

First record of *Panaeolus sylvaticus* in the Dominican Republic and notes on *Panaeolus* and *Panaeolopsis*

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Abstract: *Panaeolus sylvaticus* is reported for the first time from Dominican Republic; this documentation represents its second ever published report and its first phylogenetic characterization. An ITS sequence and pictures of basidiomes and of main micro anatomical traits support its description together with notes of comparison with other taxa of subgen. *Panaeolus*; no high correspondence was found in GenBank. Also, *Copelandia tropica* is transferred to *Panaeolus* and the genus *Panaeolopsis* is reduced to synonymy with *Panaeolus*.

INTRODUCTION

Basing on the recent paper by Kalichman, Kirk & Matheny (2020) *Panaeolus* belongs in the family *Galeropsidaceae* Singer.

P. sylvaticus, a taxon described in 2019 from south Brazil on woody humus and lacking a genetic characterization, represents a very interesting finding. In the field the peculiar beautiful jade colours of the pileus and the unusual (for this genus) habitat of woody humus were the most relevant characteristics which impressed the collector's attention.

The microscopical examination allows, by applying the dichotomous key proposed by Voto (2023), to arrive at a terminal dichotomy of *Panaeolus* sect. *Panaeolus*. Finally, the presence of pigmented inclusions in the cystidia and the delicate pileus colour univocally directs the identification towards *P. sylvaticus*, excluding the otherwise similar *P. fraxinophilus*, an old little known species described from northern USA.

Following the transfer of *Copelandia* taxa to *Panaeolopsis*, *Copelandia tropica* is transferred to *Panaeolus*. Also, the genus *Panaeolopsis* is reduced to synonymy with *Panaeolus* and the four epithets so far ascribed to *Panaeolopsis* are combined with *Panaeolus* mostly on a morphological basis. A phylogram containing an LSU sequence of *Panaeolopsis nirimbii*, the only one of this genus available in GenBank, shows that it nests phylogenetically among *Panaeolus* taxa.

MATERIALS AND METHODS

The basidiomes were photographed fresh in situ by C. Angelini using a digital camera Nikon Coolpix 8400 and subsequently dried. Microscopic characters were studied, described and photographed by P. Voto on dried material revived with 10% NH₄OH, 30% NH₄OH or 5% KOH and in some cases using Congo red as mounting medium for imaging.

The ITS sequence was commissioned to the Alvalab laboratory (Spain).

TAXONOMY

Panaeolus sylvaticus Silva-Filho & Cortez
Edinburgh Journal of Botany 76(2): 303 (2019)



Macroscopic characters

Pileus: (primordia and young specimens not observed): 14 – 18 mm, when mature applanate to very low convex, margin possibly wavy, striate for two thirds from margin; greyish to dull violet and greyish blue to bluish grey, discoloring at centre to somewhat purplish grey or paler, in periphery about violet grey often with somewhat greenish grey shades to a pale blue-greenish white.

Lamellae: about 18-20 with 7 tiers of lamellulae, adnate, ventricose, grey with bluish-greenish shades and spotted with the typical “salt and pepper” appearance; edge pale.

Stipe: 18.0 – 30.0 × 1.4 – 2.1 mm, cylindrical, sinuous, equal or slightly widened at the base; light ocher-pink to ocher-reddish; entirely covered by abundant white pruina, base with a white mycelial felt.

Context: not studied.

Microscopic characters

Spores: (n 22): (7.93) 8.55 – 9.79 (9.96) × (6.27) 6.47 – 7.3 (7.76) × 5.06 – 5.51 µm, on average 9.12 × 6.64 × 5.27 µm, Q = (1.2) 1.24 – 1.44 × 1.45 – 1.82, on average 1.34 × 1.65; in face view rhomboidal to subhexagonal or subglobose, seldom elliptic, base obtuse to rarely rounded, apex a little protruding, in side view elliptic to sometimes broadly subamygdaliform; thick-walled, henna brown in ammonia; apiculus small; germ pore 1.2 – 1.6 µm broad, distinct, central to sometimes very imperceptibly eccentric.

Basidia: 17.0 – 25.0 (27.0) × 8.0 – 10.5 (11.5) µm, clavate, clavate-pedunculate, subcylindrical, sometimes utriform or deformed, 4-spored, sterigmata 2.5 – 4.0 µm long, walls sometimes congophilous, hyaline to sometimes with a pale greenish yellowish pigment in KOH, intermixed with many small stalkless clavate basidiola approx. 7 – 11 × 7 – 8 µm; also intermixed with scattered slenderly claviform basidia and basidiola, 11.0 – 25.0 × 4.5 – 6.5, wholly golden-greenish in KOH.

Subhymenium: an approx. 10 µm broad layer of repent hyphal elements 2.5 – 4.0 (5.0) µm broad; *hymenial trama* of up to 20 (25) µm broad short hyphae; pigment in KOH intraparietal and incrusting, yellowish greenish to ochraceous greenish or distinctly ochraceous; presence of scattered grossly greenish ochraceous maculae involving the hymenial elements (see description of basidia).

