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Fungal Biodiversity Profiles 101-110

Bart BUYCK, Guillaume EYSSARTIER, Bálint DIMA, Giovanni CONSIGLIO, Machiel Evert NOORDELOOS, Viktor PAPP, Ishika BERA, Aniket GHOSH, Walter ROSSI, Marco LEONARDI & Kanad DAS

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Fungal Biodiversity Profiles 101-110

Bart BUYCK
Institut de Systematique, Évolution, Biodiversité, ISYEB (CNRS, Sorbonne Université, EPHE)
Muséum national d'Histoire naturelle, case postale 39
57 rue Cuvier, F-75231 Paris cedex 05 (France)
buyck@mnhn.fr (corresponding author)

Guillaume EYSSARTIER
180, allée du Château, F-24660 Sanilhac (France)

Bálint DIMA
Department of Plant Anatomy, Institute of Biology, Eötvös Loránd University,
Pázmány Péter sétány 1/c,H-1117 Budapest (Hungary)

Giovanni CONSIGLIO
Via C. Ronzani, 61, I-40033 Casalecchio di Reno (Italy)

Machiel Evert NOORDELOOS
Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA, Leiden (The Netherlands)

Viktor PAPP
Department of Botany, Institute of Agronomy,
Hungarian University of Agriculture and Life Sciences, Budapest (Hungary)

Ishika BERA
Central National Herbarium, Botanical Survey of India,
P. O. Botanic Garden, Howrah 711103 (India)

Aniket GHOSH
Department of Botany & Microbiology, H. N. B. Garhwal University
(A Central University) Srinagar, Garhwal 246174, Uttarakhand (India)

Walter ROSSI
Marco LEONARDI
Section Environmental Sciences, Department MeSVA,
University of L'Aquila, I-67100 L'Aquila (Italy)

Kanad DAS
Acharya Jagadish Chandra Bose Indian Botanic Garden,
Botanical Survey of India, P. O. Botanic Garden, Howrah 711103 (India)

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ABSTRACT
In this new series of Fungal Biodiversity Profiles, the authors provide a description for a new species of *Rachomyces* Thaxt. (Ascomycota, Laboulbeniales) and several Basidiomycota: for the first time illustrated type studies for two older species of *Cantharellus* Adans. ex Fr. (Hydnaceae, Cantharellales), *C. subcibarius* Corner 1966 from Malaysia and *C. pseudocibarius* P.Henn. 1907 from Cameroon are provided, while in Agaricales, family Inocybaceae, three new *Inosperma* (Kühner) Matheny & Esteve-Rav. are described from miombo woodland in Zambia (Africa): *I. afromelliolens* Eyssart. & Buyck, sp. nov., *I. boeticum* Eyssart. & Buyck, sp. nov. and *I. submaculatum* Eyssart. & Buyck, sp. nov. Still in Agaricales, family Entolomataceae, *Rhodophana corylina* Consiglio, Dima & Eyssart., sp. nov. is described and two new recombinations in the same genus are proposed together with an identification key for species of *Rhodophana* Kühner and close allies in Europe. Finally, in Russulales, family Russulaceae, *Russula xerampelinoides* K. Das, I. Bera, A. Ghosh & Buyck, sp.nov. is described from Indian Himalaya. With exception of the two type studies, all new species in Basidiomycota are supported by newly provided sequence data or already published phylogenetic analyses of sequence data.

KEY WORDS
Laboulbeniales, Ascomycota, Agaricales, Cantharellales Entolomataceae, Inocybaceae, Russulales, new species.

RÉSUMÉ
Profils de la biodiversité fongique 101-110.
Dans cette nouvelle série de Profils de la biodiversité fongique, les auteurs décrivent une nouvelle espèce de *Rachomyces* Thaxt. (Ascomycota, Laboulbeniales), et plusieurs Basidiomycota : pour la première fois, les caractères microscopiques de deux anciens types de chanterelles (Cantharellales, Hydnaceae), *Cantharellus subcibarius* Corner 1966 de Malaisie et *C. pseudocibarius* P.Henn. 1907 du Cameroun, sont illustrés en détail, tandis que, dans les Agaricales, famille Inocybaceae, trois nouvelles espèces d'*Inosperma* (Kühner) Matheny & Esteve-Rav. sont décrites du miombo zambézien (Afrique) : *I. afromelliolens* Eyssart. & Buyck, sp. nov., *I. boeticum* Eyssart. & Buyck, sp. nov. et *I. submaculatum* Eyssart. & Buyck, sp.nov. Toujours dans les Agaricales, famille Entolomataceae, *Rhodophana corylina* Consiglio, Dima & Eyssart., sp. nov. est décrit, et deux nouvelles recombinaisons dans ce genre sont proposées, accompagnées d'une clé d'identification pour les espèces de *Rhodophana* Kühner et taxons similaires en Europe. Finalement, dans les Russulales, famille Russulaceae, *Russula xerampelinoides* K. Das, I. Bera, A. Ghosh & Buyck, sp. nov. est décrit de l'Himalaya en Inde. Exception faite pour les deux études des anciens types, les nouvelles espèces de Basidiomycota sont appuyées par des analyses phylogénétiques de séquences ITS ou multigènes, certaines déjà publiées ailleurs.

MOTS CLÉS
Laboulbeniales, Ascomycota, Agaricales, Cantharellales, Entolomataceae, Inocybaceae, Russulales, espèces nouvelles.

INTRODUCTION

In this new series of Fungal Biodiversity Profiles, the authors provide a description for a new species of *Rachomyces* (Ascomycota, Laboulbeniales) and several Basidiomycota: for the first time illustrated type studies for two older *Cantharellus* species (Hydnaceae, Cantharellales), *C. subcibarius* Corner (Corner 1966) from Malaysia and *C. pseudocibarius* P.Henn. (Hennings 1905) from Cameroon are provided, while in Agaricales, family Inocybaceae, three new *Inosperma* are described from miombo woodland in Zambia (Africa): *I. afromelliolens* Eyssart. & Buyck, sp. nov., *I. boeticum* Eyssart. & Buyck, sp. nov. and *I. submaculatum* Eyssart. & Buyck, sp.nov. Still in Agaricales, family Entolomataceae, *Rhodophana corylina* Consiglio, Dima & Eyssart., sp. nov. is described and two new combinations in the same genus are proposed together with an identification key for *Rhodophana* species and close allies in Europe. Finally, in Russulales, family Russulaceae, *Russula xerampelinoides* K. Das, I. Bera, A. Ghosh & Buyck, sp. nov. is described from Indian Himalaya. With exception of the two type studies, all new species in Basidiomycota are supported by newly provided sequence data or already published phylogenetic analyses of sequence data.

MATERIAL AND METHODS

References to a colour code in descriptions follow Kornerup & Wanscher (1981). Short explanations on molecular methods that were used for building phylogenies are given in the legends of the individual phylogenetic trees.

TAXONOMY

Phylum ASCOMYCOTA R.H. Whittaker
Class LABOULBENIOMYCETES Engl.
Order LABOULBENIALES Lindau
Family LABOULBENIACEAE G. Winter
Genus *Rhachomyces* Thaxt.

101. ***Rhachomyces neoproliferans***
W.Rossi & M.Leonardi, sp. nov.
(Fig. 1)

Rhachomyces proliferans Lepesme, *Bulletin du Muséum d'histoire naturelle de Paris*, Sér. 2: 598 (1941)*, nomen invalidum*

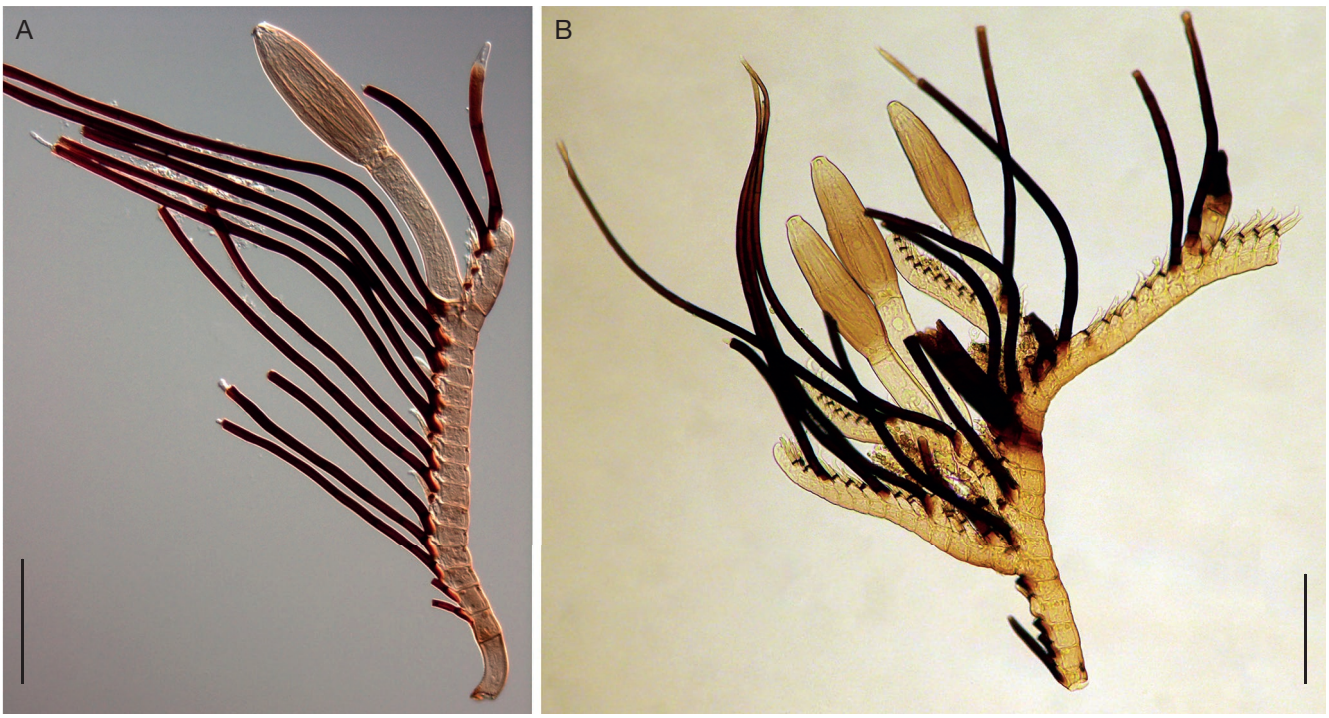

Fig. 1. — *Rhachomyces neoproliferans* W.Rossi & M.Leonardi, sp. nov.: **A**, thallus from *Duvalius* (*Biharotrechus*) *redtenbacheri bihariensis* photographed with DIC optics (slide WR 4046); **B**, old and highly ramified thallus from *D.* (*B.*) *hickeri* (slide WR 4990). Scale bars: 100 µm.

Diagnosis. — Large thalli with frequently ramified receptacle bearing very many antheridia, relatively few appendages and one or more stalked perithecia.

Holotype. — **Romania**. Muntii Apuseni, Valea Lesului, pestera cu Apa, 31.V.1996, J. Prouza, on the legs of *D.* (*B.*) *paroecus* (J. Frivaldszky) (FI WR4491b).

MycoBank. — MB 839029.

Etymology. — From Latin *neo-* = new (in compound words), and *proliferans*, the previous invalid name given to the fungus.

