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RESEARCH ARTICLE

Catalogue of fungi in China 1. New taxa of plant-inhabiting fungi

Shi-Liang Liu[a], Peng Zhao[a], Lei Cai[a], Shan Shen[a,b], Hao-Wen Wei[a,c], Qin Na[d], Menghui Han[d], Renxiu Wei[d], Yupeng Ge[e], Haixia Ma[f], Samantha Chandranath Karunarathna[g,h], Saowaluck Tibprommab[g], Bo Zhang[i], Dan Dai[i,j], Lu Lin[k], Xin-Lei Fan[k], Zong-Long Luo[l], Hong-Wei Shen[l,m,n], Li Lu[g,m], Wenhua Lu[g], Rui-Fang Xu[g,m,n], Ablat Tohtirjap[o], Fang Wu[o] and Li-Wei Zhou[a]

[a]State Key Laboratory of Mycology, Institute of Microbiology, Chinese Academy of Sciences, Beijing, China; [b]University of Chinese Academy of Sciences, Beijing, China; [c]College of Life Science, Liaoning University, Shenyang, China; [d]School of Agriculture, Ludong University, Yantai, China; [e]Institute of Edible Fungi, Fujian Academy of Agricultural Sciences, National and Local Joint Engineering Research Center for Breeding & Cultivation of Features Edible Fungi, Fuzhou, China; [f]Institute of Tropical Bioscience and Biotechnology, Chinese Academy of Tropical Agricultural Sciences, Hainan Key Laboratory of Tropical Microbe Resources, Haikou, China; [g]Center for Yunnan Plateau Biological Resources Protection and Utilization, Yunnan Engineering Research College of Biological Resource and Food Engineering, Qujing Normal University, Qujing, China; [h]National Institute of Fundamental Studies (NIFS), Kandy, Sri Lanka; [i]Engineering Research Center of Edible and Medicinal Fungi, Chinese Ministry of Education, Jilin Agricultural University, Changchun, China; [j]Institute of Agricultural Applied Microbiology, Jiangxi Academy of Agricultural Sciences, Nanchang, China; [k]The Key Laboratory for Silviculture and Conservation of Ministry of Education, Beijing Forestry University, Beijing, China; [l]College of Agriculture and Biological Science, Dali University, Dali, China; [m]Center of Excellence in Fungal Research, Mae Fah Luang University, Chiang Rai, Thailand; [n]School of Science, Mae Fah Luang University, Chiang Rai, Thailand; [o]School of Ecology and Nature Conservation, Beijing Forestry University, Beijing, China

ABSTRACT
China has a huge area of diverse landscapes and is believed to conceive incredibly high fungal diversity. To systematically and promptly report Chinese fungal species, we initiate the series of *Catalogue of fungi in China* here. In the first paper of this series, we focus on plant-inhabiting fungi. A total of 33 new taxa are described all over China. These taxa include two new genera, viz. *Cremeoefibula* and *Nothopucciniastrum*, 18 new species, viz. *Annulohypoxylon lancangensis*, *Ascotaiwania coffeae*, *Clitocella neofallax*, *Coleopuccinia yunnanensis*, *Cremeoefibula hengduanensis*, *Crepidotus furcaticystidiosus*, *C. tomentellus*, *Diachea macroverrucosa*, *Helicogloea hangzhouensis*, *Hyalopsora caprearum*, *Nemania polymorpha*, *Phanerochaetella austrosinensis*, *Physalacria tianzhongshanensis*, *Setophaeosphaeria panlongensis*, *Subulicystidium boreale*, *Trechispora subaraneosa*, *Vikalpa dujuanhuensis*, and *Xylaria pteridicola*, and 13 new combinations, viz. *Nothopucciniastrum actinidiae*, *N. boehmeriae*, *N. coriariae*, *N. corni*, *N. coryli*, *N. fagi*, *N. kusanoi*, *N. hikosanense*, *N. hydrangeae-petiolaris*, *N. miyabeanum*, *N. styracinum*, *N. tiliae*, and *N. yoshinagae*. The morphological characteristics and phylogenetic evidence are used to support the establishment of these new taxa and the accuracy of their taxonomic placements. We hope that the series of *Catalogue of fungi in China* will contribute to Chinese fungal diversity and promote the significance of recording new fungal taxa from China.

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1. Introduction

It is estimated that 2.2–3.8 million fungal species exist worldwide; however, less than 10% of the estimated species are currently recorded (Hawksworth et al. 2017). Therefore, as one important group of strategic biological resources (Bai et al. 2023), fungi, generally comprising Fungi, slime moulds, and oomycetes, deserve more attention, and much more efforts need to be made by global mycologists to recognise, utilise, and conserve fungal resources.

China has a vast area of territory and possesses highly diverse landscapes ranging from boreal to tropical zones. It is expected that a huge number of fungi exist in China. Indeed, Chinese mycologists have contributed significantly to fungal diversity in China as well outside China for the last decades (Wang and Cai 2023). The number of new fungal taxa described from China accounts for almost 7% of global recorded species, occupying the second highest worldwide. In addition, the taxonomic frameworks of certain important fungal groups have been updated by Chinese mycologists

CONTACT Li-Wei Zhou liwei_zhou1982@im.ac.cn State Key Laboratory of Mycology, Institute of Microbiology, Chinese Academy of Sciences, NO.1 Beichen West Road, Chaoyang District, Beijing 100101, China

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(Wang et al. 2021, 2023; Liu et al. 2022, 2023; Bao et al. 2023). Moreover, a series of Flora Fungorum Sinicorum (more than 60 volumes), and many other monographs focusing on special fungal groups (e.g. Li and Yang 2021) and Chinese localities (e.g. Liu et al. 2023) have been published. Nevertheless, although books can systematically summarise fungal diversity, papers normally with a short publication cycle will report new taxa much more rapidly. However, most taxonomic papers reported less than 10 new taxa from China in a single paper. This phenomenon slows the publication rate, and more importantly, lowers the significance of new taxa. Given the above, a new series compiling new fungal taxa all over China, named *Catalogue of Fungi in China*, is urgently needed to be published in *Mycology*, the official journal of the Mycological Society of China.

In the first paper of the series *Catalogue of Fungi in China*, we focus on plant-inhabiting fungi. Almost all types of fungi inhabiting plants are accommodated, including corticioid fungi, agarics, jelly fungi, plant pathogens, aquatic fungi, and slime moulds. We hope that the *Catalogue of Fungi in China* will attract wide attention to fungal diversity in China. Beyond taxonomy, the accumulated knowledge of species diversity in this series will also benefit evolutionary biology, ecology, conservation, and resource utilisation of fungi (Zhou and May 2023).

2. Materials and methods

The specimens investigated in this study were collected from various plant substrata around China. The strains isolated from some of these specimens were cultivated on potato dextrose agar (PDA), malt extract agar (MEA), and synthetic low nutrient agar (SNA). Voucher specimens were deposited in the fungarium of HMAS, ZHKU, HKAS, BJFC, HMJAU, and IFRD. The morphological observation procedure followed the methods of Zhang and Li (2016), Luo et al. (2018), and Liu et al. (2022). The taxa were described in detail along with illustrations and photographs. Total genomic DNA was extracted from the above-mentioned specimens and strains using the CTAB Genomic DNA Rapid Extraction Kit. PCR was performed to amplify various loci with selected primers as outlined in Table 1.

The newly generated sequences were deposited in the GenBank (https://www.ncbi.nlm.nih.gov/genbank/) and utilised for phylogenetic analyses. Information on all sequences used for phylogenetic analyses is available in the supplementary materials (Supplementary Tables 1–15). Generally, for a given phylogenetic analysis, each locus was separately aligned, and then the resulting alignments were concatenated as a single alignment. The best-fit evolutionary models of the single alignments were estimated using jModelTest 2.0 (Posada 2008). Phylogenetic analyses were carried out using RaxML (Stamatakis 2014; Edler et al. 2021) and MrBayes 3.2 (Ronquist et al. 2012), respectively, for maximum likelihood (ML) and Bayesian inference (BI) methods. The bootstrap (BS) values and Bayesian posterior probability (BPP) were used to judge the reliability of phylogenetic topology.

Table 1. Selected primers for amplifying various loci.

Locus	Primer	Reference
ITS	ITS1	White et al. 1990
	ITS1rustF10d	Liu and Hambleton 2013
	ITS4	White et al. 1990
	ITS4rust	Liu and Hambleton 2013
	ITS5	White et al. 1990
	RF1	Bradshaw et al. 2023
	RF5	Bradshaw et al. 2023
nLSU	ITS4_BRf	Vialle et al. 2009
	LR0R	Vilgalys and Hester 1990
	LR5	Vilgalys and Hester 1990
	LR6	Aime 2006
	LR7	Vilgalys and Hester 1990
	RF3	Bradshaw et al. 2023
	RF7	Aime 2006
	Rust2inv	Aime 2006
rpb2	5F	Liu et al. 1999
	7CR	Liu et al. 1999
	bRPB2-6F	Matheny 2005
	bRPB2-7R2	Matheny et al. 2007
nSSU	NS1	White et al. 1990
	NS4	White et al. 1990
	SMNUR 101	Rusk et al. 1995
	SU19R	Fiore-Donno et al. 2011
tef1α	983F	Rehner and Buckley 2005
	1567R	Rehner and Buckley 2005
	2218R	Rehner and Buckley 2005
tub	Bt2a	Glass and Donaldson 1995
	Bt2b	Glass and Donaldson 1995
ACT	ACT-512F	Carbone and Kohn 1999
	ACT-783R	Carbone and Kohn 1999

3. Taxonomy

Fungi

Ascomycota

Dothideomycetes

Pleosporales Luttr. ex M.E. Barr, Prodr. Cl. Loculoasc. (Amherst): 67 (1987)

Dictyosporiaceae Boonmee & K.D. Hyde, Fungal Diversity 80: 462 (2016)

Notes: *Dictyosporiaceae* was introduced to accommodate a holomorphic group of *Dothideomycetes* that are saprobes on decaying wood and plant debris (Boonmee et al. 2016). Up to now, *Dictyosporiaceae* comprises 20 genera, the species of these genera are distributed worldwide, and most taxa are saprobes on plant litter, especially dead or decaying wood in freshwater and terrestrial habitats (Boonmee et al. 2016; Li et al. 2017; Shen et al. 2022; Tian et al. 2022).

Vikalpa D'souza, Boonmee, Bhat & K.D. Hyde, Fungal Diversity 80: 479 (2016)

Notes: *Vikalpa* was introduced by Boonmee et al. (2016) based on morphological characteristics and multi-gene phylogenetic analysis, with *Vikalpa australiensis* as the type species (Boonmee et al. 2016). *Vikalpa* is a special group of cheirosporous hyphomycete, mainly characterised by euseptate conidia, with three rows of cells in different planes (Boonmee et al. 2016). Based on specific morphological and phylogenetic evidence, *Vikalpa australiensis* (*Dictyosporium australiense*), *V. freycinetiae* (*D. freycinetiae*), and *V. micronesiaca* (*D. micronesiacum*) were transferred from *Dictyosporium* to *Vikalpa* by Boonmee et al. (2016). Currently, the genus includes six species that are saprophytic on wood and decaying leaves from freshwater and terrestrial habitats (Sutton 1985; McKenzie 2008; Boonmee et al. 2016).

Vikalpa dujuanhuensis H.W. Shen & Z.L. Luo, sp. nov. Figure 1

Fungal Names: FN 571593.

Etymology: *dujuanhuensis* (Latin), refers to Dujuanhu Lake, in Yunnan Province, where this fungus was collected.

Diagnosis: Differing from *Vikalpa freycinetiae* by having a lower number of cells per row (8–10 cells *vs*. 9–13 cells) (McKenzie 2008).

Description: *Saprobic* on submerged decaying wood in a plateau freshwater lake. Asexual morph: **Hyphomycetous**. Colonies on natural substrate, punctiform, sporodochial, scattered, dark brown. *Mycelium* composed of immersed or partly superficial, branched, septate, hyaline to pale brown hyphae. *Conidiophores* mononematous, micronematous, cylindrical, unbranched, septate, hyaline to pale brown, smooth-walled, sometimes reduced to conidiogenous cells. *Conidiogenous cells* holoblastic, cylindrical, subglobose, sometimes flat at the base, septate, hyaline to pale brown, smooth-walled. *Conidia* (30–)34–41 (–43) × (11–)12–16(–20) μm ($\bar{X} = 38 \times 14$ μm, $n = 50$), solitary, cheiroid, pale brown to brown, consisting of three rows of cells in different planes, 8–10 cells in each row, euseptate, irregular, constricted at the septa, guttulate, each row 6–8(–9) μm ($\bar{X} = 7$ μm, $n = 50$) wide, with or without transparent thin gelatinous appendages. Sexual morph: **Undetermined**.

Culture characteristics: Conidia germinating on PDA within 12 h and germ tubes produced at ends. Colony growth on PDA; reaching about 2.5–3 cm in 45 days at room temperature. Mycelium papillary in the middle part, dense, creamy yellow, brown to reddish-brown, sparse, white at edge; pale cream yellow on the edge and dark reddish brown in the middle on the reverse side.

Materials examined: China. Yunnan Province, Puer City, Jingdong Yi Autonomous County, Dujuanhu Lake, 24°32′32″ N, 101°01′38″ E (2,500 m), on submerged decaying wood, 25 February 2022, H.W. Shen, YJ 26-28-1 (holotype in KUN-HKAS 125,817), ex-type living cultures (CGMCC 3.24268 = KUNCC 22–12670).

Notes: Phylogenetic analysis showed that *Vikalpa dujuanhuensis* clusters with *V. australiensis* with low support (Figure 2). Morphologically, *V. dujuanhuensis* fits with *Vikalpa* species in having euseptate conidia, with three rows of cells in different planes. However, *V. dujuanhuensis* has longer conidia than *V. lignicola* (34–41 μm *vs*. 25–40.5 μm) and *V. micronesiaca* (34–41 μm *vs*. 20–30 μm) (Matsushima 1981; Boonmee et al. 2016). *Vikalpa dujuanhuensis* can be distinguished from *V. freycinetiae* by having a lower number of cells per row (8–10 cells *vs*. 9–13 cells) (McKenzie 2008). Therefore, *V. dujuanhuensis* is introduced as a new species from a freshwater habitat, based on morphological characters and phylogenetic analysis.

Phaeosphaeriaceae M.E. Barr, Mycologia 71(5): 948 (1979)

Notes: Barr (1979) first described the family *Phaeosphaeriaceae*, which is represented by *Phaeosphaeria*, with *P. oryzae* serving as the type species. The ascomata of *Phaeosphaeriaceae* immersed to superficial, globose to subglobose, papilla short, asci bitunicate, hyaline to pigmented, ascospores fusiform to ellipsoidal, filiform, or muriform (Maharachchikumbura et al. 2019; Yang et al. 2019). Species of *Phaeosphaeriaceae*, especially the

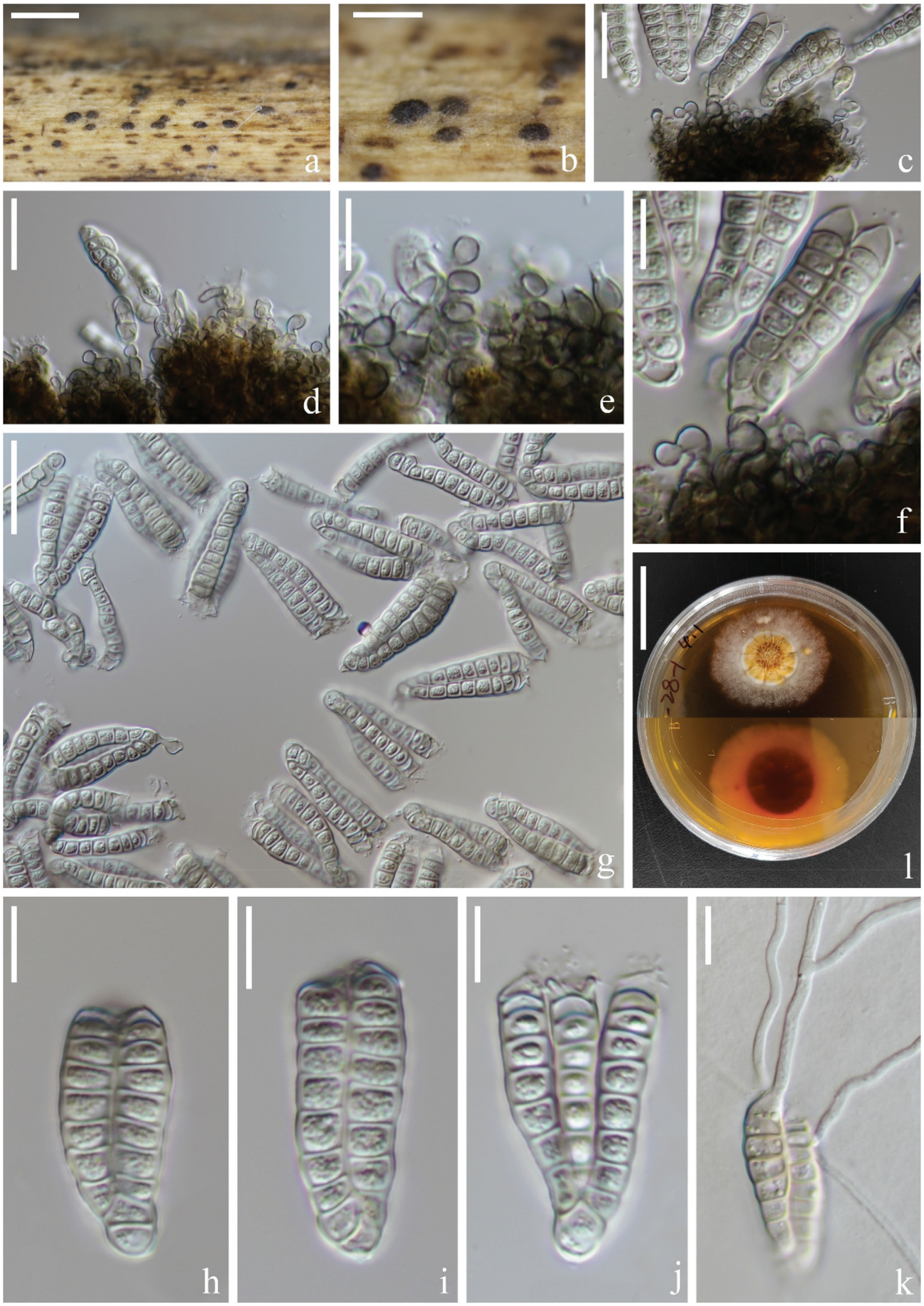

Figure 1. ***Vikalpa dujuanhuenesis*** (holotype). (a, b) Colonies on the substratum. (c, d) Conidiophores, conidiogenous cells, and conidia. (e) Conidiogenous cells. (f) Conidiogenous cells with conidia. (g–j) Conidia. (k) Germinating conidium. (l) Culture on PDA (from above and from below). Scale bars: a = 1,000 μm; b = 500 μm; c − d = 20 μm; g = 30 μm; e − f, h − k = 10 μm; l = 2 cm.

asexual taxa, are important plant pathogens infecting major crops (Yang et al. 2019).

Setophaeosphaeria Crous & Y. Zhang ter, in Crous et al., Persoonia 32: 271 (2014)

Notes: *Setophaeosphaeria* was established by Crous et al. (2014) to accommodate ascomycetes that differ from *Phaeosphaeria* by lacking ascomatal setae and possessing phoma-like anamorphs. *Setophaeosphaeria*

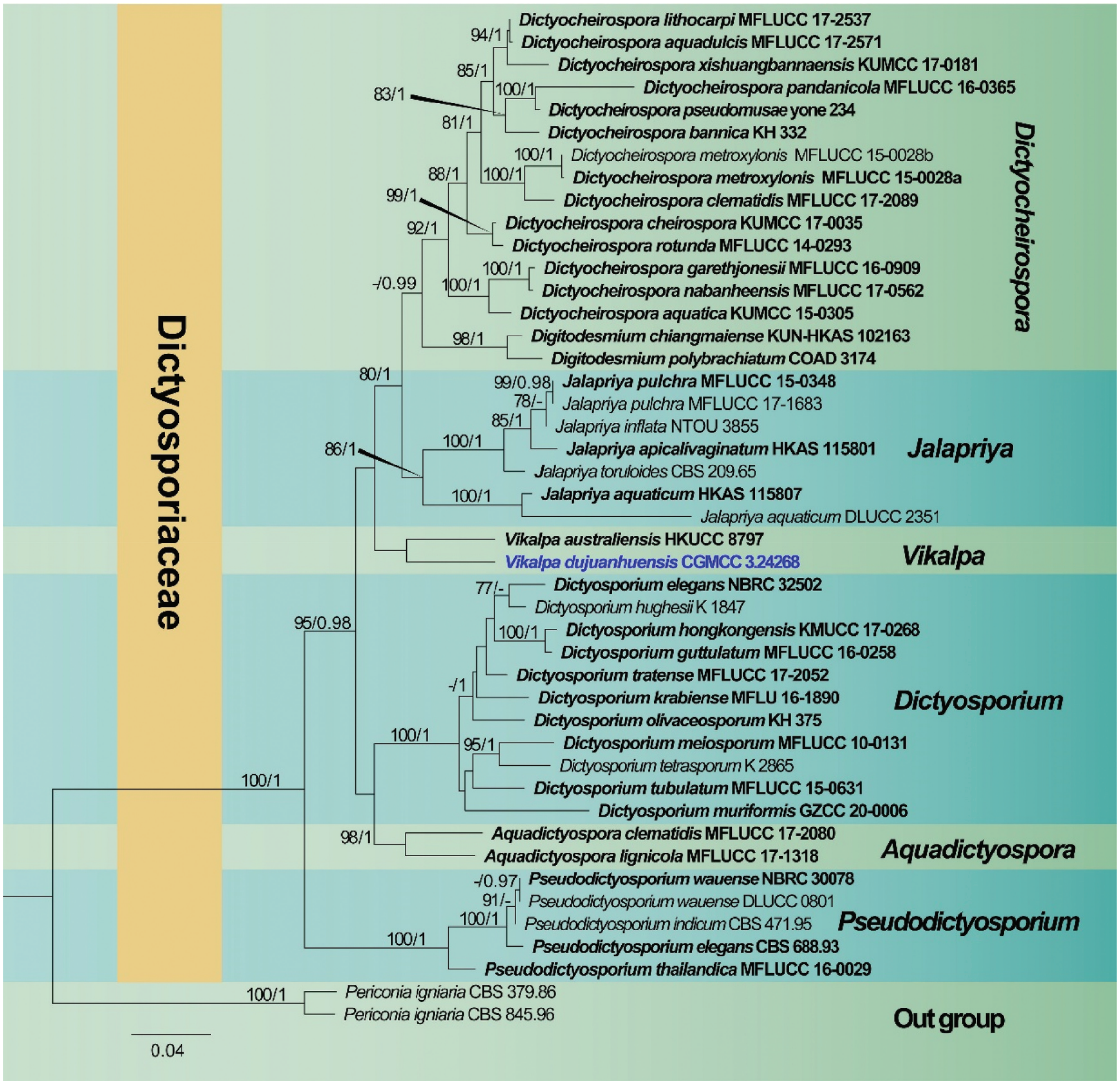

Figure 2. Phylogenetic tree of combined ITS, LSU, nSSU, and *tef1a* sequence data. Bootstrap support values for maximum likelihood ≥ 75% and Bayesian posterior probabilities ≥ 0.97 are indicated above the nodes as BS/BPP. The new species are represented in blue and the type species are in bold.

currently comprises seven species associated with leaf spots and branch dieback, including six verifiable species with living cultures and DNA data, and doubtful *Setophaeosphaeria setosa* previously known as *Phaeosphaeria setosa* (Crous et al. 2014, 2017). *Setophaeosphaeria hemerocallidis* was designed as the type species (Crous et al. 2014).

Setophaeosphaeria panlongensis L. Lin & X.L. Fan, sp. nov. Figure 3

Fungal name number: FN 571655.

Etymology: *panlongensis* (Latin), refers to the collection site of the type specimen, Panlong District in Kunming City, Yunnan Province, China.

Diagnosis: Differing from other species by the DNA sequence data.

Description: Culture sterile. On MEA, PDA, and SNA, hyphae septate, occasionally forming the constricting ring. *Setophaeosphaeria panlongensis* differs from its closest phylogenetic affinities, *S. citricola*, *S. sidae*, and *S. hemerocallidis* by unique fixed alleles of three loci based on alignments of the separate loci (Table 2).

Culture characteristics: Colonies covering the Petri dish after 21 d at 25 °C, without aerial mycelium, dense. On PDA surface salmon to hazel and buff to isabelline on the reverse. On MEA surface white to buff and buff to salmon on the reverse. On SNA surface olivaceous buff to olivaceous and smoke grey to olivaceous on the reverse.

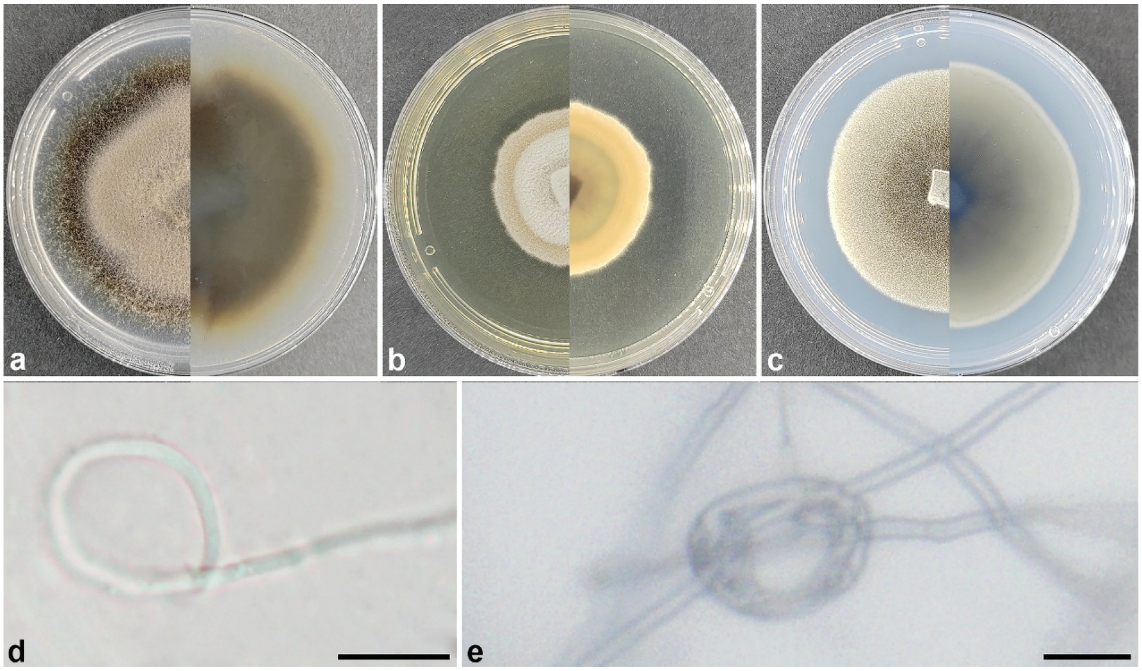

Figure 3. ***Setophaeosphaeria panlongensis*** (ex-holotype). (a) Culture on PDA. (b) Culture on MEA. (c) Culture on SNA. (d, e) Constricting ring. Scale bars: d − e = 10 µm.

Table 2. Sequence differences of three loci used to delimit *Setophaeosphaeria panlongensis* from its phylogenetic affinities.

Species	ITS position	nLSU position	*tub* position
S. citricola	2 (A), 4 (indel), 6 (G), 15 (indel), 16 (G), 17 (T), 18 (C), 71 (A), 72 (T), 77 (T), 78 (C), 107 (C), 330 (T), 331 (G), 431 (indel)	348 (C), 353 (G), 370 (A), 394 (A), 434 (A)	269 (G), 321 (T), 324 (C), 329 (C), 340 (A), 345 (T), 348 (indel), 350 (T)
S. sidae	1 (T), 2 (A), 4 (indel), 6 (G), 15 (indel), 16 (G), 17 (T), 18 (C), 66 (T), 71 (A), 72 (T), 77 (T), 78 (C), 107 (C), 322 (A), 330 (T), 331 (G), 431 (indel)	348 (C), 350 (T), 353 (G), 370 (A), 394 (A), 434 (A)	269 (G), 324 (C), 325 (C), 340 (A), 341 (G), 348 (indel), 362 (indel)
S. hemerocallidis	1 (T), 2 (A), 4 (indel), 6 (G), 15 (indel), 16 (G), 17 (T), 18 (C), 29 (G), 71 (A), 72 (T), 106 (indel), 107 (C), 331 (G), 431 (indel)	131 (G), 351 (T), 353 (G), 394 (A), 434 (A)	No available *tub* sequence data for *S. hemerocallidis*

Materials examined: China. Yunnan Province, Kunming City, Panlong District, on branches of *Juniperus formosana*, 4 August 2022, holotype in BJFC CF20231001, ex-holotype living culture CFCC 59048; *ibid*. BJFC CF20231002, living culture CFCC 59049; *ibid*. BJFC CF20231003, living culture CFCC 59050.

