-spored mushrooms that constitute an important component in the community of forest saprotrophic fungi. They occur in a wide variety of ecosystems normally colonizing small plant debris and fallen wood. Such habits could be the reason for the worldwide distribution of the genus and perhaps the patterns of occurrence currently recorded for the species, in part being influenced by the local ecological conditions, rather depend on selected sampling areas (or intensity of explorations). A small group of American species have been well documented (Hesler and Smith, 1965; Singer, 1973) with additional information on variation of taxonomically important morphocharacters, and their taxonomic circumscription and geographic

occurrence (in some cases embracing far-off points) is reasonably well supported (Horak, 1964; Singer, 1973; Bigelow, 1980; Luther and Redhead, 1981; Redhead, 1984; Nordstein, 1990; Pereira, 1990; Senn-Irlet, 1995a; Astier, 1998; Senn-Irlet and De Meijer, 1998; Bandala *et al.*, 1999, 2006, 2008; Bandala and Montoya, 2000a,b, 2004; Krisai-Greilhuber *et al.*, 2002; Ripková *et al.*, 2005). While few species are recognized to have a rather widespread distribution [e.g. *C. applanatus* (Pers.) P. Kumm, *C. epibryus* (Fr.) Quél. or *C. cinnabarinus* Peck] (Pilát, 1948; Hesler and Smith, 1965; Luther and Redhead, 1981; Senn-Irlet, 1995a; Bandala *et al.*, 1999), most representatives (including several taxa currently known only by their respective diagnoses) display an apparently restricted or fragmentary distribution. Several species described from both hemispheres, have been recorded in a variety of types of vegetation in Mexico (Bandala *et al.*, 1999; Bandala and Montoya, 2000a,b, 2004; Krisai-Greilhuber *et al.*, 2002). Type studies of phenotypically similar *Crepidotus* species described from Mexico (Bandala *et al.*, 1999, 2006; Bandala and Montoya, 2000a,b, 2004),

revealed that there are eight Mexican species that currently show an apparent endemism (Singer, 1957, 1973), excluding *C. rubrovinosus* Bandala, Montoya & E. Horak (2006), recently found also in Central America and not treated here. In Costa Rica, a single sample of *C. calolepis* subsp. *polycistis* Singer, was gathered during 1925-1926 by P.C. Standley and J. Valerio in El Cerro de Las Vueltas (San José) (Singer, 1973).

During ongoing revisions of *Crepidotus* (Bandala *et al.* 2008; Bandala and Montoya, 2008), we studied some collections from Mexico and Costa Rica that represent new species and new records related to the group of smooth-spored taxa with gelatinized, clamped hyphae that cluster around *C. albescens* (Murrill) Redhead. Besides the opportunity to give information about their ranges of extension, the comparative study of the samples with the reexamination of type specimens revealed interesting information to support the new species and to provide additional data for the taxonomic status of some type collections.

## Materials and methods

Macrocharacters were observed on fresh basidiomes collected in Mexico and Costa Rica. Specimens from Santuario del Bosque de Niebla (a cloud forest adjacent to the Instituto de Ecología A.C. at Xalapa) were collected in monitored sites (cf. Bandala *et al.*, 2006). Colour codes in descriptions refer either to Kornerup and Wanscher (1967, *e.g.* 2A2–3) or to Munsell (1994, *e.g.* 2.5Y 8/2–3). Methods employed in the microscopic analysis of specimens, including basidiospore measurements and their statistics, SEM and symbols, are the same as those used by Bandala *et al.* (1999, 2006) and Bandala and Montoya (2000a, 2004). Photographs of microscopic features were taken from hand sections of revived tissues mounted in 3% KOH or Congo Red 1% aqueous solution and observed on a microscope equipped with a digital camera. Herbarium acronyms are according to Holmgren *et al.* (1990).

## Results

The *Tremellopsis antillarum* Pat. type specimen, *Duss s.n.* from Guadaloupe, as

already noted also by Hesler and Smith (1965), Horak (1968) and Singer (1947), is in poor condition of preservation that prevents making an appropriate study. Data introduced by this latter author suggest that the microscopic information provided in his monograph is a composite description resulted by including his collections from Florida, as well as the type specimen of *Crepidotus cinchonensis* Murrill (1913) from Jamaica. Following Singer (1947), the so-called *C. "antillarum"* was therefore a taxon microscopically characterized by smooth, ellipsoid (“...with the inner side flatter...”) basidiospores, clamped hyphae, gelatinous hyphae in the pileus trama and clavate or at times subcapitate cheilocystidia (Hesler and Smith, 1965; Horak, 1968; Singer, 1973; Pegler, 1983; Senn-Irlet and De Meijer, 1998). Our reexamination of *Tremellopsis antillarum* type collection *Duss s.n.* revealed, however, information that agrees in part with the aforementioned authors, especially with observations by Horak (1968) regarding the basidiospore features (see below). Our results after studying the type of *T. antillarum* and collections from Costa Rica and Mexico, compared with published descriptions of all phenotypically related taxa, led to conclude that: *i*) the specimen of *Duss s.n.* falls within the range of variation recorded for *C. uber* (Berk. & M.A. Curt.) Sacc. and perhaps it represents a sample of this species, and *ii*) we recognized two undescribed species (one of them obscured under the name *C. "antillarum" s. auct.*) which share taxonomically important and unique set of striking features with the group of taxa around *C. albescens*, *i.e.* ellipsoid-reniform basidiospores, clamped hyphae, and gelatinized tissues. Additionally, on the basis of microscopic characters shown by the collection of *Duss s.n.* (clampless hyphae, relatively small spores) and the type specimen of *Crepidotus cinchonensis* (clamped hyphae, broad spores), they could hardly be considered to belong to the same taxon. Type studies, descriptions and discussions on these taxa are presented below in three sections, one includes the reevaluation of *Tremellopsis antillarum*, other the description of the two new species, and the third, the study of collections related to *C. albescens*.

**Taxonomy****A. Reevaluation of *Tremellopsis antillarum***

*Tremellopsis antillarum* Pat., in Duss, Enum. Champ. Guad. p.13 (1903).

(Figs 1a, 2-3a-b)

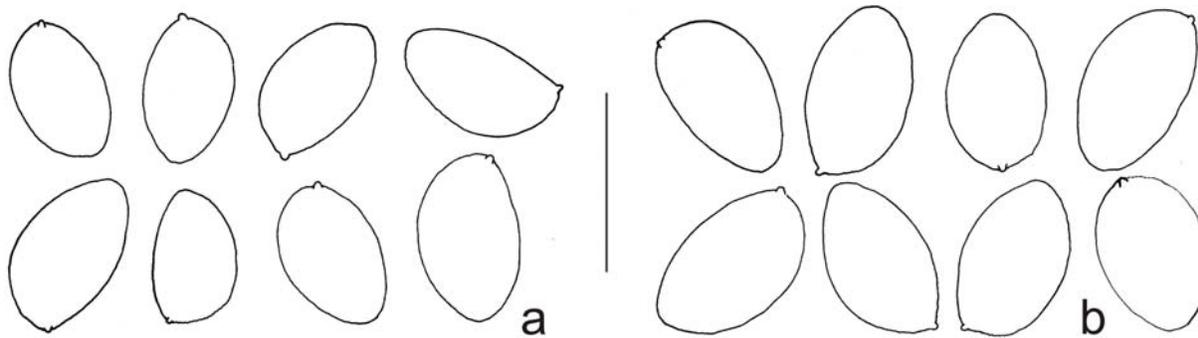
= *Crepidotus antillarum* (Pat.) Singer, Lilloa 13: 62 (1947)

*Material examined:* GUADALOUPE. Matouba, no date, *Duss s.n.* (**Holotype**, FH, Patouilliard Herbarium No. 224)

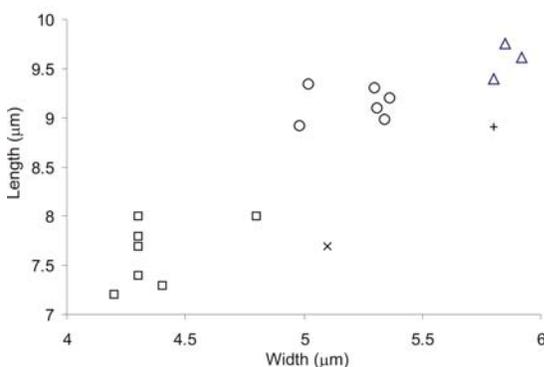
*Tremellopsis* Pat. (in Duss *op. cit.*) was conceived as a “gélatineux-tremelloïde” genus with “...basides claviformes, non septées, portant 2-4 stérigmates... cystides nulles... spores ocracées”. Macroscopic data in the protologue for the single species recognized by N.T. Patouilliard (*T. antillarum*) are the following: “...plante de 1-2 centim. de haut sur 2-3 de large... réceptacle formant une masse gélatineuse, composée de feuillets dressés, chiffonnés, entiers ou lobés, plus ou moins rameux, rayonnants autour d’un point central, sessile ou élevé sur une portion stiptiforme très courte. Feuillettes grisâtres, devenant roux-ocracés, peu épais...”. Microscopic features seen in the holotype are: *basidiospores* 6.5-9(-9.5) × (4-)4.5-6 µm,  $\bar{x}$  = 7.7 × 5.1 µm,  $Q$  = 1.50, ellipsoid, often weakly attenuated towards apex, then more or less amygdaliform on side view, smooth, thick-walled ( $\leq 0.5\mu\text{m}$  wide), pale yellowish-brown, under SEM smooth and lacking germ pore (Figs 1a and 3a-b). Tissues hardly revived with KOH but both pileus and hymenophoral tramae consist of slightly gelatinized, hyaline, clampless hyphae (at least most septa recovered). Basidia, cheilocystidia and pileipellis not recovered (in protologue the basidia were reported 30-35 × 10 µm).

*Notes:* Judging by its present, rather papyraceous consistency and appearing strongly pressed, probably the material of *Duss s.n.* was wet or overmature when collected, and considering its gelatinous nature, it practically collapsed after drying. Data provided by Duss (1903), indeed, rather suggest the inappropriate condition of his collection when gathered, perhaps the reason why N.T. Patouilliard related it to tremelloid forms. The protologue does not mention the presence or absence of clamps but it specifies the lack of cystidia. Lamellae edges can hardly be analyzed and no more than the

basidiospores and some of the features of certain tissues can be recovered. Singer (1947) recognized the taxon as *Crepidotus* especially pointing out the macromorphology in combination with basidiospore features seen in the holotype. The basidiospores in fact were the only microscopic structure clearly indicated by Singer to have been observed in the holotype [with regard to basidia in 1973: 429, he wrote: “...The type of *C. antillarum* is said to be 2-4 spored (which I could not verify any more)...”]. His previous information (Singer 1947) “... derived from the type specimen in the Patouilliard herbarium ... secured by studying the type of *C. cinchonensis* and some fresh material collected by myself in South Florida...”, denotes that the author provided a composite description. He concluded that “...summing up the data obtained from these three sources, one will attribute to *C. antillarum*... spores (8-)8.2-10.5(-11) × 5.2-6.8 µm, smooth... ellipsoid, with the inner side flatter... basidia (16-)20-37 × (5-)7.5-10.3 µm, either 2-spored or 4-spored (the Florida collection... was entirely bisporous; the other collections are predominantly tetrasporous)...; cheilocystidia ventricose... the upper ventricosity often appearing as if the cheilocystidia were capitate... 33-51 × 5.5-10.3 µm..., hyaline hyphae with clamp connections... trama of the pileus rather thin, subgelatinous...”. A similar concept was maintained until his work of 1973. One of his collections from Mexico (*Singer M 8093*) studied here fits indeed that concept. Hesler and Smith (1965) followed Singer providing a composite description also with *C. cinchonensis* as a synonym. These authors as well as Horak (1968), stressed the bad state of the holotype of *Tremellopsis antillarum*, Horak in fact, underlined not having found cheilocystidia, hence referring to information by Singer (1947) and Hesler and Smith (1965) for the interpretation of the character. We share Horak’s (1968) opinion that in the material of *Duss s.n.* it was not possible to verify the presence of cheilocystidia (although the protologue indicates indeed the absence of cystidia). The pattern of size and shape of the basidiospores observed in this revision also agrees with the results of Horak (*op. cit.*) who showed that the specimen of *Duss s.n.* is characterized by its moderately small-sized (7.5-9 × 5-6 µm), ellipsoid to amygdaliform basidiospores. Our



**Fig. 1. a.** *Tremellopsis antillarum*. Basidiospores (from **holotype**). **b.** *Crepidotus cinchonensis* (from **holotype**). Bars = 10  $\mu\text{m}$ .