Pleurocystidia: absent. Gill edge: subheteromorphic with presence of scattered basidia.

Cheilocystidia: 17 – 45 × 5 – 8 µm at base, 5 – 7 µm at apex, mostly cylindraceous to lageniform, upper half subclavate or with a swollen apex, sometimes strangled in the middle, sometimes irregular to flexuous; thin-walled, hyaline to pale or occasionally distinctly greenish-yellowish in KOH (mostly only visible in mass), sometimes covered with greenish-yellowish mucus or incrustations; numerous.

Pileipellis: composed of erect and claviform to repent and inflated cells covered with greenish-yellowish drops, walls faintly yellowish in ammonia; *subpellis* hyphal.

Pileocystidia: 30 – 55 × 7 – 10 µm at base, 5.5 – 7.5 µm broad at apex, similar to cheilocystidia; thin-walled, hyaline, covered with greenish-yellowish mucus mainly towards the apex; scattered.

Caulocystidia: not examined.

Clamp connections: present but inconspicuous.

Habitat: gregarious, in a moist, riparian, heavily anthropized forest on woody humus of deciduous trees.

Collection examined: Dominican Republic, P.to Plata, Sosúa, Puerto Chiquito, 1.XII.2019, C. Angelini ANGE1393, VER fu22 GenBank: OQ311002 - ITS

NOTES

Two macromorphological characteristics are almost striking in this species: the growth connected to arboreal material and humus, consequently in a sylvicolous habitat, which is unusual in this genus, and the peculiar colour of the pileus ranging from greyish bluish to greyish violaceous when fresh, and from light blue (cerulean) to sea green or jade colour when discoloring.

Two other lignicolous taxa in this genus are *P. bernicis* A.M. Young and *P. fraxinophilus* A.H. Sm.

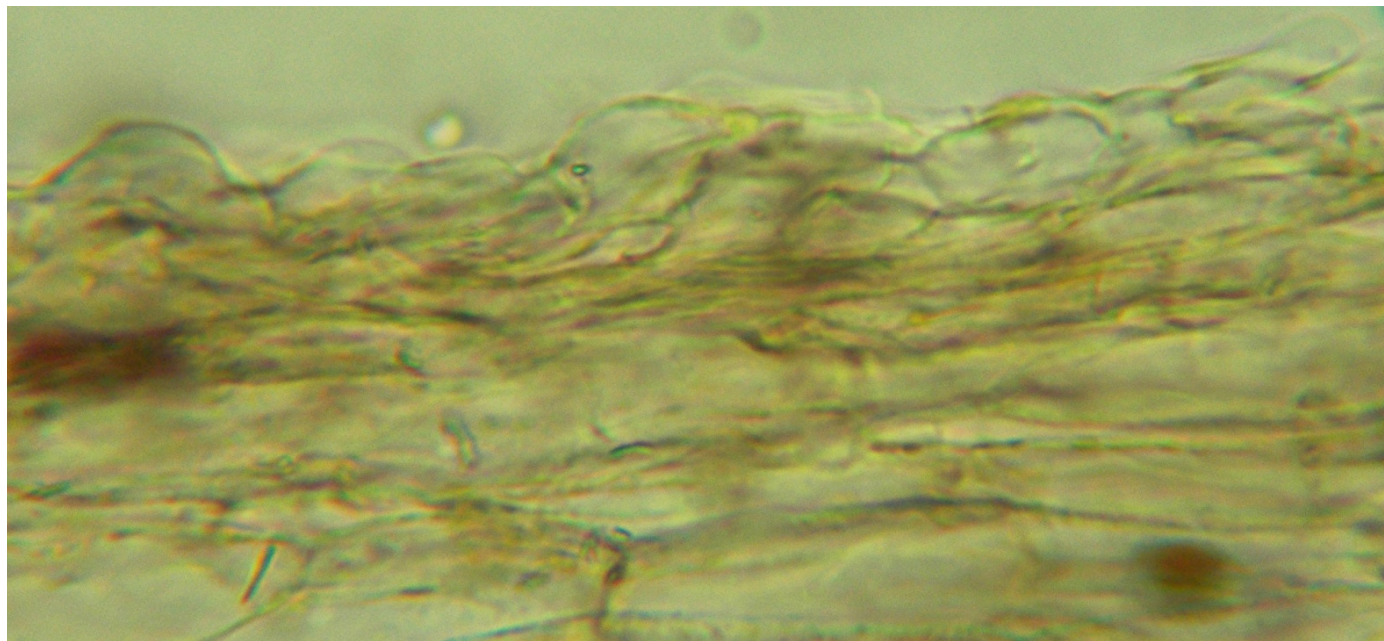
P. bernicis, described from an Australian rainforest, has sulphidia-type cystidia, therefore belonging to sect. *Anellaria* (P. Karst.) Ew. Gerhardt, larger spores of 12.5 – 15 × 10 – 11 × 6-5 – 8 µm, and mainly 2-spored

basidia. However we notice the similitude of the presence of pigment on top of hymenial and pileal cystidia (Young 1989, protolog; Gerhardt 1996, type revision). No sequence of this taxon is present in GenBank so far.

