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***Rubroboletus rubrosanguineus* (Cheype) Kuan Zhao & Zhu L. Yang**
(= *Boletus rubrosanguineus* Cheype)

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Hebeloma nauseosum (Hymenogastraceae, Agaricales) in north-east Italy

(versione italiana a pag. 5)

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Key words:
molecular sequence
taxonomy

Abstract: A find of *Hebeloma nauseosum* from the province of Trieste (Italy), near the border with Slovenia, is described with images of basidiomes and main microcharacter; an ITS sequence of the collection was generated and submitted in GenBank.

INTRODUCTION

During a dry and windy period that was hindering the growth of mushrooms some species were found in a small sheltered basin in the province of Trieste, Italy, not very distant from the border with Slovenia, where some GMV (Gruppo Micologi di Verona) members were holding a mycological meeting.

H. sinapizans (Paulet) Gillet, *Hygrophorus discoxanthus* (Fr.) Rea, *Caloboletus radicans* (Pers.) Vizzini, *Macrolepiota procera* (Scop.) Singer, *Mycena haematopus* (Pers.) P. Kumm. and *Suillellus queletii* (Schulzer) Vizzini, Simonini & Gelardi also were found, together with *Hebeloma nauseosum* in the same area.

This is the first phylogenetically evidenced report of *H. nauseosum* from north-east Italy, after some reports from central Italy (*Hebeloma*.org).

MATERIALS AND METHODS

The basidiomes were photographed in habitat; microcharacters were studied on dried material rehydrated with 5% KOH and 10% ammonia and photographed in Congo red; spores were photographed in Melzer's reagent for the dextrinoidity and in water. Cheilocystidia measurement is written in the format L x A x M x B where L = length, A = maximum width at the apex, M = minimum width in upper part below the apex, B = maximum width in lower third; the following taxonomically relevant ratios were also calculated between the width values: A/M, A/B, B/M. Each interval of measurement is represented as (a) b – c (d), where a = absolute minimum value, range b – c contains the 10% to 90% percentile ranges of the values, d = absolute maximum value. The letter n in parentheses represents the number of values measured.

All images from the author.

The ITS sequence was generated by Niccolò Forin from the University of Padua and submitted in GenBank with accession number PQ046173.

TAXONOMY

Hebeloma nauseosum sacc.
Sylloge fungorum 9: 102 (1891)

Heterotypic synonyms (fide Beker *et al*. 2016):
Hebeloma fusipes Bres., Boll. Soc. Bot. It. 1:196 (1892);
Hebeloma gigaspermum Gröger & Zschiesch., Z. Mykol. 47(2):201 (1981);
Hebeloma groegeri Bon, Documents Mycologiques 31(123):27 (2002).

Macroscopic characters

Pileus 10 – 28 mm broad, convex then applanate; at centre pale brownish beige, at margin whitish (indistinctly two-coloured); smooth, viscidulous (earth lumps easily adhering).
Lamellae little crowded (30 – 34), intermixed with 1 – 3 lamellulae, adnate with a little decurrent tooth, pale brown; edge white, without drops.
Stipe 15 – 25 × 2 – 4 mm, cylindraceous, base equal, obtuse; almost glabrous, white.
Context with a strong sweetish odour.

Microscopic characters

Basidiospores (n=30) (11.2) 12.5 – 15.0 (19.5) × (7.4) 7.7 – 9.0 (10) µm, Q (1.43) 1.56 – 1.83 (1.95), on average 1.71; in front view fusiform-oval to narrowly citriform, in side view amygdaliform-citriform, apex little papillate to strongly papillate; ornamentation scarce to medium visible (O2-3), dextrinoidity medium (O3), perispore loosened in some spores (P1-2).

Basidia 35 – 53 × 10 – 13 µm, 4-spored.

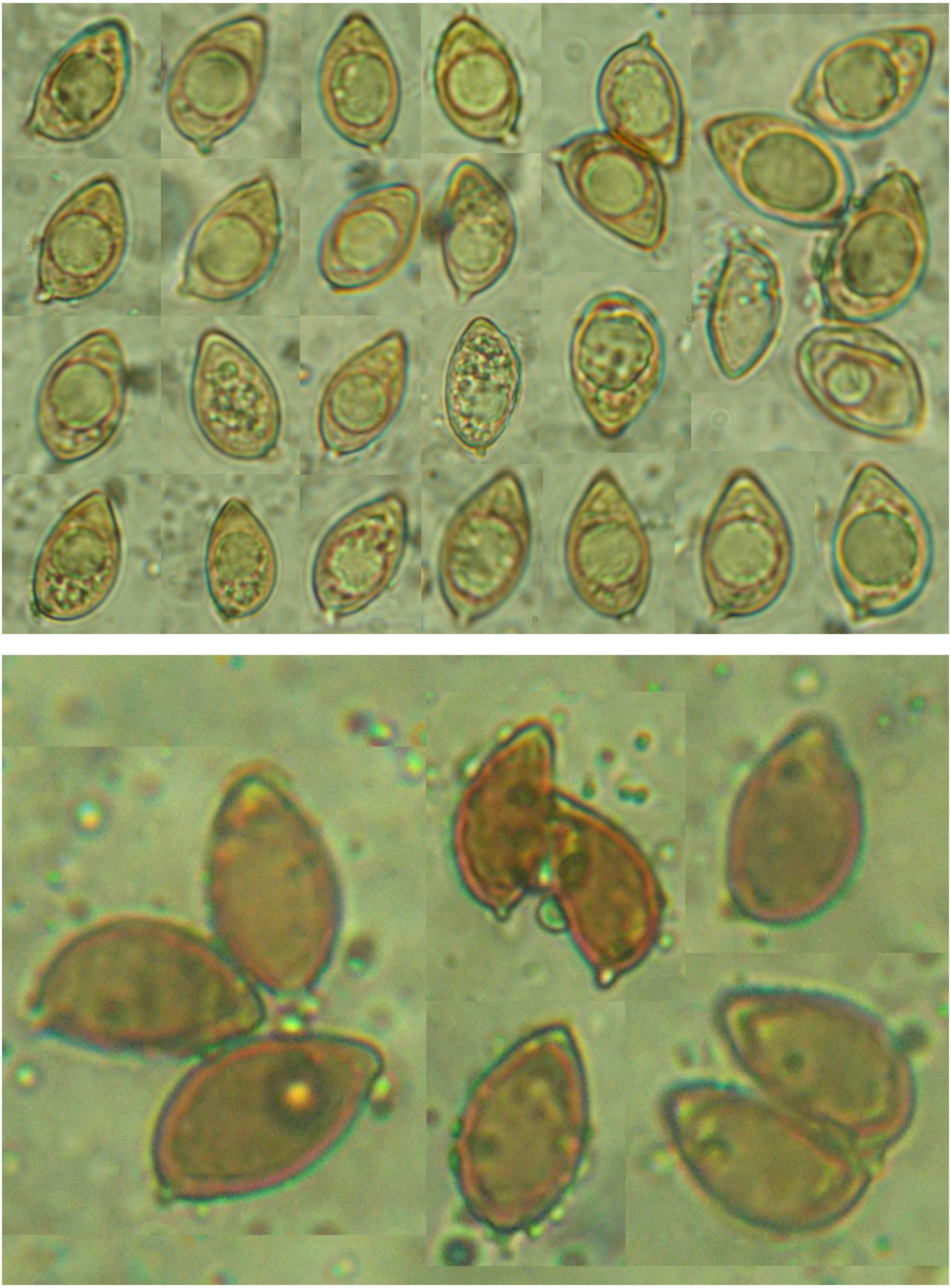
Pleurocystidia absent.

Cheilocystidia (n=50) (14.0) 20.0 – 81.8 (85.5) x (3.9) 4.5 – 10.4 (18.2) x (4.1) 4.5 – 7.3 (10.4) x (2.3) 3.0 – 9.2 (9.3) µm, cylindraceous, lageniform, utriform, clavate, sometimes cylindraceous-tapering to clavate-capitate or capitate-stipitate, numerous small and like paracystidia, A/M = (0.75) 0.96 – 1.65 (2.63), A/M = (0.63) 0.73 – 3.55 (6.62), B/M = (0.26) 0.44 – 1.56 (1.75); thin-walled, hyaline, numerous.

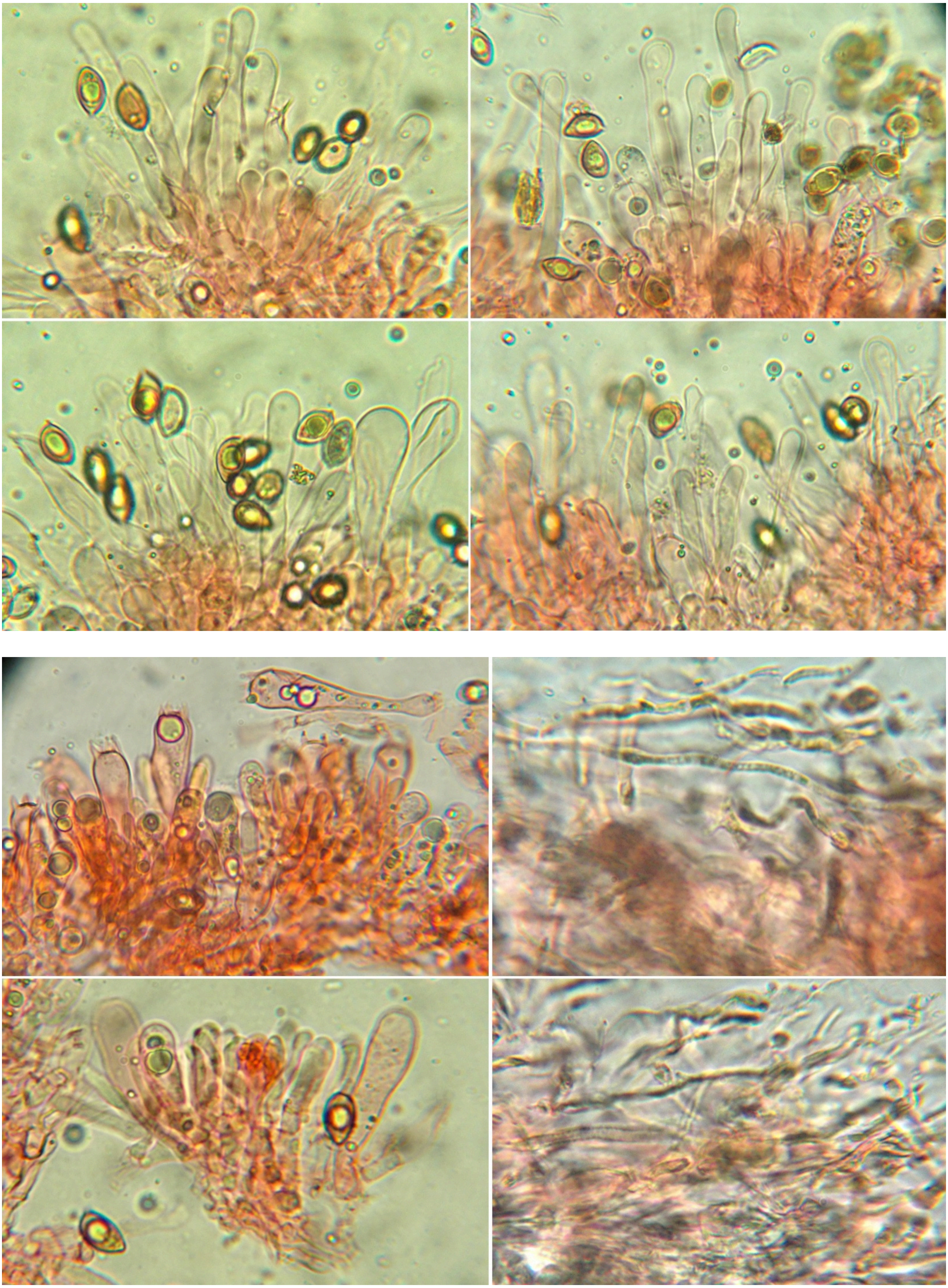
Pileipellis (observed at centre of pileus) structured as an ixocutis 100 – 110 µm broad, composed of 2 – 4 µm broad, hyaline, gelified, often incrusted hyphae.

*Clamp connection*s present.

Collection examined and Habitat: Italy, province of Trieste, Monrupino county, locality Percedol's Basin (Conca di Percedol), growing gregarious on the ground with scattered hornbeams (*Carpinus betululs*) and Turkey oaks (*Quercus cerris*) nearby, 20 October 2021, *legit P. Voto*, PAD H0062116; GenBank PQ046173 - ITS.



Spores in water (above), in Melzer’s reagent (below) / spore in acqua (sopra), nel reagente di Melzer (sotto)



Above: cheilocystidia; below: left hymenium, right pileipellis / Sopra: cheilocistidi; sotto: imenio (sx), pileipellis (dx)

NOTES

All parameters of this collection conform to the general knowledge of *Hebeloma nauseosum*.

Regarding spore ornamentation, Beker *et al.* (2016) report it as O(2)3-4 which is almost similar to O3-4 as defined by Grilli *et al*. (2020); other authors, among which Vesterholt 2005 (descriptions of the synonyms *H fusipes* and *H. gigaspermum*) and the website *Hebeloma*.org (continuously updated) report it as less accentuated: O(2)3 and O2-3 respectively.

Due to a strong smell the species belongs to *Hebeloma* sect. *Sacchariolentia* (J.E. Lange ex Bon) H. Boyle in which another relevant character shared by all members is little differentiated cheilocystidia. In this section, the only other species sharing very broad spores, averagely more than 7 µm broad, is *H. odoratissimus* (Britzelm.) Sacc., also present in north-west Italy (Voto 2022). This taxon differs by having a dry, tomentose to velutinate, often cracking pileus; in microscopy its dry pileus is confirmed by a thin, at most 70 µm broad ixocutis (compared to usually 100 – 120 µm in *H. nauseosum*).

REFERENCES / BIBLIOGRAFIA

Grilli E, Beker HJ, Eberhardt U, Schütz N (2020) *Hebeloma* (Fr.) P. Kumm. Suppl. based on collections of Italy. *Fungi Europaei*. Volume **14b**. Candusso Editrice; Alassio, Italy: 2020. pp. 1–470

Hebeloma.org [continuously updated] (last accessed 21 march 2024) available from: https://hebeloma.org/

Vesterholt J (2005) The genus *Hebeloma*. Fungi of Northern Europe - Vol. 3. Svampetryk

Voto P (2022) rare Agaricales in Polesine - IV: *Hebeloma odoratissimum*. *Mycolobs* **3**:38–43

Hebeloma nauseosum (Hymenogastraceae, Agaricales) nel nord-est d'Italia

Parole chiave:
sequenza molecolare
tassonomia

Riassunto: Si descrive una raccolta di *Hebeloma nauseosum* dalla provincia di Trieste (Italia), presso il confine con la Slovenia, con immagini dei basidiomi e dei principali microcaratteri; una sequenza ITS della raccolta è stata generata e registrata in GenBank.

INTRODUZIONE

Durante un periodo asciutto e ventoso che inibiva la crescita fungina alcune specie sono state ritrovate in una piccola conca protetta in provincia di Trieste, Italia, non molto distante dal confine con la Slovenia, dove alcuni soci del GMV (Gruppo Micologi di Verona) stavano svolgendo un incontro micologico.

Insieme a *Hebeloma nauseosum* sono stati repertati nella stessa area anche *H. sinapizans* (Paulet) Gillet, *Hygrophorus discoxanthus* (Fr.) Rea, *Caloboletus radicans* (Pers.) Vizzini, *Macrolepiota procera* (Scop.) Singer, *Mycena haematopus* (Pers.) P. Kumm. e *Suillellus queletii* (Schulzer) Vizzini, Simonini & Gelardi.

Si tratta della prima documentazione con supporto molecolare di *H. nauseosum* dal nord-est Italia, dopo alcune segnalazioni dall'Italia centrale (*Hebeloma*.org).

MATERIALI E METODI

I basidiomi sono stati fotografati in habitat; i microcaratteri sono stati studiati su materiale essiccato reidratato con KOH al 5% e ammoniaca al 10% e fotografati in rosso Congo; le spore sono state fotografate nel reagente di Melzer per la destrinoidia e in acqua. La misurazione dei cheilocistidi è riportata nel formato L x A x M x B dove L = lunghezza, A = massima ampiezza all'apice, M = minima ampiezza nella porzione superiore sotto l'apice, B = massima ampiezza nella porzione inferiore; sono stati calcolati anche i seguenti quozienti tassonomicamente rilevanti tra i valori delle ampiezze: A/M, A/B, B/M. Ciascun intervallo di misurazione è rappresentato nel formato (a) b – c (d), dove a = valore minimo assoluto, l'intervallo b – c contiene gli intervalli percentile dal 10% al 90% dei valori, d = valore massimo assoluto. La lettera n in parentesi si rferisce al numero di valori misurati. Tutte le immagini sono dell'autore.

La sequenza ITS è stata generata da Niccolò Forin all'Università di Padova e registrata in GenBank con numero di accesso PQ046173.

TASSONOMIA

Hebeloma nauseosum sacc.
Sylloge fungorum 9: 102 (1891)

Sinonimi eterotipici (fide Beker *et al*. 2016):
Hebeloma fusipes Bres., Boll. Soc. Bot. It. 1:196 (1892);
Hebeloma gigaspermum Gröger & Zschiesch., Z. Mykol. 47(2):201 (1981);
Hebeloma groegeri Bon, Documents Mycologiques 31(123):27 (2002).

Caratteri macroscopici

Cappello 10 – 28 mm di diametro, convesso poi spianato; al centro beige brunastro pallido, al margine biancastro (indistintamente di due colori); liscio, viscidulo (zolle di terra facilmente aderenti).
Lamelle poco fitte (30 – 34), inframmezzate da 1 – 3 lamellule, adnate con un dentino decorrente, di colore bruno pallido; filo bianco, privo di guttule.
Gambo 15 – 25 × 2 – 4 mm, cilindraceo, base uguale e ottusa; quasi glabro, bianco.
Carne con un forte odore dolciastro.

Caratteri microscopici

Basidiospore (n=30) (11.2) 12.5 – 15.0 (19.5) × (7.4) 7.7 – 9.0 (10) µm, Q (1.43) 1.56 – 1.83 (1.95), in media 1.71; in vista frontale da fusiformi-ovali a strettamente citriformi, in vista laterale amigdaliformi-citriformi, apice da un po' a fortemente papillato; ornamentazione da scarsa a mediamente visibile (O2-3), destrinoidia media (O3), perisporio distaccato in alcune spore (P1-2).
Basidi 35 – 53 × 10 – 13 µm, 4-sporici.
Pleurocistidi assenti.
Cheilocistidi (n=50) (14.0) 20.0 – 81.8 (85.5) x (3.9) 4.5 – 10.4 (18.2) x (4.1) 4.5 – 7.3 (10.4) x (2.3) 3.0 – 9.2 (9.3) µm, cilindracei, lageniformi, utriformi, claviformi, a volte da cilindraceo-attenuati a clavato-capitati o capitato-stipitati, numerosi di piccole dimensioni e simili a paracistidi, A/M = (0.75) 0.96 – 1.65 (2.63), A/M = (0.63) 0.73 – 3.55 (6.62), B/M = (0.26) 0.44 – 1.56 (1.75); a parete sottile, ialini, numerosi.
Pileipellis (osservata al centro del cappello) strutturata come una ixocutis ampia 100 – 110 µm, composta da ife larghe 2 – 4 µm, ialine, gelificate, sovente incrostate.
Giunti a fibbia presenti.

Raccolta esaminata e Habitat: Italia, provincia di Trieste, comune di Monrupino, località Conca di Percedol, crescente gregario al suolo con sparsi carpini (*Carpinus betululs*) e cerri (*Quercus cerris*) nei pressi, 20 ottobre 2021, *legit P. Voto*, PAD H0062116; GenBank PQ046173 - ITS.

COMMENTI

Tutti i parametri di questa raccolta sono conformi con la conoscenza generale di *Hebeloma nauseosum*.

Riguardo all'ornamentazione sporale, Beker *et al.* (2016) la riportano come O(2)3-4 che è quasi simile a O3-4 come definita da Grilli *et al*. (2020); altri autori, tra cui Vesterholt 2005 (descrizioni dei sinonimi *H fusipes* e *H. gigaspermum*) e il sito web *Hebeloma*.org (continuamente aggiornato) la riportano meno accentuata: O(2)3 e O2-3 rispettivamente.

A causa del forte odore la specie appartiene a *Hebeloma* sect. *Sacchariolentia* (J.E. Lange ex Bon) H. Boyle in cui un altro carattere rilevante condiviso da tutti i membri è dato dai cheilocistidi poco differenziati. In questa sezione, l'unica altra specie che condivide spore molto larghe, in media larghe più di 7 µm, è *H. odoratissimus* (Britzelm.) Sacc., anch'essa presente nel nord-est (Voto 2022). Questo taxon differisce per avere il cappello asciutto, da tomentoso a vellutato, sovente screpolato; in microscopia il suo cappello asciutto si accompagna a una ixocutis sottile, spessa al più 70 µm (in confronto ai solitamente 100 – 120 µm di *H. nauseosum*).

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Article received 20 April 2024, accepted 25 May 2024

Entoloma coracis in the Nordio forest

(versione italiana a pag. 11)

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Key words:
Agaricales
Entolomataceae
Mediterranean

Abstract: A finding in the Nordio forest (Italy) of the recently described *Entoloma coracis* is reported with morphological descriptions, colour images of the basidiomes and its main microcharacters, and comments on sister taxa.

INTRODUCTION

Continuing the revision of the author's *Entoloma* collections from the Nordio forest, it is now the turn of two finds dating back to the years 2010 and 2013 and identified at the time as *E. corvinus*. The morphological revision, based on the key by Noordeloos *et al*. (2022), shows that they must now be ascribed to *Entoloma coracis,* recently described in 2021 (Crous *et al*. 2021). This new species is most likely also present in other herbaria and old Mediterranean collections under the name *E. corvinus*, a very look-alike species restricted, in its modern concept by Noordeloos *et al*. (2022), to an alpine habitat and morphologically differentiated by the shape of the cheilocystidia.

MATERIALS AND METHODS

Basidiomes were photographed fresh on the collection day, in habitat and indoors, and all morphological characters were observed, photographed and described before exsiccation.

The herbarium code PAD, taken from Index Herbariorum (https://sweetgum.nybg.org/science/ih/), accessible online, refers to the Università degli Studi di Padova, Padua (Italy). All images by the author.

Entoloma coracis 14.11.2013

Entoloma coracis 14.11.2013

Entoloma coracis Brandrud, Dima, Noordel., G.M. Jansen & Vila
Persoonia 46: 445 (2021)

Macroscopic characters

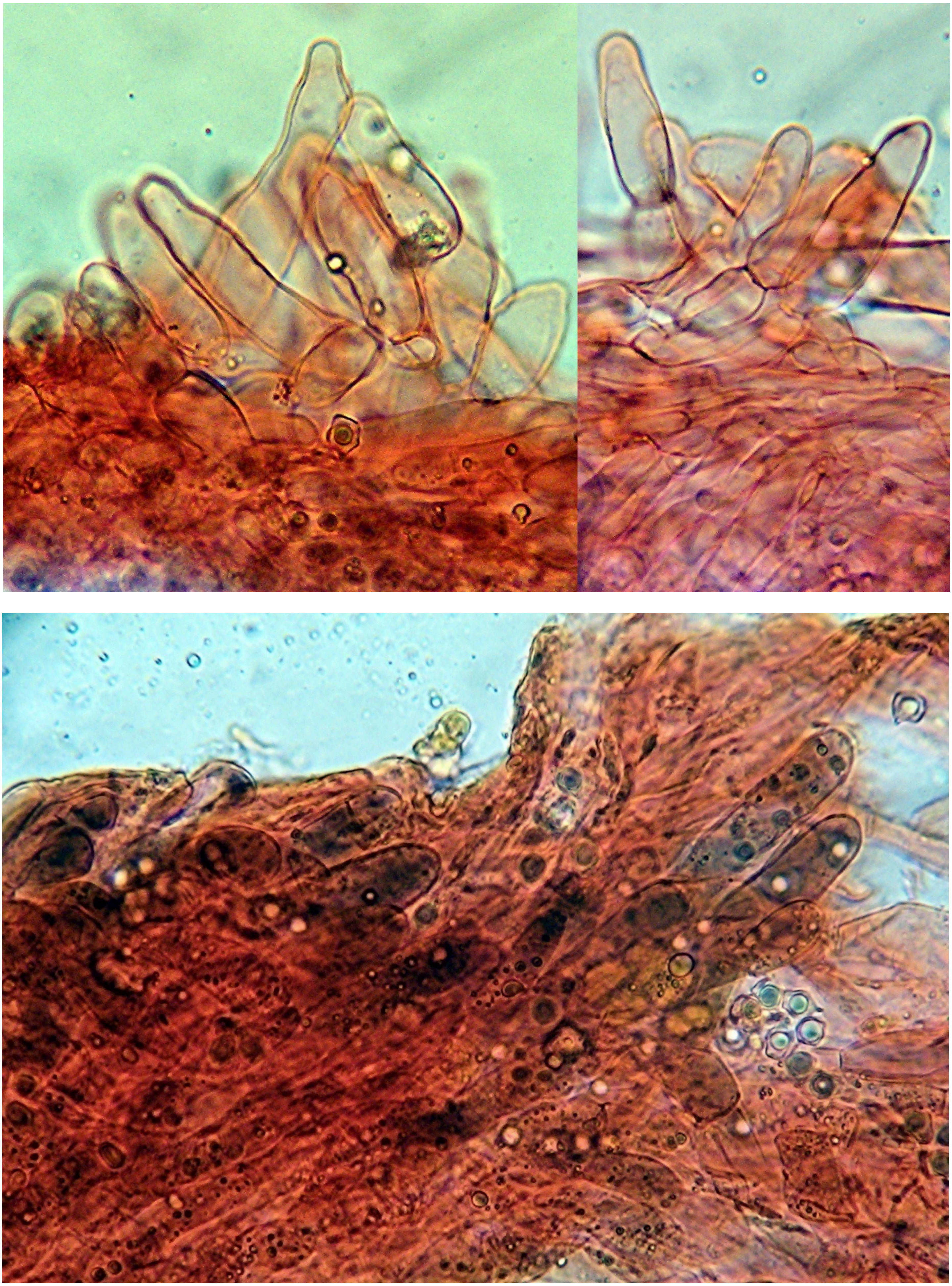
Pileus 1.0 – 3.7 cm broad, convex, somewhat depressed at centre, margin involute; cuticle tomentose to squamulose, not translucently striate, in external half radially innately fibrillose, black to violaceous-bluish black, not discolouring.

Lamellae 32 – 34, intermixed with lamellulae, emarginate-adnate, little ventricose; white, then pinkish; edge concolorous.