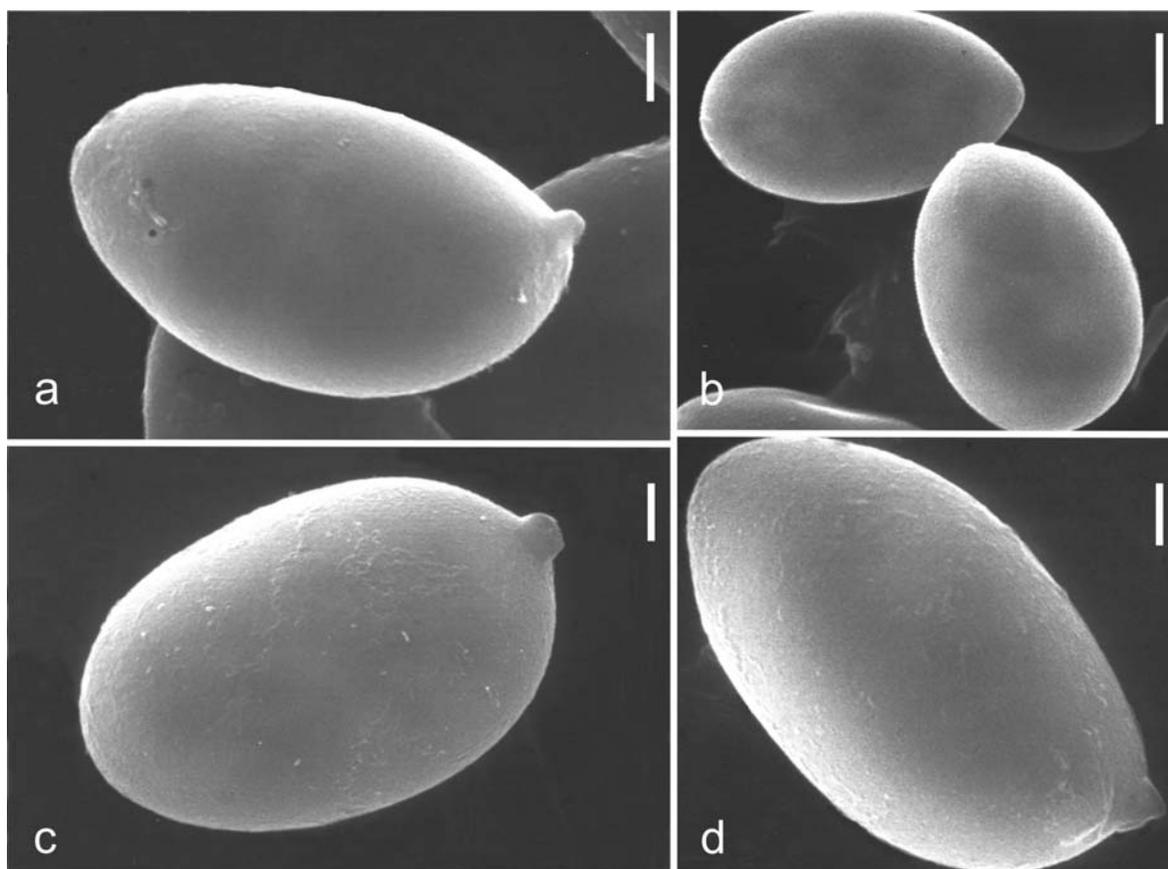


**Fig. 2.** Scatter plot of basidiospore size (means) in collections of *Tremellopsis antillarum* (x, **holotype**), *Crepidotus albescens* (□), *C. cinchonensis* (+, **holotype**), *C. herrerae* ( $\Delta$ ), and *C. pseudoantillarum* (○).

type study did not reveal clearly the presence of clamps at least in many accurately recovered septa.

On account of the ellipsoid to amygdaliform, moderately small-sized basidiospores, gelatinized, clampless hyphae, in combination with the relatively small, grayish basidiome, the specimen of *Duss s.n.* that supports *Tremellopsis antillarum*, in our opinion, represents a member of *C. uber* (for description *cf.* Singer, 1973; Senn-Irlet and De Meijer, 1998). The taxonomic implication of all this is the existence, in fact, of a distinct taxon represented by specimens inhabiting fallen wood in tropical or subtropical forest from Mexico, the Caribbean and Central and South America. This taxon exhibits just the set of characters fixed until now for what has been called *C. "antillarum"* after Singer (1947) (Hesler and Smith, 1965; Horak, 1968; Singer, 1973; Pegler, 1983; Senn-Irlet and De Meijer, 1998) but it excludes *Tremellopsis*

*antillarum* as described above. We interpret that the collections that Singer (1947) treated under *C. "antillarum"* are not the same as *Tremellopsis antillarum*, since the set of characters that include medium to large-sized, ellipsoid to oblong and more or less kidney-like or bean-like shaped (due to a flattening or a weak curving inward in the adaxial face) basidiospores, cheilocystidia mostly clavate, pileipellis bearing somewhat undifferentiated terminal elements, and tissues with gelatinized, clamped hyphae (Figs 4-6f-g) are features that taxonomically show similarity to the group of species near *C. albescens* rather than to *Tremellopsis antillarum* or even *Crepidotus cinchonensis*. We found that *C. cinchonensis* and *Tremellopsis antillarum* are only superficially similar based on macroscopic features. Hand sections of the holotype of *C. cinchonensis* (JAMAICA. Cinchona, wet mountainous region, 25 December 1908-8 January 1909, *W.A. Murrill & E.L. Murrill 610*, NY) revived with difficulty in KOH preventing us from developing an appropriate evaluation of gelatinized layers in pileus and lamellae tramae (*cf.* e.g. key in Hesler and Smith 1965). However, it presents gelatinized, clamped hyphae that more or less recall puzzle-like elements, therefore it differs from *Tremellopsis antillarum* but resembles members close to *C. albescens* (like *C. "antillarum" s. auct.*). *Crepidotus cinchonensis* is also distinguished by its pileipellis, apparently a cutis, composed of undifferentiated terminal elements, basidia  $23\text{-}35 \times 7\text{-}11 \mu\text{m}$ , clavate, 4-spored, clamped, and basidiospores  $(7.5\text{-})8\text{-}10 \times 5\text{-}6.5 \mu\text{m}$  ( $\bar{x} = 8.9 \times 5.8 \mu\text{m}$ ,  $Q = 1.54$ ), ellipsoid, mostly without an adaxial concavity (so appearing not reniform)(Figs 1b-3



**Fig. 3.** Scanning electron micrographs of *Crepidotus* basidiospores. **a-b.** *Tremellopsis antillarum* (from holotype). **c-d.** *Crepidotus cinchonensis* (from holotype). Bar: 1  $\mu\text{m}$ , except b = 2  $\mu\text{m}$ .

c-d). L.R. Hesler wrote in a note of revision accompanying the holotype (indeed the same data later published by Hesler and Smith, 1965) that most cheilocystidia are collapsed against the gill edges. In fact, the cheilocystidia revived with difficulty and prevent us to describe with confidence the shape of individual cells, to have an appropriate interpretation of their pattern of variation and compare them within the range of variation of this character shown by collections of *C. "antillarum" s. auct.*

In conclusion, *C. cinchonensis* does not seem to share unique morphological characters with the so-called *C. "antillarum"* or at least the available data from the holotype do not allow us to accurately place it within that taxon. For the time being *C. cinchonensis* should be kept separate since it is also fairly different from *Tremellopsis antillarum* or even shows a certain resemblance to *C. virgineus* Har. Takah. (Takahashi, 2003). The holotype of *Tremellopsis antillarum* strongly resembles members of *Crepidotus uber* in having similar basidiospores (size, shape) and gelatinized, clampless hyphae,

and therefore *Tremellopsis antillarum* is interpreted as a later synonym:

***Crepidotus uber*** (Berk. & M.A. Curt.) Sacc., Syll. Fung. 5: 878 (1887).

*Basionym:* *Agaricus uber* Berk. & M.A. Curt., Proc. Amer. Acad. Arts Sc. 4: 117 (1858).

*Synonym:* *Tremellopsis antillarum* Pat., in Duss, Enum. Champ. Guad. p.13 (1903).

= *Crepidotus antillarum* (Pat.) Singer, Lilloa 13: 62 (1947).

*Crepidotus uber* is a small, white, gelatinous fungus inhabiting the tropical and subtropical forest from the Gulf of Mexico area, Caribbean and South America (Singer, 1973; Pegler, 1983; Senn-Irlet and De Meijer, 1998; Bandala and Montoya, 2002).

On account of the aforementioned information, as well as the data obtained from different examined specimens (from Costa Rica and Mexico, type specimens supporting species related to the group of *C. albescens*), all compared with published descriptions of *C. "antillarum" s. auct.*, it is now accepted that three distinct species can be recognized, two of them representing undescribed taxa. These three

species share a consistent set of characters, i.e. clamps, gelatinized tissues, ellipsoid, more or less reniform and smooth basidiospores, and constitute a group of taxa phenotypically similar to the species of the *C. mollis* (Schaeff.) Stauder group which form gelatinized tissues, have smooth basidiospores but lack clamps. *Crepidotus albescens* described from the USA (Murrill, 1916 as *Geopetalum*; Redhead, 1984) is distinguished by the subcylindric to more or less narrowly lageniform, remarkably elongate cheilocystidia in combination with a pileipellis made of more or less filamentous, undifferentiated terminal elements (Figs 6a-e and 9-11). The two new species differ in having somewhat large basidiospores and clavate or moderately capitate cheilocystidia (Figs 2, 4-6f-i and 7-8). One of these species, which corresponds to what has been called *C. "antillarum" s. auct.*, is distinct in that it combines a pileipellis with undifferentiated terminal elements, while the other undescribed taxon combines a pileipellis bearing distinctly versiform (*i.e.* constrictions, short outgrowths, contorted), ventricose terminal elements similar to its cheilocystidia. The three species are described below.

