

Diversity and phylogeny of jelly fungi with longitudinally septate basidia in Auriculariales and Tremellales

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Abstract

Jelly fungi are one important group of wood-inhabiting fungi playing a crucial role in forest regeneration, and some species are important edible and medicinal fungi. Those jelly fungi with longitudinally septate basidia are mostly classified in Auriculariales, Tremellales, and Sebaciales. In the present study, the diversity and phylogeny of jelly fungi with longitudinally septate basidia in Auriculariales and Tremellales was studied based on morphological characteristics and DNA sequences of five genes including the internal transcribed spacer regions (ITS), the large subunit nuclear ribosomal RNA (nLSU), the protein-coding of the RNA polymerase II largest subunit (*RPB1*), the second largest subunit (*RPB2*), and the translation elongation factor 1- α (*TEF1*). The results showed that our studied jelly fungal samples around the world were identified as 102 species, including 47 species belonging to five genera of Auriculariales and 55 species belonging to five genera of Tremellales. A total of 46 new species, including 20 new species in Auriculariales, viz., *Exidia abieticola*, *E. brunnea*, *E. ellipsozona*, *E. latisporea*, *E. minor*, *E. ningxiaensis*, *E. nivea*, *E. orientalis*, *E. separata*, *E. sinocystidiata*, *E. sinothuretiana*, *E. subtropica*, *E. subtruncata*, *Myxarium atroalbum*, *M. miniatum*, *M. resupinatum*, *M. subnucleatum*, *M. yunnanense*, *Protohydnum translucidum*, *Pseudohydnum incarnatum*, and 26 new species in Tremellales, viz., *Phaeotremella crassitunicata*, *P. emeiensis*, *P. lonicericola*, *P. rigida*, *P. sparassidis*, *P. tenuis*, *Pseudotremella chayensis*, *P. pulvinata*, *P. subnivalis*, *Tremella aurulenta*, *T. circularis*, *T. conidiogena*, *T. crassihyphidiata*, *T. ellipsozona*, *T. guttulata*, *T. helva*, *T. hongheensis*, *T. lutea*, *T. mangiformis*, *T. microcarpa*, *T. neoyokohamensis*, *T. subhyalina*, *T. sublaurisilva*, *T. tasmanica*, *T. virgiensis*, and *T. xantha*, are described. Illustrated descriptions of these new species are provided. In addition, one new combination, *Pseudotremella indecorata*, is proposed.

Key words: Multi-gene phylogeny, Taxonomy, Wood-inhabiting fungi, 47 new taxa

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Introduction

Jelly fungi, with a long evolutionary history, are a group in the Basidiomycota usually with large gelatinous basidiomata, mainly as saprotrophs, and are ecologically important, playing a crucial role in forest regeneration (Floudas et al. 2012; Wu et al. 2019). Some jelly fungi are edible and have medicinal values (Dai et al. 2010; Wu et al. 2019; Geng et al. 2020), e.g., *Auricularia heimuer* F. Wu et al., *Naematelia*

sinensis Zhu L. Yang & J.Y. Tang and *Tremella fuciformis* Berk. These mushrooms are widely cultivated in China and have anti-inflammatory, antitumor, antioxidant, and immunity enhancement properties (Ruan et al. 2018; Zhou et al. 2018; Wu et al. 2019; Geng et al. 2020; Tang & Yang 2024).

Jelly fungi were traditionally divided among Auriculariales (including many genera currently treated in the Pucciniomy-

cotina – *Achroomyces* Bonord., *Helicogloea* Pat., *Jola* Möller etc.), Tremellales (all taxa with tremelloid basidia), Dacrymycetales, and smut fungi (e.g., *Dicellomyces* L.S. Olive). Some jelly fungi currently treated in the Sebaciniales (including *Sebacina* Tul. & C. Tul. and *Tremelloscypha* D.A. Reid) ever have been placed in the Tremellales (Donk 1966; Lowy 1971; Wells & Oberwinkler 1982) or the Auriculariales (Wells & Bandoni 2001; Weiß & Oberwinkler 2001). These species have distinct morphology of the basidia: transversely, longitudinally or obliquely septate basidia in the Auriculariales, Tremellales and Sebaciniales, and forked basidia in the Dacrymycetales and some smut fungi (Olive 1954; McNabb 1964; Lowy 1971; Wells & Oberwinkler 1982; Berndt & Sharma 1998; Weiß & Oberwinkler 2001; Wells et al. 2004; Weiss et al. 2004; Shirouzu et al. 2009). Currently, Jelly fungi with longitudinally septate basidia are mostly classified in Auriculariales, Tremellales, and Sebaciniales.

The Auriculariales, typified by *Auricularia* Bull., is a highly diverse order with gelatinous, membranous, coriaceous, waxy, corky or hard corky texture, smooth, stereoid, denticulate, hydroid, lamellate and poroid hymenophore configuration, and transversely, longitudinally, obliquely septate, or non-septate basidia (Weiß & Oberwinkler 2001; Wells et al. 2004; Sotome et al. 2014; Alvarenga et al. 2019; Spirin et al. 2019; Wu et al. 2021; Suetsugu & Okada 2025). The order was established to accommodate species that produce auricularioid basidia with transverse septa (Schroter 1889). Since variations of the basidia have been regarded as important characteristics to define taxonomic groups, basidial septation was used to divide the basidiomycetes into two major groups, the Heterobasidiomycetes and the Homobasidiomycetes (Patouillard 1887). The Auriculariales with transversely three-septate (auricularioid) basidia and the Tremellales with tremelloid basidia were treated as two large groups of Heterobasidiomycetes (Patouillard 1887; Brefeld 1888; Martin 1945). Then some new taxa were described in the two orders and other taxa were transferred into the two orders based on their morphology of basidia, e.g., *Metabourdotia* L.S. Olive, *Heteromyces* L.S. Olive, *Pseudotulasnella* Lowy etc. (Olive 1957; Lowy 1964; Hauerslev 1976; Kobayasi 1981; Li & Liu 1985; Li 1987; Roberts & Spooner 1998). However, with the increasing number of taxa of Heterobasidiomycetes, the taxonomic definition of the two orders was becoming more obscure, and subsequently their systematics was becoming difficult.