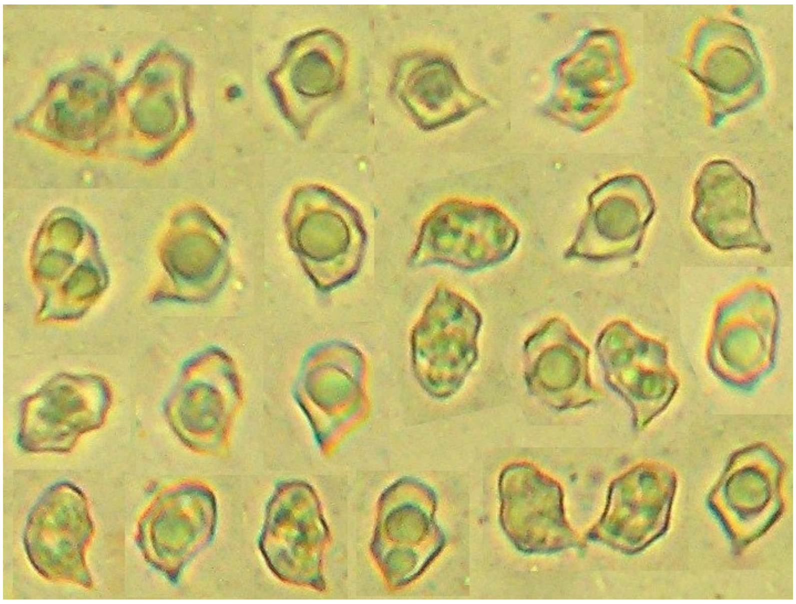
Stipe 30 – 100 × 2 – 4 mm, somewhat broader toward the base and tapering toward the apex, straight to twisted, striate-fibrillose, blackish to bluish blackish; base with abundant white mycelium often rising up to almost half the height; hollow.

Context white in stipe, concolorous with the external surface in the stipe cortex and inside the pileus.

Entoloma coracis 17.11.2010



Above: cheilocystidia; below: pileipellis. In Congo red / Sopra: cheilocistidi; sotto: pileipellis. In rosso Congo



Spores in Congo red / spore in rosso Congo

Microscopic characters

Basidiospores (8.0) 8.7 – 10.5 (11.7) × (5.7) 6.2 – 7.5 (7.9) µm, on average 9.1 – 10.4 × 6.3 – 7.3 µm, Q = 1.2 – 1.6, on average 1.4; heterodiametrical, with 5 – 7 angles in side view.

Basidia 26 – 34 × 10 – 12 µm, clavate to clavate-subcapitate, 4-spored.

Cheilocystidia 30 – 60 (80) × 7 – 17 µm (last element), often septate, cylindric or tapering at apex, occasionally subclavate or slightly swollen at apex, hyaline, numerous; edge sterile.

Pileipellis a cutis with transitions to a trichoderm composed of cylindraceous to narrowly clavate terminal elements, 40 – 100 × 9 – 20 µm; pigment intracellular with dark granular inclusions.

Clamp connections absent.

Collection examined and Habitat: Italy, Veneto, Venice, S. Anna di Chioggia, Nordio forest. Two specimens scattered, in the forest, 17 November 2010, *legit anon*., PAD H0062117; three specimens scattered, in a mossy clearing with *Quercus ilex* , *Populus alba* and other broadleaves, 14 November 2013, *legit P. Voto*, PAD H0062118.

NOTES

Entoloma coracis is a termophilic species of deciduous forests and xerophytic grasslands, mostly on calcareous soil, distributed from South Norway to the Mediterranean (Noordeloos *et al.* 2022).

Its cheilocystidia in part apically attenuated are shared by the species of the /Rhombisporum clade which however differ by 4- to 5- angled (sub) isodiametrical spores.

Following the recent key by Noordeloos *et al.* (2022), a collybioid habit, a trichodermic pileipellis and absence of clamp connections include this species in *Entoloma* subgenus *Cyanula* (Romagn.) Noordel (key 4). Furthermore, with its opaque, not translucently striate pileus pigmented with dark violaceous colours, it falls within the subkey 4.1. In this subkey, the presence of fusiform cheilocystidia, defined as porphyrogriseum-type, place *E. coracis* in the following restricted group of species.

E. rhynchocystidiatum Noordel. & Liiv, *E. holmvassdalenense* Eidissen, Lorås & Weholt and *E. nordlandicum* Noordel., Lorås, Eidissen & Dima, all northern Europe species, differ by cheilocystidia mostly attenuated in a mucronate shape (rhynchocystidiatum-type); *E. violaceoserrulatum* Noordel., Brandrud, O.V. Morozova & Dima has refractive granules in the cheilocystidia and is reported from Northern European calcareous grasslands; *E. uranochroum* Hauskn. & Noordel. has a bright bluish pileus; *E. porphyrogriseum* Noordel. and *E. roseotinctum* Noordel. & Liiv have dark bluish pilei fairly quickly discolouring to brownish tints; *E. azureopallidum* Corriol has pilei with bluish tinges and a subalpine to alpine habitat.

Two other taxa are probably relevant for studies on *Entoloma* in the Mediterranean area.

E. meridionale Mešič, Vila, Polemis, Noordel. & Dima, a Mediterranean termophilic species reported from Croatia, Greece and Spain, differs by apically rounded, not tapering, cheilocystidia (Lebeuf *et al.* 2021).

E. corvinum (Kühner) Noordel., the name originally misapplied to this collection, is treated by Noordeloos *et al.* (2022) as a species with alpine habitat and, likewise *E. meridionale*, a banally rounded apex of cheilocystidia.

Since *E. corvinus* is a recurrent name in Mediterranean fungaria, all Mediterranean collections identified with this name need to be revised and *E. meridionale* and *E. coracis* may be the correct names to replace.

Another description of *E. coracis*, supported by a molecular sequence, is in Bañares Baudet & Moreno (2023), from the Canary Islands.

REFERENCES / BIBLIOGRAFIA

Bañares Baudet Á, Moreno G (2023) Adiciones a la micobiota de las Islas Canarias. XV. Agaricomycetidae. *Bol. Soc. Micol. Madrid* 47:163–177

Crous PW, Cowan DA, Maggs-Kölling G, *et al*. (2021) Fungal Planet description sheets: 1182–1283. *Persoonia* 46: 313–528

Lebeuf R, Alexandrova AV, Cerna-Mendoza A, Corazon-Guivin MA, *et al*. (2021) Fungal Systematics and Evolution: FUSE 8. *Sydowia* 74:193–249

Noordeloos ME, Morozova O, Dima B, Reschke K, Jansen GM, Brandrud TE, Jordal JB, Bendiksen E, Vila J (2022) *Entoloma* Sensu Lato. Subgenera *Cyanula*, *Leptonia*, *Nolanea*, *Trichopilus*, and the/Rhombisporum Clade. *Fungi Europaei*. Volume 5b. Edizione Candusso; Alassio, Italy: 2022. pp. 1–968

Entoloma coracis in bosco Nordio

Parole chiave:
Agaricales
Entolomataceae
Mediterraneo

Riassunto: Segnalazione di una raccolta nel bosco Nordio di *Entoloma coracis*, descritto di recente, corredata da descrizioni morfologiche, immagini a colori dei basidiomi e dei suoi microcaratteri principali, e commenti sui taxa più simili.

INTRODUZIONE

Proseguendo nella revisione delle raccolte dell'autore di specie di *Entoloma* dal bosco Nordio, è ora la volta di due ritrovamenti che risalgono agli anni 2010 e 2013 e che furono identificate all'epoca come *E. corvinus*. La revisione morfologica, basata sulla chiave in Noordeloos *et al*. (2022), mostra che essi devono attualmente essere ascritti a *Entoloma coracis,* recentemente descritto nel 2021 (Crous *et al*. 2021). Questa nuova specie è molto probabilmente presente anche in altri erbari e vecchie raccolte mediterranee col nome *E. corvinus*, una specie molto simile ristretta, nel suo concetto moderno di Noordeloos *et al*. (2022), a un habitat alpino e differenziata morfologicamente dalla forma dei cheilocistidi.

MATERIALI E METODI

I basidiomi sono stati fotografati freschi il giorno della raccolta, in habitat e in ambiente interno, e tutti i caratteri morfologici sono stati osservati, fotografati e descritti prima dell'essiccamento.

Il codice d'erbario PAD, preso dal sito Index Herbariorum (https://sweetgum.nybg.org/science/ih/), accessibile online, si riferisce all'Università degli Studi di Padova, Padova (Italia). Tutte le immagini sono dell'autore.

Entoloma coracis Brandrud, Dima, Noordel., G.M. Jansen & Vila
Persoonia 46: 445 (2021)

Caratteri macroscopici

Cappello 1.0 – 3.7 cm di diametro, convesso, un po' depresso al centro, margine involuto; cuticola da tomentosa a squamulosa, non striata per trasparenza, nella metà esterna con fibrille innate disposte radialmente, di colore da nero a nero violaceo-bluastro, non sbiadente.

Lamelle 32 – 34, frammiste da lamellule, smarginate-adnate, un po' ventricose; bianche, poi rosastre; filo concolore.

Gambo 30 – 100 × 2 – 4 mm, un po' ingrossato verso la base e rastremato verso l'apice, da dritto a ritorto, striato-fibrilloso, da nerastro a nerastro-bluastro; base con abbondante micelio bianco sovente risalente fino a quasi metà altezza; cavo.

Carne bianca nel gambo, concolore con la superficie esterna nella corteccia stipitale e all'interno del cappello.

Caratteri microscopici

Basidiospore (8.0) 8.7 – 10.5 (11.7) × (5.7) 6.2 – 7.5 (7.9) µm, in media 9.1 – 10.4 × 6.3 – 7.3 µm, Q = 1.2 – 1.6, in media 1.4; eterodiametriche, con 5 – 7 angoli in vista laterale.

Basidi 26 – 34 × 10 – 12 µm, da clavati a clavati-subcapitati, 4-sporici.

Cheilocistidi 30 – 60 (80) × 7 – 17 µm (ultimo elemento), sovente settati, cilindrici o rastremati all'apice, occasionalmente subclavati o leggermente rigonfi all'apice, ialini, numerosi; filo sterile.

Pileipellis di tipo cutis con transizione a trichoderma, composta di elementi terminali da cilindracei a strettamente clavati, 40 – 100 × 9 – 20 µm; pigmento intracellulare con inclusioni granulari scure.

Giunti a fibbia assenti.

Raccolta esaminata e Habitat: Italia, Veneto, Venezia, S. Anna di Chioggia, bosco Nordio. Due esemplari sparsi, all'interno del bosco, 17 novembre 2010, *legit anon*., PAD H0062117; tre esemplari sparsi, in una radura muschiosa con *Quercus ilex* , *Populus alba* e altre latifoglie, 14 november 2013, *legit P. Voto*, PAD H0062118.

COMMENTI

Entoloma coracis è una specie termofila di boschi decidui e prati xerofitici, per lo più su suolo calcareo, distribuita dalla Norvegia meridionale al Mediterraneo (Noordeloos *et al.* 2022).

I suoi cheilocistidi in parte apicalmente rastremati sono condivisi dalle specie del clado /Rhombisporum le quali tuttavia differiscono per le spore con 4 – 5 angoli e (sub) isodiametriche.

Seguendo la recente chiave in Noordeloos *et al.* (2022), l'habitus collybioide, la pileipellis trichodermica e l'assenza di giunti a fibbia includono questa specie in *Entoloma* sottogenere *Cyanula* (Romagn.) Noordel (chiave 4). Inoltre, col suo cappello opaco, non striato per trasparenza e pigmentato con toni violacei scuri, essa rientra nella subchiave 4.1. In questa subchiave, la presenza di cheilocistidi fusiformi, definiti di tipo porphyrogriseum, colloca *E. coracis* nel seguente ristretto gruppo di specie.

E. rhynchocystidiatum Noordel. & Liiv, *E. holmvassdalenense* Eidissen, Lorås & Weholt e *E. nordlandicum* Noordel., Lorås, Eidissen & Dima, tutte specie nord europee, differiscono per i cheilocistidi principalmente rastremati con morfologia mucronata (di tipo rhynchocystidiatum); *E. violaceoserrulatum* Noordel., Brandrud, O.V. Morozova & Dima ha granulazioni rifrangenti nei cheilocistidi ed è segnalata da prati calcarei del nord Europa; *E. uranochroum* Hauskn. & Noordel. ha il cappello bluastro vivace; *E. porphyrogriseum* Noordel. e *E. roseotinctum* Noordel. & Liiv hanno il cappello bluastro scuro e abbastanza velocemente sbiadente verso tinte brunastre; *E. azureopallidum* Corriol ha il cappello di toni bluastri e habitat da subalpino ad alpino.

Due altri taxa sono probabilmente rilevanti per gli studi su *Entoloma* nell'areale mediterraneo.

E. meridionale Mešič, Vila, Polemis, Noordel. & Dima, una specie termofila mediterranea segnalata in Croazia, Grecia e Spagna, si differenzia per i cheilocistidi arrotondati all'apice, non rastremati (Lebeuf *et al.* 2021).

E. corvinum (Kühner) Noordel., il nome originariamente male applicato a questa raccolta, viene trattato da Noordeloos *et al.* (2022) come una specie con habitat alpino e, similmente a *E. meridionale*, apice dei cheilocistidi banalmente arrotondati.

Poiché *E. corvinus* è un nome ricorrente nei fungari mediterranei, tutte le raccolte mediterranee identificate con questo nome necessitano di essere revisionate e *E. meridionale* e *E. coracis* potrebbero essere i nomi corretti da rimpiazzare.

Un'altra descrizione di *E. coracis*, supportata da una sequenza molecolare, è in Bañares Baudet & Moreno (2023), proveniente dalle Isole Canarie.

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Diatrypella placenta (Ascomycota, Xylariales) in Bosnia and Herzegovina

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Key words:
Diatrypaceae
Alnus

Abstract: *Diatrypella placenta* is described from Bosnia with photographs of ascomes and main microcharacters. A comparison is made with similar members of the genus.

INTRODUCTION

The species here treated is a so called pyrenomycetous fungus of the family Diatrypaceae Nitschke. It is composed of a hollow perithecium growing under tree bark and erumpent outside at maturity.

Its study was carried on both classical morphology-based literature (Glawe 1986, Glawe & Rogers 1984; Medardi 2006, Rehm 1882) and modern phylogeny-based literature (Konta *et al*. 2020; Vasilyeva & Stephenson 2005; Yang *et al*. 2022), some of the above-mentioned works also providing identification keys (Glawe & Rogers 1984; Vasilyeva & Stephenson 2005).

Basing on the morphological characters of the collection, among which the parameters of spores (allantoid, hyaline, aseptate), asci (polysporous: bearing more than eight spores, unitunicate), and the habitat (erumpent from *Alnus* bark), its identification search led to the genus *Diatrypella*. However, modern molecular analyses (e.g. Konta *et al*. 2020; Vasilyeva & Stephenson 2005; Yang *et al*. 2022) have shown that the morphology is not always coherent with the phylogeny; for instance species with 8-spored asci classically belonging to the genus *Diatrype* fall in the clade of the genus *Diatrypella* classically characterized by polysporous asci and vice versa. *Diatrypella placenta* is not present in the main fungal genetic repositories (GenBank, UNITE).

MATERIALS AND METHODS

The ascomes were photographed in habitat; the micro characters were studied on fresh material in water. The spore width was measured from the midpoint dorsal side to the midpoint ventral side (width in front view), and from the midpoint dorsal side to the midpoint of a line connecting the ventral extremity at each end of the spore (width in side view). All images by the author.

TAXONOMY

Diatrypella placenta Rehm
Hedwigia 21 (8): 117 (1882)

= *Diatrype discoidea* var. *alni* Ravenel, Fungi Amer. exs., N 188, 1878 (fide Vasilyeva & Stephenson 2005)

Description of teleomorph

Stromata 1 – 4 mm broad, isolate (none found coalescing), erumpent through tree bark, more or less circular to sometimes elongate, pulvinate with upper surface very low convex to flat, with more or less distinct narrow grooves extending radially from the perithecial ostioles; brownish to purplish brown and blackish brown, bearing several perithecia; pseudoparenchymatous tissue whitish to brownish.

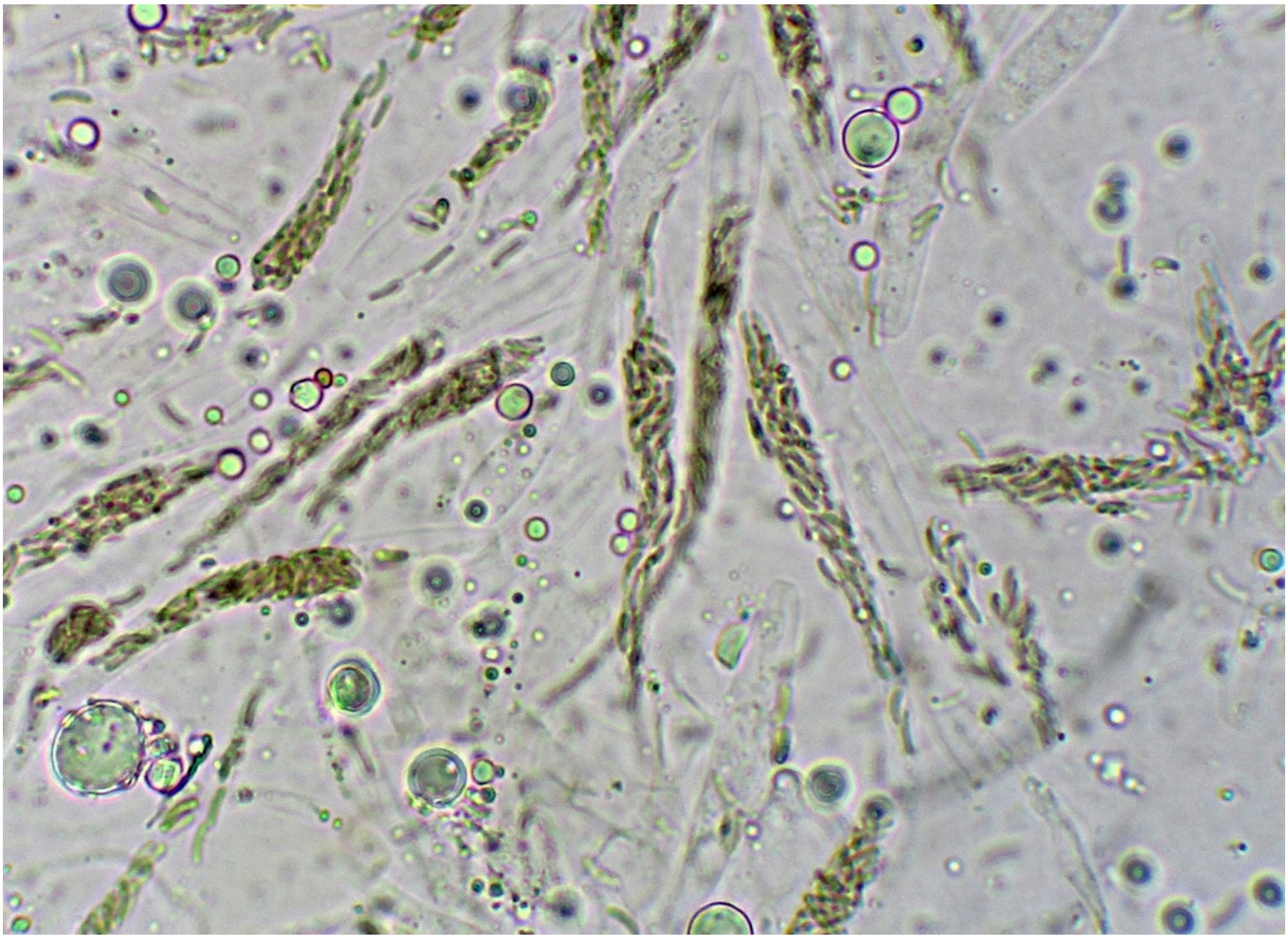
Perithecia black, usually homogeneously distributed, superiorly terminating in ostioles.

Ostioles circular, flattened, sulcate.

Asci 45 – 60 × 5 – 7 µm in the spore-bearing portion (p. sp.), narrowly fusiform-cylindrical, long- stipitate, polysporous, unitunicate, apical ring almost inamyloid.

Ascospores 4.50 – 5.20 µm long, 0.60 – 0.70 µm wide in front view, 1.15 – 1.30 µm in side view, cylindrical in front view, allantoid to suballantoid in side view, subhyaline.

Spores / spore (scale bar = 1 µm)



Asci

Collection examined and Habitat: Bosnia and Herzegovina, Banja Luka, Prijedor, Čejreci, on dead wood of *Alnus glutinosa*, 6 February 2024, *legit D. Trivič*, in the author's pers. herb

NOTES

This species seems little reported both in published literature and in websites. It is reported from Europe [Austria (Kahr et al. 1996; Rehm 1882; marn.at website), France (Mombert website), Poland (Chlebicki 2008), Russia (inaturalist.org website)] and North America [Canada (Pilley & Trieselmann 1968), USA (Petersen 1979; Ravenel 1882 sub nom. *D. discoidea* var. *alni*)]. This Bosnian collection most likely is the first report from the entire Balkan area.

Very small spores, sulcate ostioles, narrow grooves more or less extending radially from the ostioles on the stromatal surface, and alder habitat are the main characteristics identifying *Diatrypella placenta*.

The two following species also are specialized with *Alnus* wood.

Diatrypella rimosa Shear (Shear 1902), described from USA, has somewhat similar stromata with weakly sulcate ostioles but differs by white to creamy white entostromata tissue, by transversally, not radially, fissured stromatal surface, and by longer spores (5 – 7 × 1.5 µm).

Diatrypella verrucaeformis (Ehrh. ex Pers.) Nitschke is distinguished by its sub conical stromata little emerging from the bark and 6 – 8 µm long ascospores.

Diatrypella discoidea Cooke & Peck has ascospores of similar length and similarly sulcate ostioles but is a *Betula* host fungus.

REFERENCES

Baral H-O, Haelewaters D (2015) *Rommelaarsia flavovirens* gen. et sp. nov. (Helotiales), a new discomycete on *Equisetum* with a peculiar asexual state. *Ascomycete.org* 7(6):321–330

Chlebicki A (2008) Some overlooked and rare xylariaceous fungi from Poland. *Polish Botanical Journal* 53(1):71–80

Glawe DA (1986) Taxonomic notes on *Diatrypella discoidea*, *Diatrypella decorata*, and *Diatrypella placenta*. Mycotaxon 25(1):19–25

Glawe DA, Rogers JD (1984) Dyatripaceae in the pacific northwest. Mycotaxon 20(2):401–460

inaturalist.org. Observations. *Diatrypella placenta*. https://www.inaturalist.org/observations?place_id=any&subview=map&taxon_id=1526149

Kahr H, Maurer W, Michelitsch S, Scheuer C (1996). Holzabbauende Pilze der Steiermark, II. *Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark* 125:89–120

Konta S, Maharachchikumbura SSN, Senanayake IC, McKenzie EHC, Stadler M, Boonmee S,Phookamsak R, Jayawardena RS, Senwanna C, Hyde KD, Elgorban AM, Eungwanichayapant PD (2020) A new genus Allodiatrype, five new species and a new host record of diatrypaceous fungi from palms (Arecaceae). *Mycosphere* 11(1):239–268
10.5943/mycosphere/11/1/4

marn.at. Pilze im Turiawald. *Diatrypella placenta* Rehm
http://www.marn.at/pilze-index/diatrypella_placenta.html

Medardi G (2006) Atlante fotografico degli Ascomiceti d'Italia. Ed. Trento, A.M.B. Centro Studi Micologici

Mombert A. *Diatrypella placenta*
https://www.flickr.com/photos/fandebiodiversite/52597934166/

Petersen RH (1979) Checklist of fungi of the Great Smoky Mountains National Park. *Management Report* 29: 1–103

Pilley PG, Trieselmann RA (1968) A synoptic catalogue of cryptogams deposited in the Ontario region herbarium. I. Ascomycetes and Deuteromycetes. *Government of Canada, Department of Forestry and Rural Development, Forest Research Laboratory, Ontario Region, Sault Ste. Marie, Ontario. Information Report O-X-80*, 185 pp

Ravenel HW (1882) in Ravenel HW & Cooke MC. Fungi Americani Exsiccati

Rehm H (1882) Beiträge zur Ascomyceten Flora der deutschen Alpen und Voralpen. *Hedwigia* 21(8):113–123

Shear CL (1902) Mycological notes and new species. *Bulletin of the Torrey Botanical Club* 29:449–457

Vasilyeva LN, Stephenson SL (2005) Pyrenomycetes of the Great Smoky Mountains National Park. II. *Cryptovalsa* Ces. et De Not. and *Diatrypella* (Ces. et De Not.) Nitschke (*Diatrypaceae*). *Fungal Diversity* 19:189–200

Yang Z, Zhang B, Qu Z, Song Z, Pan X, Zhao C, Ma H (2022) Two New Species of *Diatrype* (Xylariales, Ascomycota) with Polysporous Asci from China. *Diversity* 14(2, no. 149):1–11
https:// doi.org/10.3390/d14020149

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Inocybe huijsmanii in Bosnia and Herzegovina

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Key words:
Agaricomycetes
Agaricales
Inocybaceae

Abstract: Based on morphological data, *Inocybe huijsmanii*, an old species of Kuyper (1986) recently revisioned by Bandini, Oertel & Eberhardt (2021), is reported for the first time from Bosnia, and most probably from the entire Balkan region, with a brief description and colour images of the basidiomes in situ and the main microcharacters.

MATERIALS AND METHODS

The basidiomes were photographed in habitat; the micro characters were studied on fresh material in ammonia for the picture of the pleurocystidium, in Congo red for all other characters. All images by the author.

TAXONOMY

Inocybe huijsmanii Kuyper
Persoonia, Suppl. 3: 134 (1986)

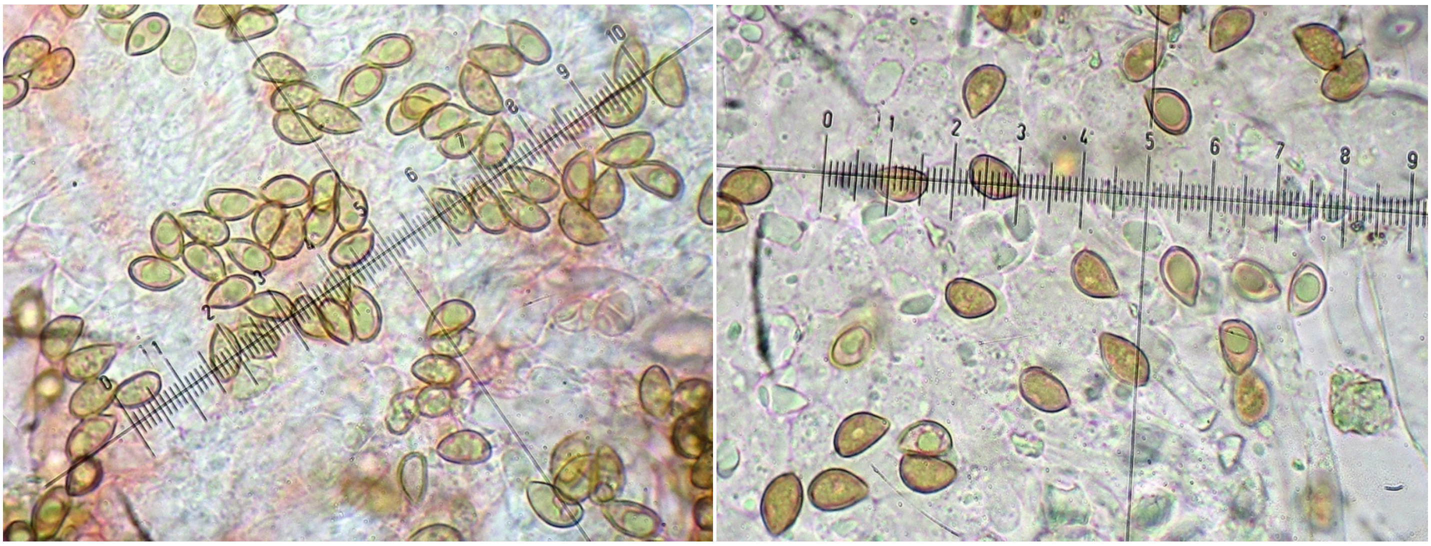
Macroscopic characters

Pileus 7.5 – 18.0 mm broad, conical-convex then broadly convex, umbonate, margin involute to straight, smooth, glabrous, with age radially innately fibrillose, when fresh very pale lilaceous, then yellowish-ochraceous at centre and whitish to sometimes pale pinkish-lilac outside centre.