## B. Description of new species

*Crepidotus pseudoantillarum* Bandala, Montoya & M. Mata, **sp. nov.** (Figs 2, 4-6f-g & 12a)  
MycoBank: 512445

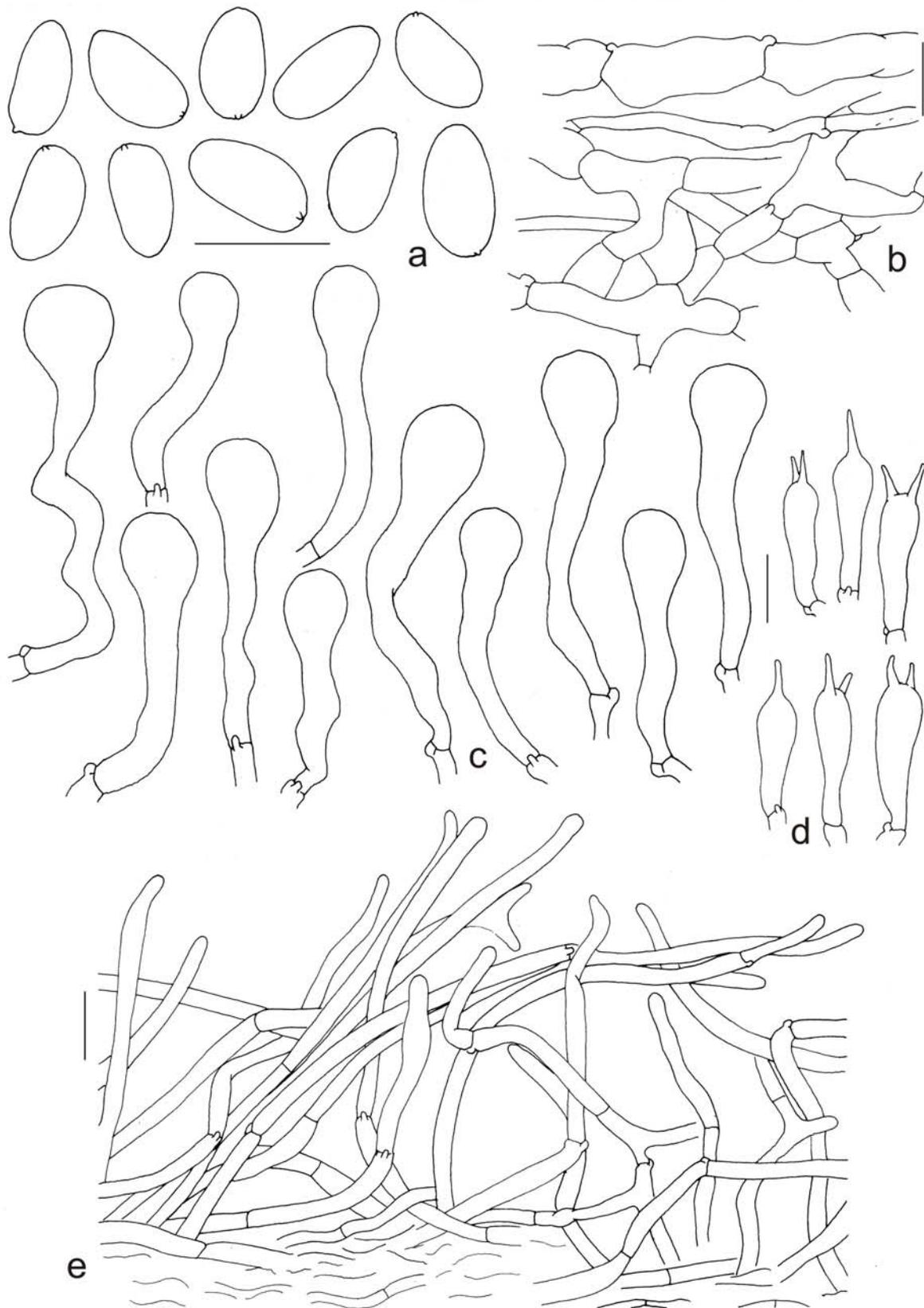
*Etymology*: referring to a false *Tremellopsis antillarum*.

*Pileus* 4-42 mm latus, dimidiatus vel flabellatus, convexus, albidus, tomentosus vel tomentoso-fibrillosus, striatulus, hygrophanus, viscidus. *Lamellae* subdistantes, albidae, dein brunneae, marginem fimbriatae. *Stipes* primo lateralis, minutus, senectute saepe deest. *Contextus* albidus, immutabilis, gelatinosus. *Basidiosporae* (7-)7.5-11 × (4-)4.5-5.5(-6.5) μm, ellipsoideae vel subreniformeae, laevis, ochraceae. *Basidia* 20-35 × 5-7 μm, clavata, bisporea vel monosporea. *Cheilocystidia* 27-65 × 4-7(-8) × (apicem) 6-13(-14) μm, clavata vel clavato-capitata, hyalinis, gelatinosus. *Pileipellis* ex hyphis hyalinis, cylindraceis, laxe intricatis, subtrichodermium vel cutem formantibus. *Tramate pilei* et *tramate hymenophoralis* gelatinosae. *Fibulae* praesentes. COSTA RICA. Guana-caste: Arenal, Volcán Tenorio, Hacienda Montezuma, 5 May 2000, López 1296 (**Holotypus**, INB; **Isotypus** XAL).

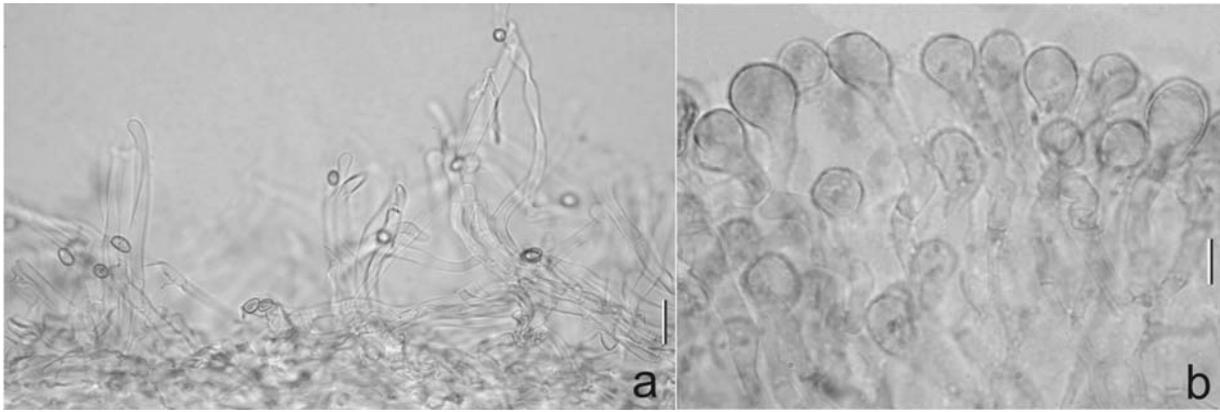
*Pileus* 4-42 mm broad, in young stages unguulate to more or less campanulate, becoming convex or almost plano-convex, subcircular or circular to dimidiate, at times more or less

rounded flabelliform or somewhat petaloid, with or without a slot in the rear portion (when seen from the hymenophore), this produces two short, lobe-like hemispheres, then somewhat rounded reniform, whitish, whitish-translucent to pale grayish, brownish in parts by spores deposit on surface, not or slightly translucent striate, variably viscid (sticky to the touch), hygrophanus, tomentose to tomentose-fibrillose, almost minutely villose near point of attachment; margin incurved, later inflexed to moderately straight, thin, weakly tomentose-fimbriate to glabrous, wavy (mainly when fully expanded), slightly exceeding the lamellae. *Lamellae* whitish becoming pale brown, some with pinkish shades, with whitish, fimbriate, somewhat irregular edges which are somewhat elastic; adnexed to narrowly adnate, some weakly subdecurrent, concurrent to a lateral point, subdistant, broad (≤ 4 mm broad), more or less ventricose, lamellulae 3-4 different length. *Stipe* in young stages lateral, rudimentary (< 2 mm long.), whitish, pruinose, with age absent or persisting as a lateral, glabrous knob (when seen from the hymenophore) but the pileus is directly attached laterally or almost dorsally to the substratum; basal mycelium white, present or absent. *Context* watery, whitish, thin to more or less thick from center backwards (2-5 mm thick), hygrophanus then opaque, soft, elastic, unchanging on exposure. *Odor* and *taste* not distinctive.

*Basidiosporae* (7-)7.5-11 × (4-)4.5-5.5(-6.5) μm,  $\bar{x}$  = 8.2-9.9 × 4.8-5.7 μm,  $Q$  = 1.7-1.79, oblong to ellipsoid or moderately narrowly ellipsoid, weakly appanate or depressed adaxially then slightly reniform, apiculus very small, apex weakly tapered but rounded, wall at times bearing a discontinuity resembling a germ pore, smooth, thin- to slightly thick-walled (≤ 0.5 μm thick), yellow to pale yellowish-brown; under SEM smooth and lacking germ pore. *Basidia* 20-35 × 5-7 μm, 2-spored, often monosporic, clavate, thin-walled, hyaline, clamped. *Pleurocystidia* absent. *Cheilocystidia* 27-65 × 4-7 (-8) μm, numerous, narrowly clavate to subclavate, often narrowly utriform, apex rounded or subcapitate 6-13 (-14) μm wide, occasionally subcylindric-capitate, straight or somewhat sinuous, hyaline, thin-walled, clamped, gelatinized, producing a more or less dense, refringent layer on lamellae edge. *Pileipellis* a loose trichoderm or a



**Fig. 4.** *Crepidotus pseudoantillarum* (from **holotype**). **a.** Basidiospores. **b.** Pileus trama hyphae. **c.** Cheilocystidia. **d.** Basidia **e.** Pileipellis. Bars: a, c & d = 10  $\mu\text{m}$ , b & e = 20  $\mu\text{m}$ .



**Fig. 5.** *Crepidotus pseudoantillarum* (from **holotype**). **a.** Tangential section of pileipellis. **b.** Cheilocystidia. Bars: a = 20  $\mu$ m, b = 10  $\mu$ m.

transition to a loose cutis, composed of cylindrical, interwoven hyphae 5-8(-11)  $\mu$ m wide, hyaline, simple or bifurcate, clamped, thin- or slightly thick-walled ( $\leq 0.5$   $\mu$ m thick), smooth, with a variable number of undifferentiated (rarely very narrowly sublageniform or elongate-subcapitate), straight terminal elements, the layer is ungelatinized and variable in depth and in density of hyphae, at times in some areas even of a single specimen the ascendant hyphae are more tightly packed and projecting or in other areas these hyphae are more prostrated. *Pileus trama* (in tangential section) differentiated in two layers, one beneath pileipellis, gelatinized, refringent, variable in depth, composed of more or less filamentous hyphae 2-5  $\mu$ m wide, hyaline, thin-walled, smooth, some occasionally obscurely punctate, somewhat flexuous, more or less radially oriented and loosely interwoven; below that layer is a distinctive moderately compact, gelatinized but not refringent stratum comprising most of the pileus context and composed of colorless, thin-walled, subcylindric to subventricose, simple, bifurcate or occasionally ramified hyphae (3-)4-15(-17)  $\mu$ m wide, often short-bifurcate, somewhat irregularly arranged forming a puzzle-like structure. *Hymenophoral trama* with a mediostratum, irregular to subregular, composed of hyphae similar to those from lower part of pileus trama; laterostrata refringent, gelatinized, composed of filamentous, colorless to pale yellowish, thin-walled hyphae 2-5  $\mu$ m wide, loosely and more or less divergently arranged. *Clamp connections* present in all tissues.