In order to accommodate all Heterobasidiomycetes, Oberwinkler & Bandoni (1982a, 1982b) and Bandoni (1984) considered three morphological features (the basidium, septal pore apparatus, and the nature of the haploid state) to be most important in characterizing heterobasidiomycetous fungi, and redefined Auriculariales and Tremellales. The Auriculariales was emended to include only taxa with the *Auricularia* type septal pore apparatus, hyphal haploid state and longitudinally septate or auricularioid basidia, and the Tremellales was emended to include only taxa with the *Tremella* type septal complex, unicellular haploid states, and tremelloid basidia (Bandoni 1984). Some species previously accommodated in Tremellales with tremelloid basidia were treated in Auriculariales, five families, viz., Auriculariaceae, Exidiaceae, Sebacinaceae, Aporpiaceae, and Hyaloriaceae, were recognized in the Auriculariales and three families, viz., Sirobasidiaceae, Tremellaceae, and Tetragonomycetaceae in the Tremellales (Bandoni 1984). Wells & Bandoni (2001)

essentially followed Bandoni's (1984) redefinition of the Auriculariales and Tremellales supplemented with additional ultrastructural data, and divided Heterobasidiomycetes into Heterobasidiomycetidae including four orders, i.e. Ceratobasidiales, Tulasnellales, Dacrymycetales, and Auriculariales, and Tremellomycetidae including Tremellales, Christianseniales and Filobasidiales. The Auriculariales included those species with complex septal pores with imperforate caps, transversely, obliquely to longitudinally, or partially septate basidia, and the Tremellales included those species with complex septal pores with sacculate cap or cap lacking, predominately longitudinally, but also obliquely or even transversely septate basidia (Wells & Bandoni 2001).

However, the systematics of the Auriculariales and Tremellales in Wells & Bandoni (2001) were not widely accepted by later studies, for example, the order Exidiiales was considered as a synonym of Auriculariales in Wells & Bandoni (2001) but it was considered as an independent order by Roberts (2003a, 2003b, 2006), and the genus *Basidiobolus* Rick was placed in the Auriculariales by Wells & Bandoni (2001) but it was placed in the Tremellales by Kotiranta & Saarenoksa (2005). With the aid of phylogenetic analysis, some genera or species were newly described in the Auriculariales (Chen et al. 2002; Kirschner & Chen 2004; Kirschner et al. 2010) and Tremellales (Sampaio et al. 2002; Kirschner & Chen 2008; Wang et al. 2008; Wang & Bai 2008), and the two orders were proved to be distantly related in the phylogenies, and respectively classified in Agaricomycetes and Tremellomycetes (Kirk et al. 2008; Boekhout et al. 2011; Millanes et al. 2011, 2012; Zhou & Dai 2013; Zhao et al. 2017).

In the Auriculariales, species of Exidiaceae and Aporpiaceae were transferred to Auriculariaceae because they were closely related to *Auricularia* and other genera in Auriculariaceae in the phylogeny (Weiß & Oberwinkler 2001; Zhou & Dai 2013; Sotome et al. 2014; Yuan et al. 2018). Sebaciniales was established to accommodate species of Sebacinaceae because these species always formed one independent clade distantly related to Auriculariales with a broad mycorrhizal potential (Weiss et al. 2004; Wells et al. 2004; Oberwinkler et al. 2014; Zhao et al. 2017; Spirin et al. 2019). DNA analyses suggested that two families, Serendipitaceae and Sebacinaceae, were well-supported in the Sebaciniales (Weiss et al. 2016). The species of Serendipitaceae are usually associated with plant roots, don't form basidiomata or have rare sexual structures (Weiss et al. 2016; Oktalira et al. 2021). Sebacinaceae encompasses mainly ectomycorrhizal and early-diverging saprotrophic species (Weiss et al. 2016), and some saprotrophic species have gelatinous basidiomata with longitudinally septate basidia, e.g., *Ditangium cerasi* (Schumacher) Costantin & L.M. Dufour, *Globulisebacina chenii* R. Kirschner (Oberwinkler et al. 2013; Kirschner et al. 2017; Malysheva et al. 2018). Therefore, a few jelly fungi are included in Sebaciniales, but they differ from those jelly fungi in Auriculariales by the absence of clamped hyphae.

Hoehnelomycetaceae, Paraphelariaceae, Patouillardiaceae, and Tremellodendropsidaceae, Saccoblastiaceae were established in the Auriculariales by Jülich (1981), but they were later rejected or transferred to other orders mostly based on phylogenetic analyses (Kisimova-Horovitz et al. 2000; Vizzini 2014; He et al. 2024). Species of Hoehnelomycetaceae, Paraphelariaceae, and Saccoblas-

tiaceae were transferred into Atractiellales of Pucciniomycotina (He et al. 2024). Patouillardaceae has obliquely septate basidia (Jülich 1981; Wells & Bandoni 2001), and it was considered as a synonym of Exidiaceae (Kirk et al. 2008), not accepted in the Auriculariales (Zhao et al. 2017; He et al. 2024). The order, Tremellodendropsidales, was established to accommodate Tremellodendropsidaceae only including *Tremellodendropsis* (Corner) D.A. Crawford by Vizzini (2014), which was confirmed based on phylogenetic analysis by Berbee et al. (2016). The species of Tremellodendropsidales usually have richly branched, consistency subcoriaceous to tough basidiomata arising from the soil, and partial longitudinally or transversely septate basidia (Vizzini 2014; Cui et al. 2024; He et al. 2024). Among *Tremellodendropsis* species, *Tremellodendropsis tuberosa* (Grev.) D.A. Crawford was ever defined as a coralloid jelly fungus (Berbee et al. 2016), but the species has more tough-gelatinous to coriaceous basidiomata and basidia with longitudinal septa at apex (He et al. 2024). Currently, Auriculariaceae and Hyaloriaceae are accepted in the Auriculariales (Wells et al. 2004; He et al. 2024; <http://www.indexfungorum.org>).

The family Auriculariaceae is widely accepted to include some genera with diverse basidiomata, e.g., *Auricularia* and *Exidia* Fr. with gelatinous basidiomata (Fries 1822; Wu et al. 2021; Tohtirjap et al. 2023), *Alloexidiopsis* L.W. Zhou & S.L. Liu and *Eichleriella* Bres. with corticioid and stereoid basidiomata (Bresadola 1903; Malysheva & Spirin 2017; Liu et al. 2022), *Elmerina* Bres. and *Grammatus* H.S. Yuan & Decock with poroid and lamellate basidiomata (Bresadola 1912; Zhou & Dai 2013; Yuan et al. 2018). The family Hyaloriaceae was established to accommodate species of *Hyaloria* Möller (Möller 1895). *Myxarium* Wallr. are morphologically similar to *Hyaloria* by sharing gelatinous basidiomata and longitudinally septate basidia with enucleate stalk (myxarioid basidia), but it was ever considered a synonym of *Exidia* (Roberts 1998). Based on molecular phylogenetic analyses, *Myxarium* was distantly related to *Exidia* (e.g., Weiß & Oberwinkler 2001; Spirin et al. 2019) and differs from *Exidia* by its myxarioid basidia, so *Myxarium* is accepted as an independent genus (Spirin et al. 2018a, 2018b, 2019, 2025). *Hyaloria* was considered a synonym of *Myxarium* because their type species formed a strongly supported clade and *Myxarium* was established before *Hyaloria* (Weiß & Oberwinkler 2001; Kirschner & Chen 2004; Stalpers et al. 2021). Hyaloriaceae is the correct name for *Myxarium* although the generic type of *Hyaloria*, *H. pilacre* Möller, has been moved to *Myxarium* (Weiß & Oberwinkler 2001; Kirschner & Chen 2004; Stalpers et al. 2021).