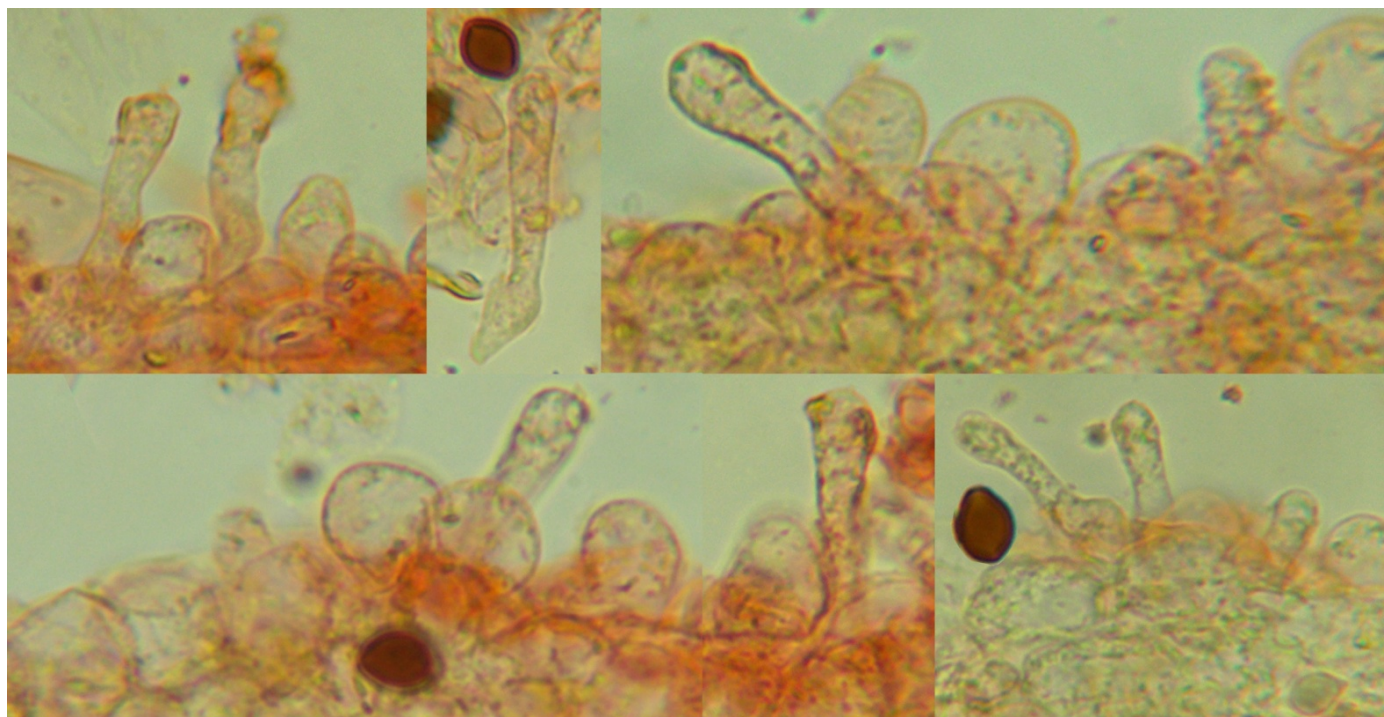
P. fraxinophilus, described from USA (New York state), shares membership in sect. *Panaeolus* and indeed it is the closest species reported in Voto's electronic key, but it has dark brownish colours in young pilei, it lacks any pigment on cystidia, it has filamentous flexuous cheilocystidia only 4 – 5 µm broad, and grows in temperate climate.

Finally, the common *P. reticulatus* Overh. is differentiated by shorter cheilocystidia, a generally brownish and often zonate pileus coloration, and the hygrophilous to sabulicolous or coprophilous habitat.