*Habitat:* Gregarious, on decaying branches

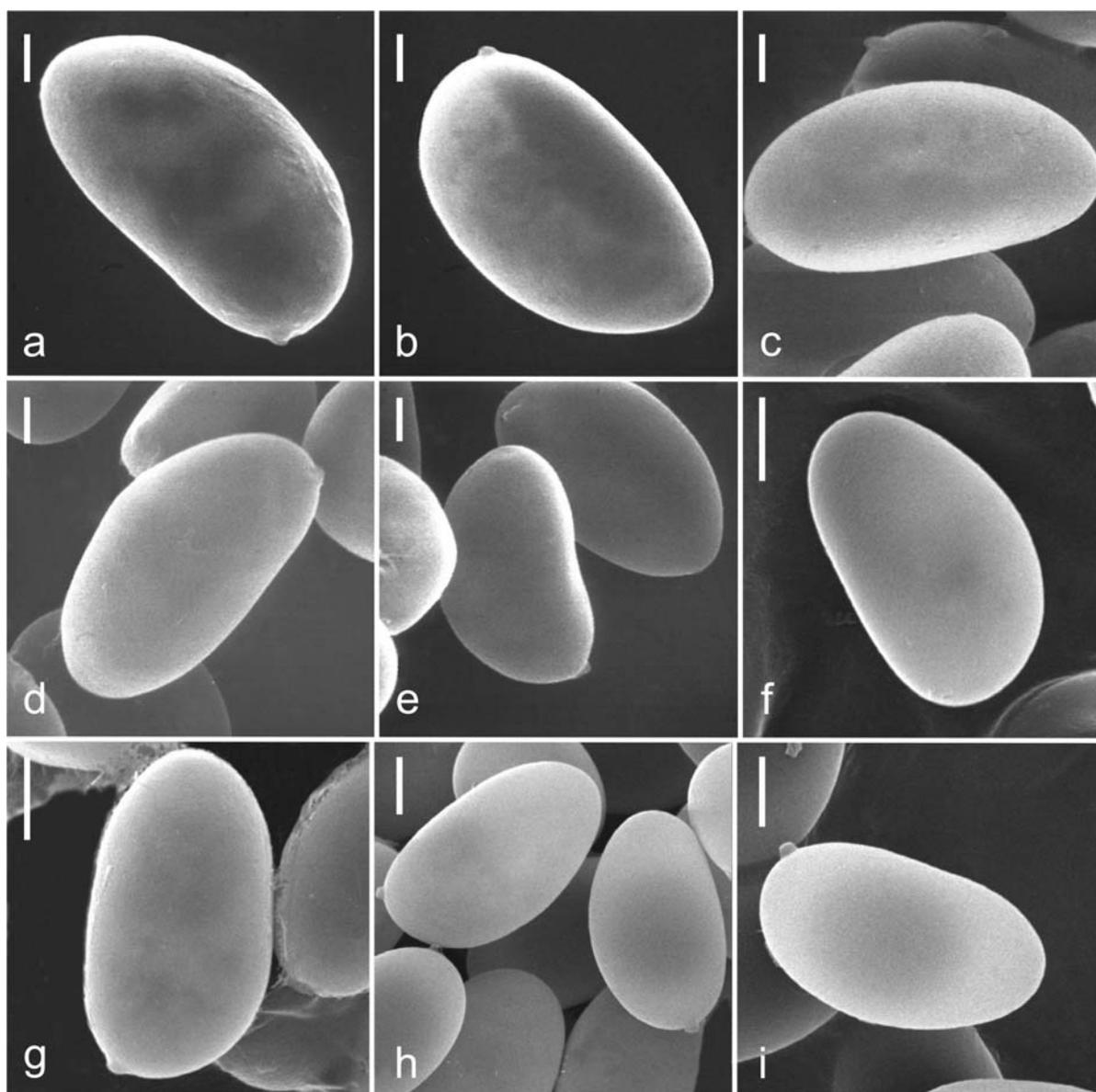
or wood, in tropical and subtropical cloud forest, at 800-1700 m alt.

*Known distribution:* Bermuda, Brazil, Colombia, Costa Rica, Cuba, Jamaica, Martinique, Mexico.

*Material examined:* COSTA RICA: Guanacaste: Arenal, P.N. Volcán Tenorio, Hacienda Montezuma, 5 May 2000, López 1296 (**Holotype**, INB; Isotype XAL). MEXICO. Chiapas: Mpio. Ocozocuaula, Reserva Laguna Bélgica, 5 September 2006, Bandala 4211 (XAL). Veracruz: 7 km S of Montepio, Estación Biológica de Los Tuxtlas, 20 May 1969, Singer M 8093 (F, as *Crepidotus antillarum*). Mpio. Rafael Lucio, Sta. Bárbara Farm, 18 February 1986, Bandala 735; Mpio. Apazapan, Apazapan, 7 August 1994, Leal 458 (XAL).

*Other material examined:* CUBA. Prov. Pinar del Río, Candelaria Co., Reserva Sierra del Rosario, 9 December 1994, Bandala 2720 (XAL). JAMAICA. Marce's Gap, mountainous region, 29 December 1908-2 January 1909, Murrill & Murrill 686 (NY, as *Crepidotus cinchonensis*).

*Notes:* Distinctive features that separate *C. pseudoantillarum* from other white, gelatinized, clamped, smooth-spored species are the clavate to more or less subcapitate cheilocystidia and a pileipellis composed of undifferentiated terminal elements. This taxon encompasses the attributes of what Singer (1947) understood and circumscribed as *C. "antillarum"*, a concept later extended in subsequent literature (for further information please refer to the discussion under *Tremelopsis antillarum* above). *Crepidotus pseudoantillarum* seems to enclose some variants producing different numbers of spores per basidium. Collections examined here often presented 2-spored or monosporic basidia; the taxon is reported to include specimens (1-)2(3)-



**Fig. 6.** Scanning electron micrographs of *Crepidotus* basidiospores. **a-e.** *C. albescens* (a-b: from holotype; c: Kelly 158, holotype of *C. phaseoliformis*; d-e: Earle 241, holotype of *C. betulae*). **f-g.** *C. pseudoantillarum* (from holotype). **h-i.** *C. herrerae* (from holotype). Bars: a-e = 1  $\mu$ m, f-i = 2  $\mu$ m.

spored, 2-4-spored or 4-spored basidia (Singer, 1947, 1973; Pegler, 1983; Senn-Irlet and De Meijer, 1998; all as *C. antillarum*). The gelatinous layer resting just beneath the pileipellis can be thick and refringent in fresh or well revived specimens, although in some cases it is weakly refringent but differentiated (as in specimen *Bandala 4211*) or it can be very compact and hence apparently absent (*Bandala 735, 2720*), in both later situations the pileipellis hyphae rather rest on the pileus trama. At times some lamellae (even of a same specimen) in tangential section show a variation in the depth of the gelatinized

laterostrata, being more refractive in some than in others. Singer (1973) observed something similar among his specimens. Pegler (1983) reported the subhymenial layer as being poorly developed and the hymenophoral trama subgelatinized, not mentioning the pileus trama characteristics. Senn-Irlet and De Meijer (1998) described a distinct gelatinous layer behind the subhymenium and jigsaw-like cells of the pileus trama. Our study of specimens of *C. pseudoantillarum* and other related members revealed that a well preserved sample from which a good revived tangential section can be obtained, allows to observe the disposition of

the gelatinized layers, one of them located just beneath the pileipellis, another just below the lower part of the context (*i.e.* the continuation of the subhymenium), and finally, the laterostrata in the lamellae (*cf.* Fig. 11a-b) (at times producing a dense, gelatinized lamellae tip where the cheilocystidia are immersed). Such layers, even in the same sample, vary to a greater or lesser degree both in depth and refraction, and consequently one or more layers can be better defined. A similar variation, more dependent on the influence of weather conditions and later drying of the material, is, in fact, observed also among samples representing different species of *Crepidotus* that form gelatinized tissues (Singer, 1973; Nordstein, 1990; Senn-Irlet, 1995a; Bandala and Montoya, 2004; Gonou-Zagou and Delivorias, 2005).

Apart from the diagnostic set of characters of *C. pseudoantillarum* the size of the basidiospores can be indicative also of taxonomic differences. Fig. 2 depicts the mean values of length and width of the basidiospores based on available collections of the three species studied in this group. Comparing these values, the specimens of *C. pseudoantillarum* show a different range in relation to that observed on *C. albescens* and the next new species treated (see below). This later taxon presented larger basidiospores, with a range above that displayed by *C. pseudoantillarum* which at the same time, showed a larger basidiospore range than *C. albescens*. Collections of *C. albescens* perhaps produce small-sized basidiospores due to the consistent presence of tetrasporic basidia, in comparison with the other two species which possess bisporic or monosporic basidia. Further confirmation of the taxonomic value of the basidiospore size will be achieved when the number of collections be increased to corroborate if those patterns are effectively consistent.

It is interesting to comment additionally that a similar situation in the size of the basidiospores is well known among bisporic and tetrasporic forms of *Simocybe* (Senn-Irlet, 1995b), the sister genus of *Crepidotus* (Moser, 1983; Singer, 1986; Moncalvo *et al.*, 2002; Aime *et al.*, 2005). The limits between *Simocybe* and *Crepidotus* have been (until recently) defined artificially to some extent by having been based exclusively on a reduced number of species of each genus for comparison. It is not surprising

that macroscopy has been used as the first criterion of segregation between a more consistently stipitate taxon (*Simocybe*) and another apparently sessile (*Crepidotus*). Through *C. pseudoantillarum* and allied species as well as other lineages, *Crepidotus* not only shares with *Simocybe* morphologically similar spores (yellowish to yellowish-brown or brownish, smooth, variably reniform, lacking germ pore) (Pegler and Young, 1975; Senn-Irlet, 1995b) but also anatomical details of the pileipellis (more than with *Agrocybe* and other *Bolbitiaceae* which differ in having a cuticle in a palisadoderm, Watling, 1965; Watling and Largent, 1976). The core species of *Simocybe*, that includes European species like *S. centunculus* (Fr.) P. Karst. and *S. sumptuosa* (P.D. Orton) Singer, or American members like *S.alachuana* (Murrill) Singer or *S. atomacea* (Murrill) Singer among others, certainly have a pileipellis with a closer arrangement pattern, bearing more defined cystidia-like terminal elements and hence appearing more trichodermoid. However, other members like *S. iberica* G. Moreno & Esteve-Rav. and *S. quebecensis* Redhead & Cauchon possess a pileipellis with a looser or somewhat entangled arrangement, composed of interwoven, more or less filamentous elements, rather radially oriented, hence appearing in parts as a loose cutis or a loose trichodermoid pileipellis (Redhead and Cauchon, 1989; Moreno and Esteve-Raventós, 1990; Senn-Irlet, 1995b; pers. obs.). The pileipellis in both cases seems to be comparable (if not identical) with that found in several *Crepidotus* species, e.g. *C. eucalyptinus* Maire & Malençon, *C. leptus* (Berk.) Sacc., *C. pezizula* (Berk. & Broome) Sacc., *C. variabilis* (Pers.) P. Kumm., among others (Malençon and Bertault, 1975; Pegler, 1986; Senn-Irlet, 1995a; pers. obs.). In cases such as *Simocybe fulvifibrillosa* (Murrill) Singer, *S. ovalis* Singer or *S. coroicensis* Singer (Singer, 1973) a pileipellis like that of many *Crepidotus*, *i.e.* with more prostrate, relatively compact hyphae and with scattered, not necessarily differentiated terminal elements, can be found. Even in species like *C. cristulatus* Singer, *C. rubriceps* Singer and the other new species herein proposed (see below), the pileipellis has more defined terminal elements, resembling cystidia-like structures in compari-

son with the core species of *Simocybe*. In very young stages *Crepidotus* possesses an almost tiny stipe, which only in a few species becomes clearly visible (elongate) with age (Horak, 1977; Bigelow, 1980; Aime *et al.*, 2002). In most species it is reduced and is perhaps not in the form of a centrally attached, elongate, single structure as commonly found in *Simocybe* but lateral or excentric (a short, subcylindric or swollen knob), often appressed against the pileus margin (occasionally free), forming together a point of attachment to the substratum (seen from the hymenophore). The placement of pleurotoid forms in *Simocybe* is firstly attributable to the presence of a reduced stipe and secondly to the pileipellis (when the basidiospores are not reniform), while inclusion of stipitate forms in *Crepidotus* is based mainly on the combination of the basidiospores being ornamented (or if smooth, not being reniform) together with other microscopic characters. Hesler and Smith (1965: 9) already suggested "... Although of minor importance as a taxonomic feature, the pseudostipe may have ontogenetic significance which indicates a phylogenetic connection from normally stipitate ancestors...". Molecular data add evidence to support the close relationship between *Simocybe* and *Crepidotus* placing the lineage of *C. pseudoantillarum* (with *C. betulae*, *i.e.* *C. albescens*, see above), in resulting trees, at the base of the *Crepidotus* clade and closely related to the grouping of *Simocybe* species (Aime *et al.*, 2005). The variation in characters represented by members of *Crepidotus* and *Simocybe*, both within and between the genera (pileus fibrillose or somewhat pruinose, stipe well defined and elongate or defined but reduced; basidiospores smooth, ellipsoid or ovoid, more or less reniform or not; pileipellis variably trichodermoid or in cutis, loose or not) would indicate that *Simocybe* differs by the abundant pileo- and caulocystidia, cheilocystidia more typically capitate and that several species have olivaceous pileus coloration. Delimitation of both genera would be based then on such subtle morphological differences exclusively. We share Aime's *et al.* (2005) opinion that the microscopic characters offer a more natural distinction but all the aforementioned information on such combination of characters found among representatives of

*Simocybe* and *Crepidotus* are perhaps more proper of an assemblage of taxa sharing a very close common ancestry than to interpret two discrete entities.