Notes: *Setophaeosphaeria panlongensis* was isolated on symptomatic branches of *Juniperus formosana* in China. It differs from other known species in this genus based on forming constricting rings on MEA, PDA, and SNA media, but significant conidial sporulation did not occur. Phylogenetically, the isolates CFCC 59048–59050 formed a distinct clade with high support value (BS = 100, BPP = 1; Figure 4) and were different with the sequences of *S. citricola*, *S. sidae*, and *S. hemerocallidis*: for ITS 15/466 bp, 18/466 bp, and 15/466 bp, respectively; for nLSU 5/752 bp, 6/752 bp, and 5/752 bp, respectively; and for *tub* 8/140 bp, 7/140 bp, and unknown (*tub* unavailable from *S. hemerocallidis*), respectively. Thus, we introduce it here as a new species.

Sordariomycetes

Savoryellales Boonyuen, Suetrong, Sivichai, Pang & E. B.G. Jones, Mycologia 103 (6): 1368 (2011)

Savoryellaceae Jaklitsch & Réblová, Index Fungorum 209: 1 (2015)

Notes: *Savoryellaceae*, established by Jaklitsch and Réblová (2015), was typified by the genus *Savoryella*. The taxonomic placement of *Savoryella* has been changed several times based on morphology and phylogeny (Kohlmeyer and Kohlmeyer 1979; Jones and Hyde 1992; Dhanasekaran et al. 2006), and later a multi-gene phylogenetic analysis showed that *Savoryella* formed a monophyletic clade close to the genera *Ascotaiwania* and *Canalisporium* (Boonyuen et al. 2011). Hence, a new

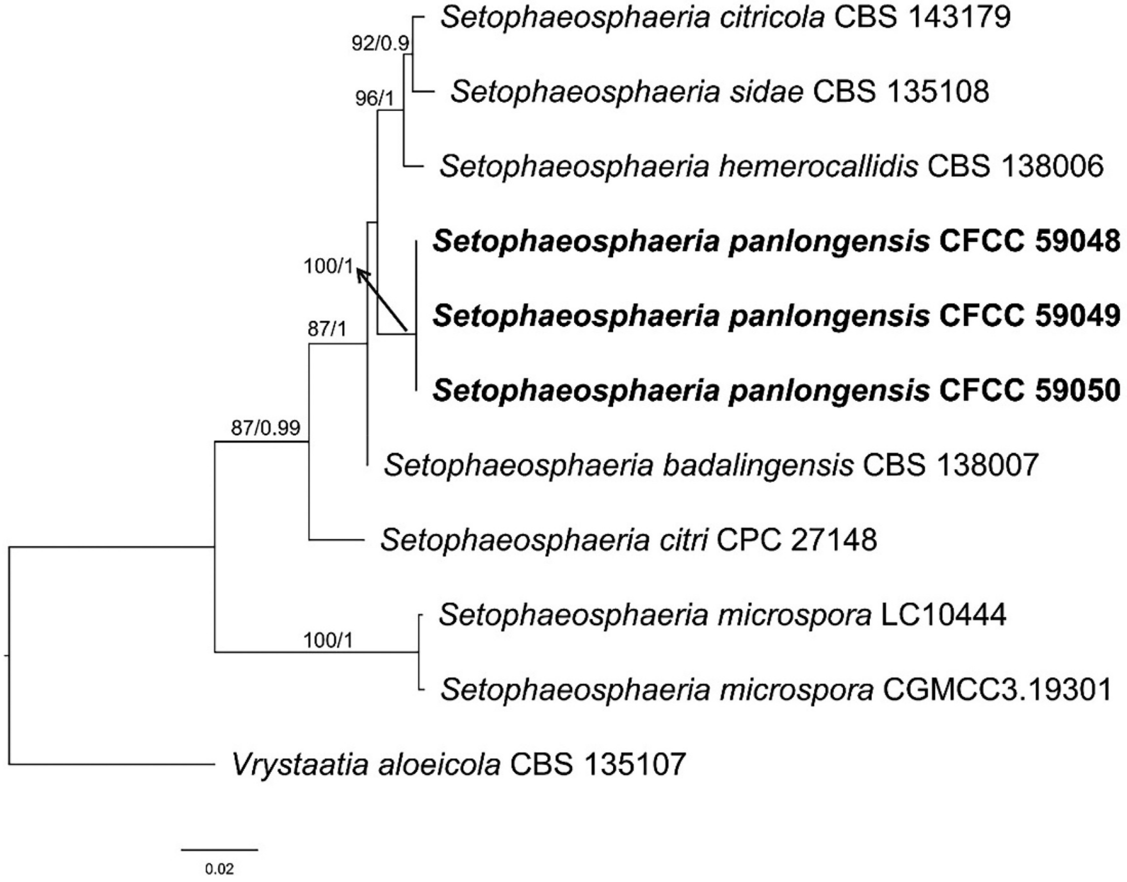

Figure 4. Phylogenetic relationship among species of *Setophaeosphaeria* inferred from the combined dataset of ITS, nLSU, and *tub* regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 50% and 0.8, respectively, are labelled at the nodes. The newly described species are in boldface.

order *Savoryellales* was proposed to accommodate *Ascotaiwania* and *Canalisporium* (Jaklitsch and Réblová 2015). The members of species in *Savoryellaceae* are abundant in submerged wood in aquatic habitats, and some species have been reported from terrestrial woody plants (Linder 1929; Jones et al. 2015; Du et al. 2022). *Savoryellaceae* always forms a monophyletic group in phylogenetic analyses, with the species belonging to *Ascotaiwania* (=*Neoascotaiwania*), *Bactrodesmium*, *Canalisporium*, and *Savoryella* (Boonyuen et al. 2011; Dayarathne et al. 2019). Currently, six genera are included in *Savoryellaceae* (Réblová et al. 2020; Yang et al. 2022).

Ascotaiwania Sivan. & H.S. Chang, Mycological Research 96: 481 (1992)

Notes: *Ascotaiwania*, introduced by Sivanesan and Chang (1992), was typified by *A. lignicola*. Fourteen species of *Ascotaiwania* are listed in Index Fungorum (2023), which have been isolated from submerged and decomposing wood in freshwater or terrestrial habitats, and they are widely distributed worldwide (Sivanesan and Chang 1992; Ranghoo et al. 1999; Dayarathne et al. 2019). The members of species in *Ascotaiwania* are saprobic lignicolous fungi with sexual and asexual morphs (Réblová et al. 2020). The sexual morph of *Ascotaiwania* is characterised by dark-brown to black with lateral neck ascomata, 8-spore asci, cylindrical and unitunicate with a prominent J-refractive and apical ring, containing versicolorous ascospore, 3–7 septate, middle cells brown, end cells hyaline to subhyaline, yellow or pale brown (Tsui and Hyde 2003; Boonyuen et al. 2011; Dayarathne et al. 2019). Asexual morphs of *Ascotaiwania* are bactrodesmium-like, monotosporella-like, monodictys-like, or trichocladium-like (Ranghoo and Hyde 1998; Chang 2001; Tsui and Hyde 2003; Réblová et al. 2016). In this study, a new species of *Ascotaiwania* with trichocladium-like characteristics is introduced from coffee in Yunnan Province, China.

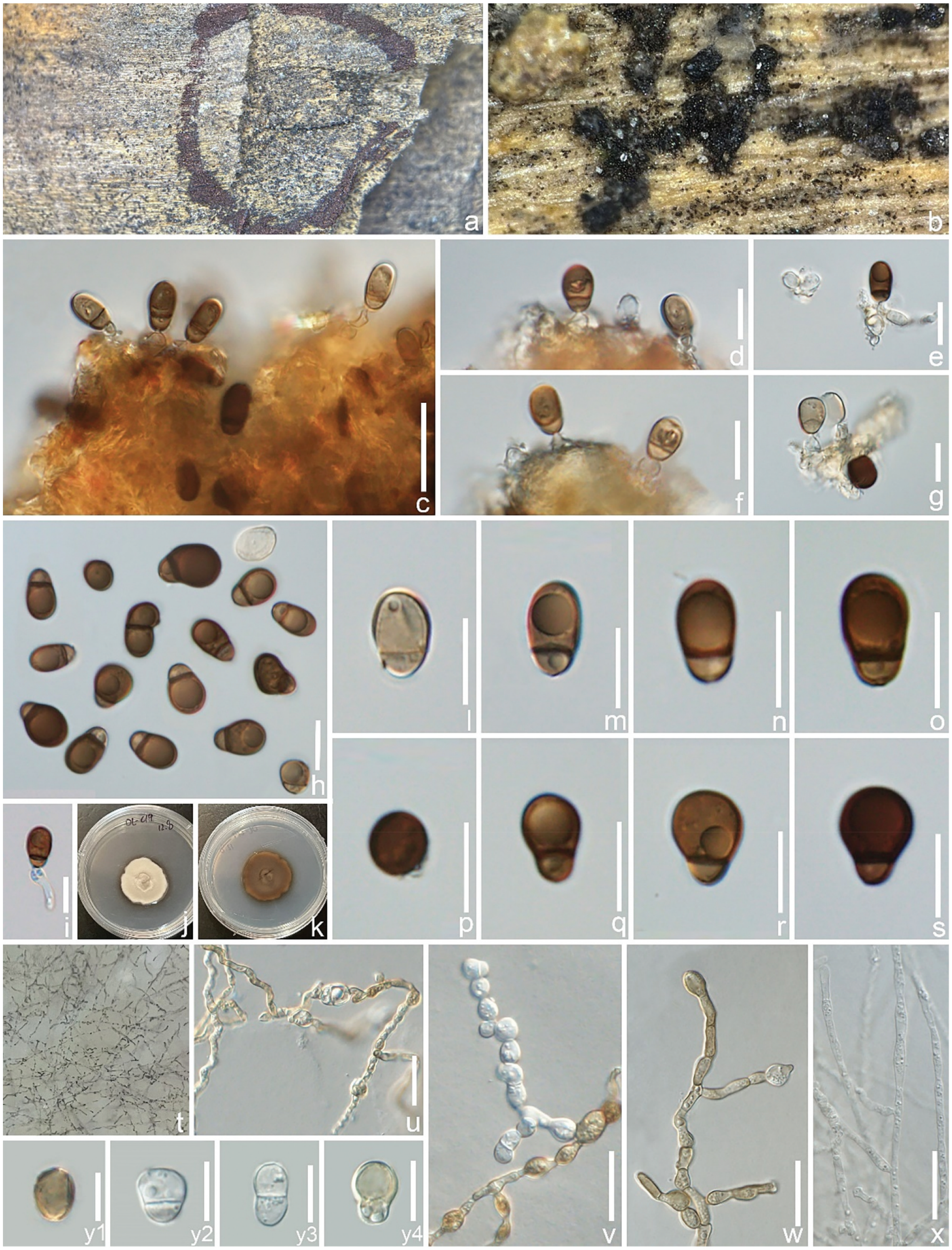

Figure 5. Microscopic structures of ***ascotaiwania coffeae*** (holotype). (a, b) Colonies on host substrate. (c–g) Conidiogenous cells with conidia. (i) Germinated conidium. (j, k) Colony on PDA (j from above, k from below). (h, l–s) Conidia. (t) Clusters of conidia formed on submerged hyphae in the agar. (u–w) Developing conidia with attached conidiogenous cells. (x) Mycelia. (y1–y4) Conidia. Scale bars: c, u − x = 20 μm, d − i, l − s, y1 − y4 = 10 μm.

Ascotaiwania coffeae L. Lu & Karun., sp. nov. Figure 5

Fungal Names: FN 571656.

Etymology: *coffeae* (Latin), refers to the host genus *"Coffea"* from which the holotype of the new species was isolated.

Diagnosis: Differing from *Ascotaiwania uniseptata* by pyriform conidia and basal cell with a guttulate (Hughes and Pirozynski 1972).

Description: *Saprobic* on decaying branch of *Coffea arabica*. Sexual morph: Undernimmed. Asexual morph: Trichocladium-like. *Colonies* effuse, black, glistening, punctiform distributed on substrates. *Mycelium* 1.5–2.5 µm, subhyaline, septate, branched. *Conidiophores* inconspicuous or micronematous, mononematous, smooth. *Conidiogenous cells* 3–4.5 × 2.5–4 µm ($\overline{X} = 3.2 \times 3$ µm, $n = 20$), holoblastic, determinate, integrated, terminal becoming intercalary, subglobose or ampulliform. *Conidia* 9–14 × 6–10 µm ($\overline{X} = 11 \times 7$ µm, $n = 30$), solitary, pyriform to obovoid, broadly rounded at the apex, straight or slightly curved, guttulate, 1-septate, septa thick and band-like, dividing the conidium into unequal cells, the upper cell being largest, 6–10 µm long ($\overline{X} = 7.5$ µm, $n = 30$), subhyaline or dark brown, and the basal cell subhyaline or pale brown.

Culture characteristics: Conidia germinating on PDA within 24 h. Colonies on PDA reaching 2 cm diam. After three months at 25 °C, irregular, smooth, with an entire edge, flat to slightly raised, from above cream, from below brown. After three months, vegetative hyphae produced on the reverse side, immersed, subhyaline to light brown, 2.5–3.5 µm wide ($\overline{X} = 3$ µm, $n = 30$), septate and branched, often monilioid. *Conidiophores* macronematous, semi-macronematous, arising from aerial or submerged hyphae, or micronematous often reduced to conidiogenous cells. *Conidiogenous cells* holoblastic, 4–8 × 3–6 µm ($\overline{X} = 6 \times 4.5$ µm, $n = 30$), hyaline to pale brown, thin-walled, sometimes thickened and pigmented near the base, sub-globose, or irregularly cylindrical, bearing a single terminal conidium. *Conidia* 8–15 × 6–10 µm ($\overline{X} = 10 \times 7$ µm, $n = 30$), sub-globose or obovoid, guttulate, normally 1-septate, sometimes constricted at the septa when mature, hyaline to pale brown.

Materials examined: China. Yunnan Province, Dali City, on a decaying branch of *Coffea arabica*, (101°91′E, 26°09′ N, 1,416.46 m), 25 July 2022, DL-C19 (holotype in ZHKU 23-0083), living culture ZHKUCC 23-0676 (ex-type), ZHKUCC 23-0677.

Notes: In our phylogenetic analyses (Figure 6), *Ascotaiwania coffeae* grouped in a clade comprising *A. uniseptata* and *A. mitriformis. Ascotaiwania coffeae* morphologically resembles *A. uniseptata*, as both have trichocladium-like asexual morphs (Hughes and Pirozynski 1972; Ranghoo and Hyde 1998). In morphology, *A. coffeae* is easily distinguishable from *A. uniseptata* by the pyriform conidia and basal cell with a guttulate (Hughes and Pirozynski 1972). Based on nucleotide comparisons, *A. coffeae* (ZHKUCC 23-0676) is different from *A. uniseptata* (Sloan 5406) by 12/365 bp (3.3%) of the nLSU, and from *A. uniseptata* only nLSU region is available (Réblová et al. 2016). Therefore, we introduce *A. coffeae* as a distinct new species based on morphology. In the future, fresh collections of *A. uniseptata* are needed to obtain single spore isolates and check their phylogenetic affinities.

Xylariales Nannf., Nova Acta R. Soc. Scient. upsal., Ser. 4 8(no. 2): 66 (1932)

Hypoxylaceae DC., in Lamarck & de Candolle, Fl. franç., Edn 3 (Paris) 2: 280 (1805)

Notes: The *Hypoxylaceae* in the *Xylariales* was introduced by de Candolle in 1805. This family comprises 18 genera, with *Hypoxylon* as the type genus (Wijayawardene et al. 2022). Asexual morph of *Hypoxylon* is characterised by varying from erect to effused-pulvinate, solitary or confluent stromata, waxy or carbonaceous peridium, with or without KOH-extractable pigments, dark brown to black, persistent or loculate. Some genera present peculiar features, such as alternating zones under the perithecial layer, or hollow and filled with liquid, observed in the *Daldinia* and *Entonaema*, respectively. Ostioles can be umbilicate, at the same level or higher than the level of the stroma surface, with or without discs. The asci are typically 8-spored, cylindrical, with apical ring discoid, distinct, highly reduced, or lacking. Ascospores brown, ellipsoid, or short fusoid, with acute, narrowly rounded, or broadly rounded ends, and most species bear a germ slit; perispore dehiscent or indehiscent in 10% KOH (Hsieh et al. 2005). The sexual morph is Nodulisporium-like with branching patterns varying from "regular" nodulisporium, periconiella, virgariella, or sporothrix-like (Silva et al. 2020).

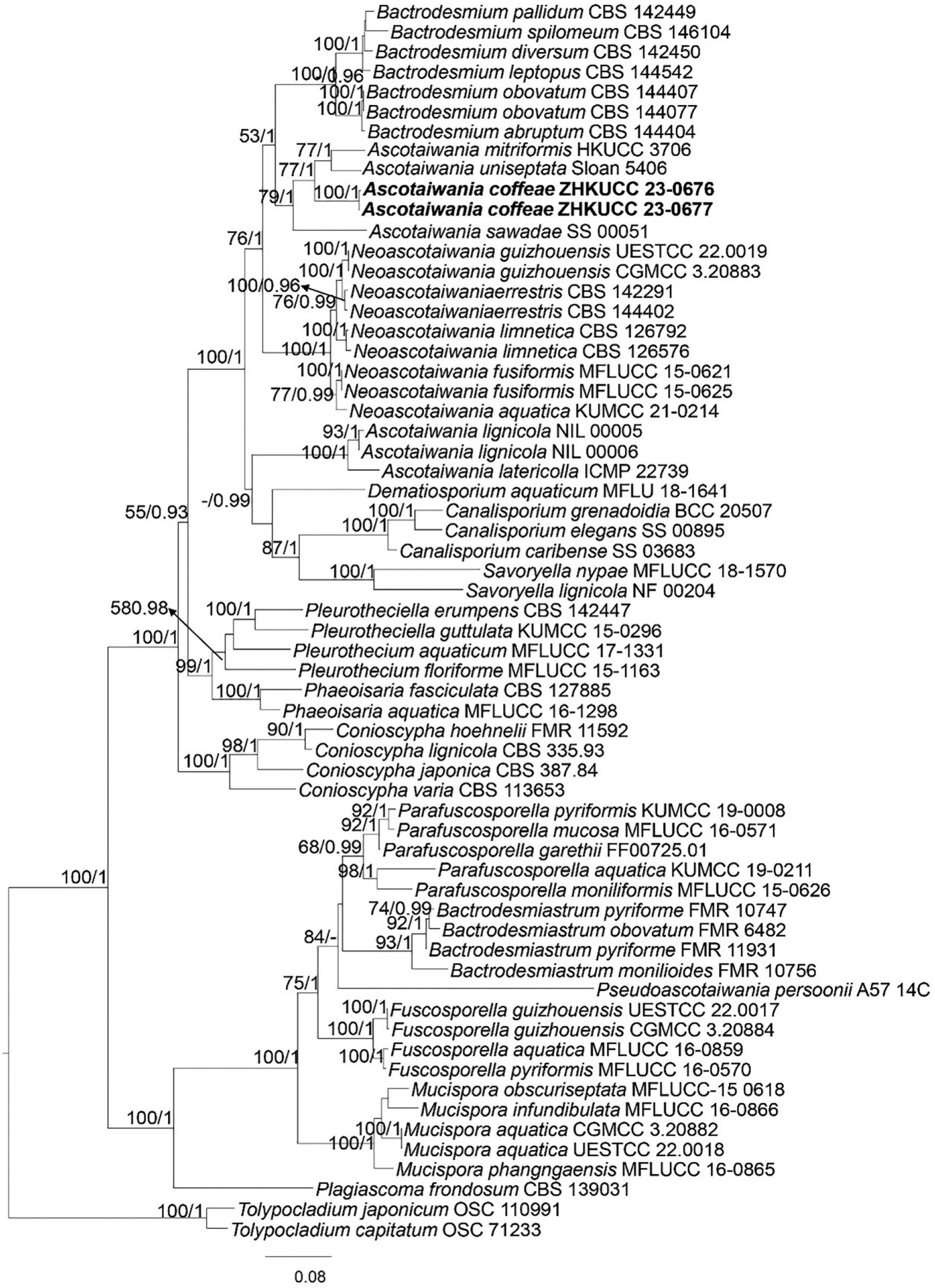

Figure 6. Phylogenetic relationship selected members of *Savoryellomycetidae* (*Sordariomycetes*) inferred from the combined dataset of LSU, nSSU, ITS, *rpb*2, and *tef1a* regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously equal to or above 50% and 0.8, respectively, are labelled at the nodes. The newly described species are in boldface.

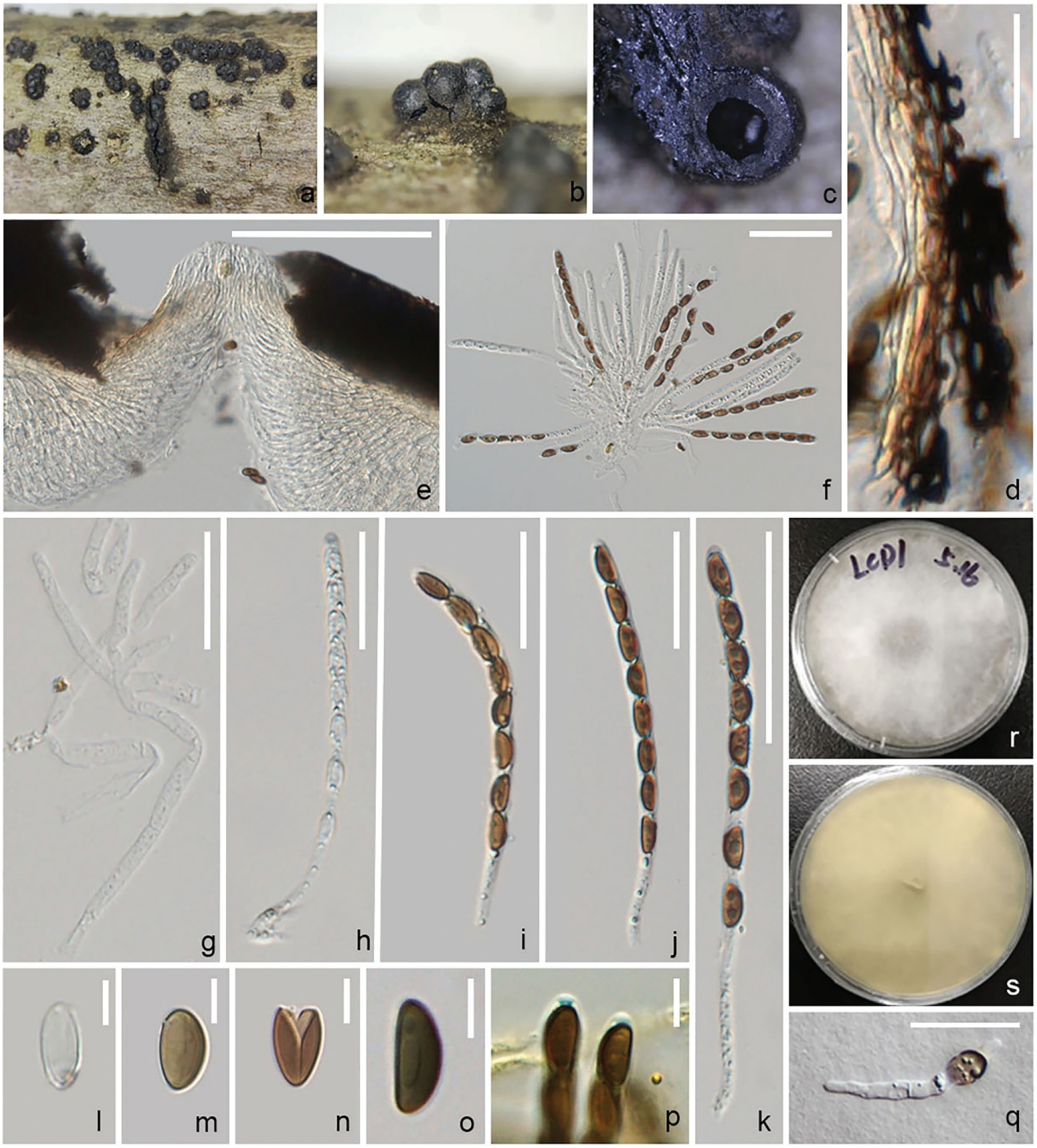

Figure 7. ***Annulohypoxylon lancangensis*** (holotype). (a–c) Stromata habit on wood. (d) Section of peridium. (e) Section of ostiole. (f) Asci with paraphyses. (g) Paraphyses. (h–k) Asci. (l–n) Ascospore. (o) Ascospore in 10% KOH. (p) Ascus in Melzer's reagent, showing the J+, subapical ring. (q) Germinating ascospore. (r, s) Colony on PDA medium. Scale bars: d, q = 20 µm, e = 200 µm, f, g, k = 50 µm, h − j = 30 µm, l − o = 5 µm, p = 10 µm.

Annulohypoxylon Y.M. Ju, J.D. Rogers & H.M. Hsieh, in Hsieh, Ju & Rogers, Mycologia 97(4): 855 (2005)

Notes: *Annulohypoxylon* was introduced by Hsieh et al. (2005) with the type species *Annulohypoxylon truncatum* and the genus has 60 species (Wijayawardene et al. 2022). *Annulohypoxylon* is characterised by effused-pulvinate or pulvinate, glomerate stromata, waxy or carbonaceous tissue immediately beneath the surface and between perithecia, with KOH-extractable pigments in most cases; spherical, obovoid, with carbonaceous stromata layer surrounding individual perithecia; higher than the level of stromata surface ostioles; light- to dark-coloured, 8-spored, cylindrical, stipitate, persistent, with apical ring discoid, amyloid or infrequently inamyloid, distinct asci; light- to dark-

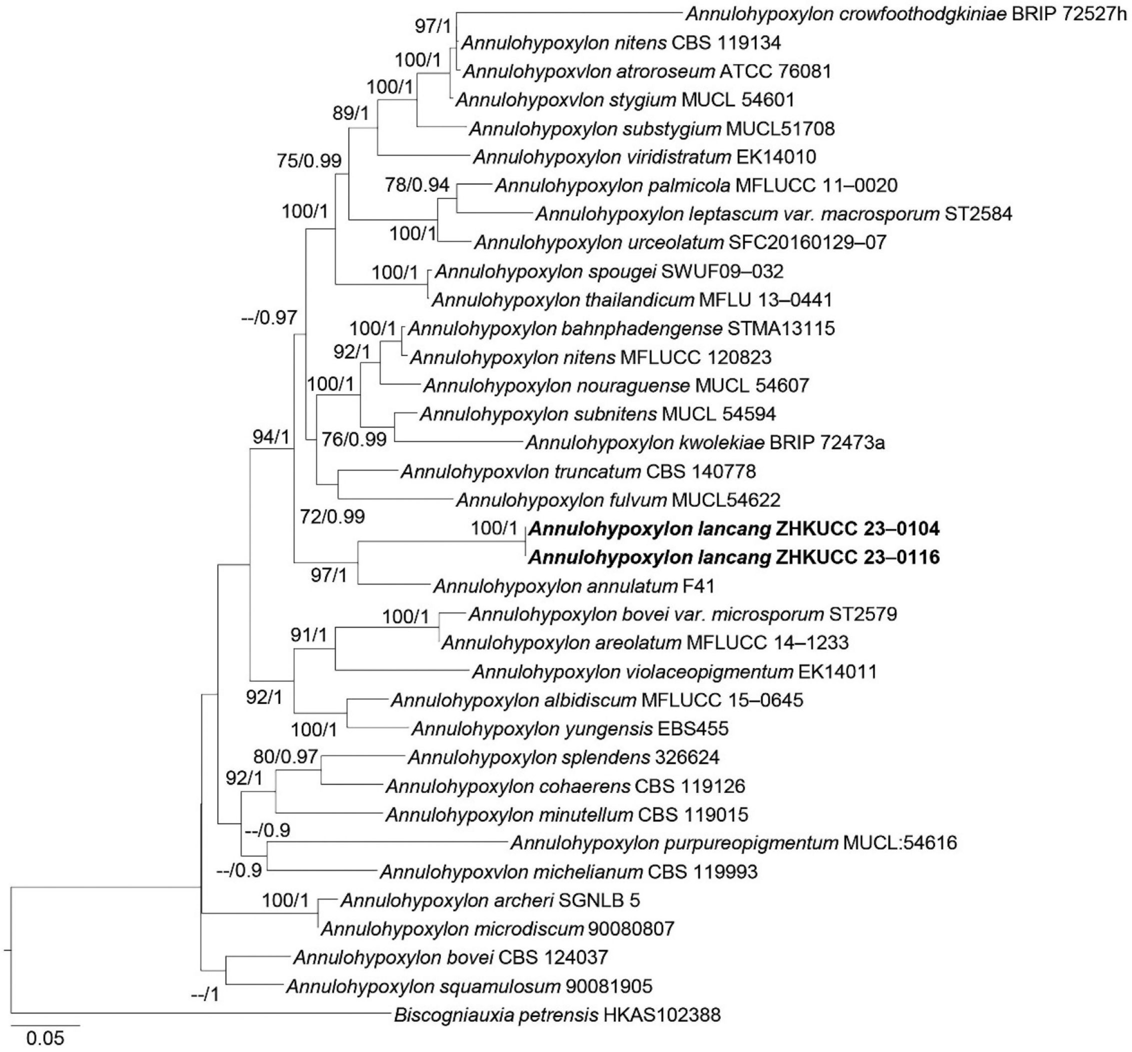

Figure 8. Phylogenetic relationship among species of *Annulohypoxylon* inferred from the combined dataset of ITS, LSU, ACT, and *tub* regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously equal to or above 70% and 0.9, respectively, are labelled at the nodes. The newly described species is in boldface.

coloured, ellipsoid or short fusoid, inequilateral, narrowly rounded, or broadly rounded ends, with a germ slit, perispore dehiscent or indehiscent in 10% KOH (Li et al. 2016).