Additional examined material. — **Romania**. Bihor Mts., near Campéni, 600-700 m, 8.V.1981, J. Janák, on *Duvalius* (*Biharotrechus*) *mallaszii rothi* Jeannel (FI WR4221); *ibidem*, 5.VI.2012-12.VII.2013, J. Janák (by trap) (FI WR4220); Mts. Padurea Craiului, pestera Ciur Ponor, 27.V.2006, V. Zieris, on *D.* (*B.*) *redtenbacheri bihariensis* Csiki (FI WR4046); Muntii Apuseni, Valea Lesului, pestera cu Apa, 31.V.1996, J. Prouza, on various ventral parts of *D.* (*B.*) *paroecus* (J. Frivaldszky) (FI WR4491a); Bihor Mts., Ghetarul de sub Zgurasti, 12.VI.1988, V. Zieris, on various ventral parts of *D.* (*B.*) *hickeri* (Knirsch) (FI WR4490).

Description

Receptacle

Pale yellow, elongate, slender, sigmoid, with the main axis consisting of 25 to 50 cells separated by oblique septa. Basal cell brownish, distinctly curved, at least three times longer than broad; subbasal cell rectangular or trapezoidal, about half as long and slightly wider than the basal. Each cell of the axis above the basal bear a small trapezoidal cell which gives rise either to a long, dark appendage or to a pair of hyaline, slender antheridia with curved distal portion.

Perithecia

One or more, arising from the upper half of the main axis, dark yellow to light brown, elongate, narrowly elliptical to narrowly ovoid, ending in a blunt apex; perithecial stalk light yellow, cylindrical, variable in length, but usually about as long as the perithecial body.

Main axis

390-650 µm. Longest appendages 525 µm. Perithecium (including basal cells) 140-200 × 45-65 µm. Longest perithecial stalk 165 µm.

Notes

With the five species described very recently (Rossi & Christian 2020; Rossi & Leonardi 2020; Santamaria *et al.* 2020), the genus *Rhachomyces* has now about 90 species. *Rachomyces neoproliferans* W.Rossi & M.Leonardi, sp. nov. is easily distinguishable from all the other species in the same genus for the very many antheridia associated with few appendages, for the frequently ramified receptacle and for the number of stalked perithecia. The latter features are uncommon in the genus *Rhachomyces* and are usually associated with serious damage of the thallus.

The "new" species described here is undoubtedly the same taxon as the one already described from Romania as *Rhachomyces proliferans* by Lepesme (1941) on *Duvalius* (*Biharotrechus*) *mallaszii* (Csiki) ssp. *gabriellae* (Mallasz) and *D.* (*B.*) *laevigatus* (Bokor). The name *Rhachomyces proliferans* is not validly published because a Latin diagnosis is missing in the protologue (art. 39 of the International Code of Nomenclature for algae, fungi, and plants, 2018).

Unfortunately, the material on which Lepesme based his description has gone lost along with his entire slide collection (personal communication of Jean Balazuc to W. R.). After description, *Rhachomyces proliferans* was recorded by Bánhegyi (1949) on *Duvalius* (*Biharotrechus*) *paroecus* (J. Frivaldszky) and *D.* (*B.*) *redtenbacheri* (I. Frivaldszky von Frivald & J. Frivaldszky) and by Balazuc (1970) on *D.* (*B.*) *cognatus* (J. Frivaldszky).

Phylum BASIDIOMYCOTA R.T. Moore
Class AGARICOMYCETES Doweld
Order CANTHARELLALES Gäum.
Family HYDNACEAE Chevall.
Genus *Cantharellus* Adans. ex Fr.

102. ***Cantharellus pseudocibarius*** P. Henn.
(Figs 2; 3)

Botanische Jahrbücher fur Systematik, Pflanzengeschichte und Pflanzengeographie 38: 123 (1905).

TYPUS. — Cameroon, Bipinde, leg. G. Zenker 2457.

Original diagnosis (from Hennings 1905): «*Pileo carnoso, subflabellato vel convexo medio depressoque, aurantiaco, levi glabro 2-5 cm diam., margine integro vel undulato lobatoque; stipite laterali vel excentrico, tereti, farcto, laevi vel substriato, basi bulbilloso, 4-6 cm longo, 3-4 cm crasso, concolori; lamellis subpliciformibus vel usque ad 2 mm latis, decurrentibus, subconfertis, furcatis,inaequilongis, acie crassis integris, aurantiis; sporis subglobosis vel ovoideis, hyalinis, 4-5 × 3 ½-4 ; odore amoeno. Kamerun: Bipindi im Urwalde am Grunde der Stämme (Zenker n. 2457. – Okt. 1901).*

DESCRIPTION

Spores
Ellipsoid, (5.6)6.0-6.36-6.7(7.1) × (4.2)4.4-4.65-4.9(5.2) µm, Q = (1.23)1.30-1.37-1.45(1.50), smooth.

Basidia
50-60 × 7-9 µm, narrowly clavate, predominantly 5-spored ; sterigmata relatively small, 5-6 × 1-2 µm.

Subhymenium
Not well inflated, most likely filamentous and composed of long, slender cells.

Pileipellis
Composed of hyphae of variable diam. and cells of variable size and width; mostly thin-walled but some cells slightly to distinctly thick-walled, subcylindrical or somewhat widening toward one septum, sometimes almost ellipsoid; the terminal cell obtuse rounded or slightly narrowing at the tip, the narrowest ones mostly thin-walled, *c.* 6-8 µm diam. and subcylindrical, but mostly terminal and often also some subterminal cells are more inflated, subclavate, ellipsoid or even ampullaceous, and more or less thick-walled, up to 10(-12) µm diam.

Clamp connections
Absent everywhere.

NOTES

We have been hesitating as to whether the duplicates of the type collection should be referred to as syntypes or isotypes. As the number of these duplicate collections are quite considerable: there are four "collections" at PC, consisting each of several fruiting bodies, and there is also at least one more collection in BR and another one in K, while the reference collection should have been originally at B but most likely destroyed by fire. It seems therefore very likely that these various collections represent different gatherings that have been filed under a single number (2457) and possibly collected at different dates as suggested by the year 1902 (versus 1901 in the original description). The spores of the examined syntypes in Paris (PC) are near identical to slightly smaller than those measured on the syntype deposited in the botanical garden of Meise (BR), which were 6-6.73-7.5 × 4-4.85-6 µm, Q = 1.17-1.39-1.62 (Eyssartier 2001). Both these measurements are well above the measurements given in the original description where spore size values are clearly too low. From the studied material (Fig. 2), it can be observed that the hymenophore consists of quite distant, unequal gill folds with dispersed forkings, neither strongly interveined nor anastomosing in between.

The here studied and illustrated microscopic features came from a syntype that revived much better than the syntype studied by Eyssartier (2001), allowing now for a detailed description and illustration of the pileipellis composition. This pileipellis is made up of variously inflated cells of different form and size and with cell walls of variable thickness, reminding strongly of the pileipellis illustrated for *C. rufopunctatus* (Beeli) Heinem. in De Kesel *et al.* (2016).

Cantharellus rufopunctatus is probably the only other orange, but distinctly larger chanterelle that occurs in the same Central African rain forest. As it has much more elongate spores (Qmean = 1.9), we can thus exclude the hypothesis that both species are contaxic. In the key by De Kesel *et al.* (2016), *C. pseudocibarius* is keyed out by comparing it with *C. rufopunctatus* but the length/width ratio (Q) for spores is mentioned there for *C. pseudocibarius* as <1.2, which was based on Heinemann's (1966) interpretation of Henning's "sporis subglobosis vel ovoideis" as "subglobose spores".

As far as we are aware, there are no other *Cantharellus* species described from Africa that match the features of Henning's species. *Cantharellus pseudocibarius* was reported and illustrated by Buyck (1994) from Burundi and had previously also been reported from Tanzania and Zambia (Pegler & Piearce 1980). In both cases, however, this involves equally orange, but different species with much more elongate spores (8-9 × 4-5 mm or Q = approximately 2 in the case of the Burundi chanterelle which produced also much smaller fruiting bodies). As for the *C. pseudocibarius* mentioned by Pegler & Piearce (1980), we think it might correspond to *C. humidicolus* Buyck & V. Hofst., described more recently from Tanzania (Buyck *et al.* 2013). The latter species has a similar size as *C. pseudocibarius* but also differs in its very elongate spores (Qmean = 2.4). In conclusion, we think that Henning's species still awaits to be rediscovered in the Central African rain forest.

Fig. 2. — *Cantharellus pseudocibarius* P. Henn.: **A**-**C**, three of the four syntype collections at PC (PC0142534-PC0142537). Scale bars: A, B, 5 mm; C, 1 cm. Photos: B. Buyck.

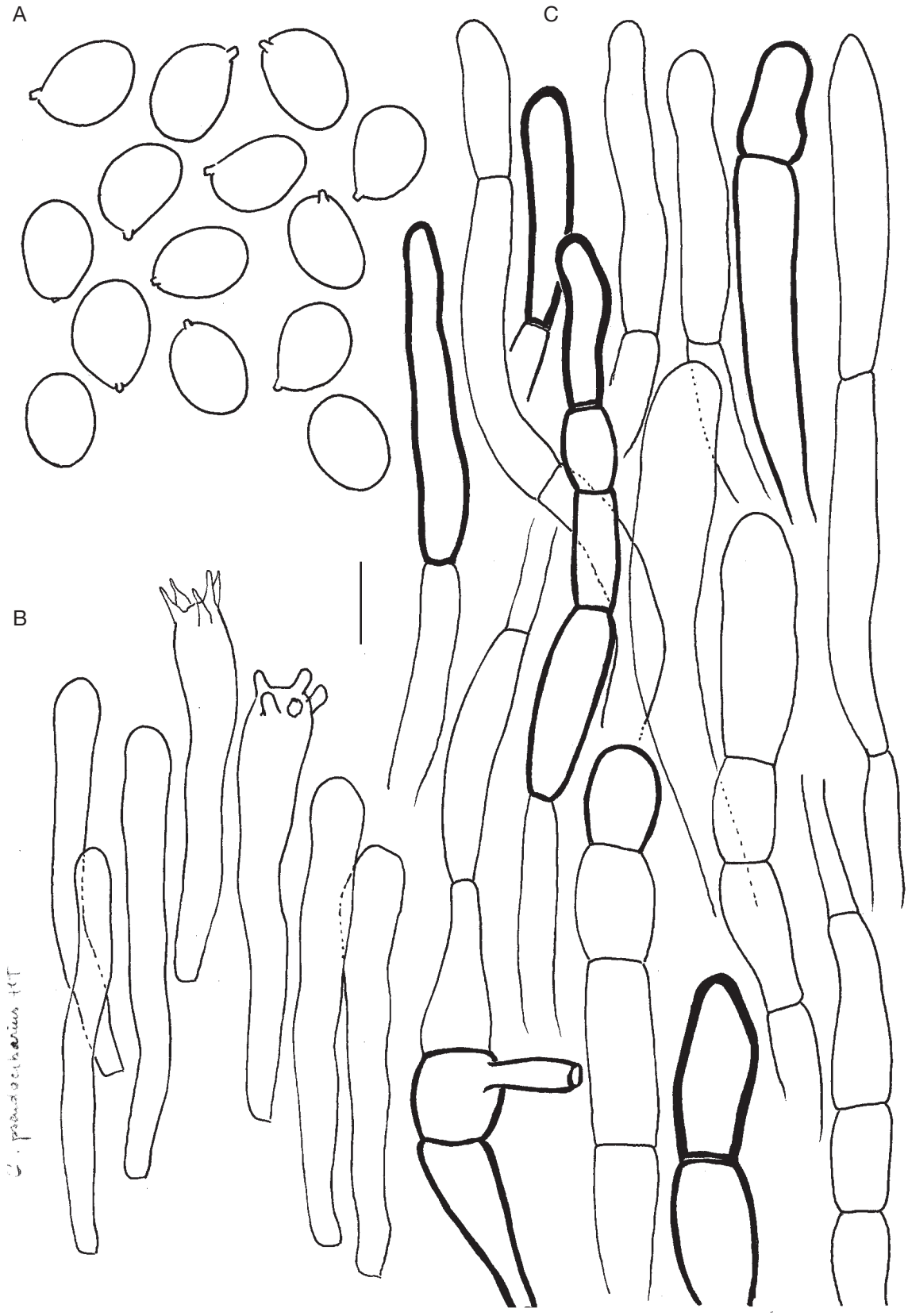

FIG. 3. — *Cantharellus pseudocibarius* P.Henn. (syntype PC), microscopic features: **A**, spores; **B**, basidia and basidiola; **C**, hyphal extremities of the pileipellis. Scale bar: A, 5 µm; B, C, 10 µm. Drawings: B. Buyck.