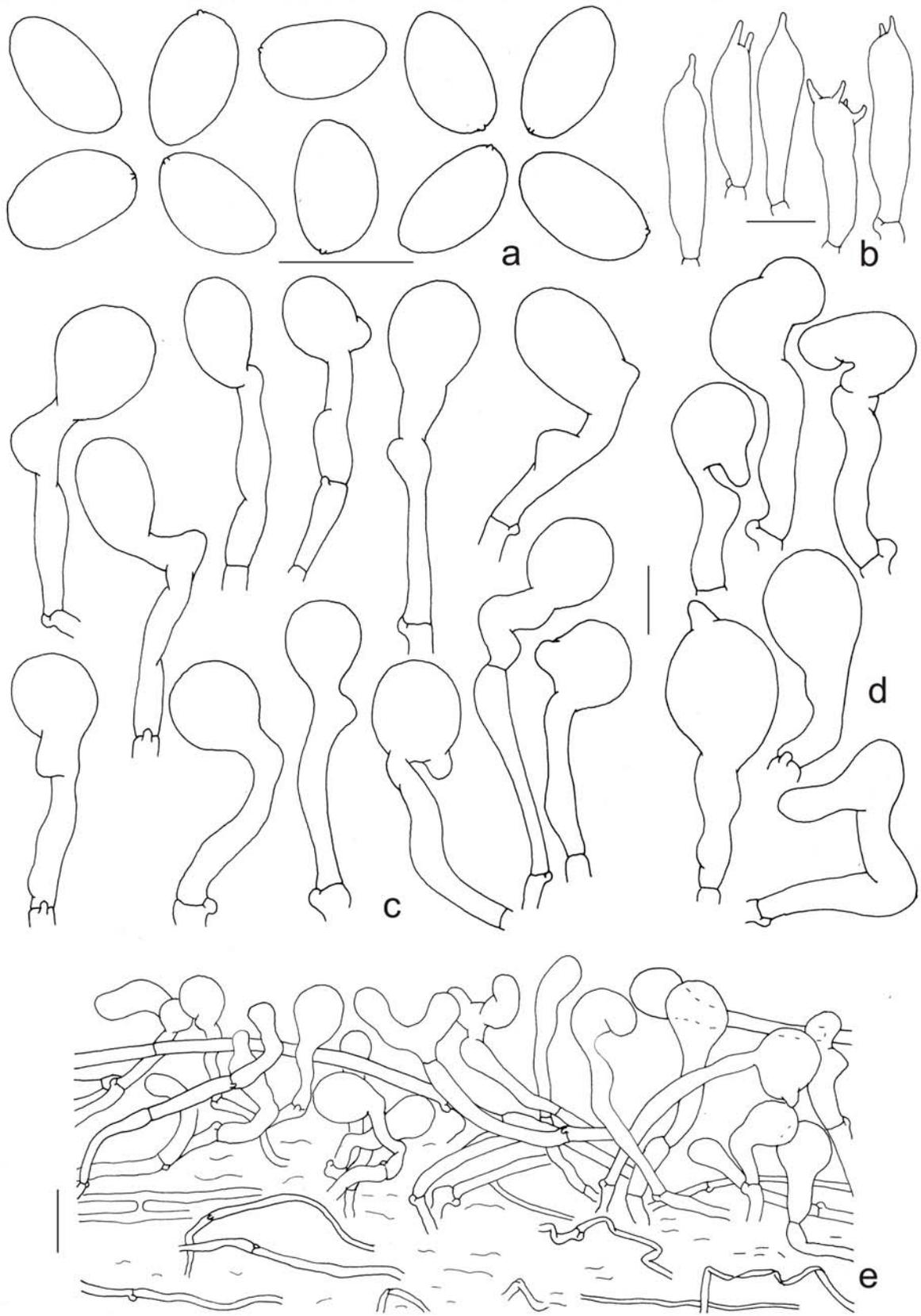
***Crepidotus herrerae* Bandala & Montoya, sp. nov.** (Figs 2, 6h-i-8 & 12b)

Mycobank: 512446

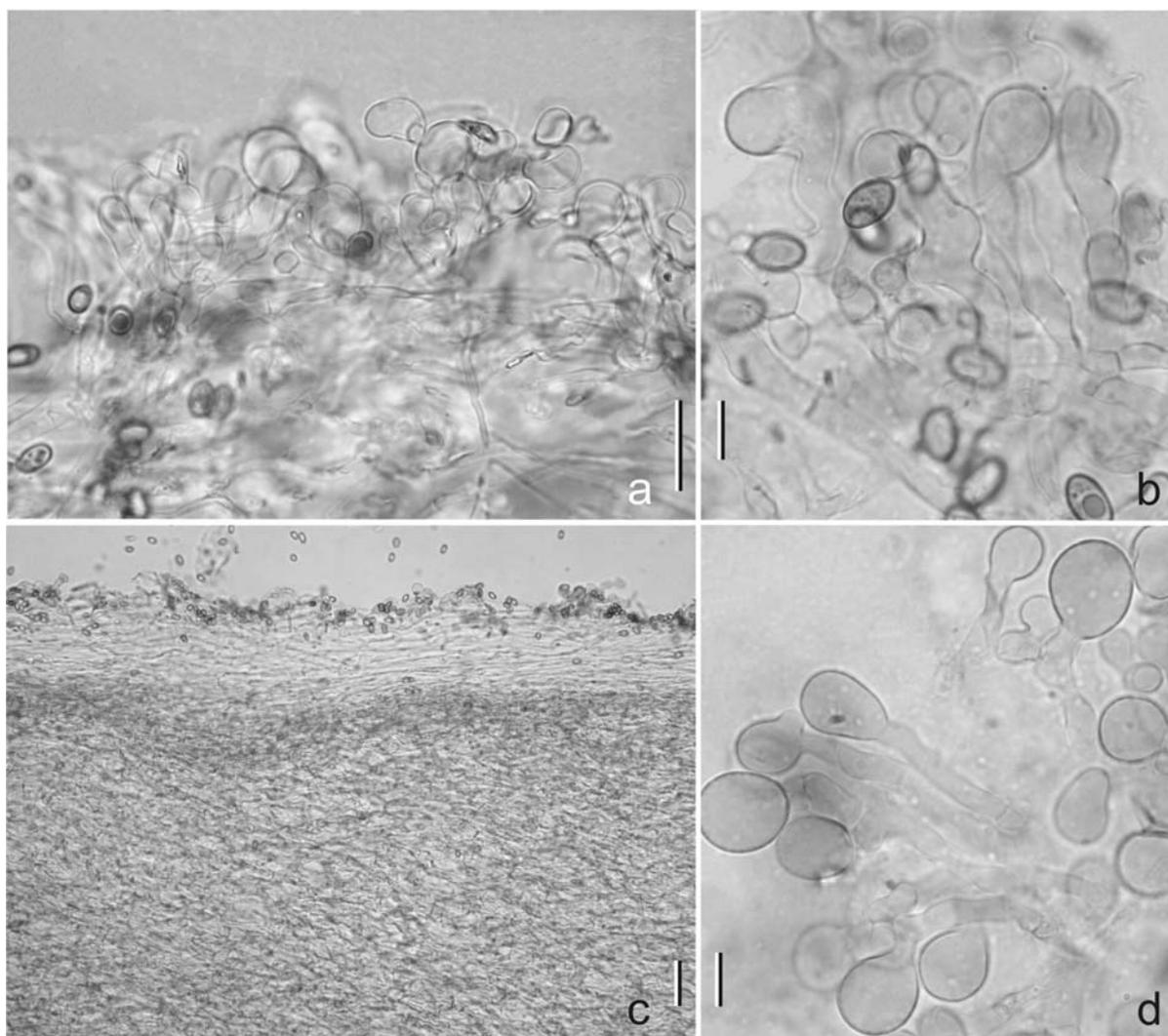
*Etymology*: in honor of Dr. Teófilo Herrera Prof. emeritus of the UNAM for his extensive work on the fleshy fungi of Mexico over the past fifty years, which have facilitated the development of taxonomic mycology in Mexico and inspired many colleagues and students.

*Pileus* (2-)5-32 mm latus, subcampanulatus vel flabellatus, convexus dein planoconvexus, albidus vel sordido-albidus, tomentosus vel tomentosus-granulosus, striatulus, hygrophanus, viscidus. *Lamellae* subdistantes, albiae dein ochraceobrunneae, marginem fimbriatae. *Stipes* primo lateralis, minutus, senectute saepe deest. *Contextus* albidus, immutabilis, gelatinosus. *Basidiosporae* (8-)8.5-10.5(-11) × 5-6(-6.5) μm, ellipsoideae vel subovoideae vel subreniformeae, laevis, ochraceae. *Basidia* 25-30 × 5-7 μm, clavata, bisporea vel monospora. *Cheilocystidia* 30-57(-68) × (3-)4-7(-8) × (apicem) (5-)6-16 μm, clavata vel clavato-capitata, saepe irregularis, contortis, hyalinis, gelatinosus. *Pileipellis* ex hyphis hyalinis, claviformis, 29-55(-62) × 5-17 μm, cheilocystidia recordatio, trichodermium intermittere formantibus. *Tramate pilei et tramate hymenophoralis* gelatinosae. *Fibulae* praesentes. MEXICO. Veracruz: Instituto de Ecología, Santuario del Bosque de Niebla, 30 March 2004, Bandala 3895 (**Holotypus**, XAL).

*Pileus* (2-)5-32 mm broad, when young umbonate near point of attachment then somewhat campanulate, becoming convex or planoconvex, at times spathulate when young, later subcircular, at times more or less rounded flabelliform or somewhat reniform, white or whitish, becoming pale-yellowish (2.5Y 8/2-3; near 2A2-3) with shades of pale yellowish-brown (2.5Y 7/3-4) or pale-grayish or darker (more or less 10YR 6-7/4), if *wet* almost entirely grayish and more or less translucent, then translucent striate in most part of disc, viscid when young, becoming slightly lubricous (weakly sticky to the touch) to dry, hygrophanus, at first more or less tomentose-granulose, becoming tomentose to glabrous, in young stages tomentose-villose near point of attachment; margin incurved, later



**Fig. 7.** *Crepidotus herrerae* (from **holotype**). **a.** Basidiospores. **b.** Basidia. **c.** Cheilocystidia. **d.** Terminal elements of pileipellis. **e.** Pileipellis. Bars: a-d = 10  $\mu$ m, e = 20  $\mu$ m.