Annulohypoxylon lancangensis R.F. Xu & S. Tibpromma, sp. nov. Figure 7

Fungal Names: FN 571657.

Etymology: *lancangensis* (Latin), refers to the place Lancang, China where the fungus was first discovered.

Description: *Saprobic* on unidentified dead wood. Sexual morph *Stromata* 330–496 × 323–460 µm, ($\overline{X} = 417 \times 400$ µm, $n = 10$), glomerate, pulvinate to effused-pulvinate, with conspicuous perithecial mounds, surface shiny black, subglobose to globose, carbonaceous. *Ostiole* conical, papillate, encircled with a white. *Peridium* laterally 64–140 µm thick, composed of carbonaceous, thick-walled, dark brown to black cells of *textura angularis*. *Hamathecium* 3.5–6 µm wide comprising long, septate paraphyses, hyaline. *Asci* 91–110 × 4–6 µm ($\overline{X} = 101 \times 5.5$ µm, $n = 10$), 8-spored, unitunicate, cylindrical, long pedicellate, J+ apical ring. *Ascospores* 7.3–9.6 × 3–4.5 µm ($\overline{X} = 8 \times 3.8$ µm, $n = 20$), uniseriate, 1-celled, inequilaterally ellipsoidal, with narrowly rounded ends, pare brown to brown, guttules, germ slit straight, running along the entire spore-length on flattened side. Asexual morph Undetermined.

Culture characteristics: Ascospores germinating on PDA within 12 h and germ tubes produced from ends.

Colonies growing fast on PDA, whitish colonies, flossy, circular with the entire edge, light yellow in reverse.

Materials examined: China. Yunnan Province, Pu'er City, Lancang, on an unidentified dead wood piece, 11 July 2020, Tian-Ye Du, LCD01 (holotype in ZHKU 23-0053), ex-type living culture, ZHKUCC 23-0104 = ZHKUCC 23-0116.

Notes: The phylogenetic analyses showed *Annulohypoxylon lancangensis* forms a monophyletic clade with *A. annulatum* (BS = 97%, BPP = 1.00; Figure 8). Moreover, the base pair comparison of *Annulohypoxylon lancangensis* and *A. annulatum* shows 131/637 bp differences in ITS (20.56%, gaps 45 bp), 41/261 bp differences in ACT (15.70%, gaps 9 bp) and 74/443 bp differences in *tub* (16.70%, gaps 20 bp). Based on the recommendation of Jeewon and Hyde (2016), a minimum of > 1.5% nucleotide differences in the ITS region indicate a new species. Morphological comparison of the new taxon (*Annulohypoxylon lancangensis*) and *Annulohypoxylon annulatum* revealed that *Annulohypoxylon lancangensis* has smaller ascospores (7.3–9.6 × 3–4.5 µm *vs.* 9.3–11.3 × 4.1–4.6 µm; Khodaparast 2012). Thus, based on both morphological characteristics and phylogenetic analyses, we introduce *Annulohypoxylon lancangensis* as a distinct new species.

Xylariaceae Tul. & C. Tul. [as "Xylariei"], Selecta fungorum carpologia. (Paris) 2: 3 (1863)

Notes: The family *Xylariaceae* (*Xylariales*), one of the largest and most commonly encountered families of *Ascomycota* (Maharachchikumbura et al. 2015, 2016), was erected based on the type genus *Xylaria* (Tulasne and Tulasne 1863). The majority of *Xylariaceae* species are widely known as saprobes, growing on wood, seeds, fruits, or leaves of angiosperms (Edwards et al. 2003; Visser et al. 2009). Some *Xylariaceae* species are endophytes and plant pathogens (Stadler et al. 2013). Sexual morphs in this family are characterised by stromata extremely variable in size, shape, and colour, perithecia embedded in more or less well-developed, 8-spored, unitunicate, cylindrical asci with or without an amyloid apical ring, and brown ascospores with germ slits. However, the classification of some genera in this family is controversial. Currently, *Xylariaceae* resides in the order *Xylariales*, and has 37 genera in the family (Wendt et al. 2018).

Nemania Gray, Nat. Arr. Brit. Pl. (London) 1: 516 (1821)

Notes: The genus *Nemania* was erected in 1821 with *Nemania serpens* as the type species. The species of this genus are found throughout the temperate and tropical regions of the world (Pouzar 1985; Van 1995; Granmo et al. 1999; Ju and Rorgers 1999; Fournier et al. 2018). *Nemania* is characterised by carbonaceous, dark- or dull-coloured pulvinate stromata, cylindrical asci usually with long-stipitate, bear apical rings that have a height/breadth ratio larger than 1/2, and yellowish to dark brown ascospores with an inconspicuous to conspicuous germ slit (Ju and Rogers 1996).

Nemania polymorpha Hai X. Ma & Y. Li, sp. nov. Figure 9

Fungal Names: FN 571663.

Etymology: *polymorpha* (Latin), refers to various shapes of ascospores.

Diagnosis: Differing from *Nemania caries* by larger ascospores (Fournier et al. 2018), and from *N. serpens* by apical ring bluing in Melzer's iodine reagent and larger ascospores (Petrini and Rogers 1986).

Description: Stromata superficial, irregularly effused-pulvinate, 2.5–18.6 mm long, 1.3–3.9 mm wide, 0.25–0.58 mm thick, with inconspicuous perithecial contours, roughened by deep cracks and wrinkles, sloping margins; surface greyish-black to black, carbonaceous outer crust immediately surface, 30–58 µm; interior whitish to cream-coloured fibrous soft tissue sometimes between the perithecia in immature stromata, turning black at maturity, carbonaceous; subperithecial tissue absent or inconspicuous. Perithecia subglobose, 0.4–0.7 mm high, 0.4–0.6 mm diam. Ostioles papillate, obtusely conical. Asci with eight ascospores, obliquely or straightly arranged in uniseriate manner, occasionally overlapping, cylindrical, long-stipitate, (140–)150–175 (−185) µm total length, the spore-bearing part (80–)88–98(−107) µm long, (6.5–)7–8(−8.6) µm diam., the stipes 55–85 µm long, with apical ring bluing in Melzer's iodine reagent, short-cylindrical, 2.2–3.0 µm high, 1.9–3.0 µm diam. (Me = 2.5 × 2.3 µm, *N* = 20). Ascospores brown, unicellular, inequilateral to sometimes slightly equilateral, ellipsoid, suballantoid to nephroid, or pyriform infrequently, with broadly rounded ends, smooth,

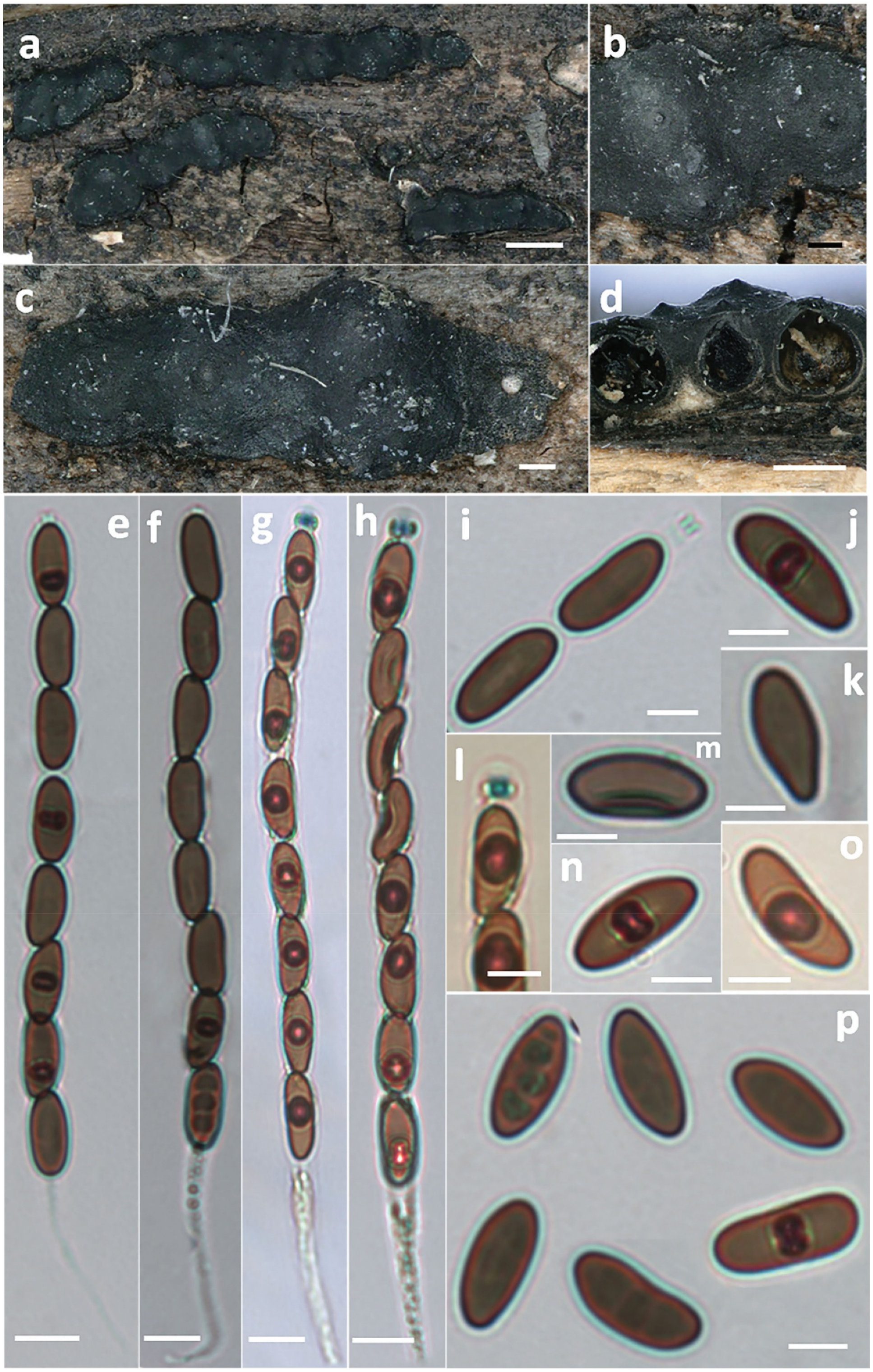

Figure 9. ***Nemania polymorpha*** (holotype). (a, c) Stromata. (b) Close-up view of stromatal surface, showing perithecial mounds and ostiolar disks. (d) Section through stromata, showing perithecia. (e, f) Asci in 5% KOH. (g, h) Asci in Melzer's reagent. (i) Ascus apical ring in 5% KOH. (j, k, o, p) Ascospores. (l) Ascus apical ring in Melzer's reagent. (m, n) Ascospore with germ slit. Scale bars: a = 1 mm; b, c = 0.2 mm; d = 0.5 mm; e − h = 10 μm; i − p = 5 μm.

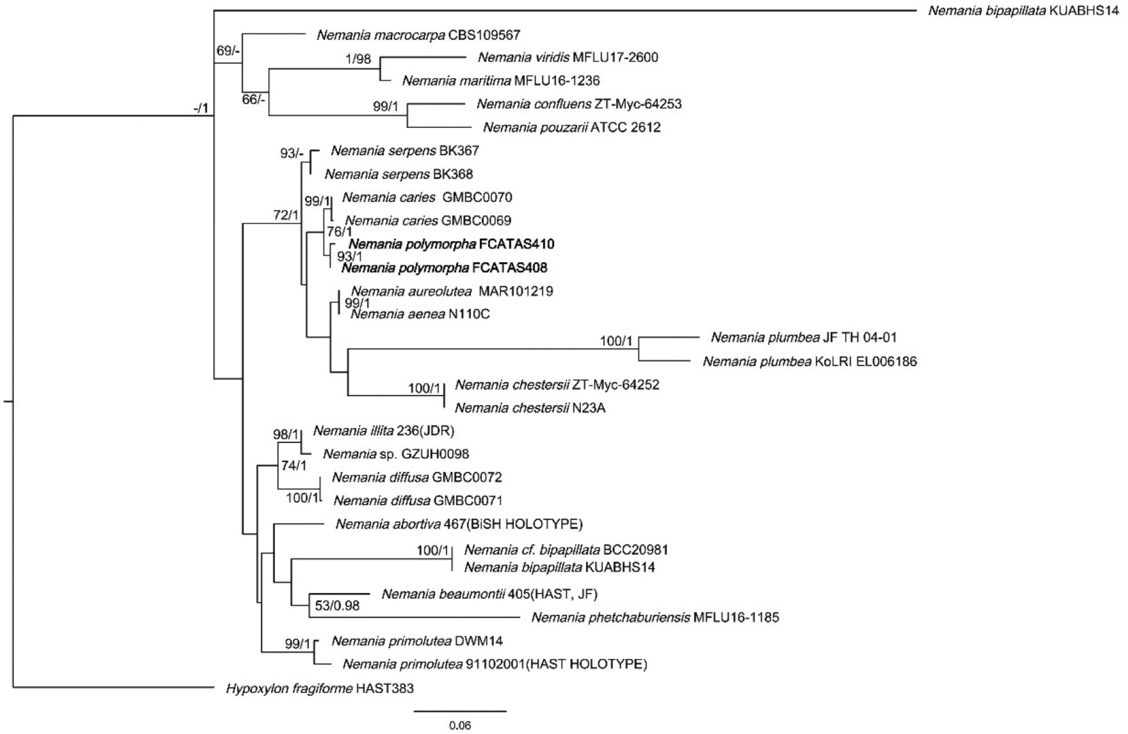

Figure 10. Phylogenetic tree of ITS and nLSU sequences of *Nemania*. Bootstrap values (≥50%, before the slash markers) and Bayesian posterior probabilities (≥0.95, after the slash markers) are shown.

(12.0–)13.0–14.2(–15.1) × (5.8–)6.0–7.0(–7.5) µm, Q = (1.7–)1.9–2.2(–2.4) (Me = 13.4 × 6.7 µm, Qe = 2.0, *n* = 60), with a straight, short, inconspicuous germ slit straight, much less than spore length.

Materials examined: China. Heilongjiang Province, Hulin City, Wulingdong Town, on decorticated wood, 21 August 2014, Du ZW, Col. D39 (holotype in FCATAS 410); Jilin Province, Jiaohe City, Ailin Forest Farm, on decorticated wood, 30 August 2013, Hai X. Ma, Col. 085 (FCATAS 408); Liaoning Province, Qingyuan County, Hunheyuan Nature Reserve, on decorticated wood, 16 September 2014, Du ZW, Col. D18 (FCATAS 409).

Notes: The phylogenetic analyses showed that the two strains of *N. polymorpha* clustered together with high support values (BS = 93, PP = 1.00) and formed a sister clade with *N. caries* (Figure 10). *Nemania caries* resembles the new species in stromatal morphology (Figure 9), but the former has smaller ascospores (9.1–)9.4–11(–11.3) × (3.9–)4–4.5(–4.8) µm (Me = 10.2 × 4.3 µm, Qe = 2.4) (Fournier et al. 2018). *Nemania serpens* is different in having ascus annulus dextrinoid in Lugol's solution, none or a barely discernible dextrinoid reaction in Melzer's iodine reagent, and slightly smaller ascospores 10–14.5 (–16.5) × 4–6 µm (Me = 12.5 × 4.8 µm) (Petrini and Rogers 1986; Granmo et al. 1999).

Xylaria Hill ex Schrank, Baier. Fl. (München) 1: 200 (1789)

Notes: *Xylaria* is one of the most important genera in the family *Xylariaceae* (Fournier et al. 2011) and more than 300 species have been reported in the world (Kirk et al. 2008). The type species, *X. hypoxylon*, was described by Linnaeus (1745) as *Clavaria hypoxylon* from Sweden and transferred to the genus *Xylaria* by Greville (1824). Species of this genus are characterised by having upright, stipitate, woody stromata with perithecia immersed Ju and Rorgers (1999). The genus is widely distributed in tropical, subtropical, and temperate regions.

Xylaria pteridicola Hai X. Ma & A.H. Zhu, sp. nov. Figure 11

Fungal Names: FN 571664.

Etymology: *pteridicola* (Latin), refers to the host which the fungus inhabits.

Diagnosis: Differing from *Xylaria amphithele* by smaller ascospores without hyaline appendage (San

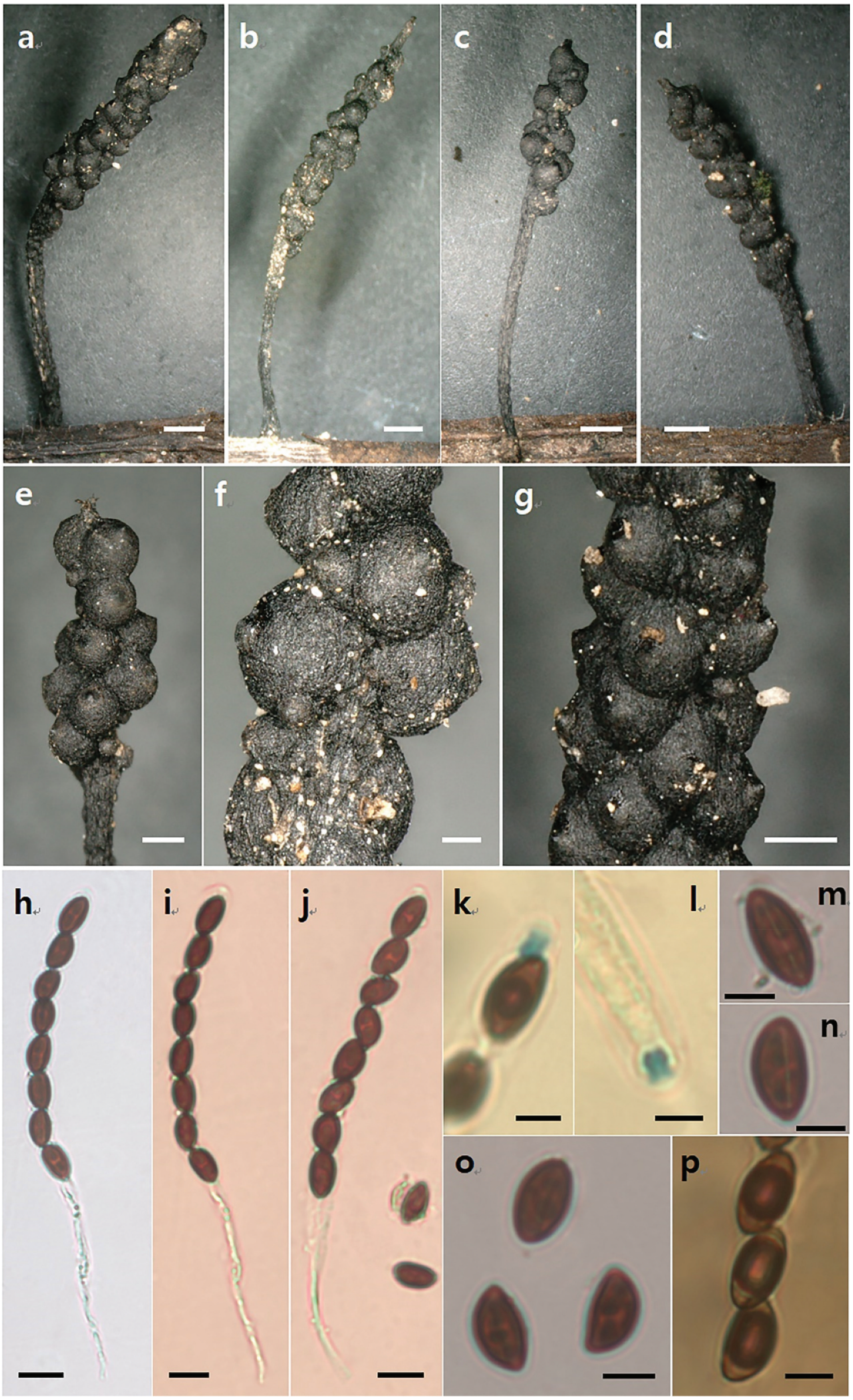

Figure 11. *Xylaria pteridicola* (holotype). (a–d) Stromata on decomposing petioles of Pteridium. (e–g) Stromatal surface. (h–j) Asci. (k–l) Ascal apical ring. (m–n) Ascospore with germ silt. (o) Ascospores in India ink. (p) Ascospores in Melzer's iodine. Scale bars: a – d = 1 mm; e, g = 0.5 mm; f = 0.2 mm; h – j = 10 μm; k – p = 5 μm.

Figure 12. Strict consensus tree of ITS and *tub* sequences of *Xylaria* and allied genera in *Xylariaceae*. Bootstrap values (≥50%, before the slash markers) and Bayesian posterior probabilities (≥0.95, after the slash markers) are shown.

Martín and Rogers 1989), and from *Xylaria juruensis* by smaller ascospores and inverted hat-shaped to urn-shaped ascal apical ring (San Martín and Rogers 1989).

Description: Stromata upright or prostrate, solitary, irregularly fusiform, unbranched, 0.5–5 cm total length, with a mucronate sterile apex up to 1.2 mm; fertile part usually consisting of few scattered exposed perithecial contours, carbonaceous, 2–5 mm long, 0.8–1.3 mm diam.; stipe black, glabrous, the base slightly swollen, 2.5–43 mm long, 0.3–0.5 mm diam.; externally black, interior white. Texture soft. Perithecia immersed, subglobose, 0.4–0.5 mm diam. Ostioles papillate. Asci cylindrical, long-stipitate, 102–135 µm total length, the spore-bearing part 55–70 × 5.5–7.5 µm, the stipes 28–61 µm long, with eight obliquely uniseriate ascospores, with apical ring bluing in Melzer's iodine reagent, inverted hat-shaped to urn-shaped, 2.5–3.3 µm high, 2.0–2.5 µm broad. Ascospores light brown to brown, unicellular, ellipsoid-inequilateral, with narrowly rounded ends, one end slightly truncate sometimes, smooth, (8.4–)9–10.3(–10.7) × (4.7–)5.0–6.0(–6.5) µm ($M = 9.5 \times 5.5$ µm, $n = 30$), with straight germ slit spore length, without sheath or appendages visible in India ink.

Materials examined: China. Yunnan Province, Jinghong City, Forest Park, on decomposing petioles of *Pteridium* sp., 22 January 2015, Hai X. Ma, Cel. 251 (holotype in FCATAS752); Cel. 296 (FCATAS 754); Dadugang Town, on decomposing petioles of *Pteridium* sp., 21 January 2015, Hai X. Ma, Cel. 288 (FCATAS 753).

Notes: *Xylaria pteridicola* somewhat resembles *X. amphithele* and *X. juruensis* in stromatal morphology, but *X. amphithele* differs in having larger ascospores (9–10.3 × 5–6 µm *vs.* 12–14 × 7–8 µm) with hyaline noncellular appendage 2–5 µm long and

2–5 µm broad, and *X. juruensis* differs from the new species by its larger ascospores (14.5–17 × 5–5.5 µm) and larger, rectangular ascal apical ring 5–7 µm high and 2–4 µm broad (San Martín and Rogers 1989). Moreover, phylogenetic analysis showed that *X. pteridicola* is distinct from *X. amphithele* and *X. juruensis* (Figure 12). In the phylogenetic tree, *X. pteridicola* groups together with *X. betulicola* from China with low support (Figure 12). Moreover, *X. betulicola* has longer stromata with a long sterile filiform apex up to 4 cm and larger ascospores 12–14 × 5–6 µm (Ma and Li 2018).

Basidiomycota

Agaricomycetes

Agaricales Underw., Moulds, mildews, and mushrooms. A guide to the systematic study of the Fungi and Mycetozoa and their literature (New York): 97 (1899)

Crepidotaceae (S. Imai) Singer, Lilloa 22: 584 (1951) [1949]

Notes: Singer (1949) proposed the tribe *Crepidoteae* with the type genus *Crepidotus* (Aime 1998; Consiglio and Setti 2008). A total of eight genera, namely *Tubaria*, *Melanomphalia*, *Crepidotus*, *Simocybe*, *Pellidiscus*, *Chromocyphella*, *Phaeosolenia*, and *Episphaeria* were included in *Crepidoteae*, which is now named *Crepidotaceae* s.l (Singer 1986). As the number of morphoanatomical and phylogenetic studies increased, some genera were grouped into *Cortinariaceae* or *Inocybaceae* (Senn-Irlet 1995; Aime 1998; Kirk et al. 2008; Consiglio and Setti 2008; Ge 2017; Ge and Bau 2020). Vizzini et al. (2012) determined that *Neopaxillus* and *Crepidotus* had a sister group relationship based on an ITS and nLSU phylogenetic analysis. Additional studies were subsequently conducted. Watling and Aime (2013) first proposed the framework of *Crepidotaceae* consisting of the genera *Crepidotus*, *Simocybe*, and *Neopaxillus* to develop the concept of *Crepidotaceae* s.s.

Crepidotus (Fr.) Staude, Schwämme Mitteldeutschl. 1: xxv, 71 (1857)

Notes: *Crepidotus*, typed by *Crepidotus mollis*, originally belonged to a tribe of *Agaricus*, but Donk was the first to designate it as a genus in 1857 (Consiglio and Setti 2008; Ge 2017). *Crepidotus* species are mainly characterised by small to medium-sized basidiomes, mostly sessile or lateral stipe, brown basidiospores, and mostly found on dead branches and deciduous leaves (Senn-Irlet 1995; Aime 1998; Consiglio and Setti 2008; Na et al. 2022). There are currently 575 recorded *Crepidotus* taxa (http://www.indexfungorum.org, accessed on 24 May 2023), most of which were described in Europe and North America. After the 20th century, most new *Crepidotus* taxa have been described in Asia (Hesler and Smith 1965; Poder and Ferrari 1984; Senn-Irlet 1991, 1992, 1993; Liu 1995; Aime et al. 2002; Ge 2017; Ge et al. 2017; Guzman-Davalos et al. 2017). Current research efforts in Asia are mainly concentrated in China and India. In the last decade, there have been 10 new taxa in China, 7 new taxa in India, and 1 new taxon in Pakistan (Agretious and Prasanth 2017; Guzman-Davalos et al. 2017; Kumar et al. 2018, 2020, 2022; Ge and Bau 2020; Izhar et al. 2021).

Crepidotus furcaticystidiosus Q. Na, M.H. Han, R.X. Wei, H. Zeng & Y.P. Ge, sp. nov. Figures 13–15

Fungal Names: FN 571591.

Etymology: *furcaticystidiosus* (Latin), refers to the furcate cheilocystidia.

Diagnosis: Differing from other *Crepidotus* species by its smooth pileus, white, basidiospores, verrucose to faintly punctate, cheilocystidia branched at the apex, and clamp connections.