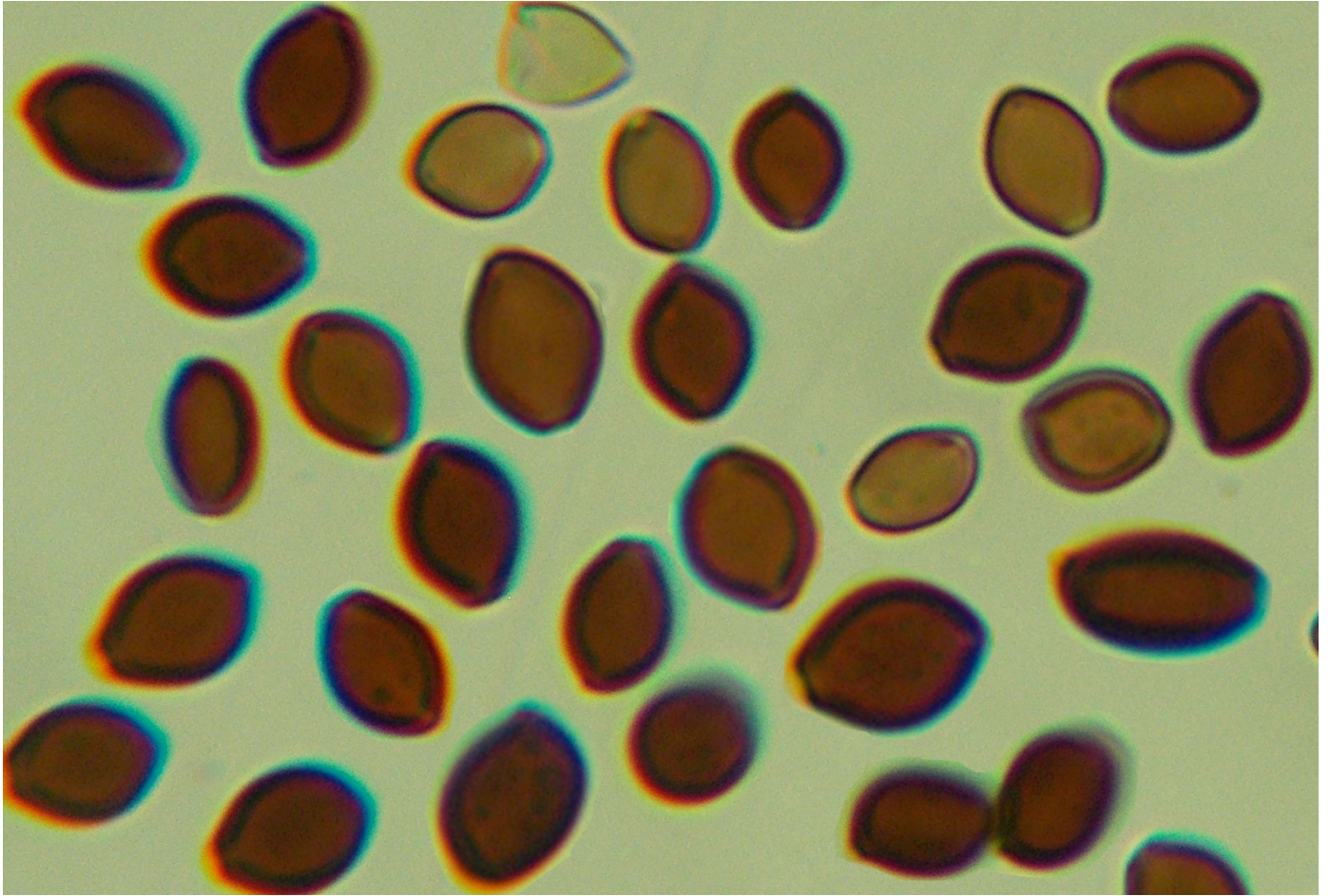
When blasting the ITS region of ANGE1393 we note that all vouchers of *Panaeolus* present in GenBank have an identity percentage lower than 95.30%.



