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# Fungal Biodiversity Profiles 21-30

*Bart BUYCK[a*], Bernard DUHEM[b], Kanad DAS[d],*
*Ruvishika S. JAYAWARDENA[e,p], Nicolás NIVEIRO[f,g], Olinto L. PEREIRA[i],*
*Indu B. PRASHER[j], Sinchan ADHIKARI[k], Edgardo Omar ALBERTÓ[l],*
*Timur S. BULGAKOV[m], Rafael F. CASTAÑEDA-RUIZ[n], Manoj E. HEMBROM[o],*
*Kevin D. HYDE[p,q], David P. LEWIS[h], Andrea MICHLIG[f,g], Jorinde NUYTINCK[r],*
*Arvind PARIHAR[d], Orlando Fabián POPOFF[f,g], Natalia Andrea RAMIREZ[f,g],*
*Meiriele da SILVA[i], Rajnish K. VERMA[j] & Valérie HOFSTETTER[c]*

*[a]Museum National d'Histoire Naturelle, CP 39, ISYEB, UMR 7205 CNRS MNHN*
*UPMC EPHE, 12 Rue Buffon, F-75005 Paris, France*

*[b]Museum National d'Histoire Naturelle, UMS2700, OMSI,*
*16 rue Buffon, F-75005 Paris, France†*

*[c]Department of Plant Protection, Agroscope Changins-Wädenswil Research*
*Station ACW, Rte De Duiller, CH-1260 Nyon 1, Switzerland*

*[d]Cryptogamic Unit, Botanical Survey of India, P.O. Botanic Garden,*
*Howrah 711103, India*

*[e]Institute of Plant and Environment Protection, Beijing Academy of Agriculture*
*and Forestry Sciences, Beijing 100097, People's Republic of China*

*[f]Instituto de Botánica del Nordeste, IBONE (UNNE-CONICET).*
*Sargento Cabral 2131, CC 209 Corrientes Capital, CP 3400, Argentina*

*[g]Departamento de Biología, Facultad de Ciencias Exactas y Naturales y*
*Agrimensura, Universidad Nacional del Nordeste. Av. Libertad 5470,*
*Corrientes Capital, CP 3400, Argentina*

*[h]Bleakwood, 262 CR 3062, Newton, Texas 75966, USA*

*[i]Departamento de Fitopatologia, Universidade Federal de Viçosa,*
*Viçosa, Minas Gerais, Brazil*

*[j]Department of Botany, Mycology and Plant Pathology Laboratory,*
*Panjab University Chandigarh, 160014, India*

*[k]Department of Botany, University of Kalyani, Kalyani 741235, Nadia,*
*West Bengal, India*

*[l]Instituto de Investigaciones Biotecnológicas – Instituto Tecnológico*
*de Chascomús. IIB–INTECH (UNSAM–CONICET).*
*Cam. Circ. Laguna Km. 6, Chascomús, Buenos Aires, CP 7130, Argentina*

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* Correspondence: buyck@mnhn.fr

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*[m]Academy of Biology and Biotechnology, Southern Federal University,*
*Rostov-on-Don 344090, Rostov Region, Russia*

*[n]Instituto de Investigaciones Fundamentales en Agricultura Tropical*
*"Alejandro de Humboldt" (INIFAT), calle 1, esq. 2, Santiago de Las Vegas,*
*Ciudad de La Habana, C.P. 17200, Cuba*

*[o]Central National Herbarium, Botanical Survey of India,*
*P.O. Botanic Garden, Howrah 711103, India*

*[p]Center of Excellence in Fungal Research, Mae Fah Luang University,*
*Chiang Rai 57100, Thailand*

*[q]Key Laboratory for Plant Biodiversity and Biogeography of East Asia (KLPB),*
*Kunming Institute of Botany, Chinese Academy of Science, Kunming 650201,*
*Yunnan, China*

*[r]Naturalis Biodiversity Center, P.O. Box 9517, 2300RA Leiden, The Netherlands*

**Abstract** – The authors describe ten new taxa for science using mostly both morphological and molecular data. In Basidiomycota, descriptions are provided for *Botryobasidium fusisporum* sp. nov., *B. triangulosporum* sp. nov., *Cantharellus hydnoides* sp. nov. and *Hydnum aerostatisporum* sp. nov. in Cantharellales; *Lactarius rahjamalensis* sp. nov. and *Russula pseudoaurantiophylla* sp. nov. in Russulales and for *Mycena paraguayensis* comb. nov. in Agaricales. In Ascomycota and hyphomycetes, descriptions are provided for *Colletotrichum eryngiicola* sp. nov. (Glomerellales), *Corynesporella indica* sp. nov. (incertae sedis) and *Repetophragma zygopetali* sp. nov. (Microthyriales).

**Agaricales / Arrilastrum / Cantharellales / Glomerellales / Microthyriales / phylogeny / Russulales / phylogeny / systematics**

## 21. ***Botryobasidium fusisporum*** Duhem & Buyck **sp. nov**. **Figs 1-2**

*MycoBank*: MB 820495.

*Systematic position*: Basidiomycota, Agaricomycotina, Cantharellales, Botryobasidiaceae.

*Etymology*: from Latin, referring to the narrowly fusiform basidiospores.

*Diagnosis*: Our species is well defined from all other previously described species by the following combination of characters: narrow hyphal cordons, clamp connections at hyphal septa, presence of hymenial cystidia and narrowly fusoid basidiospores; the latter measure 11-13.5 × 1.5-2.2 µm, are thin-walle d, inamyloid and not cyanophilous. Anamorph unknown.

*Holotype*: MADAGASCAR. Eastern escarpment, Andasibe, in hygrophilous vegetation along dirt road, on undetermined dead wood, 22 Feb. 1997, leg. Buyck, Eyssartier & Moreau, in Buyck 97.587 (PC0142476).

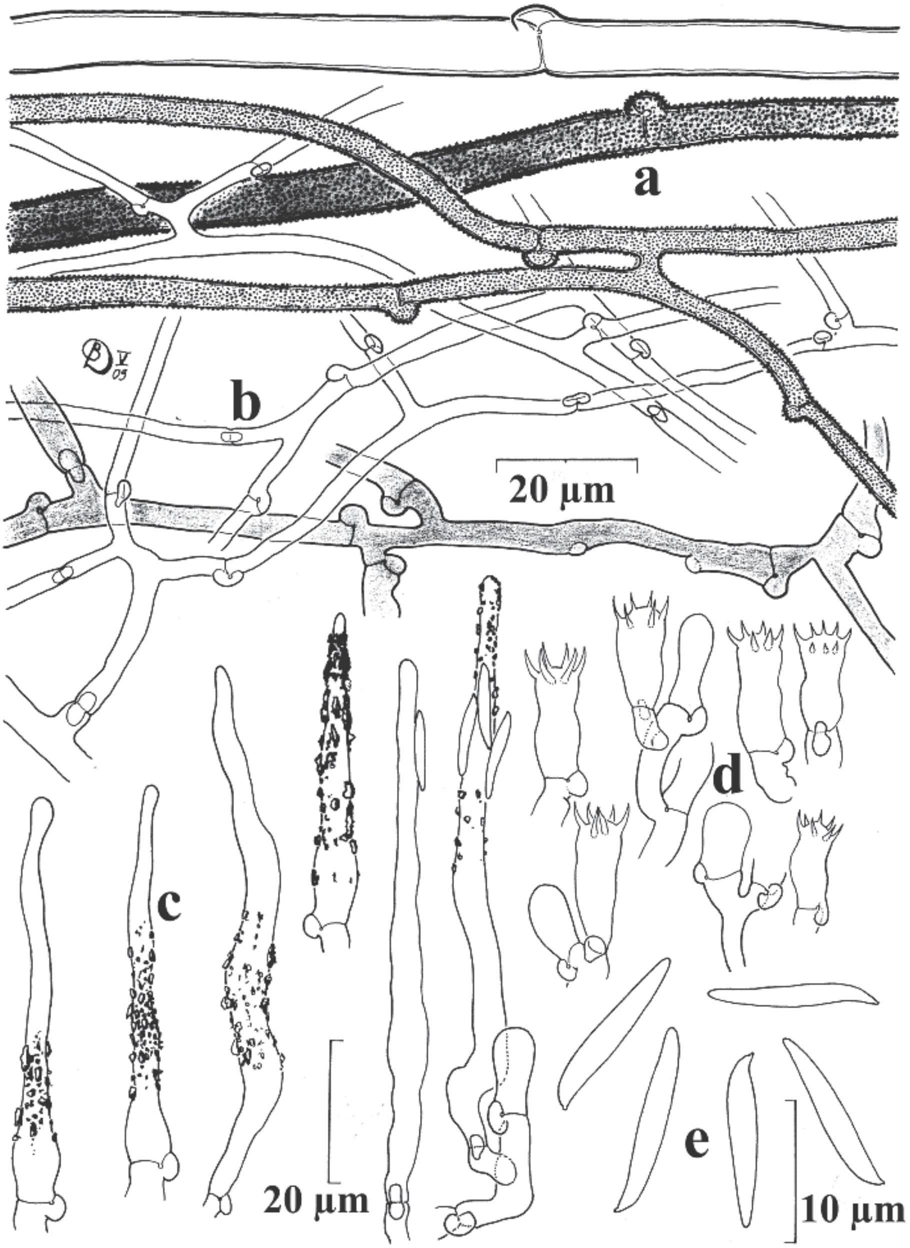

Fig. 1. *Botryobasidium fusisporum* (holotype). **a.** hyphae of the subiculum, **b.** hyphae of the subhymenium, **c.** hymenial cystidia, **d.** basidia and basidiola, **e.** spores. Drawings B. Duhem.

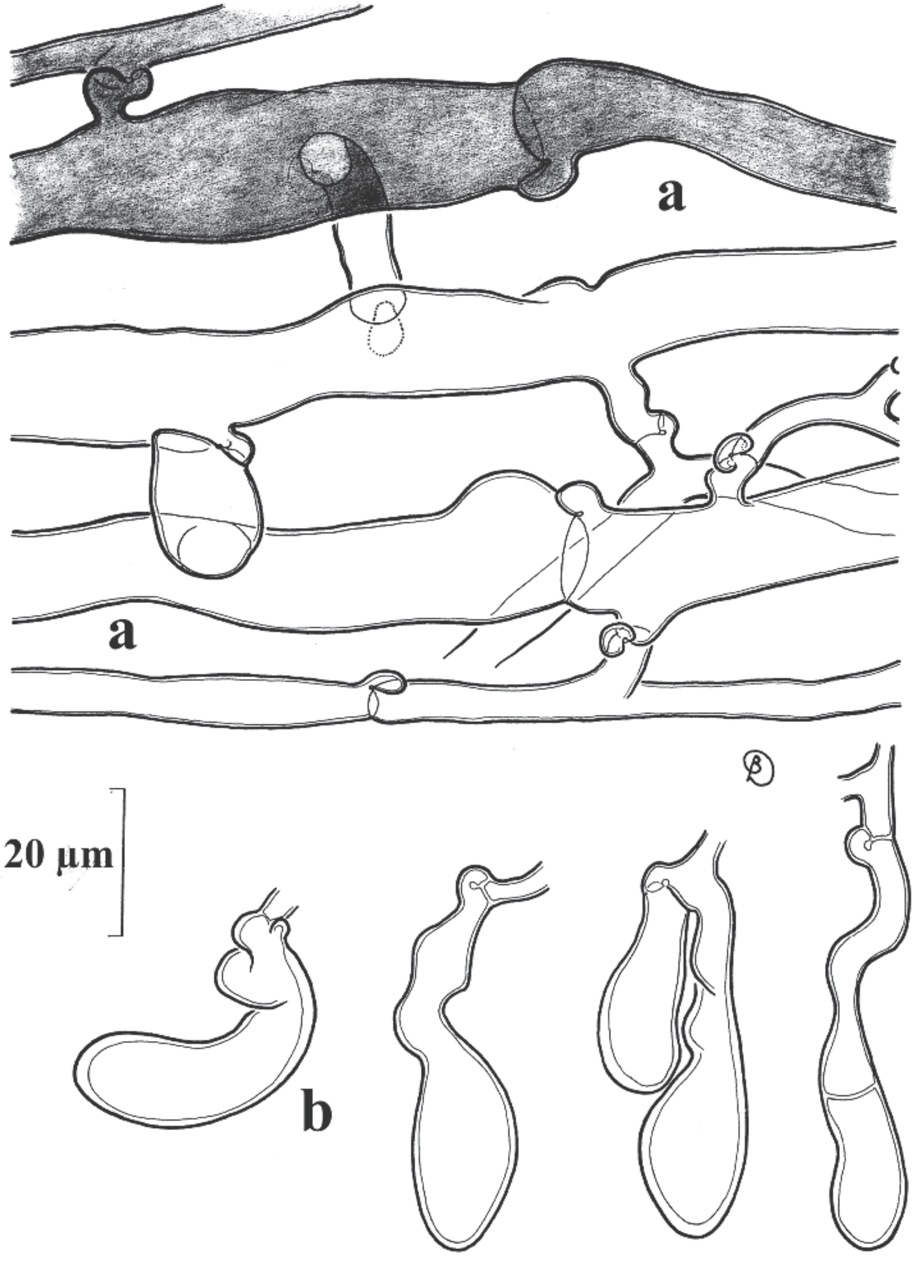

Fig. 2. *Botryobasidium fusisporum* (holotype). **a.** fragments of the hyphal cordons, **b.** terminal cells in the hyphal cordons. Drawings B. Duhem.

**Basidioma** resupinate, continuous, arachnoid-pellicular, reticulate, then becoming more structured and forming some kind of thin, separable, velutinous membrane, overall whitish to greenish with here and there well-delimited yellow areas. Marginal zone often well-developed, pellicular to more distinctly arachnoid or finely fibrillose-silky, grayish to almost transparent. Underneath the basidioma with thin, concolorous to ochraceous yellow hyphal cordons. No anamorph of the *Haplotrichum* type observed.

**Hyphal cordons** up to 120 µm diam., composed of thick-walled hyphae of variable diam., up to 23 µm wide in the central part, frequently ending in a large clavate terminal cell. **Subiculum** composed of loosely mixed, regularly clamped hyphae with cyanophilous, thickened walls; some hyphae up to 15 µm and strongly dextrinoid, reddish brown; others appearing subtly granular or warty in KOH + phloxine, but smooth in Melzer's reagent. **Subhymenium** composed of more frequently branched, short-celled hyphae, with walls reacting pale brown to reddish brown in Melzer's reagent, in lactic blue with dispersed crystals clearly visible. **Cystidia** abundant, distinctly emergent, 40-80 × 4-7 µm, regularly cylindrical or slightly flexuous, progressively narrowing upward, often subcapitate or slightly enlarged at the apex, thin-walled, smooth or covered with minute yellowish brown deposits, that are resinoid in KOH with spores sticking to their surface. **Basidia** stout, 12-18.7 × 5.5-7 µm, clavate, cylindrical to more often compressed in their 2/3 upper portion and suburniform, 6-8 spored, clamped. **Spores** narrowly fusiform, thin-walled, smooth, not amyloïd (IKI –), not cyanophilous (CB –), 11-13.5 × 1.5-2.2 µm; Mean 12.18 µm ± 0.62 × 1.93 µm ± 0.19; Q (mean) = *6.31* (not from spore print).

*Additional specimens examined*: **MADAGASCAR.** Andasibe, near the CIBA site, on fallen bark in a plantation of mixed *Eucalyptus grandis*/*robustus*, 4 Feb. 2006, leg. Buyck & Hofstetter, in Buyck 06.116 (PC0142477).

*Commentary*: Our species is well defined by the following combination of characters that make it distinct from all other described species: narrow hyphal cordons, clamp connections at hyphal septa, presence of hymenial cystidia and narrowly fusoid basidiospores.

Among the other clamped *Botryobasidium* having hymenial cystidia, three species should be mentioned here as more or less similar:

– *B. pilosellum* J. Erikss. 1958 has hyphoid, regularly cylindrical cystidia covered with dispersed crystals and distinctly shorter, slightly wider spores measuring 4.5-6 × 2.5-3 µm.

– *B. ansosum* (Jacks. & Rogers) Parm. 1968 has similar cystidia as the previous species but without crystals and it has bi-apiculate, navicular and larger spores measuring 8-9 (10) × 4-5 µm.

– *B. grandinioides* has a grandinioid basidioma surface, inconspicuous hyphoid cystidia that are perhaps simply protruding hyphal extremities, and navicular, almost biapiculate spores measuring 6-7(9) × 3-4 µm.

Two species with inconstant clamp connections or absence of clamp connections also merit comparison: *B. piliferum* Boid. & Gilles 1982 has regularly hyphoid cystidia and navicular to nearly cylindrical, shorter spores measuring 4.5-7 × 2-3 µm. *Botryobasidium intertextum* (Schw.) Jülich & Stalpers 1980, having very similar although more narrowly navicular and shorter, 6-10 × 1.5-3 µm spores, lacks cystidia and has inconstant clamps.

## 22. ***Botryobasidium triangulisporum*** Duhem & Buyck **sp. nov**. **Fig. 3**

*MycoBank*: MB 820496.

*Systematic position*: Basidiomycota, Agaricomycotina, Cantharellales, Botryobasidiaceae.

*Etymology*: from Latin, referring to the particular angular spore in front view possessing generally three sides.

*Diagnosis*: *Botryobasidium triangulisporum* is well characterized by the predominantly triangular and rather thick-walled spores, measuring 3.8-5.5 × 2.4-3.3 × 4-5.5 µm (length × depth × width), and with a central apiculus and verruculose distal surface.

*Holotype*: MADAGASCAR. Eastern escarpment, National Park of Ranomafana (400 Km SE of Antananarivo and 60 Km from Fianarantsoa), in dense humid rain forest, on wood lying on the forest floor, 1 Feb. 2000, leg. Buyck & Duhem, in Buyck 00.1071 (PC0142478).

**Basidioma** arachnoid-pellicular, then becoming somewhat more dense in structure and dirty ochraceous, especially when dried, well adhering to the substrate and minutely reticulate under a hand lens. **Hyphae** without clamps and with finely warty surface bearing many impurities; basal hyphae up to 22 µm wide, with strongly thickened walls (up to 4.5 µm) of several more or less brightly yellow layers, composed of long and straight cells with secondary septa, branching at right angles and progressively more frequently until a terminal basidium is formed, lateral hyphae 4-7 µm. **Cystidia** absent. **Basidia** 13-18 × 6.5-8 µm, clavate, cylindrical to more often compressed in their 2/3 upper portion (suburniform), (4)5-6(8)- spored, minutely asperulate in their basal portion. **Spores** 3.8-5.5 × 2.4-3.3 × 4-5.5 µm (length-depth-width), triangular in frontal view, more rarely quadrangular, with a nearly central apiculus, dorsally flattened, almost napiformous, distal part from the apiculus with slightly thickened and verruculose surface, cyanophilous, not dextrinoid. **Anamorph** not observed.

*Commentary*: *Botryobasidium triangulisporum* is well characterized by its spores which are predominantly triangular – rarely with four sides – and rather thick-walled, measuring 3.8-5.5 × 2.4-3.3 × 4-5.5 µm (length × depth × width) and have a centrally placed apiculus and a verruculose distal surface. Also the walls of basidiola, as well as those of the lower part of mature basidia and of the entire hyphae are verruculose. *Botryobasidium lacinisporum* G. Langer 1994, so far only known from Canada, has similar triangular spores but these have four small appendices disposed in a cross manner at their tips, while the apiculus is not centrally placed, but at the base of the spore, i.e. in one of the corners of the triangle.

## 23. ***Cantharellus hydnoides*** Buyck & V. Hofstetter **sp. nov**. **Figs 4-6**

*MycoBank*: MB 820497.

*GenBank*: KY800345 (*tef*-1 holotype), KY800346-KY800349 (*tef*-1 paratypes).

*Systematic position*: Basidiomycota, Agaricomycotina, Cantharellales, Hydnaceae.

*Etymology*: referring to the hydnoid aspect of the cap center.

*Diagnosis*: differs from all other known *Cantharellus* in the combination of the following features: predominantly pale and coarsely strigose-fibrillose cap surface becoming distinctly hydnoid in the center, yellow stipe and hymenophore, absence of clamp connections, thin-walled and densely septate hyphal extremities, as well as relatively small spores measuring (5.2)5.5-*5.82*-6.2(6.5) × (3.3)3.5-*3.83*-4.1(4.4) µm, Q = (1.3)1.4-*1.53*-1.6(1.8).