Lamellae subdistant 25 – 32, with 1 to 2 tiers of lamellulae, adnate, subventricose to ventricose little, at first whitish then brownish grey; edge whitish, fimbriate.
Stipe 13 – 25 × 0.7 – 1.6 mm, cylindrical, straight to somewhat flexuous, colour pale brownish ochraceous below a whitish tomentose-fibrillose covering, towards apex with a faint lilac shade, scarcely pruinose only near the apex.
Context with an indistinct smell.

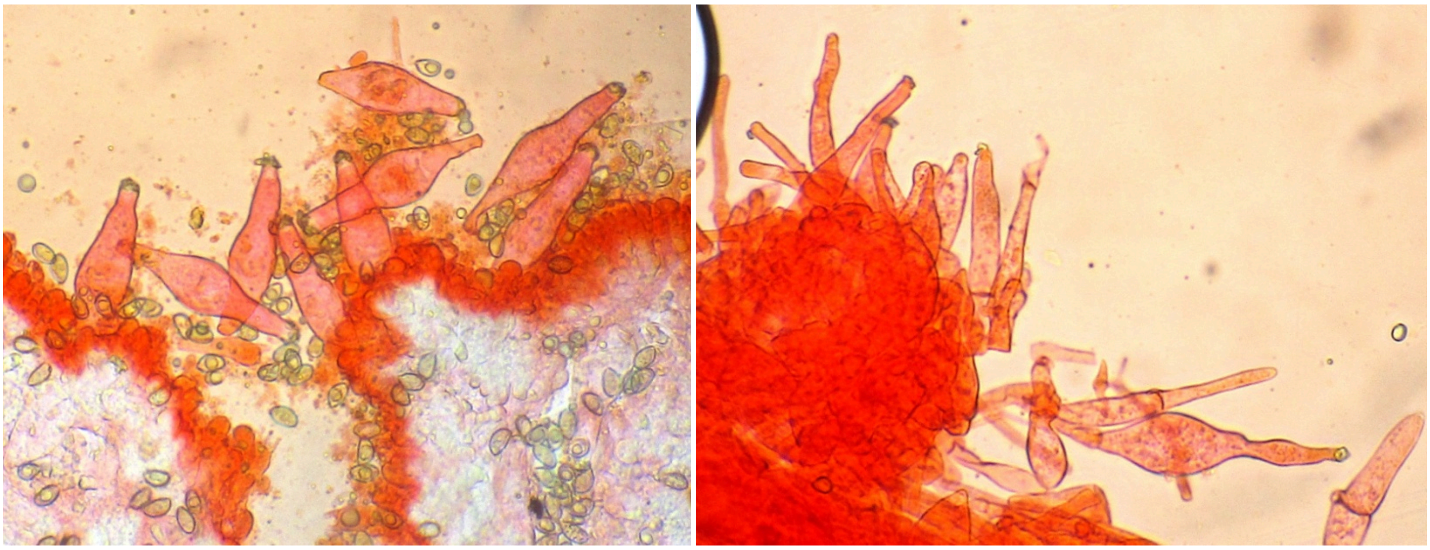
Microscopic characters

Basidiospores (8.10) 8.35 – 9.69 (10.22) × (4.81) 4.86 – 5.50 (6.00) µm, on average 9.00 – 9.10 × 5.15 – 5.25 µm, Q = (1.5) 1.6 – 1.9 (2.0), on average 1.75; in front view elliptic to navicular, in side view amygdaliform with a sometimes bulging dorsal side to adaxially flattened, sometimes with a suprahilar depression, apex rounded to conical or papillate; smooth; germ pore sometimes visible as a small callus.
Basidia 20.8 – 30.8 × 7.8 – 12.3 µm, 4-spored, clavate.
Pleurocystidia 50.0 – 70.0 × 10.0 – 18.0 µm, mainly utriform to subutriform or subfusiform, neck mostly elongate and more often somewhat tapering than cylindrical; apex obtuse to rounded, crystalliferous; walls slightly thickened up to about 1 µm, greenish-yellowish in 5% KOH.
Cheilocystidia similar to the pleurocystidia, intermixed with small paracystidia.
Caulocystidia similar to the pleurocystidia, only present at the extreme apex of the stipe.
Clamp connections present.



Spores in Congo red

Pleurocystidia. Left: in Congo red, right: colour in ammonia



Left: pleurocystidia. Right: caulocystidia. In Congo red

Collections examined and Habitat: Bosnia and Herzegovina, Prijedor, Ljubija, Brisevo village; gregarious, in a mixed wood of hornbeam (*Carpinus sp*.), lime (*Tilia sp*.) and maple (*Acer sp*.), 8 and 19 June 2024, *legit D. Trivič*, in pers. herb.

NOTES

Inocybe huijsmanii is characterized by small basidiomes with sometimes a light covering of a pale pinkish-lilac velipellis on the pileus and sometimes lilaceous tints at the stipe apex. With the vanishing of this veil, which went almost unnoticed in this collection, the pileus appears whitish to alutaceous. Other characteristics are almost thin-walled cystidia, medium spore size, and scarcity of caulocystidia. The subpapillate spore apex is also reported by Bandini, Oertel & Eberhardt (2021) and Kuyper (1986).

The spore size in this collection falls on the lower end of the expected range [(8.0) 8.5 – 10.5 × 5.0 – 6.0 µm, on average 9.1 – 10.1 × 5.2 – 5.8 µm, Q = 1.6 – 1.9, on average 1.7 – 1.8 (Kuyper 1986, protolog); 8.6 – 10.7 × 4.4 – 5.8 µm, on average 9.6 × 5.2 µm, Q = 1.6 – 2.2, on average 1.9 (Bandini, Oertel & Eberhardt 2021, paratype revision)].

Bandini, Oertel & Eberhardt (2021) studied unsequenced isotypes of *I. bolbitioides* Carteret & Reumaux and *I. gypsea* Carteret & Reumaux. In both cases they found longer spores and consequently a higher quotient (on average 10.8 × 5.4 µm, Q = 2.0 and 11.0 × 5.4 µm, Q = 2.0, respectively). However, as they found presence of 2-spored basidia they comment that a synonymy with *I. huijsmanii* '*cannot entirely be excluded*'.

I. huismanii is very similar to *I. bellidiana* Bandini, B. Oertel & U. Eberh. which shares the pale coloured pileus. However, its spores are more characteristically bulgy on the dorsal side and somewhat shorter (6.8 – 10.1 × 4.3 – 6.0 µm) resulting in a lower quotient (1.4 – 2.1, on average 1.7), and cystidia feature a partly tapering and seldom elongate apex (Bandini, Oertel & Eberhardt 2021). Also, this species has close lamellae (ca. 40 – 50) which is a sensible difference versus the subdistant lamellae of *I. huijsmanii* (25 – 35 in the protolog, 25 – 32 in this collection).

kuyper (1986) commented that probably *I. huismanii* is confused with the common *Inocybe griseolilacina* J.E. Lange; however, this taxon differs by a less smooth pileus surface and thicker-walled cystidia (Bandini, Oertel & Eberhardt 2021).

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REFERENCES

Bandini D, Oertel B, Eberhardt U (2021) A fresh outlook on the smooth-spored species of *Inocybe*: type studies and 18 new species. *Mycological Progress* 20:1019–1114

Kuyper TW (1986) A revision of the genus *Inocybe* in Europe I. Subgenus *Inosperma* and the smooth-spored species of subgenus *Inocybe*. *Persoonia* Suppl. 3:1–247

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Psathyrella sect. *Cystidiosae* and first record of *Psathyrella cloverae* in the Dominican Republic

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Key words:
Basidiomycetes
Agaricales
Psathyrellaceae
taxonomy
phylogeny
type studies

Abstract: The American species of *Psathyrella* sect. *Cystidiosae* are studied using morphological and molecular (nrITS, *tef1-α*, LSU) data. This study includes the first report of *P. cloverae* from the Dominican Republic herein described with images of the basidiomes in habitat and the main microcharacters. *P. varzeae* and *P. hesleri* are demonstrated to be later synonyms of *P. cloverae*. *P. smithii* is also treated as a later synonym though based only on morphological data due to the unsuccessful molecular analysis of its isotype. The distribution of *P. cloverae* covers a wide range of climate and vegetation types, and ranges from South America (Brazil) through Central America (Caribbean, Costa Rica, Mexico) up to North America. Based on non-type molecular studies, *P. cystidiosa* is phylogenetically closer to the Central American species *P. pivae* and is therefore considered to be a different species from *P. cloverae*.

INTRODUCTION

The family Psathyrellaceae Vilgalys, Moncalvo & Redhead (synonyms: Zerovaemycetaceae Gorovij, *nomen anamorphosis*, restricted priority; Coprinaceae Overeem & Weese pro maxima parte, excluding the type name) includes, with phylogenetic support, several genera, including *Coprinellus* P. Karst., *Coprinopsis* P. Karst., *Homophron* (Britzelm.) Örstadius & E. Larss., *Lacrymaria* Pat., *Parasola* Redhead, Vilgalys & Hopple, *Psathyrella* Fr. ex Quél. and others. In the past the name used instead of Psathyrellaceae was Coprinaceae Overeem & Weese (inclusive of only two genera, *Coprinus* Pers. and *Psathyrella* Fr. ex Quél.), until Redhead *et al.* (2001) demonstrated, based on phylogenetic data, that the Coprinaceae also included a small number of taxa belonging to the different family Agaricaceae Chevall. Since these taxa also included *Coprinus comatus* (O.F. Müll.) Pers., the type name of *Coprinus*, in turn the type name of the family Coprinaceae, it was necessary to assign a new name, Psathyrellaceae, replacing Coprinaceae, to include the rest of the species.

For this family it is customary to informally distinguish species with a ‘coprinoid’ habit and species with a ‘psathyrelloid’ habit. The former group includes taxa usually characterized, among other characters, by the deliquescence of the basidiomes, while the members of the latter group do not usually deliquesce. Among the psathyrelloid taxa, there are two groups of species well characterized morphologically by possessing pleurocystidia more or less strongly thick-walled and usually incrusted.

In the past, Smith (1972), not yet possessing phylogenetic evidence, treated the members of these two groups in *Psathyrella* subgenus *Homophron* Britzelm. This subgenus was further split into the sections *Homophron* Britzelm., characterized by pale spores, and *Cystidiosae* A.H. Sm. 1972, characterized by well pigmented spores. Current phylogenetic knowledge (see Örstadius, Ryberg & Larsson 2015) demonstrates that in this group the presence/absence of veil, and not the spore colour, is the most relevant morphological character for separating the species. Consequently, we can morphologically distinguish the species with a veil, however scanty, and with well-pigmented spores, from those completely devoid of any trace of veil and with more or less pale spores. This distinction, although sometimes difficult to evaluate regarding the veil which is affected by the degree of freshness of the specimens, is necessary because the taxa of the first group belong to the genus *Psathyrella* Fr. ex Quél., while the taxa of the second group constitute the genus *Homophron* (Britzelm.) Örstadius & E. Larss., phylogenetically very distant (Örstadius, Ryberg & Larsson 2015).

Basing on phylogenetic evidence, the Smith's taxon *Psathyrella* sect. *Cystidiosae* 1972, type name *P. cystidiosa* (Peck) A.H. Sm., is therefore not taxonomically based on the most important character. However, it is a nomenclaturally valid taxon and we propose an emendation to its definition (as see below).

Romagnesi (1982) had proposed *Psathyrella* sect. *Pygmaeae* Romagn., type name *P. pygmaea* (Bull.) Singer. However, since the type names of both sections belong to the same phylogenetically supported clade, the Romagnesi's section must be treated as a later synonym of *Psathyrella* sect. *Cystidiosae* (I.C.N. Art. 11.3).

Due to the presence of a veil our Dominican collection belongs to *Psathyrella* sect. *Cystidiosae* and corresponds phylogenetically to the holotype of *P. cloverae* (Crous *et al.* 2019). We therefore attempted to sequence holotypes, isotypes, and other representative collections related to American taxa to ascertain any presumed cases of synonymy. As we expected on a morphological basis, for *P. hesleri* and *P. varzeae* the ITS sequences obtained support their synonymy with *P. cloverae*. For *P. smithii* we propose its synonymy only on a morphological basis since repeated molecular analyses of the isotype have failed.

Regarding *P. cystidiosa*, we only obtained one ITS sequence out of five non-types collections from the MIN and TEN herbaria. That sequence does not nest in the '*cloverae* subclade' but beside *P. pivae* ('*piva* subclade'). An LSU sequence, in GenBank, obtained from another non-type collection of *P. cystidiosa* (Crous *et al.* 2019) also nests beside *P. pivae*. Therefore, there is reliable molecular support to believe that this species is excluded from synonymy with *P. cloverae* notwithstanding a close morphological similarity.

Finally, we have evaluated which name, among *P. cloverae*, *P. hesleri*, *P. smithii* and *P. varzeae*, was to be chosen to have priority. *P. cloverae* and *P. hesleri* were described in the same work (Smith 1972), while *P. varzeae* and *P. smithii* were later. The name *P. hesleri* has a somewhat contorted history: Smith (1972) described it from a collection identified as *P. cystidiosa* that he considered to be misidentified. Our analysis confirms that he was correct in noting the misidentification, but mistaken in not recognizing it as his new species *P. cloverae*, thus creating a superfluous double. Therefore we propose to assign priority to the epithet *P. cloverae*.

MATERIALS AND METHODS

Morphology

The basidiomes of the Dominican collection were photographed fresh in the habitat by C.A. using a digital camera Nikon Coolpix 8400 and subsequently dried. Microscopic characters were studied and described by P.V. on dried material revived and observed in 5% KOH or 30% NH_4OH; in some cases Congo red was also added for enhanced clarity in images. The same procedure was used by P.V. for the micro revision of the isotype of *P. smithii*.

Special terms used in this paper are: 'indented' (referred to the spores): meaning that the base presents a lateral protrusion like a tooth (as it happens in other *Psathyrella* species, e.g. *P. albescens* Hesler & A.H. Sm.); 'lepto-' (referred to the cystidia): a prefix meaning thinned-wall; 'metuloid' (referred to the cystidia): meaning thick-walled; 'muricate' (referred to the cystidia): meaning the presence of incrustations on the cell walls; 'paracystidia': sterile cells of the gill edge with a clavate to ellipsoid shape, distinctly different from the pleurocystidia.

For the description of the vegetation present in the Dominican collecting site of *P. cloverae*, see Parra *et al*. (2018).

The herbaria cited in this paper are: Instituto Politécnico Nacional, Mexico city (Mexico), code ENCB; Field Museum of Natural History, Chicago (USA), code F; Jardín Botánico Nacional Dr. Rafael M. Moscoso, Santo Domingo (Dominican Republic), code JBSD; University of Michigan, Ann Arbor (USA), code MICH; University of Minnesota, St. Paul (USA), code MIN; Università degli Studi di Padova, Padua (Italy), code PAD; University of Tennessee, Knoxville (USA), code TENN; Royal Ontario Museum, Toronto (Canada), code TRTC. Their codes are taken from the online Index Herbariorum (https://sweetgum.nybg.org/science/ih/).

The authors of the images in the figures are shown in square brackets.

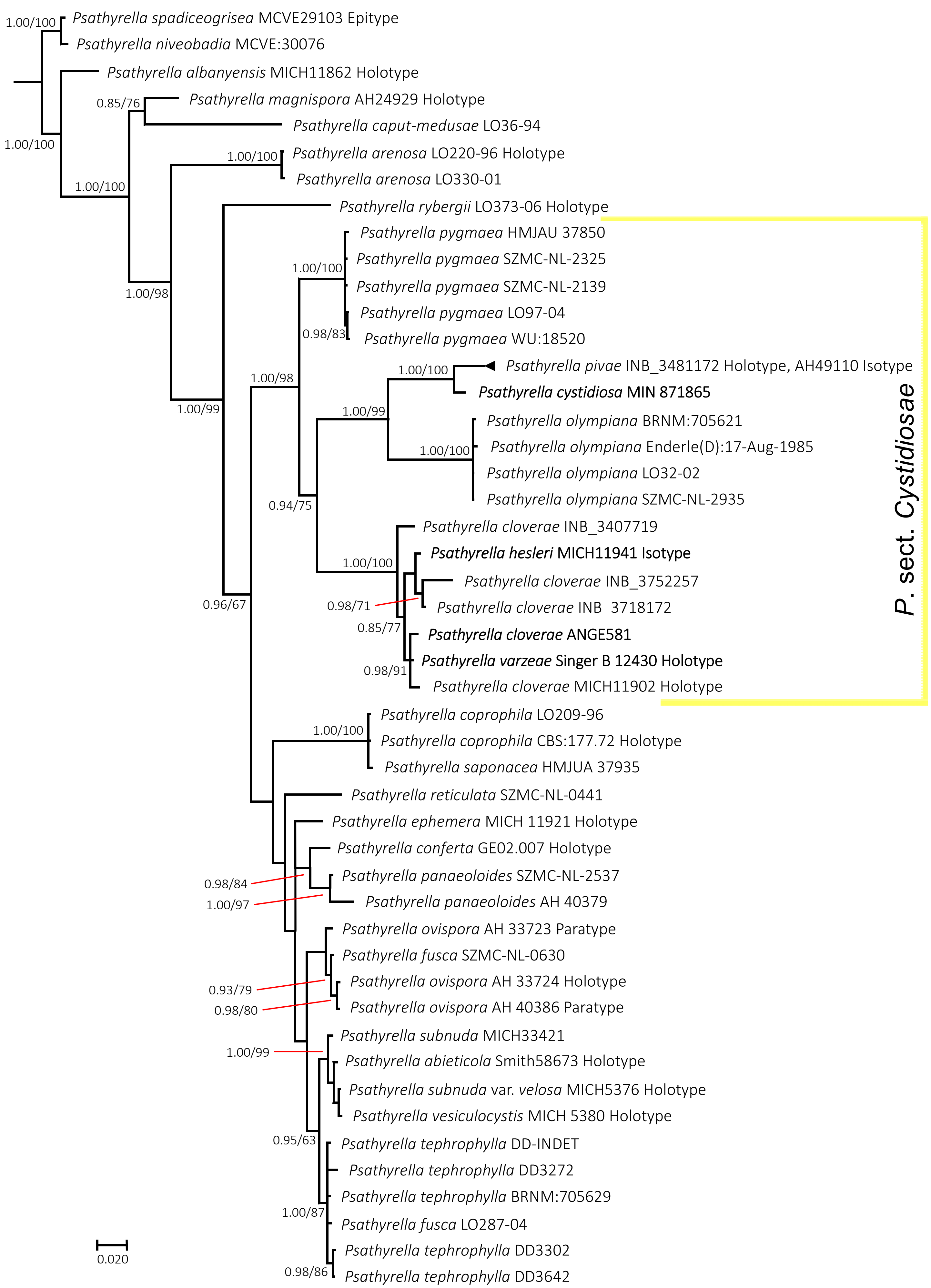
1.00/100
Psathyrella spadiceogrisea MCVE29103 Epitype
Psathyrella niveobadia MCVE:30076
Psathyrella albanyensis MICH11862 Holotype
0.85/76
Psathyrella magnispora AH24929 Holotype
Psathyrella caput-medusae LO36-94
1.00/100
1.00/100
Psathyrella arenosa LO220-96 Holotype
Psathyrella arenosa LO330-01
1.00/100
Psathyrella rybergii LO373-06 Holotype
Psathyrella pygmaea HMJAU 37850
Psathyrella pygmaea SZMC-NL-2325
1.00/100
Psathyrella pygmaea SZMC-NL-2139
1.00/98
Psathyrella pygmaea LO97-04
0.98/83
Psathyrella pygmaea WU:18520
Psathyrella pivae INB_3481172 Holotype, AH49110 Isotype
1.00/100
1.00/98
**Psathyrella cystidiosa* MIN 871865*
1.00/99
1.00/99
Psathyrella olympiana BRNM:705621
Psathyrella olympiana Enderle(D):17-Aug-1985
1.00/100
Psathyrella olympiana LO32-02
Psathyrella olympiana SZMC-NL-2935
0.94/75
Psathyrella cloverae INB_3407719
***Psathyrella hesleri* MICH11941 Isotype**
1.00/100
Psathyrella cloverae INB_3752257
0.96/67
0.98/71
Psathyrella cloverae INB 3718172
0.85/77
***Psathyrella cloverae* ANGE581**
***Psathyrella varzeae* Singer B 12430 Holotype**
0.98/91
Psathyrella cloverae MICH11902 Holotype
P. sect. Cystidiosae
Psathyrella coprophila LO209-96
1.00/100
Psathyrella coprophila CBS:177.72 Holotype
Psathyrella saponacea HMJUA 37935
Psathyrella reticulata SZMC-NL-0441
Psathyrella ephemera MICH 11921 Holotype
Psathyrella conferta GE02.007 Holotype
0.98/84
Psathyrella panaeoloides SZMC-NL-2537
1.00/97
Psathyrella panaeoloides AH 40379
Psathyrella ovispora AH 33723 Paratype
Psathyrella fusca SZMC-NL-0630
0.93/79
Psathyrella ovispora AH 33724 Holotype
0.98/80
Psathyrella ovispora AH 40386 Paratype
Psathyrella subnuda MICH33421
1.00/99
Psathyrella abieticola Smith58673 Holotype
Psathyrella subnuda var. *velosa* MICH5376 Holotype
Psathyrella vesiculocystis MICH 5380 Holotype
0.95/63
Psathyrella tephrophylla DD-INDET
Psathyrella tephrophylla DD3272
Psathyrella tephrophylla BRNM:705629
1.00/87
Psathyrella fusca LO287-04
0.020
Psathyrella tephrophylla DD3302
0.98/86
Psathyrella tephrophylla DD3642

Figure 1 (above): A 50% majority rule ITS rDNA-28S rDNA- *tef1-α* consensus phylogram of the /cystidiosa clade of genus Psathyrella (with *P. spadiceogrisea* and *P. niveobadia* of /spadiceogrisea clade as outgroups) obtained using MrBayes from 2700 sampled trees. Nodes were annotated if they were supported by ≥ 0.95 Bayesian posterior probability (left) or ≥ 70% maximum likelihood bootstrap proportions (right). Nonsignificant support values are exceptionally represented inside parentheses. New sequences generated in this study are in bold

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Table 1 (below). Fungal taxa, voucher numbers and GenBank accession numbers of the sequences used in the phylogenetic analyses; in red sequences generated in this work. Names in parentheses indicate misidentifications ('as') or prior synonyms ('→')

Taxa names of *Psathyrella*	Collection ID	ITS	*tef1- α*	LSU
P. abieticola Holotype	Smith58673/USA	KC992891	–	KC992891
P. albanyensis Holotype	MICH11862/USA	MF325952	MF521823	–
P. arenosa Holotype	LO220-96/Sweden	KC992895	KJ732784	–
P. arenosa	LO330-01/Sweden	KC992896	KJ732785	KC992896
P. caput-medusae	LO36-94/Sweden	KC992927	KJ732814	KC992927
P. cloverae Holotype	MICH11902/USA	MF966417	–	–
P. cloverae	INB_3407719/Costa Rica	MF966508	–	–
P. cloverae	INB_3752257/ Costa Rica	MF966509	–	–
P. cloverae	INB_3718172/ Costa Rica	MF966510	–	–
P. cloverae	ANGE581/Dominican Rep.	MZ856314	OK546186	–
P. cloverae (duplicate)	ANGE581/Dominican Rep.	PP476873	PP493201	–
P. conferta Holotype	GE02.007 (PC)/France	KC992890	–	KC992890
P. coprophila Holotype (→ *P. saponacea*)	CBS:177.72/UK	MH860433	–	MH872163
P. coprophila (→ *P. saponacea*)	LO209-96/Sweden	DQ389717	–	DQ389717
P. cystidiosa	MIN 871865/USA	PP469638	–	–
P. ephemera Holotype	MICH 11921/USA	NR_161023	–	–
P. fusca	LO287-04/Sweden	KC992892	KJ732779	KC992892
P. fusca (→ *P. tehrophylla*)	DD-INDET/Belgium	MK583508	–	–
P. fusca (→ *P. tehrophylla*)	DD3272/Belgium	MK577903	–	–
P. fusca (→ *P. tehrophylla*)	DD3302/Belgium	MK577904	–	–
P. fusca (→ *P. tehrophylla*)	DD3642/Belgium	MK577902	–	MK57791
P. fusca (→ *P. tehrophylla*)	BRNM:705629/Czech Rep.	AM712270	–	AM712270
P. hesleri Isotype (→ *P. cloverae*)	MICH11941/USA	PP476871	–	–
P. magnispora Holotype	AH24929/Spain	KC992863	–	–
P. niveobadia	MCVE:30076/Italy	MK400421	MK408675	–
P. olympiana	LO32-02/Sweden	DQ389722	KJ732817	DQ389722
P. olympiana	SZMC-NL-2935/Hungary	FN396103	FN396211	FN396156
P. olympiana	Enderle(D):17-Aug-1985 /Germany	AM712267	–	AM712267
P. olympiana	BRNM:705621/Czech Rep.	AM712268	–	AM712268
P. ovispora Holotype	AH 33724/Spain	MF966497	–	MN190260
P. ovispora Paratype	AH 33723/Spain	MF966496	–	MN190261
P. ovispora Paratype	AH 40386/Spain	MN190257	–	–
P. ovispora (as *P. fusca*)	SZMC-NL-0630/Hungary	FM878030	FM897256	FM876288
P. panaeoloides	SZMC-NL-2537/Hungary	FM878022	FM897255	FM876279

Taxa names of *Psathyrella*	Collection ID	ITS	*tef1- α*	LSU
P. panaeoloides	AH 40379/Spain	MF966501	–	–
P. pivae Holotype	INB_3481172/Costa Rica	MF966507	–	–
P. pivae Isotype	AH49110/Costa Rica	–	–	MN161533
P. pygmaea	HMJAU 37850/China	MG734744	MH161170	MH155959
P. pygmaea	WU:18520/Germany	AM712269		AM712269
P. pygmaea	SZMC-NL-2139/Hungary	FM878010	FM897258	FM876266
P. pygmaea	SZMC-NL-2325/Hungary	FM878011	FM897224	FM876267
P. pygmaea	LO97-04/Sweden	DQ389718	KJ732811	DQ389718
P. reticolata	SZMC-NL-0441/Hungary	–	FM897227	FN396193
P. rybergii Holotype	LO373-06/Sweden	KC992893	KJ732781	KC992893
P. saponacea	HMJUA 37935/China	MH155965	–	MH155960
P. spadiceogrisea Epitype	MCVE29103/France	MF325997	MF521779	–
P. subnuda (→ *P. abieticola*)	MICH33421/USA	MF326000	MF521778	–
P. subnuda var. *velosa* Holotype (→ *P. abieticola*)	MICH5376/USA	MF326005	MF521773	–
P. varzeae Holotype (→ *P. cloverae*)	Singer B 12430/Brazil	PP476872	–	–
P. vesiculocystis Holotype (→ *P. abieticola*)	MICH 5380/USA	MF326007	MF521772	–

Phylogenetic analyses

The phylogenetic analyses were commissioned to the Alvalab laboratory (Spain) which also generated all new sequences proposed in this paper except that of the isotype of *Psathyrella hesleri*, generated by Ida Broman Nielsen and Tobias Frøslev (Denmark).