Alongside Auriculariaceae and Hyaloriaceae, the jelly fungi are also existed in other groups of the Auriculariales, e.g. *Pseudohydnum* P. Karst. (Chen et al. 2020; Zhou et al. 2022; Spirin et al. 2023; Coelho-Nascimento et al. 2024), *Protohydnum* Möller (Spirin et al. 2025) etc. Recently, several genera and species with gelatinous basidiomata were newly proposed or described in Auriculariales, but these studies mostly focused on one genus or some limited species (Wu et al. 2014, 2015a, 2015b, 2020, 2021; Spirin et al. 2018b, 2019; Ye et al. 2020; Wang & Thorn 2021; Kout & Wu 2022; Zhou et al. 2022, 2023a; Tohtirjap et al. 2023; Spirin et al. 2025).

In the Tremellales, there are a number of anamorphic yeast taxa mostly isolated from soil, plant surfaces, humans and animals, with their teleomorphic taxa mostly inhabiting rotten wood, lichens, and fungi (Bandoni 1995; Inácio et al.

2005; Pippola & Kotiranta 2008; Wang & Bai 2008; Findley et al. 2009; Millanes et al. 2012, 2014, 2015, 2016; Malysheva et al. 2015; Zhao et al. 2019; Fan et al. 2021a, 2021b). The order was established by Fries (1821) as one of the six orders in the “Hymenomycetes”. Patouillard (1887) divided “Hymenomycetes” into Heterobasidiomycetes and Homobasidiomycetes, and Tremellales was treated as one large group in the Heterobasidiomycetes (Tulasne 1853; Patouillard 1887; Brefeld 1888; Martin 1945). According to the redefinition of Auriculariales and Tremellales, three families as mentioned above were recognized in Tremellales (Bandoni 1984; Wells & Bandoni 2001). Later, based on phylogenetic analyses, some other old families, i.e. Carcinomycetaceae, Cryptococcaceae and Rhynchogastremaceae, were accepted, and some new families, i.e. Bulleraceae, Bulleribasidiaceae, Cuniculitremaeae, Naemateliaceae, Phaeotremellaceae, Trimorphomycetaceae, Pricozymaceae were established in the order (Metzler et al. 1989; Oberwinkler et al. 1990; Kirschner et al. 2001; Liu et al. 2015a, 2015b; Feng et al. 2025). In addition, some families were excluded from this order, e.g. Tetragnomycetaceae was transferred into Trichosporonales (Liu et al. 2015b; He et al. 2024). The family Phaeotremellaceae was excluded from this order remaining of uncertain placement by He et al. (2024) but it was still placed in this order by Jiang et al. (2024) and Feng et al. (2025). We treat Phaeotremellaceae as a group of the Tremellales because the species of Phaeotremellaceae were originally from the type family of Tremellales, Tremellaceae. Currently, 12 families are included in the Tremellales, and most jelly fungi of the Tremellales are classified in Tremellaceae and Phaeotremellaceae, and a few in other families, e.g. Bulleraceae and Naemateliaceae (Kobayasi 1939; Lowy 1971; Bandoni & Oberwinkler 1983; Chen 1998; Liu et al. 2015a, 2015b; Spirin et al. 2018c; Zhao et al. 2019; Fan et al. 2021a; Yamada et al. 2022; Thomas & Kumar 2023; Tang & Yang 2024).

The family Tremellaceae was established by Fries (1821) and was restricted to genera with tremelloid basidia by Patouillard (1900). Five genera, including *Bulleromyces* Boekhout & Á. Fonseca, *Sirotema* Bandoni, *Tremella* Pers., *Trimorphomyces* Bandoni & Oberw., and *Xenolachne* D.P. Rogers, were included in the family (Bandoni 1995). The type genus of Tremellaceae, *Tremella*, typified by *T. mesenterica* Retz., usually has wood-inhabiting large gelatinous basidiomata with tremelloid basidia. The genus was divided into five groups according to Chen (1998), viz., Mesenterica, Fuciformis, Indecorata, Foliacea, and Aurantia, based on morphological characteristics and ITS rDNA, nLSU rDNA dataset phylogeny. Liu et al. (2015b) emended the definitions of Tremellaceae and *Tremella* based on phylogenetic analyses of nLSU sequences. The family Tremellaceae was emended to only include *Tremella* s.s. and the other four genera were transferred to other families or uncertain family (Liu et al. 2015b; He et al. 2024). Species in the Mesenterica and Fuciformis groups of *Tremella* remained in *Tremella* s.s., and species in Indecorata, Foliacea and Aurantia groups were transferred to *Pseudotremella* Xin Zhan Liu et al. classified in Bulleraceae, *Phaeotremella* Rea classified in Phaeotremellaceae and *Naematelia* Fr. classified in Naemateliaceae, respectively (Liu et al. 2015b; Wedin et al. 2016; Spirin et al. 2018c). Currently, Tremellaceae, Phaeotremellaceae, and Naemateliaceae are mostly comprised of teleomorphic jelly fungi, and Bulleraceae is

mostly comprised of anamorphic yeast taxa (Liu et al. 2015b; Spirin et al. 2018c; Zhao et al. 2019; Fan et al. 2021a; Tang & Yang 2024).

Recently, a large number of lichenicolous species were newly described in the Tremellales, and they were mostly placed in *Tremella* because of their usually small gelatinous basidiomata and tremelloid basidia (Zamora et al. 2011, 2016, 2017, 2018; Ariyawansa et al. 2015; Lindgren et al. 2015; Millanes et al. 2015; Diederich et al. 2022), but these lichenicolous species were never clustered into the monophyletic Tremellaceae/*Tremella* s.s. clade in the phylogenies (Zamora et al. 2016, 2017, 2018; Diederich et al. 2022). The genus *Tremella* s.l. became the largest group among the teleomorphic taxa of the Tremellales and highly polyphyletic (Boekhout et al. 2011; Millanes et al. 2011; Weiss et al. 2014; Li et al. 2020; Diederich et al. 2022). However, the species diversity of non-lichenicolous jelly fungi usually with large gelatinous basidiomata is not well known in the Tremellales, and only a few species were recently described in *Tremella* or *Phaeotremella* (Spirin et al. 2018c; Zhao et al. 2019; Fan et al. 2021a; Thomas & Kumar 2023).