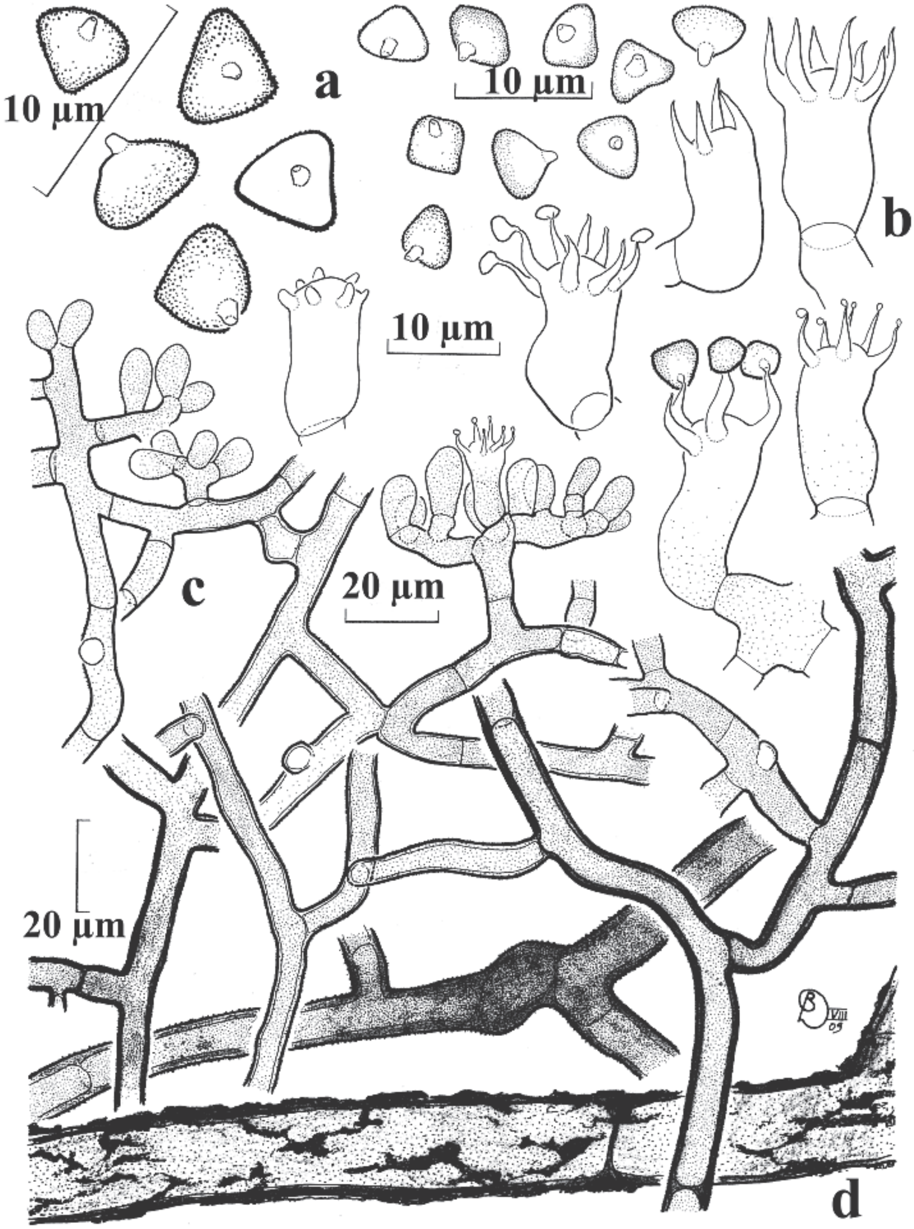

Fig. 3. *Botryobasidium triangulisporum* (holotype). **a.** spores, **b.** basidia and basidiola, **c.** hyphae of the subhymenium producing young basidiola, **d.** hyphae of the subiculum. Drawings B. Duhem.

*Holotype*: CENTRAL AFRICAN REPUBLIC. Dzanga-Sangha Forest Reserve, near Bayanga, in Bai-Hakou base camp, N 02.859934- E 16.467492, under monospecific upper story *Gilbertiodendron dewevrei* forest, on bare sandy soil, 14 May 2016, Buyck 1640/16.014 (PC0713886).

**Basidiomata** very small, slender, thin-fleshed, in small groups of a few specimens. **Pileus** young irregularly convex but already slightly depressed in the center, 10-25(-35) mm diam., margin slightly inrolled, becoming even and very thin with age; cap surface when young coarsely and densely fibrillose-strigose, distinctly hydnoid in the center, during cap expansion this cover is fragmented or torn apart,

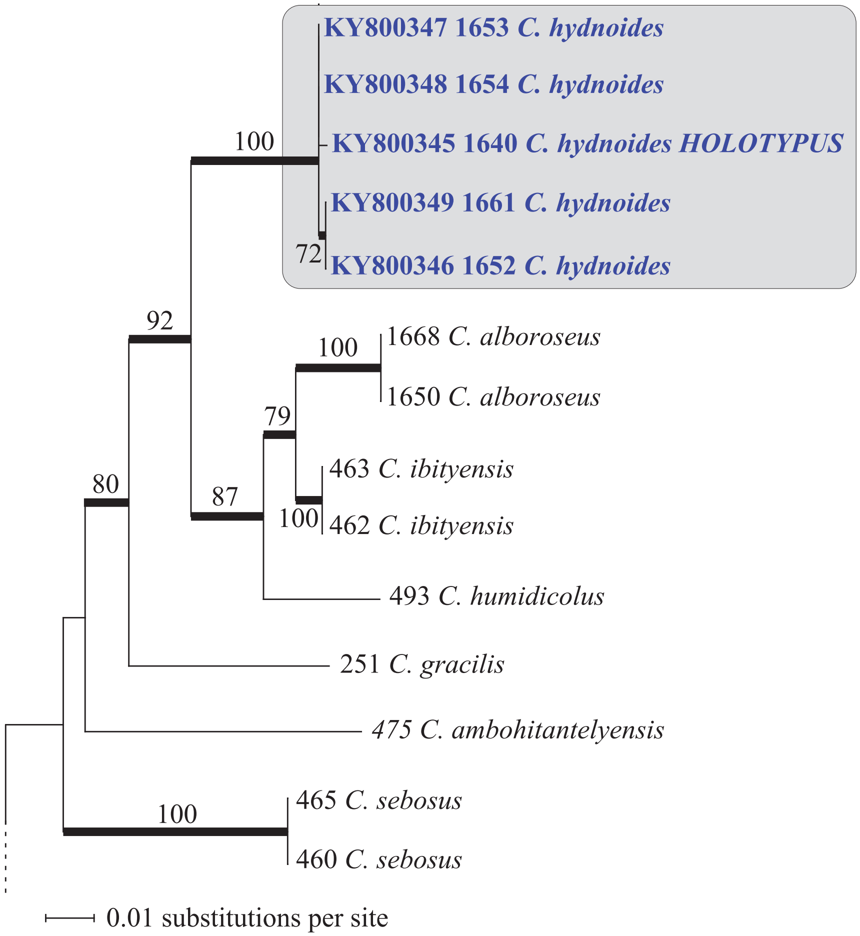

Fig. 4. Partial *tef*-1 phylogeny inferred from a 62 sequences dataset (-ln = -5541.95608). Alignment included 626 characters after exclusion of three spliceosomal introns. Phylogenetic analyses were conducted in PhyML v2.4.4 (Guindon & Gascuel, 2003), under a GTR evolutionary model, with proportion of invariable sites estimated during search, a number of substitution categories = 4, a gamma distribution parameter = 1.0 and optimizing the topology, the branch lengths and rate parameters of the starting tree. Bootstrap values were estimated based on 200 replicates and considered significant when ≥ 70% (Alfaro *et al.*, 2003). Supported branches and newly deposited sequences are in bold.

leaving more horizontally oriented, radiating patterns of the fragmented fibrillose-strigose cover on the cap surface, except in the very cap center which remains hydnoid and funnel-shaped, overall color white to pale cream with a more yellowish cap center, becoming entirely off-white and dull when dry. **Hymenophore** decurrent, well-delimited from the sterile stipe tissue, varying from low veins to mostly well-developed gill folds up to 2 mm high, not remarkably dense, but unequal to frequently forking near the very cap margin and there up to 25 terminations/cm, often also with

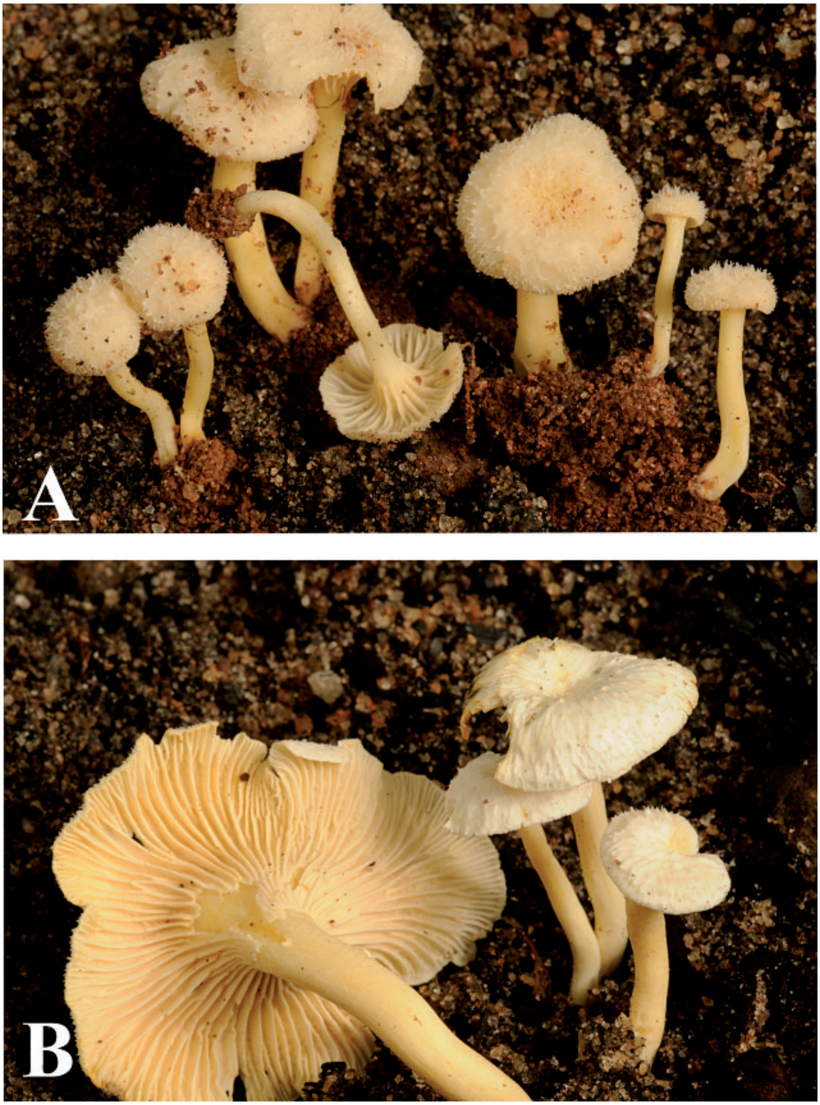

Fig. 5. *Cantharellus hydnoides* (Buyck 16.068). Field habit. **A.** Fresh young basidiomata showing the strongly fibrillose-hydnoid pileus. **B.** Same collection two days later, showing more desiccated and dehydrated specimens with disrupted pileus covering.

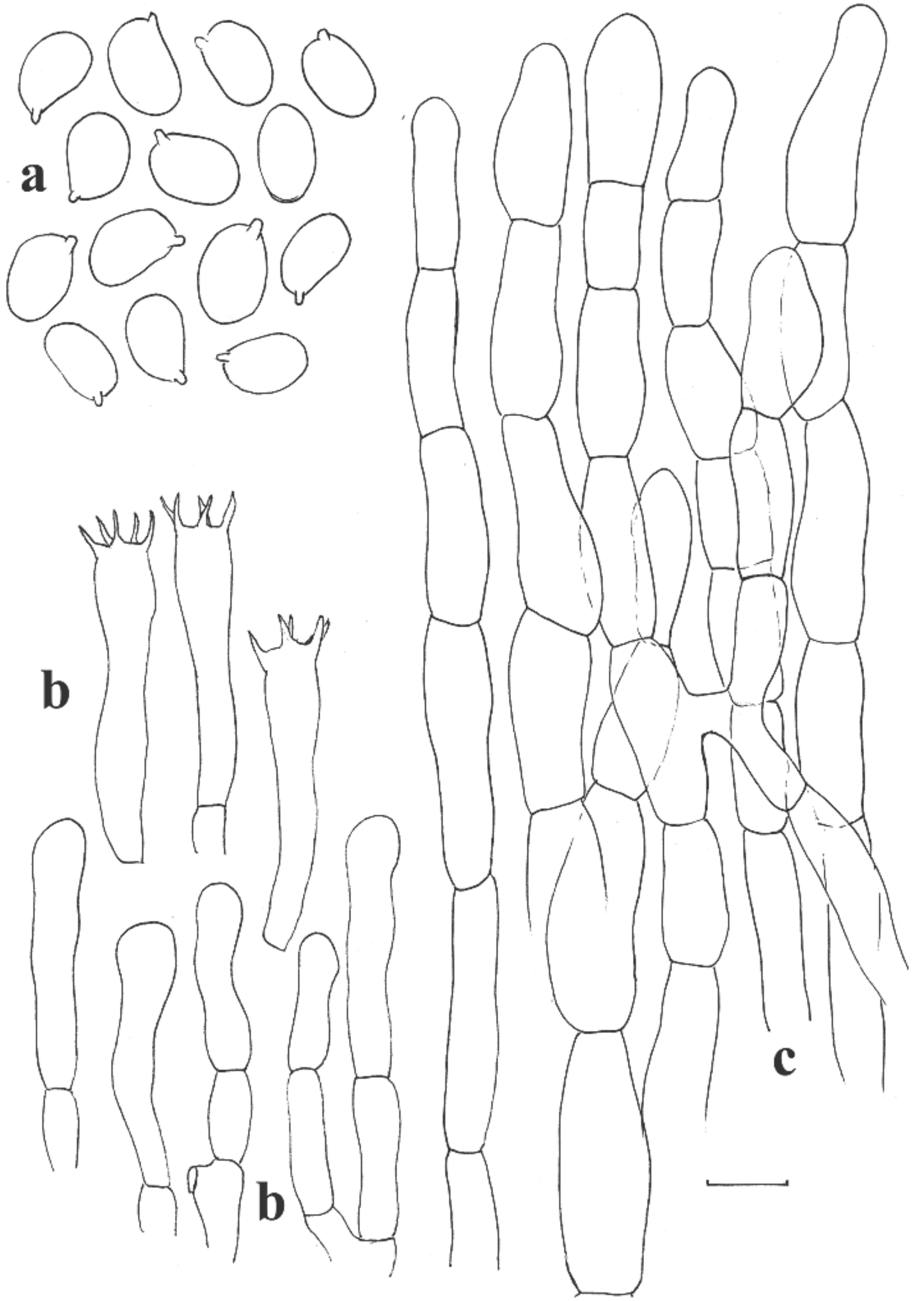

Fig. 6. *Cantharellus hydnoides*. Microscopic features: **a.** Spores. **b.** Basidia and basidiola. **c**. Hyphal extremities of the pileipellis. Scale bar = 10 µm, but only 5 µm for spores. (Drawings B. Buyck)

some transversal anastomosing veins in between gill folds, at first white but rapidly developing pale yellowish tinges. **Stipe** 10-30 × 2-4 mm, already long and slender when cap is still unopened at its tip, subcylindrical, often bent in its lower part, sometimes somewhat laterally compressed or slightly widening in its upper part, smooth, pale yellowish (slightly more yellow than the hymenophore), becoming hollow with age, at the very stipe base sometimes developing a whitish pubescence. **Context** very thin in cap, yellowing upon handling and with age. **Taste** not observed. **Smell** mild. **Spore print** not obtained.

**Spores** ellipsoid to narrowly ellipsoid, rather small, (5.2)5.5-*5.82*-6.2(6.5) × (3.3)3.5-*3.83*-4.1(4.4) µm, Q = (1.3)1.4-*1.53*-1.6(1.8), smooth. **Basidia** clavulate, 40-53 × 7-8 µm, (2-4)5(6)-spored. **Cystidia** none, **Subhymenium** short-celled but without strongly inflated subhymenial cells. **Pileipellis** forming fasciculated groups of densely septate hyphal terminations that are thin-walled, mostly 5-15 µm diam., composed of subcylindrical to slightly inflated cells; the terminal cell obtuse rounded, quite variable in form and rather short, mostly approx. 20-40 µm long. **Clamp connections** absent.

*Additional examined and sequenced specimens*: CENTRAL AFRICAN REPUBLIC. Dzanga-Sangha Forest Reserve, near Bayanga, in Bai-Hakou base camp, N 02.859934- E 16.467492, under monospecific upper story *Gilbertiodendron dewevrei* forest, on bare sandy soil, 19 May 2016, Buyck 1652/16.068 (PC 0713887), Buyck 1653/16.069 (PC 0713888), Buyck 1654/16.073 (PC 0713889); ibid., 21 May 2016, Buyck 1661/16.088 (PC 0713890).

*Commentary*: The African continent harbors presently by far the highest diversity of chanterelles (Buyck 2016) and many species continue to be described (De Kesel *et al.* 2016), facilitated by the first epitypifications of the earliest described species from Africa (Buyck *et al.* 2016a,b,e). The here presented new chanterelle is unlike any other known chanterelle because of the very strongly fribrillose-strigose cap surface becoming distinctly hydnoid in the center. Our phylogeny, based on Tef-1 sequence data, places this new species with significant support in *Cantharellus* subg. *Rubrinus* sect. *Heinemannianus*, which is in agreement with the absence of clamp connections and the overall small size. We have also found few specimens that were distinctly more colored having brightly yellowish orange stipe and cap surfaces, and with the pigment clearly descending in the context immediately underneath the surface. These more colored forms are more reminiscent of – or in line with – the predominantly orange-red pigments that are characteristic for most other species that compose this section.

*Cantharellus hydnoides* is here phylogenetically sister with high support (92% MLBS) to a clade of three close relatives, viz. the recently epitypified *C. alboroseus* Heinem. from the Central African rain forest (see Buyck *et al.* 2016a), *C. humidicolus* Buyck & V. Hofstetter from the Zambezian woodlands and the Malagasy *C. ibityensis* Buyck & V. Hofstetter, all of which are very different in their field aspect (Buyck *et al.* 2014). In contrast to their very different field habit, the microscopical features of these various species are very similar.

## 24. ***Hydnum aerostatisporum*** Buyck, Lewis & V. Hofstetter **sp. nov**. **Figs 7-9**

*MycoBank*: MB 820498.

*GenBank*: KY800344 (ITS holotype), KY800343 (ITS paratype).

*Systematic position*: Basidiomycota, Agaricomycotina, Cantharellales, Hydnaceae.

*Etymology*: named for the particular spore shape, the latin "*aerostatum*" meaning air-ship, also refers to a hot-air balloon.

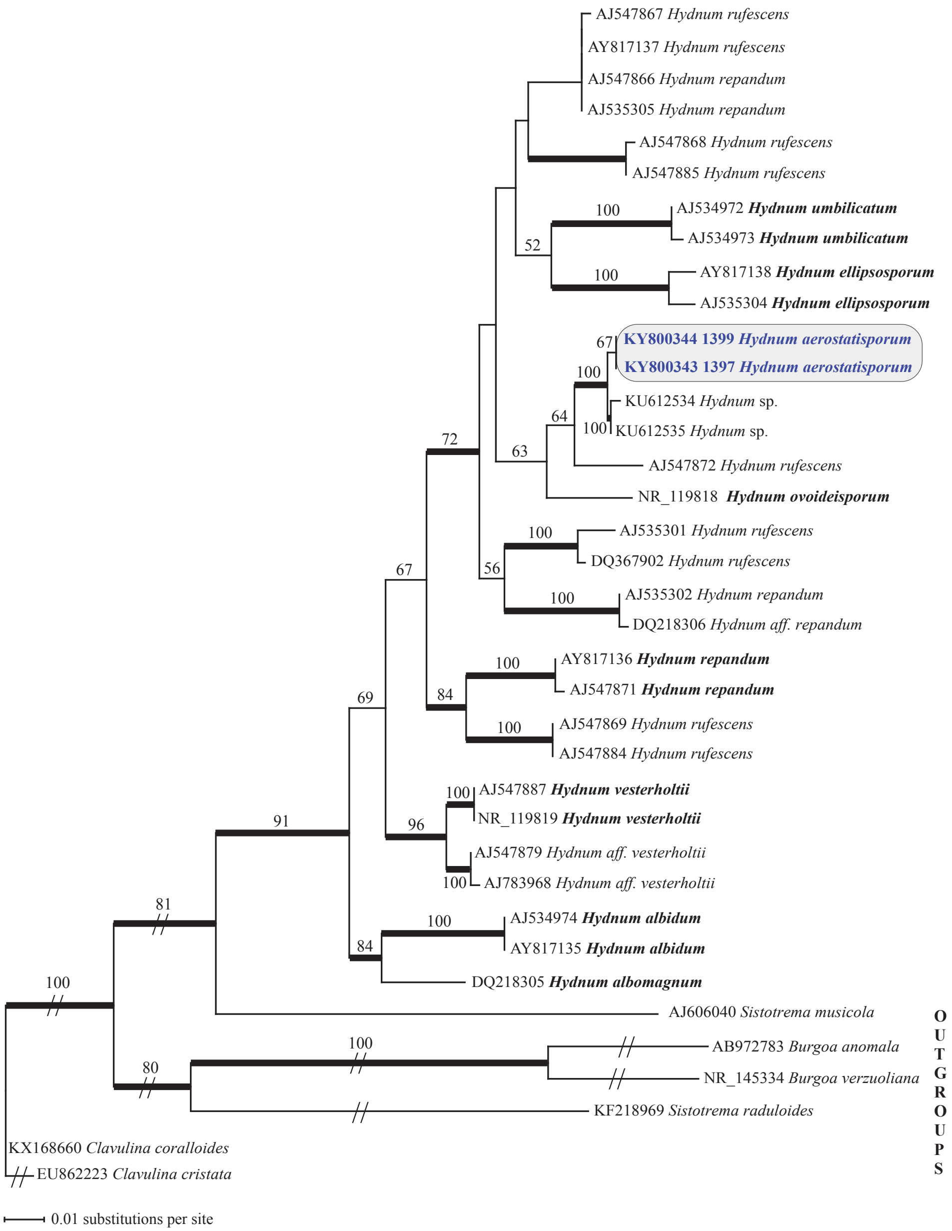

Fig. 7. *Hydnum aerostatisporum*. ITS phylogeny inferred from a 37 sequences dataset (-ln = 2897.89457). Taxon sampling included 31 *Hydnum* and six outgroups sampled in genera *Sistotrema*, *Burgoa* and *Clavulina* (alignment length = 490 characters after exclusion of ambiguously aligned regions). Phylogenetic analyses were conducted in PhyML v2.4.4 (Guindon & Gascuel, 2003), under a GTR evolutionary model, with proportion of invariable sites estimated during search, a number of substitution categories= 4, a gamma distribution parameter = 1.0 and optimizing the topology, the branch lengths and rate parameters of the starting tree. Bootstrap values were estimated based on 200 replicates and considered significant when ≥ 70% (Alfaro *et al.*, 2003). Supported branches and newly deposited sequences are in bold.