103. ***Cantharellus subcibarius*** Corner (Figs 4; 5)

Annals of Botany Memoir 2: 58 (1966).

Original diagnosis (from Corner 1966): *« Solitarius v. subcaespitosus, ex integro pallide subochraceus v. sordide albidocremeus. Pileus 7 cm latus, infundibuliformis, laevis vel centro subfloccoso-squamulosus; margine incurvato, dein undulato-expanso. Stipes 3-6 cm × 4-10 mm, solidus, laevis, fibrosus, subcylindricus. Plicae profunde decurrentes, irregulariter ter v. quater dichotomae, subdistantes, 1-2 mm latae, obtusae, intervallis marginem versus leniter reticulatis et plicis brevioribus praeditis, parte stipitis superiori saepe hymenio laevi obtecto. Contextus firmus, fibrosus, 3-8 mm crassus in centro pilei, concolor ; odore nullo. Ad terram in silva. Sporae 7,5-9 × 5,5-7 µm, albidae, obtusae. Basidia 50-65 × 7,5-8,5 µm, ad 15 µm projicientia ; sterigmatibus 4-5-6, plerumque 5, 4-6 µm longis, curvatis. Hymenium incrassatum ; cystidiis nullis. Hyphae 2,5-10 µm latae, fibulatae, irregulariter inflatae, tunicis haud v. vix incrassatis. Pilei stipitisque superficies hyphis 2,5-8 µm latis, haud fasciculatis, laxe subpatentibus praedita.».*

Holotype. — **Malaysia**. North Borneo, Kinabalu, 13.VI.1961, leg. & det. *E.J.H. Corner* 571 (K holotypus, PC isotypus).

Etymology. — Named after its resemblance to *Cantharellus cibarius.*

Description

Spores

Large, shortly ellipsoid, (7.3)7.5-7.89-8.3(8.5) × (5.2)5.6-6.10-6.5(6.9) µm, Q = (1.12)1.23-1.30-1.36(1.40), smooth, with a small apiculus.

Basidia

75-95 × 8-10 µm, narrowly clavate, long and quite regular in outline, predominantly 5-spored, with large sterigmata.

Subhymenium

Filamentous.

Pileipellis

Composed of intertwined, flexuous hyphal terminations of remarkably variable diameter but mostly rather narrow, 3-6 µm diam., some reaching 8-12 µm diam., all with remarkably spaced septa and slightly thickened walls, many with a refringent aspect (as if filled with something); terminal cells often narrower than the subapical ones and long, mostly between 50-100 µm, but also longer, obtuse-rounded at the tip; the widest terminal cells shorter, *c.* 30-70 µm, and mostly narrowing at the tip.

Hyphae of context

Underneath also very different in diam, mostly very wide.

Clamp connections

Everywhere, very distinct.

Notes

Our description of the isotype in PC is in complete agreement with the observations made by Eyssartier (2001) on the material deposited in BR [spores 7.5-7.97-8.5 × 6-6.24-6.5 µm, Q = 1.15-1.28-1.46; basidia 75-100 × 7.5-9 µm, (4) 5-6 spored; hyphae in pileipellis 3-5(8) µm diam., thick-walled. Clamps abundant]. This tropical species differs from other known yellow *Cantharellus* in Asia especially in the larger size of its spores (Shao *et al.* 2021).

Phylum BASIDIOMYCOTA R.T. Moore
Class AGARICOMYCETES Doweld
Order AGARICALES Underw.
Family Inocybaceae Jülich
Genus *Inosperma* (Kühner) Matheny & Esteve-Rav.

Remarks

The traditional ectomycorrhizal genus *Inocybe* (Fr.) Fr., with an estimated 1000 species worldwide, is still very little known on the African continent although it is not rare at all; Buyck and collaborators collected more than 25 years ago already more than 14 different species in the Zambian miombo woodlands of which only two had been officially published (Buyck & Eyssartier 1999). The checklist of macrofungi for South Africa (Kinge *et al.* 2020) only counts eleven *Inocybe* in this part of the continent, and more than half of them are named after European species that have little chance of being found in the remainder of Africa, unless under imported host trees. Pegler (1977) described five *Inocybe* from East Africa, and apart from a few articles describing one or two new tropical African species (Watling 2001; Matheny & Watling 2004; Matheny *et al.* 2017), the exact African diversity of this group of fungi remains largely unexplored.

The old Friesian genus *Inocybe* was fairly polyphyletic (Matheny *et al.* 2009) and has been recently divided into several genera: *Inocybe*, *Nothocybe* Matheny & K. P. D. Latha, *Pseudosperma* Matheny & Esteve-Rav., *Auritella* Matheny & Bougher, *Mallocybe* (Kuyper) Matheny, Vizzini & Esteve-Rav., *Tubariomyces* Esteve-Rav. & Matheny and *Inosperma* (Kühner) Matheny & Esteve-Rav. (Matheny & Bougher 2006; Matheny *et al.* 2019).

With their fibrillose-rimose cap, smooth stipe and hymenium without any cystidia, the following three new species from the Zambezian miombo woodlands belong to the genus *Inosperma* (Matheny *et al.* 2019).

104. ***Inosperma afromelliolens*** Eyssart. & Buyck, sp. nov. (Figs 6; 7)

Diagnosis. — Because of general appearance and distinct honey smell, this species is in the field very reminiscent of the European *Inosperma melliolens*, but sequence data place it in a different, old world subclade of the genus.

Holotype. — **Zambia**. In miombo woodland along road Luanshya-Ibenga, 31.I.1996, EG96080 = BB6269 (PC[PC0088778]!, holo-)

Index Fungorum. — IF558209.

GenBank. — JQ801382 (nrITS, holo-), JQ815408 (nrLSU, holo-), JQ801383 (nrITS, para-), EU600883 (nrLSU, paratype), EU600881 (RPB1, parat-), EU600882 (RPB2, para-).

Fig. 4. — **A**, **B**, *Cantharellus subcibarius* Corner (isotype, PC0142538). Scale bar: 5 mm. Photos: B. Buyck.

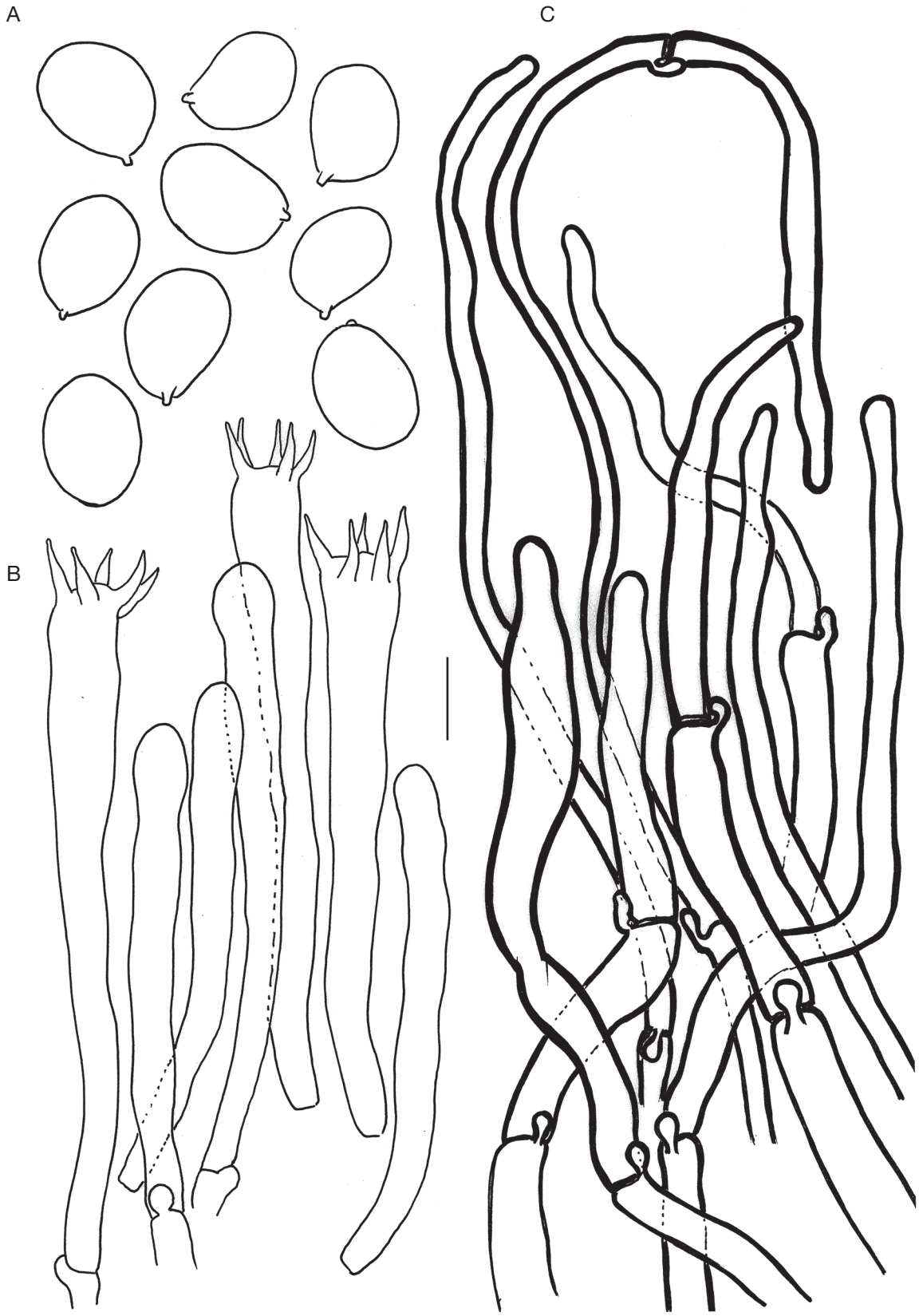

Fig. 5. — *Cantharellus subcibarius* Corner (syntype PC), microscopic features: **A**, spores; **B**, basidia and basidiola; **C**, hyphal extremities of the pileipellis. Scale bar: A, 5 µm; B, C, 10 µm. Drawings: B. Buyck.