Overall, Auriculariales and Tremellales are respectively classified in Agaricomycetes and Tremellomycetes and are phylogenetically distantly related; some groups are not yet well defined, and some families or genera are still polyphyletic; species diversity of jelly fungi in both orders with longitudinally septate basidia is poorly known.

In this study, although Auriculariales and Tremellales are two phylogenetically distant groups belonging to different classes of basidiomycetes, we try to elucidate the phylogenetic relationships of the different groups in Auriculariales and Tremellales and investigate the species diversity of jelly fungi with longitudinally septate basidia, using phylogenies of Auriculariales, Auriculariaceae and Tremellales based on ITS, nLSU, *RPB1*, *RPB2*, and *TEF1* sequences because, firstly, jelly fungi from both Auriculariales and Tremellales were previously considered as a natural group, i.e. Heterobasidiomycetes; secondly, these species macro-morphologically have similar basidiomata inhabiting rotting wood and some species in the two orders cannot be distinguished in the field; thirdly, jelly fungi from both orders micro-morphologically have septate basidia and clamped hyphae.

Materials and methods

Morphological studies

Most of studied specimens are deposited at the herbaria of Beijing Forestry University (BJFC) and of Universidade Federal de Pernambuco, Departamento de Micologia, Herbário Pe. Camille Torrend (HURM). Some materials were loaned from the Taiwan Museum of Natural Science (TNM), the herbaria of the Mycology Department of Jilin Agriculture University (HMJAU), the National Herbarium of Victoria (MEL), the Instituto de Pesquisas Ambientais (SP), University of Helsinki (H), the New Zealand Fungal and Plant Disease Collection (PDD), and the Private Herbarium of Josef Vlasák (JV). Macro-morphological illustrations refer to Pippola & Kotiranta (2008) and Wu et al. (2021), and microscopic structures refer to Chen (1998), Malysheva et al. (2015), and Wu et al. (2021). Color terms followed Petersen (1996). Handmade sections of dried basidiomata were mounted in

KOH (5%) for five minutes and treated with Phloxine B (2% $C_{20}H_4Br_4Cl_2K_2O_5$). Microscopic structures were examined using a Nikon Eclipse 80i microscope (magnification $\times 1,000$) photographed using a Nikon Digital Sight DS-L3 or Leica ICC50 HD camera. Microscopic structures were measured in the solution of KOH and Phloxine B. Thirty basidiospores of each specimen were measured; 5% of measurements were excluded from each end of the range and are given in parentheses. Stalks were excluded for the basidia measurements, and the germination tube was excluded for basidiospores measurements. Abbreviations are as follows: L = mean length (arithmetic average of all basidiospores length), W = mean width (arithmetic average of all basidiospores width), Q = L/W ratio for each specimen studied, n (a/b) = number of spores (a) measured from given number of specimens (b). The diameters of the sterigmata were measured at the base.

DNA extraction, amplification and sequencing

About 25 mg was taken from a dried sample for DNA extraction. After pretreatment using TissuePrep (Jie Ling, China), DNA was extracted using a CTAB rapid plant genome extraction kit-DN14 (Aidlab Biotechnologies Co., Ltd, Beijing) according to the manufacturer's instructions with some modifications (Wu et al. 2022). The ITS regions were amplified with primer pairs ITS5 and ITS4, the primer ITS1 was used sometimes as an alternative to ITS4 (White et al. 1990). The nLSU regions were amplified with primer pairs LR0R and LR7, and the primer LR5 was used sometimes as an alternative to LR7 (Hopple & Vilgalys 1994). The *RPB1* regions were amplified with primer pairs RPB1-Af and RPB1-Cr (Stiller & Hall 1997; Matheny et al. 2002). The *RPB2* regions were amplified with primer pairs fRPB2-5F and fRPB2-7CR (Matheny 2005) or Fcrypto and Rcrypto (Ye et al. 2012). The *TEF1* regions were amplified with primer pairs EF1-983F and EF1-1567R, and the primer EF1-2218R was used sometimes as an alternative to EF1-1567R (Rehner 2001; Rehner & Buckley 2005).

The PCR (polymerase chain reaction) cycling schedules for different DNA sequences of ITS, nLSU, *RPB1*, *RPB2*, and *TEF1* genes used in this study followed Wu et al. (2021) and Fan et al. (2021a). The PCR procedure for ITS and *TEF1* was initial denaturation at 95°C for 3 min, followed by 35 cycles at 94°C for 40s, 56°C for 45s, and 72°C for 1 min, and a final extension of 72°C for 10 min. The PCR procedure for nLSU was initial denaturation at 94°C for 1 min, followed by 35 cycles at 94°C for 1 min, 50°C for 1 min, and 72°C for 1 min, and a final extension of 72°C for 10 min. The PCR procedure for *RPB1* and *RPB2* was initial denaturation at 95°C for 3 min, followed by 9 cycles at 94°C for 45s, 60°C for 1 min and 72°C for 1.5 min, then followed by 35 cycles at 95°C for 1 min, 55°C for 45s and 72°C for 1 min, and a final extension of 72°C for 10 min. The PCR products were purified and sequenced in the Beijing Genomics Institute (BGI), China, with the same primers used in the PCR reactions. All new sequences have been submitted to GenBank, and these new sequences, along with reference sequences retrieved from GenBank, are included in Supplementary Table 1.

Phylogenetic analysis

The phylogenies of Auriculariales and Auriculariaceae were

constructed based on two different datasets composed of concatenated ITS+nLSU sequences and ITS+nLSU+*TEF1*+*RPB1*+*RPB2* sequences respectively, because only ITS and nLSU sequences were available in most existing species of the Auriculariales. The phylogeny of Auriculariaceae was constructed to identify some closely related species and demonstrate phylogenetic relationships of species of Auriculariaceae. The members of the Sebaciniales were used as outgroups of phylogenetic analyses of the Auriculariales because the current genome-based reconstruction of the Agaricomycetes shows Sebaciniales as a sister group of Auriculariales (<https://mycocosm.jgi.doe.gov/mycocosm/species-tree/tree;1L51UE?organism=agaricomycetes>). *Protoacia delicata* Spirin & Malysheva, *Pseudohydnum alienum* Spirin & Malysheva, and *Ps. gelatinosum* (Scop.) P. Karst. were used as the outgroups of phylogenetic analyses of the Auriculariaceae because the species was distantly related to species of Auriculariaceae but clustered in the Auriculariales. The phylogeny of Tremellales was constructed based on the third dataset composed of concatenated ITS+nLSU+*RPB1*+*RPB2*+*TEF1* sequences, and the members of Filobasidiales were selected as outgroups because Filobasidiales is a sister group of Tremellales (<https://mycocosm.jgi.doe.gov/mycocosm/species-tree/tree;8Kf3DR?organism=tremellomycetes>).