*Diagnosis*: differs from *Hydnum rufescens* in the more robust stature, geographic occurrence and principally in sequence data obtained from ribosomal ITS.

*Holotype*: UNITED STATES OF AMERICA. Texas. Polk Co., Big Thicket Natural Preserve, Big Sandy Creek Unit, Beaver slide trail, N 30.61586 – W 094.670594, 4 July 2014, Buyck 14.156 (PC0142475).

**Cap** 35-85 mm diam., circular to almost reniform in outline, young convex, becoming later often strongly depressed in the center, fleshy, somewhat uneven,

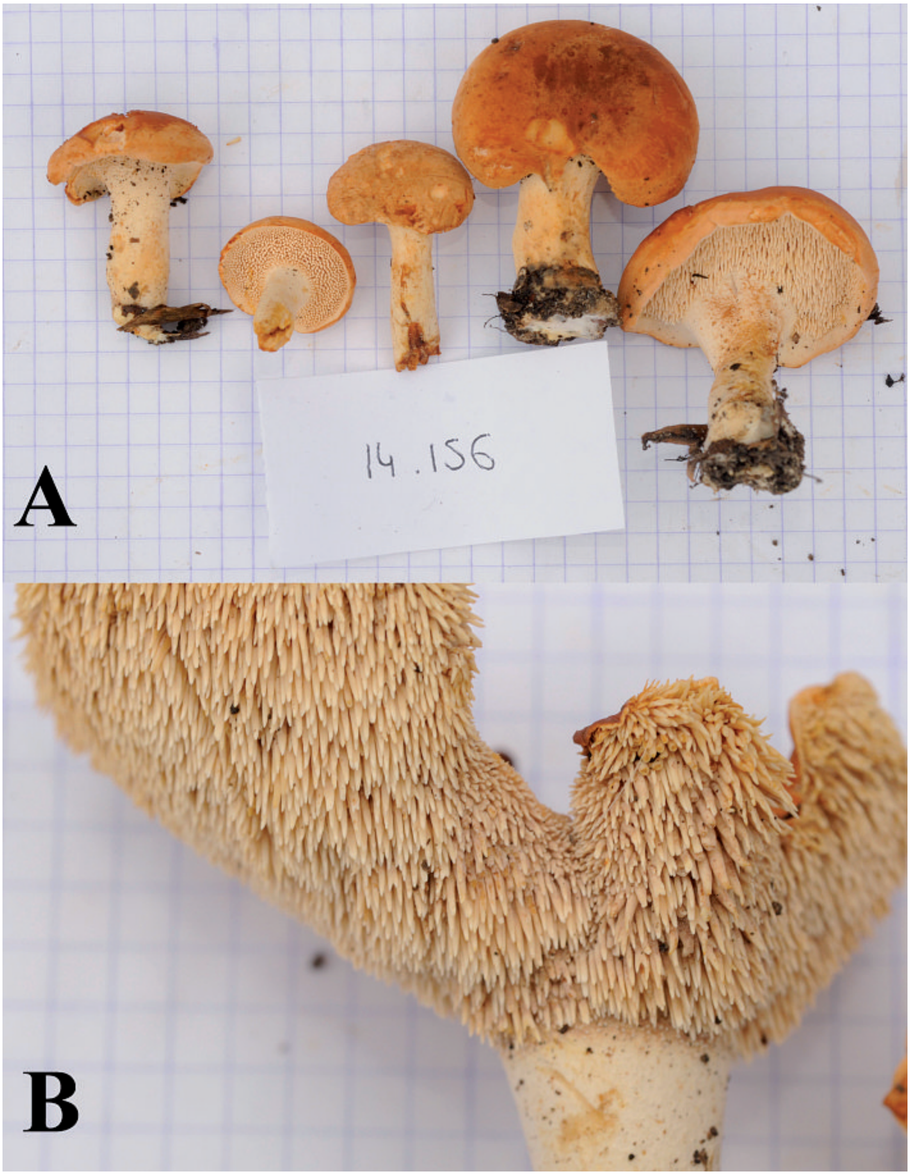

Fig. 8. *Hydnum aerostatisporum*. Field habit. **A.** holotype, **B.** paratype. Photos B. Buyck.

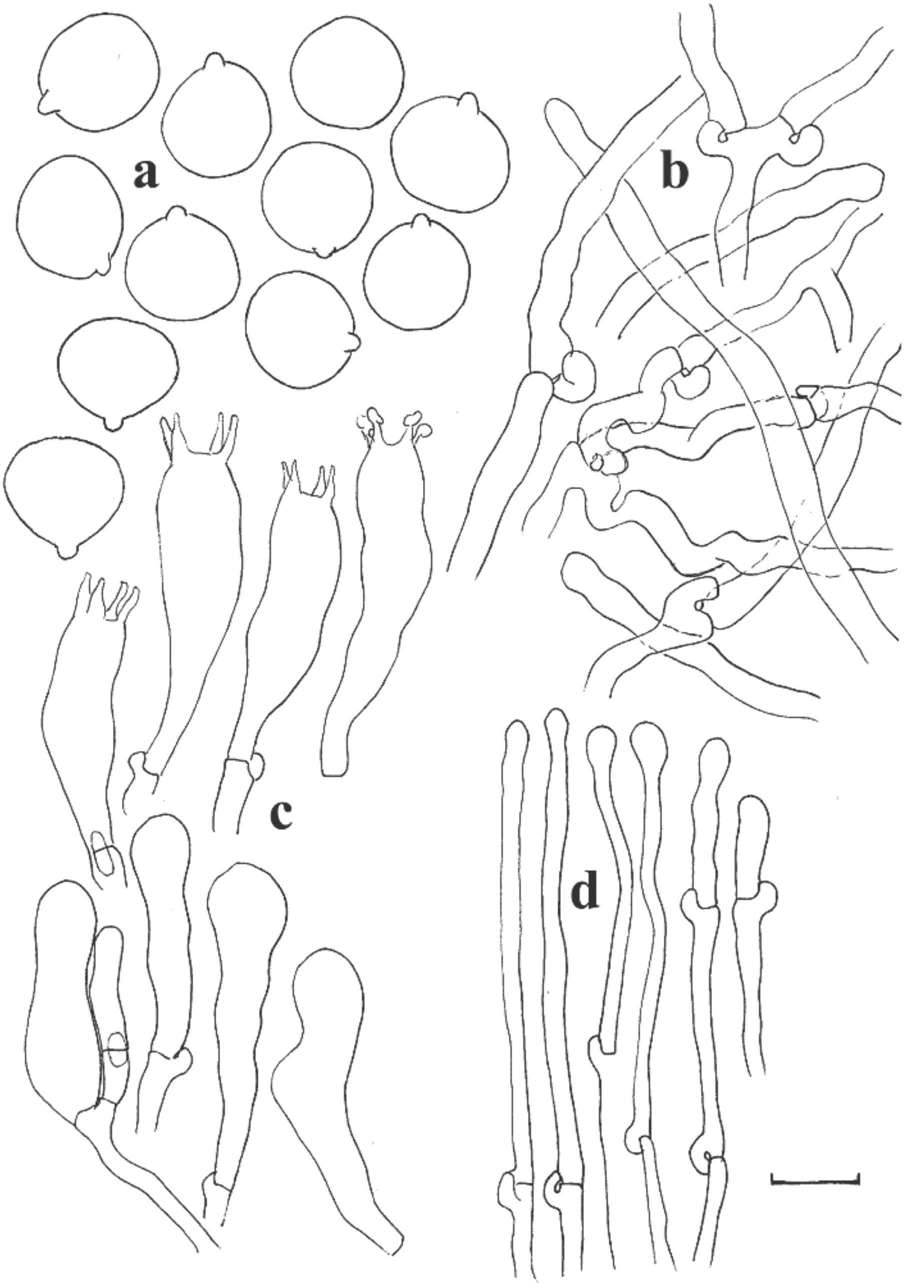

Fig. 9. *Hydnum aerostatisporum* (holotype). Microscopic features: **a.** Spores, **b.** Hyphal extremities of the pileipellis, **c.** Basidia and basidiola, **d.** Hyphal extremities of the sterile hymenophore tips. Scale bar = 10 µm, but only 5 µm for spores. (Drawings B. Buyck)

surface smooth, dull, a warm yellowish brown (Methuen 6C6-8) and with more reddish brown (Methuen 7C6-7) spots when injured or touched. **Hymenophore** smooth when immature, than gradually and centripetally becoming hydnoid, composed of spines up to 4(-6) mm long, when full-grown narrowly subcylindrical and slowly tapering in the upper half, younger spines becoming shorter, more conical toward the cap margin and finally merely represent warty outgrowths, off-white, then isabelline in color with locally faint pinkish tinges, yellowing upon injury. **Stipe** 27-74 × 10-25 mm, central to clearly eccentric, slightly inflating near the base of close to the hymenium or on both sides, smooth but under a hand lens and especially toward the base finely felty-cottony, often developing white mycelium at soil contact, just beneath the hymenophore also bearing some poorly developed to almost warty hymenophore extensions but whithout the hymenophore being distinctly decurrent at cap maturity, compact and firm. **Context** up to 12 mm thick in the cap above the hymenophore-stipe transition, off-white, faintly yellowing in the lower part of the stipe. **Spore print** whitish.

**Spores** globose to subglobose, circular in front view but dorsally often more or less flattened towards a rather centrally placed apiculus, thus reminding the form a classic hot air balloon, (7.1)7.3-*7.69*-8.1(8.5) × (6.5)6.7-*7.07*-7.5(7.9) µm, Q = 1.0-*1.09*-1.1(1.2), smooth, with a voluminous and prominent apiculus. **Basidia** 30-47 × 9-11 µm, clavate, often a bit undulate in outline and strongly tapering toward a remarkably narrow base which is only 3-4 µm wide, clamped, predominantly four-spored, near the spine tips also 1-2-3-spored; sterigmata 4-6 µm long. **Hymenial cystidia** not observed. **Hyphal endings of sterile spine apices** densely running in parallel, cylindrical and very narrow, 2-3 µm diam., thin-walled, clamped, becoming gradually more inflated at their very tips with incrementing distance from the spine tip, without crystals. **Pileipellis** composed of strongly branching, cylindrical, thin-walled hyphal extremities structured in a loose cutis, mostly 4-5 µm diam., often twisting or undulate and with very obvious clamp connections, rounded at the tips.

*Additional examined material*: UNITED STATES OF AMERICA. Texas. Polk Co., Big Sandy Creek Unit, Beaver slide trail, N 30.61586 – W 094.670594, 4 July 2014, Buyck 14.154 (PC0142474).

*Commentary*: *Hydnum* resembles *Cantharellus* not only genetically, but it also shares with it the paucity of taxonomically useful characters that allow for morphological identification of the various species. Although many species names have been published in the genus, most of these have since been transferred to unrelated clades on the basis of microscopic features. As in *Cantharellus*, macroscopic features (basidioma habit, pileus color, presence of umbilicus on the pileus, shape and attachment of spines and central or eccentric position of the stipe) have traditionally been the sole criteria used in species delimitation of *Hydnum* as microscopic features are few and their variation limited. Nevertheless, species delimitation based on sequence data suggests that calculating mean values for length-width ratio of the spores can also provide taxonomically informative data (Olariaga *et al.* 2012).

Compared to *Cantharellus*, *Hydnum* is a species-poor genus and, merely a few years ago, Olariaga *et al.* (2012) estimated the accepted number of *Hydnum* species to be no more than ten species worldwide. As in *Cantharellus* (e.g. Buyck *et al.* 2016c,d), the use of sequence data has strongly impacted species delimitation and the most recent phylogeny of *Hydnum* recognizes now 31 phylogenetic species worldwide (Feng *et al.* 2016). In America, three published *Hydnum* species are presently accepted in the genus: *H. albidum* Peck, *H. albomagnum* Banker and *H. umbilicatum* Peck, while *H. sulcatipes* Peck is generally listed as later synonym of the European *H. rufescens* Pers. The latter synonymy, however, is far from certain considering the molecular diversity recently exposed in this species complex. Yet, the latter name is not discussed in recent papers (Olariaga *et al.* 2012, Feng *et al.* 2016; Vizzini *et al.* 2013). Our phylogeny places our new species close to *H. rufescens* in a clade that is here recovered as sister to *Hydnum* Sp 4 in Feng *et al.* (2016), represented by two very similar sequences, both from much more northern parts of the United States (Fig. 7). Among the accepted *Hydnum* names from the United States, only *H. sulcatipes* appears to have a similar overall color as our species, but it corresponds to a much smaller and more slender species, 2-3 cm diam., indeed comparable to European *H. rufescens*.

**25. *Lactarius rajmahalensis*** Hembrom, K. Das & A. Parihar, **sp. nov. Figs 10-13**

*MycoBank*: MB819865.

*GenBank*: KY568700 (ITS).

*Systematic position*: Basidiomycota, Agaricomycetes, Russulales, Russulaceae.

*Etymology:* Referring to the Rajmahal hills of the state Jharkhand (India), the type locality.

*Diagnosis*: Distinct from all the known angiocarpous species of *Lactarius* by combination of the following characters: exudation of a watery white to semen-like latex which becomes slowly pale yellow on the exposed gleba, absence of macrocystidia and large basidiospores (9-*11.3*-14 × 9-*11.2*-14 µm) with very high ridges (2.5-3.5 µm) and some isolated warts creating a winged pattern of ornamentation.

*Holotype*: INDIA, Jharkhand, Rajmahal hills, Sahibganj-district, Borio-block, Dhogoda santhali forest area, south to Teenpahar Borio road, 25°02′22.3″N 87°39′03.9″E, alt. 105 m a.s.l., on the soil in the shade of *Desmodium pulchellum* (L.) Benth. growing below *Shorea robusta* C.F. Gaertn., 08 Nov. 2016, *M.E. Hembrom, MEH* 69942 (**holotype** CAL 1508).

**Basidiomata** terrestrial, humicolous, angiocarpous, semihypogeous, solitary to gregarious on the forest floor, 18-35 × 10-30 × 10-30 mm, globose to subglobose to even irregular shaped (potato like due to lobes), tough leathery to solid in consistency when fresh, hard and brittle on drying. **Peridium** glabrous, chamois-leather like, dry, greyish yellow-Champagne (4B3-4) and dark blonde (5D4) near the base adjacent to soil. **Stipe** absent. **Columella** absent. **Gleba** strongly labyrinthuloid, with small loci prominently visible in mature basidiomata but indistinct in young basidiomata, gelatinous veins between the loci, concolorous with peridium, orange grey (5B2), unchanging with $FeSO_4$, but, turning fawn (brown) (7E4) with KOH. **Latex** immediately exuded upon bruising in fresh basidiomata but absent with drying or in older basidiomata, initially semen-like or watery white but turning slowly pale yellow (3A3) on cut surface. **Taste** slightly acrid. **Smell** indistinct while on cutting pleasant (slightly mushroom like).

**Basidiospores** 9-*11.3*-14 × 9-*11.2*-14 µm, Q = 1.00-*1.00*-1.07 globose to subglobose; ornamentation amyloid consisting mainly of very high (often branched) ridges and few isolated warts giving a winged pattern of ornamentation; under SEM, ridges 2.5-3,5 µm high, thick, often with undulated surface; long warts up to 1.8 µm high, spinoid; short warts up to 0.5 µm high, conical. **Basidia** 30-60 × 6-15 µm, 2-4 spored, subcylindrical to clavate, but irregular and wrinkled mostly; sterigmata 4-10 × 1.5-3 µm. **Macrocystidia** absent. **Pseudocystida** present, with dense granular fibrillose contents, projected slightly beyond hymenium. **Peridiopellis** 120-150 µm thick, an ixotrichodermis, composed to mostly septate, erect, branched, compactly arranged, thin-walled, interwoven hyphae submerged in a thin slime layer; hyphae 1-3 µm wide, in some hyphae terminal cells with irregular projection. **Trama** composed of abundant lactiferous hyphae often branched, thin-walled with dense crystalloid contents.

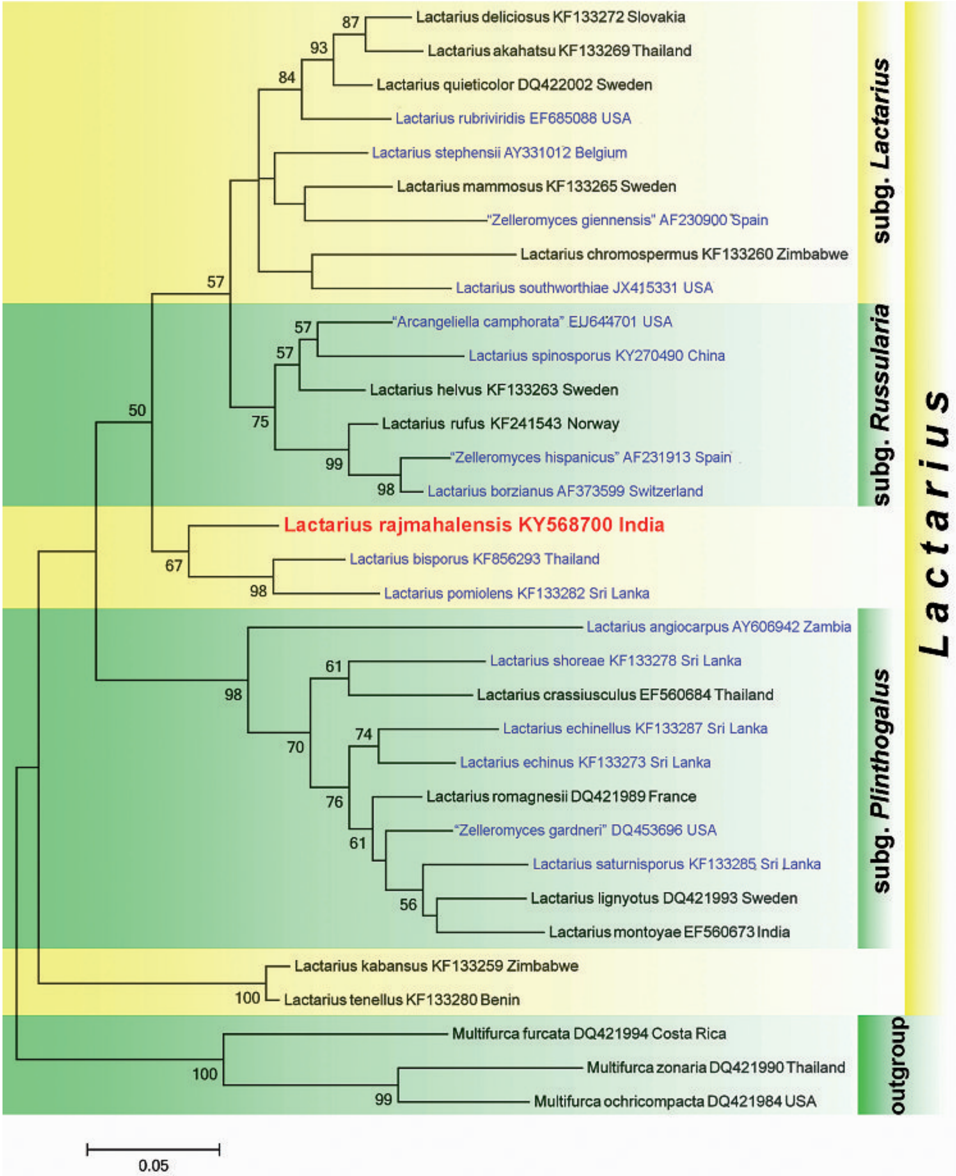

Fig. 10. Maximum Likelihood phylogeny of *Lactarius* showing the position of *L. rajmahalensis*. Bootstrap values are indicated on the branches. Three *Multifurca* species were used as outgroup. ITS sequences were aligned with the online version of MAFFT v. 7 (Katoh & Toh, 2008), using the E-INS-I strategy. Trailing ends of the alignment were trimmed in BioEdit version 7.0.9.0 (Hall, 1999). Maximum Likelihood (ML) analyses were conducted with MEGA7 (Kumar *et al.*, 2016).