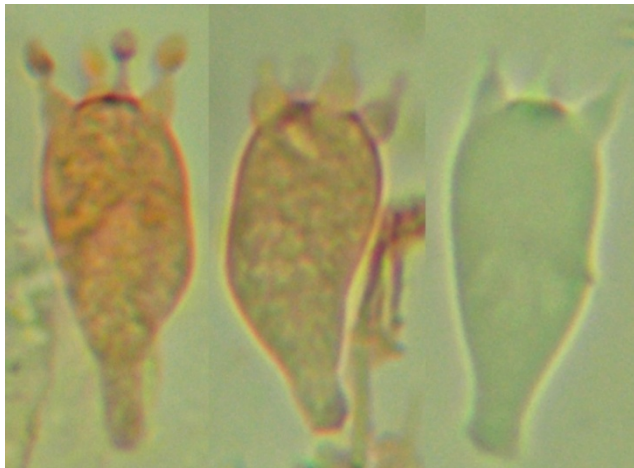
Pileipellis in ammonia



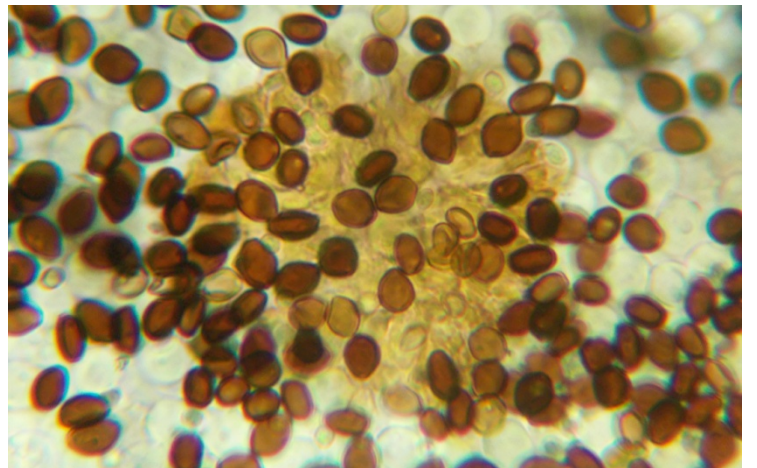
Pileocystidia in Congo red



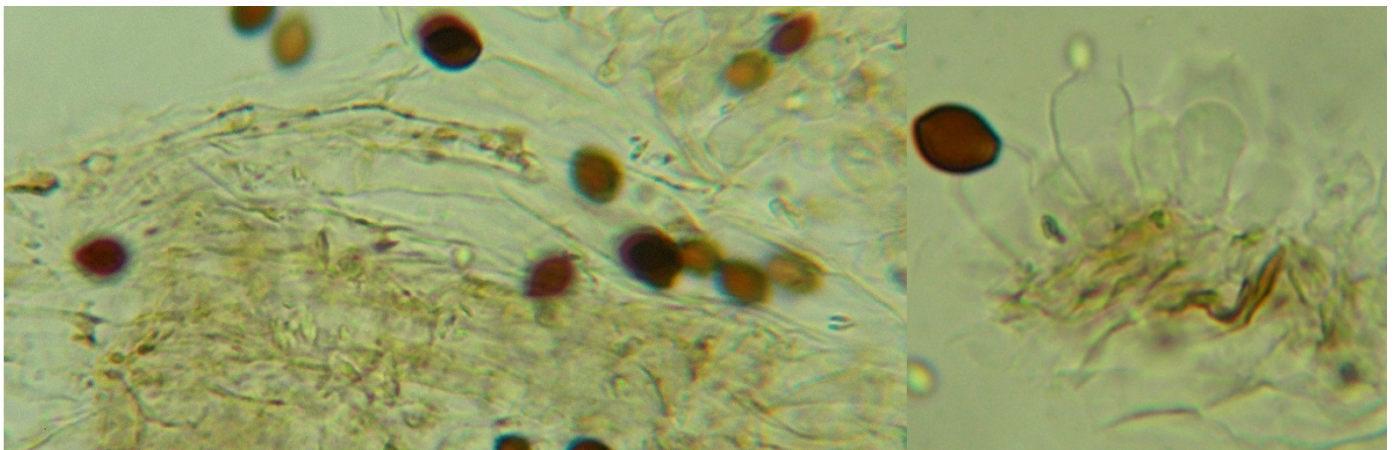
Spores in ammonia



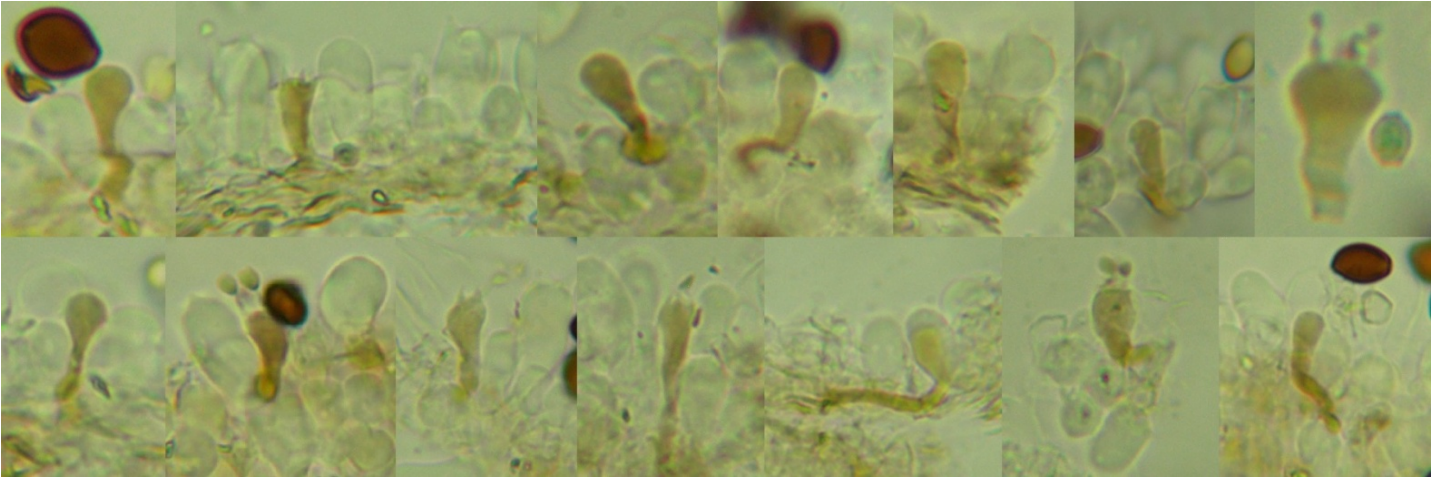
Basidia in Congo red (left), KHO (right)