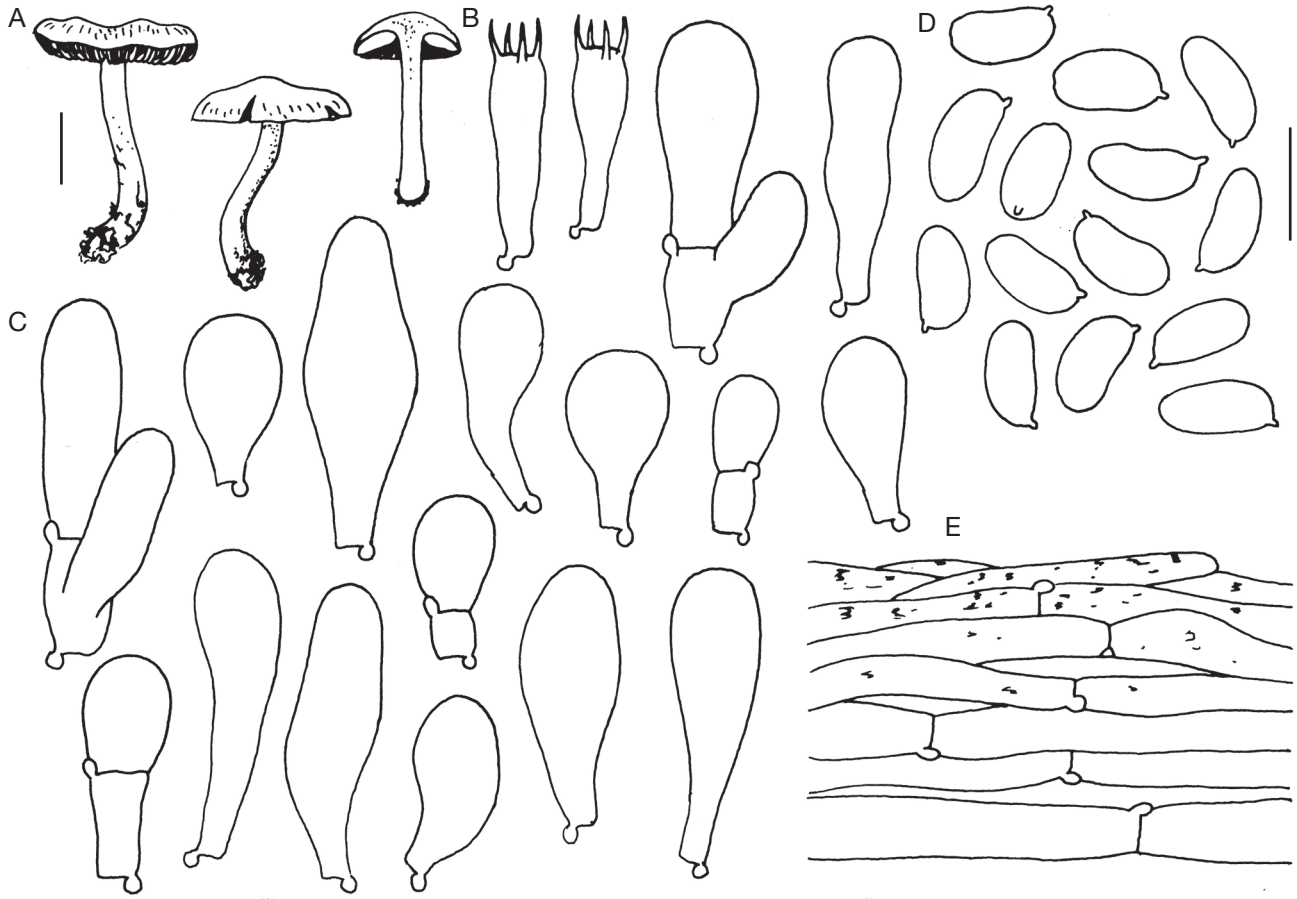

Fig. 6. — *Inosperma afromelliolens* Eyssart. & Buyck, sp. nov. (holotype): **A**, fruiting bodies; **B**, basidia; **C**, marginal cells of the gill edge; **D**, spores; **E**, pileipellis in section (detail). Drawings: G. Eyssartier. Scale bars: A, 1 cm; B-E, 10 µm.

Etymology. — Referring to the similarity with *Inosperma melliolens*.

Additional examined material. — **Zambia**. In miombo woodland, 17.I.1996, EG96013bis = BB96017b (PC[PC0088766])

Description

Pileus
10-30 mm in diam., obtuse conical or conico-campanulate then piano-convex with inflexed margin, nut-brown, caramel-brown, seldom beige brown, a long time radially fibrillose but very even, then slightly rimose with honey-yellowish tinges.

Lamellae
Subhorizontal, quite close, obtuse at the margin, (1.5) 2-3 mm broad, emarginate, dull beige then slightly ochraceous, rather brownish, with slightly flocculose edges.

Context
Whitish.

Stipe
(20) 25-40 × 3-4 (5) mm, subcylindrical or more or less bulbous or slightly marginate, dirty whitish or beige to honey-beige with sometimes pinkish tinges, white at the base.

Smell
Distinct, honey-like.

Taste
Mild.

Spores
(7.5) 8-9 (10) × 4-4.5 (5.5) µm, subellipsoid, with a tendency toward subcylindrical or reniform, very obtuse at the tip.

Basidia
Clavate, 4-spored, (20) 22-26 (28) × 7-8 µm.

Marginal cells
Broadly clavate, sometimes subutriform, (15) 20-40 (45) × (8) 10-13 (15) µm.

Cystidia
None.

Epicutis
A cutis of cylindrical hyphae, 5-8 µm broad, with a very slightly incrusting to hardly visible pigment.

Fig. 7. — *Inosperma afromelliolens* Eyssart. & Buyck, sp. nov. (holotype, PC0088778). Photo: G. Eyssartier.

Notes

The sequences deposited in GenBank for our *I. afromelliolens* Eyssart. & Buyck, sp. nov. were part of phylogenetic analyses published by Kropp *et al.* (2013), Matheny *et al.* (2009) and Aignon *et al.* (2021a).

105. ***Inosperma boeticum*** Eyssart. & Buyck, sp. nov. (Figs 8; 9)

Diagnosis. —Differs from *Inosperma bulbomarginatum* in its darker pileus color and wider spores, a <98% similarity for 100% coverage in the ITS sequence data, and in its association with different host tree species in a biogeographically distinct region (the miombo of South Central Africa).

Holotype. — **Zambia**. Copperbelt province, along Luanshya-lbenga road, in degraded miombo woodland, 03.II.1996, EG 96.082 (PC[PC0088774]!, holo-)

Index Fungorum. — IF558210.

GenBank. — JQ801412 (nrITS, holotype), JN975027 (nrLSU, holotype).

Etymology. — Named after the colour of the cap, from the latin word *boeticus*, "Spanish brown", a dark reddish brown.

Additional specimens examined. — **Zambia**. Lusaka province, near Lusaka airport, in degraded miombo woodland, under *Brachystegia* sp. and *Uapaca nitida,* 08.II.1996, GE96.082bis (PC[PC0125161]); ibid, 10.II.1996, EG 96.082ter (PC[PC0125162])

Description

Pileus

(10) 15-30 (35) mm in diam., subhemispherical or conico-convex then planoconvex with a large obtuse umbo, more rarely plane, buffy-brown, chestnut brown sometimes reddish brown, never dark, beige brownish towards the margin, with lanate appressed squamules, felty, more fibrillose towards the margin.

Lamellae

Soon horizontal, (1.5) 2-3 mm broad, emarginate, beige greyish then ochraceous, never dark; edge white, finely flocculose.

Stipe

(20) 25-40 × 3-5 (6) mm, slightly bulbous but not marginate, whitish or pale beige, a little bit plushy in the upper part. fibrillose lengthwise.

Context

White.

Taste

Mild.

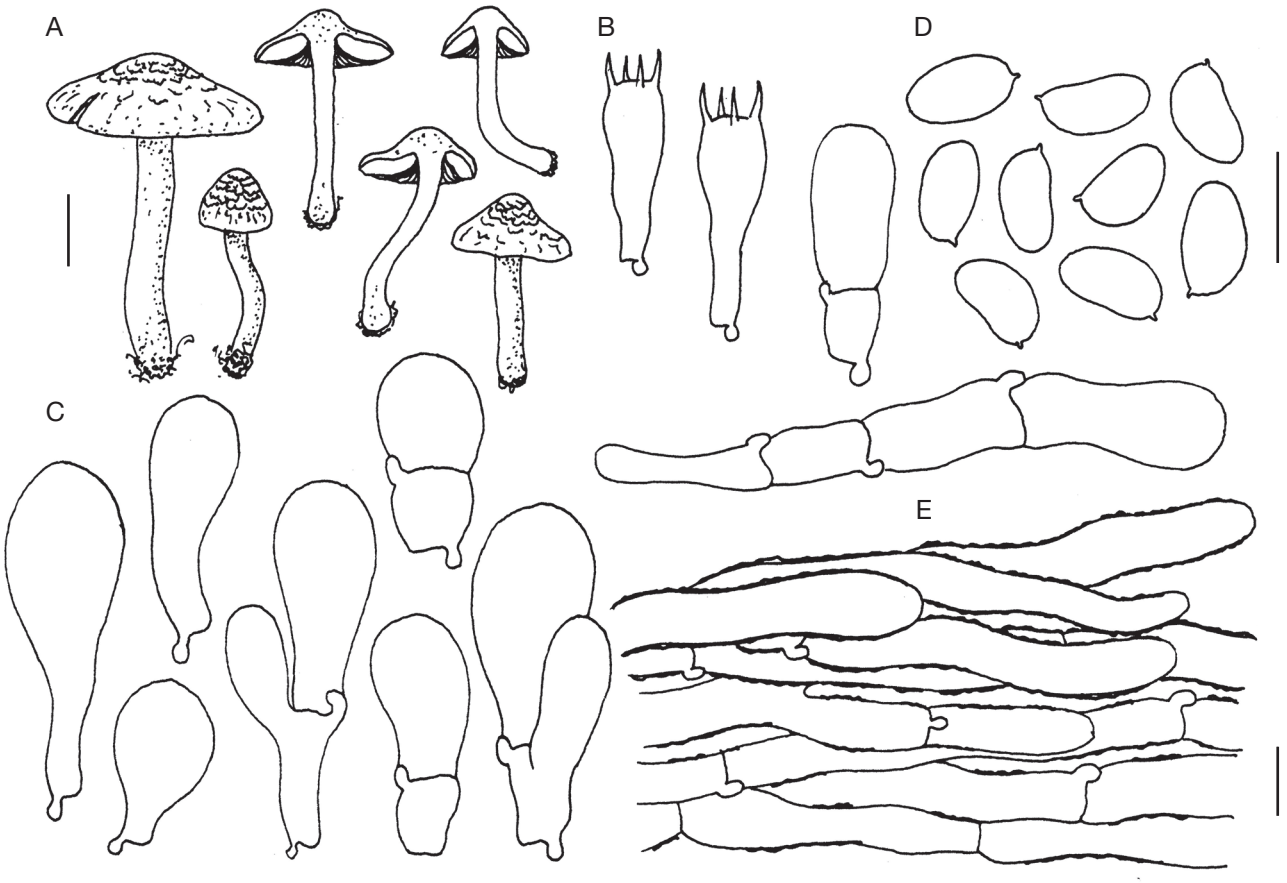

FIG. 8. — *Inosperma boeticum* Eyssart. & Buyck, sp. nov. (holotype): **A**, fruiting bodies; **B**, basidia; **C**, marginal cells of the gill edge; **D**, spores; **E**, pileipellis in section (detail). Scale bars: A, 1 cm; B-E, 10 µm. Drawings: G. Eyssartier.

Smell
Unremarkable to distinctly farinaceous.

Spores
(8) 9-10 (11) × (5) 6-6.5 µm, ellipsoid to broadly amygdaliform, often slightly reniform.

Basidia
Clavate, 4-spored, (25) 30-35 × (6) 8-10 µm.

Marginal cells
Clavate to spheropedonculate, with 1-3 short elements at the base, variable in size, (15) 20-40 (50) × (8) 10-15 (20) µm.

Pileipellis
Acutis of cylindrical hyphae, (7) 8-10 (12) µm broad, with many free extremities. Pigment parietal, brown yellowish, more or less coarsely incrusting.

Clamp connections
Present in all parts.