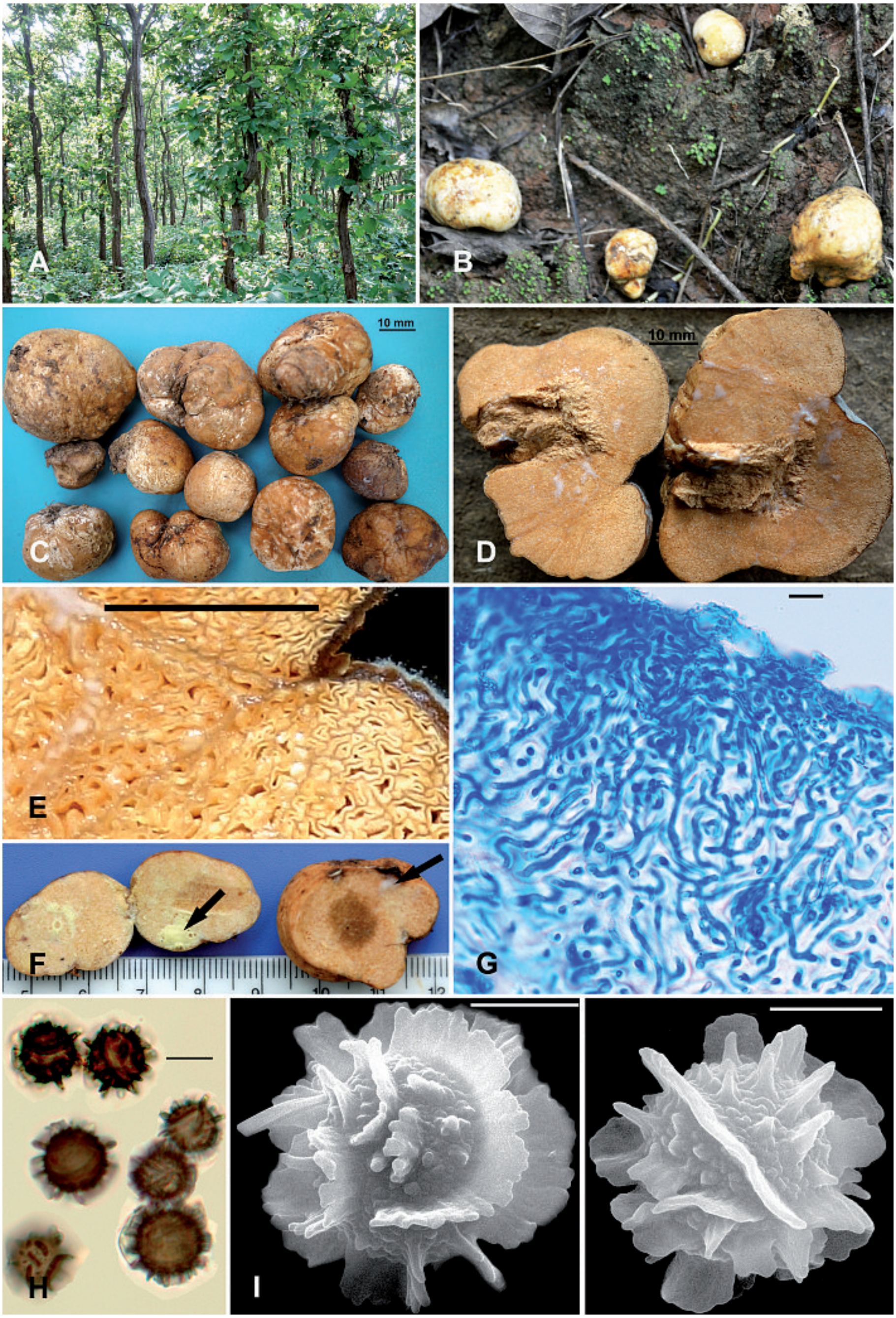

Fig. 11. *Lactarius rajmahalensis* (holotype). **A.** Habitat. **B.** Habit. **C.** Basidiomata showing size variation. **D.** Transverse Section of basidiomata with latex. **E.** Section of basidiomata showing prominent loci. **F.** Color variation of latex and color changes with KOH. **G.** Section through Peridiopellis. **H.** Basidiospores under Light microscope. **I.** Basidiospores under SEM. Scale bars: C, D = 10 mm, E = 5 mm, G, H = 10 µm, I = 5 µm.

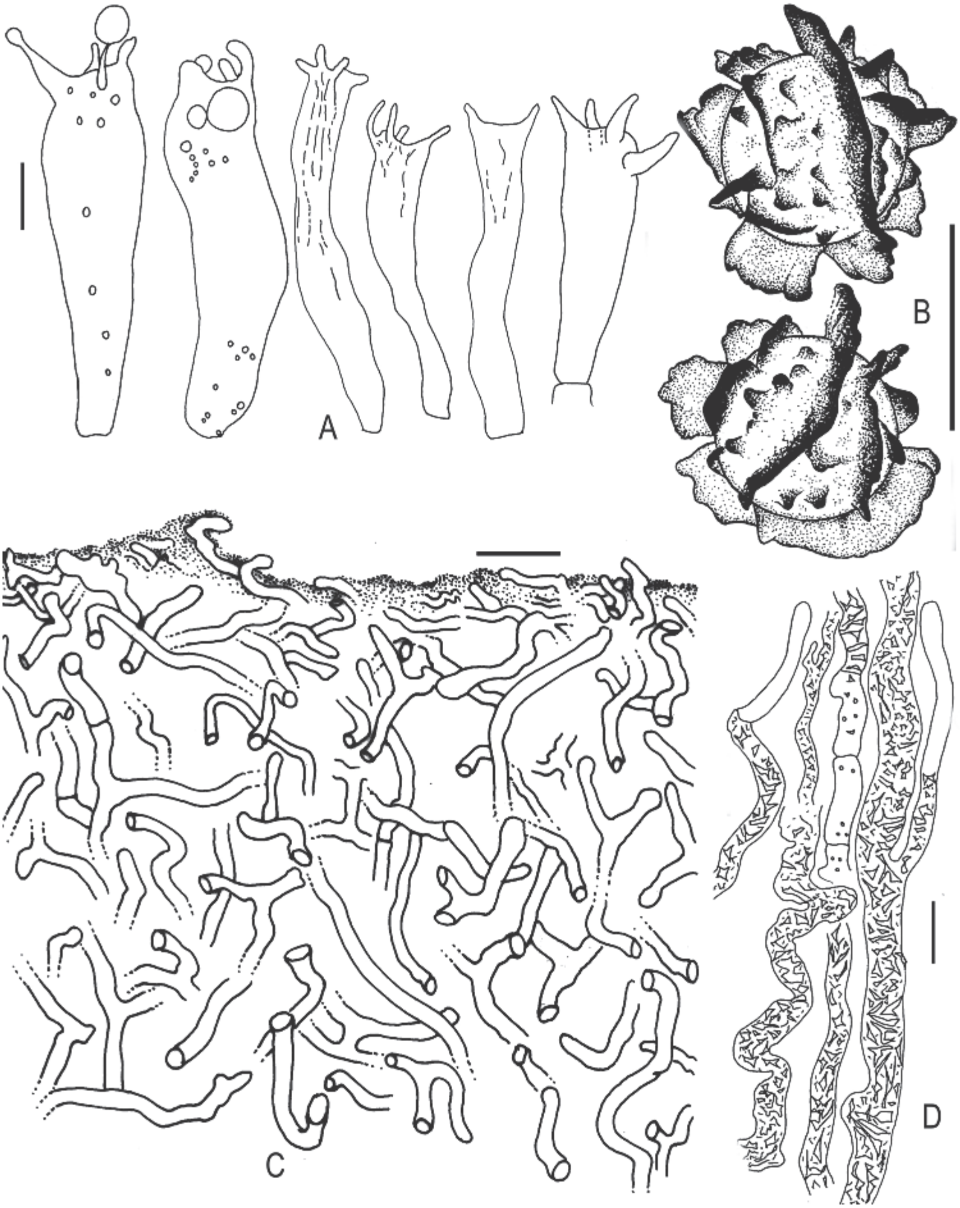

Fig. 12. The line drawings from a cross section of the basidiomata of *Lactarius rajmahalensis* (holotype). **A.** Basidia. **B.** Basidiospores under SEM. **C.** Peridiopellis. **D.** Lactiferous hyphae. Scale bars: A, C, D = 10 µm, B = 5 µm.

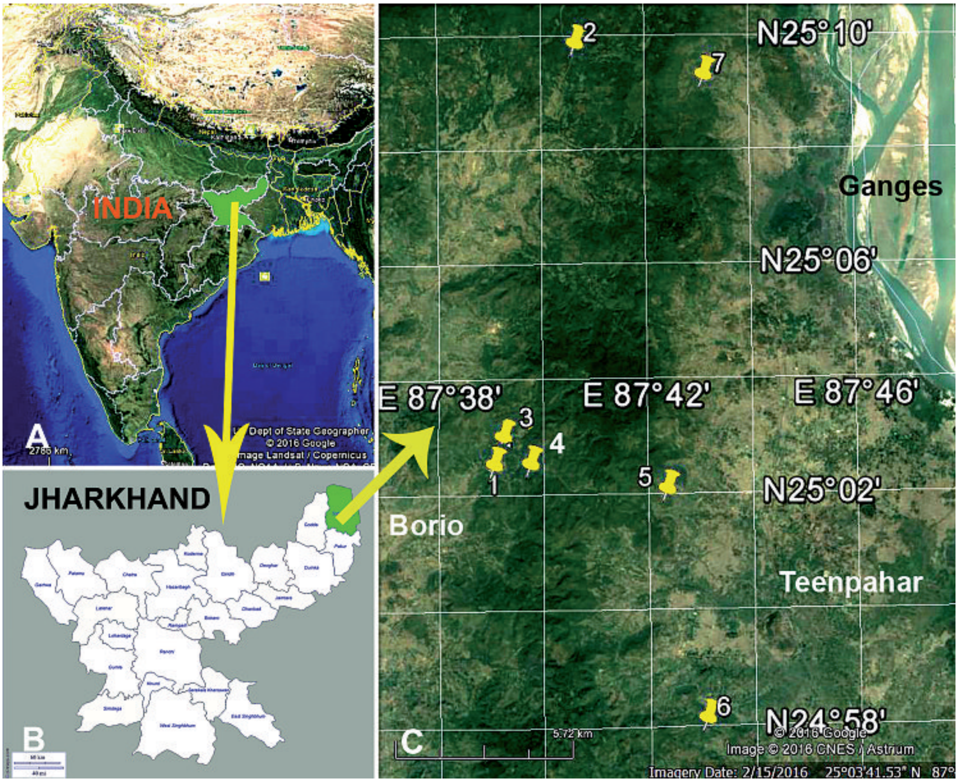

Fig. 13. Distributional map of *Lactarius rajmahalensis*. **A.** Location of Jharkhand state in India. **B.** Location of the Rajmahal hills in Jharkhand. **C.** Different collection sites of *Lactarius rajmahalensis* (shown with the yellow pointer) from the Rajmahal hills. Map is created with the help of Google Earth (www. google.com/earth).

*Additional examined materials*: INDIA, Jharkhand, Rajmahal hills, Sahibganj-district, Borio-block, West to Borio-Sahibganj road, behind Pir-Baba forest area, 113 m a.s.l., 25°09′37.6″N 87°40′37.4″E, on the soil under the shade of *Shorea robusta*, 23rd August 2013, *M.E. Hembrom*, MEH-13-080; ibid., Dalabari village forest, 109 m a.s.l., 25°02′46.3″N 87°39′08.4″E, on the soil under the shade of *Shorea robusta*, 6th September 2014, *M.E. Hembrom*, MEH-14-07; ibid., Dhogoda paharia burial west to Teenpahar-borio road, Taljhari-block, 129 m a.s.l., 25°02′18.1″N 87°39′39.6″E, on the soil under the shade of *Shorea robusta*, 13th October 2016, *M.E. Hembrom*, 69910; ibid, Brindaban-panchayat, Joshkuti rakha bir, 63 m a.s.l., 25°01′51.1″N 87°42′15.8″E, on the soil under the shade of *Shorea robusta*, 25th September 2014, *M.E. Hembrom*, MEH-14-13; ibid, Durgapur-Panchayat, Bangriya forest area towards dam, 86 m a.s.l., 24°07′54.0″N 87°42′59.0″E, on the soil under the shade of *Shorea robusta*, 17th October 2016, *M.E. Hembrom*, MEH-16-11; ibid, Karanpurato-panchayat, Karanpurato forest area, 61 m a.s.l., 25°09′04.3″N 87°43′02.6″E, on the soil under the shade of *Shorea robusta*, 5th November 2016, *M.E. Hembrom*, 69925.

*Commentary*: Our ITS-based ML phylogenetic analysis (Fig. 10) with 33 sequences (including the sequence derived from the present undescribed species) resolves the genus *Lactarius* (with all three traditional subgenera: *L.* subg. *Lactarius*, *L.* subg. *Russularia* and *L.* subg. *Plinthogalus*) with low support. ITS does not allow to delimit subgenera very well. Subgenus *Plinthogalus* and subg. *Russularia* are supported, whereas subg. *Lactarius* (as reported in various previous studies, such as Verbeken *et al.*, 2014a-b) does not receive significant bootstrap support. Similar to the phylogenetic results of Verbeken *et al.* (2014a), we also found that the members of *Zelleromyces* and *Acrangeliella* actually belong to the genus *Lactarius*. The result of our analysis (Fig. 10) also confirms that angiocarpous species (shown in blue font) are placed in all three major clades, as shown previously by Verbeken *et al.*, 2014a & b. The new Indian angiocarpous species *L. rajmahalensis* (shown in bold and red) does not fall in any one of the three traditionally recognized subgenera (of the genus *Lactarius*). It clusters with low bootstrap support with 2 angiocarpous species described from Asia, *L. bisporus* Verbeken & F. Hampe and *L. pomiolens* Verbeken & Stubbe.

Morphologically, some Asian angiocarpous species of *Lactarius,* namely *L. pomiolens*, *L. shoreae* Stubbe & Verbeken, *L. saturnisporus* Verbeken & Stubbe, *L. bisporus*, *L. echinellus* Verbeken & Stubbe, *L. spinosporus* X.Y. Sang & L. Fan and *L. echinus* Stubbe & Verbeken resemble the present Indian species in the field. But *L. bisporus* (reported from Thailand), *L. spinosporus* (reported from China), *L. echinellus* and *L. echinus* (both reported from Sri Lanka) are easily separated from *L. rajmahalensis* by their white latex (watery white and semen-like in the present new species) and echinulate to spinose ornamentation of basidiospores (Verbeken *et al.*, 2014a & b; Sang *et al.*, 2016). Moreover, *L. bisporus* shows the presence of macrocystidia (absent in the present species), *L. spinosporus* has a different peridiopellis type (ixotrichodermis in *L. rajmahalensis* while palisade to trichopalisade pattern of subpellis in *L. spinosporus*), *L. echinellus* has distinguishingly small basidiospores (6.8-*7.4-7.8*-8.6(8.8) × (5.8)6.0-*6.4-6.6*-7.1 µm) whereas, *L. echinus* has a different pattern of peridiopellis i.e. palisade to trichopalisade (Verbeken *et al.*, 2014a & b; Sang *et al.*, 2016). Like *L. rajmahalensis*, the remaining three species (*L. pomiolens*, *L. shoreae*, *L. saturnisporus*), all reported from Sri Lanka also have ridged basidiospores with a winged ornamentation pattern. But, *L. pomiolens* has white latex and abundant macrocystidia (absent in *L. rajmahalensis*); *L. saturnisporus* (that also possesses hyaline latex) has smaller basidiospores (8.0-*8.9*-9.7 × 7.6-*8.3*-9.0 µm), rather abundant macrocystidia and a different pattern of peridiopellis (trichopalisade), whereas *L. shoreae* has white latex, smaller basidiospores (7.9-*9.1*-10.3 × 7.6-*8.7*-9.9 µm) and an interwoven palisade to trichopalisade pattern of peridiopellis (Verbeken *et al.*, 2014a & b).

Other angiocarpous species [known as *Arcangeliella lactifera* (B.C. Zhang & Y.N. Yu) J.M. Vidal, *A. densa* (R. Heim) Singer & A.H. Sm., *Zelleromyces ramispinus* (B.C. Zhang & Y.N. Yu) Trappe, T. Lebel & Castellano, *Z. sinensis* B. Liu, K. Tao & Ming C. Chang and *Martellia nanjingensis* (B. Liu & K. Tao) J.M. Vidal.] reported from southeast Asia may also be confused with the present novel species. But in *A. lactifera*, *Z. ramispinus*, *M. nanjingensis* and *A. densa* basidiospores are echinulate (never winged) to spinoid. In *Z. sinensis* ridges on basidiospores are significantly lower, viz. 0.5-1.5 µm high (Verbeken *et al.*, 2014b).

### 26. ***Russula pseudoaurantiophylla*** Buyck & V. Hofstetter, ***sp. nov.*** **Figs 14-20**

*MycoBank*: MB 820499.

*GenBank*: KY800354 (ITS holotype), KY800356-KY800358 (ITS paratypes).

*Systematic position*: Basidiomycota, Agaricomycetes, Russulales, Russulaceae.

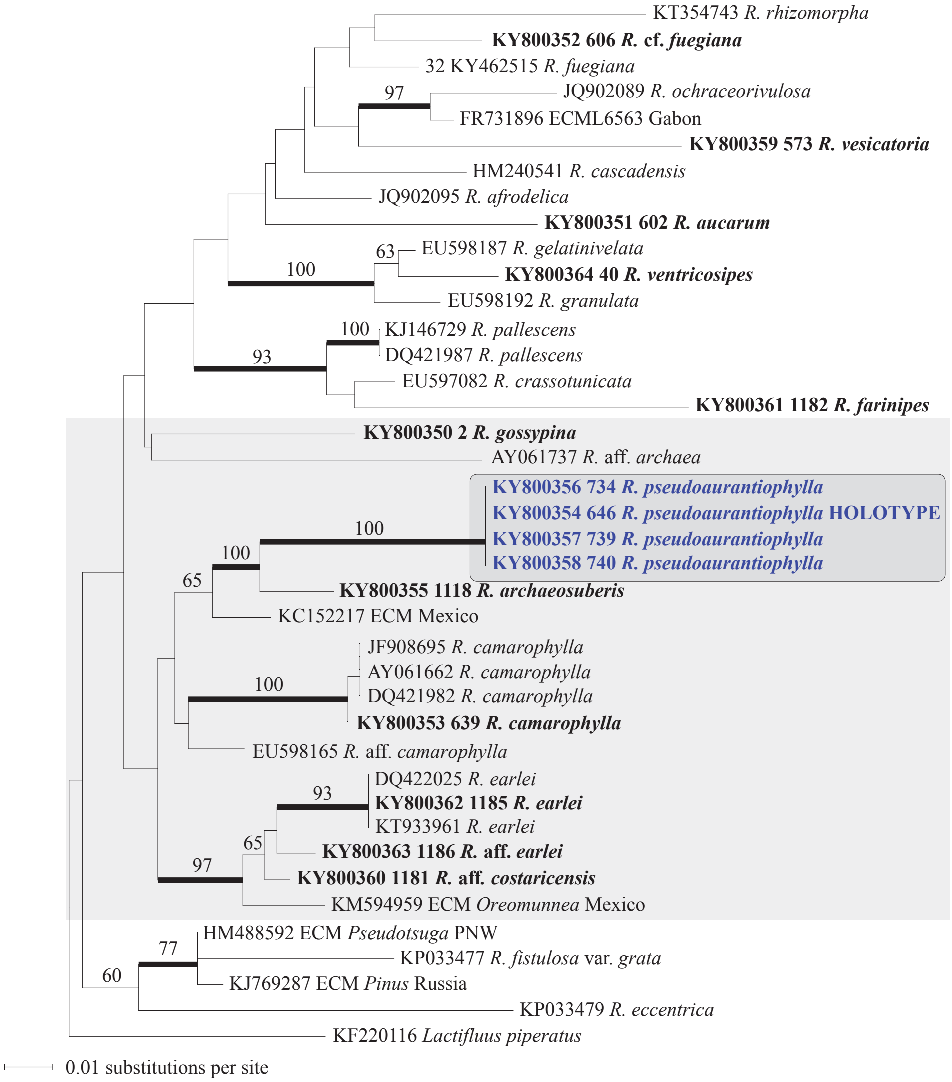

Fig. 14. Phylogeny inferred from an ITS-40 taxa dataset (-ln = -2489.12594; alignment length = 413 characters after exclusion of ambiguously aligned regions). Analyses were conducted in PhyML v2.4.4 (Guindon & Gascuel, 2003) with gaps excluded, under a GTR evolutionary model, with proportion of invariable sites estimated during search, a number of substitution categories = 4, a gamma distribution parameter = 1.0 and optimizing the topology, the branch lengths and rate parameters of the starting tree. Bootstrap values were estimated based on 200 replicates and considered significant when ≥ 70% (Alfaro *et al.*, 2003). Supported branches and newly deposited sequences are in bold. The rectangle delimits species presently assumed to belong in subg. *Archaea*. Outgroup is *Lactifluus piperatus*.

Fig. 15. *R. pseudoaurantiophylla* (holotype). Field habit of young basidiomata. (Photo: B. Buyck)

Fig. 16. *R. pseudoaurantiophylla* (Buyck 09.171). Field habit of old basidiomata showing the color change of cap and gills to orange brown. (Photo: B. Buyck)

*Etymology*: named after its resemblance to another, small-sized New Caledonian endemic, viz. *Multifurca aurantiophylla*, which has a very similar hymenophore when mature.

*Diagnosis*: differs from other Archaeinae, and in particular from the closely related *R. archaeosuberis*, in its much smaller size, strong color change toward orange brown when mature, and sequence data for the ribosomal ITS gene.

