Article received 25 April 2025, accepted 7 June 2025

Coprinellus aureodisseminatus from Australia, *C. punjabensis* from Dominican Republic and notes on *C. disseminatisimilis*

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Key words:
Agaricales
Psathyrellaceae
taxonomy
Caribbean
Oceania

Abstract: Based on morphological and phylogenetic studies, two members of the fairy inkcap (*Coprinellus disseminatus*) complex are documented: *Coprinellus aureodisseminatus* highlighting the presence in Australia of this taxon originally described from east China, and *Coprinellus punjabensis*, from Dominican Republic, showing a pan-tropical/ subtropical diffusion of this taxon originally described from Pakistan. In both cases, our descriptions bring some noteworthy features augmenting those described for their protologs. Notes are also reported on the distribution of *Coprinellus disseminatisimilis*.

INTRODUCTION

Within the genus *Coprinellus* P. Karst. there is a particular complex of fungi characterized by small basidiomes with strongly plicate and not deliquescent or only slightly deliquescent pilei, and a caespitose to strongly fasciculate growth. Most of them also have pubescent pilei and stipes, and ozonium or strigosity at the base of the stipe.

For a long time, collections with these characteristics were often collectively identified as *Coprinellus disseminatus* (Pers.) J.E. Lange and the name 'fairy inkcap' was commonly used for them. Recent phylogenetic studies (e.g. Boonmee *et al*. 2021; Zhu & Bau 2024) have diversified the taxonomy of this complex into different species, such as those discussed in this report.

Phylogenetically, the fairy inkcap complex comprises species almost all belonging to *Coprinellus* sect. *Disseminati* D. Wächt. & A. Melzer, with two occurrences in *Coprinellus* sect. *Aureodisseminati* T. Bau & L.Y. Zhu, one in *Coprinellus* sect. *Aureogranulati* D. Wächt. & A. Melzer, and some also in the genus *Tulosesus* D. Wächt. & A. Melzer (invalid, currently *Ephemerocybe* Fayod) (Zhu & Bau 2024). However, the genus *Ephemerocybe*, as *Tulosesus*, is not accepted as sequestered from *Coprinellus* by Voto (2020, 2023).

DNA sequences available on GenBank from several Australian collections were demonstrated by Zhu & Bau (2024) to match the new species *Coprinellus aureodisseminatus* T. Bau & L.Y. Zhu. However, Australian material was not examined and therefore was not included in the protolog. Subsequently, our studies show that Australian collections of *C. aureodisseminatus* exhibit some noteworthy features augmenting those described for Chinese collections by Zhu & Bau (2024). These include occurrence in recently burnt areas and variable development of the ozonium, as well as some significant features of the veil elements and the pileocystidia.

The best match we found for our Dominican collection was with *Coprinellus punjabensis* Usman & Khalid, originally described from Asia (Pakistan) and, although we found some morphological differences, we did not consider them sufficient to treat our collection as a separate species. Our ITS analysis includes vouchers from different countries and, although our collection showed the strongest pairwise similarities with several vouchers from tropical America (up to 100% identity) these are not clustered in an autonomous subclade. We attempted to make a more in-depth comparison by analyzing a second gene but we were unable to obtain a loan of the *Coprinellus punjabensis* type material.