Newly generated sequences were aligned with additional related sequences downloaded from GenBank (Supplementary Table 1) using MAFFT 7.0 online service with the Q-INS-i strategy (Katoh et al. 2019; <http://mafft.cbrc.jp/alignment/server/>) using the default parameters and manually adjusted in BioEdit (Hall 1999). Positions deemed as ambiguous to align were excluded manually. Multi-genes were concatenated as a combined file by Mesquite version 3.2. (Maddison & Maddison 2017). The analyses were applied for families, genera, and species delimitation of Auriculariales and Tremellales. The final alignments and the retrieved topologies were deposited in TreeBase (<https://treebase.org/treebase-web/home.html>; submission ID 31365, 31763) and the taxonomic novelties in MycoBank (<http://www.Mycobank.org>). Maximum Likelihood (ML) and Bayesian Inference (BI) methods were used to analyze the above tree datasets.

For each of the pre-defined partitions, the best partitioning scheme and evolutionary models were selected using PartitionFinder2 v2.1.1 (Lanfear et al. 2017) under the all algorithm and the AIC criterion. The Auriculariales dataset (ITS+nLSU): GTR+I+G (ITS), GTR+I+G (nLSU); The Auriculariaceae dataset (ITS+nLSU+*TEF1*+*RPB1*+*RPB2*): GTR+I+G (ITS), GTR+I+G (nLSU), GTR+I+G (*TEF1*), TRN+I+G (*RPB1*), and TIM+I+G (*RPB2*); The Tremellales dataset (ITS+nLSU+*RPB1*+*RPB2*+*TEF1*): GTR+I+G (ITS), GTR+I+G (nLSU), SYM+I+G (*RPB1*), GTR+I+G (*RPB2*), SYM+I+G (*TEF1*). A partition homogeneity test (PHT) of the three datasets was performed with PAUP 4.0a169* (<http://phylosolutions.com/PAUP-test/>), the PHT resulted in a *p* value > 0.5 for the three combined datasets. Maximum Likelihood phylogenies were inferred using IQ-TREE v2.4.0

(Nguyen et al. 2015) under Edge-linked partition model for 5,000 ultrafast (Minh et al. 2013) bootstraps. The Bayesian phylogenetic inference was conducted using MrBayes version 3.2.7a, as part of the PhyloSuite software package (v1.2.3; Zhang et al. 2019; Xiang et al. 2023), four Markov chains were run for two runs from random starting trees for 10 million generations (the dataset of Auriculariaceae), 20 million generations (the dataset of Auriculariales), and 10 million generations (the dataset of Tremellales) until effective sample sizes (ESSs) reached more than 200 and the potential scale reduction factors (PSRFs) were close to 1.000 for all parameters, and trees were sampled every 1,000 generations.

Phylogenetic trees were viewed by FigTree v. 1.4.2 (<http://tree.bio.ed.ac.uk/software/figtree/>) and edited by Adobe Illustrator 2021. Branches that received bootstrap support for ML and BI posterior probabilities greater than or equal to 70% and 0.90 were considered as significantly supported, respectively.

In addition, the phylogenies of Auriculariaceae and Tremellales were constructed using ML methods, based on three other datasets (ITS, ITS+nLSU, and ITS+nLSU+*RPB1*+*RPB2*) and two other datasets (ITS and ITS+nLSU), respectively, to further validate our phylogenetic analysis results. The relevant results can be seen in the Supplementary attachments.

Results

Molecular phylogeny

The concatenated ITS+nLSU dataset of Auriculariales included 358 specimens representing 178 species of Auriculariales, and three specimens representing three species of Sebaciniales. The aligned dataset had a length of 2,304 characters including gaps (937 characters for ITS, 1,367 characters for nLSU). The tree with the highest likelihood found in ML analysis is shown in Fig. 1. The BI analysis was stopped after 20 million generations with an average PSRF (PSRF = potential scale reduction factor) for parameter values of 1.006. The similar topologies were yielded in the main lineages with minor differences in statistical supports using ML and BI analyses. Therefore, only the ML tree is presented along with the support values from the BS (≥ 70%) and BPP (≥ 0.90) at the nodes (Fig. 1). Molecular phylogenetic analysis demonstrated that our samples clustered into four main clades of the Auriculariales, viz. the Auriculariaceae clade, the Hyaloriaceae clade, the *Protohydnum* clade, and the *Pseudohydnum* clade. The most of small lineages representing different species based on our specimens are strongly supported except for the *Tremellochaete japonica* lineage only with BI support value and the *Exidia crenata* lineage only with ML support value (Fig. 1). Species of Auriculariaceae formed one large monophyletic clade with high support; *Myxarium*, *Protohydnum* and *Pseudohydnum* formed three independent clades outside the Auriculariaceae clade; *Exidia* and *Tremellochaete* Raitv. remained polyphyletic and clustered in the Auriculariaceae clade (Fig. 1).