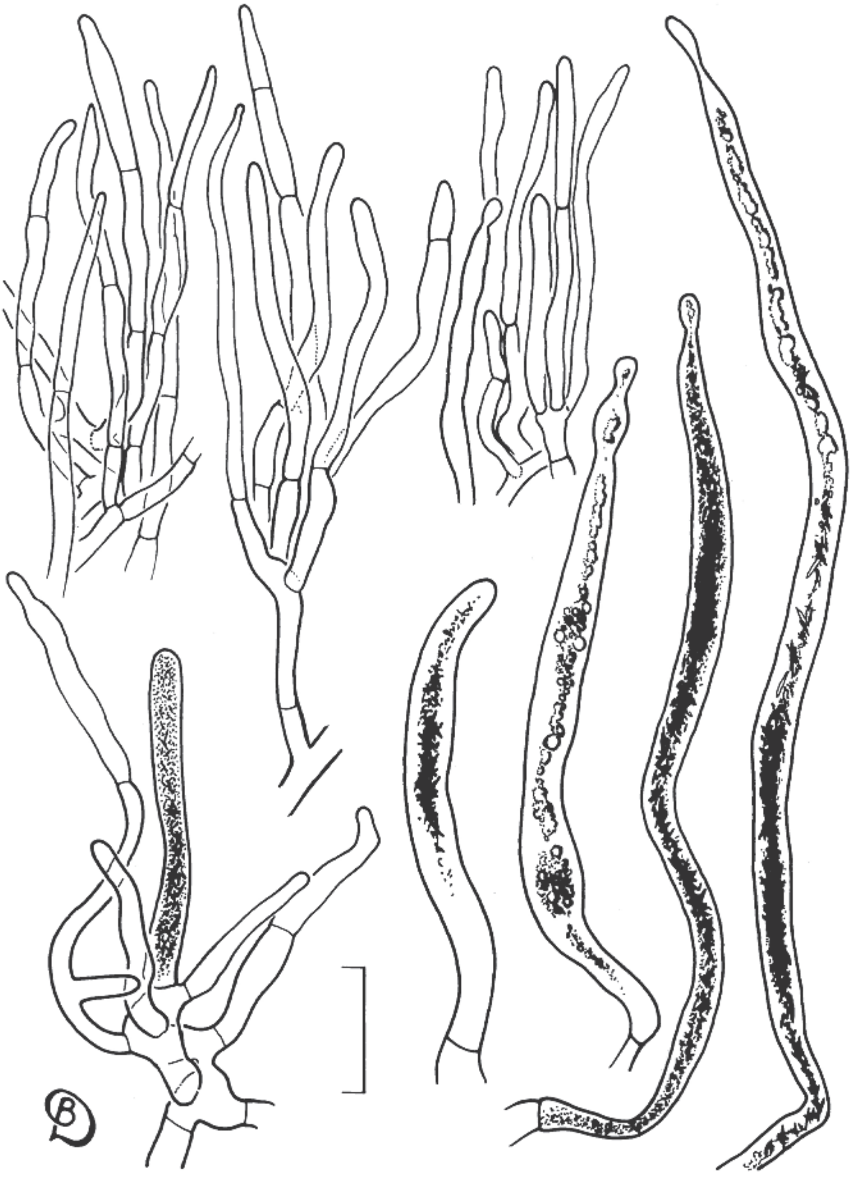

Fig. 17. *R. pseudoaurantiophylla* (holotype). Microscopic features of the pileipellis. Scale bar = 10 µm. (Drawings B. Duhem)

*Holotype*: FRANCE OUTRE MER. New Caledonia. Southern Prov., Les bois du Sud, under *Arillastrum gummiferum* (Myrtaceae), 860 m alt., 30 March 2009, leg. Buyck, Ducousso, Eyssartier & Hofstetter, Buyck 09.223 – DNA extraction nr 646 (PC 0142479).

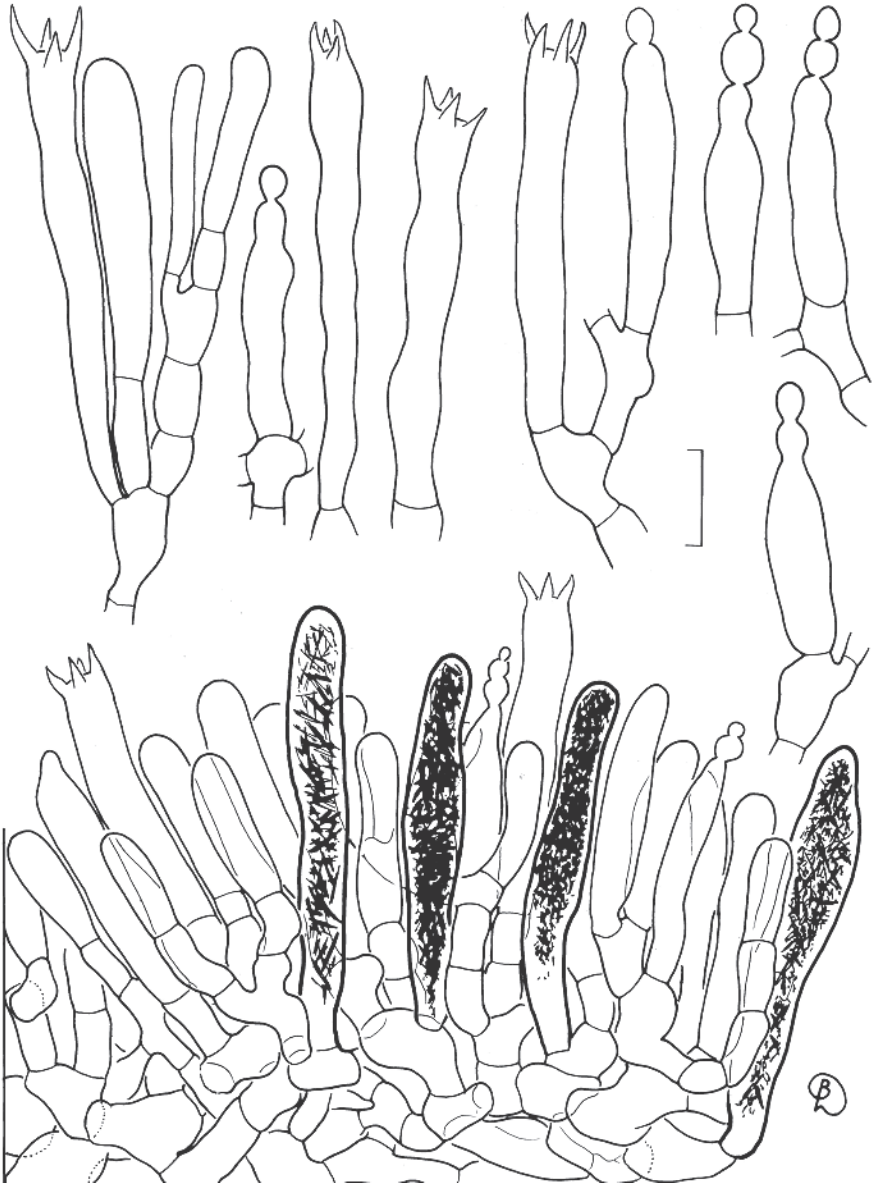

Fig. 18. *R. pseudoaurantiophylla* (holotype). Microscopic features of the hymenium. Notice the strongly capitulate-mucronate cystidia-like cells without contents as opposed to the more deeply inserted clavulate-lageniform hymenial cystidia with SV+ contents. Scale bar = 10 µm. (Drawings B. Duhem)

**Basidiomata** small to very small but firm, loosely dispersed and hardly emerging from the soil surface. **Pileus** up to 30 mm diam., young convex, firm and hard, often wavy – irregular in outline, with smooth, downward to slightly in-rolled margin that is clearly finely velutinous under a hand lens; surface not pealing, smooth, viscose but mostly covered with adhering soil, cream to pale

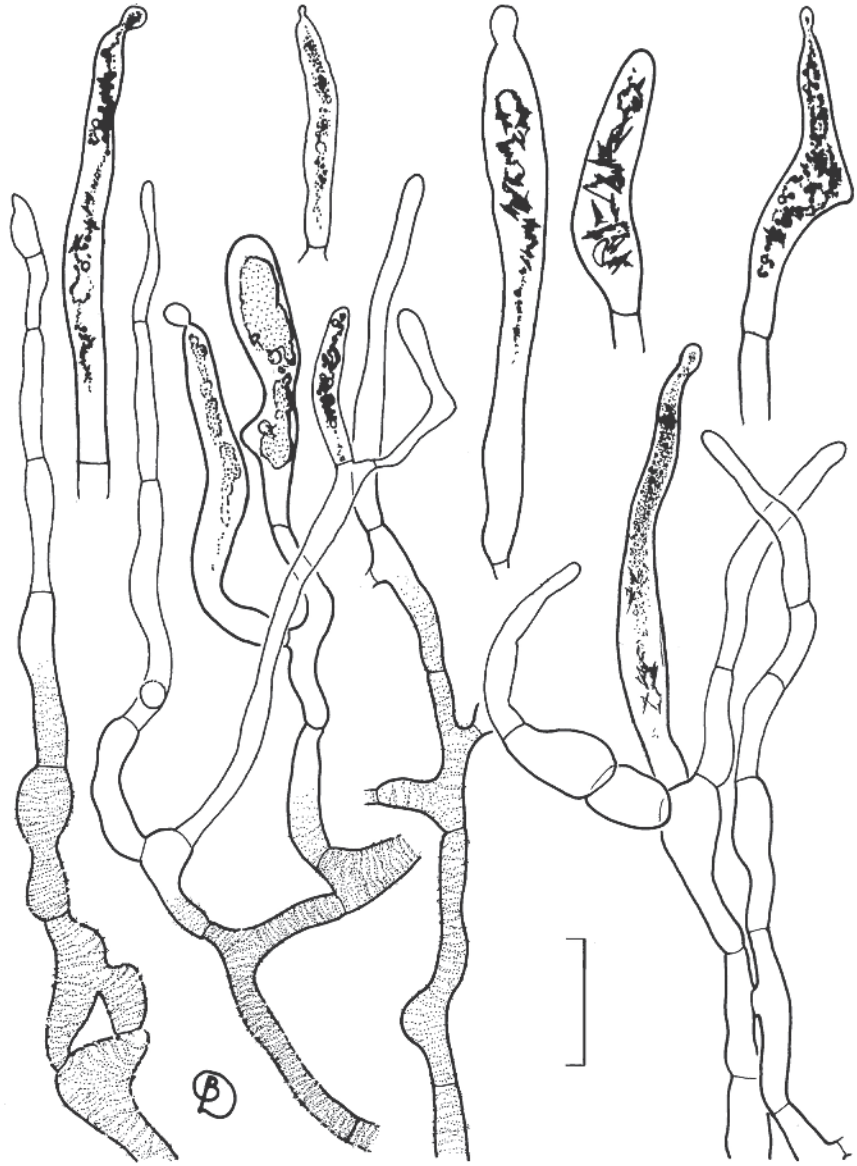

Fig. 19. *R. pseudoaurantiophylla* (Buyck 09.222). Microscopic features of the pileipellis showing the distinctly incrusted and more inflated cells just below the hyphal extremities. Scale bar = 10 µm. (Drawings B. Duhem)

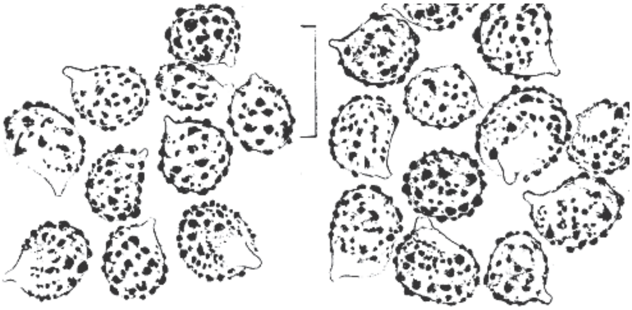

Fig. 20. *R. pseudoaurantiophylla.* Spores from the holotype (on the left) and Buyck 09.171 (on the right). Scale bar = 10 µm. (Drawings B. Duhem)

butter yellow, not zonate, often nearly white at the extreme margin, in age often deeply fissuring exposing the context underneath, becoming orange brown as the gills when humid, glabrous at first sight but becoming scurfy from appressed small squamae that dry out white. **Gills** adnate, up to 5 mm high, very abruptly separated from the stipe surface and not decurrent with a tooth, moderately to widely spaced and remarkably thick considering the small size of the mushroom, unequal with irregularly dispersed, often short lamellulae, some rare forkings occasionally present, at first white, but soon taking a yellow tinge and finally becoming orange ochre like the cap surface; lamella edge blunt, even, concolorous. **Stipe** 10-15(20) × 7-14(19) mm, central to mostly eccentric, shorter than the cap diam., very firm, slightly tapering downwards, subcylindrical but with uneven, furrowed-wrinkled surface, particularly in the lower halve, white but becoming easily dirty from handling, often partly hollowing in upper half. **Context** brittle, 3-5 mm crumble-like in texture, white, then yellowing-browning. **Taste** very acrid. **Smell** indistinct. **Spore print** not obtained, whitish on gills.

**Spores** remarkably small, ellipsoid, (4.4)4.8-*5.18*-5.5(5.8) × (3.3)3.8-*4.03*-4.3(4.4) µm, Q = (1.1)1.2-*1.29*-1.3(1.4), with an ornamentation of mostly isolated, low, obtuse-convex to almost drop-like warts of variable diameter, some of them comma-like or interconnected with short, subtle line connections, but these very few; suprahilar spot not amyloid. **Basidia** 31-39(-48) × 4-5 µm, narrowly cylindrical to faintly clavulate, sometimes somewhat undulate in outline, (1-2-3)4-spored, **Subhymenium** of mostly short, irregularly inflated and strongly intertwined cells. **Hymenial cystidia** extremely abundant, (20-)35-55(-70) × (4)5-7(8) µm, remaining short near the gill edge, thin-walled; most are subcylindrical to faintly clavulate with obtuse-rounded tips and strongly refringent from SV+, coarsely crystalline to needle-like contents, originating deep in the subhymenium, more rarely descending deep into the trama,; less frequently – and usually the shorter ones which do not descend below the upper halve of the subhymenium – having capitulate to pear-shaped appendages or moniliform tips with up to 3 consecutive constrictions and frequently filled with less differentiated contents. **Pileipellis** composed of two ill-delimited layers: subpellis with irregularly inflated elements having strongly zebroid-incrusted walls; suprapellis a loose trichoderm composed of narrowly cylindrical, ramifying and densely septate hyphal extremities; terminal cells slightly narrowing in their upper halve, (10-)15-35(-70) × 3-4 µm, some terminal cells similar in outline to pileocystidia because of their mucronate or subcapitate tip but without contents. Pileocystidia very prominent throughout the whole pileipellis and continuing in the context underneath, the smallest onces occurring at the very cap surface (as usual) and often distinctly mucronate-capitate, usually without septa and of similar diameter as the other terminal elements ; pileocystidia below the pileipellis and in context underneath more irregular in outline or locally inflated, mostly 4-8(11) µm wide, obtuse-rounded at the tip or subapically somewhat constricted, very variable in size, with distinctly incrusted walls and (particularly in *Buyck 09.171*) often with one or more septa. **Clamp connections** absent.

*Additional examined material*: FRANCE OUTRE MER. New Caledonia. Southern Prov., Les bois du Sud, under *Arillastrum gummiferum* (Myrtaceae), 860 m alt., 27 March 2009, Buyck, Ducousso & Eyssartier legunt, in Buyck 09.171 (PC0142413); ibid., 30 March 2009, Buyck 09.222 (PC0142405).

*Commentary*: Subsect. *Archaeinae* Heim 1938 *nom. inval.* was originally described as a monospecific subsection in subg. *Compacta* Fr., incorrectly validated by Romagnesi and later elevated to sect. *Archaeinae* R. Heim ex Buyck & Sarnari (in Sarnari 1998). Recently, *R. archaea* and closely related species were placed in a new subgenus, subg. *Archaea* Buyck & V. Hofstetter (in Hongsanan *et al.* 2015) along with the monospecific Sect. *Gossypinae* Buyck (see Buyck 1999) which is nevertheless very different because of the neither yellowing nor browning but distinctly reddening and then blackening context. An updated overview of the various species attributed to *Archaeinae* was recently given elsewhere (Das *et al.* 2017). Our phylogeny shows that the New Caledonian species is most closely related to the European *R. archaeosuberis* to which it is here placed sister with full support (MLbs=100%). However, as our conservative ITS alignment does not allow for higher support values, subg. *Archaea* is not supported here as a single monophyletic group (Fig. 14).

From the other species of Sect. Archaeinae, our new species stands out microscopically because of the sometimes frequently septate dermatocystidia and the presence of morphologically similar elements that are devoid of any content, both in the hymenium and at the surface of cap and stipe.

The host tree, *Arillastrum gummiferum*, is a monospecific lineage in Myrtaceae, sister to the lineage to has led to the very diverse, extant eucalypts, and is endemic to New Caledonia. Because of lack of reliable fossils and its undistinctive pollen type (Thornhill *et al.* 2015), it is presently almost impossible to determine how and why this species-poor lineage is restricted to its present distribution. However, its recently uncovered ectomycorrhizal habit is decidedly more in favour of scenarios that invoke migration and vicariance rather than long distance dispersal by wind or other means. The few presumed associated ectomycorrhizal fungi that have been reported so far, all represent ancient lineages in their respective clades: *Podoserpula miranda* (Buyck *et al.* 2012), *Cantharellus eccentricus* (Buyck 2014) and now *R. pseudoaurantiophylla*, member of sect. *Archaeinae,* a cosmopolitan group of rare to extremely rare species that are supposedly among the most ancient lineages of agaricoid Russulaceae.

The name of our new species evokes *Multifurca aurantiophylla* which possesses indeed similarly thick lamellae that present the same color change when becoming mature, but in the latter case, gills are regularly forked and not irregularly unequal.

### **27. *Mycena paraguariensis*** (Speg.) Niveiro, Popoff & Albertó, ***comb. nov.***

**Figs 21-24**

*Mycobank*: MB 817117.

≡ *Agaricus paraguariensis* Speg., *Anales de la Sociedad Científica Argentina* 16 (5): 245 (1883). Holotype: Balansa 3898 (No 16760, LPS!).

≡ *Omphalia paraguariensis* (Speg.) Speg., *Sylloge Fungorum* 5: 335 (1887).

≡ *Collybia paraguariensis* (Speg.) Speg., *Boletín de la Academia Nacional de Ciencias de la República Argentina. Córdoba* 23: 376 (1919).

= *Mycena tapeina* Maas Geest. & de Meijer*, Koninklijke Nederlandse Akademie van Wetenschappen Verhandelingen Afd. Natuurkunde, Tweede Reeks* 97: 90 (1997), **syn. nov.**

*Holotype*: A.A.R. de Meijer PAC-2774 (No 988.233-051, L!).

**Pileus** 10-25 mm diam., convex to broadly convex, with a central depression, flattening at maturity, white to gray with some pale yellow shades, completely whitish when dry, viscid when wet, forming a gelatinous film, but not separable from the pileus surface, smooth, translucent striate margin, slightly incurved at right. **Context** thin, white, fleshy; odor and taste not distinguishable. **Lamellae** white, decurrent, distant to subdistant, arcuate, with entire concolorous edge, with lamellulae of three lengths, without intervenose. **Stipe** 30-70 × 1.5-2.5 mm, cylindrical, straight to somewhat curved, white at the apex, gray-brown towards the base, viscid when moist, glabrous, hollow, the base covered with a fine, white tomentum. **Annulus** absent. **Spore-print** white.

**Spores** 3.5-5.8 × 2.1-3.2 (-3.8) µm; x = 4.8 × 2.8 µm; Q = 1.43-2.40; $Q_x$ = 1.70; n = 20; ellipsoid to pip-shaped, hyaline, smooth, thin-walled, amyloid. **Basidia** 18-20 × 4-5 µm, clavate, with four sterigmata, hyaline, thin-walled, clamped. **Pleurocystidia** 25-95 × 4-10 µm, fusiform to subcylindrical, generally long stalked, hyaline, thin-walled, clamped, scarce. **Cheilocystidia** 15-50 × 3-4 µm, fusiform, cylindrical to subcylindrical, long stalked, occasionally with one or two apical excrescences, hyaline, thin-walled, clamped, not embedded in a gelatinous matrix. **Hymenophoral trama** subregular, brownish vinescent in Melzer's reagent, hyphae 1-4 µm diam., clamped. **Pileipellis** in an ixocutis of repent hyphae of 1-4 µm wide, clamped, covered with growths, simple or branched, embedded in a gelatinous matrix. **Stipitipellis** consisting of parallel, smooth hyphae, 1.8-3.5 µm wide, clamped, embedded in a gelatinous matrix.

*Habitat*: on decaying wood, gregarious, caespitose, connate, forming groups up to 60 basidiomata.

*Distribution*: Distributed in subtropical forests of South America. Originally described from Paraguay as *Agaricus paraguariensis* (Spegazzini 1883), and known from Brazil as *Mycena tapeina* (Maas Geesteranus & de Meijer 1997) and from Argentina as *Omphalia paraguariensis* (Spegazzini 1899) and *Mycena euspeirea* (Singer 1950; Lechner *et al.* 2006; Wright *et al.* 2008).

*Specimens examined*: ARGENTINA, Salta, Santa Victoria, Parque Nacional Baritú, camping agreste Lipeo (22°26'52"S 64°44'39"W, 1421 msnm), 21/III/2011, N. Niveiro *et al.* 2193 (CTES). Misiones, Guaraní, Parque Provincial Caá Yarí, Sendero del Palmital, en interior de selva (26°52'15.5"S 54°13'28.9"W, 520 msnm), 20/III/2010, N. Niveiro *et al.* 1735 (CTES). San Pedro, Parque Provincial Moconá, Sendero de la Gruta (27°09'13.2"S 53°54'04.7"W), 17/V/2008, N. Niveiro *et al.* 810 (CTES), 1/V/2015, N. Niveiro s/n (CTES). Libertador General San Martín, Parque Provincial Salto Encantado, Salto La Olla, 2/V/2015, N. Niveiro T6-10 (CTES). BRASIL. **Holotype** of *Mycena tapeina.* Paraná, Paranaguá, Alexandra, 1/VI/1993, A.A.R. de Meijer PAC-2774 (L 988.233-051). CUBA. **Holotype** of *Agaricus euspeireus* Berk. & M. A. Curtis unlocated, without specified date, Wright 73 (K). PARAGUAY. **Holotype** of *Agaricus paraguariensis* Paraguarí, V-1883, Balansa 3898 (LPS 16760).