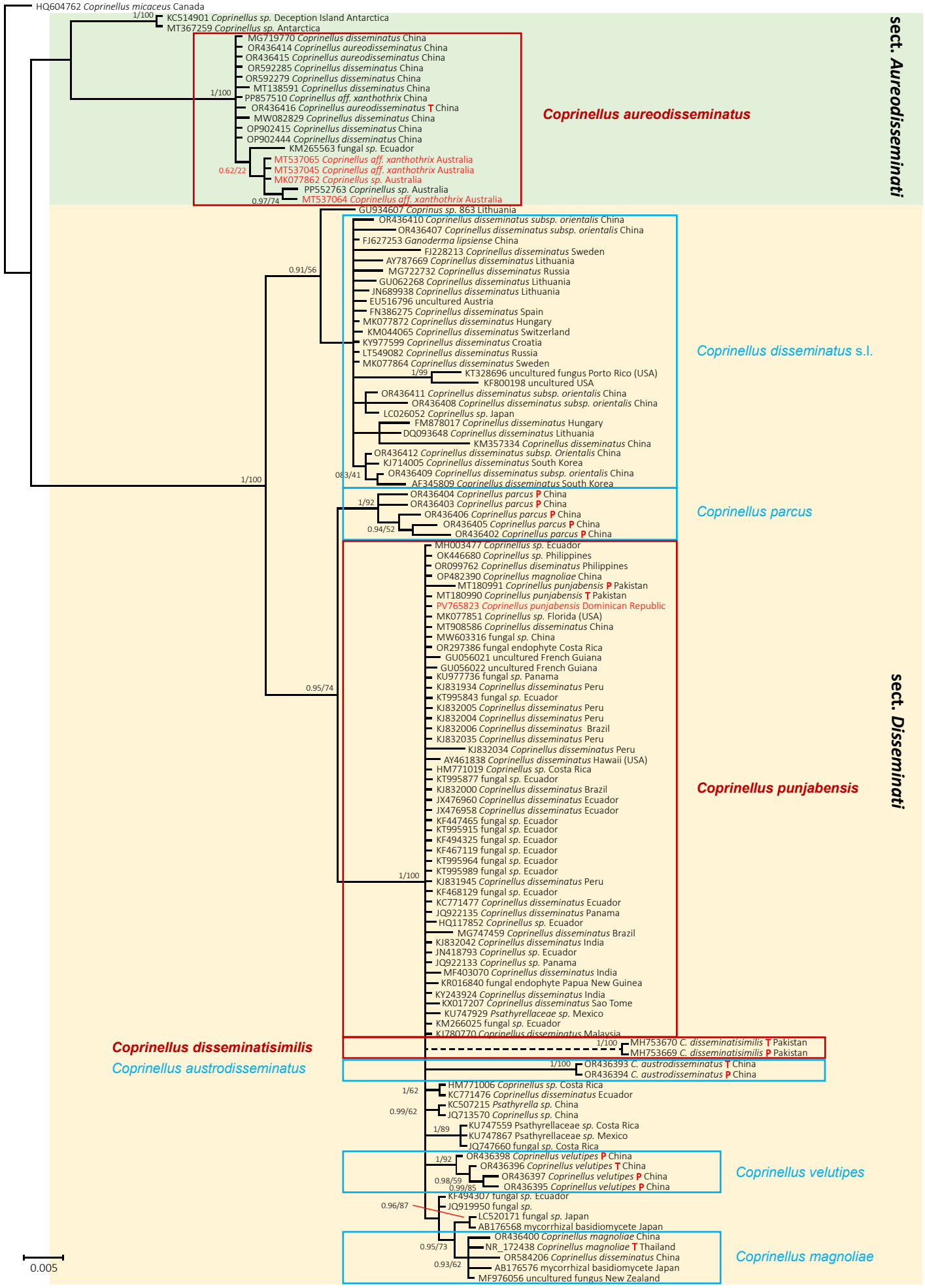
HQ604762 Coprinellus micaceus Canada
1/100
KC514901 Coprinellus sp. Deception Island Antarctica
MT367259 Coprinellus sp. Antarctica
MG719770 Coprinellus disseminatus China
OR436414 Coprinellus aureodisseminatus China
OR436415 Coprinellus aureodisseminatus China
OR592285 Coprinellus disseminatus China
OR592279 Coprinellus disseminatus China
1/100
MT138591 Coprinellus disseminatus China
PP857510 Coprinellus aff. xanthothrix China
OR436416 Coprinellus aureodisseminatus T China
MW082829 Coprinellus disseminatus China
OP902415 Coprinellus disseminatus China
OP902444 Coprinellus disseminatus China
KM265563 fungal sp. Ecuador
MT537065 Coprinellus aff. xanthothrix Australia
0.62/22
MT537045 Coprinellus aff. xanthothrix Australia
MK077862 Coprinellus sp. Australia
PP552763 Coprinellus sp. Australia
0.97/74
MT537064 Coprinellus aff. xanthothrix Australia
Coprinellus aureodisseminatus
sect. Aureodisseminati
GU934607 Coprinus sp. 863 Lithuania
OR436410 Coprinellus disseminatus subsp. orientalis China
OR436407 Coprinellus disseminatus subsp. orientalis China
FJ627253 Ganoderma lipsiense China
FJ228213 Coprinellus disseminatus Sweden
0.91/56
AY787669 Coprinellus disseminatus Lithuania
MG722732 Coprinellus disseminatus Russia
GU062268 Coprinellus disseminatus Lithuania
JN689938 Coprinellus disseminatus Lithuania
EU516796 uncultured Austria
FN386275 Coprinellus disseminatus Spain
MK077872 Coprinellus disseminatus Hungary
KM044065 Coprinellus disseminatus Switzerland
KY977599 Coprinellus disseminatus Croatia
LT549082 Coprinellus disseminatus Russia
MK077864 Coprinellus disseminatus Sweden
1/99
KT328696 uncultured fungus Porto Rico (USA)
KF800198 uncultured USA
OR436411 Coprinellus disseminatus subsp. orientalis China
OR436408 Coprinellus disseminatus subsp. orientalis China
LC026052 Coprinellus sp. Japan
FM878017 Coprinellus disseminatus Hungary
DQ093648 Coprinellus disseminatus Lithuania
KM357334 Coprinellus disseminatus China
OR436412 Coprinellus disseminatus subsp. Orientalis China
KJ714005 Coprinellus disseminatus South Korea
0.83/41
OR436409 Coprinellus disseminatus subsp. orientalis China
AF345809 Coprinellus disseminatus South Korea
Coprinellus disseminatus s.l.
1/100
OR436404 Coprinellus parcus P China
1/92
OR436403 Coprinellus parcus P China
OR436406 Coprinellus parcus P China
0.94/52
OR436405 Coprinellus parcus P China
OR436402 Coprinellus parcus P China
Coprinellus parcus
MH003477 Coprinellus sp. Ecuador
OK446680 Coprinellus sp. Philippines
OR099762 Coprinellus diseminatus Philippines
OP482390 Coprinellus magnoliae China
MT180991 Coprinellus punjabensis P Pakistan
MT180990 Coprinellus punjabensis T Pakistan
PV765823 Coprinellus punjabensis Dominican Republic
MK077851 Coprinellus sp. Florida (USA)
MT908586 Coprinellus disseminatus China
MW603316 fungal sp. China
OR297386 fungal endophyte Costa Rica
GU056021 uncultured French Guiana
GU056022 uncultured French Guiana
KU977736 fungal sp. Panama
0.95/74
KJ831934 Coprinellus disseminatus Peru
KT995843 fungal sp. Ecuador
KJ832005 Coprinellus disseminatus Peru
KJ832004 Coprinellus disseminatus Peru
KJ832006 Coprinellus disseminatus Brazil
KJ832035 Coprinellus disseminatus Peru
KJ832034 Coprinellus disseminatus Peru
AY461838 Coprinellus disseminatus Hawaii (USA)
HM771019 Coprinellus sp. Costa Rica
KT995877 fungal sp. Ecuador
KJ832000 Coprinellus disseminatus Brazil
JX476960 Coprinellus disseminatus Ecuador
JX476958 Coprinellus disseminatus Ecuador
KF447465 fungal sp. Ecuador
KT995915 fungal sp. Ecuador
KF494325 fungal sp. Ecuador
KF467119 fungal sp. Ecuador
KT995964 fungal sp. Ecuador
1/100
KT995989 fungal sp. Ecuador
KJ831945 Coprinellus disseminatus Peru
KF468129 fungal sp. Ecuador
KC771477 Coprinellus disseminatus Ecuador
JQ922135 Coprinellus disseminatus Panama
HQ117852 Coprinellus sp. Ecuador
MG747459 Coprinellus disseminatus Brazil
KJ832042 Coprinellus disseminatus India
JN418793 Coprinellus sp. Ecuador
JQ922133 Coprinellus sp. Panama
MF403070 Coprinellus disseminatus India
KR016840 fungal endophyte Papua New Guinea
KY243924 Coprinellus disseminatus India
KX017207 Coprinellus disseminatus Sao Tome
KU747929 Psathyrellaceae sp. Mexico
KM266025 fungal sp. Ecuador
KJ780770 Coprinellus disseminatus Malaysia
Coprinellus punjabensis
sect. Disseminati
Coprinellus disseminatisimilis
1/100
MH753670 C. disseminatisimilis T Pakistan
MH753669 C. disseminatisimilis P Pakistan
Coprinellus austrodisseminatus
1/100
OR436393 C. austrodisseminatus T China
OR436394 C. austrodisseminatus P China
1/62
HM771006 Coprinellus sp. Costa Rica
KC771476 Coprinellus disseminatus Ecuador
0.99/62
KC507215 Psathyrella sp. China
JQ713570 Coprinellus sp. China
1/89
KU747559 Psathyrellaceae sp. Costa Rica
KU747867 Psathyrellaceae sp. Mexico
JQ747660 fungal sp. Costa Rica
1/92
OR436398 Coprinellus velutipes P China
OR436396 Coprinellus velutipes T China
0.98/59
OR436397 Coprinellus velutipes P China
0.99/85
OR436395 Coprinellus velutipes P China
Coprinellus velutipes
KF494307 fungal sp. Ecuador
0.96/87
JQ919950 fungal sp.
LC520171 fungal sp. Japan
AB176568 mycorrhizal basidiomycete Japan
OR436400 Coprinellus magnoliae China
0.95/73
NR_172438 Coprinellus magnoliae T Thailand
OR584206 Coprinellus disseminatus China
0.93/62
AB176576 mycorrhizal basidiomycete Japan
MF976056 uncultured fungus New Zealand
Coprinellus magnoliae
0.005