Description: Basidiomes small, 5–15 mm in diam., ungulate and campanulate when young, plano-convex to shell-shaped, convex at the near base when mature, white (LIII), but sometimes Cream Colour (XVI19′f), Naples Yellow (XVI19′d), Cartridge Buff (XXX19″f), Cream Buff (XXX19″d), and Ivory Yellow (XXX21″f) because of the basidiospores that dropped from the upper layer of the basidiomes, surface smooth or nearly smooth, edge involuted, non-striated, non-hygrophanous, and covered with sparse and indistinct white (LIII) villose near the attachment. Lamellae 1–2 mm wide, free, L = 9–16, l = 3–9, ventricose, white (LIII) when young, from the base to the edge gradually darkening to Massicot Yellow (XVI21′f) and Straw Yellow (XVI21′d), Primuline Yellow (XVI19′), and Old Gold (XVI19′i) when mature, surface with a few dark spots, Buffy Citrine (XVI19′k), Saccardo's Olive (XVI19′m), and edge not fimbriate. Stipe cylindrical, 0.5–1.5 mm in length, less than 0.5 mm in diam., white (LIII), nearly transparent, pubescent, and indistinct when mature. Context thin, white (LIII) or nearly transparent. Odour and taste indistinct. Basidiospores (153/6/3) (6.0–)6.3–***6.9***–7.5

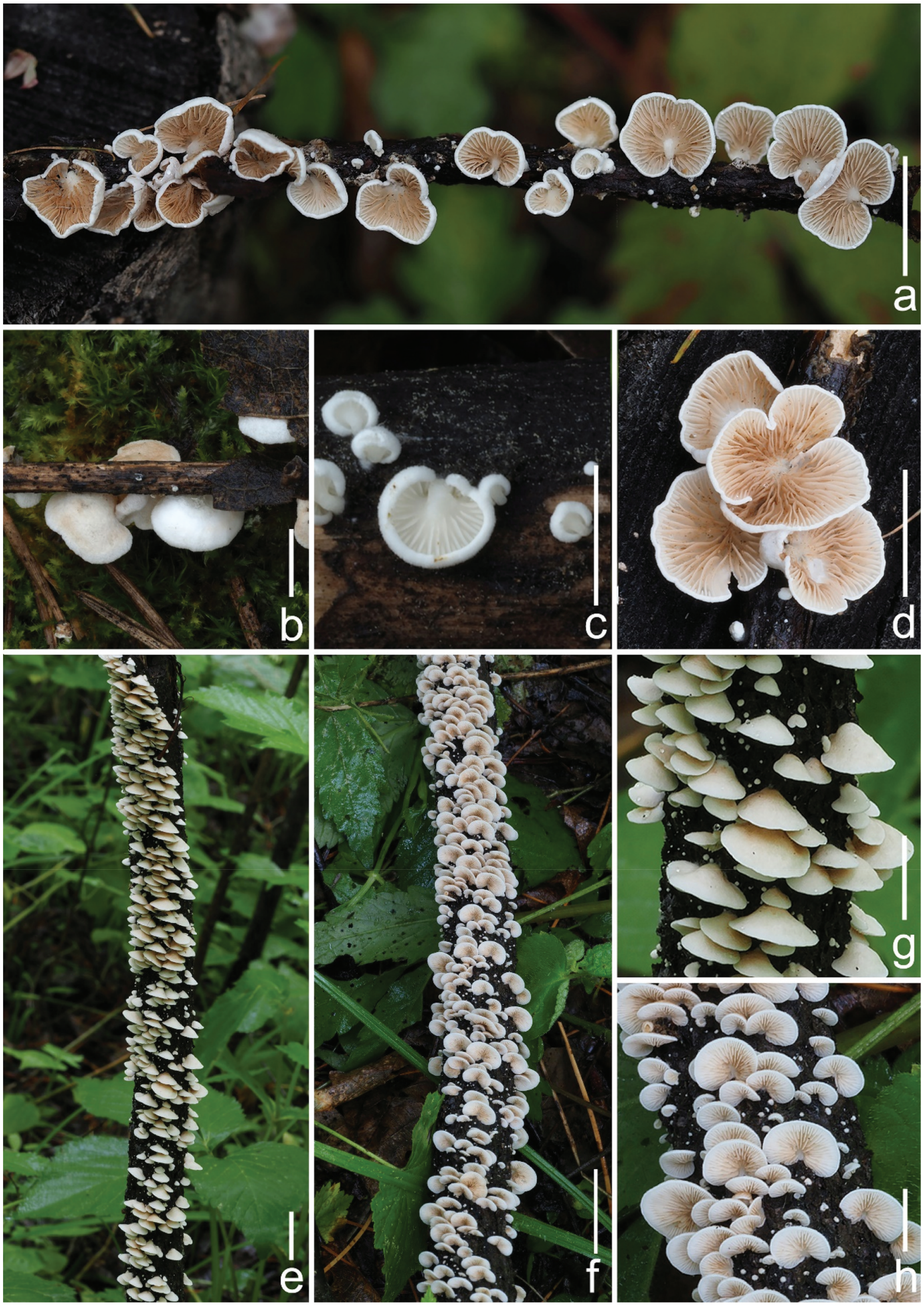

Figure 13. Basidiomes of ***Crepidotus***. (a–d) ***Crepidotus tomentellus***. (e–h) ***Crepidotus furcaticystidiosus***. Scale bars: a, d, g − h = 10 mm; b − c = 5 mm; e − f = 20 mm.

(−7.9) × (4.3–)4.5–***4.9***–5.3(−5.5) µm, Q = (1.20–)1.28–1.51 (−1.60), **Q_m** = 1.40 ± 0.07. HOLOTYPE (75/3/1) (6.0–)6.3–***6.9***–7.4(−7.7) × (4.3–)4.5–***4.9***–5.3 µm,Q = (1.27–)1.30–1.54 (−1.59), **Q_m** = 1.42 ± 0.07, amygdaliform to inaequilateral in the lateral view, ovoid to ellipsoid in the dorsoventral view, light brown, irregularly covered by punctate to faintly verrucous protuberances of varying sizes, sometimes short connections between protuberances. Basidia 17–26 × 6–9 µm, short clavate, obtuse apex, sometimes slightly attenuated in the middle,

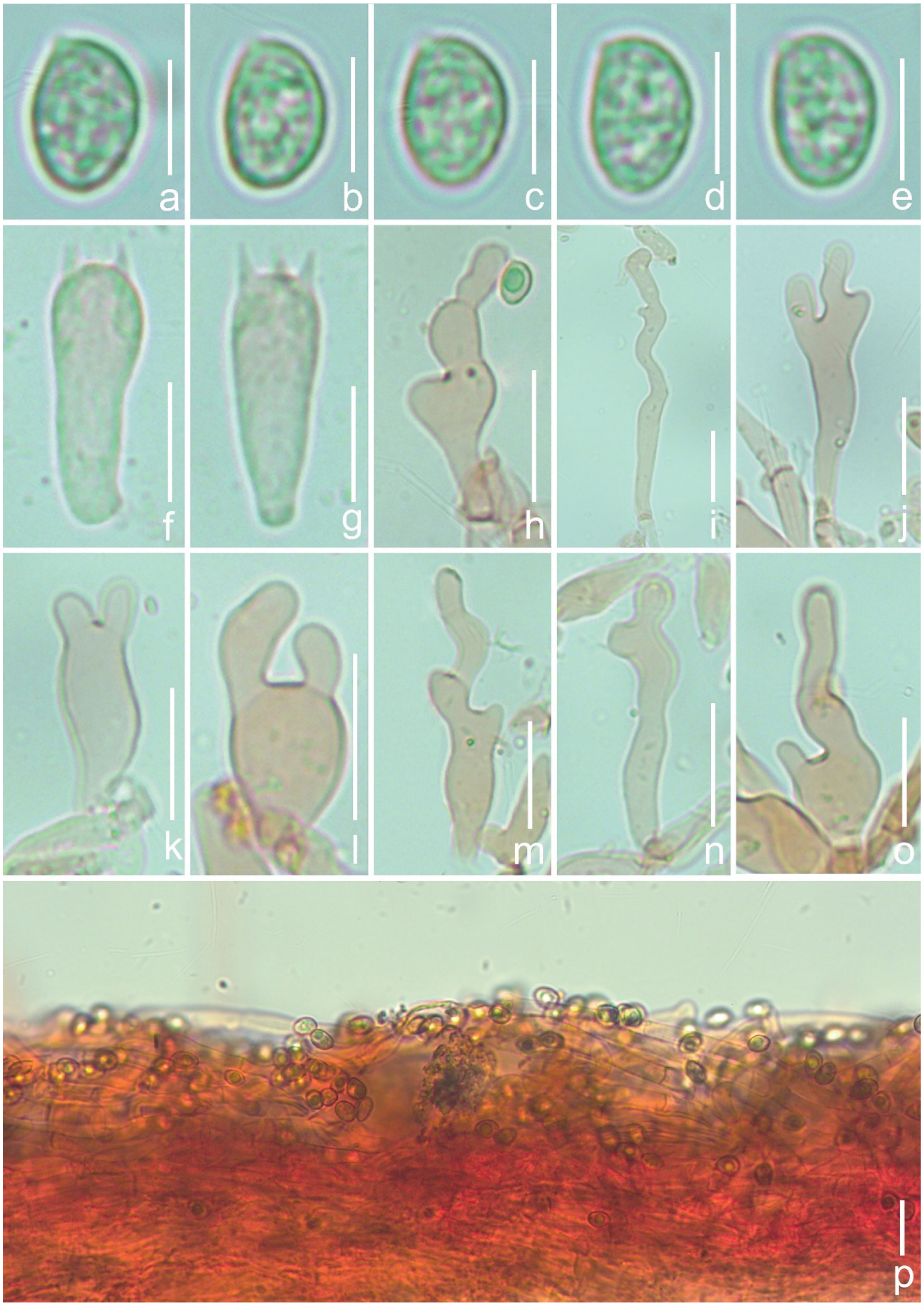

Figure 14. Microscopic features of ***Crepidotus furcaticystidiosus*** (holotype). (a–e) Basidiospore. (f–g) Basidia. (h–o) cheilocystidia. (p) Pileipellis. Scale bars: a − e = 5 µm; f − g = 10 µm; h − p = 20 µm.

basal contraction, hyaline, thin-walled, 4-spored, sterigmata 2.8–5.2 µm in length, a few 2-spored. Cheilocystidia 25–64(−73) × 6–16 µm, attenuated at the base, enlarged upwards to globose, subglobose to utriform, apex bifurcate and curved, the bifurcate part is not of equal length, the long bifurcate part can reach up to half the length of cheilocystidia, when immature, cheilocystidia expand indistinctively in the middle, long cylindrical to lageniform, curved, non-bifurcate apex or bifurcate. Pileipellis a cutis, composed of

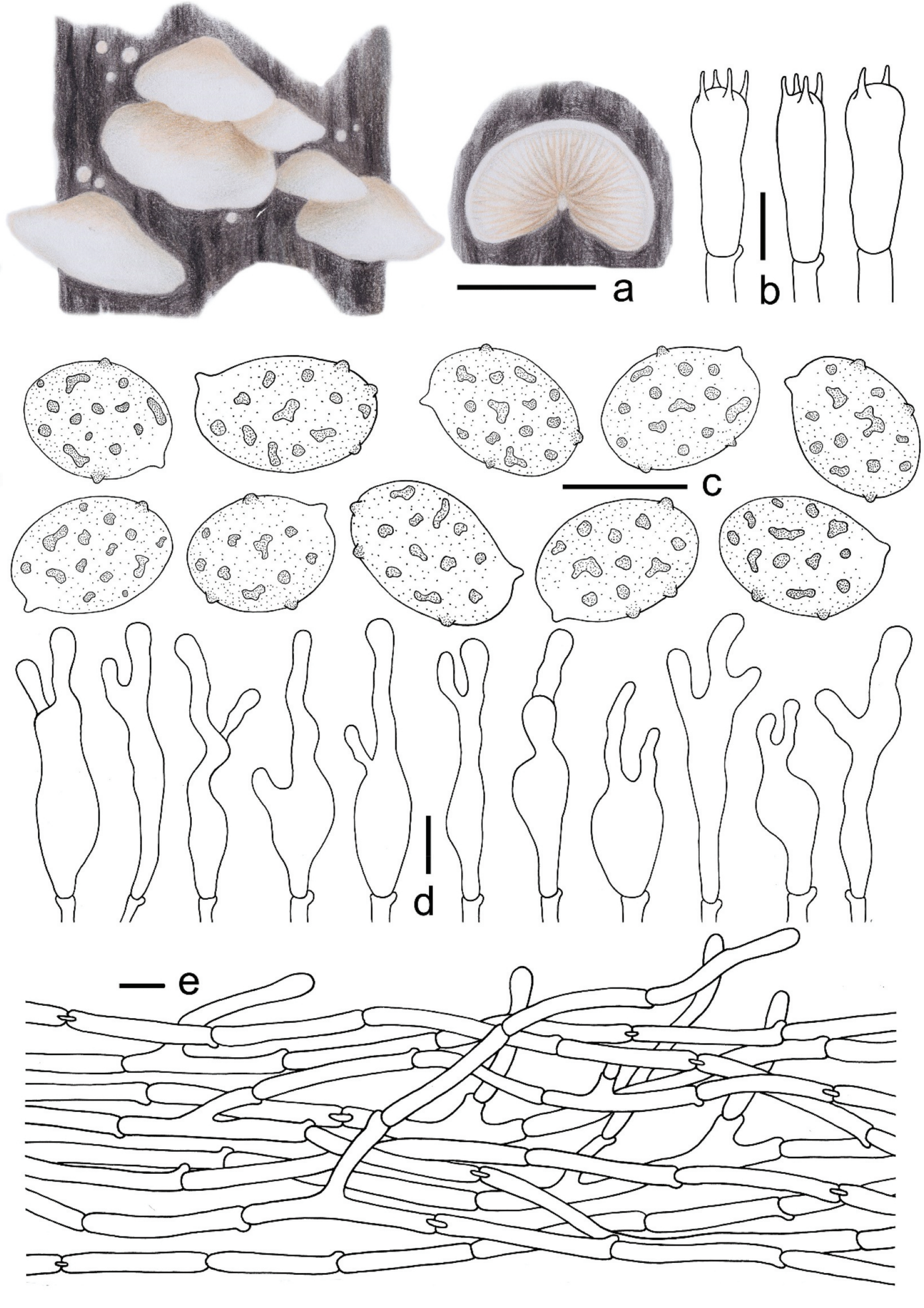

Figure 15. Morphological structures of ***Crepidotus furcaticystidiosus*** (holotype). (a) Basidiomes. (b) Basidia. (c) Basidiospores. (d) Cheilocystidia. (e) Pileipellis. Scale bars: a = 10 mm; b, d, e = 10 μm; c = 5 μm.

cylindrical hyphae 3.7–5.6 μm wide, bifurcate, hyaline, smooth, some hyphae covered by different coloured punctate ornamentation, some hyphae vertical to the pileus.

Materials examined: China. Jilin Province, Yanbian Korean Autonomous Prefecture, Changbai Mountain Nature Reserve, gregarious on broad-leaved forest twigs, 4 July 2021, GN 1080 (holotype in FFAAS 1026), GN 1074(FFAAS 1027), GN 1093 (FFAAS 1028).

Notes: Based on the faintly punctate to warty ornamented basidiospores, *C. furcaticystidiosus* should be classified in the series *Caspari*, sect. *Dochmiopus*, and subg. *Dochmiopus* (Consiglio and Setti 2008). According to Giovanni's records, there are four taxa in the series *Caspari*, viz. *Crepidotus caspari* var. *caspari*, *Crepidotus caspari* var. *subglobisporus*, *Crepidotus fusisporus*, and *Crepidotus subverrucisporus*, of which the basidiospores of *C. fusisporus* (7.9–9.5 × 4.0–5.2 µm) and *C. subverrucisporus* (7.7–9.4 × 5.1–6.3 µm) are significantly larger than the basidiospores of the other taxa. The basidiospores of *C. caspari* var. *subglobisporus* (5.6–6.6 × 4.5–5.3 µm, Q = 1.15–1.33) are smaller and more globose. The basidiospores of *C. furcaticystidiosus* are clearly distinguished from those of these three taxa. Cheilocystidia of *C. caspari* var. *caspari* are cylindrical to clavate and not branched apically, but the apical bifurcation of the cheilocystidia is the most typical characteristic of *C. furcaticystidiosus*. Thus, *C. furcaticystidiosus* can be clearly distinguished from the known European species of the series *Caspari* (Consiglio and Setti 2008).

According to the white basidiomes, absence of pleurocystidia, and morphology of the basidiospores, *Crepidotus phaseoliformis*, *Crepidotus lanuginosus*, and *Crepidotus villosus* in subg. *Dochmiopus* of sect. *Phaseoli* and sect. *Crepidotellae* are closely related to *C. furcaticystidiosus*. Macroscopically, the tomentose pileus and punctate to spiny ornamented basidiospores of *C. villosus* can be used to distinguish it from *C. furcaticystidiosus*. Microscopically, the pileipellis of *C. phaseoliformis* has a distinct gelatinous layer, whereas the pileipellis of *C. lanuginosus* comprises brown hyphae. Both taxa are distinct from *C. furcaticystidiosus* (Hesler and Smith 1965). In the current phylogenetic (Figure 16), the two samples of *C. furcaticystidiosus* form monophyletic lineages with high statistical support (BS = 100, BPP = 1.00). According to the tree topology, *C. furcaticystidiosus* belongs to the *C. cesatii* lineage and is distinct from the previously known taxa of *Crepidotus* (Figure 16).

Crepidotus tomentellus Q. Na, M.H. Han, R.X. Wei, H. Zeng & Y.P. Ge, sp. nov. Figures 13, 17, 18

Fungal Names: FN 571592.

Etymology: *tomentellus* (Latin), refers to the tomentose pileus.

Diagnosis: Differing from other *Crepidotus* species by its tomentose pileus, white, basidiospores ellipsoid to cylindric, cheilocystidia usually with branching upper part, and clamp connections.

Description: Basidiomes small, 5–18 mm in diam., flabelliform to shell-shaped when young, flabelliform to nearly circular, near plano-convex when mature, convex near the attachment, densely pubescent-woolly, white (LIII), margin involuted, non-striated, non-hygrophanous, covered by obvious white (LIII) villose hyphae near the attachment, pileus colour darkens slightly when old, Cream Colour (XVI19′f), Naples Yellow (XVI19′d), and Mustard Yellow (XVI19′b), the hyphae colour darkens slightly near the attachment, Baruta Yellow (IV21f), Martius Yellow (IV23f), some hyphae near the attachment disappear. Lamellae 0.5–1.5 mm wide, free, L = 15–22, l = 3–13, ventricose, Cartridge Buff (XXX19″f), Ivory Yellow (XXX21″f), Cream Buff (XXX19″d) when young, Maize Yellow (IV19f), Buff Yellow (IV19d), Aniline Yellow (IV19i) when mature, the lamellae colour change is consistent, not a gradient, lamellae edge covered by short punctate villose, lamellae colour darkens when old, Orange Citrine (IV19k), Medal Bronze (IV19m), deeply coloured particles or spots at the surface, Russet (XV13′k), Cinnamon Brown (XV15′k), Prout's Brown (XV15′m). Stipe 0.5–1.5 mm in length, 0.5–1.0 mm in diam., covered with white (LIII) pubescence. Context thin, white (LIII) or nearly transparent. Odour and *taste* indistinct. Basidiospores (304/6/4) (5.1–)5.5–***6.3***–7.1 (–7.4) × (2.7–)3.0–***3.3***–3.7(–4.1) µm, Q = (1.60–)1.68–2.12 (–2.29), $\boldsymbol{Q_m}$ = ***1.89*** ±0.13. HOLOTYPE (112/2/1) (5.9–) 6.2–***6.6***–7.2(–7.4) × (2.8–)3.0–***3.4***–3.7(–4.0) µm, Q = (1.66–)1.78–2.13(–2.29), $\boldsymbol{Q_m}$ = ***1.97*** ±0.13, amygdaliform to inaequilateral in the lateral view, narrowly ellipsoid to cylindrical in the dorsoventral view, whitish-yellow to light dark brown, punctate to verrucous protuberance, ornamentation inapparent and difficult to detect (×1,000). Basidia 18–26 × 5–7 µm, cylindrical to short clavate, obtuse apex, sometimes curved in the middle, basal contraction, hyaline, thin-walled, 4-spored, sterigmata 2.9–3.3 µm in length, and a few 2-spored. Cheilocystidia 18–31 × 3–14 µm, unstable shape, most are clavate at the base, irregular upper part, multiple toed bifurcate, bifurcate indistinct, apex with a long cylindrical protuberance, numerous 10–30 µm in length, a few up to 50 µm in length, 2–3 µm in diam., protuberances produce a septum at the connection with the mother cell. Pileipellis a trichoderm, composed of 2.6–3.9 µm wide cylindrical hyphae, bifurcate, but few, hyaline, smooth, the hyphae are spirally or irregularly bent to form a villous structure on the pileipellis.

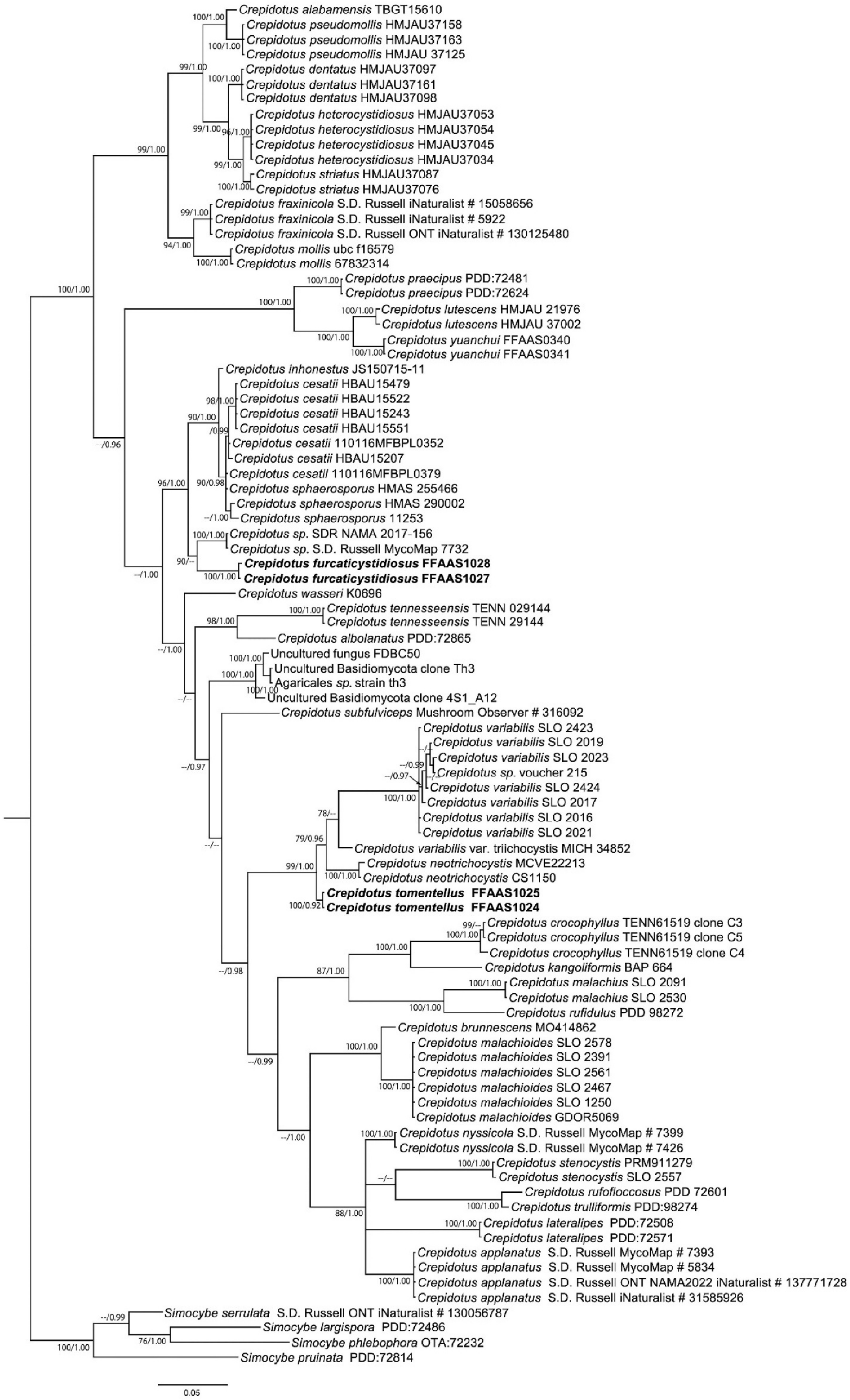

Figure 16. Phylogenetic relationship among species of *Crepidotus* inferred from ITS region. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 75% and 0.95, respectively, are labelled at the nodes. The newly described species are in boldface.

Materials examined: China. Heilongjiang Province, Greater Khingan Mountains region, Huzhong District, Huzhong National Nature Reserve, gregarious on twigs of *Larix*, 29 August 2021, GN 1423 (holotype in FFAAS 1024); Heilongjiang Province, Tahe County, Shibazhan Town, gregarious on twigs of *Larix*, 26 August 2021, GN 1429 (FFAAS 1030), GN 1433 (FFAAS 1029), GN 1434 (FFAAS 1025).

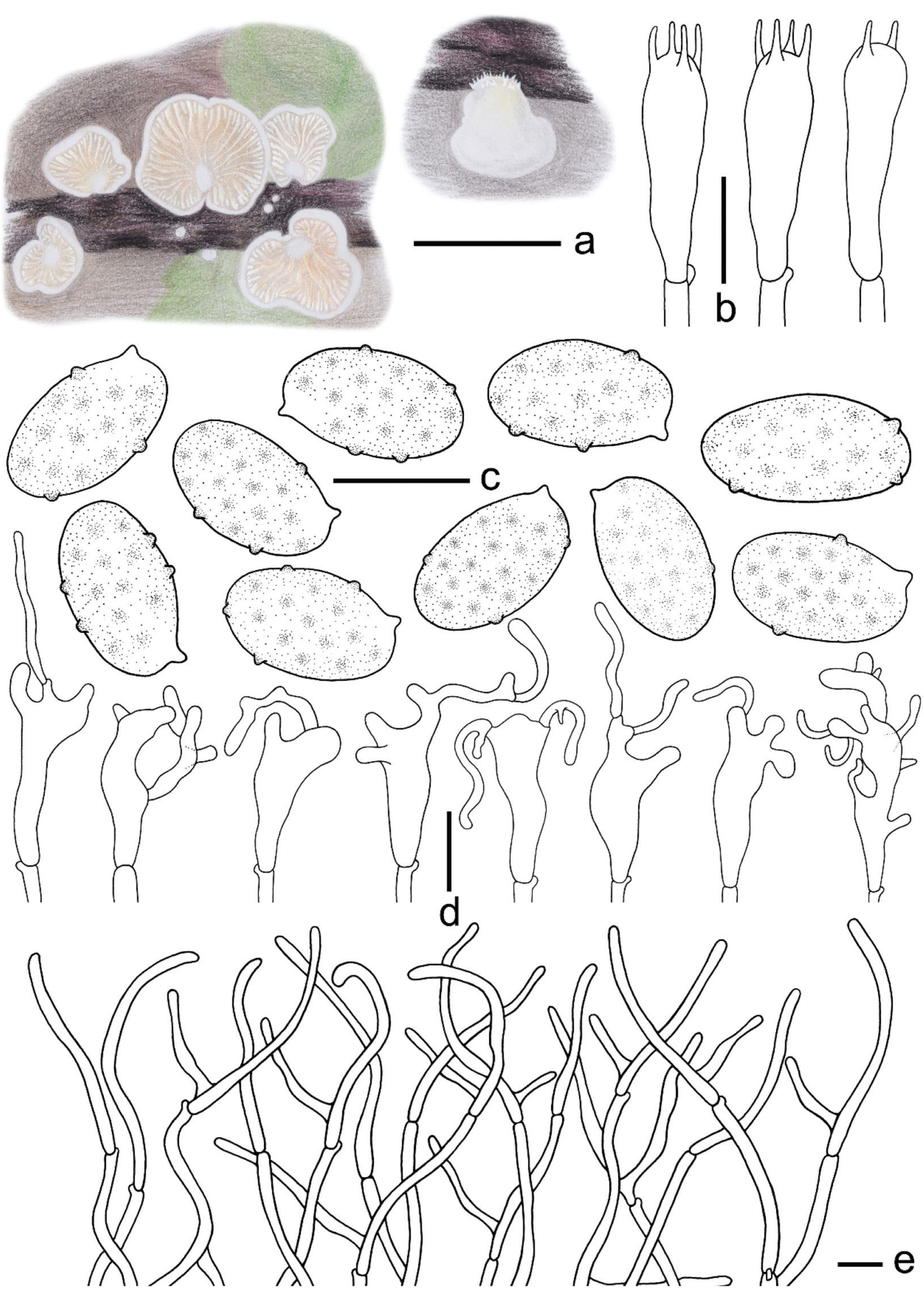

Figure 17. Morphological structures of ***Crepidotus tomentellus*** (holotype). (a) Basidiomes. (b) Basidia. (c) Dasidiospores. (d) Cheilocystidia. (e) Pileipellis. Scale bars: a = 10 mm; b, d, e = 10 μm; c = 5 μm.