*Commentary*: *Mycena* (Pers.) Roussel section *Euspeireae* Maas Geest. is characterized by its medium size basidiomata, viscid to lubricous pileus surface, edge lamellae not gelatinized, pip-shaped spores, cheilocystidia generally stalked, not embedded in a gelatinous matter, hyphae of the pileipellis smooth or diverticulated, embedded in a gelatinous matter, and hyphae of the cortical layer of the stipe smooth, embedded also in a gelatinous matter (Maas Geesteranus 1989; Maas Geesteranus & de Meijer 1997). Only four species currently belong to this section: *M. euspeirea* (Berk. & M.A. Curtis) Sacc*., M. glutinosa* Beardslee*, M. tapeina* Maas Geest. & de Meijer, with a neotropical distribution, and *M. conglobata* Maas Geest. & Hauskn. endemic to Africa (Maas Geesteranus & Hausknecht 1996).

*Agaricus paraguariensis* was originally described by Spegazzini (1883) from the locality of Paraguarí (Paraguay) characterizing it for its mycenoid, fasciculated, caespitose basidiomata; pileus convex, white with abruptly umbilicated dark center; adnate-decurrent lamellae and its slender, elongated, glabrous stipe. Murrill (1916) proposed this species as a synonym of *Mycena euspeirea*, followed by Smith (1947), Singer (1950), Dennis (1961), Pegler (1987), and Maas Geesteranus (1989). Singer (1950) analyzed the type specimen of *Agaricus* (*Omphalia?*) *paraguariensis* Speg. and assumed Murrill's interpretation was correct, affirming that *A. paraguariensis* is a species of the *M. euspeirea group*. Maas Geesteranus & De Meijer (1997) proposed the very similar *Mycena tapeina* as a new species from southern Brazil. This species differs mainly in lacking a gelatinous film separable from the surface of the pileus. Although the latter is considered as an important taxonomic character for the genus (Smith 1947; Singer 1986; Maas Geesteranus 1992), it is a complex character and habitually it is not readily apparent in dehydrated specimens.

In the specimens recently collected by the authors from different localities of northern Argentina here analyzed, we observed the viscid texture of the pileus surface which does not form a gelatinous film separable from the pileus surface, agreeing thus with the description of *M. tapeina* proposed by Maas Geesteranus & de Meijer (1997). Moreover, we have corroborated that in the original description of *A. paraguariensis* the pileus surface texture is not specified (Spegazzini 1883), which is also confirmed by the analysis made by Singer (1950), who noted that this species had the pileus surface more or less viscid. The *A. paraguariensis* type specimen consists of a set of connate basidiomata, characteristic habit of this species complex. However, microscopic structures could not be observed since they were collapsed. On the other hand, the *M. tapeina* type collection has small ellipsoid spores (3.5-5 × 2-3 µm), fusiform pleurocystidia (up to 95 × 10 µm), and fusiform to cylindrical cheilocystidia (25-55 × 5-7 µm), some of them with apical outgrowths. The pileipellis of *M. tapeina* type specimen consists of an ixocutis of repent 2-3 µm hyphae, with simple to branched excrescences. All characteristics observed in the *M. tapeina* type specimen are in agreement with the original description by Maas Geesteranus & De Meijer (1997). Additionally, we have observed that the specimens collected in northern Argentina, as well as the *A. paraguariensis* and *M. tapeina* type material, have a densely connate habit. These are formed by large groups of 30-60 basidiomata, with generally small pileus up to 10 mm diam., and occasionally larger pileus up to 20 mm (Figs 21 and 23A).

*Mycena euspeirea* (Wright 73, K!, type) has also connate basidiomata, but forming smaller groups of 5-10 basidiomata, with larger pileus, up to 25 mm diam. (Fig. 23B). Singer (1950) described the *A. paraguariensis* type as strongly fasciculate carpophores, noting that this feature is different from tropical material. The most striking morphological difference between both species is in the pileipellis characteristics and in the habit of the basidiomata. The pileipellis is composed by smooth hyphae embedded in a gelatinous matrix separable from the surface of the

Fig. 21. **A-B.** *Mycena paraguariensis* [Niveiro *et al.* 2359 (CTES)] general aspect. Scale bar: 10 mm.

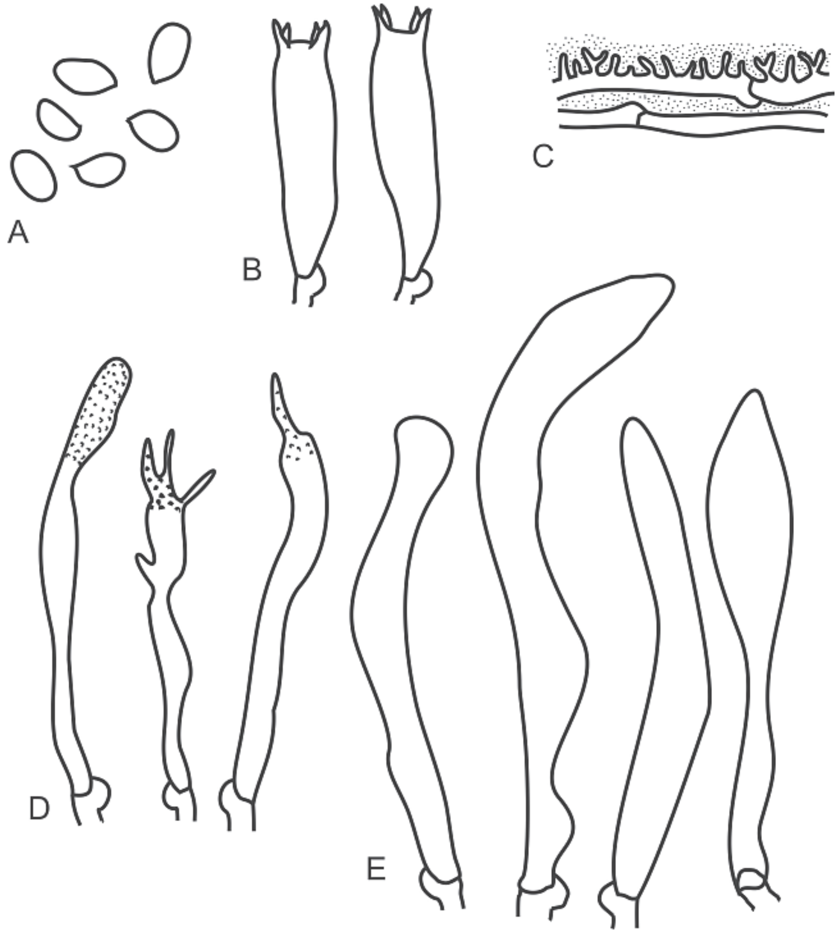

Fig. 22. *Mycena paraguariensis* [Niveiro *et al.* 2359 (CTES)] microscopic characters: **A.** spores, **B.** basidia, **C.** hyphae of the pileipellis, **D.** cheilocystidia, **E.** pleurocystidia. Scale bar: 10 µm.

pileus in *M. euspeirea* (Maas Geesteranus 1989), and diverticulated hyphae embedded in a gelatinous matrix not separable from the surface of the pileus in *M. paraguariensis*. The habit of the basidiomata differs in pileus number and their size, being very abundant and smaller in *M. paraguariensis*; while fewer and larger in *M. euspeirea*. Moreover, *M. euspeirea* and *M. paraguariensis* have different distribution patterns which do not overlap (Fig. 24), being the latter distributed in subtropical South America, and the former in Central America and northern South America (Murrill 1916; Smith 1947; Dennis 1961; Pegler 1987; Maas Geesteranus 1989).

We therefore consider *A. paraguariensis* and *M. tapeina* to correspond to the same species, the former being a forgotten species synonymized for a long time to *M. euspeirea*, but according to their current concept they need to be separated as distinct species. *Agaricus paraguariensis* was transferred to the genus *Omphalia* (Spegazzini 1887) and *Collybia* (Spegazzini 1919), but has not been previously transferred to *Mycena*, so a new combination is here proposed, *M. paraguariensis*, with *M. tapeina* as its later synonym.

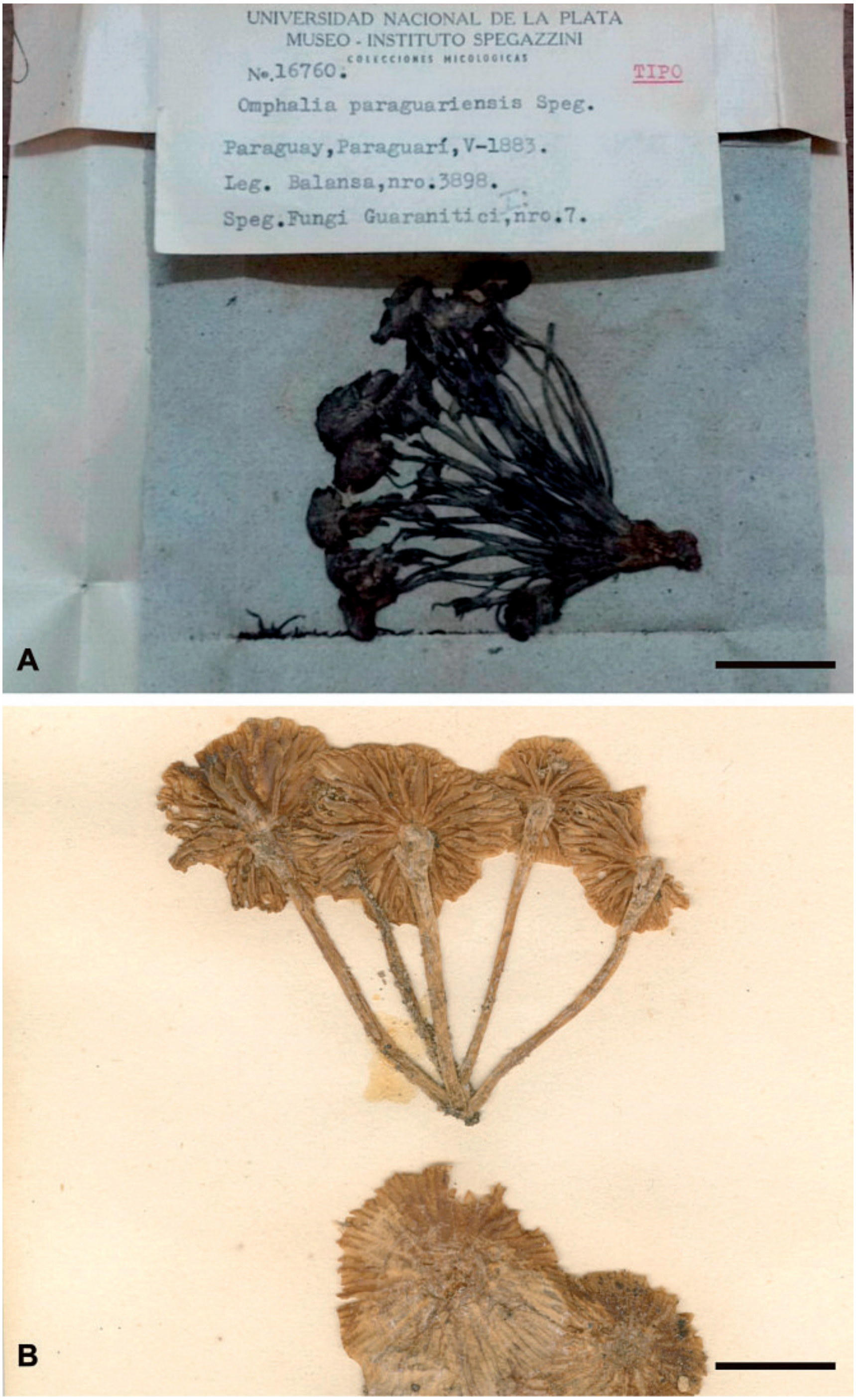

Fig. 23. Type specimens studied: **A.** *Agaricus paraguariensis* [Balansa 3898 (LPS)], **B.** *Agaricus euspeireus* [Wright 78 (K)]. Scale bar: 10 mm.

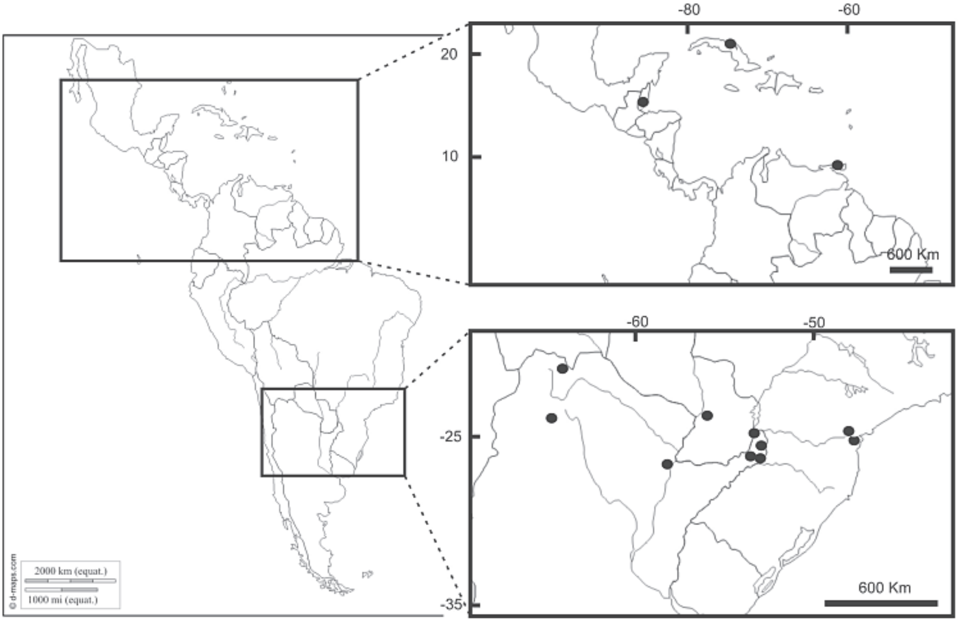

Fig. 24. Distribution map of *Mycena euspeirea* (a) and *Mycena paraguariensis* (b).

Other similar species within the same section (*Euspeireae*) are *M. glutinosa* and *M. conglobata*. The former shares with *M. paraguariensis* the pileipellis composed by diverticulated hyphae, character which differentiates both species from *M. euspeirea.* However, *M. glutinosa* presents completely white basidiomata, a gelatinous cuticle separable from the surface of the pileus, and smooth or with one or more apical outgrowths, wider cheilocystidia (45-63 × 7-11.5 µm) (Beardslee 1934; Maas Geesteranus 1989). *Mycena conglobata* is similar to *M. paraguariensis* in having the pileus surface with a darker center, but differs by its smooth cheilocystidia and absence of pleurocystidia (Maas Geesteranus & Hausknecht 1996).

Other South American species similar in appearance are *M. micromphale* Singer and *M. luxaeterna* Desjardin, B.A. Perry & Stevani. The former, described from northwestern Argentina, resembles *M. paraguariensis* in its habit, gray-white basidiomata similar in size, and a pileus covered by a gelatinous cuticle; but differs by its larger spores, 6-7.5 × 4.5-6 µm (Singer & Digilio 1952; Raithelhuber 2004). *Mycena luxaeterna,* a luminescent species described from Brazil, is also characterized by a grayish white middle basidiomata, but it is differentiated by its darker gray to brownish pileus, and the absence of pleurocystidia (Desjardin *et al.* 2010).

*Mycena paraguaya Speg.* (Spegazzini 1922) has been confused with *A. paraguariensis* Speg. (Spegazzini 1883) by Maas Geesteranus (1989), who considered *M. paraguayensis* (Speg.) Speg. a homotypic synonym of *Agaricus paraguayensis* Speg. among the synonyms of *M. euspeirea* following Murrill's (1916) criteria. However, Murrill (l.c.) cited *Omphalia paraguariensis* Speg. as *M. euspeirea* synonym, not *M. paraguayensis* (Speg.) Speg. as described by Maas Geesteranus (1989). The specimen described by Spegazzini (1922) actually corresponds to *M.*

*paraguaya* Speg. with diagnostic characters, sites and date of collection clearly different from *A. paraguariensis*. *Mycena paraguaya* has smaller basidiomata (8-12 mm diam.) growing scattered and not caespitose in the substrate, with completely white to ashy pileus, lacks a central depression and has a mealy to powdery (non-viscous) surface, and also lacks pleurocystidia (Spegazzini 1922). Based on Spegazzini's descriptions, *M. paraguaya* (Spegazzini 1922) and *M. paraguariensis* (Spegazzini 1883) are two clearly distinct species, with *M. paraguayensis* (Speg.) Speg. *sensu* Maas Geesteranus (1989) being an invalid name.

### **28. *Corynesporella indica*** Prasher I. B. and Verma R. K **sp. nov**. **Figs 25-26**

*MycoBank* MB 820524.

*Etymology – indica*, after the country of origin.

*Systematic position*: Fungi, Ascomycota, incertae sedis.

*Diagnosis*: *C. indica* is distinguished from other species of *Corynesporella* by its exceptionally long conidiophores and the size of its conidia.

*Holotype*: India**,** Himachal Pradesh, Manali on the way to Hadimba Mata Tample, collected on fallen twigs 1 Oct. 2012 I. B. Prasher and Rajnish Kumar Verma, PAN 32794 (herbarium of Botany Department, Panjab University, Chandigarh, India).

**Colonies** on natural substratum effuse, dark brown, hairy. **Mycelium** partly superficial, partly immersed in the substratum. **Conidiophores** macronematous, mononematous, arising singly, erect, branched at the apex forming a stipe, stipe straight to slightly flexuous, 9-30 septate, 961-1518 µm long, 23-28.3 µm wide in the middle. Branches usually paler than stipe, producing secondary or tertiary branches. **Conidiogenous cells** monotretic, integrated, terminal on stipe and branches, elongating by successive percurrent proliferations, smooth, brown, cylindrical or subcylindrical, 31.1-50.8 × 6.2-10.2 µm. **Conidia** solitary, dry, acrogenous, obclavate, 18-28 distoseptate, smooth walled, rarely in chains, 129.7-293.8 × 5.5-8.6 µm.

*Commentary*: The genus *Corynesporella* was established by Munjal & Gill (1960) with *C. urticae* as type species. Siefert *et al* (2011) accepted five species. Subsequently *C. obclavata* L.G. Ma & X.G. Zhang, *C. licualae* Y.D. Zhang & X.G. Zhang, *C. cinnamomi* Y.D. Zhang & X.G. Zhang, and *C. bannaense* J.W. Xia & X.G. Zhang were described by Ma *et al.* (2012), Zhang *et al.* (2012a, 2012b) and Xia *et al.* (2014), respectively. The present *C. indica* is distinguished from other species of *Corynesporella* by its exceptionally long conidiophores and the size of its conidia (Table 1).

### **29. *Repetophragma zygopetali*** O.L. Pereira, Meir. Silva & R.F. Castañeda, **sp. nov.** **Figs 27-29**

*MycoBank*: MB814477.

*GenBank*: KU609074 (ITS), KT732418 (LSU).

*Systematic position*: Ascomycota, Pezizomycotina, Dothideomycetes, Incertae sedis, Microthyriales, Micropeltidaceae.

*Etymology*: Name derived from the plant host genus *Zygopetalum*.

*Holotype*: Brazil, Minas Gerais, Araponga, Parque Estadual da Serra do Brigadeiro, on living leaves of *Zygopetalum mackayi* (*Orchidaceae*), O.L. Pereira, 05 Apr. 2015, (**holotype** VIC 42946, **culture ex-type** COAD 1978).