Figure 1 (previous page). A 50% ITS rDNA majority rule consensus phylogram of *Coprinellus* focused on sections *Aureodisseminati* and *Disseminati* (with *Coprinellus micaceus* from *Coprinellus* sect. *Micacei* as outgroup) obtained using MrBayes from 1650 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. Sequences newly generated in this study are in red. The letters T and P in bold after a species name stands for Type and Paratype respectively.

Table 1. Data of the collections included in the phylogenetic analysis. Collections treated in this study are written in red. The letters T and P in bold after a species name stand for Type and Paratype respectively. The origin of the vouchers is reported in the phylogram.

species name in GenBank	current name	voucher	ITS
Coprinellus micaceus outgroup		UBC:F19714	HQ604762
C. aureodisseminatus T		HMJAU67119	OR436416
C. aureodisseminatus		HMJAU67120	OR436414
C. aureodisseminatus		HMJAU67121	OR436415
C. austrodisseminatus T		HMJAU67134	OR436393
C. austrodisseminatus P		HMJAU25112	OR436394
C. disseminatus	*C. aureodisseminatus*	420526MF0012	MG719770
C. disseminatus	*C. aureodisseminatus*	218LXJ-4	OR592285
C. disseminatus	*C. aureodisseminatus*	218LXJ-1	OR592279
C. disseminatus	*C. aureodisseminatus*	9Y-G71	MT138591
C. disseminatus	*C. aureodisseminatus*	DJF10	MW082829
C. disseminatus	*C. aureodisseminatus*	RF21	OP902415
C. disseminatus	*C. aureodisseminatus*	MF27	OP902444
C. disseminatus		r11.2	FJ228213
C. disseminatus		olrim955 (SUAS)	AY787669
C. disseminatus		I241	GU062268
C. disseminatus		R175	JN689938
C. disseminatus		aurim1138	DQ093648
C. disseminatus		3515	FN386275
C. disseminatus		SZMC:NL-3401	MK077872
C. disseminatus		4_3_2_3	KM044065
C. disseminatus		DWM51	KM357334
C. disseminatus		66_DS.ST19.IZV1	KY977599
C. disseminatus		F2	LT549082
C. disseminatus		LE-BIN 2127	MG722732
C. disseminatus		SZMC:NL-0786	MK077864
C. disseminatus		SZMC-NL-2337	FM878017
C. disseminatus		KUC11047	KJ714005
C. disseminatus		KACC500820	AF345809
C. disseminatus subsp. orientalis	*C. disseminatus*	HMJAU67127	OR436412
C. disseminatus subsp. orientalis	*C. disseminatus*	HMJAU67128	OR436409
C. disseminatus subsp. orientalis	*C. disseminatus*	HMJAU67129	OR436410
C. disseminatus subsp. orientalis	*C. disseminatus*	HMJAU67131	OR436407
C. disseminatus subsp. orientalis	*C. disseminatus*	HMJAU67130	OR436411
C. disseminatus subsp. orientalis	*C. disseminatus*	HMJAU22008	OR436408
C. disseminatus	*C. punjabensis*	CVS19	OR099762

species name in GenBank	current name	voucher	ITS
C. disseminatus	*C. punjabensis*	MS423	KJ831934
C. disseminatus	*C. punjabensis*	PNB034B	KJ832005
C. disseminatus	*C. punjabensis*	PNB034A	KJ832004
C. disseminatus	*C. punjabensis*	PNB034D	KJ832006
C. disseminatus	*C. punjabensis*	Otu0211	MT908586
C. disseminatus	*C. punjabensis*	TC198	KJ832034
C. disseminatus	*C. punjabensis*	TC222	KJ832035
C. disseminatus	*C. punjabensis*	SFSU MRK18	AY461838
C. disseminatus	*C. punjabensis*	NHB64	KJ832000
C. disseminatus	*C. punjabensis*	E12507B	JX476958
C. disseminatus	*C. punjabensis*	E12515B	JX476960
C. disseminatus	*C. punjabensis*	MS547	KJ831945
C. disseminatus	*C. punjabensis*	CEQCA-M1203	KC771477
C. disseminatus	*C. punjabensis*	B1b085-5-P302	JQ922135
C. disseminatus	*C. punjabensis*	AS02AmareloMQ	MG747459
C. disseminatus	*C. punjabensis*	TC6	KJ832042
C. disseminatus	*C. punjabensis*	-	KY243924
C. disseminatus	*C. punjabensis*	A2S6-11	KJ780770
C. disseminatus	*C. punjabensis*	CEQCA-M1202	KC771476
C. disseminatus	*C. punjabensis*	BAP 608 (SFSU)	KX017207
C. disseminatus	*C. punjabensis*	GKVK-15	MF403070
C. disseminatus	*C. magnoliae*	DJL1	OR584206
C. magnoliae T		MFLUCC 18-0942	NR_172438
C. magnoliae		HMJAU49305	OR436400
C. magnoliae	*C. punjabensis*	WZ-485	OP482390
C. parcus P		HMJAU46320	OR436402
C. parcus P		HMJAU46323	OR436403
C. parcus P		HMJAU46315	OR436404
C. parcus P		HMJAU67133	OR436405
C. parcus P		HMJAU67132	OR436406
C. punjabensis T		LAH35321_MU30	MT180990
C. punjabensis P		LAH36392_MU58	MT180991
C. punjabensis		ANGE1988	PV765823
C. sp.	*C. aureodisseminatus*	PERTH:E8297	MK077862
C. sp.	*C. aureodisseminatus*	TLO-4A	PP552763
C. sp.	*C. disseminatisimilis T*	Coprinellus_sp._Cr_3wT	MH753670
C. sp.	*C. disseminatisimilis P*	Coprinellus_sp._Cr_3b	MH753669
C. sp.	*C. disseminatus*	MA-1	LC026052
C. sp.	*C. punjabensis*	BOP235AH	MH003477
C. sp.	*C. punjabensis*	SJ13	OK446680
C. sp.	*C. punjabensis*	MICH:232898	MK077851
C. sp.	*C. punjabensis*	INBio3713C	HM771019
C. sp.	*C. punjabensis*	E8514c	HQ117852
C. sp.	*C. punjabensis*	E10216b	JN418793
C. sp.	*C. punjabensis*	P1057-2-PD1	JQ922133