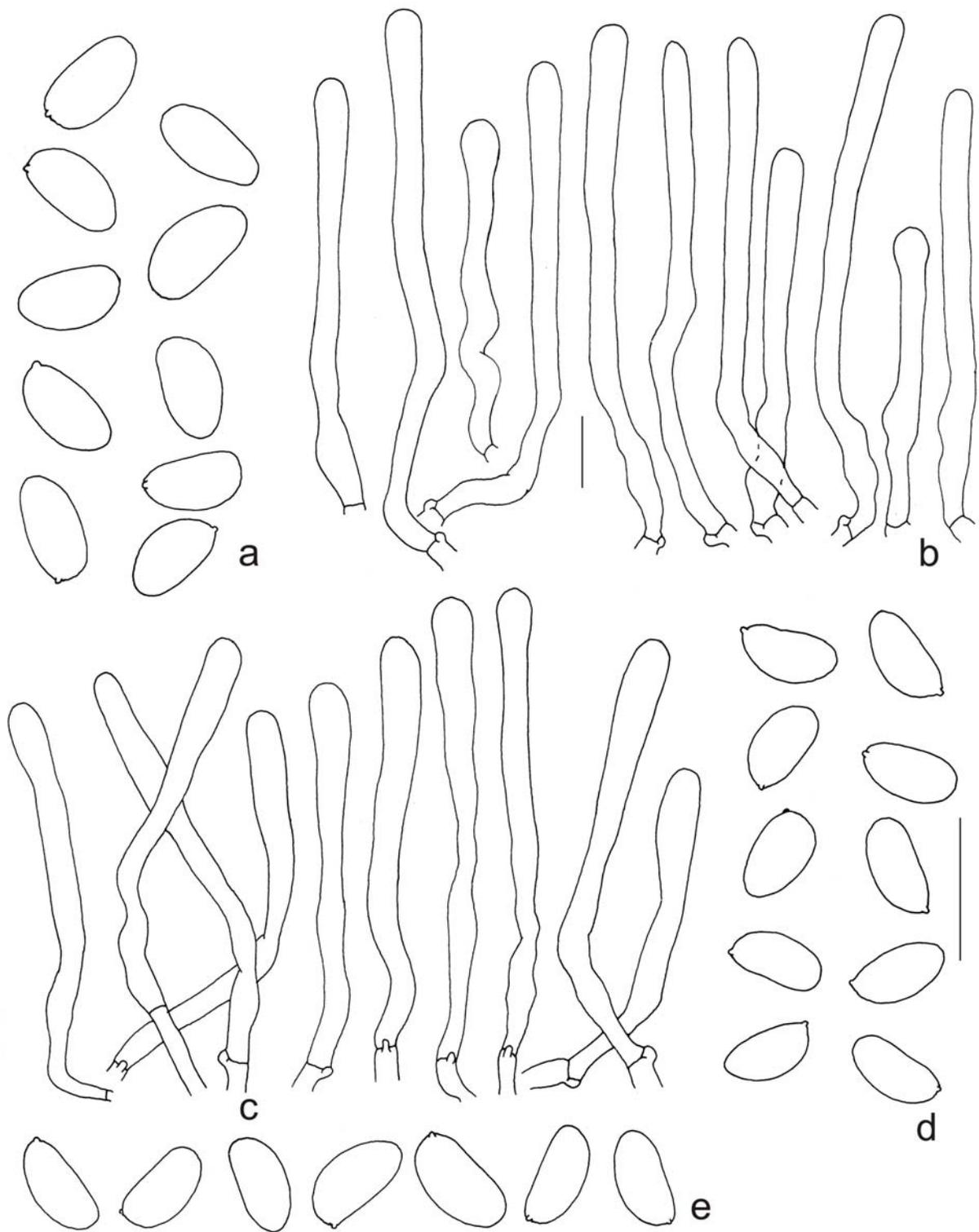


**Fig. 8.** *Crepidotus herrerae* (from holotype). **a.** Tangential section of pileipellis. **b.** Terminal elements of pileipellis. **c.** Pileipellis and refringent, gelatinized layer of context (tangential section). **d.** Cheilocystidia. Bars: a = 25  $\mu\text{m}$ , b & d = 10  $\mu\text{m}$ , c = 50  $\mu\text{m}$ .

straight, smooth, translucent striate or not; laterally attached to substrate. *Lamellae* whitish, becoming faintly brownish (10YR 7/3-4), yellowish-brown to pale brown (10 YR 6/6) or grayish-brown (more or less 10YR 5-6/4), some with pinkish shades, with whitish, fimbriate edges which are somewhat elastic; adnexed to narrowly adnate, some weakly subdecurrent, concurrent to a lateral point, subclose to subdistant, broad ( $\leq 3$  mm broad), more or less ventricose, at times exceeding the pileus margin, lamellulae up to 3 different lengths. *Stipe* in young stages lateral, rudimentary (up to 2 mm long.), pruinose, with age absent or persisting as a lateral, cylindrical, whitish, glabrous knob (when seen from the hymenophore) but the pileus is directly attached to the substratum; basal myce-

lium white when present. *Context* white, thin ( $< 1$  mm thick), hygrophanous, soft, gelatinous, elastic near pileus surface, unchanging on exposure. *Odor* and *taste* not distinctive. *Spore print* (seen on pileus surface) yellowish-brown to dark brownish (near 10YR 5-6/6).

*Basidiospores* (8-)8.5-10.5(-11)  $\times$  5-6(-6.5)  $\mu\text{m}$ ,  $\bar{x}$  = 9.4-9.8  $\times$  5.8-5.9  $\mu\text{m}$ ,  $Q$  = 1.62-1.66, oblong or ellipsoid, some subovoid in dorso-ventral view, at times weakly applanate or depressed adaxially then slightly reniform, with rounded extremes, apiculus inconspicuous, wall often bearing a discontinuity resembling a germ pore, smooth, thick-walled ( $< 1$   $\mu\text{m}$  wide), yellowish to pale yellowish-brown, under SEM smooth and lacking germ pore. *Basidia* 25-30  $\times$  5-7  $\mu\text{m}$ , 2-spored, often monosporic, rarely 4-



**Fig. 9.** *Crepidotus albescens*. **a.** Basidiospores. **b.** Cheilocystidia (from **holotype**). **c.** Cheilocystidia. **d.** Basidiospores (Earle 241, **holotype** of *C. betulae*). **e.** Basidiospores (Kelly 158, **holotype** of *C. phaseoliformis*). Bars = 10  $\mu\text{m}$ .

spored, subclavate to subcylindric, thin-walled, hyaline, clamped. *Pleurocystidia* absent. *Cheilocystidia* 30-57(-68)  $\times$  (3-)4-7(-8)  $\mu\text{m}$ , numerous, narrowly clavate to subclavate, at times narrowly utriform, often with constrictions or

short outgrowths, then somewhat irregular in form, occasionally septate, apex rounded or subcapitate (5-)6-16  $\mu\text{m}$  wide, hyaline, at times with a yellowish content, thin-walled, clamped, gelatinized. *Pileipellis* an interrupted tricho-

derm, composed of clusters of terminal elements which are colorless (occasionally intermixed pale yellowish), thin-walled, clavate, narrowly utriform, narrowly lageniform, or rarely subcylindric, apically rounded,  $29-55 (-62) \times 5-17 \mu\text{m}$ , often contorted or with constrictions, with short outgrowths or bifurcate, then more or less irregular in form (more or less resembling the cheilocystidia), at times loosely arranged or almost prostrated and then in a transition between a loose cutis and a trichoderm; near pileus trama the hyphae are  $2-9 \mu\text{m}$  wide, interwoven, more or less radially oriented, hyaline, thin-walled, forming an undifferentiated, ungelatinized, thin layer. *Pileus trama* (in tangential section) differentiated in two layers, one beneath pileipellis, gelatinized, refringent, variable in width, composed of more or less filamentous hyphae  $(1-2-3(-5) \mu\text{m})$  wide, hyaline, thin-walled, smooth, some occasionally obscurely punctate, more or less radially oriented and loosely interwoven, some oleiferous-like hyphae present; just downwards with a moderately compact to loose, gelatinized but not refringent tissue comprising most of the pileus context, composed of colorless, thin-walled, subcylindric to subventricose, simple, bifurcate or occasionally ramified hyphae  $(3-5-20 \mu\text{m})$  wide, often short, somewhat irregularly arranged forming a puzzle-like structure. *Hymenophoral trama* with a mediostratum, irregular, composed of hyphae similar to those from lower part of pileus trama; laterostrata refringent, gelatinized, composed of filamentous, colorless to pale yellowish, thin-walled hyphae  $(1-2-5 \mu\text{m})$  wide, loosely and more or less divergently arranged. *Clamp connections* present in all tissues.

*Habitat*: Gregarious, on a decaying liana, and branches, in subtropical cloud forest, at 1300 m alt.

*Known distribution*: Mexico.

*Material examined*: MEXICO. Veracruz: Mpio. Xalapa, Instituto de Ecología, Santuario del Bosque de Niebla, 1 July 2003, *Bandala* 3775; 30 March 2004, *Bandala* 3895 (**Holotype**); October 19, 2005, *Jarvio* 2477 (all at XAL).

*Notes*: *Crepidotus herrerae* is a striking white, clamped, smooth-spored species related to *C. albescens* and *C. pseudoantillarum* (both treated here). It differs in the cheilocystidia and terminal elements of the pileipellis, both clavate and remarkably lobed, angled or bifurcate (due to constrictions or short outgrowths).

*Crepidotus herrerae* also seems to have bigger spores in comparison with these two species (Fig. 2). Cheilocystidia somewhat similar to those of *C. herrerae*, i.e. more or less versiform-clavate (seen in outline), are also present in other members of *Crepidotus* (e.g. *C. croceitinctus* Peck, *C. macedonicus* Pilát or even *C. variabilis*) but members combining cheilocystidia and pileipellis terminal cells similar in shape are very rare. In some stages of development the basidiomes of *C. herrerae* could superficially recall specimens of *C. applanatus*, another white taxon recognized by different microscopical features (globose, ornamented basidiospores, lack of gelatinized tissues) (Josserand, 1937; Nordstein, 1990; Senn-Irlet, 1995a).

### C. Description and new records of *Crepidotus albescens*

*Crepidotus albescens* (Murrill) Redhead, *Sydowia* 37: 255 (1984)

(Figs 2, 6a-e & 9-11)

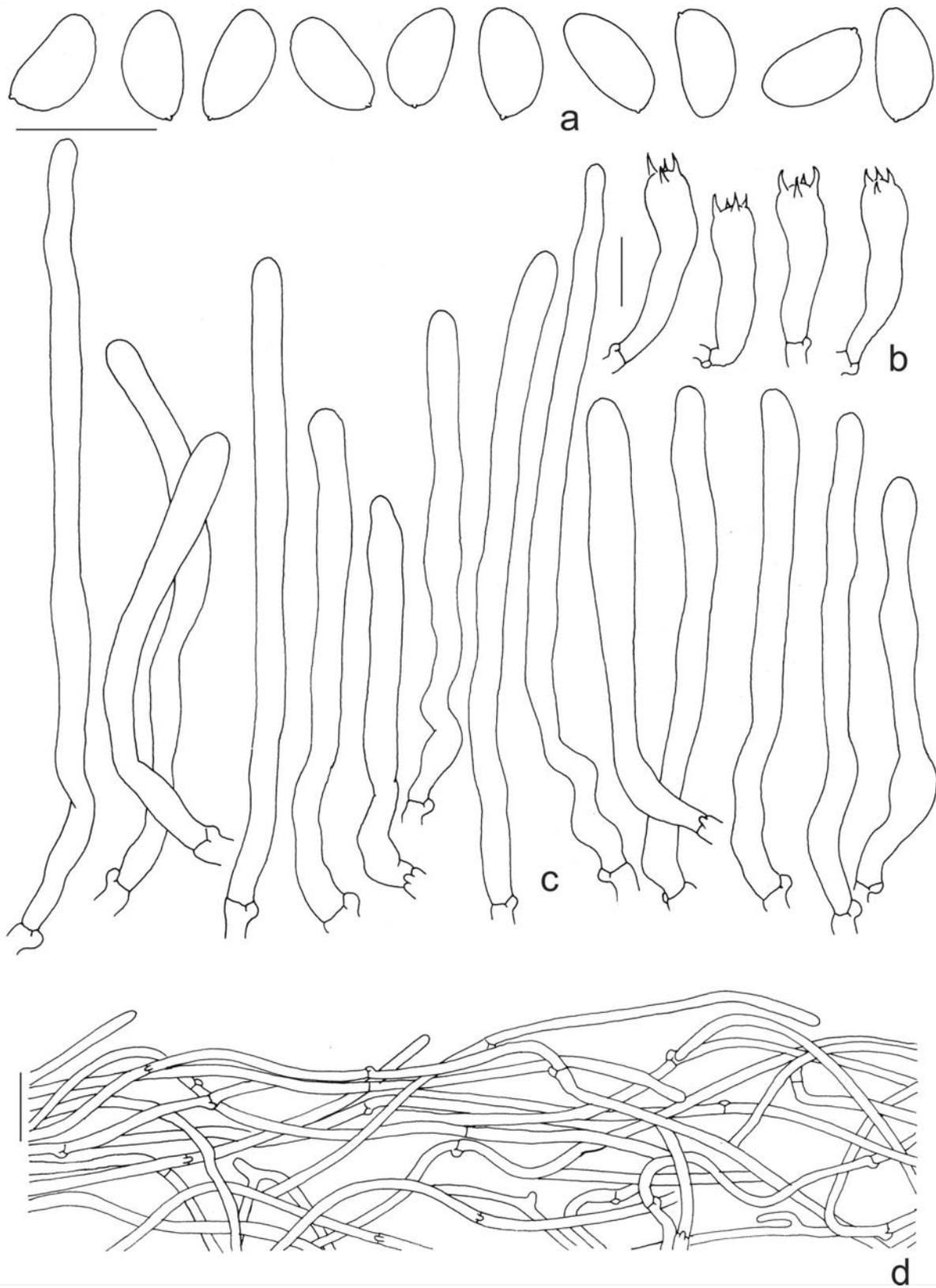
*Basionym*: *Geopetalum albescens* Murrill, N. Am. Fl. 9: 299 (1916).