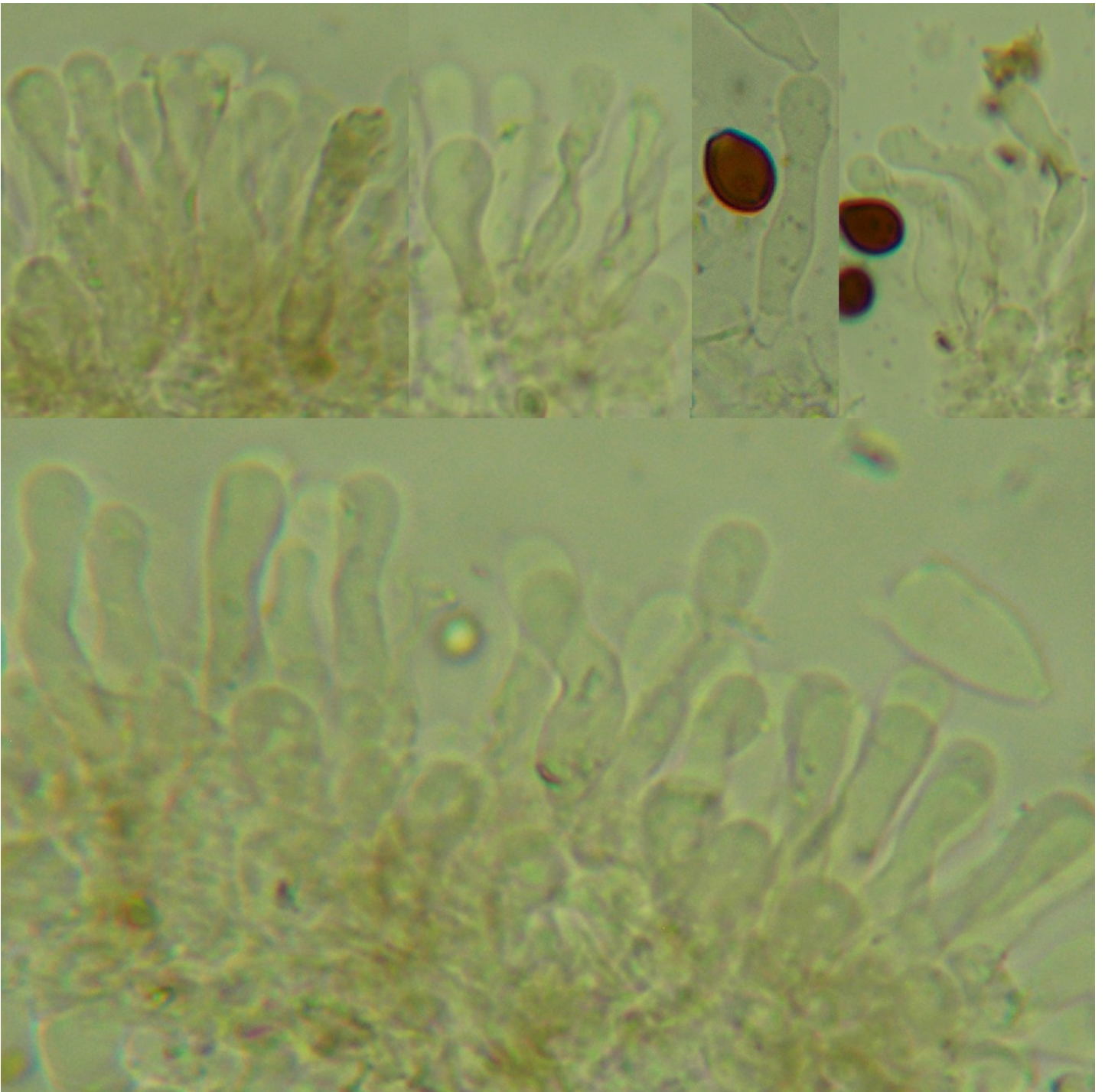
Golden macula in hymenium in ammonia



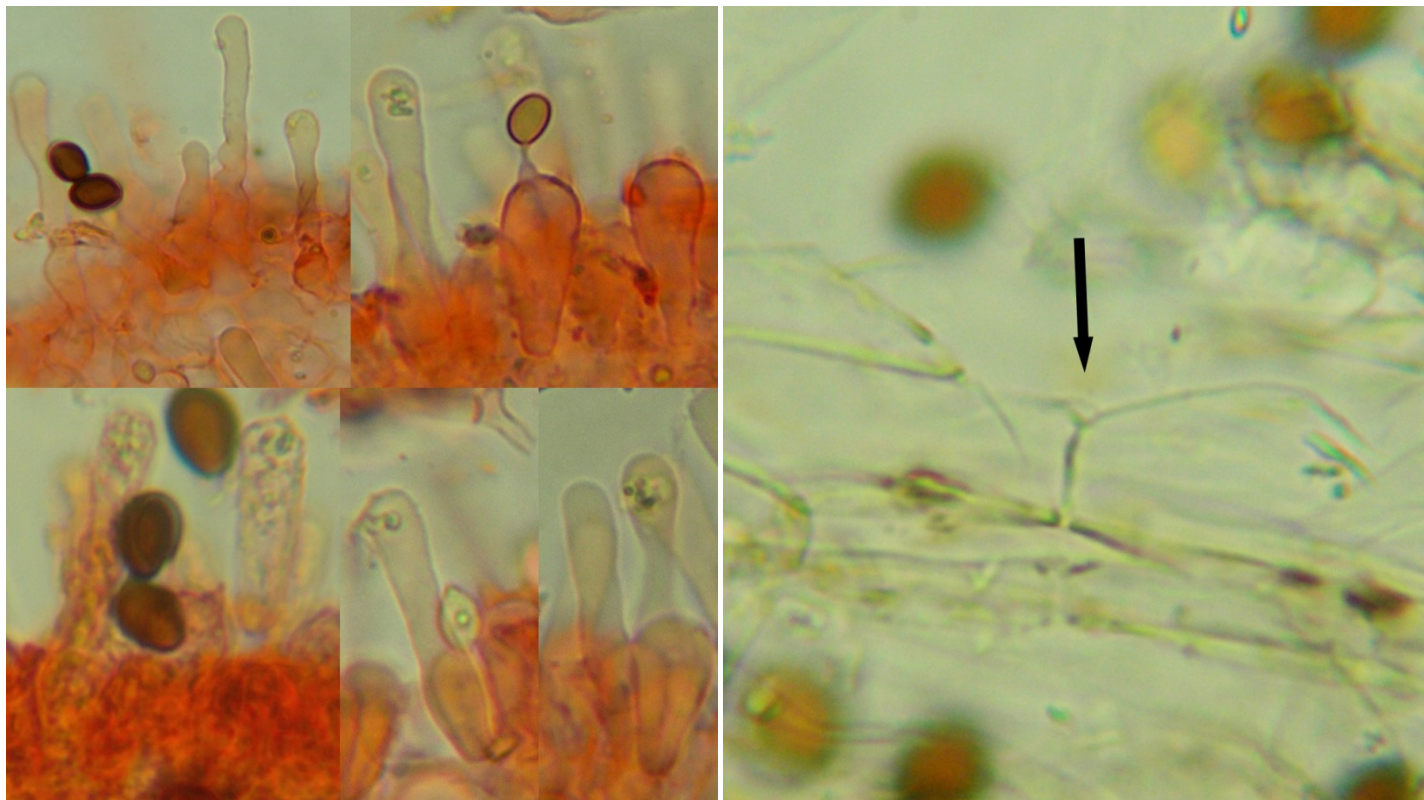
Pigment of hymenial trama (left) and subhymenium (right) in KOH



Golden-greenish small basidia and basidiola in KOH



Cheilocystidia in KOH



Cheilocystidia in Congo red

Clamp connection in the hymenial trama in KOH

NOVELTIES - GENUS COPELANDIA

Panaeolus tropicus (Natarajan & Raman) Voto, comb. nov. [MB 847744]

Basionym: *Copelandia tropica* Natarajan & Raman, Bibliotheca Mycologica 89: 41. 1983.

NOVELTIES - GENUS PANAEOLOPSIS

Panaeolus brasiliensis (Singer) Voto, comb. nov. [MB 847745]

Basionym: *Panaeolopsis brasiliensis* Singer, Revue de Mycologie (Paris) 40(1): 62. 1976.

Panaeolus nirimbii (Watling & A.M. Young) Voto, comb. nov. [MB 847746]

Basionym: *Panaeolopsis nirimbii* Watling & A.M. Young, Notes from the Royal Botanical Garden Edinburgh 41(2): 395. (1983).

Panaeolus obtusus (Contu) Voto, comb. nov. [MB 847747]

Basionym: *Panaeolopsis obtusa* Contu, Bulletin trimest. de la Société Mycologique de France 114(1): 12. 1998.

Panaeolus sanmartinianus (Singer) Voto, comb. nov. [MB 847748]

Basionym: *Panaeolopsis sanmartiniana* Singer, Beihefte zur Nova Hedwigia. 29: 367. 1969.

NOTES

The genus *Panaeolopsis* Singer is here considered a gasteroid evolutionary lineage inside genus *Panaeolus* (Fr.) Quél. An LSU sequence in GenBank, the only one at all under this generic name, identified as *Panaeolopsis nirimbii*, from Australia, nests amid the agaricoid members of this genus (see Table 1 and Figure 1).

Singer (1969) himself thus commented about *Panaeolopsis sanmartinianus*: 'If this were an agaric, it would enter the genus *Panaeolus* hence the generic name proposed'.

Attempts were made in every way and for a long time to obtain the type of *Panaeolopsis sanmartiniana*, hosted in BAFC (Argentina), which is the type name of the genus, but the protocol to follow for the loan, even if available, turned out to be really complicated.