species name in GenBank	current name	voucher	ITS
C. sp.	*C. punjabensis*	INBio3081K	HM771006
C. sp.	*C. punjabensis*	M-15	JQ713570
C. sp.		2Di102-1	KC514901
C. sp.		HSXSD-10	MT367259
C. velutipes T		HMJAU67124	OR436396
C. velutipes P		HMJAU67123	OR436398
C. velutipes P		HMJAU67125	OR436397
C. velutipes P		HMJAU67126	OR436395
C. aff. *xanthothrix*	*C. aureodisseminatus*	60CN1	PP857510
C. aff. *xanthothrix*	*C. aureodisseminatus*	PERTH08871604 (NLB1363)	MT537065
C. aff. *xanthothrix*	*C. aureodisseminatus*	PERTH07699182 (E8297)	MT537045
C. aff. *xanthothrix*	*C. aureodisseminatus*	PERTH08871590 (NLB1361)	MT537064
Coprinus sp.	*Coprinellus sp.*	863	GU934607
fungal endophyte	*C. punjabensis*	754	KR016840
fungal endophyte	*C. punjabensis*	SM2S2N2_3	OR297386
fungal *sp.*	*C. aureodisseminatus*	E14512I	KM265563
fungal *sp.*	*C. punjabensis*	N4 III (1-3)	MW603316
fungal *sp.*	*C. punjabensis*	ARIZ:PS0352	KU977736
fungal *sp.*	*C. punjabensis*	E12011A	KT995843
fungal *sp.*	*C. punjabensis*	E12123L	KT995877
fungal *sp.*	*C. punjabensis*	E13018D	KF447465
fungal *sp.*	*C. punjabensis*	E13223D	KT995915
fungal *sp.*	*C. punjabensis*	E13528A	KF494325
fungal *sp.*	*C. punjabensis*	E13609E	KF467119
fungal *sp.*	*C. punjabensis*	E13735A	KT995964
fungal *sp.*	*C. punjabensis*	E13918A	KT995989
fungal *sp.*	*C. punjabensis*	E12909G	KF468129
fungal *sp.*	*C. punjabensis*	E15418I	KM266025
fungal *sp.*	*C. sp.*	E13509F	KF494307
fungal *sp.*	*C. sp.*	MS66c	JQ919950
fungal *sp.*	*C. sp.*	F138	JQ747660
fungal *sp.*	*C. sp.*	E333	LC520171
Ganoderma lipsiense	*C. disseminatus*	Cui5604	FJ627253
mycorrhizal basidiomycete	*C. magnoliae*	KA3-1	AB176576
mycorrhizal basidiomycete	*C. sp.*	ME1-1	AB176568
Psathyrella sp.	*C. punjabensis*	AX136	KC507215
Psathyrellaceae sp.	*C. punjabensis*	F2173	KU747929
Psathyrellaceae sp.	*C. sp.*	F0138	KU747559
Psathyrellaceae sp.	*C. sp.*	F2047	KU747867
Uncultured *Coprinellus*	*C. disseminatus*	IVN4-13	EU516796
Uncultured fungus		OTU_F263_R399	MF976056
Uncultured fungus	*C. disseminatus*	OTU 209	KT328696
Uncultured fungus	*C. disseminatus*	CMH107	KF800198
Uncultured *Psathyrellaceae*	*C. punjabensis*	1.3_I2	GU056021
Uncultured *Psathyrellaceae*	*C. punjabensis*	6.1_I1	GU056022

MATERIALS AND METHODS

Samples analysed

Morphological and molecular analyses were attempted on two *Coprinellus* samples, one from the Dominican Republic and another one from Australia. They are deposited in the herbaria of the Padova Botanical Garden at the University of Padova, Italy (herbarium code PAD) and in the Western Australian Herbarium, Perth, Australia (herbarium code PERTH).

All additional sequences used in the phylogenetic analyses were retrieved from GenBank. The analysis is shown in the phylogram of Figure 1, while all samples analysed are listed in Table 1.

Morphology

Fresh basidiomes of *Coprinellus punjabensis* were photographed in situ by C. Angelini using a digital camera Nikon Coolpix 8400 and immediately dried; while microscopic characters were studied and described by P. Voto after reviving dried collections with 10% NH4OH or 30% NH4OH and using Congo red as mounting medium for imaging. N. Bougher photographed fresh basidiomes of *Coprinellus aureodisseminatus* using a digital Canon SLR camera, and studied microscopic characters of dried material after reviving material with 3% KOH.

In the description of the basidiospores numbers in square brackets represent, in order, the total amount of spores measured, the number of basidiocarps, and the number of collections examined. Basidiospore dimensions were recorded as (a) b – c (d), where a = absolute minimum value, range b – c contains at least 90% of the calculated values, and d = absolute maximum value; Q indicates individual spore length to width ratios. In tridimensional spores measures are reported as length × breadth in front view × breadth in side view. Fungal species names with authorities follow MycoBank (http://www.MycoBank.org) (Crous *et al.* 2004).

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.

Sequence alignment and phylogenetic analyses

A single dataset was built using ITS rDNA sequences of genus *Coprinellus* sect. *Disseminati* (using *C. micaceus* as outgroup). BLASTn (Altschul et al. 1990) was used to select the most closely related sequences from the International Nucleotide Sequence Database Collaboration public database (INSDC, Arita et al. 2021) and Unite (Nilsson et al. 2018). 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 (single partition, 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 12.75 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

Phylogeny

In our ITS phylogenetic analysis all Australian collections of *Coprinellus aureodisseminatus* form an autonomous subclade sister to that of the Chinese collections. This may suggest the possible evolution of an isolated form or a speciating variety. However, the values at the node of that subclade are poorly supported (0.62/22). Similarly, in the two-gene analysis, ITS and LSU, by Zhu & Bau (2024) the same vouchers are also placed in their own separate subclade.

The phylogenetic analysis shows that our Dominican collection of *Coprinellus punjabensis*, ANGE1988, has a 99% – 100% identity with several other collections from the tropical and subtropical American areas (Brazil, Costa Rica, Ecuador, French Guyana, Hawaii, Mexico, Panama, Peru, Florida). However, the phylogenetic tree

does not construct an isolated clade around our voucher and, instead, it places it, with an identity range between 98.17% – 99.84%, alongside other vouchers from different regions [China, India, Malaysia, Pakistan (locus typicus, 98.17% identity with our voucher), Papua New Guinea, Philippines]. The concept that arises from the phylogenetic analysis seems to be that *Coprinopsis punjabensis* is a widespread species spanning the whole belt of tropical and subtropical regions with the probable evolution of local forms.