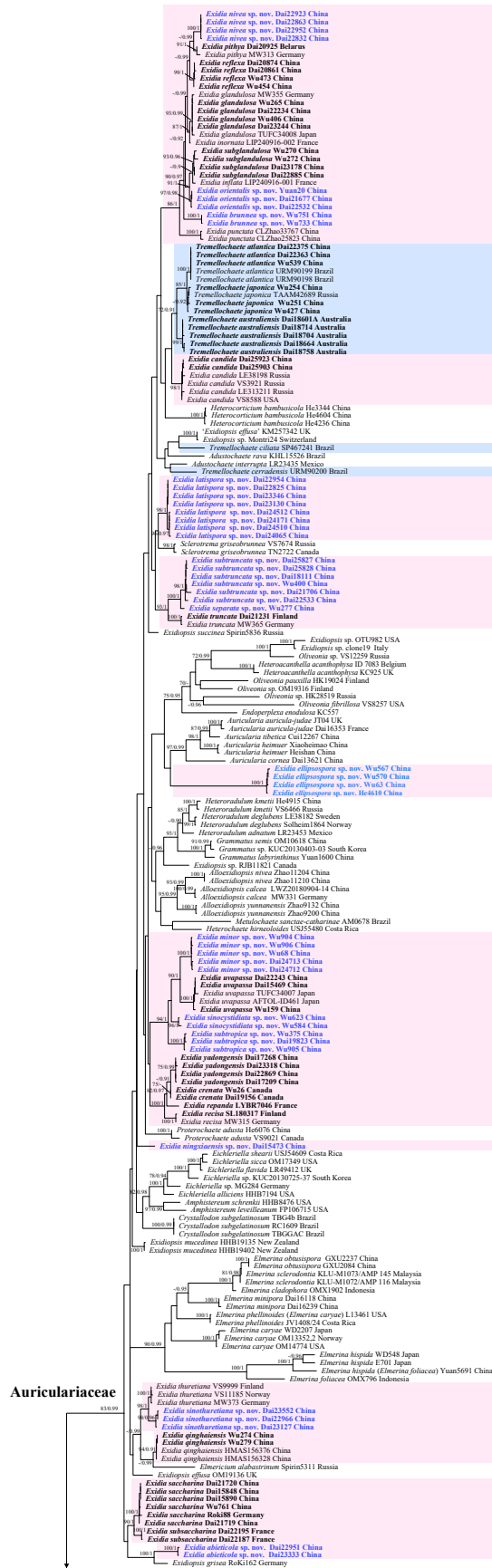


Fig. 1 Maximum likelihood (ML) tree illustrating the phylogeny of the Auriculariales based on the concatenated ITS+nLSU dataset. Branches are labeled with maximum likelihood bootstrap values higher than 70%, and Bayesian posterior probabilities higher or equal to 0.90. Samples that we examined are in bold, and new taxa are in blue.



clustered in 12 different clades, of which 11 clades could be assigned to *Exidia*, one clade to *Tremellochaete*. *Exidia* and *Tremellochaete* also remained polyphyletic (Fig. 2). The two lineages, *Tremellochaete japonica* lineage and the *Exidia crenata* lineage are strongly support by BI and ML analysis here (Fig. 2).

The maximum likelihood (ML) analyses of Auriculariaceae based on the ITS, ITS+nLSU, and ITS+nLSU+RPB1+RPB2 datasets are shown in Supplementary Figs. 1–3. The results were largely consistent with those from the phylogenetic analysis based on the ITS+nLSU+TEF1+RPB1+RPB2 dataset.

The concatenated ITS+nLSU+RPB1+RPB2+TEF1 dataset of Tremellales included 456 specimens representing 277 species of Tremellales, and three specimens representing three species of the Filobasidiales. The aligned dataset had a length of 6,565 characters including gaps (1,091 characters for ITS, 1,477 characters for nLSU, 1,164 characters for RPB1, 1,238 characters for RPB2, and 1,595 characters for TEF1). The tree with the highest likelihood found in ML analysis is shown in Fig. 3. The BI analysis was stopped after 10 million generations with an average PSRF (PSRF = potential scale reduction factor) for parameter values of 1.001. ML and BI analyses yielded similar topologies in the main lineages with minor differences in statistical supports. Therefore, only the ML tree is presented along with the support values from the BS ($\geq 70\%$) and BPP (≥ 0.90) at the nodes (Fig. 3).

Molecular phylogenetic analysis demonstrated that Tremellales formed one large monophyletic clade with high support, and 12 known families of Tremellales all formed monophyletic clades except for Bulleraceae, Carcinomycetaceae, Bulleribasidiaceae. The species of those clades (e.g. the *Pseudotremella* clade, the *Genolevuria* clade, the *Tremella* clade I, and the *Tremella* clade II) previously classified in Bulleraceae (Liu et al. 2015b; He et al. 2024; Feng et al. 2025) clustered into one large clade but without support value, and a lot of monophyletic small clades or single species lineages were formed in the Bulleraceae clade (Fig. 3). The Bulleraceae clade is highly polyphyletic. One monophyletic clade (*Tremella* II) previously classified in Carcinomycetaceae (Liu et al. 2015b) is distantly related to the core group of Carcinomycetaceae, and another monophyletic clade (*Vishniacozyma* clade) previously classified in Bulleribasidiaceae (Liu et al. 2015b; He et al. 2024) is distantly related to the core group of Bulleribasidiaceae. The three clades are indicated Incertae sedis in the phylogenetic trees (Fig. 3).

Our jelly samples formed 55 lineages that were scattered in five large clades of the Tremellales, of which four lineages clustered in the Bulleraceae clade, one lineage in the Sirobasidiaceae clade, two small lineages in the Naemateliaceae clade, 37 small lineages in the Tremellaceae clade, and eleven small lineages in the Phaeotremellaceae clade (Fig. 3). These small lineages could be assigned to five genera, viz., *Naematelia*, *Phaeotremella*, *Pseudotremella*, *Sirobasidium* Lagerh. & Pat., and *Tremella*. In addition, *Sirobasidium* and *Tremella* s.l. remained polyphyletic (Fig. 3).

The maximum likelihood (ML) analyses of Tremellales based on the ITS and ITS+nLSU datasets are shown in

Supplementary Figs. 4–5. The results were largely consistent with those from the phylogenetic analysis based on the ITS+nLSU+RPB1+RPB2+TEF1 dataset.

Taxonomy

Auriculariales Bromhead 1840.

The order was established to accommodate *Auricularia* species with gelatinous basidiomata and narrowly clavate to subcylindrical and transversely septate basidia (Bromhead 1840; Kobayasi 1981). Nowadays, it includes many corticioid, hydroid, lamellate and poroid species with longitudinally septate basidia (Yuan et al. 2018; Alvarenga et al. 2019; Liu et al. 2022), and jelly fungi with longitudinally septate basidia have become one of the most important groups of this order (Weiß & Oberwinkler 2001; Spirin et al. 2018b, 2019, 2025; Ye et al. 2020; Wu et al. 2020; Wang & Thorn 2021; Zhou et al. 2022, 2023a; Tohtirjap et al. 2023; Wang & Bau 2023).

In this study, we focus on the jelly fungi in Auriculariales with longitudinally septate basidia. Our jelly fungal samples of the order were identified as 47 species belonging to five genera, viz., *Exidia*, *Myxarium*, *Protohydnum*, *Pseudohydnum*, and *Tremellochaete*. Brief introductions to these five genera are provided, and 20 new species are proposed and described.

***Exidia* Fr., Syst. mycol. (Lundae) 2(1): 225 (1822).**

Type species: Exidia glandulosa (Bull.) Fr.

Basidiomata gelatinous, occasionally waxy when fresh, variable in color, orbicular, sub-orbicular, pulvinate, cupulate or cerebriform, sessile, usually separate, fusing together and becoming coalescent or effused in some species; hymenial surface smooth or slightly ridged, with or without papillae; hyphal structure monomitic; hyphae clamped; hyphidia present or absent; basidia longitudinally septate, 4-celled, more or less ovoid or subglobose, thin-walled, with a basal clamp connection; basidiospores mostly allantoid, hyaline, thin-walled.