NOTES
The ITS and LSU holotype sequence for this species were part of phylogenetic analyses by Kropp *et al.* (2013) and Ryberg & Matheny (2012), and more recently also in those by Aignon *et al.* (2021a, b) who included our Zambian collection in their concept of *I. bulbomarginatum sensu lato*. In our opinion, as well as in the opinion of these authors, the combination of molecular and morphological differences justifies the recognition of two sister species confined to different habitats in different biogeographic parts of tropical Africa, as equally demonstrated for other ectomycorrhizal genera such as *Russula* (Sanon *et al.* 2014) and *Cantharellus*, a genus that has mostly strict endemics in West Africa (Buyck *et al.* 2020).

106. ***Inosperma submaculatum***
Eyssart. & Buyck, sp. nov.
(Figs 10-12)

DIAGNOSIS. — Differs from *I. maculatum* (Boud.) Matheny & Esteve-Rav. in obtained sequence data that place it in a different, old world African subclade of genus *Inosperma* with no publicly deposited sequences closer than 90% similarity and no similar described African species known.

INDEX FUNGORUM. — IF558211.

GENBANK. — JQ815428 (nrLSU, paratype), EU600870 (nrLSU, holotype), EU600869 (RPB2, holotype), JQ801417 (nrITS, holotype).

Fig. 9. — *Inosperma boeticum* Eyssart. & Buyck, sp. nov. (holotype, PC0088774). Photo: B Buyck.

Etymology. — Named after its similarity to *Inosperma maculatum.*

Holotype. — **Zambia**. Copperbelt Prov., Chibouli, gregarious on soil in miombo woodland, 1.II.1996, EG96073 (= Buyck 96262, PC[PC0088776]!, holo-).

Additional examined material. — **Zambia**. Copperbelt Prov., Chibouli, gregarious on soil in miombo woodland, 31.I.1996, EG 96062 (= Buyck 96.232, PC[PC0088777]) along Mpongwe-Chibouli road, EG 96067 (= Buyck 96247, PC[PC0088757])

Description

Pileus
(13)20-30 mm in diam., obtuse conico-campanulate with a involuted margin, seldom plano-convex, chesnut-brown, reddish-brown, like *I. maculata* Boudier, with a white veil soon missing, in appressed patches at the center, even, sometimes slightly rimose at the margin.

Lamellae
Slightly ascendant or subhorizontal, emarginate, (1.5) 2-3 mm broad, pale beige for a long time, only ochraceous in the oldest stages.

Stipe
(8) 20-35 (40) × (2) 3-5 mm, bulbous marginate, up to 9 (10) mm in the bulb, whitish or pale beige.

Context
White.

Smell
Very slightly honey-like or with a complex herbaceous component.

Spores
(6.5) 7-9 (10) × (4.5) 5-5.5 (6) µm, ellipsoid or slightly reniform, sometimes with a tendency toward subcylindrical, quite pale under the microscope, containing a conspicuous oil drop.

Basidia
Clavate, 4-spored, 25-30 (35) × 8-10 µm, filled with an oily solution.

Hymenial cystidia
Absent

Marginal cells
Variable in size, clavate, (20) 25-40 (50) × 8-12 (15) µm.

Pileipellis
A cutis of cylindrical hyphae, 5-8 µm broad, with finely encrusting pigment on cell walls.

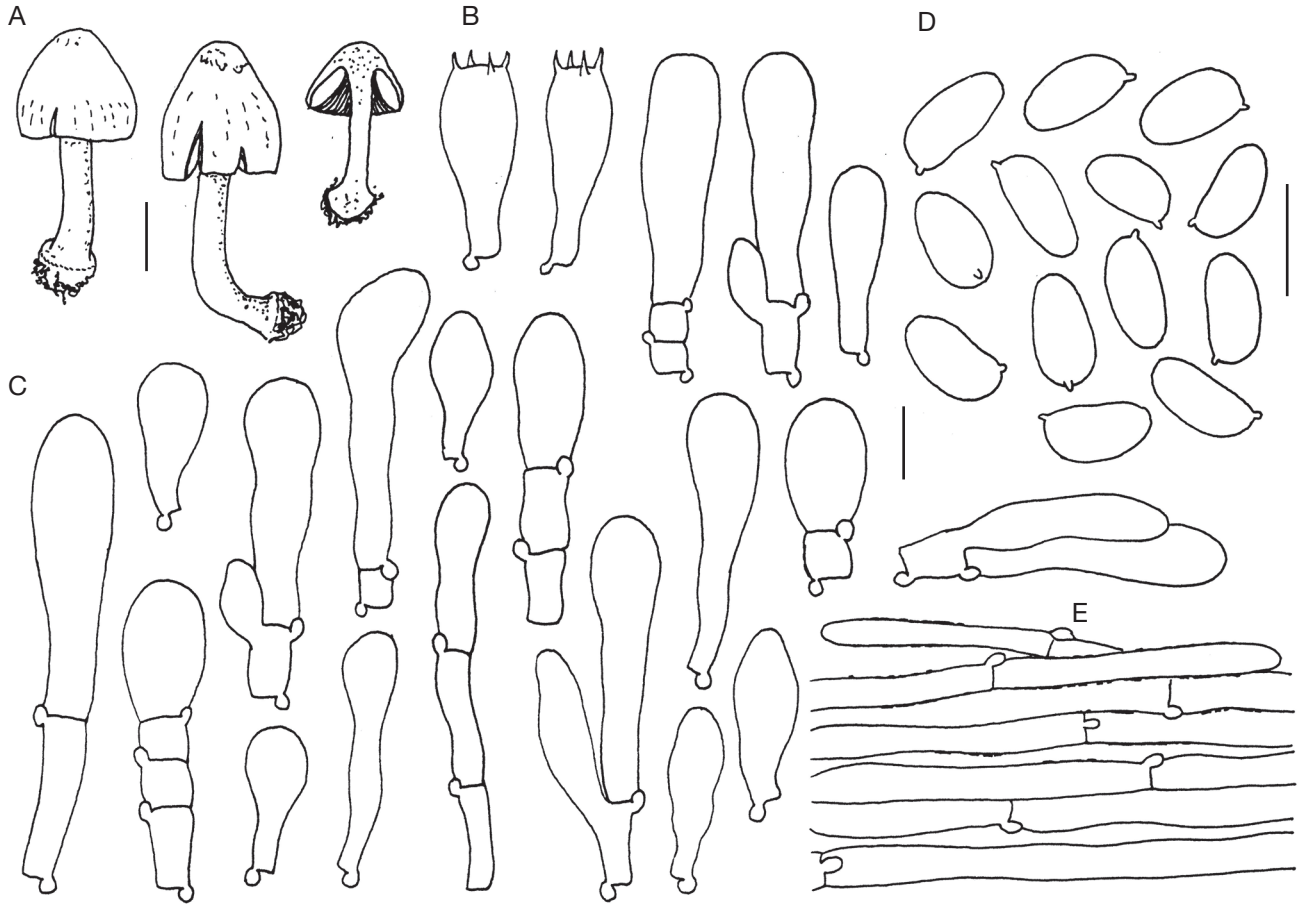

Fig. 10. — *Inosperma submaculatum* Eyssart. & Buyck, sp. nov. (holotype): **A**, fruiting bodies; **B**, basidia; **C**, marginal cells of the gill edge; **D**, spores; **E**, pileipellis in section (detail). Scale bars: A, 1 cm; B-E, 10 µm. Drawings: G. Eyssartier.

Clamp connections
Present in all parts.

Notes
For a European mycologist, *Inosperma submaculatum* Eyssart. & Buyck, sp. nov. is of course reminiscent of *I. maculatum* (Boud.) Matheny & Esteve-Rav., not only macroscopically – in particular by its slight honey-like smell – but also with its quite small and more or less reniform spores and the absence of metuloid cystidia. Buyck & Eyssartier (1999) had already noted that some endemic African *Inocybe* bear a strong resemblance to European species, but in all these cases morphological and/or genetical differences support these African taxa as new and independent species. Against all odds, the look-alike of *I. submaculatum* Eyssart. & Buyck, sp. nov. studied here does not belong to the "*Maculata* clade" (Pradeep *et al.* 2016), one of the major subgroups of the genus *Inosperma* , but to the African and basal "Old World tropical clade" of this genus, where all three of the here described species belong. Sequences generated from the above-mentioned specimens of *I. submaculatum* Eyssart. & Buyck, sp. nov. were part of the phylogenetic analyses published by Kropp *et al.* (2013) and Matheny *et al.* (2009).

Phylum BASIDIOMYCOTA R.T. Moore
Class AGARICOMYCETES Doweld
Order AGARICALES Underw.
Family Entolomataceae
Genus *Rhodophana* Kühner

107. ***Rhodophana corylina***
Consiglio, Dima & Eyssart., sp. nov.
(Figs 13-15)

Well-characterized by the combination of its ochraceous brown pileus, dark grey-brown stipe, very pale and contrasting gills, strong farinaceous odour, pink spore print, and subamygdaliform to ellipsoid, verrucose spores, as well as by produced ITS sequence data.

Holotype. — **France**. Dordogne, Razac-sur-l'Isle, *regional nature reserve* of Peyssac (RNR 62); on a rich soil, under *Prunus laurocerasus*, with various *Lepiota* and other nitrophilic species, leg. G. Eyssartier, 29.X.2019, GE 19.017 (holotype PC[PC0142533]).

Mycobank. — MB838804.

GenBank. — MW604812 (ITS holotype), MW604813, MW604814 (ITS paratypes)

Fig. 11. — *Inosperma submaculatum* Eyssart. & Buyck, sp. nov. (PC0088757). Photo: B. Buyck.

Fig. 12. — *Inosperma submaculatum* Eyssart. & Buyck, sp. nov. (holotype, PC0088776). Photo: B. Buyck.

Etymology. — Named after the dull ochraceous brown pileus, which evokes a little bit the color of some hazelnuts.

Additional examined material. — **Italy**. Riserva Naturale Bosco della Mesola (Ferrara), under *Quercus ilex*, leg. G. Consiglio, R. Bolletta, C. Orlandini & M. Panchetti, 12.XI.2004, Herbarium AMB no. 18726, GenBank MW604813; Roncosambaccio (Pesaro-Urbino), in a mixed forest of broadleaved trees, leg. M. Maletti, 16.XI.2009, Herbarium AMB no. 18727, GenBank MW604814.

Description

Pileus

Measuring (5) 10-15 (20) mm, quickly flat, with an often wavy margin, a little greasy to the touch or satiny, smooth or very finely wrinkled radially, of a fairly dull ochraceous brown, hazelnut to bistre, paler towards the margin which is clearly striate over nearly half the radius.

Gills

Shortly emarginate, moderately spaced, pale, whitish to very pale with greyish cream tinges, sometimes yellowish in places, forming a clear contrast with the stipe; entire edge concolorous.

Stipe

(15) 20-25 (30) × 1.5-2.5 (3) mm, equal or only slightly tapering towards the base, more or less wavy-irregular or sinuous, giving a somewhat "moire" effect to the otherwise finely fibrous surface, with fine white floccules at the top and sometimes up to mid-height, on a rather dark grey-brown surface, contrasting sharply with the pale tinge of the gills; mycelium white.

Flesh

Thin, pale brownish flesh.

Odour

Strong, of rancid flour or rancid oil.

Taste

Evoking odour and astringent or slightly bitter, unpleasant.

Spore print

Fresh with a beautiful bright pink color.

Spores

(4.3) 4.4-5-5.5 (5.9) × (3.2) 3.3-3.5-3.8 (4.5) µm, Q = (1.1) 1.3-1.4-1.5 (1.6), n = 80, subamygdaliform to ellipsoid, often with a deep suprahilar depression in side view, ellipsoid to ovoid in front view, distinctly warty when still attached to the basidia, then nodulose-verrucose to indistinctly nodulose when fully mature, sometimes also slightly polygonal, distinctly cyanophilic, inamyloid, with one to several oily drops and a hilar appendix rather showy, conical and refractive, up to 1 µm long.