TAXONOMY

Coprinellus aureodisseminatus T. Bau & L.Y. Zhu (Fig. 2–5)
Mycology 15(3): 440 (2024)

Figure 2. *Coprinellus aureodisseminatus* PERTH 07699182 N.L. Bougher

Macroscopic characters

Pileus 7 – 15 mm broad (at maturity), cylindrical or barrel-shaped when young, becoming convex or campanulate; surface soon becoming radially sulcate, at first pale blonde with persistently dark tan brown centre then radially brown on the ridges and pale in furrows, eventually becoming pale grey from margin inwards; margin scalloped when young, not usually uplifting, eventually often deeply split. Veil composed of low piles of glistening spherical granules over entire young pileus, soon breaking up into scattered easily removed small patches.

Lamellae adnexed, to 3 mm deep, smooth-edged, cream then pale grey, finally dark grey with brown tinge, developing a black edge but not copiously deliquescent.

Stipe 20 – 35 × 1 – 5 mm, cylindrical; young stipe densely covered with soft fine white hairs, later with only scattered hairs near the stipe apex; overall white, dulling slightly with age; base with basal tufts of strigose hairs, and sometimes with an indistinct basal ring with velar particles underneath.

Ozonium tufts of strigose hairs at the stipe base comprised of red-brown/bronze sharp-pointed soft flexible hairs up to 2 (4) mm; sometimes also present are patches of rust-coloured mycelial mats on the substrate.

Context concolorous with stipe surface; odour not distinctive. *Spore print* purplish-black.

Figure 3. *Coprinellus aureodisseminatus* PERTH 07699182 with a detail of the stipe base N.L. Bougher

Figure 4. *Coprinellus aureodisseminatus* PERTH 08871604 N.L. Bougher

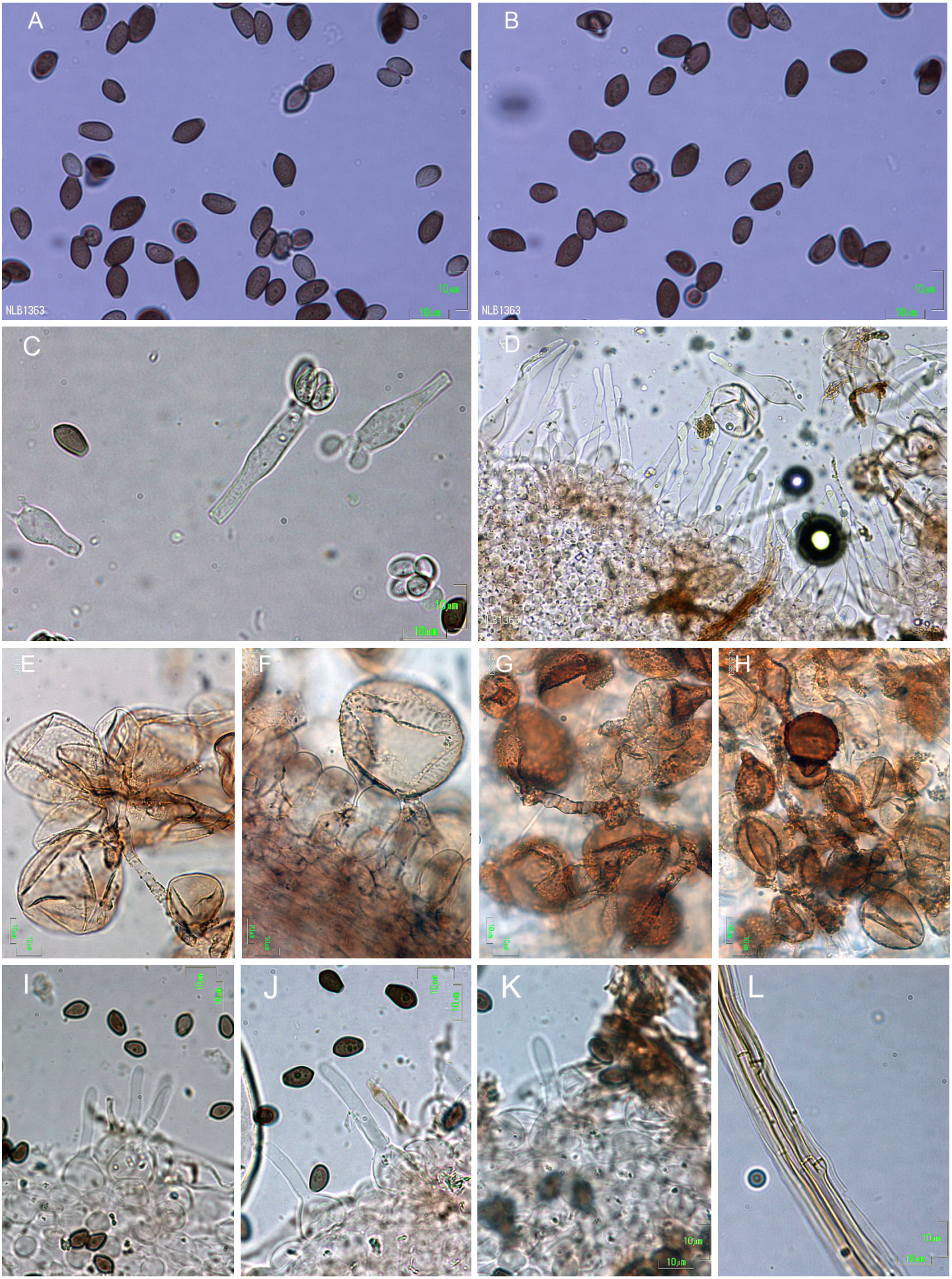

Fig. 5. *Coprinellus aureodisseminatus*. A-B: Spores; C: Basidia; D: Cheilocystidia; E-F: Veil on pileus; G-H: Veil on stipe; I-J-K: Pileocystidia; L: Hyphae of the ozonium. A-B-C-D-E-F-G-H-L: from NLB1363; I-J-K: from NLB1755

Microscopic characters

Basidiospores [30, 1, 1] 8.0 – 10.9 × 5.0 – 7.0 × 4.9 – 6.2 µm, mean 9.4 – 9.5 × 5.8 × 5.4 µm, Q = 1.50 – 1.79 × 1.60 – 1.92, Q mean 1.62 × 1.75; in face view ovoid to elliptic or occasionally submitriform, base obtuse to subconical, in side view elliptic to subamygdaliform; pale to dark brownish-grey in 5% KOH, smooth-walled; germ pore central, truncate, up to 2.0 µm wide.