Notes: *Exidia* is characterized by its usually gelatinous, orbicular or sub-orbicular basidiomata, a monomitic hyphal structure, clamped hyphae, longitudinally septate 4-celled basidia and mostly allantoid basidiospores. The genus was addressed to Tremellaceae of the Tremellales for a long time because of its gelatinous basidiomata and 4-celled basidia (Olive 1954; Lowy 1971; Roberts 2001). Later the genus was revealed as a polyphyletic group of Auriculariaceae in Auriculariales based on phylogenetic analyses (Weiß & Oberwinkler 2001; Xiong et al. 2013; Spirin et al. 2019; Ye et al. 2020; Tohtirjap et al. 2023).

Approximately 70 legitimate names of *Exidia* are recorded according to Index Fungorum and MycoBank, among them, 17 species were confirmed by molecular data. According to our studies, 27 species were identified as *Exidia* based on our samples, of which four were described in our previous publications (Wu et al. 2020; Ye et al. 2020; Tohtirjap et al. 2023), and 13 are described here as new. The key morphological characteristics of the 13 new species based on our samples are described in Table 2.

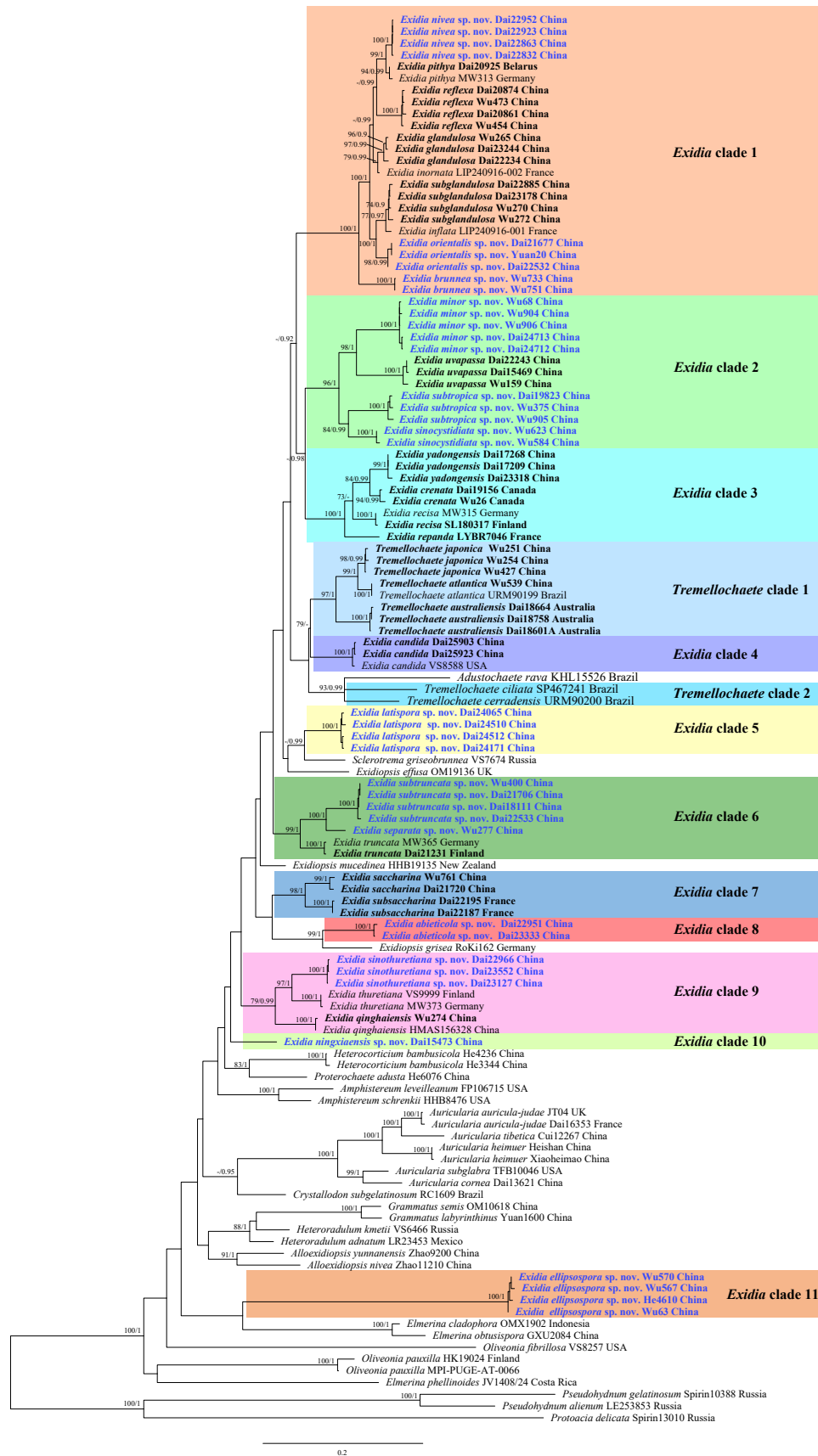


Fig. 2 Maximum likelihood (ML) tree illustrating the phylogeny of the Auriculariaceae based on the concatenated ITS+nLSU+TEF1+RPB1+RPB2 dataset. Branches are labeled with maximum likelihood bootstrap values higher than 70%, and Bayesian posterior probabilities higher or equal to 0.9. Samples that we examined are in bold, and new taxa are in blue.