Notes: Based on the elongated ellipsoid to cylindrical basidiospores, *Crepidotus tomentellus* should be classified in the series *Dochmiopus*, sect. *Dochmiopus*, and subg. *Dochmiopus* (Consiglio and Setti 2008). There are seven taxa in the series *Dochmiopus*, of which *Crepidotus variabilis* var. *variabilis*, *Crepidotus neotrichocystis*, and *Crepidotus variabilis* var. *trichocystis* are closely related to *C. tomentellus*. Microscopically, the basidiospores of *C. tomentellus* are elongated ellipsoid to cylindrical. The cheilocystidia are much narrower and distinct from those of *C. variabilis* var. *variabilis*,

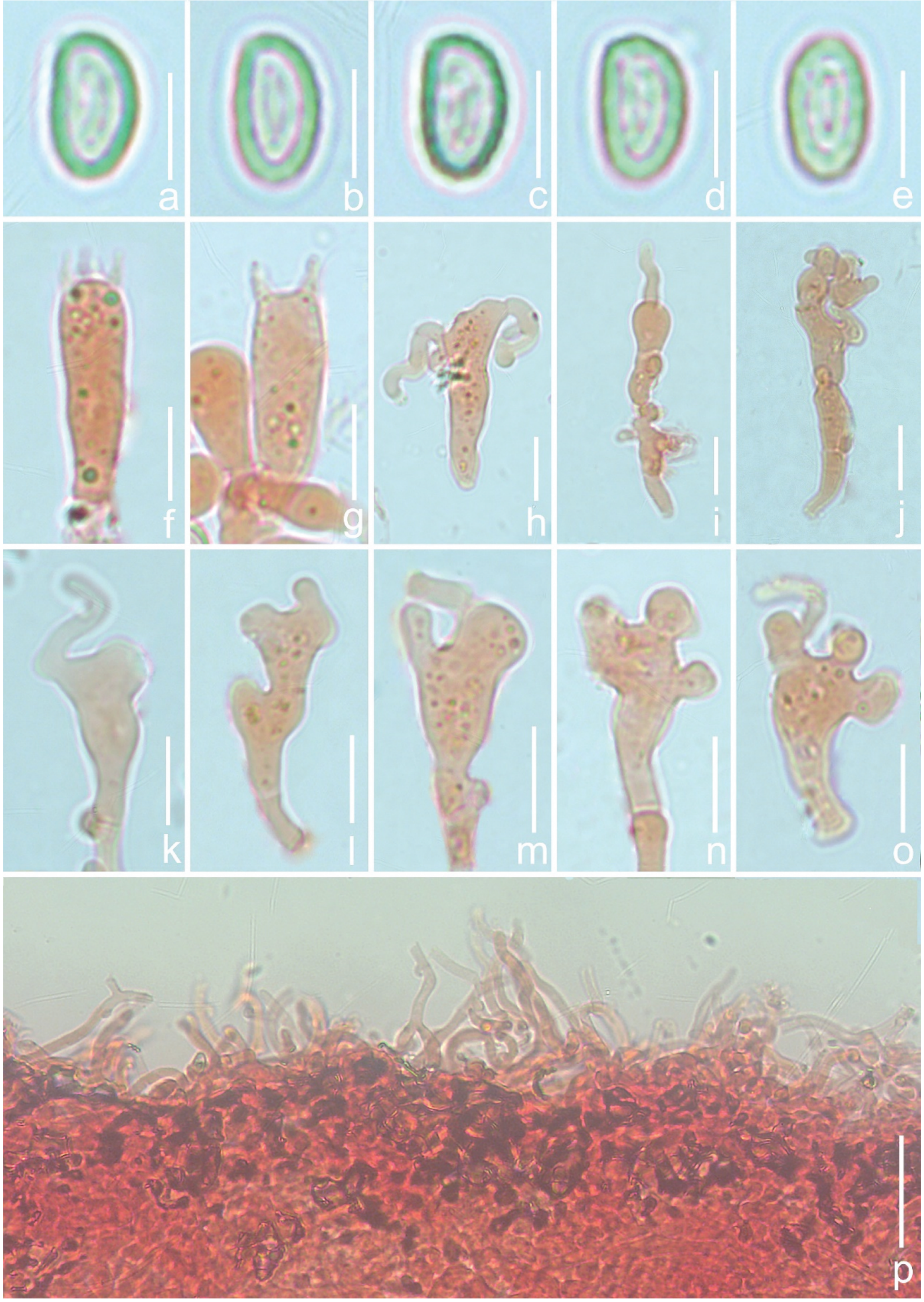

Figure 18. Microscopic features of ***Crepidotus tomentellus*** (holotype). (a–e) Basidiospore. (f–g) Basidia. (h–o) Cheilocystidia. (p) Pileipellis. Scale bars: a − e = 5 µm; f − o = 10 µm; p = 20 µm.

C. neotrichocystis, and *C. variabilis* var. *trichocystis* (Senn-Irlet 1995; Consiglio and Setti 2008; Jančovičová et al. 2020). Although species in the *C. variabilis* lineage have no special substrate requirements, they are rarely found on twigs in coniferous forests. In contrast, specimens of *C. tomentellus* have been found on twigs of *Larix* trees, which is a distinct feature in *Crepidotus* (Jančovičová et al. 2017). The phylogenetic analysis revealed that *C. tomentellus* belongs to the

Figure 19. Basidiomes of ***Clitocella neofallax*** (holotype). (a) Upper surface. (b) Lower surface. Scale bars: 1 cm.

C. variabilis lineages, and was resolved as monophyletic with strong support (BS = 100, BPP = 1.00; Figure 16).

Entolomataceae Kotl., Pouzar, Česká Mykol. 26(4): 218 (1972)

Notes: The family *Entolomataceae* was introduced by Kotlába and Pouzar (1972) with the type genus *Entoloma*. *Entolomataceae* is a species-rich family that occurs worldwide from arctic to tropical habitats with seven accepted genera viz. *Clitocella*, *Clitopilopsis*, *Clitopilus*, *Entocybe*, *Entoloma*, *Rhodocybe*, and *Rhodophana* (Co-David et al. 2009; He et al. 2019; Noordeloos and Hausknecht 2007). The family is highly variable in terms of basidiomes and micromorphology (Noordeloos 2004). The majority of species live as saprotrophic communities on soil, wood, or moss, while others are parasitic on other mushrooms and plants, or ectomycorrhizal fungi (Antibus et al. 1981; Agerer and Waller 1993; Noordeloos 2004; Montecchio et al. 2006). Co-David et al. (2009) first conducted a thorough molecular phylogenetic analysis of the *Entolomataceae* by multigene analysis (mtSSU, nLSU, and *rpb2*).

Clitocella Kluting, T.J. Baroni & Bergemann, Mycologia 106(6): 1135 (2014)

Notes: *Clitocella* (*Entolomataceae*, *Agaricales*) was established with *C. popinalis* as the type species (Kluting et al. 2014). The genus *Clitocella* is characterised by clitocyboid basidiomes; convex to planoconvex or applanate pileus; narrow and crowded, decurrent lamellae; central to eccentric stipe; thin-walled (<0.5 µm) basidiospores with undulate pustules or minute bumps; presence of clamp connections; and usually absence of pleurocystidia and cheilocystidia (Baroni et al. 2020; Jian et al. 2020; Mao et al. 2022).

Clitocella neofallax W.H. Lu, Karun. & S. Tibpromma, sp. nov. Figures 19, 20

Fungal Name: FN 571612.

Etymology: *neofallax* (Latin), reflects its morphological similarity to *Clitocella fallax*.

Diagnosis: Differing from *Clitocella fallax* by slightly smaller basidiospores and slightly shorter basidia.

Description: Basidiomes clitocyboid, small. Pileus 10–30 mm wide, dry, low convex, sometimes infundibuliform, with a shallow depression at the centre; margin incurved, not striate, often enrolled or flat, sometimes slightly uplifted; surface pale white to greyish white (1B1), context white to greyish white (1B1). Lamellae decurrent, yellowish white (2A2) to pale yellow (2A3), becoming greyish yellow (3B4) or dull yellow (3B5) on drying, crowded, edges entire and concolorous, thin and fragile, lamellulae numerous and concolorous with lamellae. Stipe 10–25 × 1–2 mm, central to eccentric, occasionally lateral, cylindrical to subcylindrical, equal or sometimes slightly tapering at base, pale white to greyish yellow (4B6), smooth or tomentose. Odour unrecorded. Taste not recorded. Chemical colour reaction: not reacting with KOH 5% at pileus of dried specimens. Basidiospores ellipsoid to ovoid, occasionally amygdaliform, hyaline, smooth, oil drop at central, obscure pustules (4.0–)4.8–6.3 × (3.5–)

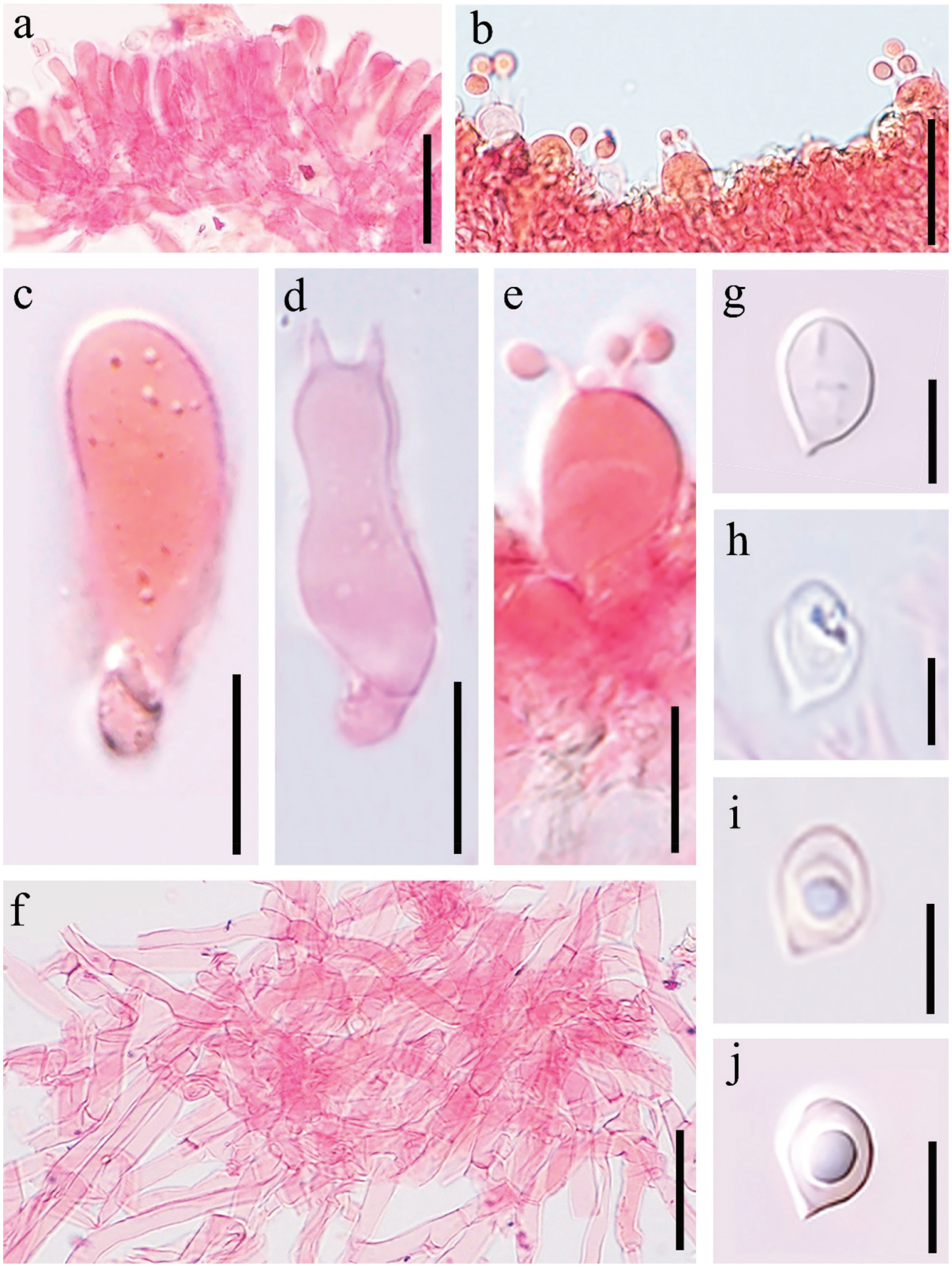

Figure 20. Microscopic structures of ***Clitocella neofallax*** (holotype). (a) Hymenium showing basidioles. (b–e) Basidia. (f) Pileipellis. (g–j) Basidiospore. Scale bars: a, b, f = 20 µm; c − e = 10 µm; g − j = 5 µm.

4–5 µm, L = 5.3 µm, W = 4.1 µm, Q = 1.2 (*n* = 20). Basidia clavate, hyaline, with four sterigmata, 15–23.5 × 6–9 µm; basidioles similar in shape to basidia, but smaller. Stipitipellis a cutis composed of parallel, compactly arranged, thin-walled, hyaline hyphae, 1–2 µm wide. Pleurocystidia and cheilocystidia absent.

Materials examined: China. Yunnan Province, Qujing City, Qujing Normal University, on the soil associated with bamboo roots, 25°31′37′′ N, 103° 44′40″ E, 11 June 2022, QJ 093 (holotype in HKAS 128149); *ibid*. Wenhua Lu, QJS10 (HKAS 128152).

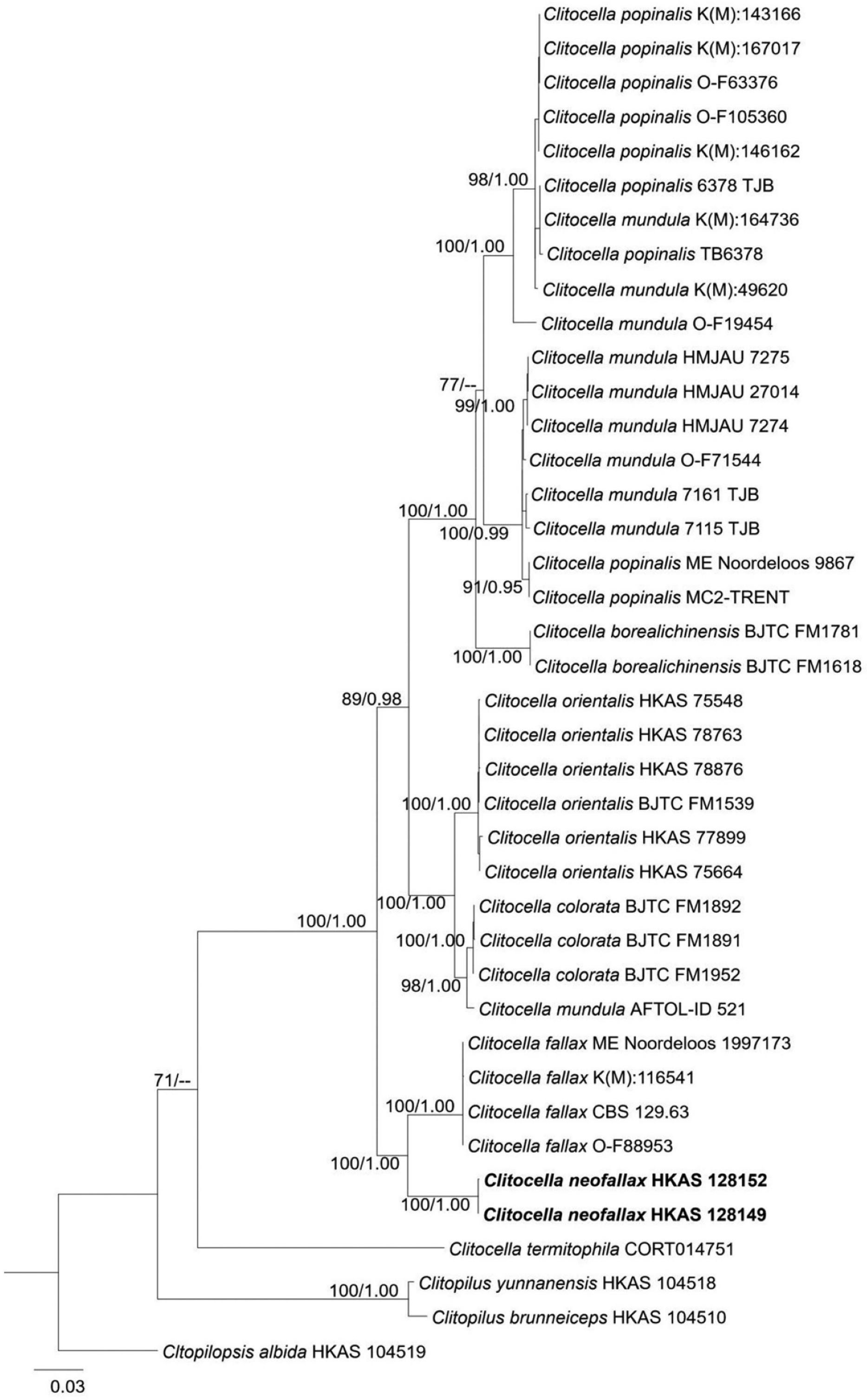

Figure 21. The phylogenetic relationship among species of *Clitocella* inferred from the combined dataset of nLSU, *rpb2*, and *tef1* regions. The maximum likelihood algorithm has generated the topology. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 70% (left) and 0.90 (right), respectively, are labelled at the nodes. The newly described species is in black bold.

Notes: In the multilocus phylogenetic tree, *Clitocella neofallax* formed a distinctly separate sister clade to *C. fallax* strains with 100% BS and 1.00 of BPP (Figure 21). Morphologically, *Clitocella neofallax* closely resembles *C. fallax* and *C. borealichinensis* by basidia and basidiospores. However, *C. fallax* has longer basidia and slightly larger basidiospores 6.5–8 × 4–5 µm *vs.* (4.0–)4.8–6.3 × (3.5–)4–5 µm (Jian et al. 2020), while

C. borealichinensis differs by clitocyboid basidiomes in having small basidia and larger pileus (13–50 µm), and being reported on the ground in a broad-leaved forest (Mao et al. 2022). Moreover, *C. neofallax* is easily confused with *C. mundula*, but *C. mundula* differs from *C. neofallax* by its yellowish grey or brown to dark smoky grey pileus, and somewhat larger basidiospores (4–)4.5–6(–6.5) × 4–5 µm (Jian et al. 2020). Based on phylogeny and morphology, our specimens are identified as a new species *C. neofallax*. In China, four species have been reported from the genus *Clitocella*, including three new species *Clitocella orientalis*, *C. colorata*, *C. borealichinensis*, and one new record *C. mundula* (Jian et al. 2020; Mao et al. 2022), and the diversity of *Clitocella* will be high based on morphology and phylogeny in the future.

Physalacriaceae Beihefte zur Nova Hedwigia 33: 10 (1970)

Notes: *Physalacriaceae* belongs to *Agaricales* (*Agaricomycetes*) and is typified by *Physalacria* (Peck 1882; Park et al. 2017). The family was originally described by Corner (1970) and revised by Berthier (1985). Approximate 21 genera have been reported from *Physalacriaceae* worldwide (Park et al. 2017; Wani et al. 2021), and the family was confirmed as a monophyletic group by phylogenetic analyses (Moncalvo et al. 2002; Matheny et al. 2006; Park et al. 2017). This family is characterised by possessing highly variable basidiomes ranging from agaricoid, secotioid, cantharelloid to corticoid, narrowly clavate basidia with two to four basidiospores, and smooth, thin-walled, ellipsoidal, fusiform, cylindrical, or lacrimiform basidiospores (Park et al. 2017). Most species in *Physalacriaceae* are saprobic on decaying leaves and wood, and several species are parasitic (Park et al. 2017; Wani et al. 2021).

Physalacria Peck, Bull. Torrey bot. Club 9(1): 2 (1882)

Notes: *Physalacria* typified by *P. inflata*, includes more than 40 species (Qin and Yang 2016; Crous et al. 2022). Most species in this genus have shorter than 10 mm, stipitate-capitate (hollow, inflated, head-like caps) basidiomes, a geotropic and smooth hymenium on the surface of the hollow head, sterile stipe, smooth and inamyloid basidiospores, and abundant clamp connections (Berthier 1985; He and Xue 1996; Desjardin and Hemmes 2001; Qin and Yang 2016). *Physalacria auricularioides* has discoid-peltate and cupulate basidiomes with an auriculiform hymenophoral surface and negative geotropism, and is the only one species to be described in Europe (Crous et al. 2022). *Physalacria* has a wide distribution range, being reported in North America, South America, Central America, Oceania, Africa, Europe, and Asia, but mostly in the Southern Hemisphere and the tropics (Kobayasi 1951; Berthier 1985; He and Xue 1996; Inderbitzin and Desjardin 1999; Antonín and Mossebo 2002; Qin and Yang 2016; Crous et al. 2022).

Physalacria tianzhongshanensis A. Tohtirjap, L.R. Zhang & F. Wu, sp. nov. Figures 22–23

Fungal Names: FN 571652.

Etymology: *tianzhongshanensis* (Latin), referring to the species being found in Tianzhongshan.

Diagnosis: Differing from *Physalacria auricularioides* by smaller basidia and basidiospores, sessile, whitish to cream, soft coriaceous basidiomes.

Description: Basidiomes soft coriaceous, more or less gelatinous when fresh, whitish to cream, single, scattered, in group, 2–5 mm, discoid-peltate, cupulate, sessile, hymenial surface smooth, negative geotropic, becoming coriaceous and cream to buff after drying. Margin not lobed and rounded. Hyphal system monomitic; usually simple septate, hyaline, thin-walled, and 0.5–2.0 µm in diam. Basidia clavate or cylindrical, thin-walled, with 1–4 sterigmata up to 4 µm long, 17.2–37.2 × 6.2–7.8 µm; basidioles similar in shape to basidia, but smaller. Basidiospores hyaline, thin-walled, smooth, subglobose, ellipsoid to ovoid, subovoid, subcitriform, lacrymoid, usually with one or two oil drops, (5.8–)6.5–10.2(–11.0) × (4.0–)4.5–5.5(–5.8) µm, $L = 8.12$ µm, $W = 5.07$ µm, $Q = 1.59$ ($n = 30/1$). Cystidia subfusiform, apex narrow, thin-walled, colourless and hyaline, 34.5–42.2 × 9.5–11.4 µm.

Materials examined: China. Zhejiang Province, Hangzhou City, Fuyang District, Tianzhongshan, on fallen angiosperm branch, 26 March 2023, Wu 653 (holotype in BJFC039977), Wu 907 (BJFC040387).

Notes: *Physalacria tianzhongshanensis* closely resembles *P. auricularioides* by sharing discoid-peltate and cupulate basidiomes, but the latter species has a stipe or rudimentary pseudo-stipe, hard and leathery basidiomes when fresh, larger basidia (26.6–42.0 × 6.7–12.5 µm) and basidiospores (8.4–12.5 × 5.1–6.8 µm; Crous et al. 2022). The new species is also closely related to *P. auricularioides* in our phylogeny (Figure 24), but the ITS similarity between *P. auricularioides* (AMI-SPL676)

Figure 22. Basidiomes of ***Physalacria tianzhongshanensis*** (holotype). (a) A distant view. (b) A close shot. Scale bars = 1 cm.

and *P. tianzhongshanensis* is only 95.61% (Wu 653) and 95.15% (Wu 907) of 753 bp.

In addition, *Physalacria subpeltata* also resembles the new species by its discoid-peltate basidiomes, but it has a stipe, larger basidia (30–55 × 9–10 μm) and basidiospores (10–12.5 × 4.5–5 μm), and distribution in Hawaii (Berthier 1985). Moreover, *P. subpeltata* was transferred in *Anastrophella* by Horak (Horak et al. 1994), and its molecular data is not available, so the species is not sure to be one of *Physalacria*.

Polyporales Gäum., Vergleichende Morphologie der Pilze: 503 (1926)

Phanerochaetaceae Jülich, Bibliotheca Mycologica 85: 384 (1982)

Notes: *Phanerochaetaceae* is a globally distributed group of wood-inhibiting fungi. This family is typified by *Phanerochaete* with *P. alnea* as the type species (Spirin et al. 2017). *Phanerochaetaceae* consists of four well-recognised clades: the *Phanerochaete*, *Donkia*, *Phlebiopsis*, and *Bjerkandera* clades, encompassing a total of 23 genera (Chen et al. 2021). In recent years, the known number of taxa within the *Donkia* clade has significantly increased (Chen et al. 2021; Shen et al. 2023). In this study, one more new species occupying an independent position from all known genera was revealed from this clade (Figure 25).

Cremeoefibula S.L. Liu, Shan Shen & L.W. Zhou, gen. nov.

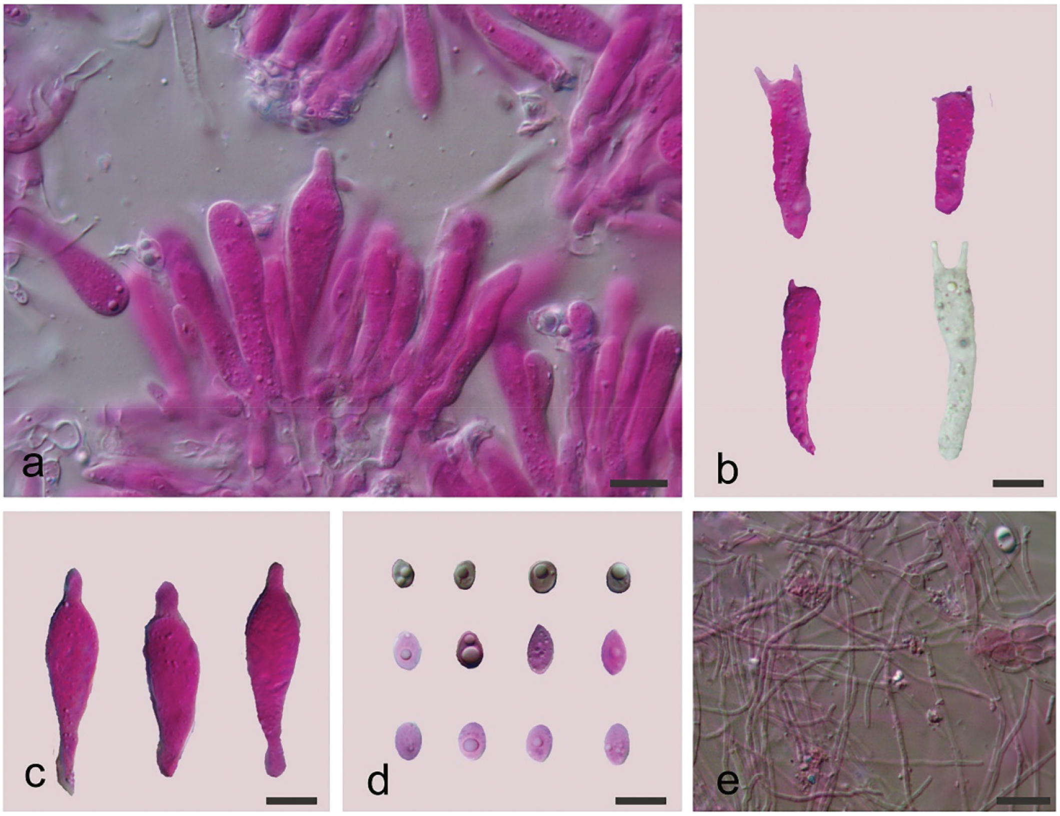

Figure 23. Microscopic structures of ***Physalacria tianzhongshanensis*** (holotype). (a) A vertical section of basidiomes. (b) Basidia. (c) Cystidia. (d) Basidiospores. (e) Hyphae. Scale bars: 10 μm.

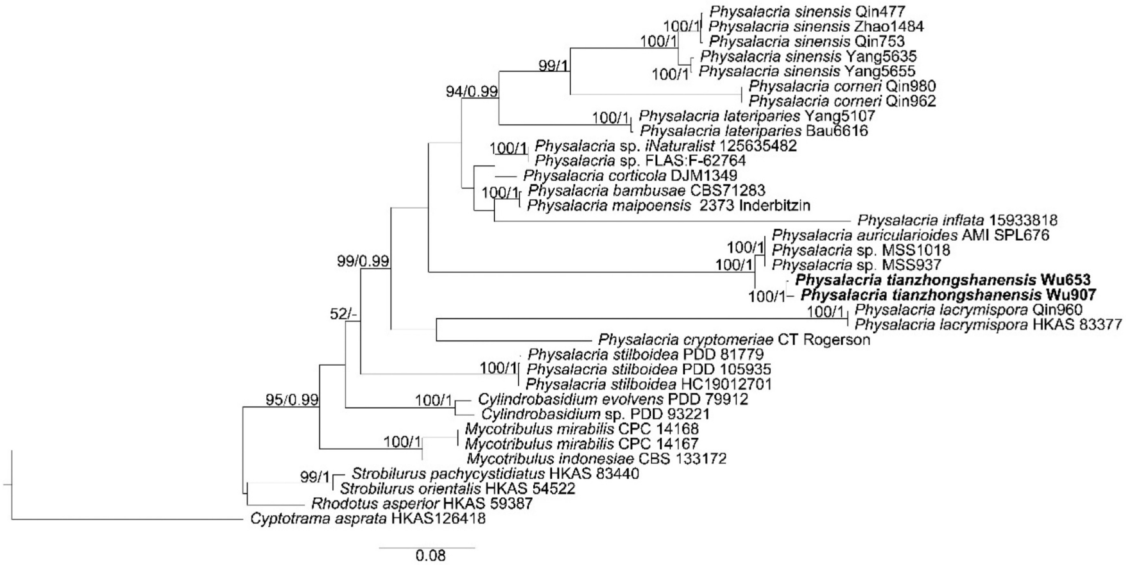

Figure 24. Phylogenetic relationship among species of *Physalacria* inferred from the combined dataset of ITS and nLSU regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 50% and 0.8, respectively, are labelled at the nodes. The newly described species are in boldface.