Basidia (length of sterigmata included) trimorphic; squat clavate and 17.5 – 23.0 × 6.6 – 7.8 µm, mean 19.3 × 7.4 µm, slender cylindrical to utriform (with elongate, 2.3 – 3.5 µm wide peduncle) and 26.0 – 40.0 × 5.9 – 7.6 µm, mean 31.9 × 6.6 µm; four-spored; sterigmata up to 3 µm long. Basidioles 15.0 – 18.0 × 7 – 10 µm, oblong to broadly clavate.

Cheilocystidia 50.0 – 90.0 × 5.0 – 6.5 µm at apex, lageniform with long cylindrical or slightly tapered upper part, unswollen apex, and with swollen base 15 – 20 µm long x 10 – 15 µm wide subtended by a short narrow pedicel; thin-walled, occurring amid basidia.

Pleurocystidia absent.

Pileipellis a hymeniderm of clavate to pyriform or vesiculose/subglobose cells 30.0 – 50.0 × 20.0 – 30.0 µm.

Pileocystidia 32 – 42 × 10 – 13 µm at the ventricose base, lageniform with an elongate, cylindrical, 3 – 4 µm wide neck; infrequent - observed near pileus margin of young specimens, not found in old specimens.

Veil (observed on pileipellis and at base of stipe) dominated by abundant globose and subglobose (less often pyriform) cells 30.0 – 80.0 µm wide; these include thick-walled orange-brown cells encrusted with flat-topped warts up to 2 µm tall, and thinner-walled partly collapsing less coarsely ornamented cells; ornaments not dissolving in 5% KOH; some cells subtended by a short septate hypha up to 6 µm wide; infrequent extended interconnecting hyphae and short chains of swollen elements observed.

Caulocystidia 40.0 – 100.0 × 4.0 – 7.5 µm, lageniform with long cylindrical or slightly tapering upper part; sparsely scattered in mature stipe.

Basal strigose hairs comprised of tightly-packed parallel bundles of septate, brown, smooth-walled, thick- to slightly thick-walled hyphae 2.0 – 5.0 µm wide.

Clamp connections absent.

Habitat in Australia: in southern Australian *Eucalyptus* forests and woodlands, in clusters on rotting wood or woody debris and soil.

Collections examined

Australia, Western Australia, Bold Park, approx. 15 m S of Ecology Centre building, Perry Lakes Drive, City Beach, Lat.: 31° 56’ 23.3 S, Long.: 115° 46’ 54.3” E; under a young planted eucalypt, amid and attached to woodchips, 28 May 2016, *legit N.L. Bougher NLB1361* (PERTH 08871590); GenBank MT537064 - ITS+nLSU;

Australia, Western Australia, Bold Park, N of Tuart carpark, Perry Lakes Drive, City Beach, Lat.: 31° 56’ 31.1’’ S, Long.: 115° 46’ 46” E; in woody humus amid old woodchips, 2 June 2016, *legit N.L. Bougher NLB1363* (PERTH 08871604); GenBank MT537065 - ITS+nLSU;

Australia, Western Australia, Bold Park, Camel Lake area - east of lake across trail, City Beach, Lat.: -31.94666667, Long.: 115.7788889; in clusters and singly on moss-covered rotting burnt log of *Eucalyptus gomphocephala*, 27 July 2005, *legit N.L. Bougher E8297* (PERTH 07699182); GenBank MT537045 and MK077862 - ITS+nLSU;

Australia, Western Australia, Bold Park, S of the eastern path leading up to Reabold Hill, City Beach, Lat.: 31° 56’ 24.2’’ S, Long.: 115° 46’ 47.8” E; in a crowded cluster in ash-rich soil - bases attached to soil and to bits of wood, in area burnt 7 months earlier, 5 August 2022, *legit N.L. Bougher NLB1785* (PERTH 09589597);

Australia, Western Australia, Bold Park, approx. 100 m N of Camel Lake carpark, Bold Drive, City Beach, Lat.: 31° 56’ 46.3’’ S, Long.: 115° 46’ 48.5” E; on well-rotted (perhaps burnt?) wood encased with soil at base of *Eucalyptus gomphocephala* tree, 18 June 2022, *legit N.L. Bougher NLB1755* (PERTH 09589694);

Australia, Western Australia, Bold Park, Camel Lake area, City Beach, Lat.: 31° 56’ 55’’ S, Long.: 115° 46’ 46.5” E; in decomposing litter and bark, 24 June 2008, *legit N.L. Bougher & E. Davison BOU0044* (PERTH 08072809);

Australia, Western Australia, Worsley Alumina Pty Ltd, Bauxite Mine, Boddington, Lat.: --32.93333333, Long.: 116.46666667; on soil in rehabilitated forest 1990, 5 June 2001, *legit N.L. Bougher & E. Sarrionandia E6668* (PERTH 07674724);

Australia, Western Australia, Tinglewood Road, west of Walpole, Lat.: -34.98333333,Long.: 116.65; on rotting wood and surrounding soil in burnt forest (*Eucalyptus jacksonii*), 5 June 1995, *legit N.L. Bougher E5415* (PERTH 07551711). Morphological details of this collection are described and illustrated in Bougher & Syme (1998) as '*Coprinus sp.* (section *Micaceus*, stirps *Domesticus*)';

Australia, Western Australia, 500 m W of Flybrook Road on Tank Road, Flybrook Forest Block, (Flybrook plot 17), Lat.: 34º 28' 35" S, Long.: 115º 51' 20" E; in *Eucalyptus diversicolor* forest (regen. 1972 & burnt Dec. 1997), 20 May 1998, *legit R.M. Robinson FF169* (PERTH 04579054);

Australia, Western Australia, 1.2 km on Gobblecannup Road, SE of Strachan Road, 6.5 km SSE of Beard Tower, Gobblecannup Forest Block, (Plot 13), Lat.: 34º 28' 40 S, Long.: 116º 27' 15" E; in *Eucalyptus diversicolor* forest (regen. 1979 & burnt Dec. 1997), 13 July 1998, *legit R.M. Robinson FF426* (PERTH 05339944).

NOTES

Coprinellus aureodisseminatus is characterized by presence of infrequent pileocystidia (at least in Australian collections; Zhu & Bau 2024 do not mention their frequency) lageniform in shape and with an elongate slender neck, basically bidimensional spores of medium size with a more or less conical base and partially with an oval-submitriform shape in front view, 4-spored basidia, absence of clamps, only lageniform cheilocystidia (none observed with swollen apex in our Australian collections, sometimes so by Zhu & Bau 2024), and habitat on woody material.