BLASTn (Altschul *et al*. 1990) was used to select the most closely related ITS rDNA sequences from the International Nucleotide Sequence Database Collaboration public database (INSDC, Arita *et al*. 2021), as well as LSU and *tef1-α* sequences of the same collections. Sequences first were aligned in MEGA 5.0 (Tamura *et al*. 2011) with its Clustal W application and then realigned manually as needed to establish positional homology. Aligned loci were loaded in MrBayes 3.2.6 (Ronquist *et al.* 2012), where a Bayesian analysis was performed (three partitions: ITS, LSU, *tef1-α*; model GTR+G+I, two simultaneous runs, four chains, temperature set to 0.2, sampling every 100th generation) until the average split frequencies between the simultaneous runs fell below 0.01 after 0.36 M generations. Finally, a full search for the best-scoring maximum likelihood tree was performed in RAxML 8.2.12 (Stamatakis 2014) using the standard search algorithm (same partitions, GTRGAMMAI model, 2000 bootstrap replications). The significance threshold was set above 0.95 for posterior probability (PP) and 70% bootstrap proportions (BP).

RESULTS

Emendation

Psathyrella sect. *Cystidiosae* A.H. Sm. emend. Voto
Memoirs of the New York Botanical Garden **24**:246 (1972)

Species of *Psathyrella* having pleurocystidia with crystalliferous to incrusted apex, and with walls in most cases yellowish and slightly to distinctly thickened.
Synonym: *Psathyrella* sect. *Pygmeae* Romagn., *Bull. trimest. Soc. mycol. Fr.* **98**(1):10 (1982)

Notes

This emendation is proposed basing on the characters of all species so far known to phylogenetically belong to this section. As shown by the phylogram, *P. rybergii* Örstadius & E. Larss. is a sister node to the "*cystidiosa* clade"; its pleurocystidia share a pale yellow pigment but are neither incrusted nor thick-walled therefore it is ruled out of the section.

This section comprises only two species in Europe: *P. pygmaea* (Bull.) Singer and *P. olympiana* A.H. Sm., both also present in North America. More species, and more names, are present in the American continent, beside the autonymous species, which are discussed below.

Taxonomy

P. cloverae A.H. Sm.
Memoirs of the New York Botanical Garden 24:248. 1972

Typus: E. Clover 1229 (MICH11902), USA, Texas, Hidalgo, Canal South Mission, 2.VI.1933
Molecular heterotypical synonyms proposed here:
= *Psathyrella hesleri* A.H. Sm., *Mem. N. Y. Bot. Gard*. 24: 249. 1972;
= *Psathyrella varzeae* Singer, *Fieldiana Botany* 21: 102. 1989.
Morphological heterotypical synonyms proposed here:
= *Psathyrella smithii* Guzmán, *Bol. Soc. Mex. Mic.* 8:94. 1974.

Description of the Dominican collection (Fig. 2-8).

Fig. 2. *Psathyrella cloverae*. ANGE581. Bar: 10mm [C. Angelini]

Macroscopic characters

Pileus (young and fresh specimens not observed) 18 − 32 mm; convex, sometimes undulate; margin radially ribbed-striated up to two thirds of the radius, with inconspicuous whitish residues of veil; surface smooth, hygrophanous, grey-brownish at first, often with an olivaceous shade while discoloring, finally beige to whitish with a (pale) greyish violaceous necropigment from the margin.
Lamellae approx. 30, intermixed with 3 − 7 lamellulae; adnate; not or slightly ventricose; greyish purplish brown; edge pale.

Stipe 15 − 36 × 3.0 − 6.0 mm, cylindrical or slightly tapering upwards, straight to somewhat flexuous, base equal or somewhat swollen; surface white, flocculose at apex, minutely flocculose elsewhere.
Context white in stipe.

Macroscopic characters

Spores (n = 20) (6.82) 7.20 − 8.00 (8.60) × (4.39) 4.55 − 5.20 (5.80) µm, on average 7.51 × 4.76 µm, Q = (1.35) 1.48 − 1.69 (1.73), on average 1.58; in face view oval to oval-pentagonal or elliptic, base broadly rounded to truncate, in side view adaxially flattened, subamygdaliform, subphaseoliform, sometimes weakly indented above the base; in water and in ammonia orange- to reddish- brown, in KOH grey-brown (cocoa-brown); germ pore distinct, 0.8 − 1.5 µm broad, broadly rounded to truncate; ; apiculus very small.
Basidia 4-spored, very rarely 2-spored, 16.0 − 19.5 × 7.5 − 9.0 µm, clavate.
Pleurocystidia (33.0) 40.0 − 50.0 × (12.5) 13.0 − 18.0 (22.0) µm; (ventricose) fusoid, ventricose-lageniform, utriform, mucronate-clavate; metuloid with walls 0.7 − 1.4 (2.0) µm thick at extreme base and 3.0 − 5.2 µm thick in neck, often completely occluding the space in extreme apex, hyaline to yellowish in ammonia; apex subacute to obtuse, sometimes rounded, muricate with incrustations; pedicel often elongate; abundant near the edge.
Cheilocystidia of three kinds, a) similar to pleurocystidia, scarce; b) paracystidia 15.0 − 26.0 × 8.8 − 13.0 (17.0) µm, clavate to ellipsoid, thin-walled, abundant; c) intermediate with paracystidioid shape and thickened walls or with more or less utriform shape and thin walls, scattered.
Pileipellis composed of a paraderm of cellular elements.
Caulocystidia more or less similar to pleurocystidia or smaller in size, occasionally thin-walled; scattered to abundant. *Clamp connections* present.

Habitat and collection examined: gregarious, growing on a fallen degraded trunk in a humid rain forest with deciduous trees; Dominican Republic, P.to Plata, Sosúa, Puerto Chiquito, (19°44'50.1"N 70°31'34.2"W), 4 January 2016, *legit C. Angelini* ANGE581, exsiccatum in JBSD124849, duplicate in PAD H0062119; GenBank: MZ856314 and PP476873- ITS, OK546186 and PP493201- *tef1-α* (same collection sequenced twice).

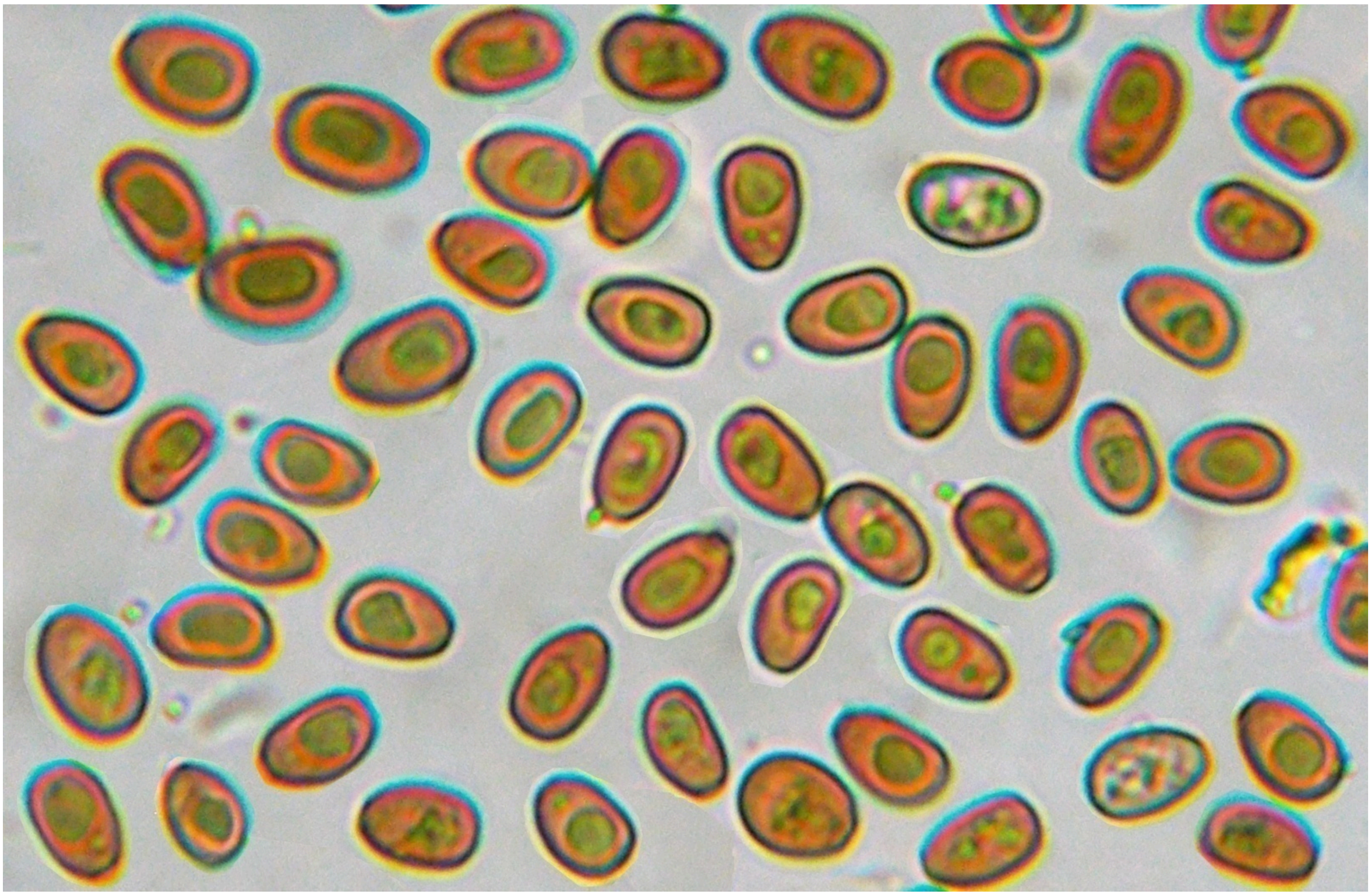

Fig. 3: *P. cloverae*, ANGE581. Spores in water [P. Voto]

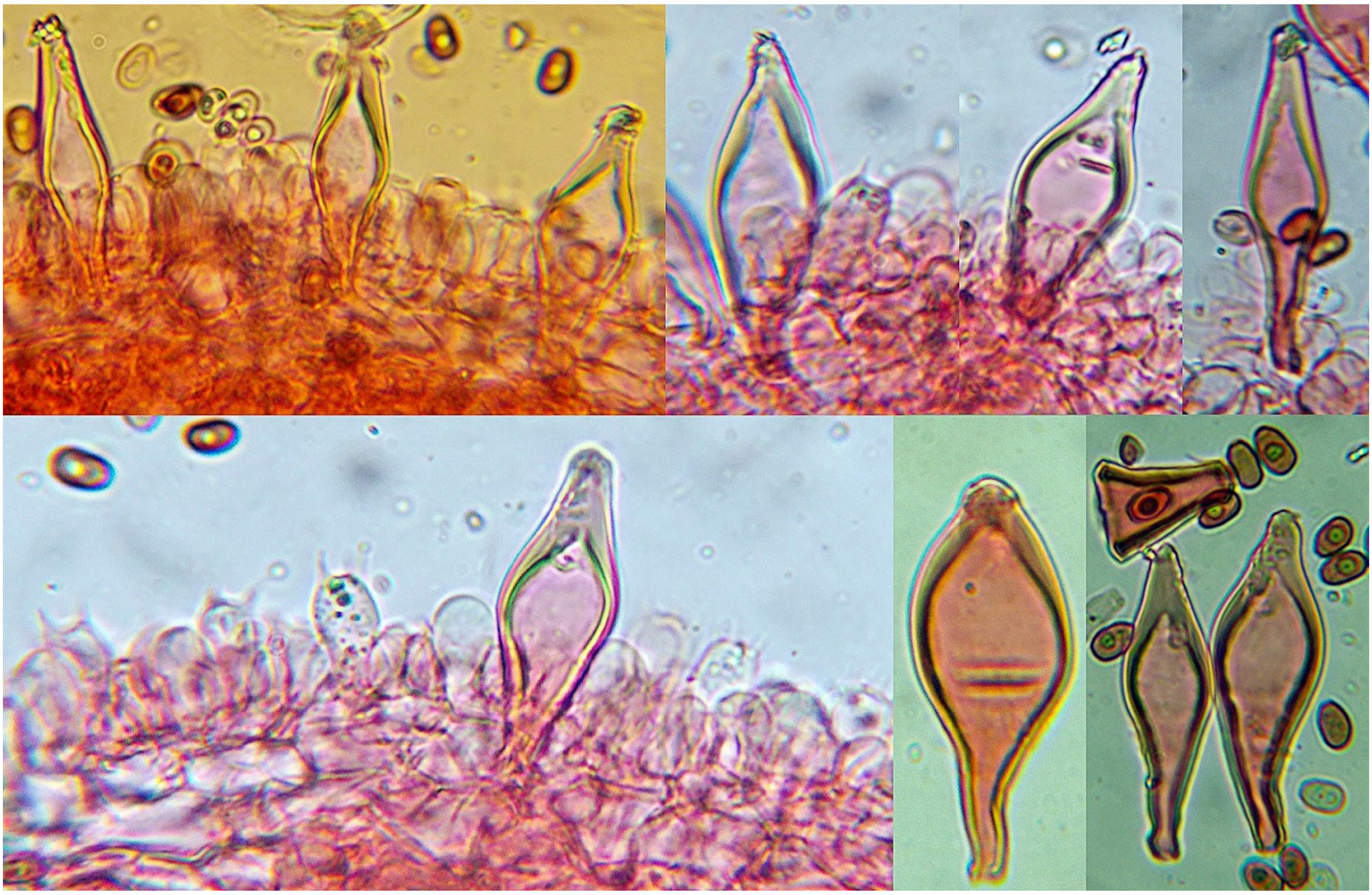

Fig. 4: *P. cloverae*, ANGE581. Pleurocystidia in Congo red [P. Voto]

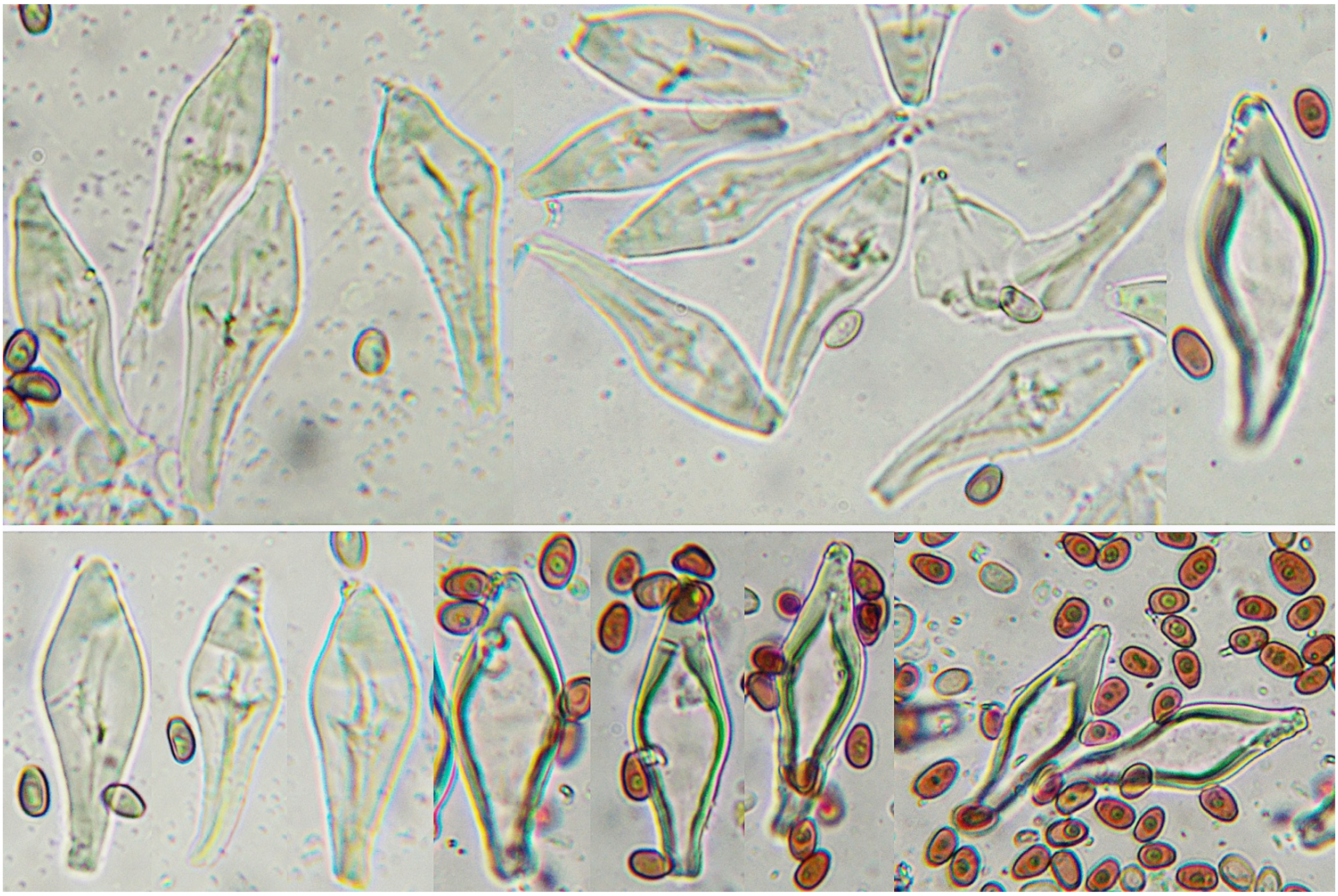

Fig. 5: *P. cloverae*, ANGE581. Pleurocystidia in 5% KOH (top), in ammonia (bottom) [P. Voto]

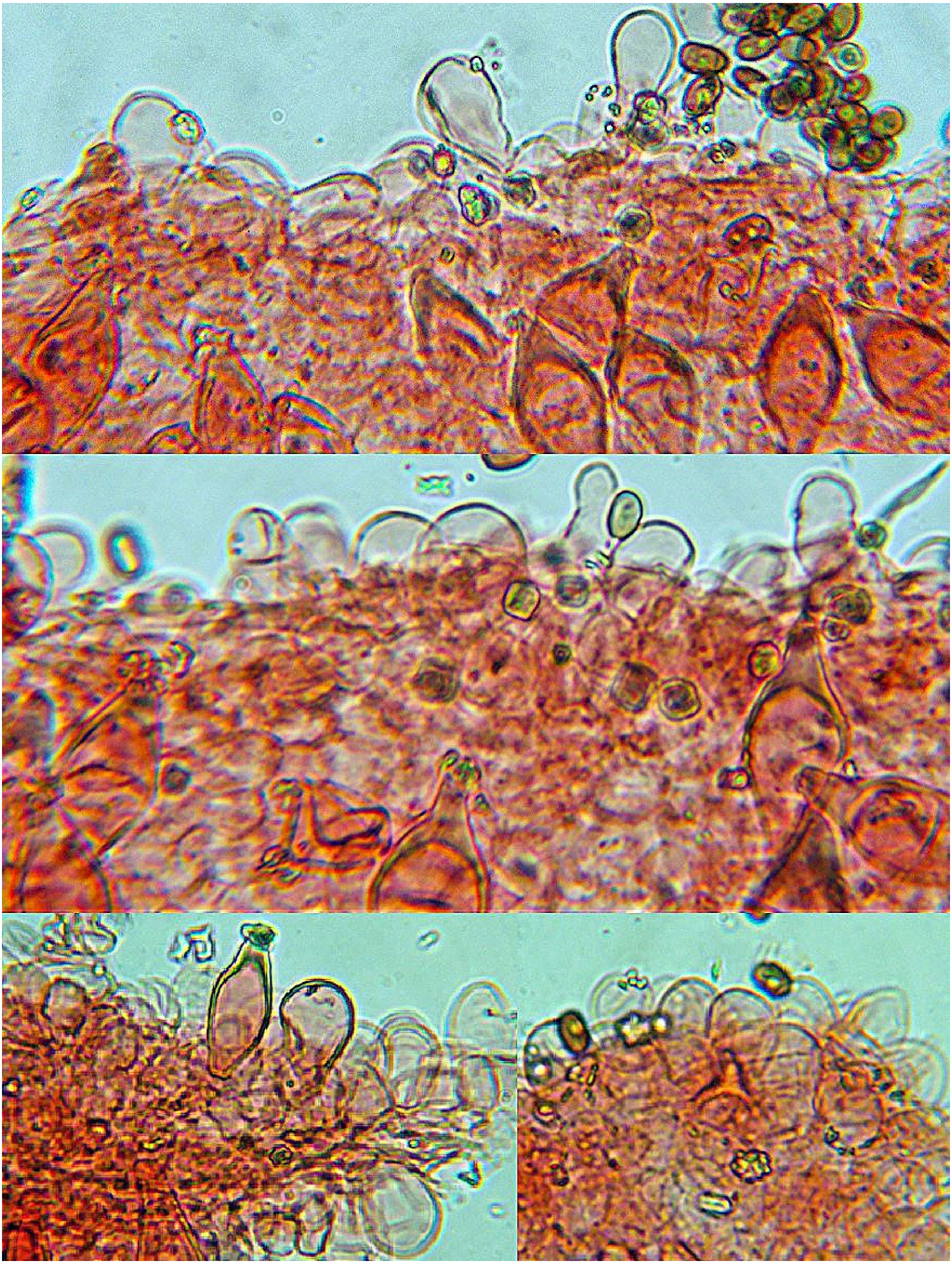

Fig. 6: *P. cloverae*, ANGE581. Gill edge in Congo red [P. Voto]

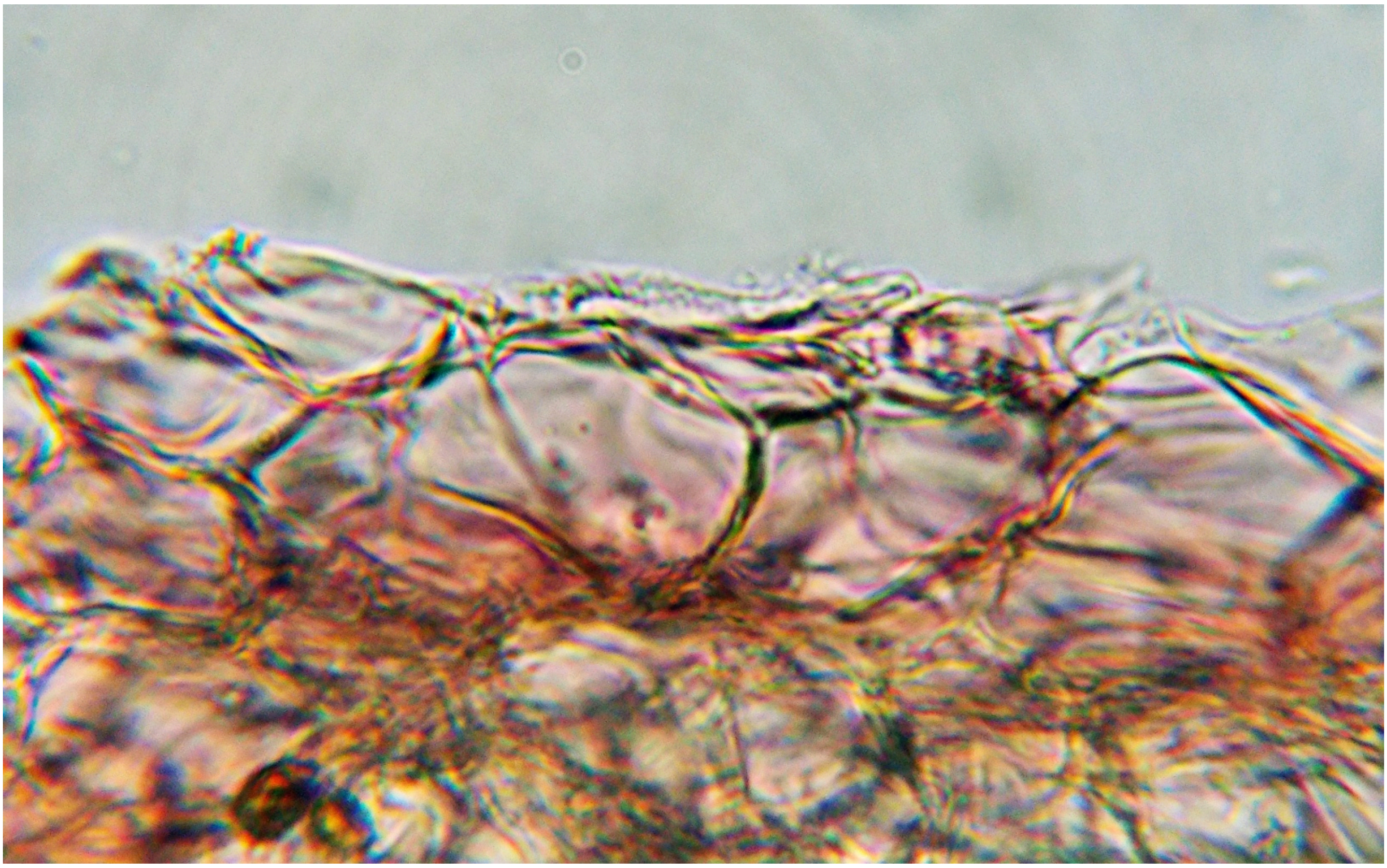

Fig. 7: *P. cloverae*, ANGE581. Pileipellis in Congo red [P. Voto]