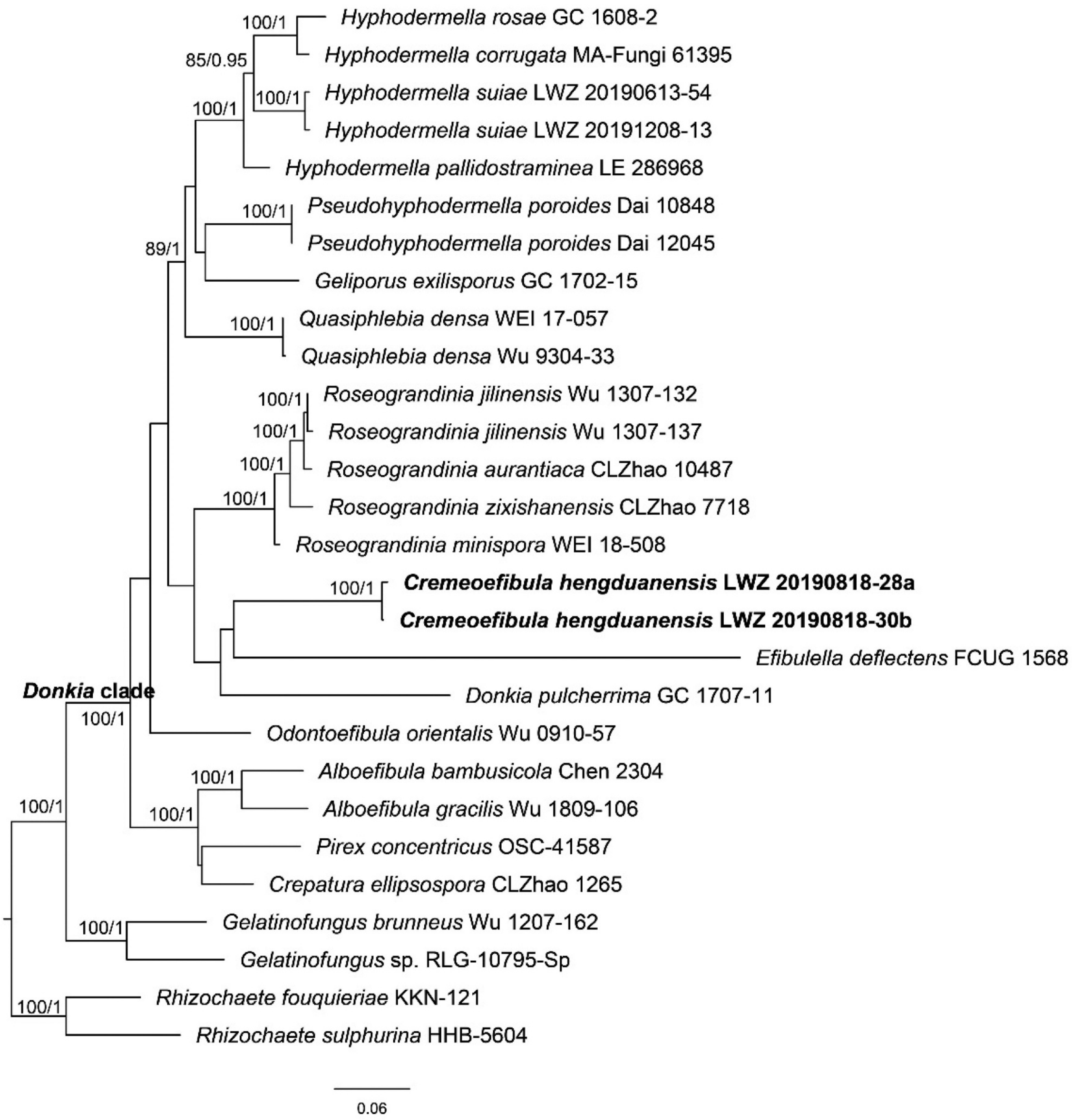

Figure 25. Phylogenetic relationship among *Cremeoefibula* and related genera inferred from the combined dataset of ITS, nLSU, and *rpb2* regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 50% and 0.8, respectively, are labelled at the nodes. The newly described species are in boldface.

Fungal Names: FN 571240.

Etymology: *Cremeoefibula* (Latin), refers to cream basidiomes and simple-septate hyphae.

Type species: *Cremeoefibula hengduanensis* S.L. Liu, Shan Shen & L.W. Zhou.

Diagnosis: Differing from *Efibulella* in the absence of cystidia (Li et al. 2022).

Basidiomes annual, effused, adnate, membranaceous to subceraceous. Hymenophore cream to straw-yellow, smooth to tuberculate, unchanged in KOH.

Hyphal system monomitic; generative hyphae without clamp connections. Subicular hyphae hyaline, thin to slightly thick-walled. Cystidia absent. Basidia clavate, thin-walled, with four sterigmata. Basidiospores ellipsoid, hyaline, thin-walled, smooth, inamyloid, acyanophilous. On wood.

Notes: *Cremeoefibula* is characterised by having cream to straw-yellow, membranaceous to subceraceous basidiomes with smooth to tuberculate hymenophores, simple-septate generative hyphae, the absence of cystidia and ellipsoid basidiospores. Morphologically, *Efibulella* closely resembles *Cremeoefibula*; however, the presence of leptocystidia in *Efibulella* is a distinguishing characteristic from the new genus (Zmitrovich 2018).

Figure 26. Basidiomes of *Cremeoefibula hengduanensis* (holotype).

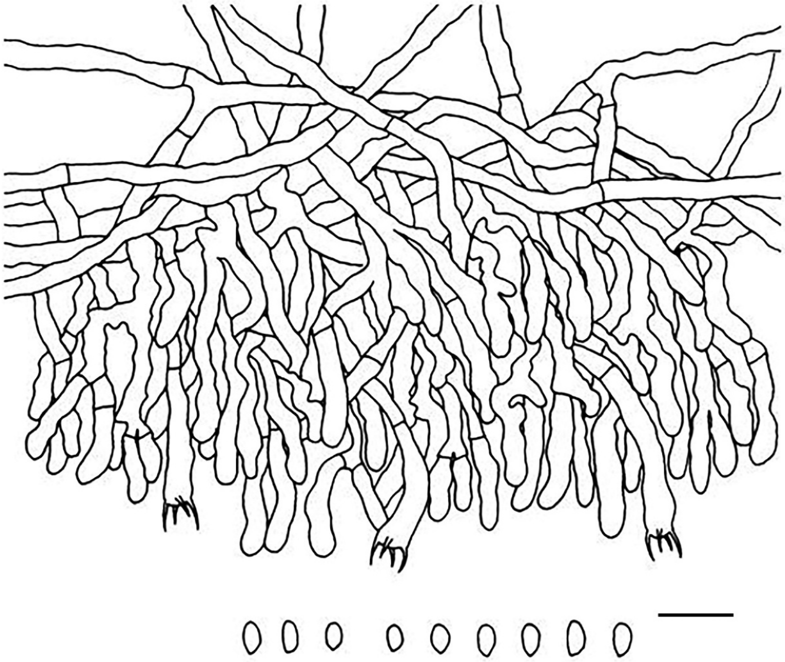

Figure 27. Microscopic structures of *Cremeoefibula hengduanensis* (holotype). Scale bar: 10 μm.

Cremeoefibula hengduanensis S.L. Liu, Shan Shen & L.W. Zhou, sp. nov. Figures 26–27

Fungal Names: FN 571261.

Etymology: *hengduanensis* (Latin), refers to the type locality Hengduan Mountains.

Diagnosis: Characterised by the membranaceous to subceraceous basidiomes with smooth to tuberculate hymenophores, the absence of cystidia, and ellipsoid basidiospores.

Description: Basidiomes annual, resupinate, effused, closely adnate, inseparable from substrate, membranaceous to subceraceous, first as small patches, later confluent up to 10 cm long, 1.5 cm wide, up to 200 μm thick in section. Hymenophore smooth to tuberculate, cream to straw-yellow, unchanged in KOH, not cracked; margin concolorous with hymenophore, slightly arachnoid.

Hyphal system monomitic; generative hyphae without clamp connections; subicular hyphae hyaline, thin-walled to slightly thick-walled, moderately branched, 3–5 μm in diam. Cystidia absent. Basidia clavate, with four sterigmata and a simple septum, 20–26 × 2.5–3 μm.

Basidiospores ellipsoid, hyaline, thin-walled, smooth, inamyloid, acyanophilous, 3.8–4.5 × 1.8–2.4 µm, L = 4.1 µm, W = 2.1 µm, Q = 1.9 (*n* = 60/2).

Materials examined: China. Sichuan Province, Meigu County, Dafengding National Nature Reserve, on fallen angiosperm branch, 18 August 2019, LWZ 20190818-28a (holotype in HMAS 257914); on fallen angiosperm branch, 18 August 2019, LWZ 20190818-30b (paratype in HMAS 257915).

Notes: From the phylogenetic tree, *Cremeoefibula hengduanensis* formed by two specimens is adjacent to *Efibulella deflectens* but without reliable statistical support (Figure 25). Morphologically, the macroscopic appearance of *E. deflectens* is similar to *C. hengduanensis*, but differs in the presence of cystidia (Zmitrovich 2018).

Irpicaceae Spirin & Zmitr., Mycena 3: 48 (2003)

Notes: *Irpicaceae* was introduced in *Polyporales* with *Irpex* as a genus by Spirin (2003) and currently comprises 13 genera, including a recently described genus *Phanerochaetella* (Chen et al. 2021). The majority of species in *Irpicaceae* are white rot fungi except for the genus *Leptoporus*, which is known for causing brown rot (Chen et al. 2021).

Phanerochaetella C.C. Chen & Sheng H. Wu, Fungal Diversity 111: 415 (2021)

Notes: *Phanerochaetella* was introduced by Chen et al. (2021), who treated *P. angustocystidiata* as the type species. This genus is characterised by yellowish cream and membranaceous basidiomes with smooth to tuberculate hymenophores, simple-septate generative hyphae, and ellipsoid to cylindrical basidiospores (Chen et al. 2021). Cystidia may be absent or present in the species of *Phanerochaetella* (Chen et al. 2021). Currently, seven species are accepted in this genus worldwide (Li et al. 2022). This study uncovered a new distinct lineage from other species within this genus (Figure 28).

Phanerochaetella austrosinensis S.L. Liu, Shan Shen & L.W. Zhou, sp. nov. Figures 29–30

Fungal Names: FN 571658.

Etymology: *austrosinensis* (Latin), refers to the distribution in southern China.

Diagnosis: Differing from *P. sinensis* in its wider basidiospores (Li et al. 2022).

Description: Basidiomes annual, effused, adnate, inseparable from substrate, membranaceous to coriaceous, up to 10 cm long, 2 cm wide, up to 300 µm thick in section. Hymenophore smooth, white to cream, unchanged in KOH; margin paler or concolorous with hymenophoral surface.

Hyphal system monomitic; generative hyphae without clamp connections. Subicular hyphae indistinct, hyaline, thick-walled, smooth, rarely branched, parallel to substrate, 3–5 µm in diam. Lamprocystidia arising from hymenial layer or medullary layer, cylindrical, hyaline, thick-walled, heavily encrusted, 35–65 × 6–11 µm. Basidia clavate to subcylindrical, hyaline, thin-walled, smooth, with four sterigmata and a basal simple septum, 28–35 × 4–6 µm; basidioles in shape similar to basidia but slightly smaller. Basidiospores cylindrical, hyaline, thin-walled, smooth, inamyloid, acyanophilous, 5–7 × 3–4 µm, L = 5.9 µm, W = 3.3 µm, Q = 1.8–1.9 (*n* = 60/2).

Materials examined: China. Yunnan Province, Dali, Cangshan-Erhai National Nature Reserve, on fallen trunk of angiosperm, 4 November 2019, LWZ 20191104–20 (holotype in HMAS 257916); Sichuan Province, Xichang, Luoujishan Scenic Spot, on fallen *Pinus* branch, 11 August 2019, LWZ 20190811-16b (paratype in HMAS 257917).

Notes: *Phanerochaetella austrosinensis* and *P. xerophila* are similar in the presence of smooth to tuberculate hymenophores and larger basidiospores than other species in the genus. However, the main difference between them is that *P. xerophila* lacks cystidia (Burdsall 1985).

A specimen, viz. LWZ 20190809-21b collected from Mianning County, the Hengduan Mountains exhibits larger basidiospores (6.9–8.6 × 4.5–5.4 µm) than *P. austrosinensis*, but cannot be differentiated through the ITS and nLSU regions from this species (Figure 28). The situation with almost identical ITS and nLSU sequences but differentiated morphological characteristics was also observed between *Basidioradulum mayi* and *B. tasmanicum* when Wang et al. (2020) described these two new species. However, due to only one specimen being available in the current case, we would not like to describe one more new species.

Trechisporales K.H. Larss., in Hibbett et al., Mycol. Res. 111(5): 541 (2007)

Hydnodontaceae Jülich, Biblthca Mycol. 85: 372 (1982) [1981]

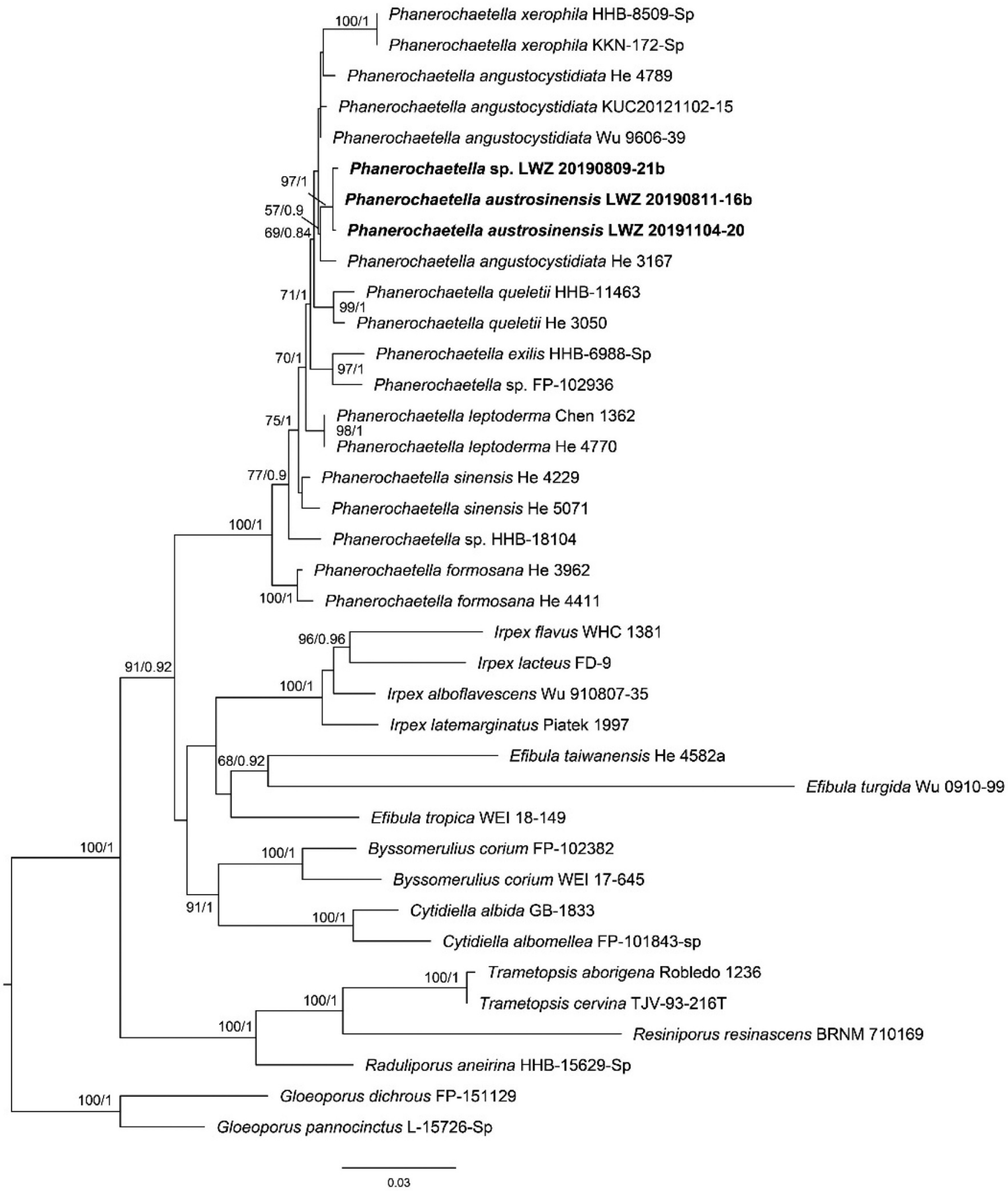

Figure 28. Phylogenetic relationship among species of *Phanerochaetella* inferred from the combined dataset of ITS and nLSU regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 50% and 0.8, respectively, are labelled at the nodes. The newly described species are in boldface.

Notes: *Hydnodontaceae* was established by Jülich (1981), with *Hydnodon* as the type genus. However, *Hydnodon* is now recognised as a later synonym of *Trechispora* (Ryvarden 2002). Currently, 12 genera are accepted within the family *Hydnodontaceae* (Liu et al. 2022). For the latest taxonomic emendation of this family as well as *Trechisporales* and *Sistotremastrales*, please refer to Liu et al. (2022).

Subulicystidium Parmasto, Conspectus Systematis Corticiacearum: 120 (1968)

Notes: *Subulicystidium*, typified by *S. longisporum*, has unique long subulate or sword-like cystidia in *Trechisporales* (Ordynets et al. 2018; Liu et al. 2022). Fifteen new species have been described in the tropical and subtropical areas of the world over the past five years (Ordynets et al. 2018; Liu et al. 2019, 2022).

Figure 29. Basidiomes of ***Phanerochaetella austrosinensis*** (holotype).

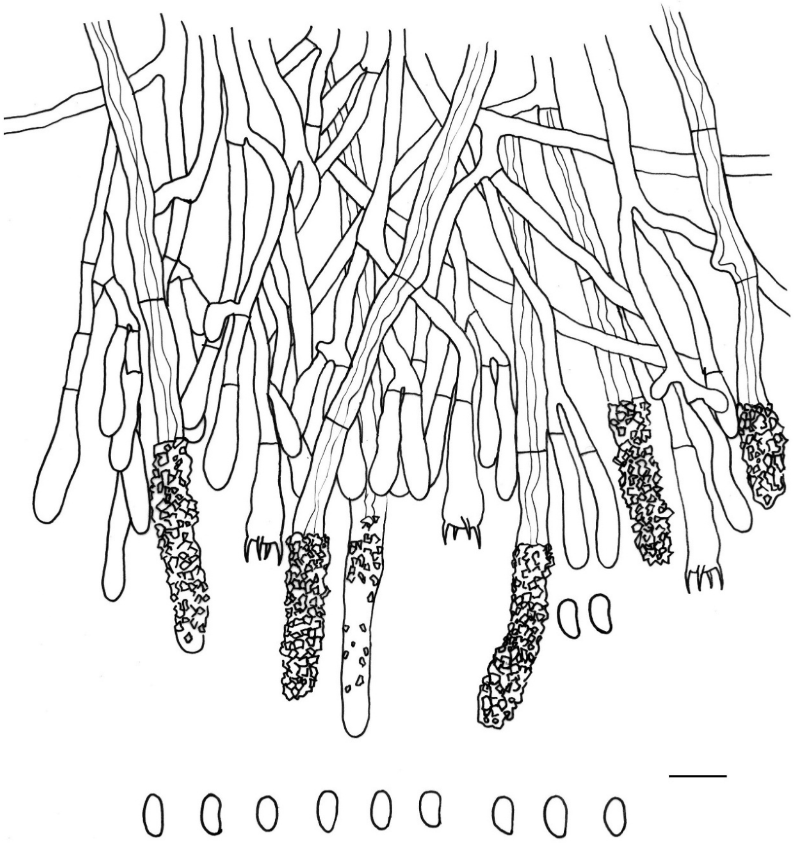

Figure 30. Microscopic structures of ***Phanerochaetella austrosinensis*** (holotype). Scale bar: 10 µm.

Now, a new species, occupying a distinctive position on the phylogenetic tree (Figure 31), is described from the temperate forests of China below.

Subulicystidium boreale S.L. Liu & L.W. Zhou, sp. nov. Figures 32–33

Fungal Names: FN 571659.

Etymology: *boreale* (Latin), refers to the distribution in northern China.

Diagnosis: Differing from *S. tropicum* in its wider basidiospores and a boreal distribution (Liu et al. 2019).

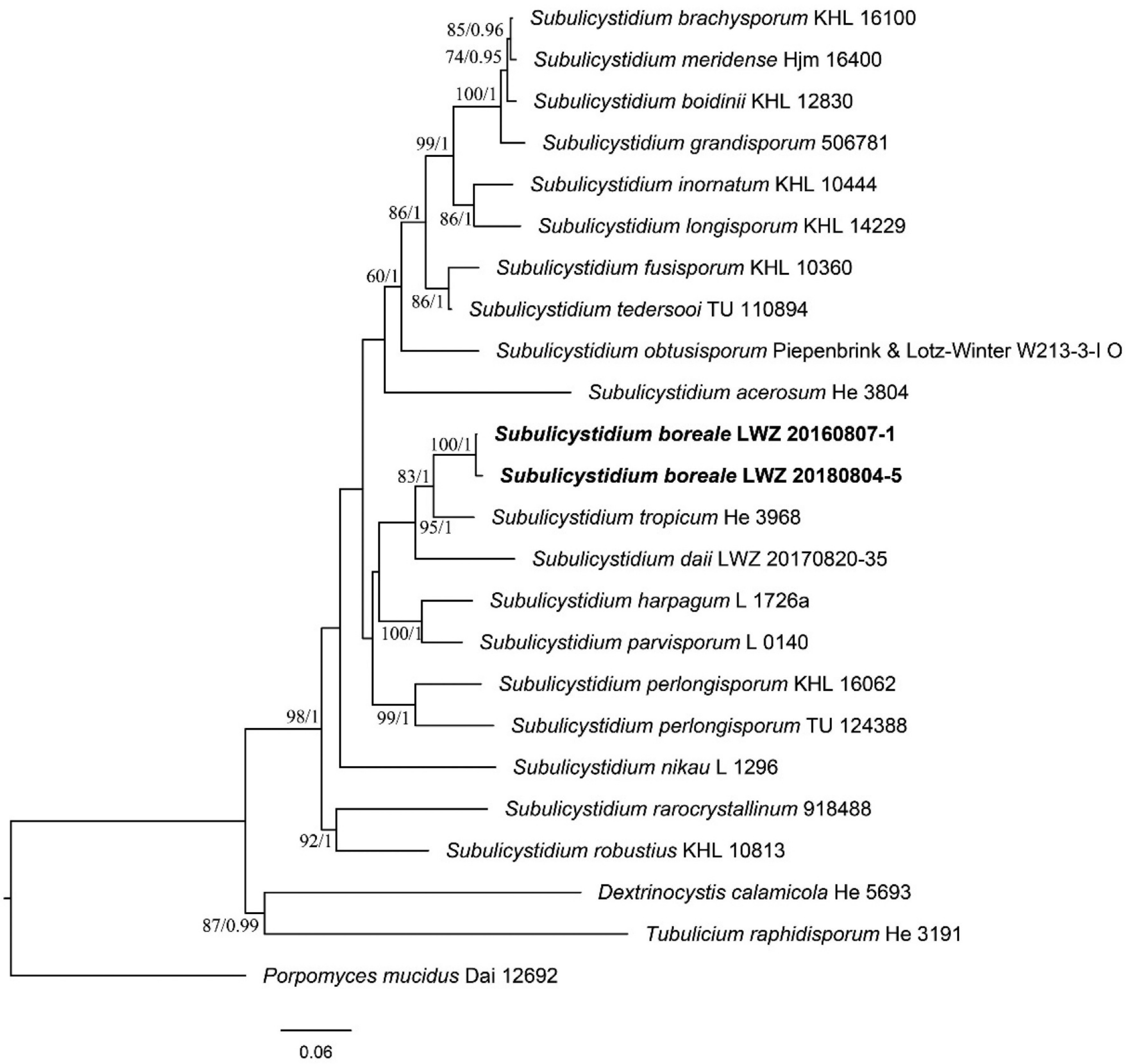

Figure 31. Phylogenetic relationship among species of *Subulicystidium* inferred from the combined dataset of ITS and nLSU regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 50% and 0.8, respectively, are labelled at the nodes. The newly described species are in boldface.

Description: Basidiomes annual, resupinate, effused, thin, up to 10 cm long, 3 cm wide. Hymenophore smooth, white to orange-grey, not cracked; margin undifferentiated.

Hyphal system monomitic; generative hyphae with clamp connections, hyaline, slightly thick-walled, frequently branched and septate, loosely interwoven, 2.5–3.5 µm in diam. Cystidia abundant, subulate, projecting beyond hymenium, hyaline, thick-walled, 60–90 × 4–5 µm. Basidia subclavate to suburniform, hyaline, thin-walled, with four sterigmata and a basal clamp connection, 12–15 × 5–6 µm; basidioles in shape similar to basidia, but slightly smaller. Basidiospores fusiform to slightly vermicular, hyaline, thin-walled, smooth, inamyloid, acyanophilous, 10–13 × (1.8–)2–2.5(–2.8) µm, L = 11.4 µm, W = 2.2 µm, Q = 5.1 (*n* = 60/2).

Materials examined: China. Jilin Province, Antu County, Changbaishan National Nature Reserve, on fallen angiosperm branch, 7 August 2016, LWZ 20160807-1 (holotype in HMAS 257918); Beijing, Xiaolongmen Forest Park, on fallen angiosperm branch, 5 August 2018, LWZ 20180804-5 (paratype in HMAS 257919).

Notes: *Subulicystidium boreale* may be confused with *S. fusisporum* by whitish hymenophores, and similar cystidia and basidiospores. However, *S. fusisporum* has slightly wider basidiospores (2.5–3.5 µm in width; Ordynets et al. 2018).

Figure 32. Basidiomes of ***Subulicystidium boreale*** (holotype).

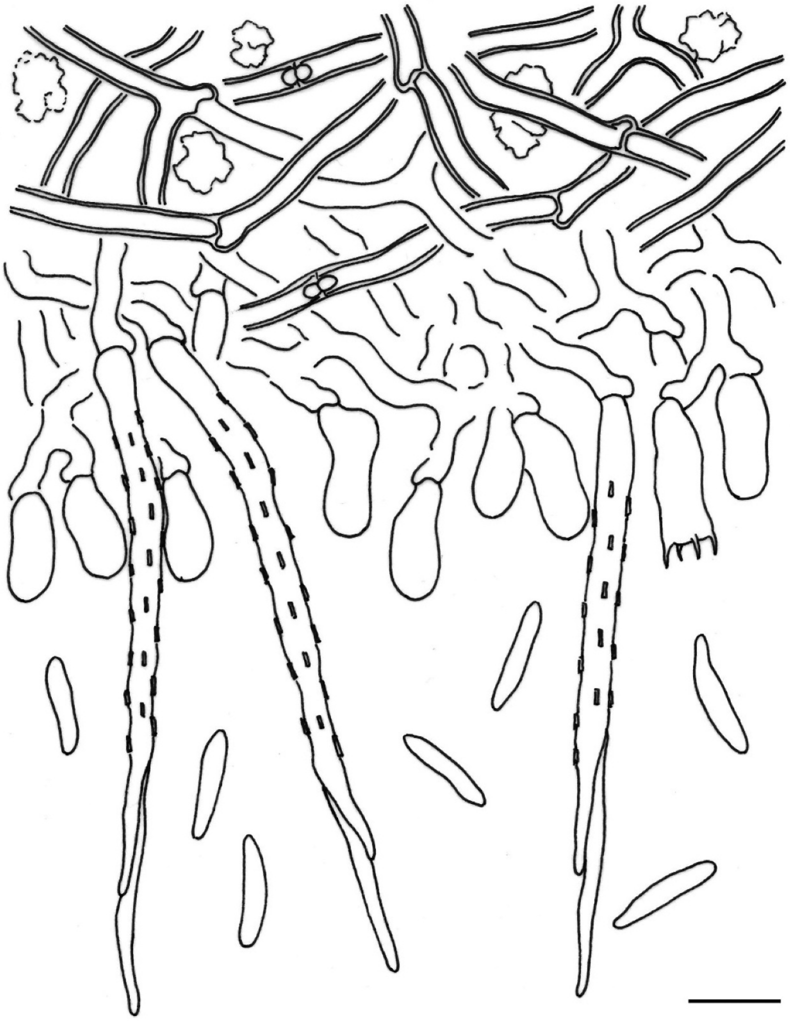

Figure 33. Microscopic structures of ***Subulicystidium boreale*** (holotype). Scale bar: 10 µm.