Basidia

Tetrasporic, with fine sterigmata up to 6 µm long, slightly clavate, measuring 18-22 (30) × 5-5.5 (6.5) µm; sclerobasidia present.

Cystidia

Absent. Occasional long hairs present on the lamellar edge.

Lamellar trama

Regular, composed of parallel, cylindrical to enflated, smooth, hyaline or pale yellowish, hyphae, 5-15 (25) µm wide on average, often with fairly short elements, narrowing at the walls and then taking on a "sausage-like" appearance, tapering towards the subhymenium, colourless or almost so. Occasional trombopleurogenic hyphae with a grey-yellowish content present.

Stipitipellis

Composed of tightly packed hyphae (2) 5-15 µm wide, with a rather abundant ochraceous-brown intracellular and parietal pigment, the last finely encrusting, from which emerge here and there cylindrical, clavate or slightly irregular hyphae, tightly assembled and difficult to dissociate at least on *exsiccata*, reaching 10 (20) µm wide on average; these hyphae form the floccules visible on the surface of the stipe.

Pileipellis

Composed of a thin cutis of cylindrical hyphae, 3-5 (8) µm wide, the external hyphae slightly gelatinized with pale yellowish to brownish yellow parietal and cytoplasmatic contents; sparse fascicules of erected, agglutinate, cylindrical to subvesiculose, 6-12 µm wide hyphae present; occasional trombopleurogenic hyphae with a grey-yellowish content present; pseudoparenchymal-like hypoderm composed of hyaline, cylindrical to fusiform or enflated, smooth-walled elements easily reaching 20 µm wide; yellowish-brown parietal pigment, coating or finely encrusted.

Clamp-connections

Present throughout.

Notes

The genus *Rhodophana* Kühner is still very little known and some groups of species are just beginning to reveal their complexity. As an example, the *Rhodophana nitellina* (Fr.) Kühner group is genetically composed of at least fifteen operational taxonomic units (Dima *et al.* 2018, see also our Fig. 13). Our new species is obviously akin to *Rhodocybe melleopallens* P.D. Orton (Orton 1960), but is distinguished by its slightly less dull colors, by its distinctly lighter gills, forming an evident contrast with the stipe, and by its slightly shorter spores. *Rhodocybe leucophylla ad int.*, which also has very pale gills, is odourless and has significantly larger spores (Corriol & Trichies 2013). The recently described *Rhodophana griseobrunnea* E. Musumeci is another brownish coloured species with strong farinaceous odour, but its spores are much larger and measure 7-11 (13) × 4.7-5.5 (6) µm (Musumeci 2020).

New combinations

Many new combinations are still to be made in the genus *Rhodophana*. We propose two of them below, in a group of species that we have sufficiently studied (Dima, unpublished).

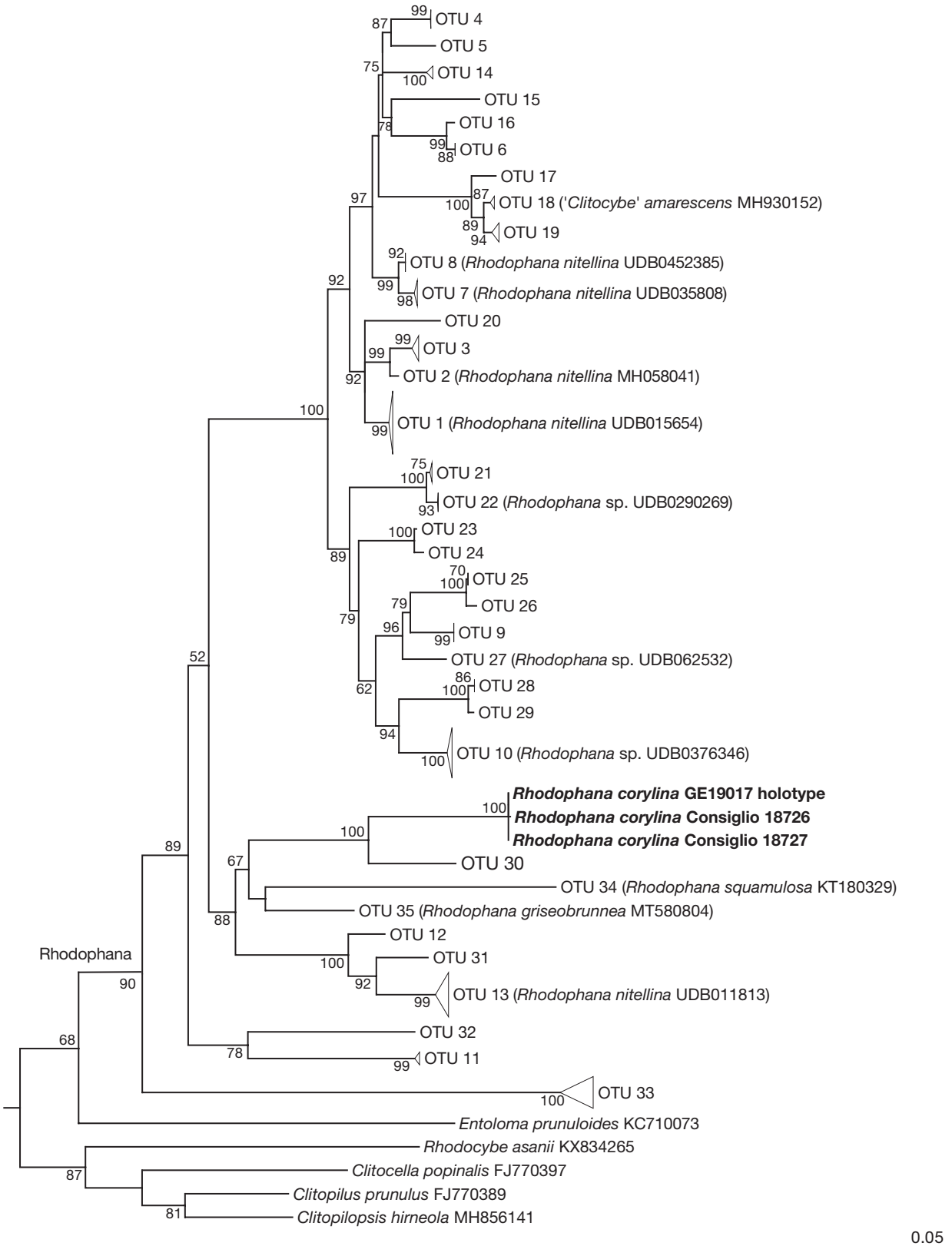

Fig. 13. — Phylogram based on analysis of both published and still unpublished ITS sequence data (by B. Dima & V. Papp) showing the position of *Rhodophana* within Entolomataceae and the various operational taxonomic units that need to be named in Europe. Phylogenetic tree inferred from nrDNA ITS sequences using PhyML 3.1 (Guindon & Gascuel 2003) with the following settings: GTR+I+G model of evolution, gamma distribution of 10 rate categories, and tree topology search as SPR. Branch support was tested using the non-parametric, Shimodaira-Hasegawa version of the approximate likelihood-ratio test (SH-aLRT). PhyML SH-aLRT support values (>50) are indicated at the branches. Clades represented by at least one unpublished sequence are compressed. All published sequences from repositories are shown in brackets. Newly generated sequences for our new species are highlighted in boldface. Bar indicates 0.05 expected change per site per branch.

Fig. 14. – *Rhodophana corylina* Consiglio, Dima & Eyssart., sp. nov.: **A**, fresh basidiomata of the holotype; **B**, fresh basidiomata of collection AMB18727. Photos: G. Eyssartier & G. Consiglio.

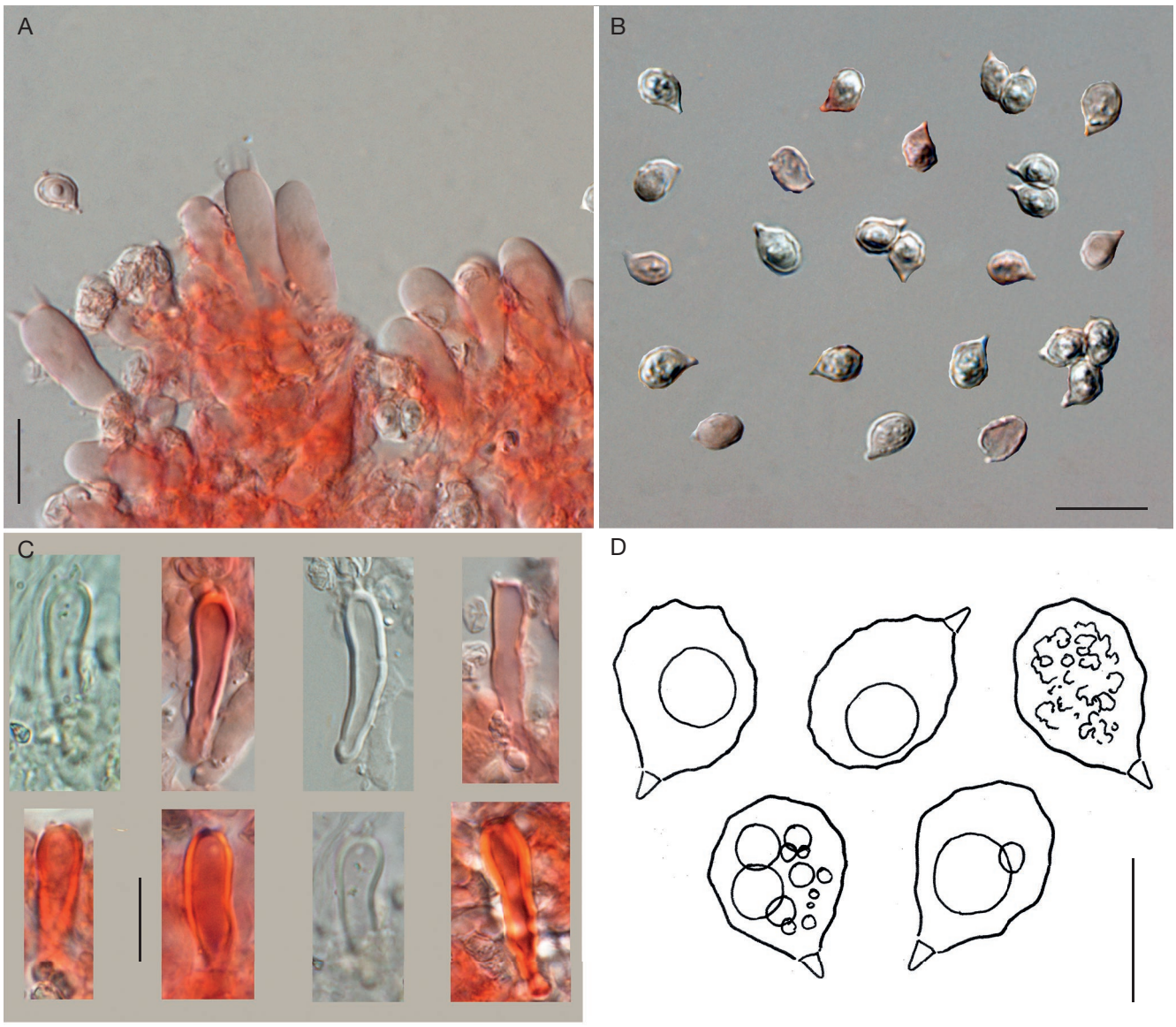

Fig. 15. – *Rhodophana corylina* Consiglio, Dima & Eyssart., sp. nov.: **A**, hymenium with basidia and spores; **B**, spores; **C**, sclerobasidia; **D**, spores of the holotype. Photos: M. Marchetti. Drawings: G. Eyssartier. Scale bars: A-C, 10 µm; D, 5 µm.