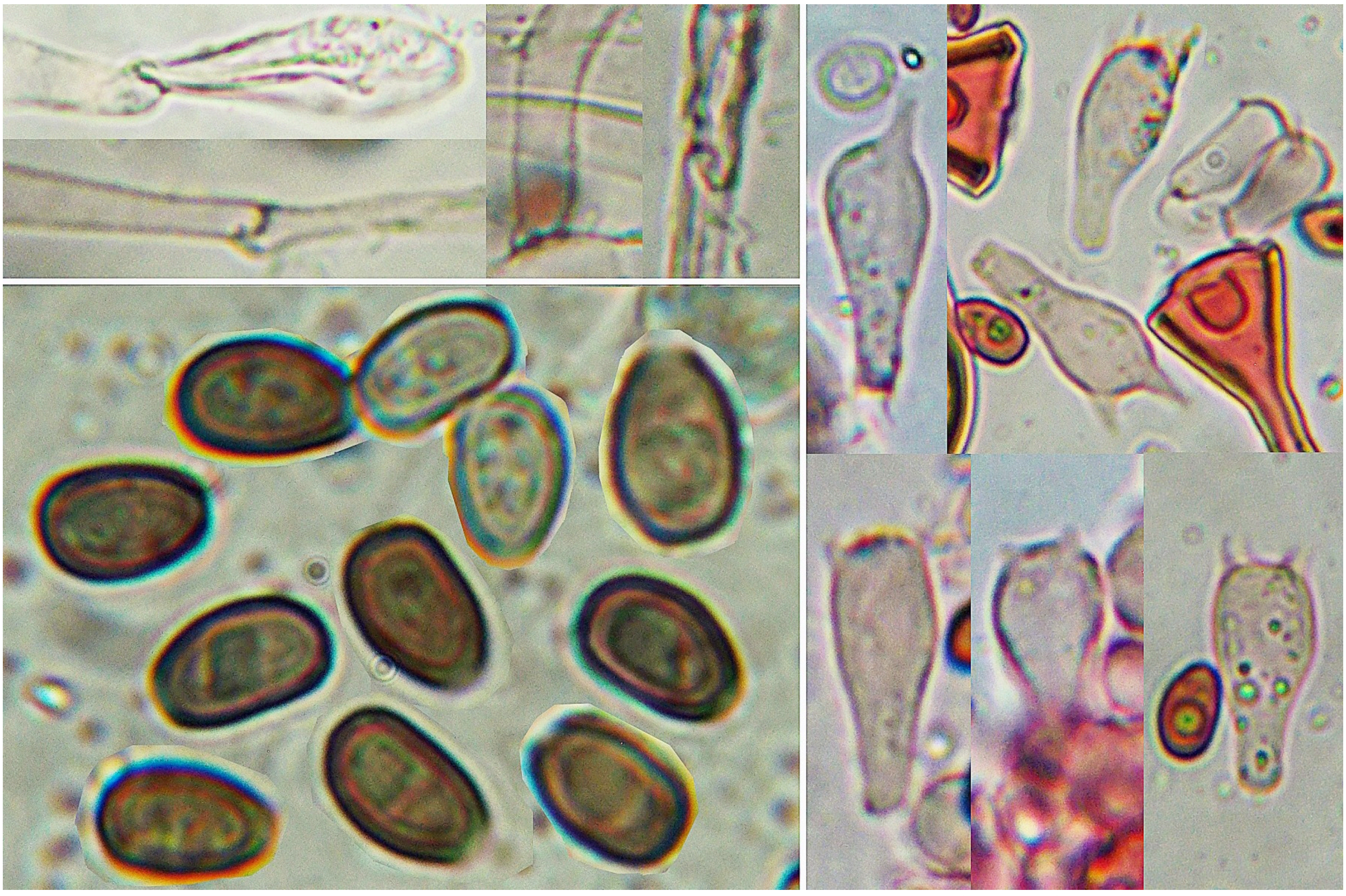

Fig. 8: *P. cloverae*, ANGE581. Clamps in pileipellis in Congo red (top left), spore germ pore in 5% KOH (bottom left), basidia in Congo red (right) [P. Voto]

General description of *Psathyrella cloverae*
(Based on ANGE581 and the original descriptions of all species synonymized)

Macroscopic characters

Pileus 15− 40 (80) mm broad; obtusely conic then through conical-convex to convex, margin sometimes radially lobed when expanded; usually translucently striate up to two thirds of radius; dull cinnamon brown to strong brown, hygrophanous, discoloring from centre through pale brown, dull greyish brown, dull dingy cinnamon brown to honey yellow, yellowish brown, ochraceous-yellow, olivaceous-yellow, finally beige to whitish often with greyish violaceous necropigment from margin; surface lubricous; veil made of a coating of delicate white fibrillose flecks, initially dense, later fugacious.

Lamellae approx. 30− 40 intermixed with 3 − 7 lamellulae, adnate, narrow, possibly intervenose, whitish then dark purplish brown, edge fimbriate, pale.

Stipe (15) 20− 90 (108) × (1.0) 2.0− 6.0 mm, equal or slightly broadening downward (up to 8.0 mm broad), base often abruptly swollen or with a narrow marginate bulb; hollow; at the top flocculose, below at most minutely flocculose-pruinose but glabrescent and silky; white, discoloring pallid above and brownish below.

Context pale brownish, very thin and fragile in pileus, white in stipe; smell indistinctive, taste indistinctive to bitter. Spore print dark (greyish, purplish) brown.

Microscopic characters

Spores (6.5) 7.0 − 9.5 (10.5) × 4.0 − 5.5 (6.0) µm, in face view oblong, elliptic, (broadly) oval, oval-pentagonal, base broadly rounded to truncate, in profile adaxially flattened, subamygdaliform, subphaseoliform to phaseoliform or weakly indented above the base, smooth, in water and in ammonia orange- to reddish- brown, in KOH grey brown (cocoa-colour) or chocolate-brown, in Melzer's reagent tawny to reddish tan; germ pore distinct, 0.8 − 1.5 µm broad, mostly broadly rounded to truncate; apiculus very small.

Basidia 11− 30 × 7− 9 µm, 4-spored, very rarely 2-spored, (narrowly) clavate, hyaline in KOH.

Pleurocystidia metuloid, 33− 90 × 8− 22 (26) µm; narrowly to ventricose fusoid, also ventricose-lageniform, utriform, mucronate-clavate, pedicel short to elongate; walls 0.7 − 1.4 (2.0) µm thick at extreme base and 3.0 − 5.2 µm thick in neck, often completely occluding the space in extreme apex, hyaline to yellowish in ammonia; apex obtuse to acute, sometimes rounded, mostly with (sub) hyaline incrustations in fresh material; cell body (sub) hyaline in KOH, content not distinctive; very abundant.

Cheilocystidia metuloid like the pleurocystidia but smaller, sometimes simply clavate, not abundant; paracystidia thin-walled, 15− 30 × 7− 13 (17) µm, clavate to ellipsoid or sometimes subutriform, hyaline in KOH, numerous.

Caulocystidia similar to pleurocystidia but generally smaller, somewhat more versiform, possibly thin-walled, and with apex obtuse to subacute; scattered to abundant.

Pileipellis a paraderm composed of a layer of vesiculose to sometimes clavate or pedicellate cells 1 − 4 deep with (sub) hyaline, sometimes subgelatinous wall in KOH.

Clamp connections numerous.

Habitat and collection examined: scattered to gregarious or caespitose, saprotroph on the ground or on rotten deciduous wood in or out of forest, March through September; in tropical to temperate climate, in boreal and austral hemisphere. Brazil: Amazonas, Lago Janauari (*P. varzeae*, holotype). Dominican Republic: (ANGE581). Mexico: Chichotla, Mitzalhoc falls (*P. smithii*, holotype). USA: Tennessee, Knox Co., Knoxville (*P. hesleri*, holotype); Texas, Hildalgo Co., Mission (*P. cloverae*, holotype).

NOTES

By this study it emerges that *P. cloverae* is a taxon embracing a series of synonyms described throughout a great portion of the entire American continent, from Northern Brazil to the northern states of the USA, apparently independent of the type of climate and vegetation.

Its distinctive characteristics are its small to medium size; a brown pileus discoloring from the centre into various shades of yellowish and olivaceous shades, conical then convex, deeply striate when fresh; a dense but fugacious veil of fibrillose flocks on the pileus but scarcely present on the stipe; hyaline to yellowish, metuloid and muricate pleurocystidia; leptoparacystidia and leptocheilocystidia present on the gill edge; spores generally 7.0 − 9.5 × 4.0 − 5.5 µm, usually in part oval-pentagonal in front view and in part (sub) phaseoliform in side view, of a medium brown colour and with a large germ pore; a detriticolous habitat.

The three taxa we list among the synonymies represent species which had been separated only by weakly sustainable morphological differences, as commented below.

a) Notes on *Psathyrella hesleri*

In mycoportal.com there are two collections reported with the same date and place of collection (21 July 1948, United States, Tennessee, Knox, Knoxville, Highland Ave., in lawn, 35.96083333 -83.93222222) but with two different names and voucher numbers: *P. cystidiosa*, TENN-F-018562, and *P. hesleri*, TENN-F-017725. P. B. Matheny contributed to resolving this ambiguity by hypothesizing that TENN-F-018562 was considered Peck's true "*P. cistidiosa*" until Smith (1972), examining that collection, described it as a new species, *P. hesleri*, and housed the portion of exsiccata received for study in TENN-F-017725 (holotype) and MICH 11941 (isotype). Then, TENN-F-018562 was never updated with the name change and Smith did not refer to TENN-F-018562 under *P. hesleri* in his monograph.

Smith (1972) only compares *P. hesleri* with *P. subagraria* (G.F. Atk.) A.H. Sm., easily differentiated by thin-walled cystidia, and with *P. spadicea* P. Kumm. [currently *Homophron spadiceum* (P. Kumm) Örstadius & E. Larss.], strongly distinguishable by the absolute absence of veil and pale spores. No comparison is made with the truly closest species, such as *P. cloverae* and *P. cystidiosa*, although he places these species very close to each other in his key.

As no sequences of *P. hesleri* were available in the databases, we tried to sequence the holotype, TENN-F-017725, a non-type collection, MIN 920377, and the isotype, MICH 11941; we succeeded to generate an ITS sequence only from the latter (GB PP476871) and the phylogenetic evidence supports its synonymy with *P. cloverae*.

b) Notes on *Psathyrella smithii*

Guzmán & Johnson (1974) describe this species from a veil-less Mexican collection on the ground among grass, with a striate, fissurated pileus with greyish yellowish brown, darker in the centre, colours, and spores (6.6) 7.2 − 8.4 × (4.2) 4.8 − 6 µm, elliptic-globose in front view, subphaseoliform in side view. They comment that *P. cystidiosa* only differs by the spore size and the absence of incrustations on pleurocystidia (for this assumed absence of incrustations see below, comments on *P. cystidiosa*).

Our revision of the isotype Johnson 1973-051132 (TRTC 154105) follows (Fig. 9-11):

Spores (n = 123) (6.29) 6.65 − 7.74 (8.46) × (3.85) 4.41 − 5.16 (5.56), on average 7.14 × 4.76 µm; Q = (1.24) 136 − 1.64 (1.82), on average 1.51; inconspicuously tridimensional, in front view elliptic, ovoid, subpentagonal, base broadly rounded to truncate or sometimes weakly oblique to indented (like in *P. albescens*), in side view adaxially flattened to subphaseoliform or sometimes phaseoliform to subamygdaliform; in water orangish brown, in ammonia more brownish; germ pore distinct but small, 0.8 − 1.5 µm broad.

Pleurocystidia 35.0 − 72.0 × 10.0 − 34.5 µm; fusiform to claviform, sometimes utriform, apex in fusiform and utriform cells obtuse to sometimes subacute or mucronate, peduncle short to elongate and narrow to stocky; walls up to 2.5 µm thickened towards the apex, greenish to weakly yellowish in ammonia; apical crystals mostly scarce to absent.

Clamp connections numerous.

The spore shape of *Psathyrella smithii*, as described in the protolog and as observed in our revision, is precisely the same as the shape found in the Dominican material (compare figure 40 in Guzmán & Johnson 1974 and our figure 3). Pleurocystidia walls are hyaline to pale coloured as in *P. cloverae*. We find no differences between *P. smithii* and *P. cloverae*.

Unfortunately, we have made multiple unsuccessful attempts to sequence this isotype Johnson 1973-051132 (we housed the remaining material at PAD H0062120 as isoparatype). We could not obtain the holotype at ENCB (Mexico).

Fig. 9: *P. smithii* isotype Johnson 1973-051132 (TRTC 154105). Exsiccata received [P. Voto]

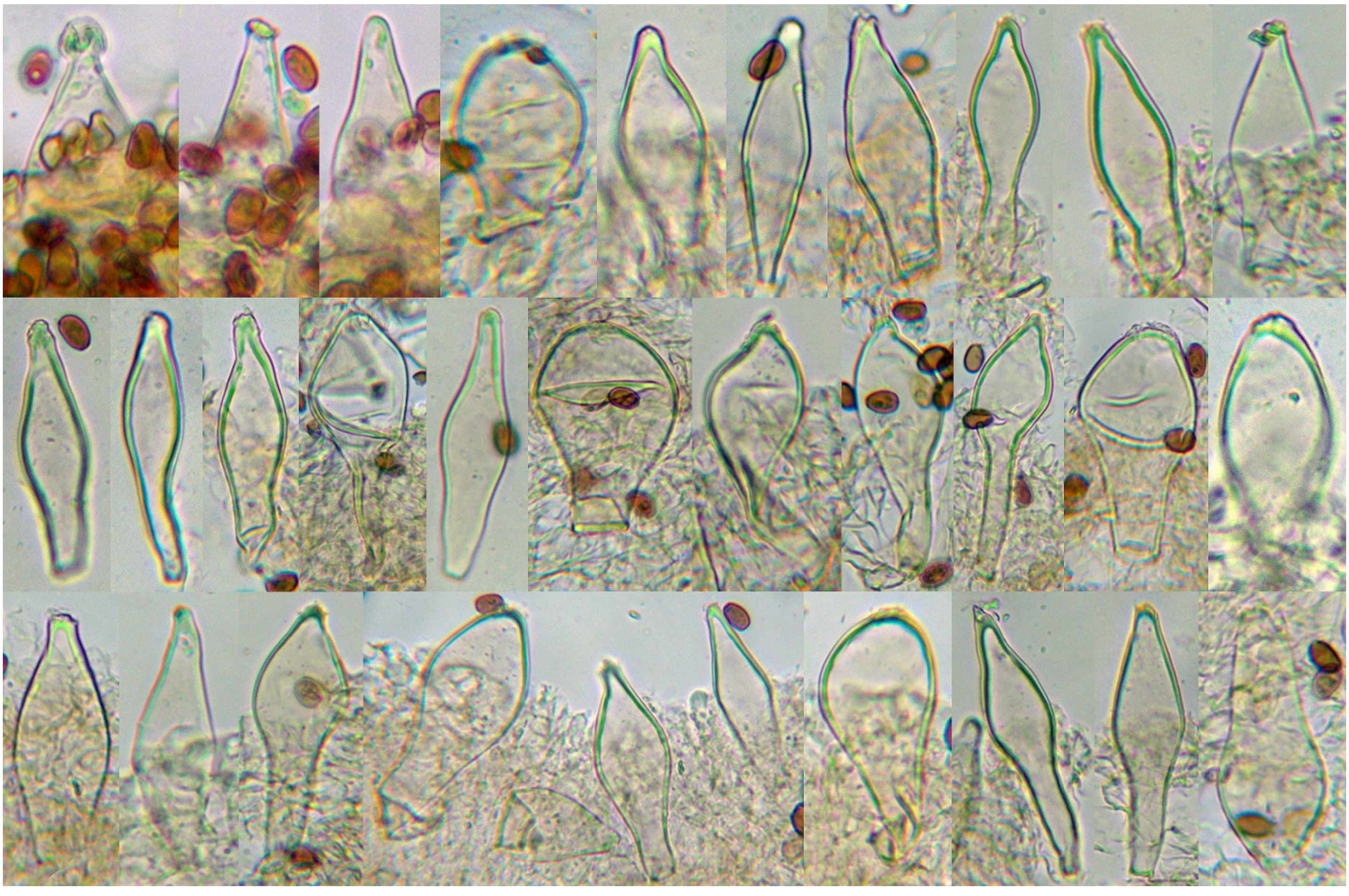

Fig. 10: *P. smithii*, isotype Johnson 1973-051132. Hymenial metuloid cystidia in Congo red [P. Voto]

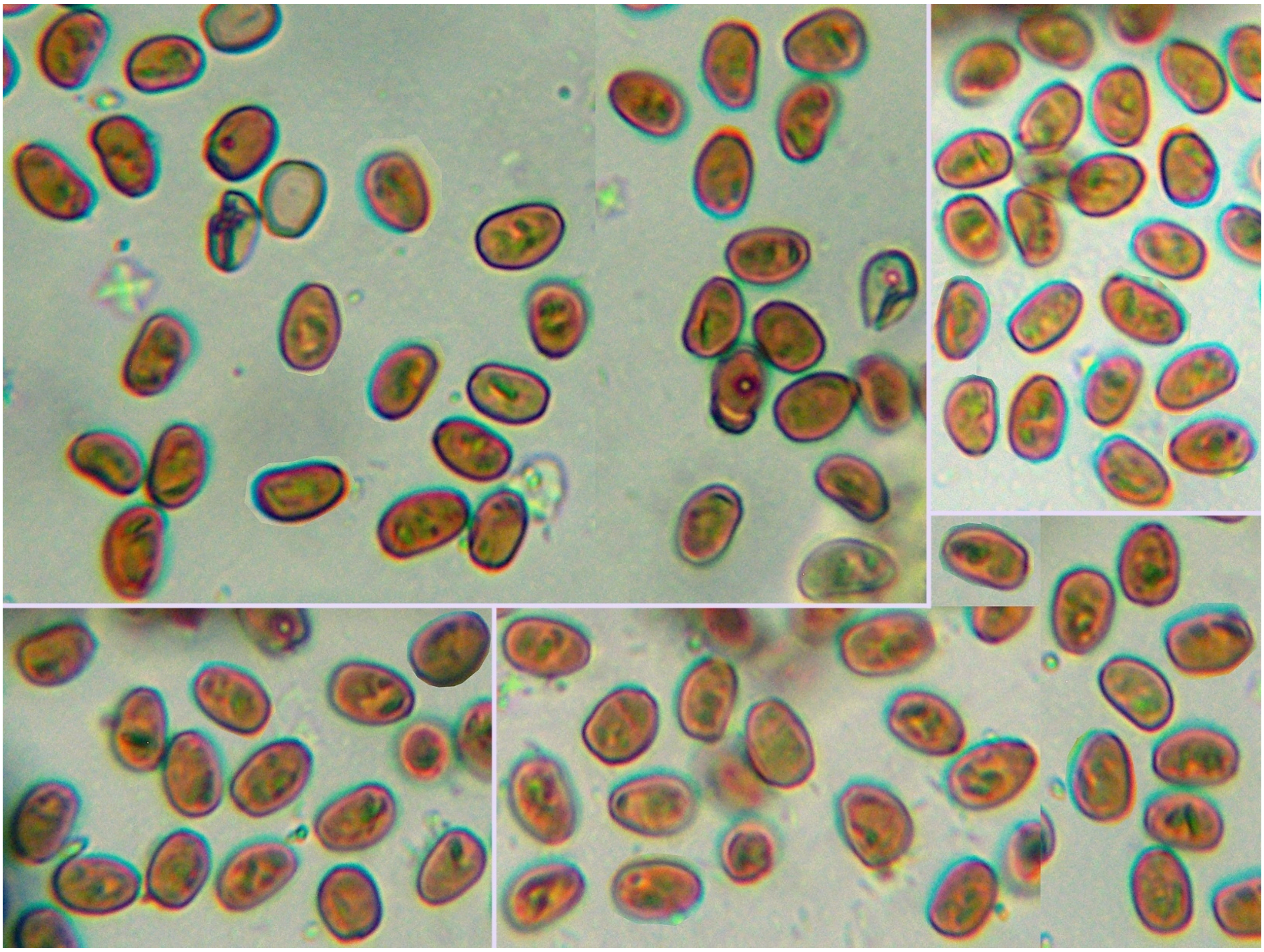

Fig. 11: *P. smithii*, isotype Johnson 1973-051132. Spores in water [P. Voto]

c) Notes on *P. varzeae*

Singer (1989) only compared this species with *P. cystidiosa*, ignoring *P. hesleri*, *P. cloverae* and *P. smithii*. He differentiated it from *P. cystidiosa* by a truncate germ pore, a darker colour of the pileus, somewhat shorter spores and metuloid cystidia, a longer stipe, and the habitat in varzea vegetation of the Amazon forest. All these morphological characters are usually subject to an intraspecific range of variability in *Psathyrella* species. We succeeded generating an ITS sequence (GB PP476872) from the holotype, F 1053727, voucher Singer B 12430, and the phylogenetic evidence supports the synonymy with *P. cloverae*.

P. cystidiosa (Peck) A.H. Sm., *Mem. N. Y. Bot. Gard*. 24: 250. 1972.

Basionym *Psilocybe cystidiosa* Peck, *Bull. N.Y. St. Mus.* 167: 46. 1913 ('1912')

Smith (1972), in his observations, only distinguished *P. cloverae* from *P. cystidiosa* by the copious universal veil and long narrow basidia of the former but he himself specified that the veil of *P. cloverae* is delicate, therefore much liable to be often found already reduced or absent as occurred, for example, in the holotype collection of the synonymous *P. varzeae*.

Also, Smith (1972) did not mention any incrustations on the pleurocystidia of *P. cystidiosa* but they are reported as present in the description by Padamsee (2001).

In addition to the Smith's (1972) description, we gathered some additional descriptive information as follows.

Padamsee (2001) (cumulative description of four collections examined) reports the pileus deep yellowish brown at margin and medium yellowish brown at centre when young, light greyish yellowish brown at margin and light yellowish brown at centre when mature, mostly glabrous with scattered micaceous particles, slightly ridged, possibly rugulose; spores (7.5) 7.9 − 9.5 × (4.1) 4.3 − 5.1 (5.3) µm, on average 8.3 − 8.9 × 4.7 − 4.9 µm, obovate in front view, reniform in side view; pleurocystidia crystalliferous and with yellowish thickened-walls; habitat on ground or on fallen branches.

Kuo's website (see reference) reports a collection from Illinois identified as *P. cystidiosa* and described with the pileus brown and drying out to yellowish buff or brownish, the margin becoming finely lined, no veil seen on about 20 specimens collected, spores 7 − 9.5 × 4 − 5 µm, crystals present in the image of the pleurocystidia.

The Minnesota Department of Natural Resources (see reference) hosts a page with some data on *P. cystidiosa*: pileus up to 30 mm broad, with concentric zones of colour from light yellowish brown at the centre to deep yellowish brown towards the edge; stipe 16-50 × 1-3 mm, white; habitat on soil or on dead wood in shady places of deciduous forests; the species is considered rare and endemic to Minnesota (USA).

McLaughlin (1998, 1999) also offers some comments on Minnesota's collections.

Since no ITS sequences of *P. cystidiosa* were available in the databases, we attempted to sequence five non-type collections (MIN 859496, MIN 871863, MIN 871864, MIN 871865 and MIN 890991) the first four of which from Padamsee (2001) which we consider a reliable reference for this species. We obtained an ITS sequence only from the first (GenBank acc. no. PP469638). The LSU region of MIN 859496 had been previously sequenced (Padamsee *et al*. 2008). Because these two sequences are nested beside the holotype of *P. pivae* Heykoop, G. Moreno & M. Mata, outside the clade of *P. cloverae*, there is sufficient phylogenetic support to consider *P. cystidiosa* different from *P. cloverae*. Morphologically, *P. pivae* differs by larger spores.

From all morphological data that we have gathered on *P. cystidiosa*, it seems that a solid morphological difference between it and *P. cloverae* is difficult to delineate. Following Smith (1972) the scarcity of veil of *P. cystidiosa* from young stage seems to be a sufficiently appreciable difference (the pileus is glabrous in the basionym description by Peck 1913). This is so at least in case of collections with distinctly developed veil which would exclude *P. cystidiosa*.

Furthermore, all the descriptions consulted seem to indicate two other possible differences regarding the pileus.

A distinct striation is usually reported for *P. cloverae* while it is defined as absent to scarce for *P. cystidiosa* (the pileus is sometimes obscurely striate on the margin when dry in the basionym description by Peck 1913).

The pileus colour of *P. cystidiosa* is usually reported as pale brown to deep or medium yellowish brown discoloring to light (greyish) yellowish brown colour (it is defined as pale brown when moist, and yellowish drab with a brownish centre when dry in the basionym description by Peck 1913). In contrast, for *P. cloverae* the colour is saturated brown, cinnamon brown to strong brown or tawny discoloring to greyish brown, pale cinnamon, honey-yellow, often with an olivaceous shade. These two differences are evidently only partial as they are strongly conditioned by the degree of freshness and discoloration of the specimens due to hygrophaneity.

Finally, Smith (1972), citing Peck (1913), reports that the pileus of *P. cystidiosa* sometimes becomes lacerate when expanded; this character was not reported by Padamsee (2001) but was detected in the *P. smithii*'s type collection by Guzmán & Johnson (1974).

Eventually, cases will occur where only the molecular analyses can differentiate the two species with certainty.

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REFERENCES

Altschul SF, Gish W, Miller W, Myers EW, Lipman DJ (1990) Basic local alignment search tool. *Journal of Molecular Biology* 215:403–410 https://doi.org/10.1016/S0022-2836(05)80360-2

Arita M, Karsch-Mizrachi I, Cochrane G (2021) The international nucleotide sequence database collaboration. *Nucleic Acids Research* 49:D121–D124 https://doi.org/10.1093/nar/gkaa967

Crous PW; Wingfield MJ; Lombard L *et al*. (2019) Fungal Planet description sheets: 951–1041. *Persoonia* 43:223–425 https://doi.org/10.3767/persoonia.2019.43.06

Guzmán G; Johnson G (1974). Registro y especies nuevas de los hongos de Palenque, Chiapas. *Boletín de la Sociedad Mexicana de Micología* 8:77−105

Heykoop M; Moreno G; Alvarado P; Esteve-Raventós F (2017) The genus *Psathyrella* (Fr.) Quél. s.l. in Spain. VI. New or rare species and re-evaluation of others*. Bol. Soc. Micol. Madrid* 41:71–98

Kuo M. *Psathyrella cystidiosa* https://www.mushroomexpert.com/psathyrella_cystidiosa.html

McLaughlin DJ (1998) A search for three rare, endemic Minnesota mushroom species. Final report submitted to the Natural Heritage and Nongame Research Program, Minnesota Department of Natural Resources. 5 pp.

McLaughlin DJ (1999) A search for two rare, endemic Minnesota mushroom species. Final report submitted to the Natural Heritage and Nongame Research Program, Minnesota Department of Natural Resources. 3 pp.