*Synonyms*: *Crepidotus betulae* Murrill, N. Am. Fl. 10: 151 (1917).

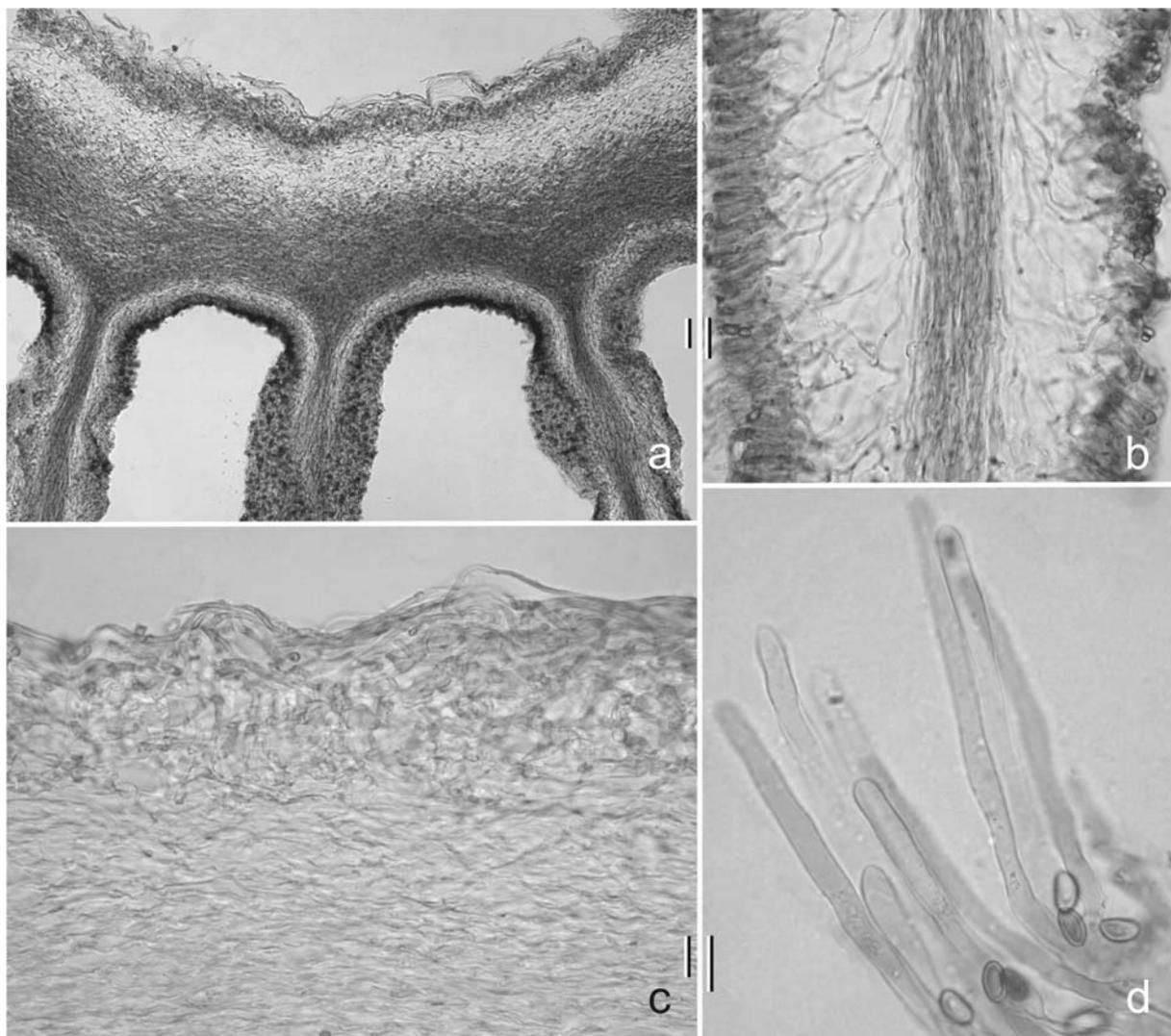
= *C. phaseoliformis* Hesler & A.H. Sm., N. Am. Sp. Crep., p. 92 (1965).

*Pileus* 5-70 mm broad, more or less unguulate in young stages, becoming convex or plano-convex, subcircular or circular to dimidiate or more or less rounded flabelliform, white or whitish to pale grayish, not or translucent striate, somewhat viscid (sticky to the touch), hygrophanous, tomentose or slightly tomentose-fibrillose; margin inflexed. *Lamellae* pale brown to grayish-brown with whitish, fimbriate edges which are somewhat elastic; adnexed to narrowly adnate, concurrent to a lateral point, subclose, broad ( $\leq 3$  mm broad), more or less ventricose, lamellulae up to three different lengths. *Stipe* absent or as a lateral, cylindrical, whitish, glabrous knob (when seen from the hymenophore) but the pileus is laterally or dorsally attached to the substratum. *Context* somewhat translucent, watery, more or less thick (2-5 mm thick), hygrophanous then becoming opaque, soft, elastic, unchanging on exposure. *Odor* and *taste* not distinctive.

*Basidiospores*  $6.5-8.5(-9) \times 4-5 \mu\text{m}$ ,  $\bar{x} = 7.2-8 \times 4.2-4.8 \mu\text{m}$ ,  $Q = 1.65-1.88$ , ellipsoid to more or less narrowly amygdaliform, often rath-



**Fig. 10.** *Crepidotus albescens*. **a.** Basidiospores. **b.** Basidia. **c.** Cheilocystidia. **d.** Pileipellis (Mata 870). Bars: a-c = 10  $\mu\text{m}$ , d = 20  $\mu\text{m}$ .



**Fig. 11.** *Crepidotus albescens*. **a.** Pileus and hymenophore in tangential section showing the refringent, gelatinized layers of context and subhymenium. **b.** Mediostratum and laterostrata (gelatinized) in a lamella in tangential section (Mata 1272). **c.** Pileipellis. **d.** Cheilocystidia (Mata 870). Bars: a-c = 50  $\mu$ m, d = 10  $\mu$ m.

er depressed adaxially then more or less narrowly reniform, moderately attenuated towards the apex but rounded apically, apiculus inconspicuous, smooth, thick-walled (< 1  $\mu$ m wide), yellowish to pale yellowish-brown. *Basidia* 20-32  $\times$  6-8  $\mu$ m, 4-spored, occasionally tri- or monosporic forms are present, clavate to narrowly clavate, thin-walled, hyaline, clamped. *Pleurocystidia* absent. *Cheilocystidia* (35-)38-119  $\times$  3-6(-7)  $\mu$ m, numerous, subcylindric or slightly broadened downwards, then elongate and more or less narrowly lageniform (or occasionally narrowly utriform), prominently projected above the hymenium level, often somewhat sinuous towards the base, apex rounded, occasionally attenuated (2-)3-7  $\mu$ m

wide, neck rarely with short, lateral outgrowths or bifurcate, hyaline, thin- or slightly thick-walled (< 0.5  $\mu$ m thick), clamped, not or weakly gelatinized producing a more or less dense, refringent layer on lamellae edge. *Pileipellis* a moderately broad ( $\pm$  75-125  $\mu$ m deep) non-gelatinized, hyaline layer forming a cutis or a transition between a loose cutis and a loose trichoderm, with a variable number of undifferentiated, repent or often erect terminal elements, consisting of more or less filamentous, (1-)2-4(-6)  $\mu$ m wide, hyaline, somewhat loosely interwoven or entangled hyphae, occasionally some segments pale yellowish, simple or bifurcate, moderately sinuous, often curved, at times with short, lateral outgrowths, clamped,



**Fig. 12. a.** *Crepidotus pseudoantillarum* (Bandala 4211). **b.** *Crepidotus herrerae* (Bandala 3895). Bars = 20 mm.

thin- or slightly thick-walled ( $\leq 0.5 \mu\text{m}$  thick), smooth or at times some segments obscurely encrusted (colorless). *Pileus trama* (in tangential

section) differentiated in two layers, one beneath pileipellis, gelatinized, refringent, variable in depth, composed of more or less filamentous

hyphae (1-)2-4(-5)  $\mu\text{m}$  wide, hyaline, some segments with a dense, yellowish content, thin-walled, smooth or occasionally obscurely punctate, somewhat flexuous, more or less radially oriented and loosely interwoven; below that layer is a distinctive, moderately compact to loose, gelatinized but not refringent stratum comprising most of the pileus context and composed of colorless, thin-walled, subcylindric to subventricose, simple or bifurcate hyphae (2-) 5-19  $\mu\text{m}$  wide, often elongate-bifurcate, somewhat radially oriented. *Hymenophoral trama* with a mediostratum, subregular to regular, composed of cylindric to subventricose, compactly arranged, hyaline, non-gelatinized hyphae 5-19  $\mu\text{m}$  wide; laterostrata refringent, gelatinized, composed of filamentous, colorless to pale yellowish, thin-walled hyphae (1-)2-3(-5)  $\mu\text{m}$  wide, loosely and more or less divergently arranged. *Clamp connections* present in all tissues.

*Habitat*: Gregarious, on a decaying wood, in tropical forest, at 1300-1700 m alt.

*Known distribution*: Canada, Costa Rica, U.S.A.

*Material examined*: COSTA RICA. Puntarenas: La Amistad, Pacífico, Z.P. Las Tablas, Finca Confragosa, 19 September 2000, *Mata 870*; Finca La Neblina, 8 June 2005, *Mata 1272* (INB).

*Other material examined*: CANADA. Ontario: Perry Sound District, September 1919, Kelly 158 (MICH, **holotype** of *Crepidotus phaseoliformis*). U.S.A. Michigan: Cheboygan Co., Reese's Bog, University of Michigan Biol. St., 24 July 1963, *A.H. Smith 66940*; Ogemaw Co., Ogemaw Reserve, 4 September 1963, *A.H. Smith 67413* (both at MICH as *Crepidotus betulae*). New York: on fallen twigs of *Betula lenta*, New York Botanical Garden, June 1902, *F.S. Earle 241* (NY, **holotype** of *Crepidotus betulae*); on birch, New York Botanical Garden, 4 September 1915, *W.A. Murrill s.n.* (NY, **holotype** of *Geopetalum albescens*).