Morphologically, with this set of characters *Coprinellus aureodisseminatus* can be clearly distinguished from all other species of *Coprinellus*. Even in a potential situation where pileocystidia were not observed in a collection, it could not be misidentified as any species of *Coprinellus* sect. *Domestici* s.l. (which are without caulocystidia) or as any species of *Coprinellus* sect. *Micacei* s.l. (where the presence of an ozonium is unknown).

Prior to the formal designation of *Coprinellus aureodisseminatus* by Zhu &Bau (2024), Australian collections of this species had already previously been referred to as '*Coprinus sp.* (section *Micaceus*, stirps *Domesticus*)' (Bougher & Syme 1998 – description based on PERTH 07551711), and as '*Coprinellus cf. xanthothrix*' (Bougher & Barrett 2020). Zhu &Bau (2024) commented that this species might have a widespread presence in subtropical or tropical areas. Based on the records so far it seems likely that *Coprinellus aureodisseminatus* also occurs widely throughout temperate southern Australia.

The Australian collections of *Coprinellus aureodisseminatus* exhibit some noteworthy features augmenting those described for Chinese collections by Zhu & Bau (2024). The habitat of the Australian collections includes recently burnt areas as well as unburnt areas. Unlike as described for the Chinese description, some elements of the veil in the Australian collections are encrusted with flat-topped warts (Figure 5e-h). Pileocystidia are infrequent in the Australian collections, and have been observed only near the pileus margin in some of the collections examined to date. The Australian collections have at least some spores with a submitriform shape in front view, while Zhu & Bau (2024) describe the spores of Chinese collections as oval. All of the Australian collections of *C. aureodisseminatus* examined to date have tufts of red-brown strigose hairs around the stipes, ranging from few to many. Some of the Australian collections also have well developed rusty-coloured ozonium mats, e.g. collection PERTH 07699182 displayed abundant conspicuous tufts of hairs, as well as rusty-coloured carpet-like mycelial mats widely spread over a rotting burnt *Eucalyptus* log (Figures 2 and 3). In this case, dense rust-coloured mycelial mats firstly developed on the wood. Then some coarser mycelium and darker red-brown strigose hairs formed upon the mats. Basidiomes emerged from amongst the earlier-developed mats and hairs (Figure 3).

Further studies on more collections of *C. aureodisseminatus* from different geographical regions and habitats will be required to assess the breadth and consistency of such features.

Coprinellus punjabensis Usman & Khalid (Fig. 6-8)

Fungal Diversity 111: 266 (2021)

Figure 6. *Coprinellus punjabensis* PAD H0062395 C. Angelini

Figure 7. *Coprinellus punjabensis* PAD H0062395 C. Angelini

Figure 8. *Coprinellus punjabensis* PAD H0062395 C. Angelini

Macroscopic characters

Pileus 5.5 – 12 mm, conical with obtuse to umbonate or flattened centre, sulcate to centre; white to pale grey, centre concolorous or pale brownish; covered by a minute and easily lost pubescence; macroscopically barren of any ornamentation and veil remains.

Lamellae distant to subdistant, with 0-3 lamellulae, adnexed, greyish, not deliquescent.

Stipe 12 – 30 × 0.7 – 1.7 mm, cylindric, slightly tapering toward apex and slightly enlarged toward base; white; smooth or almost so in the upper half, bearing a fugacious flocculose-pubescent covering in the lower half of young specimens, base strongly mycelial-strigose.

Microscopic characters

Basidiospores [30, 1, 1] 8.0 – 10.9 × 5.0 – 7.0 × 4.9 – 6.2 µm, mean 9.4 – 9.5 × 5.8 × 5.4 µm, Q = 1.50 – 1.79 × 1.60 – 1.92, Q mean 1.62 × 1.75; in face view ovoid to elliptic or occasionally submitriform, base obtuse to subconical, in side view elliptic to subamygdaliform; pale to dark brownish-grey in 5% KOH, smooth-walled; germ pore central, truncate, up to 2.0 µm wide.

Basidia (length of sterigmata included) trimorphic; squat clavate and 17.5 – 23.0 × 6.6 – 7.8 µm, mean 19.3 × 7.4 µm, slender cylindrical to utriform (with elongate, 2.3 – 3.5 µm wide peduncle) and 26.0 – 40.0 × 5.9 – 7.6 µm, mean 31.9 × 6.6 µm; four-spored; sterigmata up to 3 µm long. Basidioles 15.0 – 18.0 × 7 – 10 µm, oblong to broadly clavate.

Cheilocystidia 50.0 – 90.0 × 5.0 – 6.5 µm at apex, lageniform with long cylindrical or slightly tapered upper part, unswollen apex, and with swollen base 15 – 20 µm long x 10 – 15 µm wide subtended by a short narrow pedicel; thin-walled, occurring amid basidia.

Pleurocystidia absent.

Pileipellis a hymeniderm of clavate to pyriform or vesiculose/subglobose cells 30.0 – 50.0 × 20.0 – 30.0 µm.

Pileocystidia 32 – 42 × 10 – 13 µm at the ventricose base, lageniform with an elongate, cylindrical, 3 – 4 µm wide neck; infrequent - observed near pileus margin of young specimens, not found in old specimens.