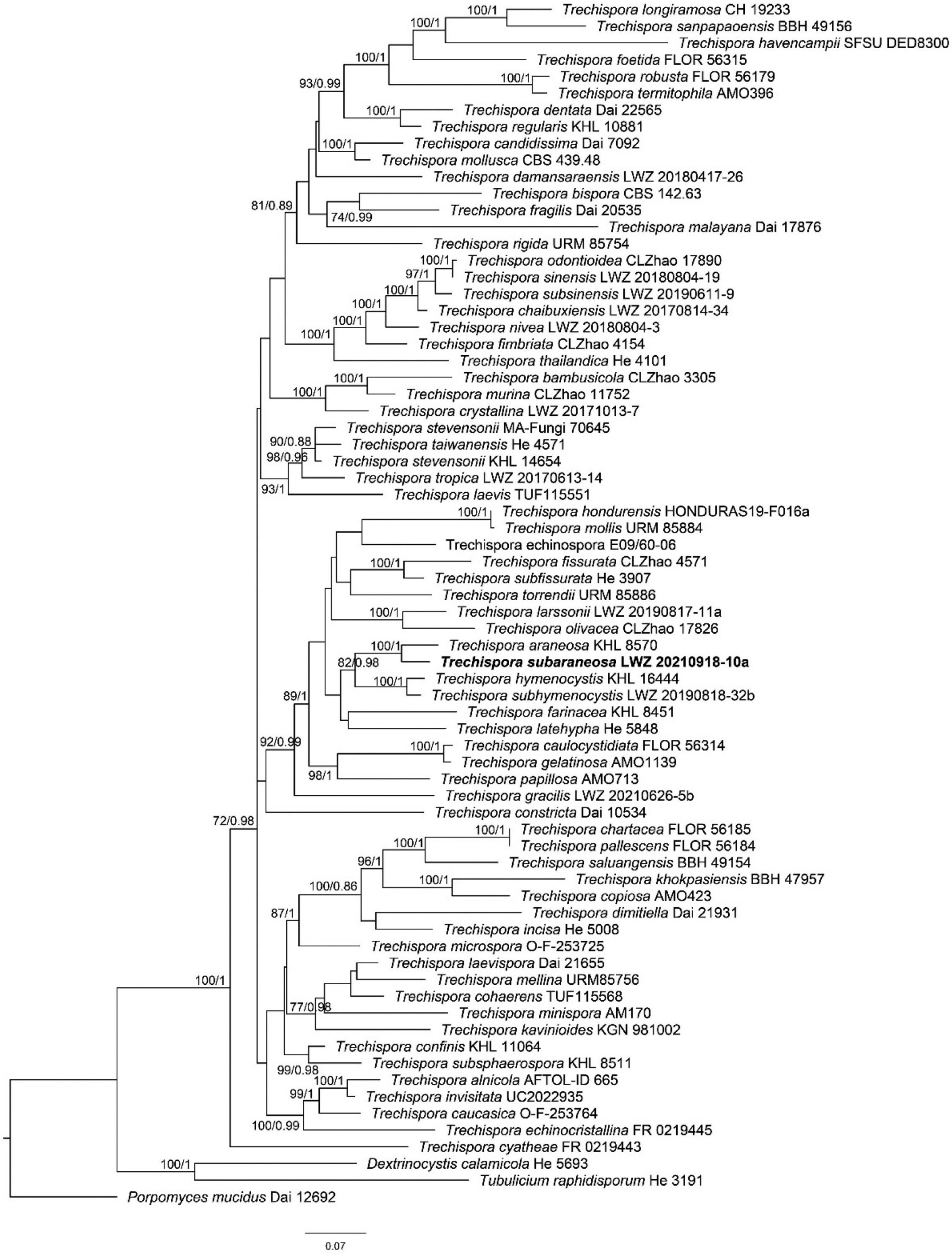

Figure 34. Phylogenetic relationship among species of *Trechispora* inferred from the combined dataset of ITS and nLSU regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 50% and 0.8, respectively, are labelled at the nodes. The newly described species are in boldface.

Trechispora P. Karst.

Notes: *Trechispora* was introduced by Karsten (1890) with *T. onusta* as the type species. Species in this genus exhibit a diverse range of hymenophoral configurations, including smooth, grandinioid, odontioid, hydnoid, and poroid forms. A total of 149 names have been recorded in Index Fungorum (http://www.indexfungorum.org) and 93

Figure 35. Basidiomes of *Trechispora subaraneosa* (holotype).

species have been previously recorded around the world (Liu et al. 2022; Luo and Zhao 2022; Sommai et al. 2023). Based on the latest comprehensive phylogenetic backbone of *Trechispora* provided by Liu et al. (2022), a new lineage is discovered (Figure 34) and described as a new species in the present study.

Trechispora subaraneosa S.L. Liu, H.W. Wei & L.W. Zhou, sp. nov. Figures 35–36

Fungal Names: FN 571660.

Etymology: *subaraneosa* (Latin) referring to the similarity to *T. araneosa*.

Diagnosis: Differing from *T. araneosa* in smaller basidiospores and a distribution in the Northern Hemisphere (Larsson 1995).

Description: Basidiomes annual, resupinate, effused, soft and fragile, thin, easily separated from substrates, up to 10 cm long, 3 cm wide. Hymenophore at first smooth, with age grandinioid, white to greyish white when fresh, greyish white when dry; margin thinning out, arachnoid, concolorous, about 2 mm wide. Cords frequent in subiculum, white.

Hyphal system monomitic; generative hyphae with clamp connections. Subicular hyphae distinct, hyaline, thin to slightly thick-walled, frequently branched, smooth, interwoven, 3.5–5.5(–8) μm in diam. Cystidia absent. Crystals butterfly-like, easily broken into irregular shapes. Basidia cylindrical with a slight median constriction, hyaline, thin-walled, with four sterigmata and a basal clamp connection, 9–13 × 4–5.5 μm; basidioles in shape similar to basidia, but slightly smaller. Basidiospores ellipsoid, hyaline, slightly thick-walled, aculeate, inamyloid, acyanophilous, (3.1–)3.2–4 × (2.4–)2.8–3 μm excluding the aculei, L = 3.7 μm, W = 2.9 μm, Q = 1.3 (*n* = 30/1).

Material examined: China. Hubei Province, Huanggang County, Taohuachong Scenic Spot, on fallen angiosperm branch, 18 September 2021, LWZ 20210918-10a (holotype in HMAS 257920).

Notes: *Trechispora subaraneosa* is characterised by white to greyish white basidiomes, smooth to grandinioid hymenophores, a monomitic hyphal system, butterfly-like crystals, and aculeate basidiospores. *Trechispora subaraneosa* has tuberculate ornamentations on the basidiospore aculei (Figure 36f), which reminds us of *T. araneosa* known only in Australia (Larsson 1995). *Trechispora minima* is morphologically similar to *T. subaraneosa*, but differs in shorter basidiospores and the absence of butterfly-like crystals (Larsson 1996).

Atractiellomycetes

Atractiellales Oberw. & Bandoni, Can. J. Bot. 60(9): 1740 (1982)

Phleogenaceae Weese, Ber. dt. bot. Ges. 37(10): 518 (1920)

Notes: *Phleogenaceae* belongs to *Atractiellales* (*Atractiellomycetes*) and is typified by *Phleogena*.

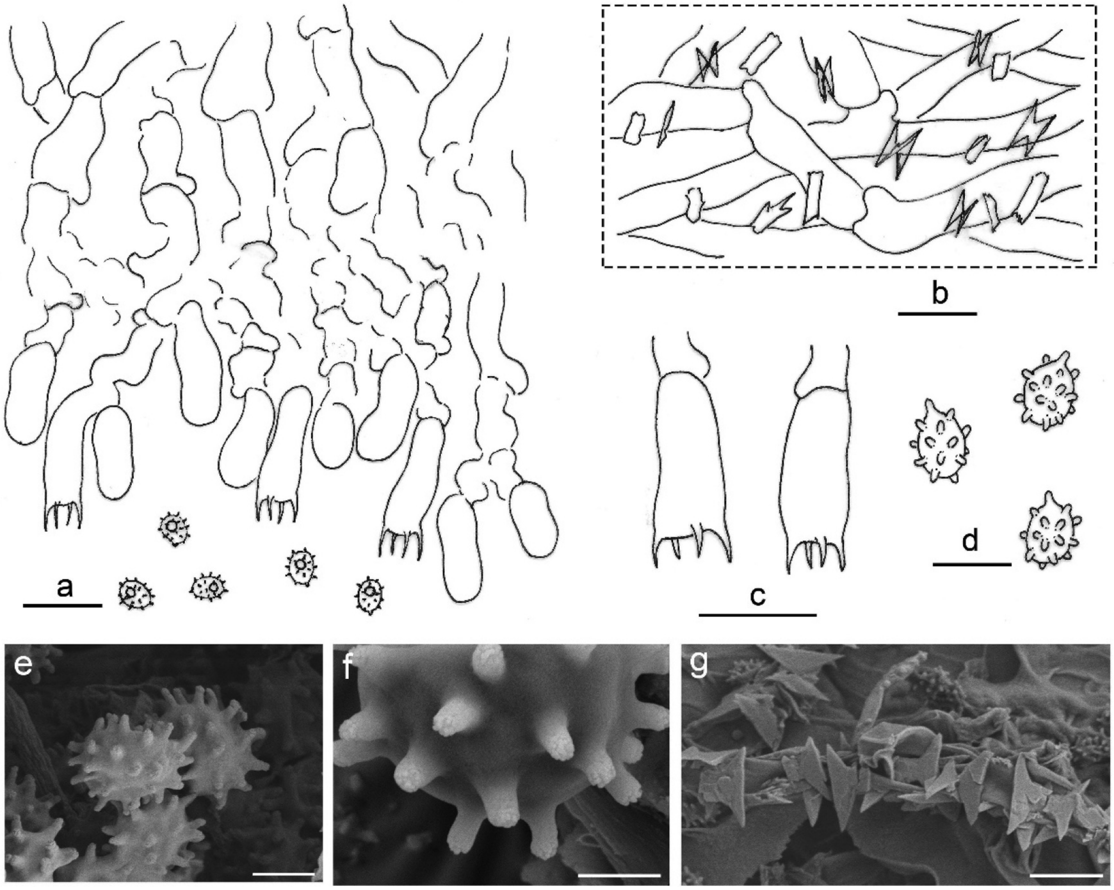

Figure 36. Microscopic structures of ***Trechispora subaraneosa*** (holotype). (a) Vertical section of basidiomes. (b) Hyphae in subiculum. (c) Basidia. (d–f) Basidiaspores. (g) Crystals. Scale bars: a – c = 10 μm; d, g = 5 μm; e = 2 μm; f = 1 μm.

This family is characterised by stipitate, capitate basidiomes, 4-celled basidia, thick-walled basidiospores, and clamped hyphae (Bandoni and Oberwinkler 1982). Currently, some species with effused and gelatinous basidiomes, thin-walled basidiospores, and simple-septate hyphae are included in the family (Schoutteten et al. 2018; Malysheva et al. 2019).

Helicogloea Pat., in Patouillard & Lagerheim, Bull. Soc. mycol. Fr. 8(3): 121 (1892)

Notes: *Helicogloea* was described by Patouillard and de (1892) based on a single species *H. lagerheimii* from Ecuador. The genus is characterised by effused basidiomes varying in texture from soft gelatinous to floccose, probasidia with a lateral probasidial sac, in which karyogamy occurs, and segmented hypobasidia with the segments in linear series (Baker 1936, 1946; Wells 1990; Spirin et al. 2018; Malysheva et al. 2019). Nowadays, a total of 36 valid names are listed in Index Fungorum (www.indexfungorum.org/Names/Names.asp, accessed on 3 July 2023), but only 17 species were confirmed by molecular data (Malysheva et al. 2019). *Helicogloea* species were widely reported in North America, South America, Europe, and Asia, but mostly in Europe and South America (Spirin et al. 2018; Malysheva et al. 2019).

Helicogloea hangzhouensis F. Wu, L.R. Zhang & A. Tohtirjap, sp. nov. Figures 37–38

Fungal Names: FN 571651.

Etymology: *hangzhouensis* (Latin), refers to the species distributed in Hangzhou, China.

Diagnosis: Differs from *H. septifera* by shorter basidia, no tuberculate on hymenophoral surface, and never septate basidiospores.

Description: Basidiomes annual, gelatinous when fresh, hyaline to whitish, first postulate to cerebriform, then fusing together, effused, continuous, up to 3 cm long, 1 cm wide and 0.1 cm thick, almost invisible when dry. Hyphal system monomitic; simple septate, hyaline, thin-walled, 2.5–4.0 μm in diam. Probasidia

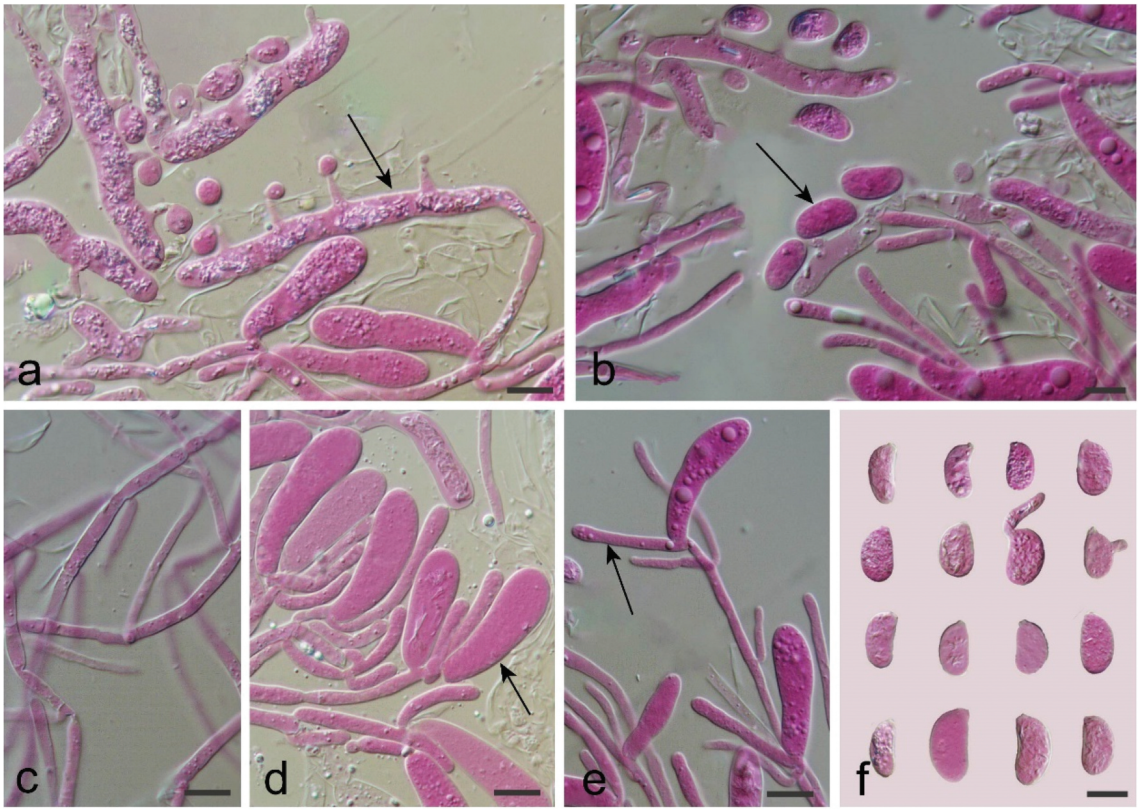

Figure 37. Microscopic structures of ***Helicogloea hangzhouensis*** (holotype). (a, b) A vertical section of hymenium [basidia indicated by an arrow in (a) and basidiospores indicated by an arrow in (b)]. (c) Hyphae. (d) Probasidia indicated by an arrow. (e) Hyphidia indicated by an arrow. (f) Basidiospores. Scale bars: 10 µm.

abundant, saccate-clavate, more or less straight to somewhat sinuous, 30.2–39.5 × 8.1–10.5 µm, having basal cylindrical hyphidia. Basidia tubular-clavate, 4-celled, sterigmata straight to curved, transversally septate, thin-walled, 45.8–68.5 × 5.2–7.5 µm. Basidiospores germinating by germ tubes, cylindrical to broadly cylindrical, slightly or distinctly curved, hyaline, thin-walled, (10.8–)12.1–15.1(–18.2) × (5.8–)6.2 – 8.6(–9.2) µm, L = 13.82 µm, W = 7.23 µm, Q = 1.91 (*n* = 30/1).

Materials examined: China. Zhejiang Province, Hangzhou, Xiaoshan District, Shiniushan, on fallen angiosperm branch, 27 March 2023, Wu 642 (holotype in BJFC039975), Wu 652 (BJFC039976).

Notes: *Helicogloea hangzhouensis* is morphologically similar to *H. microsaccata*, but *H. microsaccata* differs by its thinner basidiomes (0.03–0.06 mm thick), and shorter probasidia (15–27 × 7–11 µm). The new species is closely related to *H. septifera* in our phylogeny (Figure 39), but the ITS similarity between *H. septifera* (LE 253866, LE 260, and VS 11043) and *H. hangzhouensis* (Wu 642 and Wu 652) is only 92.81% of 583 bp, and *H. septifera* has longer basidia (56–101 × 6.8–9.0 µm), often tuberculate hymenophoral surface, and occasionally 1–2-septate basidiospores (Spirin et al. 2018). In addition, *H. aseptata* also resembles the new species by its whitish, gelatinous, and effused basidiomes, but *H. hangzhouensis* has larger basidiospores (10.3–13.8 × 5.8–8.1 µm in *H. aseptata*) and is distantly related to *H. aseptata* as a single lineage with high support in the phylogeny (Figure 39).

Pucciniomycetes

Pucciniales

Hyalopsoraceae P. Zhao and L. Cai, Mycology 10.1080/21501203.2022.2089262: 19.2022

Notes: Cummins and Hiratsuka (1983, 2003) included *Hyalopsora*, *Melampsoridium*, and other seven genera in *Pucciniastraceae*, and Cummins and Hiratsuka (2003) also considered *Coleopuccinia* as a synonym of *Gymnosporangium*

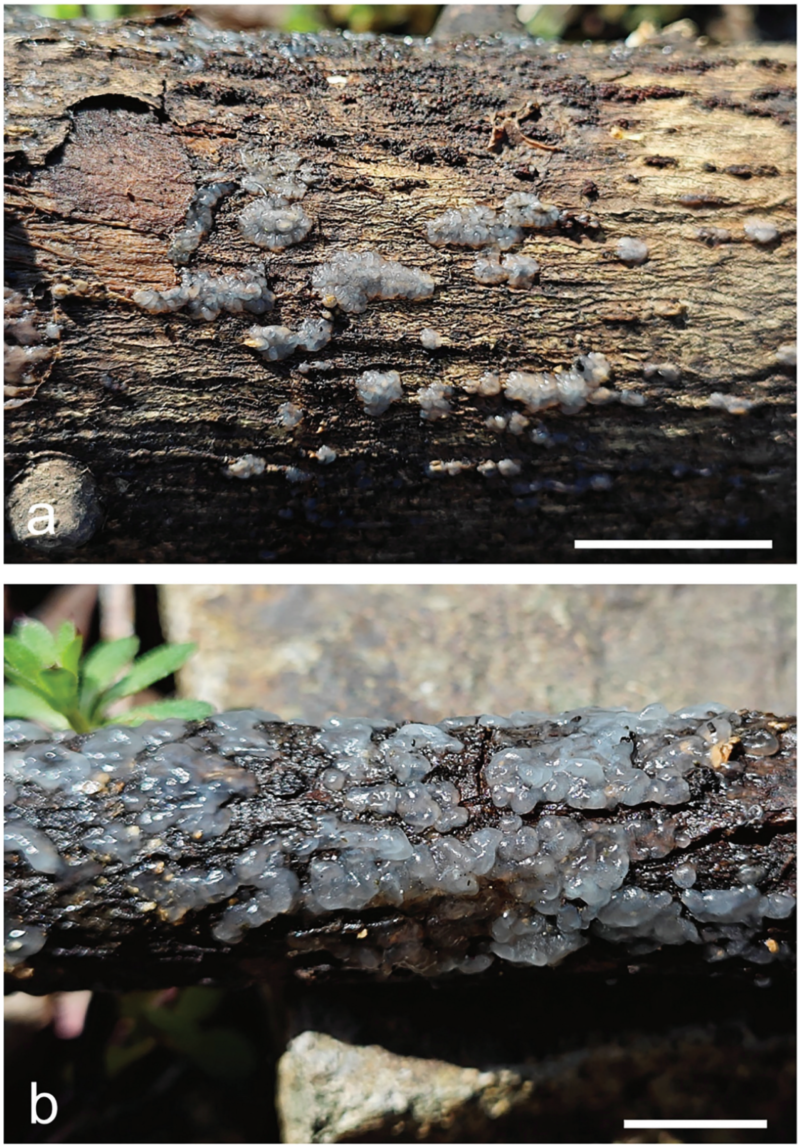

Figure 38. Basidiomes of ***Helicogloea hangzhouensis.*** (a) Wu 642 (holotype). (b) Wu 652. Scale bars: = 1 cm.

(*Gymnosporangiaceae*) based on teliospore similarities. Phylogenetic results indicated that these three genera were allied but distinct from other members (especially the type genus) in the families *Gymnosporangiaceae* and *Pucciniastraceae* (Zhao et al. 2020). Based on phylogenetic results and detailed morphological comparisons, a new family *Hyalopsoraceae* was proposed to include *Coleopuccinia*, *Hyalopsora*, and *Melampsoridium* (Zhao et al. 2023).

Coleopuccinia Pat., Revue mycol., Toulouse 11 (no. 41): 36.1889

Notes: The genus *Coleopuccinia* was established by Patouillard (1889) with *C. sinensis*, which occurs on *Cotoneaster* species, as the type species. The second species, *C. kunmingensis*, was described by Tai (1948) from *Cotoneaster franchetii*. Until recently, *Coleopuccinia* has only been reported in China and has only been described in the telial stage on plants of *Cotoneaster*. Cao et al. (2018) treated *C. kunmingensis* as a synonym of *C. sinensis* due to their morphological similarities and revealed that *Coleopuccinia* should be treated as a separate genus from *Gymnosporangium*. In our previous studies, we assigned the genus *Coleopuccinia* to the family *Hyalopsoraceae* (Zhao et al. 2023).

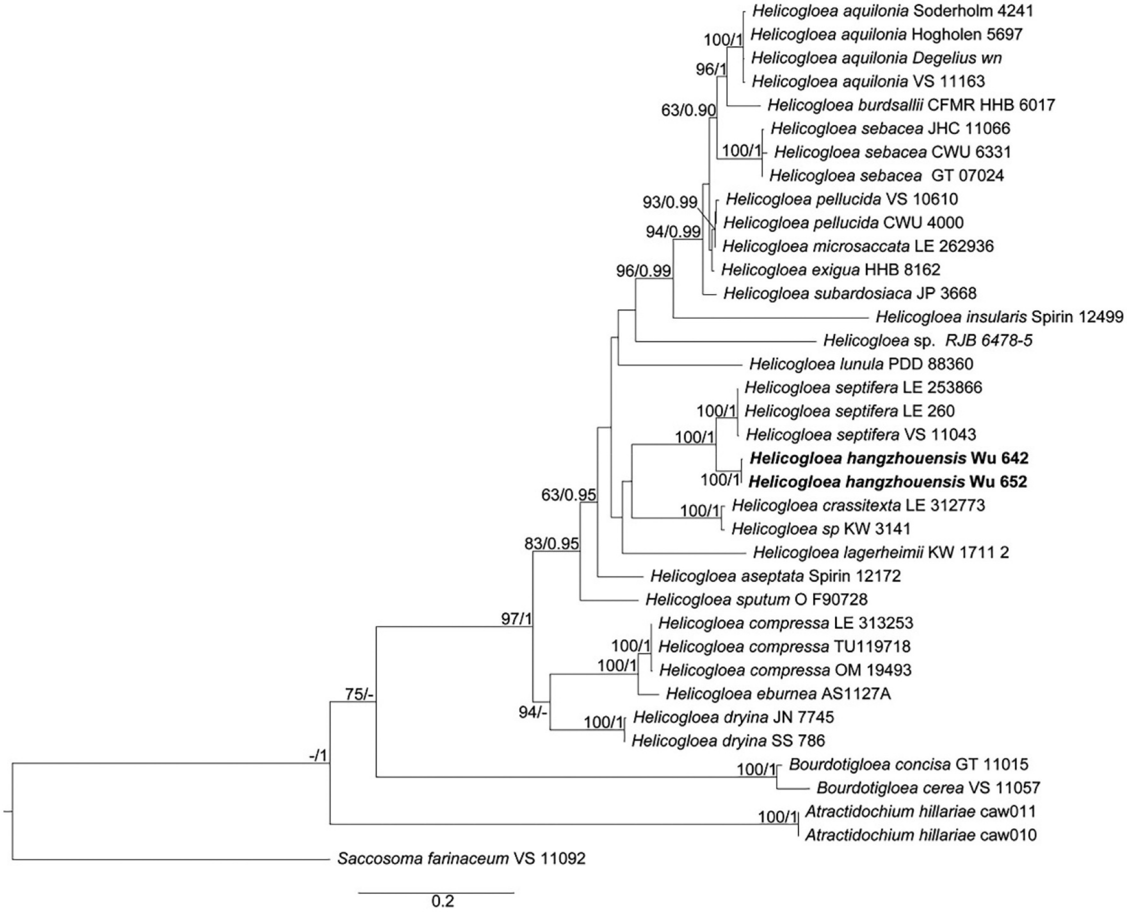

Figure 39. Phylogenetic relationship among species of *Helicogloea* inferred from the combined dataset of ITS and nLSU regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 50% and 0.8, respectively, are labelled at the nodes. The newly described species are in boldface.

Coleopuccinia yunnanensis P. Zhao and L. Cai, sp. nov. Figure 40

Fungal Names: FN 571661.

Etymology: *yunnanensis* (Latin), refers to the province where this new species was collected.

Diagnosis: Differing from *C. sinensis* by relatively larger teliospores.

Description: Spermogonia, aecia, and uredinia unknown. Telia hypophyllous, subepidermal, erumpent, with basally united, scattered, waxy in appearance, orange-yellow, 50–400 µm across; teliospores 2-celled by transverse septa, ellipsoid or fusiform, yellowish, catenulate in gelatinous matrix, 30–57 × 8–19 µm, walls smooth and evenly thickened.

Materials examined: China. Yunnan, Lijiang, III on *Cotoneaster* sp., 7 September 2014, Y.M. Li (ZP-R711, holotype in HMAS 352525); Yunnan, Lijiang, III on *Cotoneaster* sp., 7 September 2014, Y.M. Li, ZP-R6701 (HMAS).

Notes: Here, we found a new species *Coleopuccinia yunnanensis*, which is distinguishable from both *C. sinensis* and its synonym *C. kunmingensis* in the dimension of teliospores (30–57 × 8–19 µm *vs*. 17–45 × 7–19 µm).

Hyalopsora caprearum P. Zhao & L. Cai, sp. nov. Figure 41

Fungal Names: FN 571662.

Etymology: *caprearum* (Latin), refers to urediniospores with apparently thickened apical walls.

Diagnosis: Differing from phylogenetically allied species *H. nodispora* by comparatively larger urediniospores with an apparently thickened apical wall.

Description: Spermogonia and aecia unknown. Uredinia amphigenous, scattered, 0.4–0.8 mm, urediniospores ovoid or pyriform, hyaline, 66–89 × 37–48 µm, wall smooth, angular, wall 5–10 µm thick, not evenly thickened, apparently thickened at the angles, up to 24 µm, no paraphyses. Telia not detected.