**Colonies** on living leaf leaves, effuse, black, forming a dark mycelial mat (sooty blotch). Mycelium mostly superficial, composed of septate, branched, dark

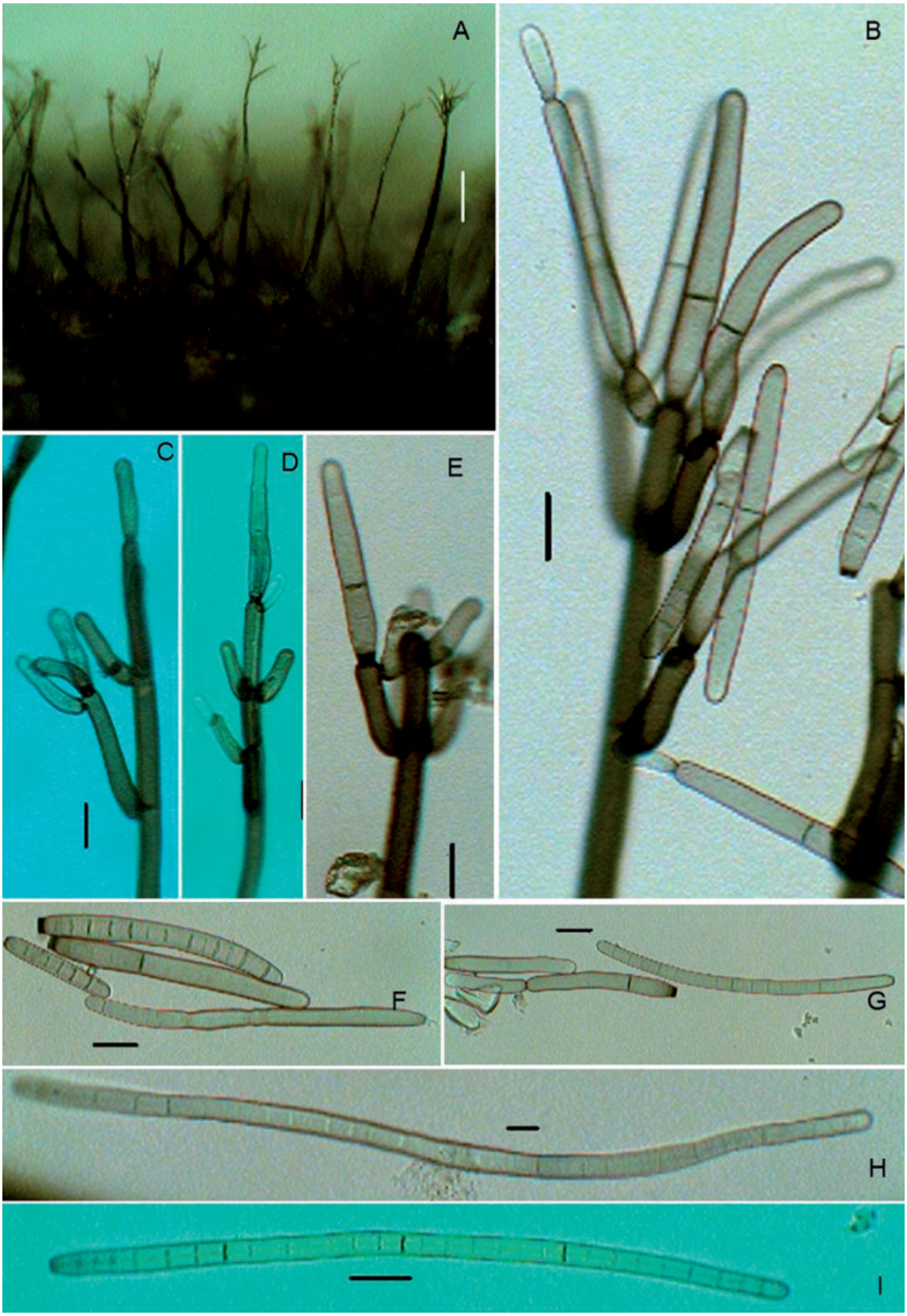

Fig. 25. *Corynesporella indica* **A.** Colonies on natural substratum. **B-E.** Conidiophores with attached conidiogenous cells and conidia. **F-I.** Conidia. Scale bars = 10 µm.

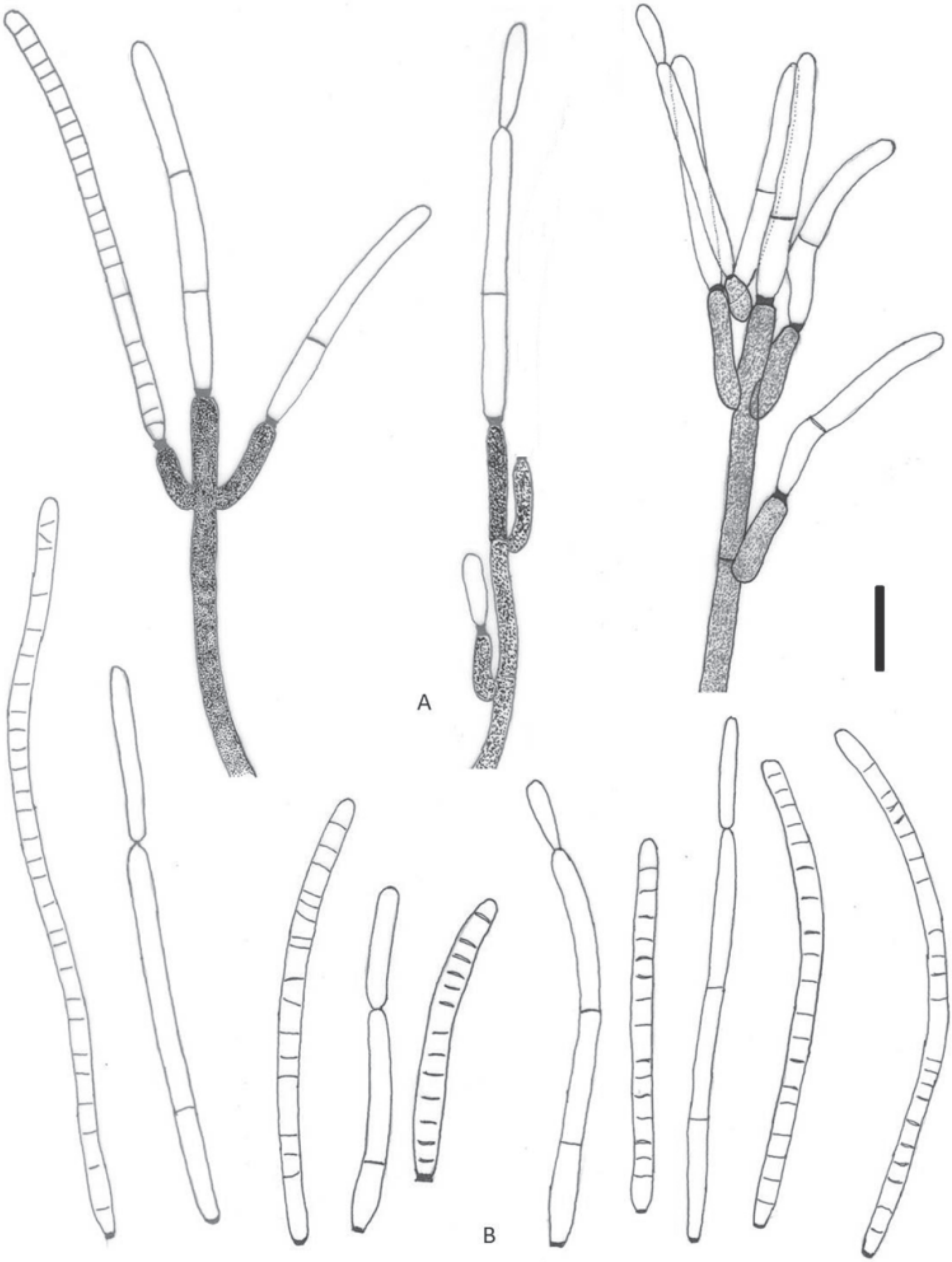

Fig. 26. *Corynesporella indica* (Line Drawings) **A.** Conidiophores with attached conidiogenous cells and conidia. **B.** Conidia. Scale bars = 10 µm.

Table 1. Comparision of *Corynesporella* spp

| *Species* | *Conidiophores [µm]* | *Conidia [µm]* | *Reference* |
|---|---|---|---|
| ***C. cinnamomi*** | Macronematous, mononematous, arising singly, erect, up to 500 high, 7-10.5 wide, straight to slightly flexuous, branched at the apex, brown to dark brown, often swollen at the base, 8-12 wide | Solitary, dry, acrogenous, obclavate, 3-5-distoseptate, smooth-walled, brown, apical cell pale brown, 31.5-52 long, 4.5-10 thick in the widest part, tapering to 2-3 at the apex | Zhang *et al.* (2012b) |
| ***C. bannaense*** | Conidiophores macronematous, mononematous, erect, branched, straight or flexuous, cylindrical, thick-walled, smooth, 9-12-septate, pale brown to brown, 350-500 × 8-10 | Solitary, 12-16 distoseptate, smooth, obclavate, thick-walled, pale brown, 100-140×10-14, truncate at the base, rounded at the apex | Xia *et al.* (2014) |
| ***C. obclavata*** | Macronematous, mononematous, erect, branched, straight or flexuous, cylindrical, brown, thick-walled, multiseptate, smooth, 230-635 long, 3.5-6.5 wide at the apex, 8.5-15 wide at the base | Solitary, acrogenous, obclavate, brown, apical cells pale brown, smooth, thick-walled, 5-7 distoseptate, 33-55 × 6.5-11 | Ma *et al.* (2012) |
| ***C. licualae*** | Macronematous,mononematous,arising singly, erect, branched at the apex forming a stipe,stipe straight to slightly flexuous, 185-300 × 9 5-8.5, often swollen at the base, 7-10 wide | Solitary, dry, acrogenous, obclavate, 3-5 distoseptate, smooth walled, brown, paler at the apex, 27-48 long, 6.5-8.5 lm thick in the widest part, 3-4.5 wide at the truncate base, sometimes apex extended into a hyaline to subhyaline, aseptate, smooth, with filiform appendage of 11-32 × 0.5-1.5 | Zhang *et al.* (2012a) |
| ***C. bhowaliensis*** | Macronematous, mononematous, erect, straight, flexuous, curved or bent, thick-walled, 8-14 septate, 920-1120 long, 10-14 wide | Solitary, dry, mostly subhyaline or pale brown, long and vermiform, cylindrical or subcylindrical, 15-32 dis to euseptate, 70-192 × 8-10 | Subramanian & Srivastava (1994) |
| ***C. helminthosporioides*** | 95-900 × 8-20 | Obclavate, occasionally rostrate, Subhyaline, 50-75 × 9-13, 9-13 septate | Holubová-Jechová (1987) |
| ***C. urticae*** | Macronematous, mononematous, simple, solitary, erect, straight , or flexuous septate, 1mm long 19-25 thick near base, 11-14 near apex | Solitary or catenate, acrogenous, simple, cylindrical to obclavate up to 270 long, 7-20 thick and 5-29 septate | Munjal & Gill (1961) |
| ***C. pinarensis*** | Macronematous, mononematous, simple, solitary, erect, straight, or flexuous septate, smooth, 350 long, 7-14 thick | Catenate, brown to olive brown, obclavate, 25-75×3.5-7, (1-)3(-5) septate | Castañeda, (1985) |
| ***C. simpliphora*** | Macronematous, mononematous, 150-600 × 6.5-8 | Pale olive, catenate, obclavate, 18-62 × 6.5-10, 1-7 septate | Matsushima, (1993) |
| ***C. superioramifera*** | Macronematous, mononematous, branched, 20-160 × 2-5 | Moderately black, catenate, cylindrical, 5-90 × 2.5-9, 0-5 septate | Matsushima, (1993) |
| ***C. indicum*** | Macronematous, mononematous, simple, solitary, erect, straight or flexuous, 9-30 septate, 961-1518 µm long, 22.97-28.32 µm wide in the middle | Dry, acrogenous, obclavate, 18-28 distoseptate, smooth walled, rarely in chains, 129.67-293.85 µm long, 5.50-8.60 µm wide | Present study |

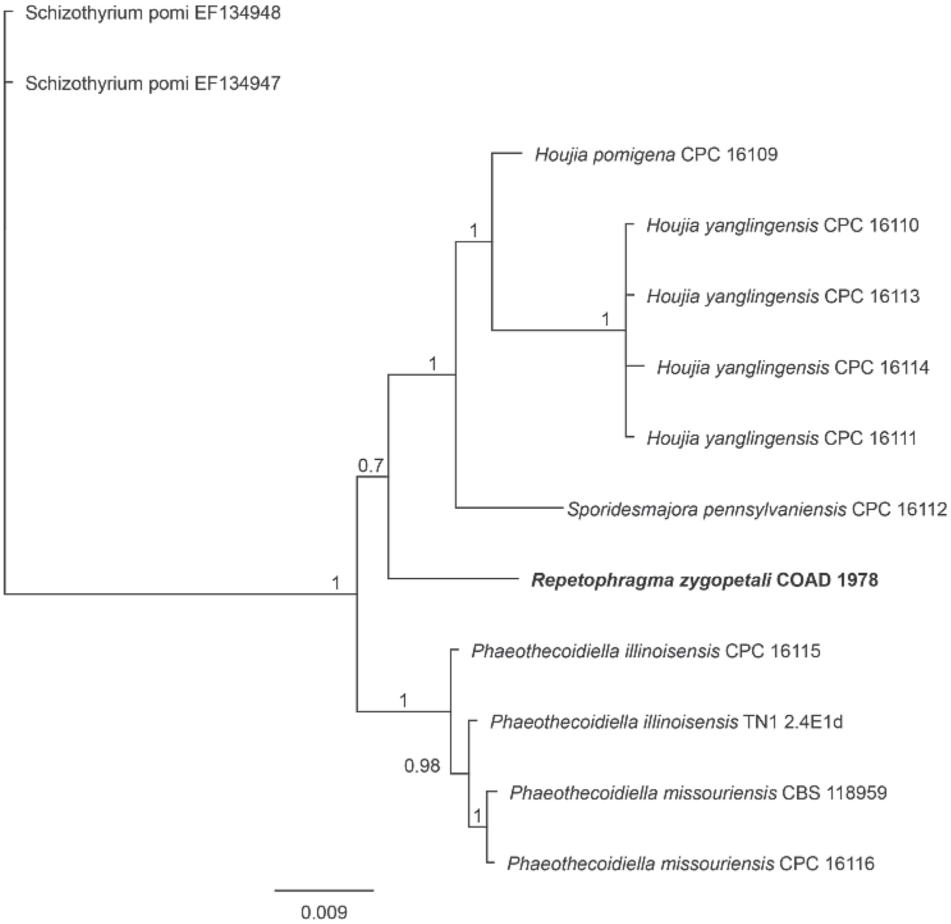

Fig. 27. The phylogenetic tree was obtained by Bayesian inference methods using the sequences of the LSU region. The posterior probability values are indicate at the nodes. Strain numbers are indicated after species names. New sequence data are in black bold. The analyses included 13 strains and is rooted with *Schizothyrium pomi* for the out group; the alignment comprises 852 characters. The newly generated nucleotide sequences were compared against NCBI's GenBank nucleotide database using their megaBLAST algorithm. The most similar sequences were downloaded in FASTA format and the sequence datasets were aligned using the MAFFT v. 7 online portal (http://mafft.cbrc.jp/alignment/server/index.html) (Katoh & Standley, 2013). Resulting sequence alignments were manually checked and adjusted in MEGA v. 6.06 (Tamura *et al.*, 2013). MrModeltest v. 2.2 (Nylander 2004) was used to select the optimal model of nucleotide substitution prior to the Bayesian Inference (BI) analysis using MrBayes v. 3.2.1 (Ronquist & Huelsenbeck, 2003). The general time-reversible model of evolution (Rodriguez *et al.*, 1990), including estimation of invariable sites (GTR + I) was used. Two sets of four MCMC (Markov Chain Monte Carlo) chains were run simultaneously, starting from random trees and lasting until the critical value for the topological convergence diagnostic reached 0.01. Trees were sampled every 1 000 generations and the first 25% of the trees were discarded as the burn-in phase for each analysis and posterior probabilities (Rannala & Yang, 1996) were determined from the remaining trees and are presented on the left of each node. Sequences derived from this study were deposited in GenBank (http://www.ncbi.nlm.nih.gov/genbank). The resulting phylogenetic tree was printed with Geneious v. 7.1.8 (http://www.geneious.com, Kearse *et al.*, 2012), and the layout of the tree for publication was carried out using in Adobe Illustrator v. CS5.

Fig. 28. **A.** Flower of *Zygopetalum mackayi* in the Atlantic rainforest at Parque Estadual da Serra do Brigadeiro, state of Minas Gerais, Brazil. **B.** Sooty blotch on living leaves.

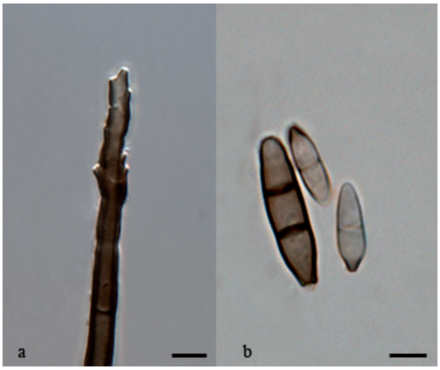

Fig. 29. *Repetophragma zygopetali* (holotype). **A.** Conidiogenous cell with enteroblastic percurrent extensions. **B.** Conidia. Scale bars: A = 5 µm, B = 10 µm.

brown, smooth hyphae. **Conidiophores** macronematous, simple, erect, straight or slightly geniculate towards the apex, annellate, 53-151 × 3.5-5 µm, 3-8 septate, dark brown to brown. **Conidiogenous cells** monoblastic, with 2-6 enteroblastic percurrent extensions. Conidial secession schizolytic. **Conidia** solitary, acrogenous, cylindrical to slightly obclavate, truncate at the base, rounded at the apex, 0-3 septate, 24-33 × 5-7 µm, brown, dark brown at the septa, thick-walled smooth, dry.

**Colonies cultured on PDA** reaching 25 mm diam after 2 wk at 25°C in the dark; slightly irregularly lobate margins, aerial mycelium velvety, dark grey, reverse iron-grey, sterile.

*Commentary*: The genus *Repetophragma* proposed by Subramanian (1992) is characterized by producing conidiophores with annellations produced after enteroblastic percurrent extensions of the conidiogenous cell and euseptate conidia which secede schizolytically (Subramanian, 1992). *Repetophragma zygopetali* is similar to *Repetophragma dennisii* (M.B. Ellis) Subram., but the latter species is quite different by having wider conidia (11-13 µm) and longer and wider conidiophore (80-310 × 6-8) (Castañeda-Ruiz *et al.*, 2011). Shenoy *et al.* 2006 show in their study that the genus *Repetophragma* is polyphyletic associated with members of two classes, Dothideomycetes and Sordariomycetes. According to our phylogenetic analysis, *R. zygopetali* belongs to the family Micropeltidaceae (Dothideomycetes) (Fig. 3). *Repetophragma zygopetali* does not correspond to any sequences available in GenBank at present and differs morphologically and phylogenetically from others previously described species. Hence, it is described here as new. In addition, this is the first *Repetophragma* species reported associated with sooty blotch on living leaves.

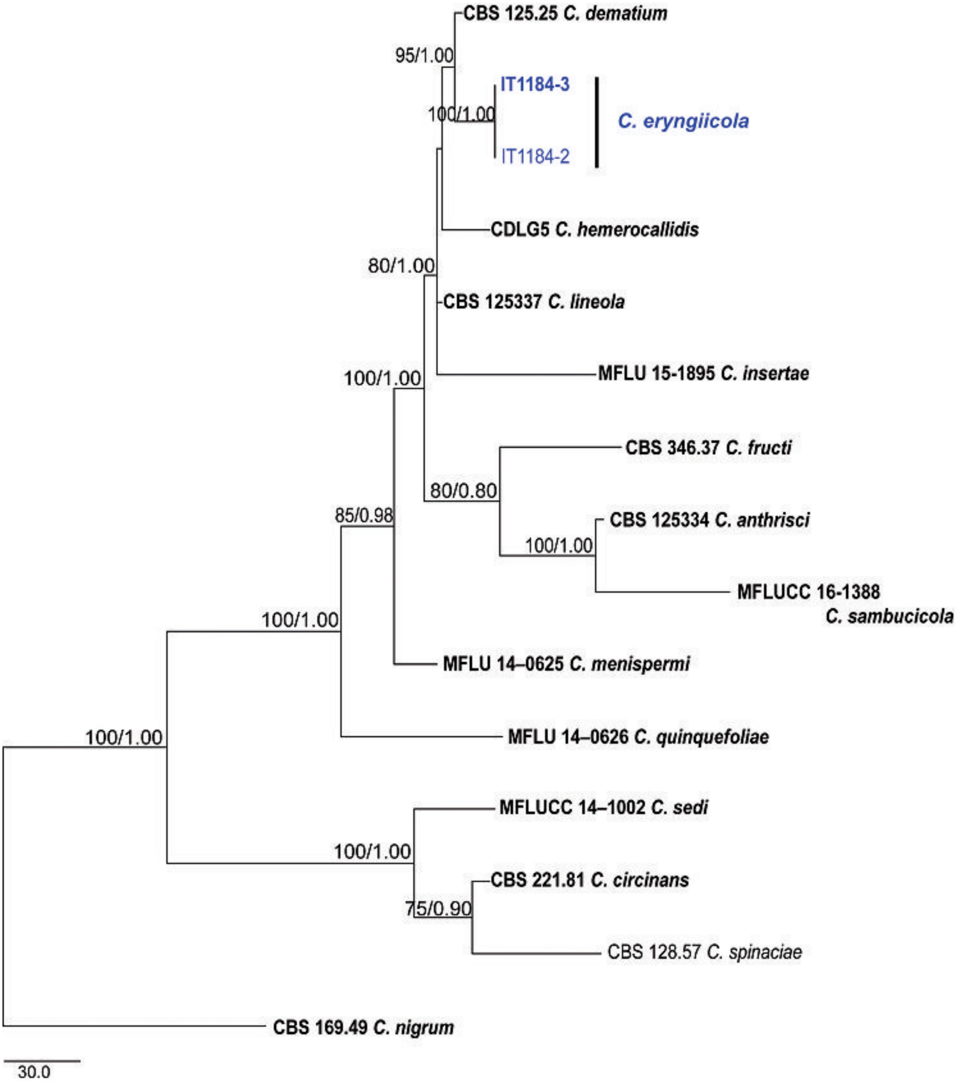

Fig. 30. Phylogram generated from maximum parsimony analysis based on combined ITS, GADPH, CHS, ACT and TUB2 sequenced data from species of *C. dematium* complex. Maximum parsimony bootstrap support values greater than 75% and Bayesian posterior probabilities greater than 0.80 are shown above the branches. The ex-type strains are in bold and the new isolate is in blue. The tree is rooted with *Colletotrichum nigrum*.

***Colletotrichum eryngiicola*** Jayawardena, Bulgakov & K.D. Hyde **sp. nov**.
**Figs 30-31**

*MycoBank*: MB 820465.

*GenBank*: KY792717 (ACT), KY792729 (TUB2), KY792723 (GAPDH), KY792720 (CHS), KY792726 (ITS).

*Systematic position*: Ascomycota, Pezizomycotina, Sordariomycetes, Hypocreomycetidae, Glomerellales, Glomerellaceae.