Minnesota Department of Natural Resources. *Psathyrella cystidiosa* (Peck) A.H. Smith. https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=NFFUN03030

Örstadius L; Ryberg M; Larsson E (2015). Molecular phylogenetics and taxonomy in Psathyrellaceae (Agaricales) with focus on psathyrelloid species: introduction of three new genera and 18 new species. *Mycological Progress* 14(25):1−42

Padamsee M (2001) A biogeographic and systematic study of certain Minnesotan *Psathyrella* species. Thesis, University of Minnesota, St. Paul, Minnesota. 74 pp.

Padamsee M; Matheny PB; Dentinger BTM; McLaughlin DJ (2008) The mushroom family Psathyrellaceae: Evidence for large-scale polyphyly of the genus *Psathyrella*. *Molecular Phylogenetics and Evolution* 46:415–429

Parra LA; Angelini C; Ortiz-Santana B; Mata G; Billette C; Rojo C; Chen J; Callac P (2018). The genus *Agaricus* in the Caribbean. Nine new taxa mostly based on collections from the Dominican Republic. *Phytotaxa* 345(3):219−271 https://doi.org/10.11646/phytotaxa.345.3.2

Peck CH (1913, '1912'). Report of the State Botanist. 1912. *Bulletin of the New York State Museum* 167:1−137

Redhead SA, Vilgalys R, Moncalvo J-M, Johnson J, Hopple JS Jr (2001). *Coprinus* Persoon and the disposition of *Coprinus* species sensu lato. *Taxon* 50(1):203−241

Ronquist F, Teslenko M, van der Mark P, Ayres DL, Darling A, Höhna S, Larget B, Liu L, Suchard MA, Huelsenbeck JP (2012) MrBayes 3.2: Efficient Bayesian phylogenetic inference and model choice across a large model space. *Systematic Biology* 61(3):539–542 https://doi.org/10.1093/sysbio/sys029

Singer R (1989). New taxa and new combinations of Agaricales (Diagnoses fungorum novorum Agaricalium 4). *Fieldiana Botany* 21:1−133

Smith AH (1972). The North American species of *Psathyrella*. *Memoirs of the New York Botanical Garden* 24:1–633

Stamatakis A (2014) RAxML Version 8: A tool for phylogenetic analysis and post-analysis of large phylogenies. *Bioinformatics* 30(9):1312–1313 https://doi.org/10.1093/bioinformatics/btu033

Tamura K, Peterson D, Peterson N, Stecher G, Nei M, Kumar S (2011) MEGA5: Molecular evolutionary genetics analysis using maximum likelihood, evolutionary distance, and maximum parsimony methods. *Molecular Biology and Evolution* 28(10):2731–2739 https://doi.org/10.1093/molbev/msr121

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New data and update in the *Panaeolus papilionaceus* complex, first record of *P. punjabensis* and new finds of *P. sylvaticus* in the Dominican Republic

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Abstract: *Panaeolus punjabensis*, recently described from Pakistan, is first documented from the Dominican Republic based on morphological description and molecular analyses (ITS sequence and phylogram). An updating on the *Panaeolus papilionaceus* complex is reported based on new molecular evidence on *P. papilionaceus* var. *parvisporus*. New finds of *P. sylvaticus* in the Dominican Republic are documented with photographs and morphological notes.

INTRODUCTION

In the family Galeropsidaceae, the genus *Panaeolus* has a cosmopolitan diffusion and is mainly composed of fimicolous to nitrophilous species (Voto & Angelini 2024). It is widely spread in the Dominican Republic where the habit of raising numerous herbivorous farm animals (such as cows, sheep, goats, horses and donkeys) exclusively on pasture in grassy unwooded spaces creates a particularly favourable habitat.

To the four Dominican species of *Panaeolus* (*P. antillarum*, *P. mexicanus*, *P. pantropicalis* sp. nov., *P. sylvaticus*) documented in previous works (Voto & Angelini 2021; Angelini & Voto 2023; Voto & Angelini 2024) we add now *P. punjabensis*.

In the second part of the work, following very recent new molecular evidence, we propose an update of our previous work regarding nomenclatural issues in the *Panaeolus papilionaceus* complex.

Finally, new photographs of *P. sylvaticus* are published showing more chromatic aspects of its pileus.

MATERIALS AND METHODS

Morphology

The collections of *Panaeolus punjabensis* and *P. sylvaticus* were photographed when fresh *in situ* by C. Angelini using a digital camera Nikon Coolpix 8400 and subsequently dried; macroscopic characters where observed by C. Angelini on fresh material; microscopic characters were studied, described and photographed by P. Voto on dried material revived with 10% NH_4OH or 5% KOH and in some cases using Congo red as mounting medium for imaging. All collections are housed in C. Angelini's personal herbarium and will successively be transferred to the herbarium JBSD (Jardín Botánico Nacional Dr. Rafael M. Moscoso, Santo Domingo, Dominican Republic). The authors of the images in the figures are shown in square brackets.

DNA extraction, PCR and DNA sequencing

Total DNA was extracted from dry specimens employing a modified protocol based on Murray & Thompson (1980). PCR reactions (Mullis & Faloona 1987) included 35 cycles with an annealing temperature of 54 ºC. The primers ITS1F and ITS4 (White *et al.* 1990; Gardes & Bruns 1993) were employed to amplify the ITS rDNA region. PCR products were checked in 1% agarose gels, and amplicons were sequenced with one or both PCR primers. Sequences were corrected to remove reading errors in chromatograms. An alignment of ITS rDNA sequences related to the one obtained from the sample studied was assembled, using the dataset employed before (Voto & Angelini 2024) as well as selected sequences produced by Consiglio & Marchetti (2023).

Sequence alignment and phylogenetic analyses

Sequences first were aligned in MEGA 5.0 (Tamura *et al*. 2011) with its Clustal W application and then realigned manually as needed to establish positional homology. Aligned sequences were loaded in MrBayes 3.2.6 (Ronquist *et al.* 2012) and subjected to Bayesian analysis (one partition, GTR+G+I model, two simultaneous runs, four chains, temperature set to 0.2, sampling every 100th generation) until the average split frequencies between the simultaneous runs fell below 0.01 after 14.55 M generations. Finally, a full search for the best-scoring maximum likelihood tree was performed in RAxML 8.2.12 (Stamatakis 2014) using the standard search algorithm (same partitions, GTRGAMMAI model, 2000 bootstrap replications). The significance threshold was set above 0.95 for posterior probability (PP) and 70% bootstrap proportions (BP).

RESULTS

Phylogenetic analyses

Our phylogram demonstrates that *Panaeolus punjabensis* is a cosmopolitan species that, besides Asia (Pakistan) and Central America (Dominican Republic) is also present in Africa (Egypt and Namibia).

Concerning the *Panaeolus papilionaceus* complex, the results obtained in our previous work (Voto & Angelini 2024) are confirmed with the corrections, thanks to the inclusion of the holotype of *Panaeolus papilionaceus* var. *parvisporus*, that the clade there identified as *P. parvisporus* must be named *P. retirugis* and that this name must be treated as autonomous, not as a synonym of *P. papilionaceus*.

Table 1. Data of specimens used in this study. The column 'Current name' is used for the current name of species which are synonymised (in bold) or vouchers which are misidentified (not in bold). Current names proposed here or in Voto & Angelini (2024) are in red, those proposed by other authors are identified by asterisks (*: Malysheva *et al*. 2019, **: Asif *et al*. 2023). The accession numbers of the newly generated sequences are in bold blue. Bold capital letters after species names represent Holotype (T), Epitype (E), Paratypes (P) and Lectotypes (L)

species name in GenBank	current name	voucher/origin	ITS
Galeropsis bispora **T**	***P. plantaginiformis******	LE 2863/Uzbekistan	MK397580
G. desertorum	***P. desertorum******	NL-1863/Hungary	JX968154
Gastrocybe iberica **T**	***P. desertorum******	AH 9990/Spain	MK397542
G. iberica **P**	***P. desertorum******	AH 9993/Spain	MK397543
G. iberica	***P. desertorum******	AH 10396/Spain	MK397544
G. iberica	***P. desertorum******	AH 42860/Spain	MK397545
G. iberica	***P. desertorum******	AH 10493/Spain	MK397546
Panaeolus acuminatus **E**		Gerhardt 83049 (B)/Germany	PP447476
P. acuminatus		CBS:270.47/?	MH856251
P. acuminatus		AMB 20065/Italy	PP447475
P. acuminatus		inaturalist.org/observations/141352004/USA	OQ372246
P. acuminatus		SGL09/China	OR035540
P. acuminatus		CBS 269.47/?	MH856250
P. acuminatus	*P. olivaceus*	PRM 935914/Czech Republic	MW352021
P. acuminatus	*P. fimicola*	4084/Italy	JF908518
P. alcis		Mushroom Observer #88085/Sweden	KM982723
P. alcis		SAT-14-239-20/USA(Alaska)	MW597122
P. antillarum		SFSU:DED7874/Thailand	MF497585
P. antillarum		PAD H0061942/Dominican Republic	PP590043

species name in GenBank	**current name**	**voucher/origin**	**ITS**
P. antillarum		CORT:013830/Dominican Republic	MF497586
P. antillarum		JL27/China	ON059337
P. antillarum		EGDA-N15/Egypt	ON024905
P. antillarum		BR5020167127933/Togo	OR035499
P. antillarum		WANG 140007/Taiwan	KR998382
P. antillarum		FLAS-F-69480/USA	OQ746434
P. antillarum		DQS36F/Philippines	MZ735416
P. antillarum		HYW22/Thailand	OR035522
P. antillarum		HYW21/Thailand	OR035520
P. antillarum	*P. semiovatus*	748/Italy	JF908515
P. axfordii T		MFLU:19-2367/China	NR_169700
P. bisporus	***P. cyanescens***	KaiR95/Benin	MT110229
P. bisporus	***P. cyanescens***	MushroomObserver.org/188954/USA	MG966283
P. bisporus	***P. cyanescens***	HYW197/China	OR035518
P. bisporus	***P. cyanescens***	T2507/China	OR035542
P. cambodginiens	*P. cyanescens*	NBRC-30222/Japan?	AB158633
P. campanulatus	***P. papilionaceus***	10141/Italy	JF908522
P. campanulatus	***P. papilionaceus***	Mushroom2/China	MT451920
P. campanulatus	*P. cinctulus*	/China	JF961376
P. castaneifolius	*P. foenisecii*	Mushroom Observer 90428/USA	KX010428
P. cinctulus E		Gerhardt 83052/Germany	PP447483
P. cinctulus		iNAT:56796374/USA	OQ147191
P. cinctulus		iNAT:126276059/USA	OP751540
P. cinctulus		S.D. Russell ONT iNaturalist 130442846/USA	OP549138
P. cinctulus		PRM 935916, Mushroom Observer 204889/Italy	MW352022
P. cinctulus		Mushroom Observer # 321948/USA	MH590045
P. cinctulus		OMDL K. Canan iNaturalist # 169757989/USA	OR987159
P. cinctulus		OMDL K. Canan iNaturalist # 170057671/USA	OR987260
P. cinctulus		MCVE 1084/Italy	PP447482
P. cinctulus		iNat86856915/USA	OQ389417
P. cinctulus		BR5020180462561/Netherlands	OR035501
P. cinctulus		HYW186/China	OR035517
P. cyanescens		AF163/China	OQ450458
P. cyanescens		D36/China	KT002152
P. cyanescens		MHHNU 31855/China	OP862802
P. cyanescens		SIV1/India	MK855517
P. cyanescens		FS1/India	MK855516
P. cyanescens		SIV2/India	MK855518
P. cyanescens		LAH37983_Panaeolus_cyanescens_sm38/PAK	OR668690
P. cyanescens		LAH37985_Panaeolus_cyanescens_sm40/PAK	OR668692
P. cyanescens		MES-4248/USA	OR664094
P. cyanescens		BP17M/Philippines	OR062405
P. cyanescens		1S/Croatia?	KU640168
P. cyanescens		18S/?	HM035084

species name in GenBank	current name	voucher/origin	ITS
P. cyanescens		0709305/JG/France	PP447485
P. cyanescens		AMB 20070/Italy	PP447484
P. cyanescens var.	*P. cyanescens*	n. 6576 AQUI/Italy	EU834287
P. desertorum		LE 313090/Russia	MK397566
P. desertorum		LE 313250/Russia	MK397568
P. desertorum		LE 313091/Greece	MK397567
P. desertorum		B. Dima BG-2022-10-19-1/Hungary	PP447487
P. desertorum		GB-0073426/Hungary	PP447486
P. desertorum	*P. plantaginiformis*	LE 2864/Uzbekistan	MH055384
P. desertorum	*P. plantaginiformis*	LE 2865/Uzbekistan	MH055383
P. dunensis		AMB 20210/France	PP447489
P. dunensis		AMB 20211/Italy	PP447490
P. fimicola **E**		Gerhardt 75349 (B)/Germany	PP447491
P. fimicola **E**		Gerhardt 75349 (B)/Germany	PP447492
P. fimicola	*P. semiovatus*	NSK 1017274/Russia	OR242695
P. fimicola	*P. semiovatus*	Mushroom6/China	MT451924
P. fimicola	*P. semiovatus*	20180624002/China	MT347601
P. fimicola	*P. semiovatus*	474/Italy	JF908514
P. fimicola	*P. semiovatus*	HMJAU66147/China	OQ927089
P. foenisecii		T-790/USA	KC176293
P. foenisecii		S.D. Russell MycoMap # 5430/USA	ON561649
P. foenisecii		S.D. Russell ONT iNaturalist # 141290781/USA	OQ297023
P. foenisecii		iNAT:21657597/USA	OM212934
P. foenisecii		S.D. Russell MycoMap # 5431/USA	ON561650
P. foenisecii		OMDL K. Canan iNaturalist # 172543719/USA	OR732083
P. foenisecii		OMDL K. Canan iNaturalist # 169180865/USA	OR825597
P. foenisecii		OMDL K. Canan iNaturalist # 171232504/USA	OR785929
P. foenisecii		S.D. Russell ONT iNaturalist 118906067/USA	OP749347
P. foenisecii		S.D. Russell ONT iNaturalist # 121782791/USA	OP470404
P. foenisecii		OMDL K. Canan iNaturalist # 170924896/USA	OR732074
P. foenisecii		JLF9301 iNaturalist # 81665784/USA	OQ859921
P. foenisecii		S.D. Russell MycoMap # 5536/USA	ON561653
P. foenisecii		S.D. Russell ONT iNaturalist 127360021/USA	OP549249
P. foenisecii		GS6/China	OR035507
P. foenisecii		M8/Hungary	OQ029266
P. foenisecii		AMB 20071/Italy	PP447493
P. foenisecii		AMB 20072/Italy	PP447494
P. foenisecii		OTA:71571/New Zealand	OQ064958
P. foenisecii		6643/Italy	JF908520
P. foenisecii		K(M):250281/United Kingdom	MZ159698
P. foenisecii		BR5020160357160/Belgium	OR035496
P. foenisecii		CBS 142.40/?	MH856067
P. foenisecii		CBS 143.40/?	MH856068

species name in GenBank	**current name**	**voucher/origin**	**ITS**
P. foenisecii	*P. sp.*	CBS 251.37/?	MH855904
P. foenisecii	*P. antillarum*	NSK 1017353/Russia	OR364524
P. foenisecii	*P. antillarum*	UOC-KAUNP-MK62/Sri Lanka	KP764810
P. foenisecii	*P. antillarum*	UOC KAUNP K01/Sri Lanka	KR867660
P. foenisecii	*P. antillarum*	PC14/Philippines	OK446756
P. fraxinophilus	*P. dunensis*	OMDL K. Canan iNaturalist # 170758482/USA	OR987324
P. fraxinophilus	*P. dunensis*	MushroomObserver.org/455364/USA	OL629088
P. desertorum		LE 313090/Russia	MK397566
P. desertorum		LE 313250/Russia	MK397568
P. desertorum		LE 313091/Greece	MK397567
P. desertorum		B. Dima BG-2022-10-19-1/Hungary	PP447487
P. desertorum		GB-0073426/Hungary	PP447486
P. desertorum	*P. plantaginiformis*	LE 2864/Uzbekistan	MH055384
P. desertorum	*P. plantaginiformis*	LE 2865/Uzbekistan	MH055383
P. dunensis		AMB 20210/France	PP447489
P. dunensis		AMB 20211/Italy	PP447490
P. fimicola **E**		Gerhardt 75349 (B)/Germany	PP447491
P. fimicola **E**		Gerhardt 75349 (B)/Germany	PP447492
P. fimicola	*P. semiovatus*	NSK 1017274/Russia	OR242695
P. fimicola	*P. semiovatus*	Mushroom6/China	MT451924
P. fimicola	*P. semiovatus*	20180624002/China	MT347601
P. fimicola	*P. semiovatus*	474/Italy	JF908514
P. fimicola	*P. semiovatus*	HMJAU66147/China	OQ927089
P. foenisecii		T-790/USA	KC176293
P. foenisecii		S.D. Russell MycoMap # 5430/USA	ON561649
P. foenisecii		S.D. Russell ONT iNaturalist # 141290781/USA	OQ297023
P. foenisecii		iNAT:21657597/USA	OM212934
P. foenisecii		S.D. Russell MycoMap # 5431/USA	ON561650
P. foenisecii		OMDL K. Canan iNaturalist # 172543719/USA	OR732083
P. foenisecii		OMDL K. Canan iNaturalist # 169180865/USA	OR825597
P. foenisecii		OMDL K. Canan iNaturalist # 171232504/USA	OR785929
P. foenisecii		S.D. Russell ONT iNaturalist 118906067/USA	OP749347
P. foenisecii		S.D. Russell ONT iNaturalist # 121782791/USA	OP470404
P. foenisecii		OMDL K. Canan iNaturalist # 170924896/USA	OR732074
P. foenisecii		JLF9301 iNaturalist # 81665784/USA	OQ859921
P. foenisecii		S.D. Russell MycoMap # 5536/USA	ON561653
P. foenisecii		S.D. Russell ONT iNaturalist 127360021/USA	OP549249
P. foenisecii		GS6/China	OR035507
P. foenisecii		M8/Hungary	OQ029266
P. foenisecii		AMB 20071/Italy	PP447493
P. foenisecii		AMB 20072/Italy	PP447494
P. foenisecii		OTA:71571/New Zealand	OQ064958
P. foenisecii		6643/Italy	JF908520

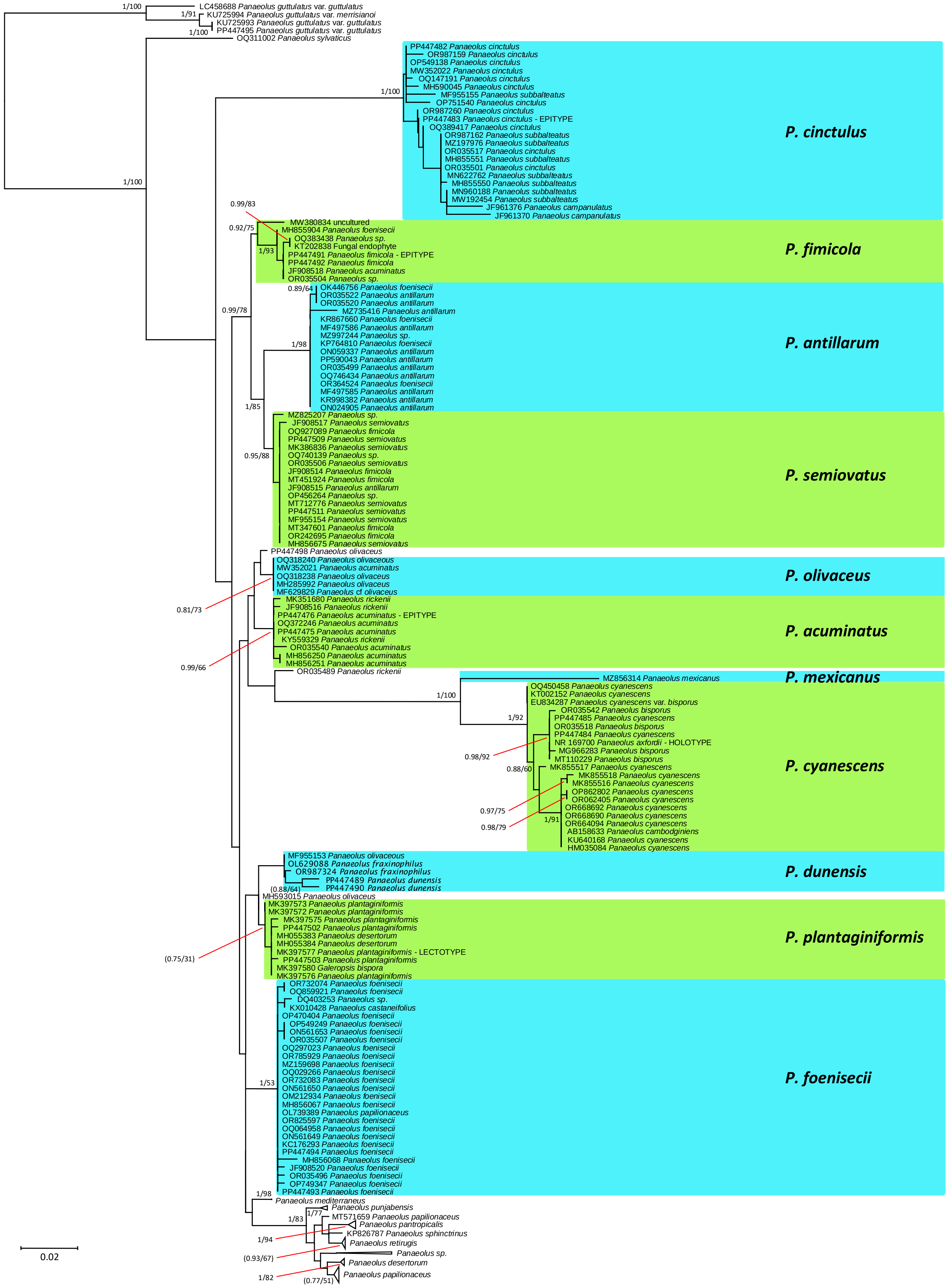
species name in GenBank	current name	voucher/origin	ITS
P. foenisecii		K(M):250281/United Kingdom	MZ159698
P. foenisecii		BR5020160357160/Belgium	OR035496
P. foenisecii		CBS 142.40/?	MH856067
P. foenisecii		CBS 143.40/?	MH856068
P. foenisecii	*P. sp.*	CBS 251.37/?	MH855904
P. foenisecii	*P. antillarum*	NSK 1017353/Russia	OR364524
P. foenisecii	*P. antillarum*	UOC-KAUNP-MK62/Sri Lanka	KP764810
P. foenisecii	*P. antillarum*	UOC KAUNP K01/Sri Lanka	KR867660
P. foenisecii	*P. antillarum*	PC14/Philippines	OK446756
P. fraxinophilus	*P. dunensis*	OMDL K. Canan iNaturalist # 170758482/USA	OR987324
P. fraxinophilus	*P. dunensis*	MushroomObserver.org/455364/USA	OL629088
P. guttulatus		STA5/Iraq	LC458688
P. guttulatus		AMB n. 18101/Italy	KU725993
P. guttulatus		AMB 20073/Italy	PP447495
P. guttulatus var.		AMB 18102/Italy	KU725994
P. mediterraneus T		AMB 20075/Italy	PP447497
P. mediterraneus P		AMB 20074/Italy	PP447496
P. mexicanus		ANGE1557/Dominican Republic	MZ856314
P. cf. *olivaceus*	*P. olivaceus*	MushroomObserver.org/158389/USA	MF629829
P. olivaceus		inaturalist.org/observations/141678308/USA	OQ318240
P. olivaceus		Pan.Olivaceus-ITS1/USA	OQ318238
P. olivaceus		MushroomObserver.org/89608/USA	MH285992
P. olivaceus	*P. dunensis*	UBC F-32268/Canada	MF955153
P. olivaceus	*P. sp.*	AMB 20076/Italy	PP447498
P. olivaceus	*P. sp.*	139/Iran	MH593015
P. pantropicalis T		JBSD 130972/Rep. Dominicana	PP590037
P. pantropicalis P		PAD H0061940/Rep. Dominicana	PP590036
P. pantropicalis P		PAD H0061941/Rep. Dominicana	PP590038
P. pantropicalis P		PERTH 09605894/Australia	PP590039
P. papilionaceus E		Gerhardt 87085 (B)/Germany	PP447500
P. papilionaceus E		Gerhardt 87085 (B)/Germany	PP447499
P. papilionaceus		iNAT:22477730/USA	OM338968
P. papilionaceus		MushroomObserver.org/312080/USA	MH100727
P. papilionaceus		MushroomObserver.org/312173/USA	MH100681
P. papilionaceus		Mushroom Observer 428579/USA	MW633031
P. papilionaceus		S.D. Russell MycoMap # 5533/USA	ON245337
P. papilionaceus		Montri-76/Switzerland?	MK028487
P. papilionaceus		Mushroom Observer # 114447/Mexico	MF628989
P. papilionaceus		STA2/Iran	LC458685
P. papilionaceus		RA400/Iraq	MH632116
P. papilionaceus	*P. detriticola* T	PERTH 08944954/Australia	MT571659
P. papilionaceus	*P. sp.*	MHHNU31392/China	MK439503
P. papilionaceus	*P. sp.*	HNL501769/Lao	UDB033926