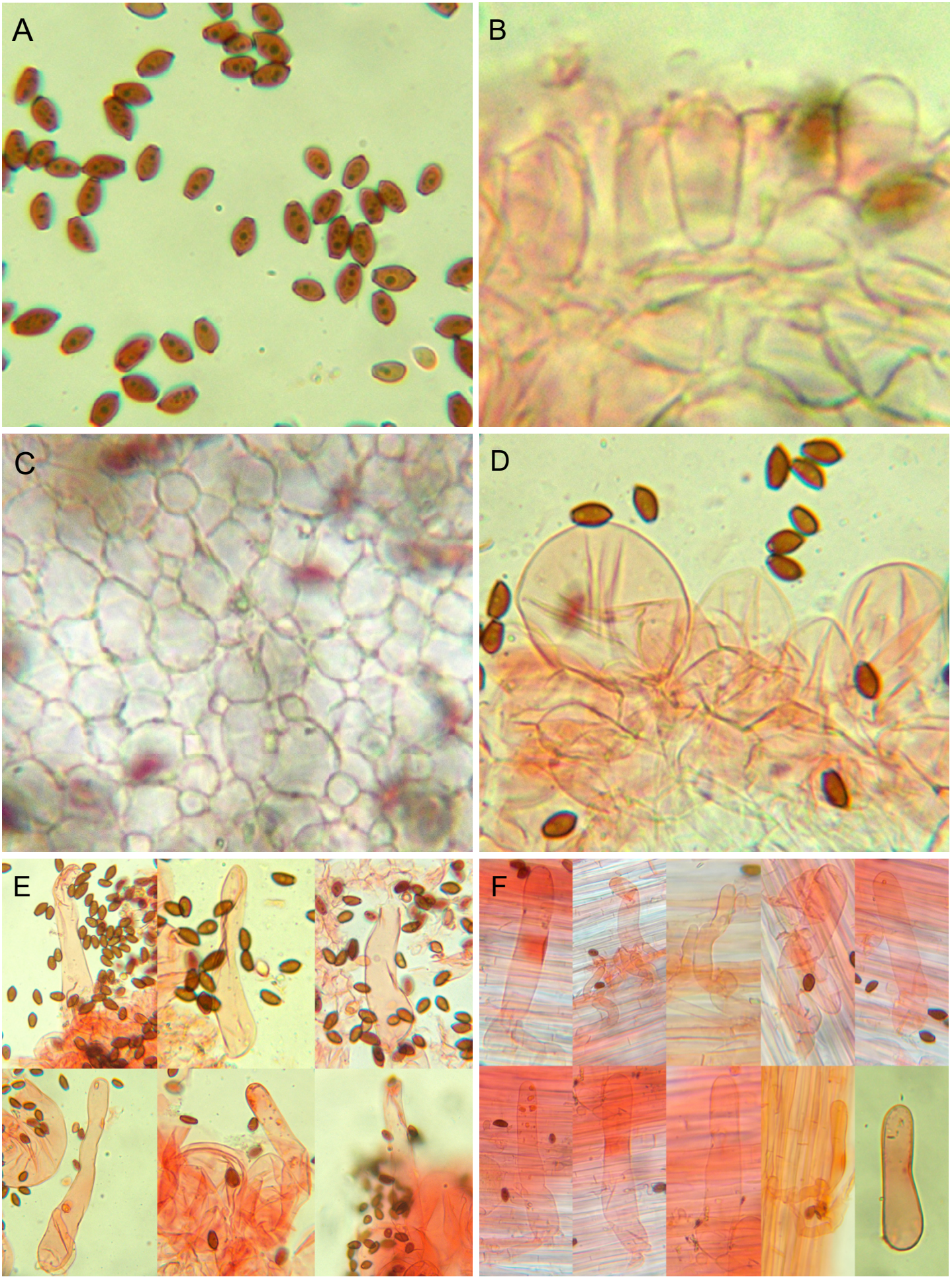

Fig. 8. *Coprinellus punjabensis* PAD H0062395. A: Spores; B: Basidia and subhymenium; C: Hymenophysalides; D: Pileipellis; E: Pileocystidia; F: Caulocystidia

Veil (observed on pileipellis and at base of stipe) dominated by abundant globose and subglobose (less often pyriform) cells 30.0 – 80.0 µm wide; these include thick-walled orange-brown cells encrusted with flat-topped warts up to 2 µm tall, and thinner-walled partly collapsing less coarsely ornamented cells; ornaments not dissolving in 5% KOH; some cells subtended by a short septate hypha up to 6 µm wide; infrequent extended interconnecting hyphae and short chains of swollen elements observed.

Caulocystidia 40.0 – 100.0 × 4.0 – 7.5 µm, lageniform with long cylindrical or slightly tapering upper part; sparsely scattered in mature stipe.

Basal strigose hairs comprised of tightly-packed parallel bundles of septate, brown, smooth-walled, thick- to slightly thick-walled hyphae 2.0 – 5.0 µm wide.

Clamp connections absent.

Habitat and collection examined: Dominican Republic, Puerto Plata, Cabarete, Sea Horse Ranch; densely gregarious and caespitose on deteriorated trunks on the ground of a coastal forest with almond trees and other broadleaf trees,4 February 2024, *legit C. Angelini (ANGE1988)*, PAD H0062395; GenBank PV765823 - ITS.

NOTES

All characters of this collection make it a typical representative of the fairy inkcap (*Coprinellus disseminatus*) morphological complex. The only partially deviating parameters are the pileocystidia found very scattered (but perhaps simply already lost), and the caulocystidia mostly found only on the lower half of the stipe and well visible only in young specimens. The lesser conspicuousness of both these types of cystidia is the most evident morphological difference from the typical *C. disseminatus* and is distinctly perceivable macroscopically when comparing the pileus and stipe ornamentation of both species (compare with the photograph of a typical *C. disseminatus* collection, Fig. 9).

The original description of *Coprinellus punjabensis* makes no mention at all of cystidia on pileus and stipe (Boonmee *et al*. 2021).

Figure 9. *Coprinellus disseminatus* PAD 00623975 November 2015 Nordio forest (Italy) P. Voto

Coprinellus disseminatisimilis S. Hussein
Mycokeys 39:51 (2018)

NOTES

Due to the correspondence of the climatic and geographic region, we have examined Pegler's descriptions of *Coprinus disseminatus* from Central African countries (Pegler 1966, 1977) and from the Lesser Antilles (Pegler 1983), the latter varying from the former only by virtue of a slightly different spore range. All these descriptions differ from the true *Coprinellus disseminatus* of the temperate regions and from *Coprinellus punjabensis* by the presence of cheilocystidia. They also differ from *C. punjabensis* by having thin-walled pileocystidia.

When we browse these Pegler's descriptions as represented in Voto's (2020) world key we find a full morphological match with *C. disseminatisimilis*, described from Pakistan (Hussain *et al*. 2018). Voto (2020, Key to *Psathyrellaceae* - version 2020.II.20) had already synonymized with this Pakistani taxon a well documented description from Hawaii by Keirle, Hemmes & Desjardin (2004) which had been identified as *Coprinellus disseminatus*.

Now we also recognize a strong conformity with the descriptions by Pegler (1977, 1983) mentioned above. Like *Coprinellus punjabensis*, *Coprinellus disseminatisimilis* is widely distributed in (sub) tropical areas covering Asia, Africa and the tropical regions of Central America (inclusive of Hawaii). Among the various species of the fairy inkcap morphological complex, *Coprinellus disseminatisimilis* is particularly distinguished by thin-walled pileocystidia, presence of abundant cheilocystidia and uncinate-subdecurrent gill attachment.

Pegler (1997) also mentions *Coprinus disseminatus* from Southern Brazil, and we suggest that this is likely to be referable to *C. disseminatisimilis*. However, this cannot be confirmed because the Brazilian collection is only included in a dichotomous key without offering the necessary morphological data required to accurately determine its identity.

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