Previously, Malysheva *et al.* (2019) found that some other gasteroid species (see *Galeropsis allospora* Singer, *Galeropsis desertorum* Velen. & Dvorák and *Psammomyces plantaginiformis* Lebedeva) belonged to *Panaeolus* on a molecular basis and accordingly they transferred them to *Panaeolus*.

Species	Collection / Origin	GenBank
<i>Agrocybe arvalis</i> (Fr.) Singer	DSM 9710 / Germany	MN306170
<i>Cortinarius khangensis</i> M.L. Xie, T.Z. Wei & Y. Li	HMJAU44507 / China	NG_149031
<i>Descolea phlebophora</i> E. Horak	PDD97884 / New Zealand	HQ728544
<i>Galerina atkinsoniana</i> A.H. Sm.	PBM 2719 (CUW) / USA	DQ457668
<i>Hemistropharia albocrenulata</i> (Peck) Jacobsson & E. Larss.	NL-5161 / USA	MK278139
<i>Panaeolopsis nirimbii</i> Watling & A.M. Young	PERTH 7680368 / Australia	MK278427
<i>Panaeolus acuminatus</i> (P. Kumm.) Quél.	GLM 46071 / Germany	DQ071695
<i>Panaeolus cinctulus</i> (Bolton) Sacc.	NL-0454 / Hungary	MK278430
<i>Panaeolus cyanescens</i> Sacc.	NL-0429 / Hungary	MK278429
<i>Panaeolus fimicola</i> (Fr.) Quél.	NL-0232 / Hungary	MK278431
<i>Panaeolus foenisecii</i> (Pers.) Maire	FO 46609 / Germany	DQ071696
<i>Panaeolus semiovatus</i> (Sowerby) S. Lundell & Nannf.	GLM 51235 / Germany	DQ071694
<i>Thaxterogaster turcopes</i> (Soop) Niskanen & Liimat.	KS-CO1814 / New Zealand	MK277872

Table 1. Fungal taxa, Voucher numbers and GenBank accession numbers of the sequences used in the phylogenetic analyses of LSU

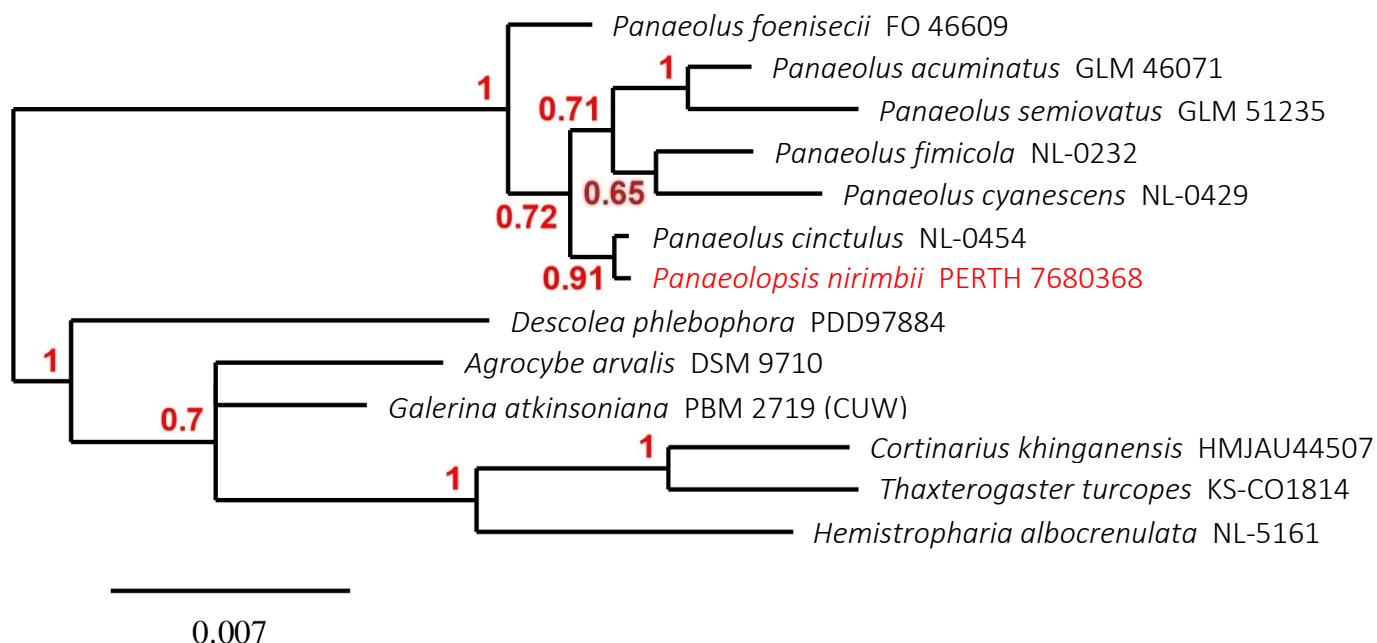


Figure 1. LSU topology from Bayesian inference analysis showing the placement of *Panaeolopsis nirimbii* within genera of order *Agaricales*. Support values of the Bayesian posterior probability are given at the branches.

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