species name in GenBank	**current name**	**voucher/origin**	**ITS**
P. papilionaceus	*P. foenisecii*	CIRM BRFM 715/?	OL739389
P. papilionaceus	*P. pantropicalis*	Mushroom Observer # 288725/Mexico	MH169580
P. papilionaceus	*P. pantropicalis*	FLAS-F-69055/USA	OP163246
P. papilionaceus	*P. pantropicalis*	FLAS-F-69481/USA Florida	OQ746433
P. papilionaceus	*P. pantropicalis*	DNA1940/USA Florida	KF830093
P. papilionaceus	*P. pantropicalis*	D15/China	KC414234
P. papilionaceus	*P. pantropicalis*	HFJAU0032/China	MN258670
P. papilionaceus	*P. pantropicalis*	MHHNU 31396/China	OP862800
P. papilionaceus	*P. punjabensis*	Shelly024/Namibia	UDB080025
P. papilionaceus	*P. punjabensis*	EGDA-Pan228/Egypt	MW915589
P. papilionaceus	*P. retirugis*	ECO-TA-HO 7877/Mexico	MF156263
P. papilionaceus	*P. retirugis*	iNAT:69899192/USA	MZ666372
P. papilionaceus	*P. retirugis*	NAMA 2017-161/USA	MH979305
P. cf papilionaceus	*P. retirugis*	MushroomObserver.org/312079/USA	MH101639
P. papilionaceus var. *capitatocystis*	*P. retirugis*	TUF118728/Estonia	UDB019537
P. papilionaceus var. *parvisporus* T	*P. papilionaceus*	Gerhardt 5.7.1988 (B)/Germany	PP447501
P. papilionaceus var. *parvisporus* P	***P. retirugis***	B700108103/Germany	PP590041
P. papilionaceus var. *parvisporus* P	***P. retirugis***	B700108102/Germany	PP590042
P. papilionaceus var. *parvisporus* P	*P. pantropicalis*	B700108104/Brazil	PP590040
P. papilionaceus var. *retirugis*	***P. retirugis***	iNAT:21623086/USA	OM212937
P. plantaginiformis		LE 313092/Russia	MK397573
P. plantaginiformis		LE 2869/Russia	MK397572
P. plantaginiformis L		LE 2862/Russia	MK397577
P. plantaginiformis		LE 2870/Uzbekistan	MK397576
P. plantaginiformis		LE 2867/Uzbekistan	MK397575
P. plantaginiformis		TAAM120547/Uzbekistan	PP447502
P. plantaginiformis		TAAM120647/Uzbekistan	PP447503
P. punjabensis T		LAH 36793/Pakistan	NR189851
P. punjabensis P		LAH37417/Pakistan	OP681142
P. punjabensis P		BWN_45/Pakistan	MZ265143
P. punjabensis		ANGE1898/Dominican Republic	PP998475
P. retirugis		CBS:272.47/France	MH856253
P. retirugis		CBS:273.47/France	MH856254
P. retirugis		CBS:274.47/France	MH856255
P. retirugis		CBS:324.34/?	MH855549
P. retirugis		7070/Italy	JF908521
P. retirugis		AMB 20077/Italy	PP447508
P. retirugis		AMB 20078/Italy	PP447505
P. rickenii	***P. acuminatus***	KA16-1041/Kyrgyzstan	MK351680
P. rickenii	***P. acuminatus***	TENN:054965/Argentina	KY559329
P. rickenii	***P. acuminatus***	749/Italy	JF908516
P. rickenii	*P. papilionaceus*	12446/Italy	JF908523

species name in GenBank	current name	voucher/origin	ITS
P. rickenii	*P. sp.*	4474/China	OR035489
P. semiovatus		AMB 20084/Italy	PP447509
P. semiovatus		AMB 20082/Italy	PP447511
P. semiovatus		4083/Italy	JF908517
P. semiovatus		GL-13/India	MK386836
P. semiovatus		GS2/China	OR035506
P. semiovatus		Mushroom Observer 377584/USA	MT712776
P. semiovatus		UBC F-23942/Canada	MF955154
P. semiovatus		CBS 388.50/France	MH856675
P. semiovatus	*P. retirugis*	CBS:276.39/?	MH856012
P. sp.	*P. fimicola*	BR5020211847626V/Belgium	OR035504
P. sp.	*P. foenisecii*	705-2/China	DQ403253
P. sp.		iNat72986889/USA	OQ383438
P. sp.	*P. semiovatus*	LAH05071008/Pakistan	MZ825207
P. sp.	*P. semiovatus*	JLF9258/USA	OQ740139
P. sp.	*P. semiovatus*	ubco14/Canada	OP456264
P. sp.	*P. antillarum*	biocode08-94/French Polynesia	MZ997244
P. sp.	*P. punjabensis* P**	S1 (LAH36792)/Pakistan	KY636363
P. sp.	*P. papilionaceus*	PDD: 105318/New Zealand	MH380188
P. sphinctrinus	***P. papilionaceus***	CBS:582.79/?	HM035081
P. sphinctrinus	***P. papilionaceus***	CBS:582.79/France	MH873000
P. sphinctrinus	***P. papilionaceus***	TFB8627/Argentina	KY559331
P. sphinctrinus	***P. papilionaceus***	AFTOL-ID 1499/USA	DQ182503
P. sphinctrinus	***P. papilionaceus***	HMAS 290139/China	MK966651
P. sphinctrinus	*P. retirugis*	232/Italy	JF908513
P. sphinctrinus	*P. sp.*	UOC SIGWI S47/Sri Lanka	KP826787
P. aff. *sphinctrinus*	*P. sp.*	NY04449017/Colombia	PP590035
P. subbalteatus	***P. cinctulus***	UBC F-23948/Canada	MF955155
P. subbalteatus	***P. cinctulus***	OMDL K. Canan iNaturalist # 148029993/USA	OR987162
P. subbalteatus	***P. cinctulus***	iNAT:16440988/USA	MZ197976
P. subbalteatus	***P. cinctulus***	CBS 326.34/USA	MH855550
P. subbalteatus	***P. cinctulus***	CBS 327.34/USA	MH855551
P. subbalteatus	***P. cinctulus***	HFJAU-ND146/China	MN622762
P. subbalteatus	***P. cinctulus***	4/China	MW192454
P. subbalteatus	***P. cinctulus***	NX180911-04/China	MN960188
P. subbalteatus	***P. cinctulus***	/China	JF961370
P. sylvaticus		ANGE1393/Dominican Republic	OQ311002
undetermined	*P. sp.*	54A2/Colombia	MW380834
undetermined (fungal endophyte)	*P. sp.*	C111L/USA	KT202838

Figure 1 (next page). Best scoring ITS rDNA phylogram of genus *Panaeolus* (with *P. guttulatus* as outgroup) obtained using RAxML. Nodes were annotated if they were supported by ≥ 0.95 Bayesian posterior probability (left) or ≥ 70% maximum likelihood bootstrap proportions (right). Nonsignificant support values are exceptionally represented inside parentheses. Sequences newly generated in this study are in bold.


1/100
LC458688 Panaeolus guttulatus var. guttulatus
1/91
KU725994 Panaeolus guttulatus var. merrisianoi
KU725993 Panaeolus guttulatus var. guttulatus
1/100
PP447495 Panaeolus guttulatus var. guttulatus
OQ311002 Panaeolus sylvaticus
1/100
1/100
Panaeolus cinctulus
0.92/75
Panaeolus fimicola
1/98
Panaeolus antillarum
1/59
Panaeolus semiovatus
0.95/88
0.81/78
Panaeolus olivaceus
Panaeolus acuminatus
0.99/66
OR035489 Panaeolus rickenii
1/100
Panaeolus cyanescens
0.73/51
Panaeolus plantaginiformis
1/98
Panaeolus foenisecii
1/98
PP447497 Panaeolus mediterraneus
PP447496 Panaeolus mediterraneus
P. mediterraneus
MW915589 Panaeolus papilionaceus
1/77
MZ265143 Panaeolus punjabensis
OP681142 Panaeolus punjabensis
NR 189851 Panaeolus punjabensis - HOLOTYPE
0.95/60
KY636363 Panaeolus sp.
0.81/75
PP998475 Panaeolus punjabensis
UDB0800254 Panaeolus papilionaceus
P. punjabensis
MT571659 Panaeolus papilionaceus
P. detriticola
0.89/68
MN258670 Panaeolus papilionaceus
OP862800 Panaeolus papilionaceus
MH169580 Panaeolus papilionaceus
KC414234 Panaeolus papilionaceus
OP163246 Panaeolus papilionaceus
1/94
KF830093 Panaeolus papilionaceus
PP590037 Panaeolus pantropicalis
PP590036 Panaeolus pantropicalis - HOLOTYPE
1/83
PP590038 Panaeolus pantropicalis
P590039 Panaeolus pantropicalis
Q746433 Panaeolus papilionaceus
PP590040 Panaeolus papilionaceus var. parvisporus
P. pantropicalis
0.95/84
KP826787 Panaeolus sphinctrinus
PP447508 Panaeolus retirugis
0.91/46
PP590042 Panaeolus papilionaceus var. parvisporus
MH856253 Panaeolus retirugis
MH101639 Panaeolus cf. papilionaceus
MH856254 Panaeolus retirugis
PP447505 Panaeolus retirugis
PP590041 Panaeolus papilionaceus var. parvisporus
MH856012 Panaeolus semiovatus
JF908521 Panaeolus retirugis
0.93/67
OM212937 Panaeolus papilionaceus var. retirugis
MH856255 Panaeolus retirugis
MH979305 Panaeolus papilionaceus
MH855549 Panaeolus retirugis
JF908513 Panaeolus sphinctrinus
MF156263 Panaeolus papilionaceus
UDB019537 Panaeolus papilionaceus
MZ666372 Panaeolus papilionaceus
P. retirugis
0.96/58
PP590035 Panaeolus aff. sphinctrinus
MK439503 Panaeolus papilionaceus
0.93/98
UDB033926 Panaeolus papilionaceus
P. sp.
0.95/80
MK397544 Gastrocybe iberica
MK397542 Gastrocybe iberica - HOLOTYPE
MK397543 Gastrocybe iberica
MK397566 Panaeolus desertorum
PP447487 Panaeolus desertorum
1/82
MK397567 Panaeolus desertorum
JX968154 Galeropsis desertorum
MK397545 Gastrocybe iberica
MK397568 Panaeolus desertorum
PP447486 Panaeolus desertorum
MK397546 Gastrocybe iberica
P. desertorum
= Gastrocybe iberica
MH632116 Panaeolus papilionaceus
MK966651 Panaeolus sphinctrinus
MF628989 Panaeolus papilionaceus
(0.91/40)
ON245337 Panaeolus papilionaceus
HM035081 Panaeolus sphinctrinus
JF908523 Panaeolus rickeni
MH380188 Panaeolus sp.
PP447500 Panaeolus papilionaceus - EPITYPE
MK028487 Panaeolus papilionaceus
JF908523 Panaeolus rickenii
PP447499 Panaeolus papilionaceus
DQ182503 Panaeolus sphinctrinus
(0.77/51)
PP447501 Panaeolus papilionaceus var. parvisporus - HOLOTYPE
MH100727 Panaeolus papilionaceus
MH100681 Panaeolus papilionaceus
MW633031 Panaeolus papilionaceus
JF908522 Panaeolus campanulatus
KY559331 Panaeolus sphinctrinus
LC458685 Panaeolus papilionaceus
MT451920 Panaeolus campanulatus
MH873000 Panaeolus sphinctrinus
OM338968 Panaeolus papilionaceus
MW597122 Panaeolus alcis
KM982723 Panaeolus alcis
P. papilionaceus
= P. campanulatus
= P. papilionaceus var. parvisporus
= P. sphinctrinus
0.02


1/100
LC458688 Panaeolus guttulatus var. guttulatus
1/91
KU725994 Panaeolus guttulatus var. merrisianoi
KU725993 Panaeolus guttulatus var. guttulatus
1/100
PP447495 Panaeolus guttulatus var. guttulatus
OQ311002 Panaeolus sylvaticus
PP447482 Panaeolus cinctulus
OR987159 Panaeolus cinctulus
OP549138 Panaeolus cinctulus
MW352022 Panaeolus cinctulus
OQ147191 Panaeolus cinctulus
1/100
MH590045 Panaeolus cinctulus
MF955155 Panaeolus subbalteatus
OP751540 Panaeolus cinctulus
OR987260 Panaeolus cinctulus
PP447483 Panaeolus cinctulus - EPITYPE
OQ389417 Panaeolus cinctulus
OR987162 Panaeolus subbalteatus
MZ197976 Panaeolus subbalteatus
OR035517 Panaeolus cinctulus
MH855551 Panaeolus subbalteatus
OR035501 Panaeolus cinctulus
MN622762 Panaeolus subbalteatus
MH855550 Panaeolus subbalteatus
MN960188 Panaeolus subbalteatus
MW192454 Panaeolus subbalteatus
JF961376 Panaeolus campanulatus
JF961370 Panaeolus campanulatus
P. cinctulus
1/100
0.99/83
MW380834 uncultured
0.92/75
MH855904 Panaeolus foenisecii
OQ383438 Panaeolus sp.
1/93
KT202838 Fungal endophyte
PP447491 Panaeolus fimicola - EPITYPE
PP447492 Panaeolus fimicola
JF908518 Panaeolus acuminatus
OR035504 Panaeolus sp.
P. fimicola
0.89/64
OK446756 Panaeolus foenisecii
OR035522 Panaeolus antillarum
OR035520 Panaeolus antillarum
0.99/78
MZ735416 Panaeolus antillarum
KR867660 Panaeolus foenisecii
MF497586 Panaeolus antillarum
MZ997244 Panaeolus sp.
1/98
KP764810 Panaeolus foenisecii
ON059337 Panaeolus antillarum
PP590043 Panaeolus antillarum
OR035499 Panaeolus antillarum
OQ746434 Panaeolus antillarum
OR364524 Panaeolus foenisecii
MF497585 Panaeolus antillarum
KR998382 Panaeolus antillarum
1/85
ON024905 Panaeolus antillarum
P. antillarum
MZ825207 Panaeolus sp.
JF908517 Panaeolus semiovatus
OQ927089 Panaeolus fimicola
PP447509 Panaeolus semiovatus
MK386836 Panaeolus semiovatus
0.95/88
OQ740139 Panaeolus sp.
OR035506 Panaeolus semiovatus
JF908514 Panaeolus fimicola
MT451924 Panaeolus fimicola
JF908515 Panaeolus antillarum
OP456264 Panaeolus sp.
MT712776 Panaeolus semiovatus
PP447511 Panaeolus semiovatus
MF955154 Panaeolus semiovatus
MT347601 Panaeolus fimicola
OR242695 Panaeolus fimicola
MH856675 Panaeolus semiovatus
P. semiovatus
PP447498 Panaeolus olivaceus
OQ318240 Panaeolus olivaceus
MW352021 Panaeolus acuminatus
OQ318238 Panaeolus olivaceus
MH285992 Panaeolus olivaceus
MF629829 Panaeolus cf olivaceus
P. olivaceus
0.81/73
MK351680 Panaeolus rickenii
JF908516 Panaeolus rickenii
PP447476 Panaeolus acuminatus - EPITYPE
OQ372246 Panaeolus acuminatus
PP447475 Panaeolus acuminatus
KY559329 Panaeolus rickenii
OR035540 Panaeolus acuminatus
MH856250 Panaeolus acuminatus
MH856251 Panaeolus acuminatus
P. acuminatus
0.99/66
OR035489 Panaeolus rickenii
MZ856314 Panaeolus mexicanus
P. mexicanus
1/100
OQ450458 Panaeolus cyanescens
KT002152 Panaeolus cyanescens
EU834287 Panaeolus cyanescens var. bisporus
1/92
OR035542 Panaeolus bisporus
PP447485 Panaeolus cyanescens
OR035518 Panaeolus bisporus
PP447484 Panaeolus cyanescens
NR 169700 Panaeolus axfordii - HOLOTYPE
0.98/92
MG966283 Panaeolus bisporus
MT110229 Panaeolus bisporus
0.88/60
MK855517 Panaeolus cyanescens
MK855518 Panaeolus cyanescens
MK855516 Panaeolus cyanescens
OP862802 Panaeolus cyanescens
0.97/75
OR062405 Panaeolus cyanescens
OR668692 Panaeolus cyanescens
0.98/79
OR668690 Panaeolus cyanescens
1/91
OR664094 Panaeolus cyanescens
AB158633 Panaeolus cambodginiens
KU640168 Panaeolus cyanescens
HM035084 Panaeolus cyanescens
P. cyanescens
MF955153 Panaeolus olivaceus
OL629088 Panaeolus fraxinophilus
OR987324 Panaeolus fraxinophilus
PP447489 Panaeolus dunensis
(0.88/64)
PP447490 Panaeolus dunensis
P. dunensis
MH593015 Panaeolus olivaceus
MK397573 Panaeolus plantaginiformis
MK397572 Panaeolus plantaginiformis
MK397575 Panaeolus plantaginiformis
PP447502 Panaeolus plantaginiformis
MH055383 Panaeolus desertorum
MH055384 Panaeolus desertorum
(0.75/31)
MK397577 Panaeolus plantaginiformis - LECTOTYPE
PP447503 Panaeolus plantaginiformis
MK397580 Galeropsis bispora
MK397576 Panaeolus plantaginiformis
P. plantaginiformis
OR732074 Panaeolus foenisecii
OQ859921 Panaeolus foenisecii
DQ403253 Panaeolus sp.
KX010428 Panaeolus castaneifolius
OP470404 Panaeolus foenisecii
OP549249 Panaeolus foenisecii
ON561653 Panaeolus foenisecii
OR035507 Panaeolus foenisecii
OQ297023 Panaeolus foenisecii
OR785929 Panaeolus foenisecii
MZ159698 Panaeolus foenisecii
OQ029266 Panaeolus foenisecii
1/53
OR732083 Panaeolus foenisecii
ON561650 Panaeolus foenisecii
OM212934 Panaeolus foenisecii
MH856067 Panaeolus foenisecii
OL739389 Panaeolus papilionaceus
OR825597 Panaeolus foenisecii
OQ064958 Panaeolus foenisecii
ON561649 Panaeolus foenisecii
KC176293 Panaeolus foenisecii
PP447494 Panaeolus foenisecii
MH856068 Panaeolus foenisecii
JF908520 Panaeolus foenisecii
OR035496 Panaeolus foenisecii
OP749347 Panaeolus foenisecii
PP447493 Panaeolus foenisecii
P. foenisecii
1/98
Panaeolus mediterraneus
Panaeolus punjabensis
1/77
MT571659 Panaeolus papilionaceus
1/83
Panaeolus pantropicalis
1/94
KP826787 Panaeolus sphinctrinus
Panaeolus retirugis
(0.93/67)
Panaeolus sp.
Panaeolus desertorum
1/82
Panaeolus papilionaceus
(0.77/51)
0.02

TAXONOMY

Panaeolus punjabensis M. Asif, Q. Firdous, A. Izhar, Niazi & Khalid (Fig. 2-7)

European Journal of Taxonomy 888: 85 (2023)

=? *Panaeolus alcis* (as '*alcidis*') sensu Kaur, Atri & Kaur (2014)

Macroscopic characters

Pileus (primordia and young specimens not observed): 12 – 18 mm broad, paraboloid-convex; off-white to pale grey, at centre with a pale ochraceous-pinkish shade; cuticle dry, cracking and eroded with age, margin not striate; veil absent.

Lamellae adnate, spaced, approx 18 – 20, intermixed with 1-3 lamellulae, adnate, ventricose; at first olivaceous, then violaceous-bluish grey with blackish spots ("salt and pepper" appearance); edge pale.

Stipe 110 – 130 × 3 – 4.5 mm, base swollen up to 6.6 mm, cylindric, flexuous, straight to twisted; surface pale brownish with an olivaceous shade at apex, medium to darkish brown to reddish-violaceous brown elsewhere, distinctly covered in white pruina at apex and white fibrils elsewhere, base covered with white mycelial felt and floccules; bruising blue towards base; annulus absent.

Context not examined.

Fig. 2: *P. punjabensis*. ANGE188 [C. Angelini]

Fig. 3: *P. punjabensis*. ANGE188 [C. Angelini]

Fig. 4: *P. punjabensis*. ANGE188 [C. Angelini]

Fig. 5: *P. punjabensis*. ANGE1898. Stipe base with bluish tints [C. Angelini]

MIcroscopic characters

Basidiospores (n=20) (14.0) 15.0 – 17.6 (19.2) × 9.0 – 10.2 (12.0) × 7.7 – 9.5 µm, Q 1.50 – 1.73 × 1.65 – 1.94; in front view broadly elliptic to broadly fusiform or subhexagonal, base obtuse to conical-obtuse, in side view elliptic-oblong; apex not or little protruding; dark brown to blackish brown in 5% KOH, distinctly thick-walled; germ pore distinct, 2.0 – 2.5 µm broad.

Basidia 24.0 – 34.0 × 10.0 – 13.7 µm, stoutly cylindric to stoutly subululiform, rarely clavate, 4-spored; hyaline.

Cheilocystidia 35.0 – 50.0 µm long, base 5.0 – 11.5 µm broad, apex (3.0) 5.0 – 11.0 µm broad, lageniform, lageniform-clavate, clavate- to capitate-pedicellate, rarely cylindric or tapering at apex, usually when swollen at apex then little ventricose at base; mostly hyaline and smooth, thin-walled, abundant. *Pleurocystidia* absent.

Pileipellis cellular composed of up to 30 µm broad elements.

Pileocystidia approx. 35 – 45 × 7 – 13 µm, lageniform, scattered.

Clamp connections found in pileus trama and at base of cheilocystidia.

Collection examined and habitat: Dominican Republic, P.to Plata, Cabarete, on grassy, heavily horse grazed ground of back dunes among shrubs of *Coccoloba uvifera*, 12 November 2023, *legit C. Angelini* (pers. herb. ANGE1898), GenBank: PP998475 - ITS.

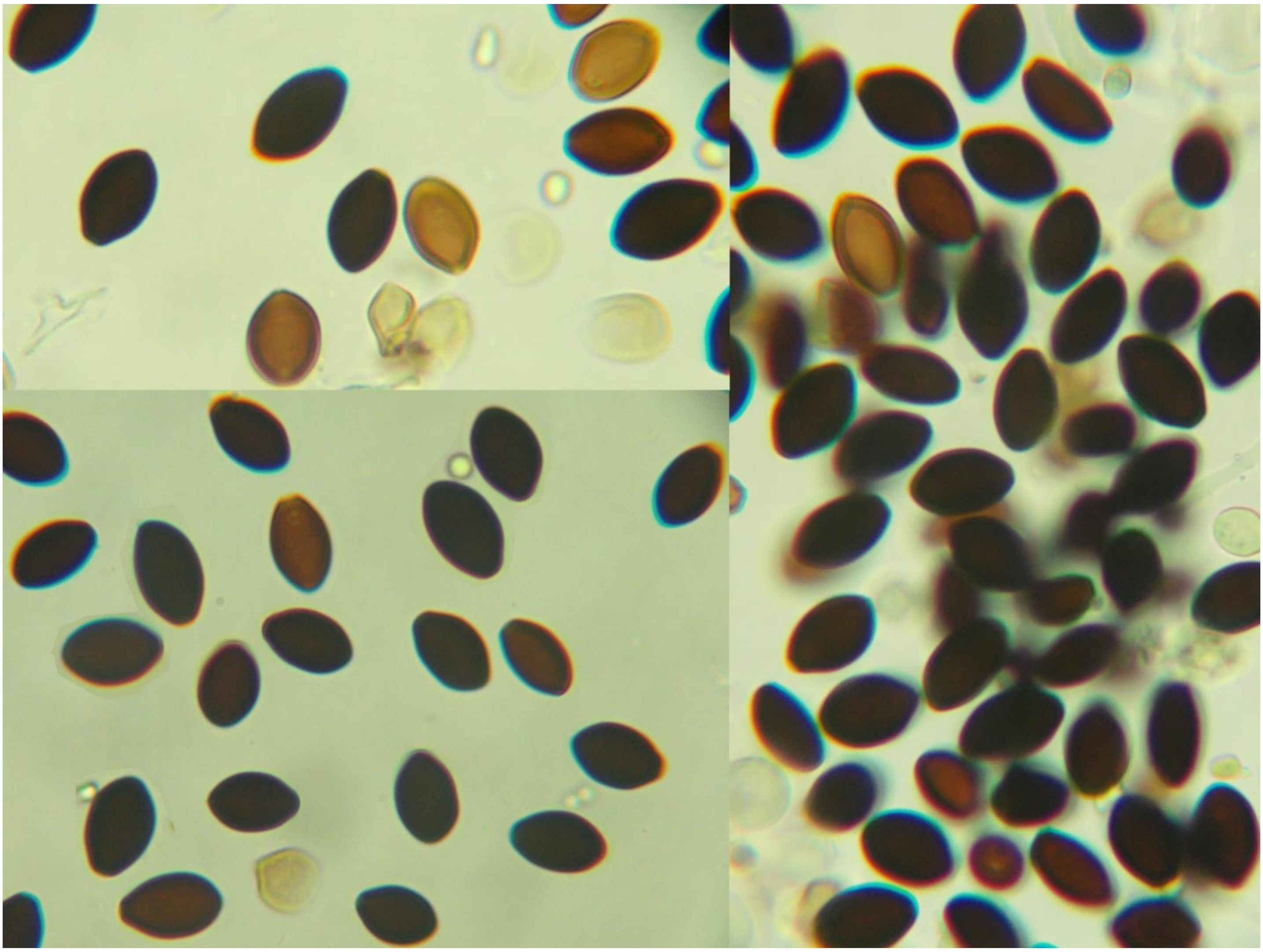


Fig 6: *P. punjabensis*. ANGE1898. Spores in 5% KOH [P. Voto]

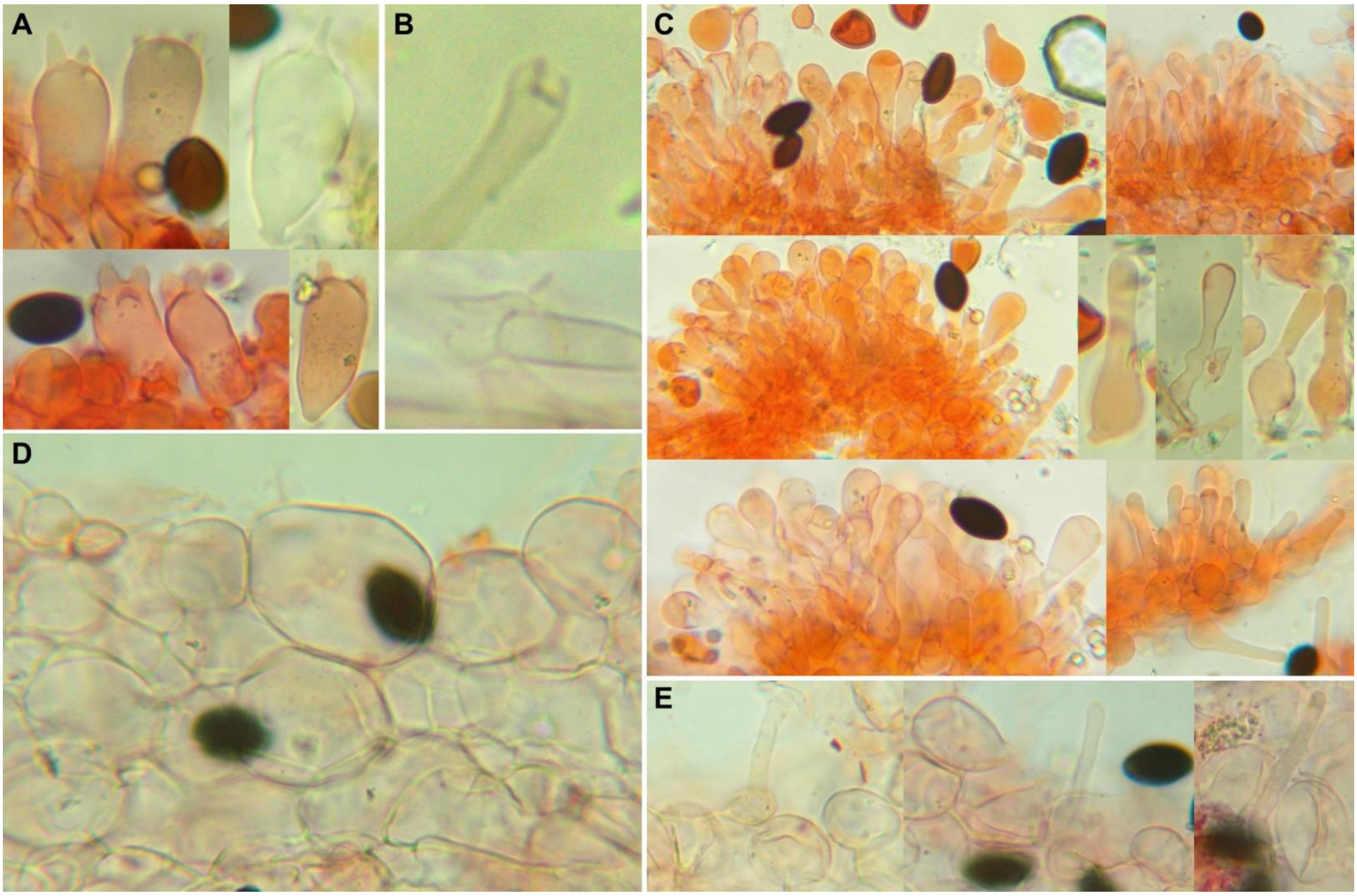


Fig 7: *P. punjabensis*. ANGE1898. A) Basidia, B) Clamps, C) Cheilocystidia, D) Pileipellis, E) Pileocystidia. All images in Congo red [P. Voto]

Notes

Our description offers new relevant data integrating those reported in the protolog (Asif *et al*. 2023).