*Notes*: *Crepidotus albescens* is a moderately small, white fungus that is differentiated from closely allied species by its distinctive elongate cheilocystidia, the pileipellis with cylindric to filamentous, undifferentiated terminal elements and the relatively narrow and small basidiospores. *Crepidotus phaseoliformis*, thought to be a separate species (Hesler and Smith, 1965), was synonymized with *C. albescens* since Redhead (1984) found that both share the same pattern of taxonomically critical characters (i.e. tramal and subhymenial tissues, spores, cystidia and clamped hyphae). Our results largely agree with Redhead but we

found also that the variation shown by the characters supporting *C. betulae* (Fig. 9) overlaps within the range of variation exhibited by *C. albescens*. We interpret that as well as *C. phaseoliformis*, specimens of *C. betulae* also represent the individual variation of members of *C. albescens* hence we propose here *C. betulae* as a later synonym. While *C. albescens* was described as having glabrous pileus, that of *C. phaseoliformis* and *C. betulae* was recorded as appressed fibrillose (or the fibrils more or less erect when young) or villose with felted hairs, glabrous towards the margin with age, respectively (Murrill, 1916, 1917; Hesler and Smith, 1965). Macroscopic description above is based on the Costa Rican specimens that showed all the characters of *C. albescens*. Microscopically the pileipellis of all examined collections is very similar. The upper layer of pileus displays to a greater or lesser degree a moderately compact or loose arrangement of the hyphae. Consequently the hyphal arrangement is interwoven with radially orientation recalling a more or less lattice-like structure. The pileipellis varies also in thickness and in number of repent or erect, undifferentiated terminal elements. Due to gelatinous consistency of the basidiome, some dried samples are somewhat tough which often prevents the complete rehydration of the outermost layer (as occurs often with samples of the *C. mollis* group). This layer then appears as a compact, entangled layer of radially oriented hyphae. Since all examined specimens exhibit the same kind of hyphae and share a similar hyphal arrangement of the pileipellis, we are not convinced that the variation shown by the pileipellis is of taxonomic value to distinguish more than one taxon. Apart of individual variation, it depends perhaps on the basidiomes age, on the variable abundance of superficial tomentum in individual collections, on the point between the base and the pileus margin from which the hand section was taken or even, the proper dehydration of the sample.

*Crepidotus albescens* has been collected in the eastern part of North America [Ontario (Canada), Michigan, New Hampshire, New York, and southwards, in Tennessee and Virginia (USA)], inhabiting *Alnus*, *Betula*, *Fagus* and other deciduous forests (Murrill, 1916, 1917; Hesler and Smith, 1965). The

present record in Costa Rica is interesting and perhaps indicates that *C. albescens* has a potentially wide range of extension, also reaching the more diverse broad-leaved forests from the south.

### Acknowledgements

We acknowledge the loan of specimens from the herbaria FH, MICH and NY. We express our thanks to Dr. T.J. Baroni (State University of New York, College at Cortland) for reviewing the manuscript and providing suggestions. Part of this work was supported by CONACYT (Project 52364-Q to V.M. Bandala).

### References

- Aime, M.C., Baroni, T.J. and Miller, O.K. (2002). *Crepidotus thermophilus* comb. nov., a reassessment of *Melanomphalia thermophila*, a rarely collected tropical agaric. *Mycologia* 94: 1059-1065.
- Aime, M.C., Vilgalys, R. and Miller, O.K. (2005). The *Crepidotaceae* (*Basidiomycota*, *Agaricales*): phylogeny and taxonomy of the genera and revision of the family based on molecular evidence. *American Journal of Botany* 92: 74-82.
- Astier, J. (1998). Un *Crepidotus* nord-américain récolté en France: *C. sinuosus* Hesler & A.H. Smith. *Documents Mycologiques* 109-110: 11-13.
- Bandala, V.M. and Montoya, L. (2000a). A taxonomic revision of some American *Crepidotus*. *Mycologia* 92: 341-353.
- Bandala, V.M. and Montoya, L. (2000b). A revision of some *Crepidotus* species related to Mexican taxa. *Mycological Research* 104: 495-506.
- Bandala, V.M. and Montoya, L. (2002). *Crepidotus* (*Agaricales*) grupo mollis en el neotrópico: revisión taxonómica con énfasis en miembros relacionados con taxones mexicanos. In: *Abstracts IV Latin American Congress of Mycoloy*. Instituto de Ecología, Xalapa.
- Bandala, V.M. and Montoya, L. (2004). *Crepidotus* from Mexico: new records and type studies. *Mycotaxon* 89: 1-31.
- Bandala, V.M. and Montoya, L. (2008). Type studies in the genus *Crepidotus* from Mexico. *Mycotaxon* 103: 235-254.
- Bandala, V.M., Montoya, L. and Moreno, G. (1999). Two *Crepidotus* from Mexico with notes on selected type collections. *Mycotaxon* 72: 403-416.
- Bandala, V.M., Montoya, L. and Horak, E. (2006). *Crepidotus rubrovinosus* sp. nov. and *Crepidotus septicooides*, found in the cloud forest of eastern Mexico, with notes on *Crepidotus fusisporus* var. *longicystis*. *Mycologia* 98: 137-146.
- Bandala, V.M., Montoya, L. and Mata, M. (2008). *Crepidotus crocophyllus* found in Costa Rica and Mexico, and revision of related species in Subsection *Fulvifibrillosi*. *Mycologia* 100: 335-346.
- Bigelow, H.E. (1980). *Crepidotus nyssicola*. *Mycologia* 72: 1227-1231.
- Capelari, M., Rosa, L.H. and Lachance, M.A. (2006). Description and affinities of *Agaricus martineziensis*, a rare species. *Fungal Diversity* 21: 11-18.
- Duss, R.P. (1903). *Énumération méthodique des champignons recueillis à la Guadeloupe et à la Martinique*. Lons-le-Saunier.
- Gonou-Zagou, Z. and Delivorias, P. (2005). Studies on *Basidiomycetes* in Greece I: The genus *Crepidotus*. *Mycotaxon* 94: 15-42.
- Hesler, L.R. and Smith, A.H. (1965). *North American Species of Crepidotus*. Hafner Publ., New York.
- Holmgren, P.K., Holmgren, N.H. and Barnett, L.C. (1990). *Index Herbariorum*. Part I. The Herbaria of the world. 8th edn. New York.
- Horak, E. (1964). *Fungi Austroamerici* XI. *Nova Hedwigia* 8: 333-346.
- Horak, E. (1968). *Synopsis generum agaricalium*. *Beitr. Kryp. Fl. Schw.* 13. Wabern-Bern.
- Horak, E. (1977). *Crepidotus episphaeria* and related species from the Southern Hemisphere. *Bericht der Schweizerischen Botanischen Gesellschaft* 87: 227-235.
- Josserand, M. (1937). Notes critiques sur quelques champignons de la Région Lyonnaise (2<sup>a</sup> série). *Bulletin trimestrale de la Société Mycologique de France* 28: 175-230.
- Kornerup, A. and Wanscher, J.H. (1967). *Methuen Handbook of Colour*. 2nd edn. Methuen, London.
- Krisai-Greilhuber, I., Senn-Irlet, B. and Voglmayr, H. (2002). Notes on *Crepidotus* from Mexico and the south-eastern USA. *Persoonia* 17: 515-539.
- Lechner, B.E., Wright, J.E. and Popoff, E. (2006). New taxa and new records of fungi for Argentina from Iguazú National Park, Misiones. *Fungal Diversity* 21: 131-139.
- Luther, B.S. and Redhead, S.A. (1981). *Crepidotus cinnabarinus* in North America. *Mycotaxon* 12: 417-430.
- Maleçon, G. and Bertault, R. (1975). *Champignons supérieurs du Maroc II*. *Inst. Cient. Cherifiend-Fac. Sc. Rabat, Rabat*.
- Moncalvo, J.M., Vilgalys, R., Redhead, S.A., Johnson, J.E., James, T.Y., Aime, M.C., Hofstetter, V., Verduin, S.J.W., Larsson, E., Baroni, T.J., Thorn, R.G., Jacobsson, S., Clemençon, H. and Mille, O.K. (2002). One hundred and seventeen clades of euagarics. *Molecular Phylogenetics and Evolution* 23: 357-400.
- Moreno, G. and Esteve-Raventós, F. (1990). *Gymnopilus microsporus* (Sing.) Sing. y *Simocybe iberica* sp. nov. en España peninsular. *Revista di Micologia* 33: 287-292.
- Moser, M. (1983). *Key to agarics and boleti (Polyporales, Boletales, Agaricales, Russulales)*. Roger Phillips, London.
- Munsell, Soil Colour Charts (1994). Macbeth, New Windsor.

- Murrill, W.A. (1913). The *Agaricaceae* of tropical North America, VI. *Mycologia* 5: 18-36.
- Murrill, W.A. (1916). *Agaricales. Agaricaceae. Agariceae*. *North American Flora* 9: 297-374.
- Murrill, W.A. (1917). *Agaricales. Agaricaceae. Agariceae*. *North American Flora* 10: 145-226.
- Ortiz-Santana, B., Lodge, D.J., Baroni, T.J. and Both, E.E. (2007). Boletes from Belize and the Dominican Republic. *Fungal Diversity* 27: 247-416.
- Ovrebo, C.L. and Baroni, T.J. (2007). New taxa of *Tricholomataceae* and *Entolomataceae (Agaricales)* from Central America. *Fungal Diversity* 27: 157-170.
- Nordstein, S. (1990). *The genus Crepidotus (Basidiomycotina, Agaricales) in Norway*. *Synopsis Fungorum* 2. Fungiflora, Oslo.
- Pegler, D.N. (1983). *Agaric flora of The Lesser Antilles*. *Kew Bulletin Additional Series IX*, HMSO, London.
- Pegler, D.N. (1986). *Agaric flora of Sri Lanka*. *Kew Bulletin Additional Series XII*, HMSO, London.
- Pegler, D.N. and Young, T.W.K. (1975). Basidiospore form in the British species of *Naucoria*, *Simocybe* and *Phaeogalera*. *Kew Bulletin*. 30: 225-240.
- Pereira, A.B. (1990). O genero *Crepidotus* no Rio Grande do Sul, Brasil. *Caderno de Pesquisa Botanica Sta. Cruz do Sul* 2: 65-85.
- Pilát, A. (1948). Monographie des espèces européennes du genre *Crepidotus* Fr. In: *Atlas des champignons de l'Europe 6* (eds. A. Pilát and K. Kavina). Praha: 1-84.
- Redhead, S.A. (1984). Mycological observations, 4-12: on *Kuehneromyces*, *Stropharia*, *Marasmius*, *Mycena*, *Geopetalum*, *Omphalopsis*, *Phaeomarasmius*, *Naucoria* and *Prunulus*. *Sydowia* 37: 246-270.
- Redhead, S.A. and Cauchon, R. (1989). A new species of *Simocybe* from Canada. *Sydowia* 41: 292-295.
- Ripková, S., Aime, M.C. and Lizoň, P. (2005). *Crepidotus crocophyllus* includes *C. nephrodes*. *Mycotaxon* 91: 397-403.
- Senn-Irlet, B. (1995a). The genus *Crepidotus* (Fr.) Staude in Europe. *Persoonia* 16: 1-80.
- Senn-Irlet, B. (1995b). Die gattung *Simocybe* Karsten in Europa. *Mycologia Helvetica* 7: 27-61.
- Senn-Irlet, B. and De Meijer, A. (1998). The genus *Crepidotus* from the state of Paraná, Brazil. *Mycotaxon* 66: 165-199.
- Singer, R. (1947). Monograph of the genus *Crepidotus*. *Lilloa* 13: 59-95.
- Singer, R. (1957). *Fungi mexicani series prima, Agaricales*. *Sydowia* 11: 354-374.
- Singer, R. (1973). The genera *Marasmiellus*, *Crepidotus* and *Simocybe* in the neotropics. *Beih. Nova Hedwigia* 44: 1-484.
- Singer, R. (1986). *The Agaricales in modern taxonomy*. 4ed, Koeltz Sc. Books, Koenigstein.
- Takahashi, H. (2003). New species of *Clitocybe* and *Crepidotus (Agaricales)* from eastern Honshu, Japan. *Mycoscience* 44: 103-107.
- Watling, R. (1965). Observations on the *Bolbitiaceae* 2. A conspectus of the family. *Notes Royal Bot. Gard. Edinb.* 26: 289-323.
- Watling, R. and Largent, D. (1976). Macro- and microscopic analysis of the cortical zones of basidiocarps of selected agaric families. *Nova Hedwigia* 28: 569-636.