108. ***Rhodophana fuscofarinacea*** (Noordel. & Kosonen) Consiglio, Noordel., Dima & Eyssart., comb. nov.

Rhodocybe fuscofarinacea Noordel. & Kosonen, *Karstenia* 34 (2): 43 (1994).

Mycobank. — MB838805.

109. ***Rhodophana hausknechtii*** (Consiglio & Contu) Consiglio, Dima & Eyssart., comb. nov.

Rhodocybe hausknechtii Consiglio & Contu, *Rivista di Micologia* 51 (1): 16 (2008).

Mycobank. — MB838806.

Order Russulales Kreisel ex P.M.Kirk, P.F.Cannon & J.C.David
Family Russulaceae Lotsy
Genus *Russula* Pers.

110. ***Russula xerampelinoides*** K. Das, I. Bera, A. Ghosh & Buyck sp. nov. (Figs 16-18)

Diagnosis. — *Russula xerampelinoides* is mainly separated from similarly looking species of *Xerampelinae* by its sequence data (nrITS), its geographical distribution and the association with *Abies densa* in subalpine forest.

Holotype. — **India**. Sikkim, North district, Yumthang valley, 27°21.108'N, 88°49.660'E, alt. 3644 m a.s.l., under *Abies densa*

KEY OF THE EUROPEAN SPECIES OF *RHODOPHANA* KÜHNER AND OTHER CLOSELY RELATED TAXA

1. Species with fairly bright shades of red, orange-red to orange brown 2
— Dull, whitish, grey-brown, ochraceous brown or brown species 4

2. Orange-brown species with a strong odour and taste of rancid flour ..... *Rhodophana nitellina* (Fr.) Kühner *sensu lato*
— Species odourless or with not distinctive fungoid smell 3

3. Orange-fulvous then rosy buff cap; spores 5-6.5 × 3-4.5 µm ..... *Rhodophana rubroparvula* (Dähncke, Contu & Vizzini) T.J. Baroni & Bergemann
— Dark red to orange-red cap; spores 6.5-7.5 × 4-4.5 µm ..... *Collybia cuprea* J. Favre, *nom. inval.*

4. Reduced lateral stipe; pleurotoid species, with fairly large spores of 7.3-10 × 4.6-6 µm ..... *Rhodocybe tillii* Krisai & Noordel.
— Well-developed and central stipe 5

5. Stipe with large irregular bulb (sclerotia) resulting from parasitism of another fungus (probably a *Lyophyllum*); whitish species ..... *Rhodophana stangliana* (Bresinsky & Pfaff) Vizzini
— Not this character 6

6. Spore-print greyish, no or slight floury odour 7
— Spore-print pink; variable odour 8

7. Greyish to whitish cap; subglobose spores measuring 5-6 × 4-4,5 µm ..... *Rhodocybe peculiaris* Contu & Bon
— Ochraceous to yellowish-brown; ellipsoid spores measuring 6.5-7.5 × 3.5-4 µm ..... *Rhodocybe griseospora* (A. Pearson) P.D. Orton

8. Whitish beige pileus, more or less funnel-shaped 9
— More colourful, plane or papillate pileus 10

9. Spores clearly polygonal-verrucose, 3,5-4,5 × 3-3,5 µm; non-nitrophilic species ..... *Rhodocybe infundibuliformis* Bidaud & Contu
— Spores appearing almost smooth, 4-5 × 2,7-3,5 µm; nitrophilic species ..... *Rhodocybe subcaespitosa* Esteve-Rav

10. Pileus dark brown to blackish brown 11
— Pileus ochraceous brown to greyish brown or olive brown 13

11. Pileus dark brown with purplish hue at the margin; spores 4.7-7 × 3.4-4.7 µm ..... *Rhodocybe microspora* (Velen.) Noordel.
— Pileus blackish-brown with no purplish tinges 12

12 . Odour faint; spores 5-6 (6.5) × 3.5-4.5 µm ..... *Clitopilus fuscoumbonatus* Pérez-De-Greg., Contu, Roqué & Vizzini
— Strong farinaceous odour; spores 6-8 × 4.5-5 µm ..... *Rhodophana fuscofarinacea* (Noordel. & Kosonen) Consiglio, Noordel., Dima & Eyssart.

13. Strong farinaceous odour 14
— No, faint or at most slightly floury odour when cut 16

14. Spores 7-11 (13) × 4.7-5.5 (6) µm ..... *Rhodophana griseobrunnea* E. Musumeci
— Spores much smaller 15

15. Cap dark brown, yellowish to ochraceous, gills pale cream to ochraceous-beige, forming little or no contrast with the top of the stipe; spores 4.5-7 × 3-4 µm ..... *Rhodophana melleopallens* (P.D. Orton) Kluting, T.J. Baroni & Bergemann
— Rather dull ochraceous-brown cap, hazelnut to bistre, whitish to creamy greyish very pale, forming a striking contrast with the stipe; spores 4.4-5.5 × 3.3-3.8 µm ..... *Rhodophana corylina* Consiglio, Dima & Eyssart., sp. nov.

16. Large spores 7-10 × 4.4-6 µm ..... *Rhodocybe hispanica* Esteve-Rav. & G. Moreno
— Spores up to 7.5 µm long 17

17. Brown cap, stipe with obvious white floccules (looks like *Myochromella boudieri*); spores 4.9-6.4 × 3.3-4.2 µm ..... *Rhodophana hausknechtii* (Consiglio & Contu) Consiglio, Dima & Eyssart.
— Stipe without floccules 18

18. Slender habit (of a *Nolanea*), cap up to 4 cm in diameter, blackening at the margin; subglobose spores 6.5-8 × 5-6.5 µm ..... *Rhodocybe priscua* T. J. Baroni
— Stocky habit, cap up to 2 cm in diameter, not blackening; spores narrowly ellipsoid, 5.7-7.25 × 3.3-4.3 µm.. ..... *Rhodocybe leucophylla ad int.*

in subalpine mixed forest, 18.VII.2019, *Kanad Das*, KD 19-001 (CAL[CAL1819]!, holo-).

MycoBank. — MB 838573.

Index Fungorum number. — IF558128.

Facesoffungi number. — FoF 09582.

GenBank. — MN922560 (ITS holotype) and MN922561 (ITS paratype).

Etymology. — Referring to its similarity with European *R. xerampelina*.

Additional specimens examined. — **India**. Sikkim, East district, Gnathang, 27°21.108'N, 88°49.660'E, alt. 3629 m a.s.l., under *Abies densa* in subalpine mixed forest, 7.VIII.2018, *Kanad Das*, KD 18-034 (CAL 1820); West Sikkim, Hilley, 27°21.108'N, 88°49.660'E, 28.V.2010, *Kanad Das*, KD 10-006; West Sikkim, between Hilley & Barsey, 27°21.108'N, 88°49.660'E, 29.V.2010, *Kanad Das*, KD 10-014, KD-017.

Pileus
Medium to large sized, 40-95 mm in diam., hemispherical when young, then convex, planoconvex, applanate to slightly uplifted with broadly depressed centre; margin initially incurved, decurved to plane or sometimes uplifted with maturity, entire; cuticle dry, viscid when moist, often with combination of concentric zonation, dark purple (14F4) or olive (2E3-4) at centre often with combination of dark magenta (13F3) and pale yellow (4A3) or greyish yellow (4B5), marginally paler, greyish ruby to ruby (12D3-E4) or olive grey to olive (2F2-3).

Lamellae
Adnexed, subdistant (7-10/cm at pileus margin), chalky white (1-2A1), forked near stipe apex; lamellulae present, up to in 2 series; edges entire and concolorous.

Stipe
45-90 × 17-33 mm, subclavate to clavate, brittle, central; surface dry, longitudinally striate, chalky white (1-2A1) to yellowish white (3A2), with pastel red (9A4-5) tinge throughout, changing yellowish to brownish when injured; turning greyish yellow with KOH, greenish grey to dull green (27D2-E3) with $FeSO_4$ and greyish green or darker (25E5-6) with guaiacol.

Stipe context
Solid when young, becoming stuffed with age, chalky white (1-2A1); turning greyish yellow (4B4) with KOH, greenish grey to dull green (27D2-E3) with $FeSO_4$ and greyish green or darker (25E5-6) with guaiacol.

Odour
Indistinctive.

Taste
Mild.

Spore print
Not obtained.

Basidiospores
Rather large and subglobose to broadly ellipsoid, (7.5-)8.31-9.11-9.9(-10.5) × (6-)6.96-7.65-8.34(-8.87) µm, Q = (1.06-)1.11-1.19-1.28(-1.54), ornamentation amyloid, consisting of isolated spines, up to 2 µm high, locally fused in pairs or triplets; suprahilar plage amyloid.

Basidia
(40-)40-44-48(-50) × (9-)9-10-11(-12) µm, subclavate to clavate, 4-spored; sterigmata up to 5.6 µm long. Subhymenium up to 20 µm thick, made up of pseudoparenchymatous cells.

Hymenophoral trama
Mainly composed of sphaerocytes intermixed with hyphae.

Hymenial gloeocystidia
On lamellar sides numerous; measuring (49.5-)59-67-75(-82) × (3-)5-8-11(-14) µm, emergent up to 42 µm beyond the basidiole tips, cylindrical to fusiform, tapered toward the base, mostly rounded-obtuse to appendiculate or mucronate at the apex; contents fibrous to crystalline, staining grey-black in sulfovanillin; on lamellar edges somewhat smaller, (40.5-)44.4-50-55.5(-54) × (5-)4.5-6-8(-9) µm, cylindrical and mostly rounded-obtuse at the apex, with similar contents. Lamellar edges fertile with basidia and cystidia.

Pileipellis
Orthochromatic in Cresyl Blue, up to 235 µm thick, two-layered and sharply delimited from the underlying sphaerocytes of the context; suprapellis a 90-100 µm deep ixotrichoderm, composed of dispersed, erect or ascending hyphal ends and pileocystidia in a gelatinous layer; hyphal endings branched, septate; subpellis less gelatinized, 125-135 µm deep, composed of intertwined, more or less horizontally oriented hyphae.

Acid-resistant incrustations
Absent.

Fig. 16. — Maximum Likelihood (ML) phylogram inferred from raxmlGUI 2.0 (Edler *et al*. 2019) based on nrITS sequences of *Russula*. One thousand bootstrap replicates were analyzed to obtain nodal support values. Bootstrap support values (>70%) obtained from ML analysis are shown above or below the branches at nodes. Two collections of the novel Indian species are indicated in red and the holotype in **bold**.