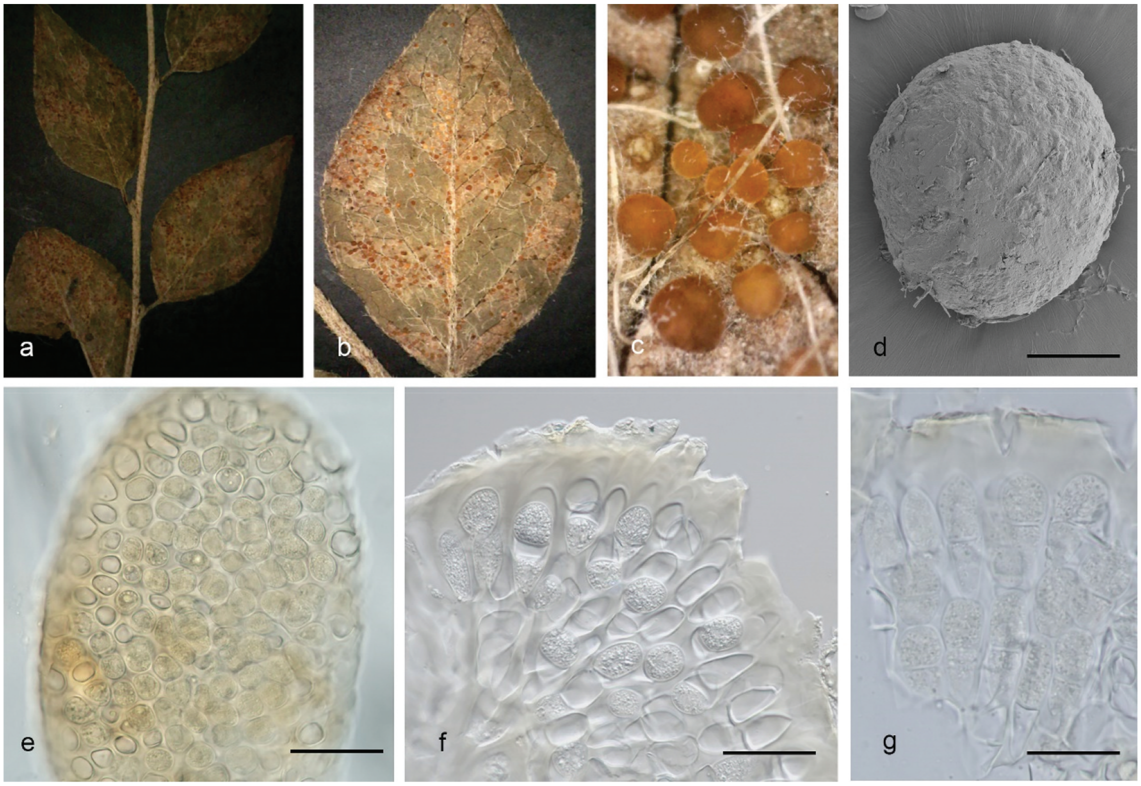

Figure 40. Morphology of ***Coleopuccinia yunnanensis*** (holotype) designated in this study. (a–c) Telia on both sides of leaf. (d) Ultrastructure of telia. (e) Section of telia. (f) Ellipsoid or pyriform teliospores catenulate in gelatinous matrix. (g) 2-celled teliospores with transverse septa. Scale bars: d – f = 50 μm; g = 30 μm.

Materials examined: China. Yunnan Province, Diqing, Shangri-la, II on *Pteris wallichiana*, 7 September 2014, Y. M. Li (ZP-R2073, holotype in HMAS 352526); Yunnan Province, Diqing, Shangri-la, II on *Pteris wallichiana*, 7 September 2014, Y.M. Li, ZP-R9 (HMAS).

Notes: *Hyalopsora caprearum* is characterised by its relatively larger urediniospores with apparently thickened apical walls. It was phylogenetically close to *H. nodispora* (Figure 42), but morphologically the dimension of urediniospores of *H. caprearum* is comparatively larger than *H. nodispora* (40–57 × 27–44 μm) (Sydow and Sydow 1915; Hiratsuka et al. 1992). In addition, the apical walls of urediniospores were relatively thick and uneven, which differs from all other *Hyalopsora* species present.

Nothopucciniastraceae P. Zhao and L. Cai, Mycology: 10.1080/21501203.2022.2089262, 20 (2022)

Notes: The traditionally defined *Pucciniastraceae* with nine genera (Cummins and Hiratsuka 1983, 2003) is highly polyphyletic (Zhao et al. 2020). Recent studies on *Pucciniastraceae* have reclassified several genera: *Milesia*, *Naohidemyces*, and *Uredinopsis* are now classified under *Milesinaceae* (Aime and McTaggart 2021), while *Coleopuccinia*, *Hyalopsora*, and *Melampsoridium* are now classified under *Hyalopsoraceae*, and *Thekopsora* is now classified under *Thekopsoraceae* (Zhao et al. 2023). Additionally, *Pucciniastrum* species have been found to form two distinct clades, and the presence of ostiolar peridial cells in uredinia differs between these two clades as observed in comprehensive morphological comparisons by Liang (2006) and Yang (2015). Based on morphological and molecular evidence, Zhao et al. (2023) have proposed a new family called *Nothopucciniastraceae*.

Nothopucciniastrum P. Zhao and L. Cai, gen. nov.

Fungal Names: FN 571594.

Etymology: *Notho* = nothus in Greek, fake, close but different; *pucciniastrum* = *pucciniastrum*-like morphology.

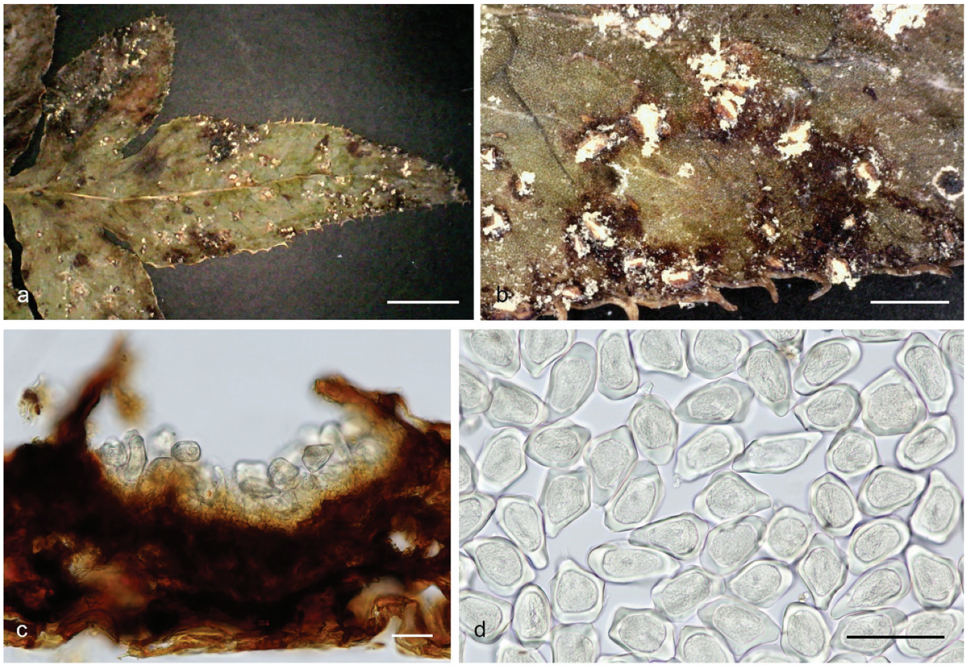

Figure 41. Morphology of ***Hyalopsora caprearum*** (holotype) designated in this study. (a–b) Uredinia on both sides of leaf. (c) Section of uredinia. (d) Ovoid or pyriform urediniospores with apparently thickened at the angles. Scale bars: a = 1 cm; b = 1 mm; c – d = 50 μm.

Type species: *Nothopucciniastrum tiliae* (Miyabe) P. Zhao and L. Cai.

Description: *Spermogonia* Group I (types 2 and 3), subepidermal or subcuticular, determinate, with flat hymenia, bounding structures lacking. *Aecia Peridermium*-type, or *Milesia*-type, with well-developed peridia, aeciospores borne singly on pedicels, verrucose. *Uredinia Milesia*-type, with well-developed ostiolar cells, urediniospores borne singly, verrucose. *Telia* subepidermal or intraepidermal, not erumpent, consisting of laterally adherent teliospores one spore deep, teliospores sessile, aseptate or multiseptate, with vertical septa. *Basidia* external.

Nothopucciniastrum actinidiae (Hirats. f.) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571595.

Basionym: *Pucciniastrum actinidiae* Hirats. f., J. Jap. Bot. 27: 111.1952.

Synonymy: *Pucciniastrum actinidiae* Hirats. f., Mem. Tottori Agric. Coll. 4: 279. 1936.

Nothopucciniastrum boehmeriae (Dietel) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571596.

Basionym: *Uredo boehmeriae* Dietel, Bot. Jb. 28(3): 290. 1900.

Synonymy: *Pucciniastrum boehmeriae* (Dietel) Syd. and P. Syd., Ann. Mycol. 1(1): 19. 1903.

Nothopucciniastrum coriariae (Dietel) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571597.

Basionym: *Pucciniastrum coriariae* Dietel, Bot. Jb. 28(3): 286.1900.

Nothopucciniastrum corni (Dietel) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571598.

Basionym: *Pucciniastrum corni* Dietel, Bot. Jb. 34: 587. 1905.

Nothopucciniastrum coryli (Kom.) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571606.

Basionym: *Pucciniastrum coryli* Kom., in Jaczewski, Komorov & tranzschel, Fungi Rossiae Exsicc.: no. 275.1899.

Nothopucciniastrum fagi (Dietel) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571599.

Basionym: *Pucciniastrum fagi* G. Yamada, Bot. Mag., Tokyo 44: 280. 1930.

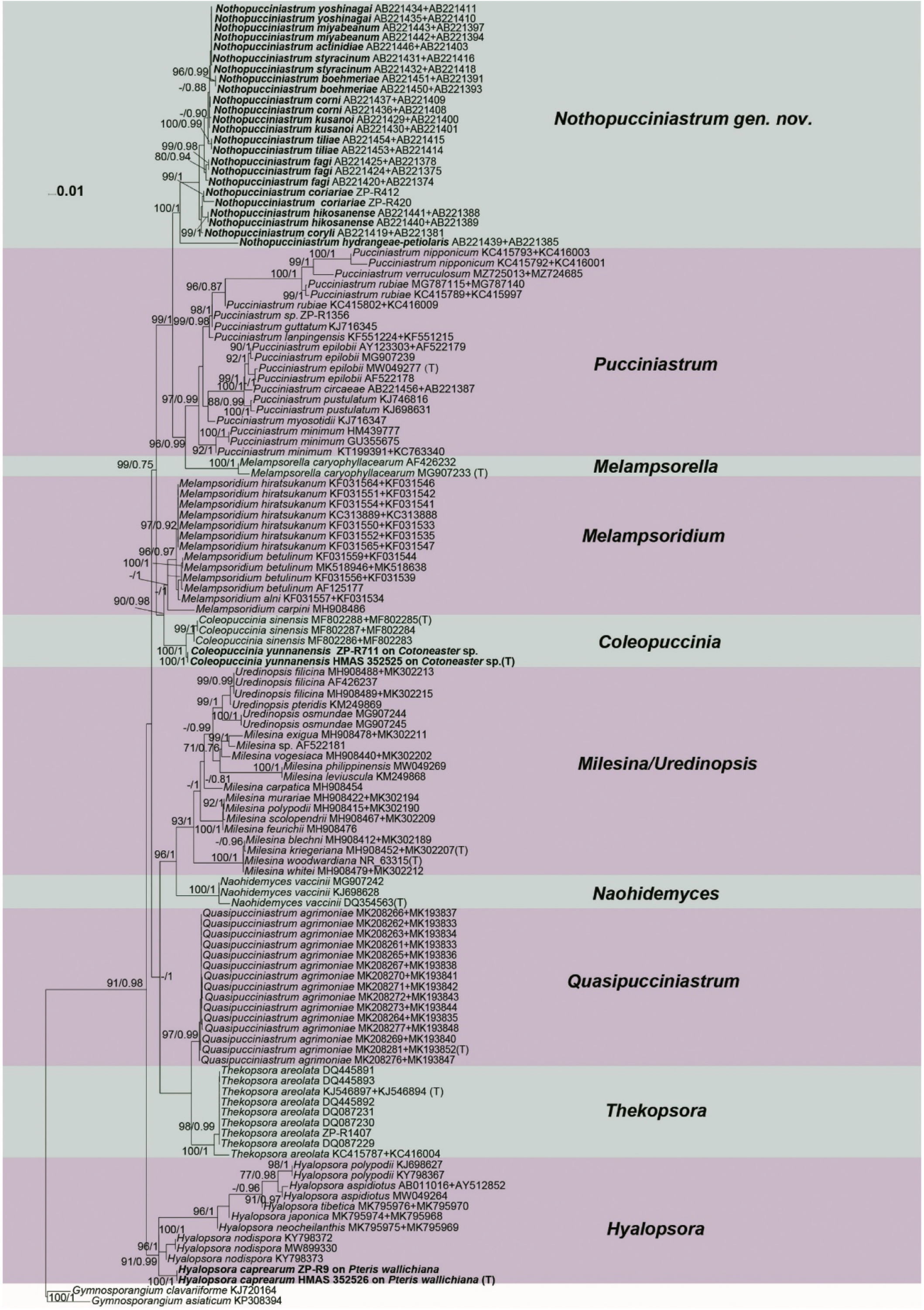

Figure 42. Phylogenetic relationship among species of morphologically related genera in the family *Pucciniastraceae* inferred from the combined dataset of ITS and nLSU regions. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 75% and 0.75, respectively, are labelled at the nodes. The newly described species are in boldface.

Nothopucciniastrum kusanoi (Dietel) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571600.

Basionym: *Pucciniastrum kusanoi* Dietel, Bot. Jb. 32: 629. 1903.

Nothopucciniastrum hikosanense (Hirats. f.) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571601.

Basionym: *Pucciniastrum hikosanense* Hirats. f., Ann. Phytopath. Soc. Japan 10: 154. 1940.

Nothopucciniastrum hydrangeae-petiolaris (Hirats. f.) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571607.

Basionym: *Pucciniastrum hydrangeae-petiolaris* Hirats. f., J. Fac. agric., Hokkaido Imp. Univ., Sapporo 21(1): 27.1927.

Nothopucciniastrum miyabeanum (Hirats.) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571602.

Basionym: *Pucciniastrum miyabeanum* Hirats., Bot. Mag., Tokyo 12: 3 (extr.). 1898.

Nothopucciniastrum styracinum (Hirats.) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571603.

Basionym: *Pucciniastrum styracinum* Hirats., Bot. Mag., Tokyo 12: 2 (extr.). 1898.

Nothopucciniastrum tiliae (Miyabe) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571604.

Basionym: *Pucciniastrum tiliae* Miyabe, in Hiratsuka, Bot. Mag., Tokyo 11: 47. 1897.

Nothopucciniastrum yoshinagae (Hirats.) P. Zhao and L. Cai, comb. nov.

Fungal Names: FN 571605.

Basionym: *Pucciniastrum yoshinagae* Hirats. f. [as "yoshinagai"], Trans. Tottori Soc. Agric. Sci. 2: 247. 1931.

Notes: According to Zhao et al (2020, 2023), morphologically defined *Pucciniastrum* species show bifurcation into two phylogenetically distinct clades. Among these species, 13 species formerly classified under the genus *Pucciniastrum*, namely *P. actinidiae*, *P. boehmeriae*, *P. coriariae*, *P. corni*, *P. coryli*, *P. fagi*, *P. hikosanense*, *P. hydrangeae-petiolaris*, *P. kusanoi*, *P. miyabeanum*, *P. styracinum*, *P. tiliae*, and *P. Yoshinaga*, formed a distinct clade that received strong support, and it separated from the *Pucciniastrum* clade that comprised the type species *P. epilobii* (Figure 42). Morphologically, these 13 species differed from *Pucciniastrum* and *Melampsorella* in their *Milesia*-type uredinia with ostiolar cells (Liang 2006; Yang 2015). This outcome aligns consistently with Qi et al. (2019) and Zhao et al. (2020). Based on the morphology and molecular findings, a novel family named *Nothopucciniastraceae* along with a new genus *Nothopucciniastrum*, and 10 new combinations have been proposed (Zhao et al. 2023). Here, we offered nomenclatural corrections and outlined the establishment of the new genus *Nothopucciniastrum* and 10 new combinations, with detailed information on basionyms, synonymies, and their registration numbers in the Fungal Names database. Moreover, we added three new combinations, *Nothopucciniastrum coriariae*, *Nothopucciniastrum coryli*, and *Nothopucciniastrum hydrangeae-petiolaris* in this study.

Protozoa

Incertae sedis

Myxomycetes G. Winter, Rabenhorst's Kryptogamen-Flora, Pilze – Schizomyceten, Saccharomyceten und Basidiomyceten 1(1): 32 (1880)

Notes: *Myxomycetes*, the plasmodial or true slime moulds, is a monophyletic group within the Amoebozoa and is characterised by producing uninucleate amoeboflagellates, multinucleate plasmodia, and ornate spore-bearing fruiting bodies in its life cycle (Adl et al. 2012).

Physarales T. Macbr., The North American slime-moulds: 22 (1922)

Notes: This order is characterised by spores black, deep purplish, or violaceous brown in mass, lime in some and often all parts of the fructification except the spores, stalk subhapothallic, and assimilative stage a phaneroplasmodium.

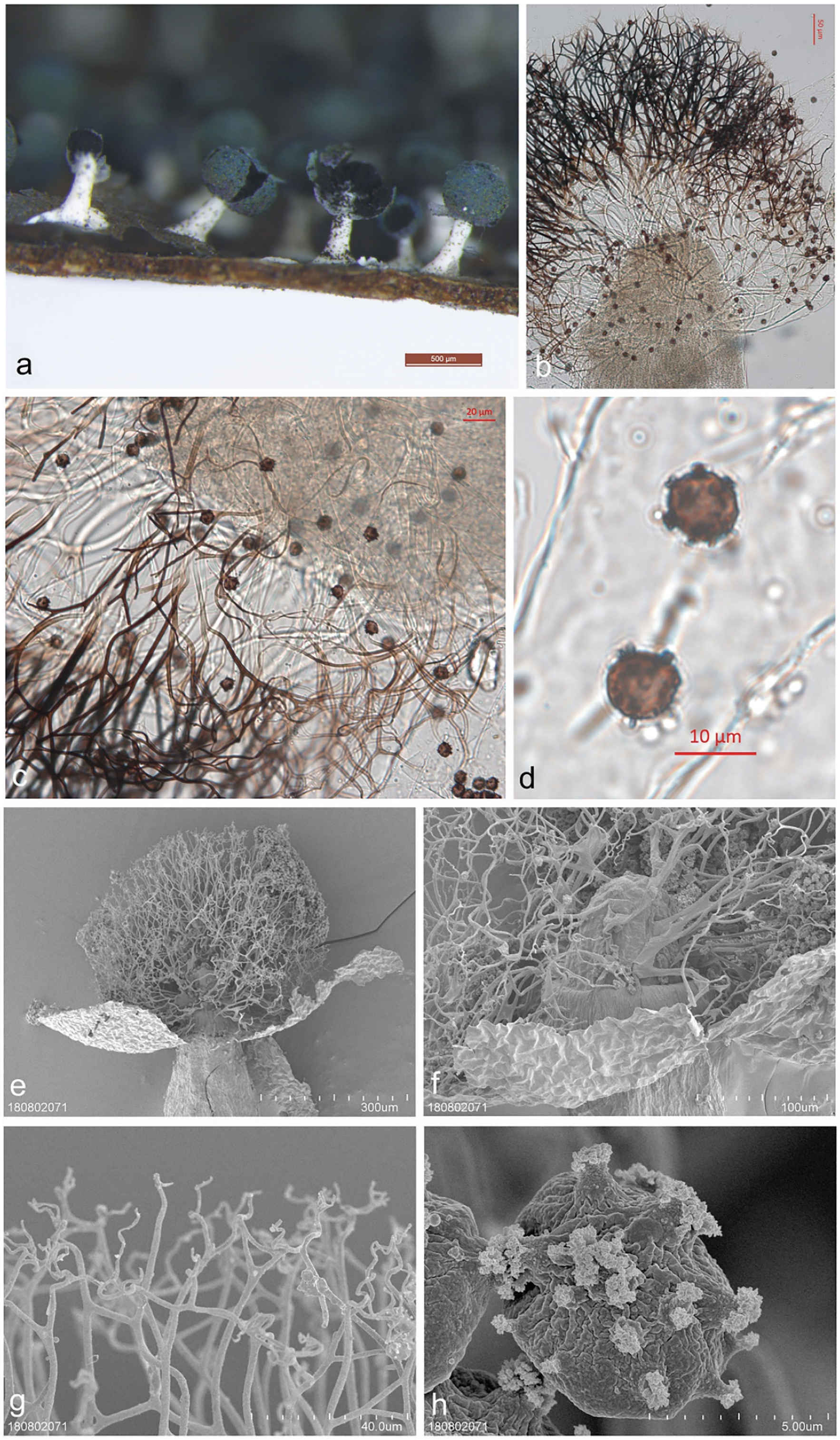

Figure 43. ***Diachea macroverrucosa*** (holotype). (a) Sporocarps. (b–c) Capillitia. (d) Spores by TL. (e) Sporotheca by SEM. (f) Columella by SEM. (g) Capillitia tips by SEM. (h) Spores by SEM. Scale bars: a = 500 μm; b = 50 μm; c = 20 μm; d = 10 μm; e = 300 μm; f = 100 μm; g = 40 μm; h = 5 μm.

Physaraceae Chevall., Flore Générale des Environs de Paris 1: 332 (1826)

Notes: This family is characterised by capillitium netted, limy, very rarely nearly limeless, peridium usually limy, and spores black, deep violaceous, or dark grey in mass, deep purplish brown to violaceous brown to pale violaceous by transmitted light.

Diachea Fr., Novitiae florae svecicae 5(2): 80 (1819)

Notes: *Diachea* is an important genus of *Myxomycetes* that was reported by Fries in 1825. Species of *Diachea* are common inhabitants of decaying wood, bark, leaves, and leaf litter in humid environments (Thind and Manocha 1964; Yamamoto 1987, 2007; Keller et al. 2004; Lado et al. 2022). The members of this genus are characterised by their always-stalked sporocarps, with a stalk and columella filled with lime granules, and a single, iridescent, limeless peridium (Kirk et al. 2008). *Diachea* formed a monophyletic clade in recent molecular phylogenetic studies, but the position of this genus remains unresolved (Prikhodko et al. 2023).

According to different authors, the genus *Diachea* currently comprises between 12 to 15 accepted species (Yamamoto 1987, 2007; Kirk et al. 2008; Lado et al. 2022; Lado 2023), of which five species, *Diachea bulbillosa*, *D. leucopodia*, *D. splendens*, *D. subsessilis*, and *D. synspora* have been reported in China (Li 1988).

A new species found on the surface of fallen leaves in Haitangshan National Nature Reserve, Liaoning Province, China, in September 2012 is described and illustrated below.

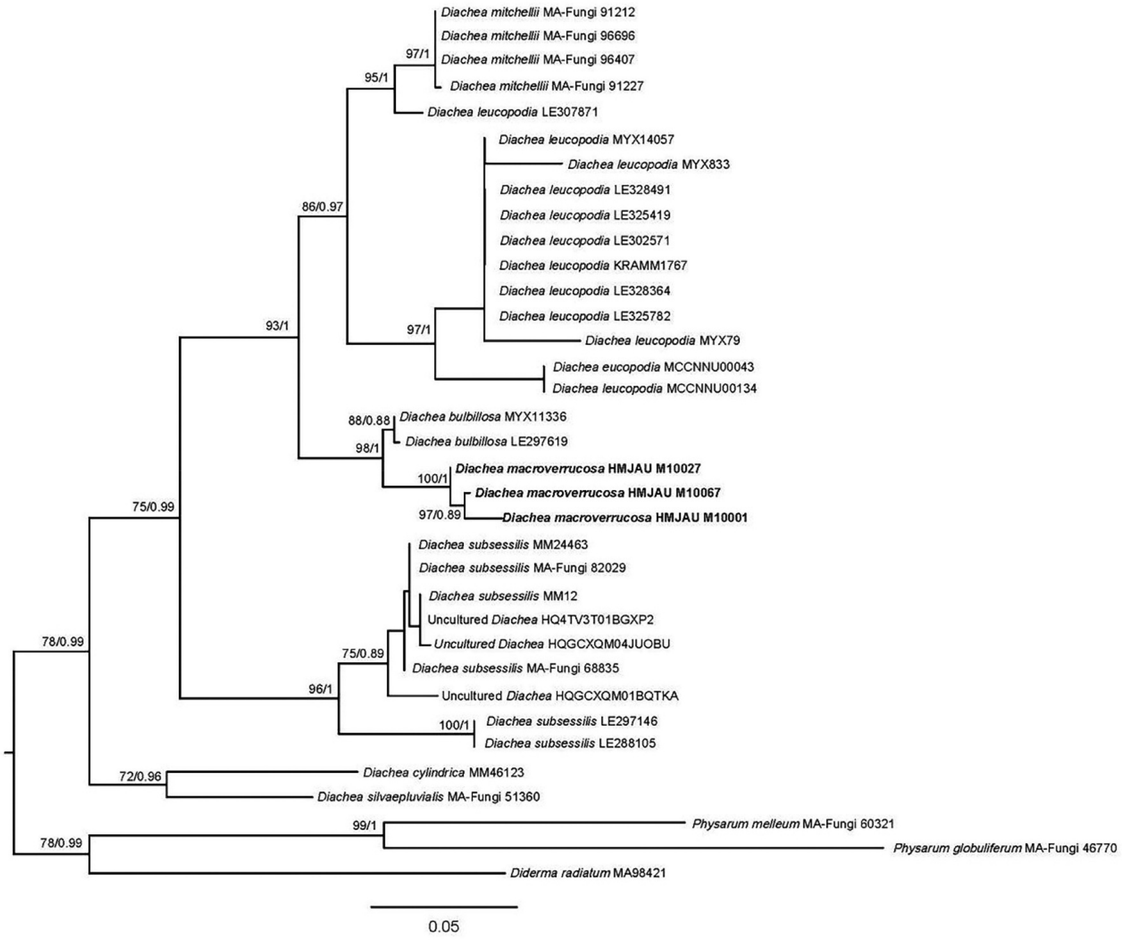

Figure 44. Phylogenetic relationship among species of *Diachea* inferred from the dataset of nSSU region. The topology is generated by the maximum likelihood algorithm. Bootstrap values and Bayesian posterior probabilities, when simultaneously above 50% and 0.8, respectively, are labelled at the nodes. The newly described species are in boldface.

Diachea macroverrucosa D. Dai & B. Zhang, sp. nov. Figure 43

Fungal Names: FN 571653.

Etymology: *macroverrucosa* (Latin), refers to the large verrucose spores.

Diagnosis: Differing from *D. bulbillosa* by a conical columella and big capitate-warted spores.

Description: Sporocarps gregarious, not closely crowded, more often stipitate, 0.75–0.9 mm in total height (Figure 43a); sporotheca globose, 0.35–0.4 mm in diam., iridescent with blue tints; peridium membranous, fragile, iridescent, appearing translucent and smooth without spores by transmitted light, dehiscence occurring irregularly from apex when mature, usually with basal remnants adhering to the columella and stalk (Figure 43e); hypothallus membranous, colourless, no calcareous; stalk up to 1/2 of total height, white, glossy, stout, consisting of a translucent membrane densely packed with white, small, globose, lime granules, basally enlarged; columella a continuation of the stalk, white, absent to 1/2 the height of sporotheca, conical, tapering to a blunt point (Figure 43b,f); capillitium arise as stiff threads from all columella, smooth, forming an open network of branching and anastomosing threads, free of peridium, diminish towards the periphery (Figure 43g), dark brown under transmitted light, paler at tips and colourless at attachment to columella (Figure 43b,c); spores globose, free, dark brown to black in mass, dark brown under transmitted light, ornamentation appearing stout warts under light microscopy (Figure 43d), big warts with irregular, capitate ends under SEM (Figure 43h), 8–13 µm in diam.; Plasmodium not observed.

Materials examined: China. Liaoning Province, Fuxin Mongolia Autonomous County, Haitangshan National Nature Reserve, on a fallen leaf, 1 September 2012 (holotype in HMJAU M10067); Jilin Province, Chibei County, on a fallen leaf, 25 August 2013 (paratype in HMJAU M10027); Shanxi Province, Zhashui County, Niubeiliang Nature Reserve, on a fallen leaf, 21 July 2014 (paratype in HMJAU M10001).

Notes: Diachea macroverrucosa closely resembles *D. bulbillosa* (Figure 44). The character of the spore ornamentation is striking in *D. macroverrucosa*, because the big capitate warts are special. Concerning species with white stalk in *Diachea*, it is somewhat similar to *Diachea bulbillosa*, *D. leucopodia*, *D. radiata*, *D. splendens*, *D. subsessilis*, and *D. synspora*. However, *D. macroverrucosa* differs from the above-mentioned speies as follows: *D. bulbillosa* develops a club-shaped columella and sparsely and irregularly warted spores (Penzig 1898); *D. leucopodia* produces broadly ovoid to cylindrical sporotheca and spinulose spores (Rostafiński 1874); *D. synspora* produces cylindrical sporotheca and clustered spores (Li 1988); *D. subsessilis* produces the distinctly reticulate spores (Peck 1878b); *D. splendens* produces spores marked with scattered tubercles, more or less connected by low ridges to form an imperfect reticulation (Peck 1878a); and *D. radiata* usually produces sessile, rarely short-stalked sporocarps and spinulose-reticulated spores (Farquharson and Lister 1916).

Disclosure statement

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ORCID

Lei Cai http://orcid.org/0000-0002-8131-7274
Wenhua Lu http://orcid.org/0000-0001-7283-7596

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