In particular we have noticed in our collection a not striate margin of pileus, a partial lentiform shape of the spores, narrower and 4-spored basidia, lageniform and scattered pileocystidia, presence of clamps.

Panaeolus punjabensis is characterized by absence of pleurocystidia (subgenus *Panaeolus*), agaricoid habit, absence of veil, whitish to pale grey pileus with ochraceous shades only at centre, and tending to crack and peel off, bluish tints on handling or bruising (we have not performed chemical tests attesting the presence of hallucinogenic substances), a mixture of lageniform to lageniform-clavate or claviform-capitate cheilocystidia, large elliptic-subfusiform, scarcely hexagonal-lentiform spores, habitat on nitrogenous soil with herbivorous dung present or directly on dung in tropical/subtropical climate.

Beyond the Indian region and the Caribbean, the taxon is also present, based on Genbank ITS sequences, in Egypt and in Namibia, evincing a broad diffusion.

Morphologically, the closest taxon seems to be *Panaeolus moellerianus* Singer, typified from the Macquarie Island in Oceania on humus among graminaceous plants, unsequenced. The pileus is defined as scrobiculate to reticulate-wrinkled (Singer 1960).

There are other unveiled, large-spored species in subgenus *Panaeolus*, they all differ by distinctly lentiform spores: *P. cinctulus* (Bolton) Sacc. (with also a partially eccentric germ pore), *P. acuminatus* (P. Kumm.) Quél., *P. paludosus* Cleland and *P. goossensiae* Beeli.

Finally, we report an unsequenced collection identified as *P. alcis* (as '*alcidis*') by Kaur, Atri & Kaur M (2014), from India. This material features all characteristics we found in our collection. The authors report having noticed a bluing also on the pileus and in the context. We are convinced this represents a misidentification of *P. punjabensis*.

NEW DATA IN THE *PANAEOLUS PAPILIONACEUS* COMPLEX

An ITS sequence of the holotype of *Panaeolus papilionaceus* var. *parvisporus* has very recently become available (it was repeatedly and unsuccessfully tried by Voto & Angelini 2024). Since the phylogram demonstrates that it nests in the clade *Panaeolus papillionaceus* s.str. (see Fig. 1), the systematics of the *Panaeolus papilionaceus* complex as proposed in Voto & Angelini (2024) needs to be reassessed.

Voto & Angelini (2024) had phylogenetically demonstrated the presence in Europe of two taxa in the *P. papilionaceus* complex (ignoring the galeroid taxa).

Basing on the ITS sequences obtained from two German paratypes of *P. papilionaceus* var. *parvisporus*, they assumed that these two taxa could be separated on the base of the spore length: a large-spored (more than 15 µm long on average) taxon identified as *P. papilionaceus* (= *P. campanulatus* = *P. retirugis* = *P. sphinctrinus*) and a small-spored (at most 15 µm long on average) taxon they named *P. parvisporus* comb. nov. (the choice of the names followed the systematics proposed by Gerhardt 1996, 2012).

With the new molecular evidence of a small-spored collection occurring in the clade of *P. papilionaceus* s. str., the separation based on the spore length would become incorrect. The only morphological difference between these two taxa would therefore be based on the tendency towards a smooth and more greyish pileus in *P. papilionaceus* compared to a corrugated and more brownish pileus in *P. retirugis*.

However, we have examined the three following considerations.

a) Over time, several authors (e.g. Hora 1957; Ola'h 1970; Watling & Gregory 1987; Bon & Courtecuisse 2003) having treated the *Panaeolus papilionaceus* complex never reported small-spored collections combined with a smooth, non-corrugated pileus;

b) In all descriptions of the above mentioned authors the pileus breadth of *P. papilionaceus* falls in the range 20-45 mm. Therefore, a pileus 8-15 mm broad, as described by Gerhardt (1996) for *P. papilionaceus* var. *parvisporus*, is unusually very small;

c) In Bulliard's (1782, table 58) iconography of *Agaricus papilionaceus* (see reproduction in Voto & Angelini 2024 figure 19) mature pilei are drawn conical-convex to convex, and in Fries's (1821) sanction they are defined convex. On the contrary, Gerhardt (1996) defines the pileus of *P. papilionaceus* var. *parvisporus* as thimble-shaped to campanulate.

Ultimately, basing on these observations, we propose to treat the type collection of *P. papilionaceus* var. *parvisporus* as consisting of still immature specimens and therefore with spores not yet of the definitive size.

On this assumption, we confirm Voto & Angelini's (2024) proposal of using the spore length for separating the two taxa, we add to it the pileus characteristics and we renounce the use of the epithet '*parvisporus*' instead of '*retirugis*'.

The two European non-galeroid taxa of the *P. papilionaceus* complex are therefore:

- ***P. papilionaceus*** (= *P. campanulatus* = *P. sphinctrinus*) with spores on average more than 15 µm long, and pileus smooth and mostly in the greyish tones;
- ***P. retirugis*** (= *P. papilionaceus* var. *parvisporus* = *P. parvisporus*) with spores on average at most 15 µm long, and pileus corrugated and mostly in the brownish tones.

Pileus colour and corrugation of course may depend on environmental conditioning and the freshness of the basidiomata.

The tree used in Voto & Angelini's (2024) is here reproduced expanded with the sequence of the typus of *P. papilionaceus* var. *parvisporus* and some others and with the names of the species updated.

Panaeolus sylvaticus Silva-Filho & Cortez (Fig. 8-10)

Edinburgh Journal of Botany 76(2): 303 (2019)

Collections examined and habitat. Dominican Republic, P.to Plata, Cabarete, Sea Horse Ranch, gregarious on woody debris between piles of decaying plant material (landfill of material from pruning) in an almond forest near the beach, 4 February 2024, *legit C. Angelini*, pers. herb. ANGE1992; ibid, pers. herb. ANGE1993.

Fig. 8: *P. sylvaticus*. ANGE1992 [C. Angelini]

Fig. 9: *P. sylvaticus*. ANGE1993 [C. Angelini]

Notes

Our two new collections feature morphological data fully correspondent to those already reported in Angelini & Voto (2023). We can only add that we found occasional larger spores attaining to 11.1x8.1x5.8 µm and somewhat more evident greenish-yellowish mucus or content of cheilocystidia (Fig. 10). The photographs here published show the colours in discoloring pilei.

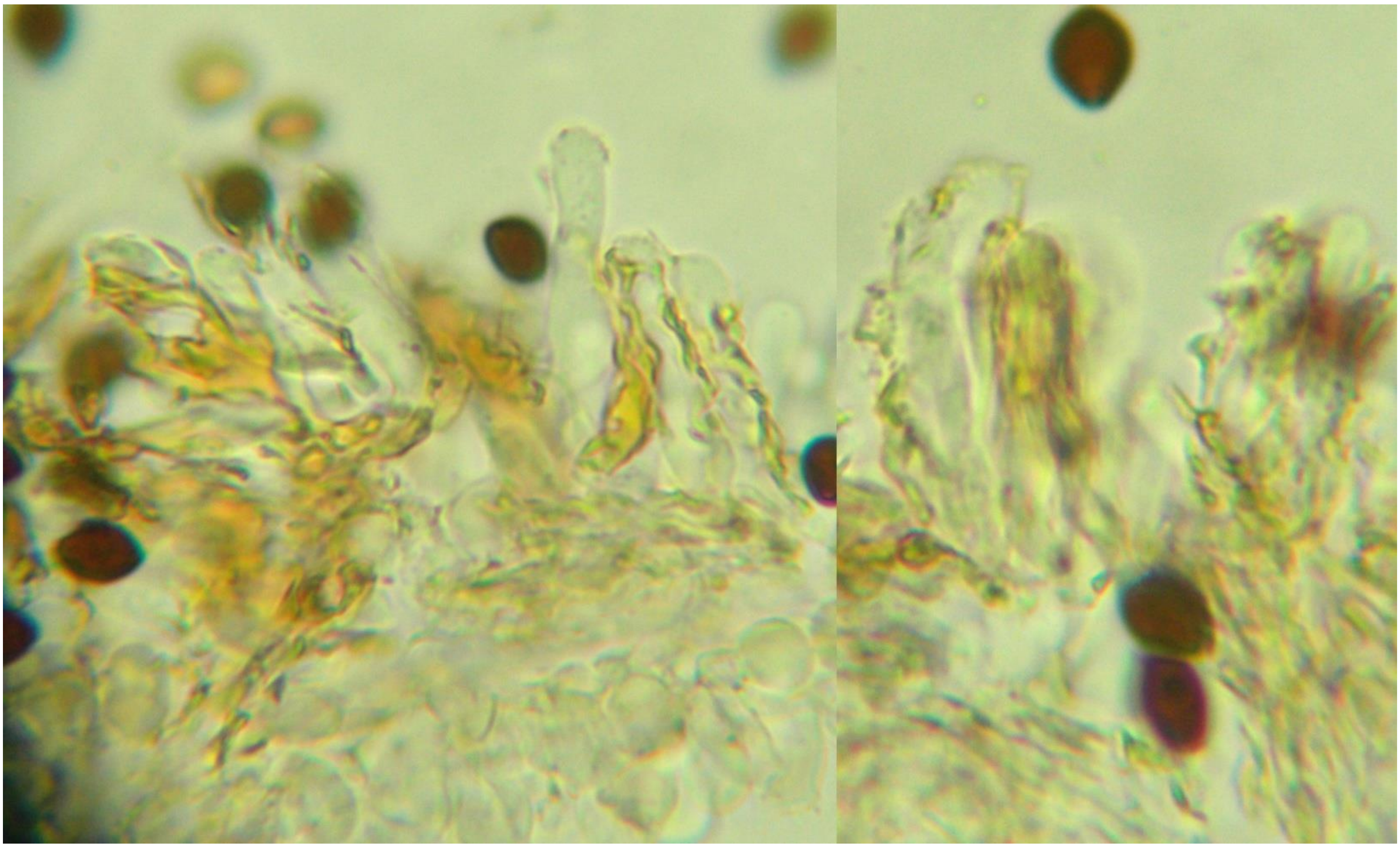


Fig. 10: *P. sylvaticus*. ANGE1992. Cheilocystidia in 5% KOH

REFERENCES

Angelini C, Voto P (2023). First record of *Panaeolus sylvaticus* in the Dominican Republic and notes on *Panaeolus* and *Panaeolopsis*. *MycolObs* **6**:22–29

Asif M, Firdous Q, Izhar A, Niazi AR, Sarwar A, Khalid AN (2023) Molecular and morphological studies reveal a new species of *Panaeolus* (Agaricales, Basidiomycota) from Punjab, Pakistan. *European Journal of Taxonomy* **888**:77–96

Bon M, Courtecuisse R (2003) Clé de détermination du genre *Panaeolus* (Fr.) Quélet. *Doc. Mycol*. **32**(127-128):75–93

Bulliard JBF (1782) *Herbier de la France* **2**:Pls. 49–96. Paris

Consiglio G, Marchetti M (2024 '2023') Contributo alla conoscenza del Genere *Panaeolus* sensu lato. *Rivista di Micologia* **66**(3):209–286

Fries EM (1821) *Systema Mycologicum* **1**:1–520. Ed. Lundæ

Gardes M, Bruns TD (1993) ITS primers with enhanced specificity for Basidiomycetes — application to the identification of mycorrhizae and rusts. *Molecular Ecology* **2**:113–118 https://onlinelibrary.wiley.com/doi/10.1111/j.1365-294X.1993.tb00005.x

Gerhardt E (1996) Taxonomische revision der Gattungen *Panaeolus* und *Panaeolina* (Fungi, Agaricales, Coprinaceae). *Bibliotheca Botanica* **147**:1–149

Gerhardt E (2012) *Panaeolus* (Fr.) Quél. In: Knudsen H, Vesterholt J (Eds) Funga Nordica. Agaricoid, boletoid, cyphelloid and gasteroid genera, Nordswamp, Copenhagen: 950–954.

Hora FB (1957) The genus *Panaeolus* in Britain. *Naturalist*, July-September 1957:77–88. The University of Leeds

Kaur A, Atri NS, Kaur M (2014) Diversity of coprophilous species of *Panaeolus* (Psathyrellaceae, Agaricales) from Punjab, India. *Biodiversitas* **15**(2):115–130

Malysheva E, Moreno G, Villarreal M, Malysheva V, Svetasheva T (2019) The secotioid genus *Galeropsis* (Agaricomycetes, Basidiomycota): a real taxonomic unit or ecological phenomenon? *Mycological Progress* **18**:805–831
https://doi.org/10.1007/s11557-019-01490-6

Mullis K, Faloona FA (1987) Specific synthesis of DNA in vitro via a polymerase-catalyzed chain reaction. *Methods in Enzymology* **155**:335–350
https://doi.org/10.1016/0076-6879*(*87*)*55023-6

Murray MG, Thompson WF (1980) Rapid isolation of high molecular weight plant DNA. *Nucleic Acids Research* **8**(19):4321–4325
https://doi.org/10.1093*/*nar*/*8.19.4321

Ola'h GM (1970) Le genre *Panaeolus*. Essai taxonomique et physiologique. *Rev. Mycol. [Paris] Mém. Hors-série* **10**:1–273

Ronquist F, Teslenko M, van der Mark P, Ayres DL, Darling A, Höhna S, Larget B, Liu L, Suchard MA, Huelsenbeck JP (2012) MrBayes 3.2: Efficient Bayesian phylogenetic inference and model choice across a large model space. *Systematic Biology* **61**(3):539–542
https://doi.org/10.1093/sysbio/sys029

Singer R (1960) Sobre algunas especies de hongos presumiblemente psicotropicos. *Lilloa* **30**:117–127

Stamatakis A (2014) RAxML Version 8: A tool for phylogenetic analysis and post-analysis of large phylogenies. *Bioinformatics* **30**(9):1312–1313
https://doi.org/10.1093/bioinformatics/btu033

Tamura K, Peterson D, Peterson N, Stecher G, Nei M, Kumar S (2011) MEGA5: Molecular evolutionary genetics analysis using maximum likelihood, evolutionary distance, and maximum parsimony methods. *Molecular Biology and Evolution* **28**(10):2731–2739
https://doi.org/10.1093/molbev/msr121

Voto P, Angelini C (2021) First record of *Copelandia mexicana* in Dominican Republic and notes on *Panaeolus*. *MycolObs* **1**:44-58

Voto P, Angelini C (2024) Studies in the *Panaeolus papilionaceus* complex (Agaricales, Galeropsidaceae): two new species discovered in the Dominican Republic and Australia. *MycolObs* **9**:1−32

Watling R, Gregory NM (1987) British Fungus Flora: Agarics and Boleti. Volume 5, Strophariaceae & Coprinaceae p.p. *Hypholoma*, *Melanotus*, *Psilocybe*, *Stropharia*, *Lacrymaria* & *Panaeolus*. Edinburgh: Royal Botanic Garden Edinburgh

White TJ, Bruns TD, Lee S, Taylor JW (1990) Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In: Innis MA, Gelfand DH, Sninsky J, White TJ (eds) PCR protocols: a guide to methods and applications. Academic Press, London, 482 pp.
http://dx.doi.org/10.1016/B978-0-12-372180-8.50042-1

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Rommelaarsia flavovirens in Bosnia and Herzegovina

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[1]https://www.facebook.com/dusko.trivic.9

Key words:
Ascomycota
Helotiales

Abstract: *Rommelaarsia flavovirens*, a species described, together with its monospecific genus, in 2015 from collections from Western Europe is reported from Bosnia.

INTRODUCTION

This species is regularly found every year in a damp portion of an unkempt meadow near a river since the beginning of the spring, from March to May.

MATERIALS AND METHODS

The basidiomes were photographed fresh in habitat; microcharacters were observed and photographed on fresh material in water.

TAXONOMY

Rommelaarsia flavovirens Baral, Tanchaud & Romm.
Ascomycete.org 7 (6): 323 (2015)

BRIEF DESCRIPTION OF THE SEXUAL STATE

Apothecia moist 0.5–1.0 mm diam., non-translucent, round to roundish, non-gelatinous, gregarious, sometimes two or three side by side; dull coloured, beige to pale yellowish olivaceous and a little darkening from margin; cyathiform at start, then concave and finally applanate, margin distinct, whitish tomentose to hairy toothed; subsessile to shortly stipitate, loosely attached to the substrate; external surface sterile, concolorous to brownish, whitish tomentose to hairy like the margin.

Asci 55.0 – 75.0 × 6.0 – 9.0 µm, 8-spored, with obliquely biseriate spores; tapering toward a narrowly obtuse apex provided with a small, approx. 1.0-1.5 µm broad, amyloid ring; base with a short to long, often flexuous stalk arising from croziers.

Ascospores 8.0 – 12.0 × 2.5 – 3.4 µm, oblong to fusiform or narrowly clavate, apex narrowly obtuse, without sheath.

Paraphyses subcylindrical or narrowly lanceolate, septate; apex obtuse or subacute, not forked, not exudating; contents free of refractive vacuoles.

Ectal excipulum composed in the exterior layer by greenish yellow encrusted hyphae.

Collection examined and habitat: Bosnia and Herzegovina, Banja Luka, Prijedor, in a damp unkempt grassy area near river Sana, gregarious on rotting stalks of *Equisetum arvense* L., 13 March 2023, *legit D. Trivič,* in pers. herb.

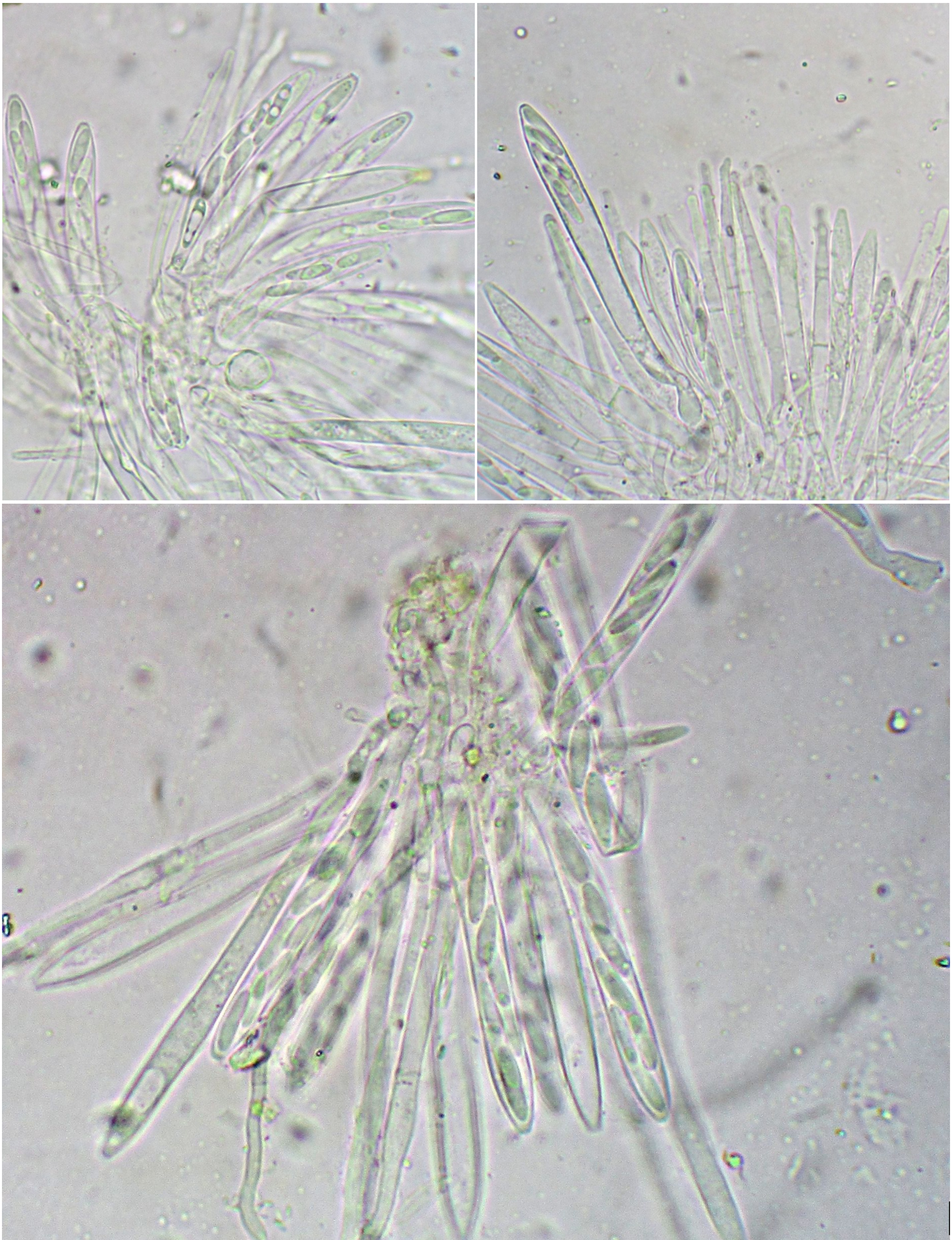
Asci and spores in water (scale bar = 1 µm)

NOTES

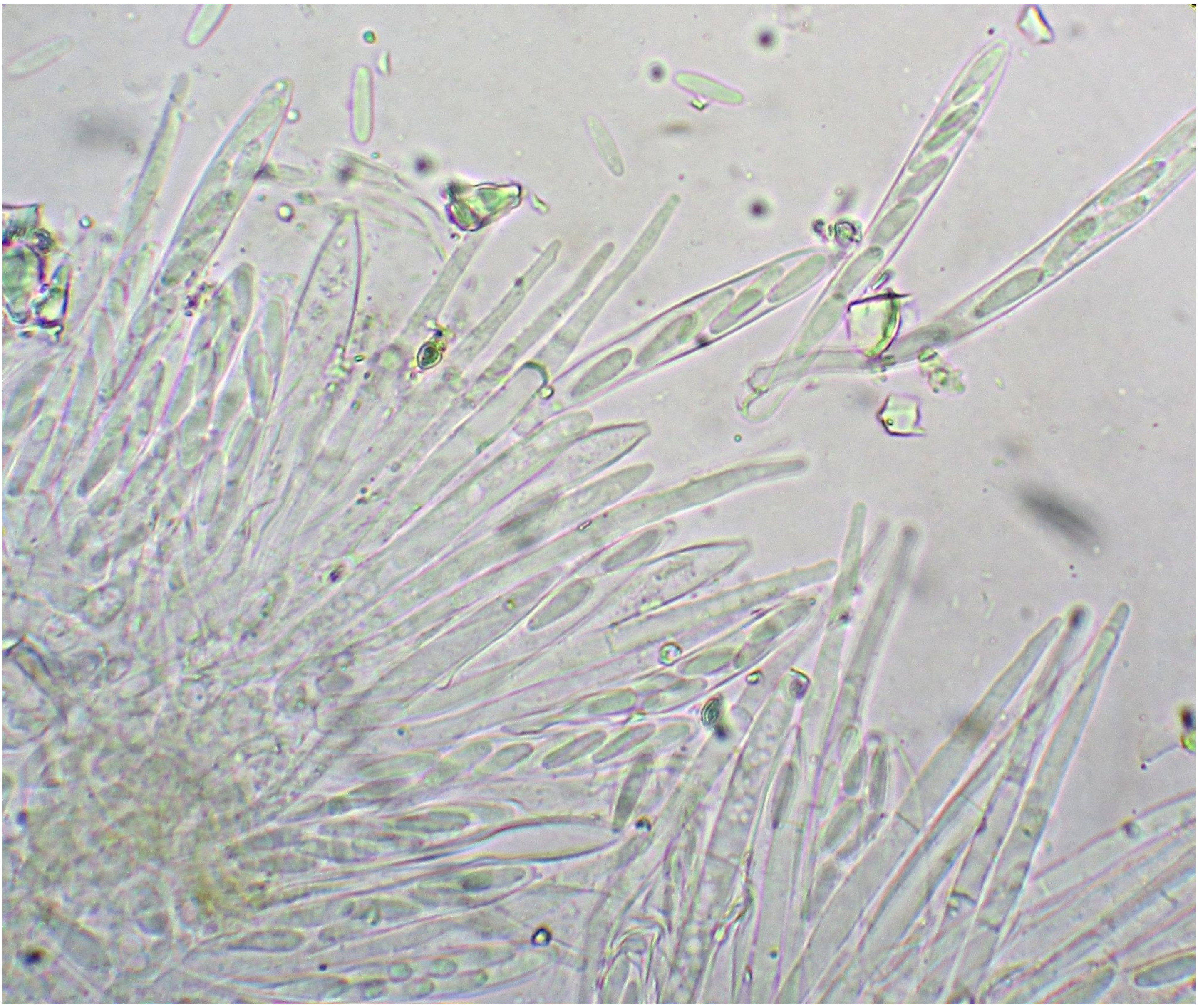
Greenish-yellow exudate encrusting the cortical hyphae of the ectal excipulum separate this species and its genus by the look-alike taxa of the genus *Psilachnum* Höhn. which also differ by having refractive vacuoles in paraphyses and hairs (Baral & Haelewaters 2015).

Stamnaria americana Massee & Morgan has somewhat similar colours (orangish to yellowish) and an identical habitat (on *Equisetum* ssp.) but differs by distinctly larger spores (Haelewaters, Filippova & Baral 2018).

The species of the genus *Cistella* Quél., some of which appear phylogenetically close in the tree by Baral & Haelewaters (2015), were also checked but none was found to be morphologically comparable.



Asci and spores in water



Asci and spores in water

REFERENCES

Baral H-O, Haelewaters D (2015) *Rommelaarsia flavovirens* gen. et sp. nov. (Helotiales), a new discomycete on *Equisetum* with a peculiar asexual state. *Ascomycete.org* 7(6):321–330

Haelewaters D, Filippova NV, Baral H-O (2018) A new species of *Stamnaria* (Leotiomycetes, Helotiales) from Western Siberia. *MycoKeys* 32:49–63 https://doi.org/10.3897/mycokeys.32.23277