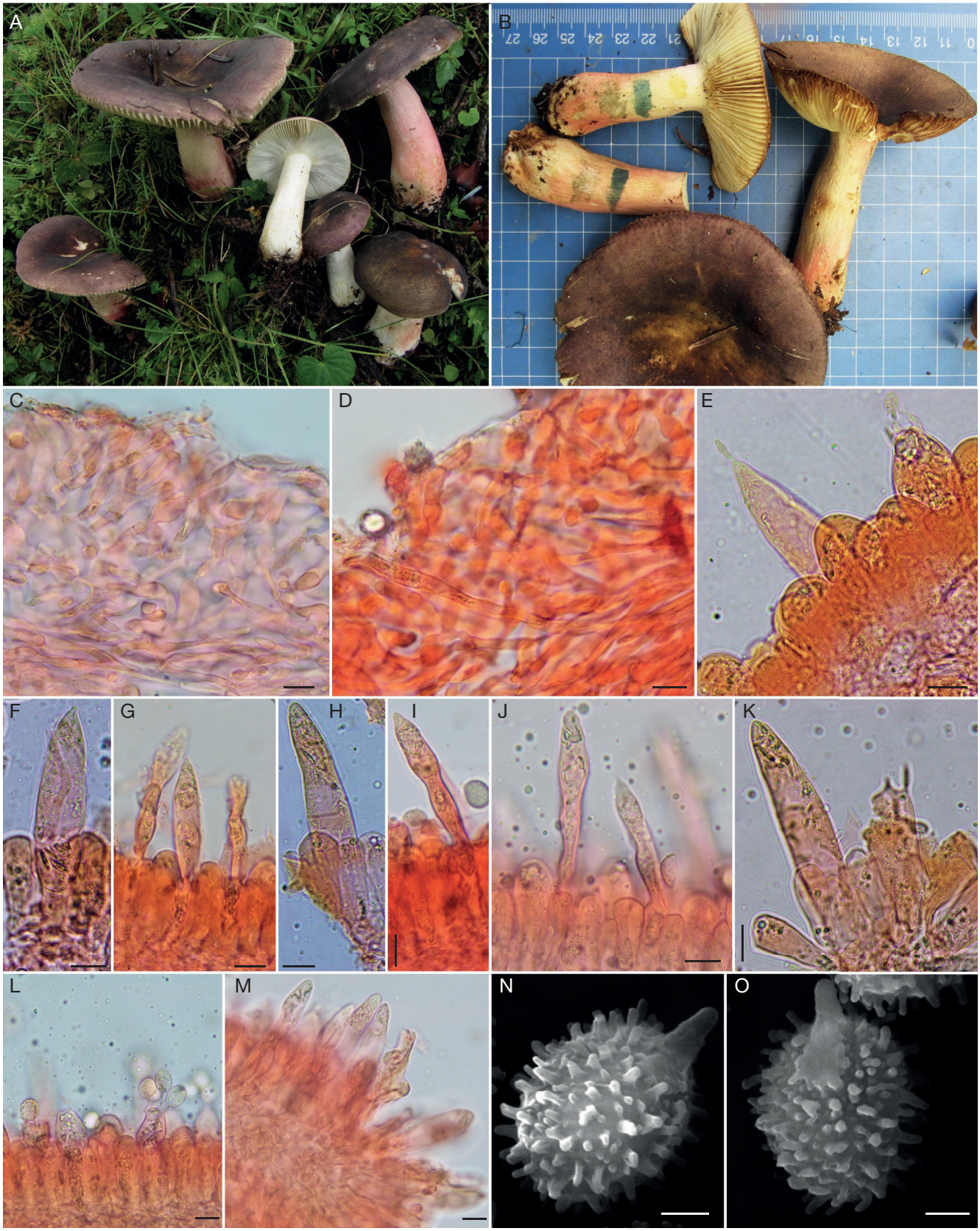

Fig. 17. — *Russula xerampelinoides* K.Das, I.Bera, A.Ghosh & Buyck, sp. nov. (from holotype): **A**, **B**, fresh and dissected basidiomata in the field and basecamp; **C**, **D**, transverse section through pileipellis showing elements; **E**-**K**, transverse section through lamellae showing hymenial gloeocystidia near the lamellae sides; **L**, transverse section through lamellae showing basidia; **M**, transverse section through lamellae showing hymenial gloeocystidia near the lamellae edges; **N**, **O**, SEM images of basidiospores. Scale bars: C-M, 10 µm, N, O, 2 µm.

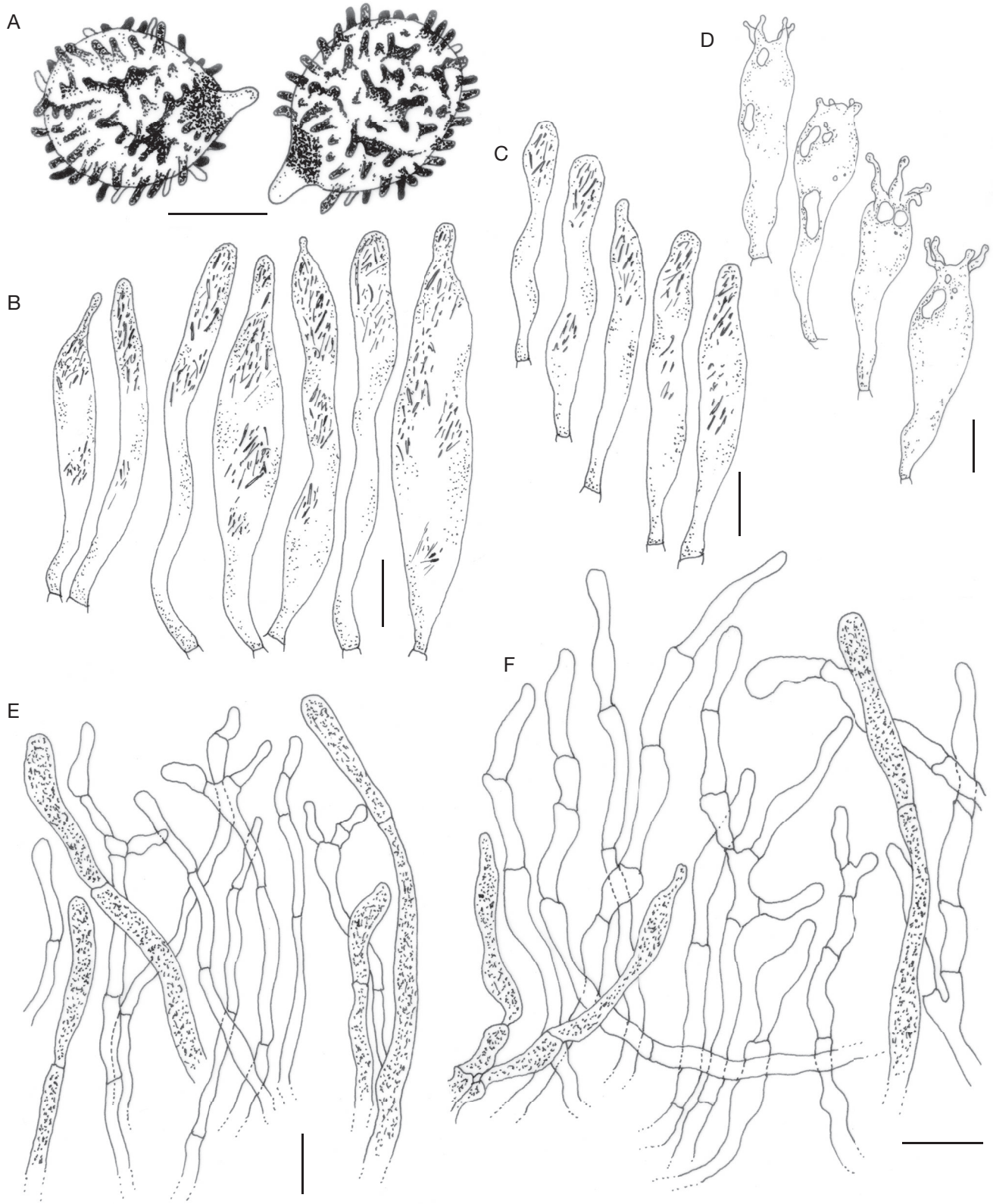

FIG. 18. — *Russula xerampelinoides* K.Das, I.Bera, A.Ghosh & Buyck, sp. nov. (from holotype): **A**, basidiospores; **B**, hymenial gloeocystidia near the lamellae sides; **C**, hymenial gloeocystidia near the lamellae edges; **D**, basidia; **E**, elements of the pileipellis near the pileus centre: hyphal terminations and pileocystidia; **F**, elements of the pileipellis near the pileus margin: hyphal terminations and pileocystidia. Scale bars: A, 5 µm, B-F, 10 µm.

Hyphal
Terminations near the pileus margin composed of a single or a few cells only; the terminal cells cylindrical to subcylindrical and variable in length, measuring (6-)10-15-20(-24) × (2-)3-4-5(-6) µm, mostly with obtuse-rounded apex, subterminal cells cylindrical; in the pileus centre often shorter, fusoid, cylindrical to subcylindrical with inflated or swollen base, mostly obtuse-rounded toward the tip or branched, measuring (5-)7.0-10.5-14(-17) × 2-2.5-3(-3.5) µm; subterminal cells cylindrical or irregularly branched Pileocystidia near the pileus margin long, mostly one celled, rarely two-celled, with terminal cell measuring (31-)30.3-48.5-47(-55) × (2-)3-4.5-6 µm, mostly cylindrical, obtuse-rounded apex; contents fibrous, grey-black in sulfovanillin. Pileocystidia in the pileus centre long, mostly one, rarely two-celled, with terminal cell measuring (20-)19.0-31.5-44 (-56) × 3-4-5(-5.5) µm, mostly cylindrical, obtuse-rounded apex; contents fibrous, grey-black in sulfovanillin.

Clamp connections
Absent in all parts.

Notes

The combination of a suprahilar amyloid spot on basidiospores, colored spore print, pileocystidia without acid-resistant incrustation and flesh that is browning when bruised, and turning green with $FeSO_4$ places the present taxon among the members of *Russula* subsect. *Xerampelinae*. In our phylogeny (Fig. 16) *R. xerampelinoides* is clustered with two possibly contaxic Chinese collections (GenBank accessions KX441055 and MT024038, at 100% and 99.63% similarity respectively) and firmly placed inside a clade corresponding to *Xerampelinae* (MLbs=99% and MLbs=100% respectively). As far as we are aware, this is the first detailed description of a species of *Xerampelinae* from Asia, although the subsection was already reported from northern China by Liu *et al.* (2017) with first reports of *R. nuoljae* Kühner.

Pileus colours, host association and general habitat are the traditional key characters used to differentiate among the various fishy Russulas in the field. As such, it is possible to characterize most species of European *Xerampelinae* following Buyck & Adamčík (2013): "the *R. graveolens* Romell complex is associated with oaks at lower altitudes; *R. faginea* Romagn. is a strict associate of beech, whereas *R. xerampelina* (Schaeff.) Fr. occurs with conifers at lower altitudes and is replaced by *R. favrei* M. Moser on calcareous soils at higher altitudes; *R. pascua* (F.H. Møller & Jul. Schaeff.) Kühner is found in alpine and arctic areas; *R. clavipes* Velen. is associated with birch or conifers on peaty soil and grows from lower altitudes up to the boreal-subalpine forests. The latter species is replaced at higher altitudes by *R. nuoljae* Kühner growing with *Betula*. Finally, *R. subrubens* (J.E. Lange) Bon is found at all altitudes in association with *Salix*".

Following this same approach, our new taxon from India and China can be described as a species associated with conifers (*Abies densa*, *Juniperus salturaria*) but apparently also with *Populus deltoides* Marshall (GenBank MT730592) in temperate to subalpine mountain areas. Higher elevations are also the typical habitat for European *R. favrei*, which is indeed one of the closest relatives as suggested by our phylogeny (Fig. 16) and nBLAST similarity percentages. As *R. favrei* has an nrITS sequence less than 98% similar to our species, it is definitely not contaxic with *R. xerampelinoides* sp. nov.

Compared to the more diverse fishy Russulas in North America (Buyck & Adamčík 2013; Adamčík *et al.* 2019), the absence of sequence data for most American species limits the possibilities of comparison to morphological features. Following the identification key provided in Buyck & Adamčík (2013), the closest matches would be with northwestern *R. viridifusca* Grund and the northeastern *R. serissima* Peck, both growing with conifers and having very similar spores. The size and form of terminal elements of the pileipellis hyphae near the pileus margin are more similar to those of *R. serissima* rather than *R. viridifusca*. Nevertheless, conspecificity with the Indian taxon is unlikely for these American taxa as evidenced by the very high endemicity of the Asian mycota and possible conspecificity being limited presently to circumarctic taxa occurring in the most northern parts of the northern hemisphere (e.g., Liu *et al.* 2017), but undocumented for other regions.

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