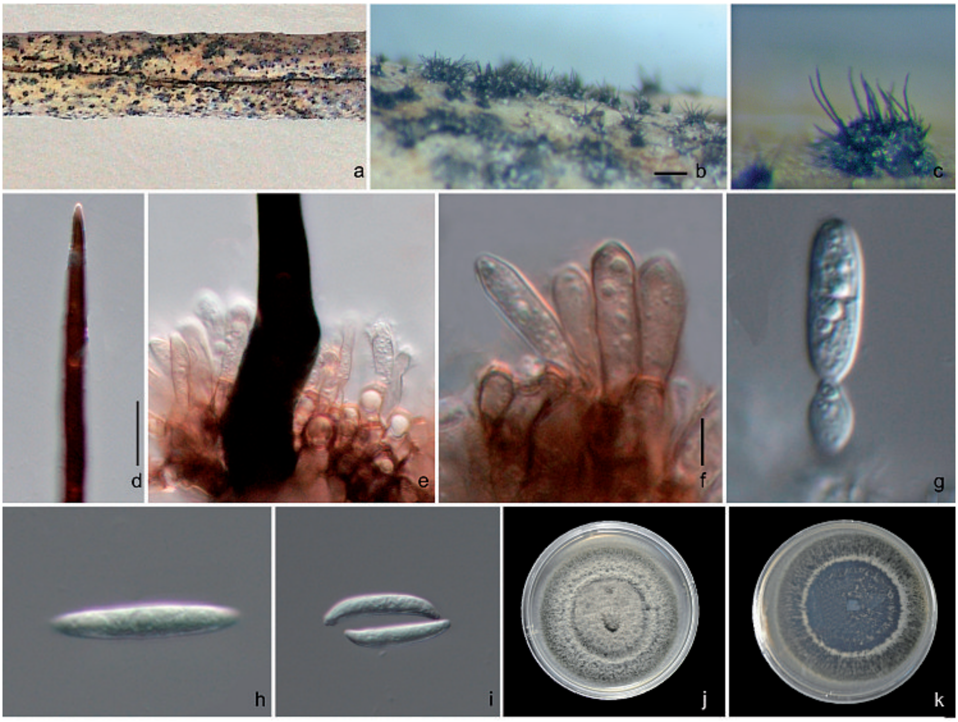

Fig. 31. ***Colletotrichum eryngiicola*** (holotype). **a-c.** Appearance of conidiomata on host d Apex of setae. **e.** Base of setae. **f.** Conidiophores. **g.** Conidiogenous cell. **h-i.** Conidia. **j.** Upper view of 7 d old culture. **k.** Reverse view of 7 d old culture. Scale bars: b-c = 0.2 mm, d = 20 µm, f = 10 µm scale bar of b applies to c, scale bar of d applies to e and scale bar of f applies to g-i.

*Etymology*: from Latin, referring to the host genus *Eryngium.*

*Diagnosis*: differs from other known species of the *Colletotrichum dematium* complex in having conidiomata with abundant setae, as well as in producing larger conidia (L/W ratio = 6.3).

*Holotype*: RUSSIA. Rostov Region, Shakhty City, N 47.726753 – E 40.2598715, steppe slopes near Grushevsky pond, on dying leafstalks of *Eryngium campestre* L., 18 February 2016, TS Bulgakov T1184-3 (MFU16-1477); dried culture, HKAS97448; ex-holotype living cultures, MFLUCC 17-0318.

**Conidiomata** 0.03-0.07 mm diam., black, acervulus, oval, solitary, gregarious, comprising dark brown, roundish cells from which setae and conidiophores develop. **Setae** abundant, straight or ± bent, abundant, dark brown, becoming paler towards the apex, opaque, smooth-walled, septate, 3-5 septate, 131 µm long, base cylindrical, slightly inflated, 6.1 diam., apex acute to rounded, smooth-walled. **Conidiophores** simple, to 21 µm long, pale brown to brown, smooth-walled. **Conidiogenous cells** (3.6)4.9-*6.5*-8.3(9.6) × (1.5)2.1-*3.4*-4(4.7) µm, enteroblastic, hyaline to pale brown, smooth-walled, cylindrical to slightly inflated, opening 0.5-1 mm wide, collarette or periclinal thickening not observed. **Conidia** (16.3)17.7-*20.2*-22.2(23.6) × (2.4)2.7-*3.21*-3.9(4.3) µm, L/W ratio 6.3, hyaline, smooth-walled or verruculose, aseptate, curved, both sides gradually tapering towards the rounded to slightly acute apex and truncate base. **Appressoria** not observed.

**Culture characteristics**: Colonies on PDA flat with entire margin, aerial mycelium sparse, short, pale olivaceous-grey, colony surface buff, some sectors dark grey-olivaceous to dark-olivaceous-grey, iron-grey acervuli can be observed mainly on the edge of the colony. Reverse olivaceous green, concentric rings can be clearly observed, reaching 40-55mm in 7 d at 18°C. **Chlamydospores** not observed.

*Additional examined and sequenced* s*pecimens*: RUSSIA. Rostov Region, Shakhty City, N 47.726753 – E 40.2598715, steppe slopes near Grushevsky pond, on dying leafstalks of *Eryngium campestre* L., 18 February 2016, TS Bulgakov T1184-1 (KUMCC 17-0071), T1184-2 (MFLUCC 17-0317).

*Commentary*: *Colletotrichum dematium* species complex is mainly characterized by species with curved conidia (Damm *et al.* 2009, Jayawardena *et al.* 2016). *Colletotrichum dematium* and *C. eryngii* have been previously recorded from the genus *Eryngium*. However, Damm *et al.* (2009) synonymized *C. eryngii* (basionym *Vermicularia eryngii*) under *C. dematium*. *Colletotrichum eryngiicola* falls within the *C. dematium* species complex clade and forms a separate branch with 100% bootstrap support and 1.00 Bayesian posterior probability and is a sister taxon to *C. dematium* (Fig. 30). *Colletotrichum eryngiicola* differs from *C. dematium* in having conidiomata with abundant setae, in not producing chlamydospores, as well as in having larger conidia. A BLASTn search of NCBI GenBank with the ITS sequence of MFLUCC 17-0318 showed 99% similarity to quite a number of *Colletotrichum* species with angular conidia. The closet match in a BLASTn search in GenBank with the GAPDH sequence of MFLUCC 17-0318 was GenBank JX669425 (99% identity, 3 bp differences), CHS JX669431 (98% identity, 5 bp differences) and ACT KP859503 (99% identity, 2 bp differences). The newly described taxon differs from its sister taxon *C. dematium* in 4bp in ITS, 4bp in GAPDH, 4bp in CHS, 4bp in ACT and 4bp in TUB2. Morphological characters as well as phylogenetic evidence support this taxon to be a new species of *Colletotrichum*.

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## REFERENCES

ALFARO M., ZOLLER S. & LUTZONI F., 2003 — Bayes or bootstrap? A simulation study comparing the performance of Bayesian Markov chain Monte Carlo sampling and bootstrapping inassessing phylogenetic confidence. *Molecular Biology and Evolution* 20: 255-266.

BEARDSLEE H.C., 1934 — New and interesting Fungi. *Mycologia* 26 (3): 253-260.

BUYCK B., 1999 — Revision of Russula section *Archaeinae*. Belgian. Journal of Botany 131: 116-126.

BUYCK B., 2014 — Exploring the diversity of „smooth“ chanterelles (Cantharellus, Cantharellales). *Cryptogamie, Mycologie* 35(1): 23-40.

BUYCK B., 2016 — Editorial Special issue *Cantharellus*: Towards completing the world inventory for *Cantharellus*. *Cryptogamie, Mycologie* 37: 255-258.

BUYCK B., DE CROP E., VERBEKEN A. & HOFSTETTER V., 2016a — Untangling the Central African *Cantharellus* sect. *Tenues*: *Cantharellus minutissimus sp.nov.* and epitypification of *Cantharellus alboroseus*. *Cryptogamie, mycologie* 37(3): 279-294.

BUYCK B., DUHEM B., EYSSARTIER G. & DUCOUSSO M., 2012 — *Podoserpula miranda sp. nov.* (Amylocorticiales, Basidiomycota) from New Caledonia. *Cryptogamie, mycologie* 33(4): 453-461.

BUYCK B., HENKEL T.W., DENTINGER B.T.M., SÉNÉ O. & HOFSTETTER V., 2016b — Multigene sequencing provides a suitable epitype, barcode sequences and a precise systematic position for the enigmatic, African *Cantharellus miniatescens*. *Cryptogamie Mycologie* 37(3): 265-278.

BUYCK B., KAUFF F., EYSSARTIER G., COULOUX A. & HOFSTETTER V., 2014 — A multigene world phylogeny for *Cantharellus*. *Fungal Diversity* 64: 101-121.

BUYCK B., OLARIAGA I., JUSTICE J., LEWIS D., ROODY W. & HOFSTETTER V., 2016c — The dilemma of species recognition in the field when sequence data are not in phase with phenotypic variability. *Cryptogamie, Mycologie* 37.

BUYCK B., OLARIAGA I., LOONEY, B., JUSTICE J. & HOFSTETTER V., 2016d — Wisconsin chanterelles revisited and first indications for very wide distributions of *Cantharellus* species in the United States East of the Rocky Mountains. *Cryptogamie, Mycologie* 37(3): 345-366.

BUYCK B., RANDRIANJOHANY E. & HOFSTETTER V., 2016e — Almost one century later... *Cantharellus avellaneus* finally rediscovered! *Cryptogamie, mycologie* 37(3): 255-264.

CASTAÑEDA-RUÍZ, R.F. — 1985 Deuteromycotina de Cuba, Hyphomycetes, III.:1-42.

CASTAÑEDA-RUIZ R.F., HEREDIA G., ARIAS R.M., MCKENZIE E.H.C., HYDE K.D., STADLER M., SAIKAWA M., GENÉ J., GUARRO J., ITURRIAGA T., MINTER D.W. & CROUS P.W., 2011 — A new species and re-disposed taxa in *Repetophragma*. *Mycosphere* 2: 273-289.

DAMM U., WOUDENBERG J.H.C., CANNON P.F., CROUS P.W., 2009 — *Colletotrichum* species with curved conidia from herbaceous hosts. *Fungal Diversity* 39: 45-87.

DAS K., GHOSH A., BAGHELA A., MEHTA N., BHATT R.P. & BUYCK B., 2017 — Morphological study and phylogenetic evidence of *Russula butyroindica* sp. nov. (Rusulaceae) from India. *Nova Hedwigia* (submitted).

DE KESEL A., AMALFI M., KASONGO B., YOROU N.S., RASPÉ O., DEGREEF J. & BUYCK B., 2016 — New and interesting *Cantharellus* from tropical Africa. *Cryptogamie, Mycologie* 37: 283-328.

DENNIS R.W.G., 1961 — Fungi venezuelani: IV. *Kew Bulletin* 15 (1): 67-156.

DESJARDIN D.E., PERRY B.A., LODGE D.J., STEVANI C.V. & NAGASAWA E., 2010 — Luminiscent *Mycena*: new and noteworthy species. *Mycologia* 102 (2): 459-477.

DIEDERICH P. & LAWREY J.D., 2007 — New lichenicolous, muscicolous, corticolous and lignicolous taxa of Burgoa s. l. and Marchandiomyces s. l. (anamorphic Basidiomycota), a new genus for Omphalina foliacea, and a catalogue and a key to the non-lichenized, bulbilliferous basidiomycetes. *Mycological Progress* 6: 61-80.

FENG B., WANG X.-H., RATKOWSKY D., GATES G., LEE S.S., GREBENC T. & YANG Z.L., 2016 — Multilocus phylogenetic analyses reveal unexpected abundant diversity and significant disjunct distribution pattern of the Hedgehog Mushrooms (*Hydnum* L.). *Scientific Reports* 6:25586 | DOI: 10.1038/srep25586.

GUINDON S. & GASCUEL O., 2003 — A simple, fast, and accurate algorithm to estimate large phylogenies by maximum likelihood. *Systematic Biology* 52(5): 696-704.

HALL T.A., 1999 — BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucleic Acids Symposium Series* 41: 95-98.

HOLUBOVÁ-JECHOVÁ V., 1987 — Studies on hyphomycetes from Cuba VI. New and rare species with tretic and phialidic conidiogenous cells. *Ceská Mykologie* 41(2): 107-114.

HONGSANAN S., HYDE K.D., BAHKALI A.H., CAMPORESI E., CHOMNUNTI P., EKANAYAKA H., GOMES A.M., HOFSTETTER V., JONES E.B.G., PINHO D.B., PEREIRA O.L., TIAN Q., WANASINGHE D.N., XU J-C. & B. BUYCK, 2015 — Fungal Biodiversity Profiles 11-20. *Cryptogamie, Mycologie* 36(3): 355-380.

JAYAWARDENA R.S., HYDE K.D., DAMM U., CAI L., LIU M., LI X.H., ZHANG W., ZHAO W.S. & YAN J.Y., 2016 — Notes on currently accepted species of *Colletotrichum*. *Mycosphere* 7: 1192-1260

KATOH K. & STANDLEY D.M., 2013 — MAFFT multiple sequence alignment software version 7: improvements in performance and usability. *Molecular Biology and Evolution* 30: 772-780.

KATOH K.A. & TOH H., 2008 — Recent developments in the MAFFT multiple sequence alignment program. *Briefings in Bioinformatics* 9(4): 286-98.

KEARSE M., MOIR R., WILSON A., STONES-HAVAS S., CHEUNG M., STURROCK S., BUXTON S., COOPER A., MARKOWITZ S., DURAN C., ASHTON B., MEINTJES P. & DRUMMOND A., 2012 — Geneious Basic: an integrated and extendable desktop software platform for the organization and analysis of sequence data. *Bioinformatics* 28: 1647-1649.

KORNERUP A. & WANSCHER J.H., 1981 — Methuen handbook of colour. 3rd Ed. London, Methuen.

KUMAR S., STECHER G. & TAMURA K., 2016 — MEGA7: Molecular Evolutionary Genetics Analysis version 7.0 for bigger datasets. *Molecular Biology and Evolution* 33:1870-1874.

LECHNER B.E., WRIGHT J.E. & POPOFF O.F., 2006 — New taxa and new records for Argentina of fungi from Iguazú National Park, Misiones. *Fungal Diversity* 21: 131-139.

MA L.G., MA J., ZHANG Y.D. & ZHANG X.G. 2012 — A new *Corynesporella* species and two first records from China. *Mycotaxon* 119:83-88

MAAS GEESTERANUS R.A. & DE MEIJER A.A.R., 1997 — Mycenae paranaenses. *Koninklijke Nederlandse Akademie van Wetenschappen Verhandelingen Afd. Natuurkunde, Tweede Reeks* 97: 1-164.

MAAS GEESTERANUS R.A. & HAUSKNECHT A., 1996 — Two new *Mycena* species form La Réunion (France, Africa). *Österreichische Zeitschrift für Pilzkunde* 5: 237-243.

MAAS GEESTERANUS R.A., 1989 — Conspectus of the Mycenas of the Northern Hemisphere 12. Sections *Fuliginellae, Insignes, Ingratae, Euspeireae*, and *Cespitosae*. *Proceedings, Koninklijke Nederlandse Akademie van Wetenschappen. Series C* 92 (3): 331-365.

MAAS GEESTERANUS R.A., 1992 — Key to the sections. *In*: Maas Geesteranus RA. (ed.) *Mycenas of the Northern Hemisphere. II. Conspectus of the Mycenas of the Northern Hemisphere. Koninklijke Nederlandse Akademie van Wetenschappen Verhandelingen Afd. Natuurkunde, Tweede Reeks* 90: 1-6.

MATSUSHIMA T., 1993 — Matsushima mycological memoirs no. 7, Matsushima fungus collection. Published by the author, Kobe

MUNJAL R.L. & GILL H.S., 1961 — *Corynesporella*: a new genus of hyphomycetes. *Indian Phytopathology* 14: 6-9

MURRILL W.A., 1916 — *Prunulus*. *North American Flora* 9: 319-344.

NYLANDER J.A.A., 2004 — MrModeltest v. 2.2. Program distributed by the author. Evolutionary Biology Centre, Uppsala University.

OLARIAGA I., GREBENC T., SALCEDO I. & MARTÍN M. P., 2012 — Two new species of *Hydnum* with ovoid basidiospores: *H. ovoideisporum* and H. *vesterholtii*. *Mycologia* 104, 1443-1455 (2012).

PEGLER D.N., 1987 — A revision of the Agaricales of Cuba 1. Species described by Berkeley & Curtis. *Kew Bulletin* 42 (3): 501-585.

RAITHELHUBER J., 2004 — Nueva Flora Micológica Argentina. Stuttgart, Mycosur. 576 p.

RANNALA B. & YANG Z., 1996 — Probability distribution of molecular evolutionary trees: a new method of phylogenetic inference. *Journal of Molecular Evolution* 43: 304-311.

RODRIGUEZ F., OLIVER J.F., MARIN A. & MEDINA J.R., 1990 — The general stochastic model of nucleotide substitutions. *Journal of Theoretical Biology* 142: 485-501.

RONQUIST F. & HUELSENBECK J.P., 2003 — MrBayes 3: Bayesian phylogenetic inference under mixed models. *Bioinformatics* 19: 1572-1574.

SANG X., LI X., WANG Y. & FAN L., 2016 — Four new sequestrate species of Russulaceae found in China. *Phytotaxa* 289(1):101-117.

SARNARI M., 1998 — *Monografia illustrata del genre Russula in Europa*. Associazione Micologica Bresadola, Trento.

SHENOY B.D., JEEWON R., WU W.P., BHAT D.J. & HYDE K.D., 2006 — Ribossomal and RPB2 DNA sequence analyses suggest that Sporidesmium and morphologically similar genera are polyphyletic. *Mycological Research* 110: 916-928.

SINGER R. & DIGILIO A.P.L., 1952 — Pródromo de la Flora Agaricina Argentina. *Lilloa* 25: 6-461.

SINGER R., 1950 — Type studies on Basidiomycetes IV. *Lilloa* 23: 147-246.

SINGER R., 1986 — The Agaricales in Modern Taxonomy. 4th ed. Koenigstein, Koeltz Scientific Books. 461 p.

SMITH A.H., 1947 — *North American species of Mycena*. Ann Arbor, University of Michigan Library. 521 p.

SPEGAZZINI C., 1883 — Fungi guaranitici. Pugillus 1. *Anales de la Sociedad Científica Argentina* 16 (6): 272-284.

SPEGAZZINI C., 1899 [1898] — Fungi argentini novi v. critici. *Anales del Museo Nacional de Historia Natural "Bernardino Rivadavia"* 6: 6-365.

SPEGAZZINI C., 1919 — Reliquiae Mycoilogicae Tropicae. *Boletín de la Academia Nacional de Ciencias de la República Argentina. Córdoba* 23: 365-541.

SPEGAZZINI C., 1922 — Fungi paraguayensis. *Anales del Museo Nacional de Historia Natural de Buenos Aires* 31: 355-450.

SUBRAMANIAN C.V., 1992 — A reassessment of *Sporidesmium* (hyphomycetes) and some related taxa. *Proceedings of the Indian National Science Academy Botany* 58: 179-190.

SUBRAMANIAN C.V. & SRIVASTAVA V., 1994 — Two new hyphomycetes from Kumaon Himalayas. *Proceedings of the Indian National Science Academy* 60: 167-171.

TAMURA K., STECHER G., PETERSON D., FILIPSKI A. & KUMAR S., 2013 — MEGA6: Molecular Evolutionary Genetics Analysis version 6.0. *Molecular Biology and Evolution* 30: 2725-2729.

THIERS B., (continuously updated) Index Herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium [online]. Available at http://sweetgum.nybg.org/ih/.

THORNHILL A.H., HO S.Y.W., KUELHEIM C. & CRISP M.D., 2015 — Interpreting the modern distribution of Myrtaceae using a dated molecular phylogeny. *Molecular Phylogenetics and Evolution* 93: 29-43.

VERBEKEN A., HAMPE F., WISSITRASSAMEEWONG K., HYDE K., EBERHARDT U. & NUYTINCK J., 2014a —A new angiocarpous *Lactarius* species from Thailand. *Phytotaxa* 181 (3): 163-170.

VERBEKEN A., STUBBE D., VAN DE PUTTE K., EBERHARDT U. & NUYTINCK J., 2014 — Tales of the unexpected: angiocarpous representatives of the *Russulaceae* in tropical South East Asia. *Persoonia* 32:13-24.

VIZZINI A., PICILLO B., ERCOLE E., VOYRON S. & CONTU M., 2013 — Detecting the variability of *Hydnum ovoideisporum* (Agaricomycetes, Cantharellales) on the basis of Italian collections, and *H. magnorufescens* sp. nov. *Mycosphere*, doi: 10.5943/mycosphere/4/1/2

WRIGHT J.E., LECHNER B.E. & POPOFF O.F., 2008 — Hongos. Atlas Pictórico del Parque Nacional Iguazú. Buenos Aires, L.O.L.A. 227 p.

XIA J-W., MA L-G. & ZHANG X-G., 2014 — *Minimelanolocus bicolorata* sp. nov., *Paradendryphiopsis elegans* sp. nov. and *Corynesporella bannaense* sp. nov. from southern China. *Mycoscience* 55: 299-307

ZHANG Y.D., MA J., MA L.G. & ZHANG X.G., 2012a. — *Parablastocatena tetracerae* gen. et sp. nov. and *Corynesporella licualae* sp. nov. from Hainan, China. *Mycoscience* 53: 381-385.

ZHANG Y.D., MA J., MA L.G., CASTAÑEDA-RUÍZ R.F. & ZHANG X.G., 2012b. — A new species of *Corynesporella* and two new records from southern China. *Cryptogamie Mycologie* 33: 99-104.