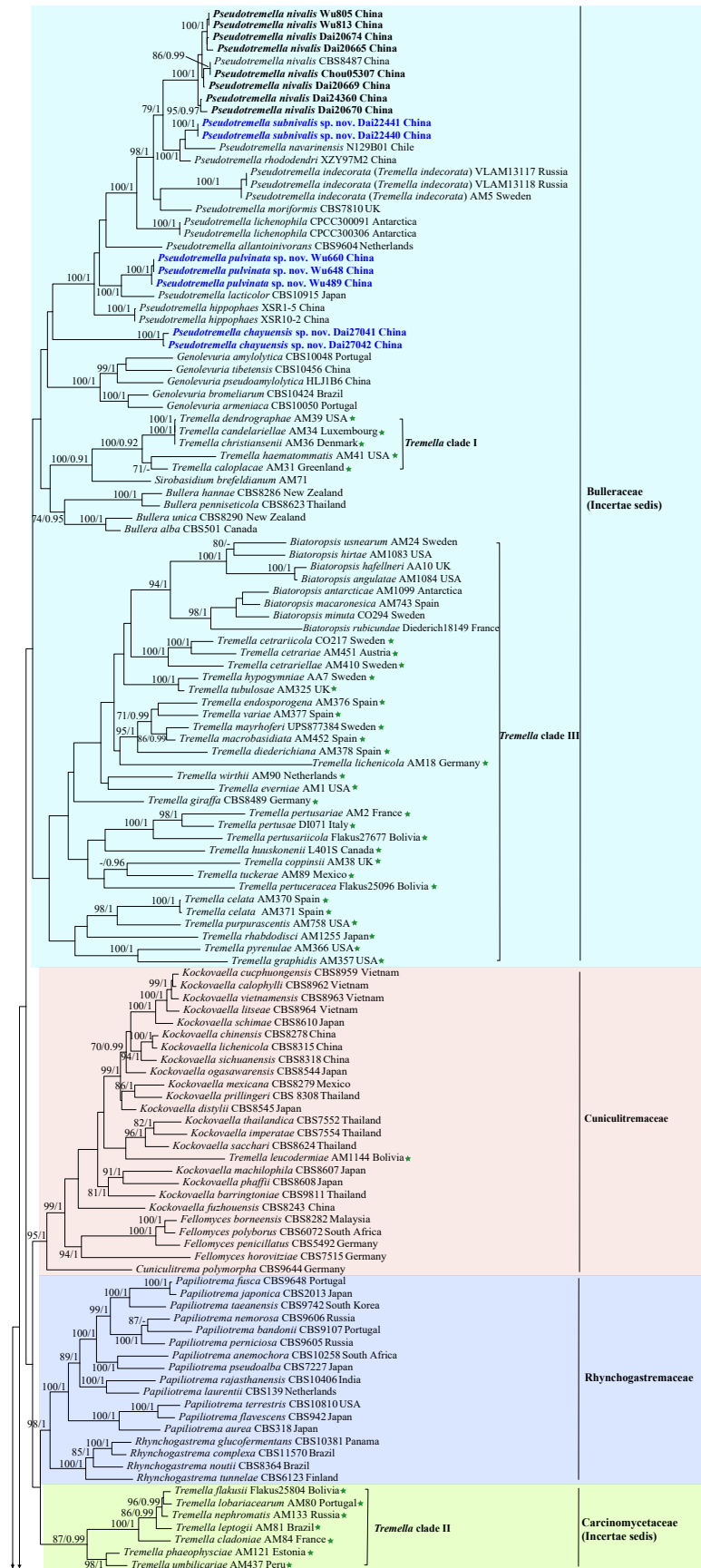


Fig. 3 Maximum likelihood (ML) tree illustrating the phylogeny of the Tremellales based on the concatenated ITS+nLSU+RPB1+RPB2+TEF1 dataset. Branches are labeled with maximum likelihood bootstrap values higher than 70%, and Bayesian posterior probabilities higher or equal to 0.9. Samples that we examined are in bold, and new taxa are in blue. Green pentagrams represent lichenicolous *Tremella* species.

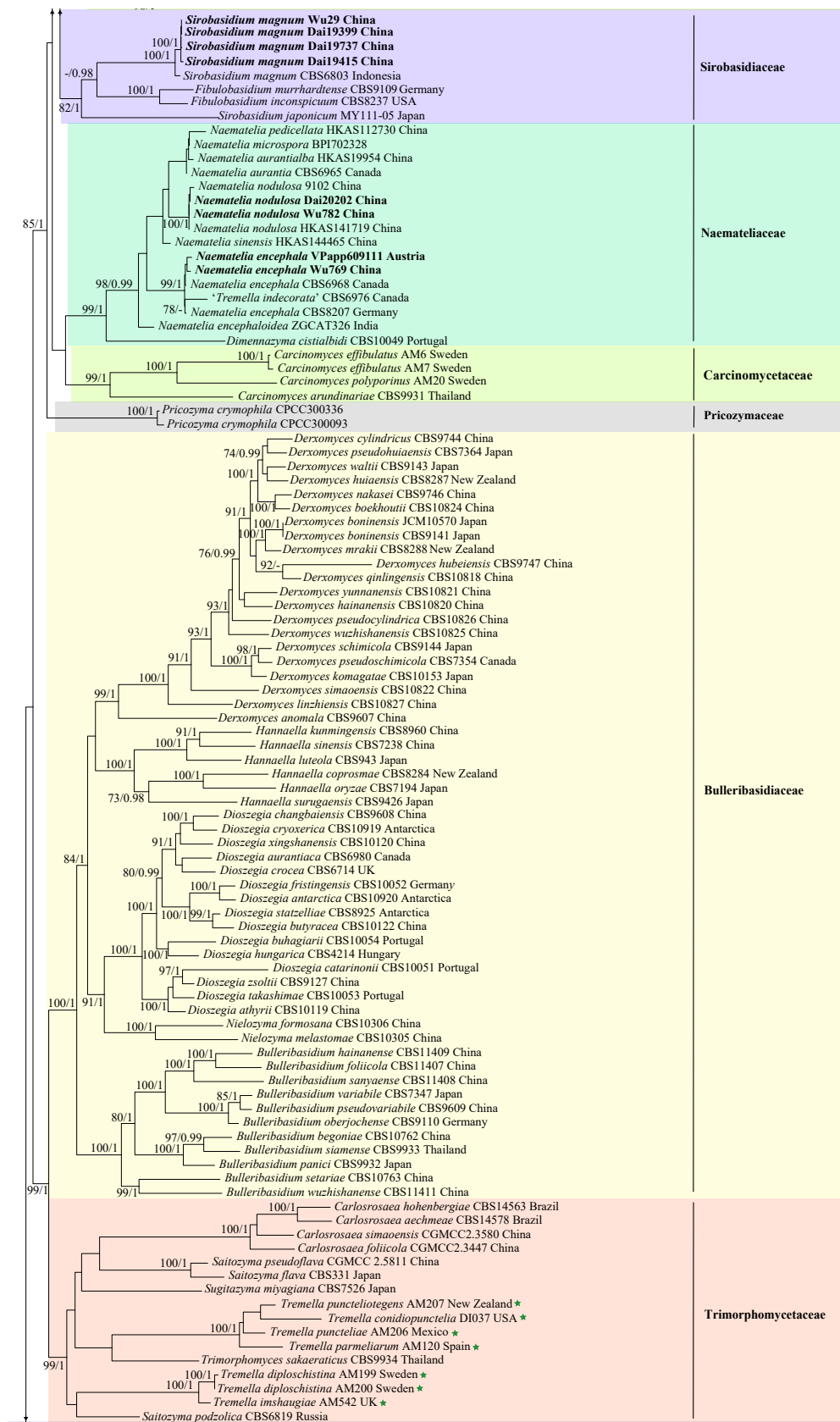


Fig. 3 (continued)

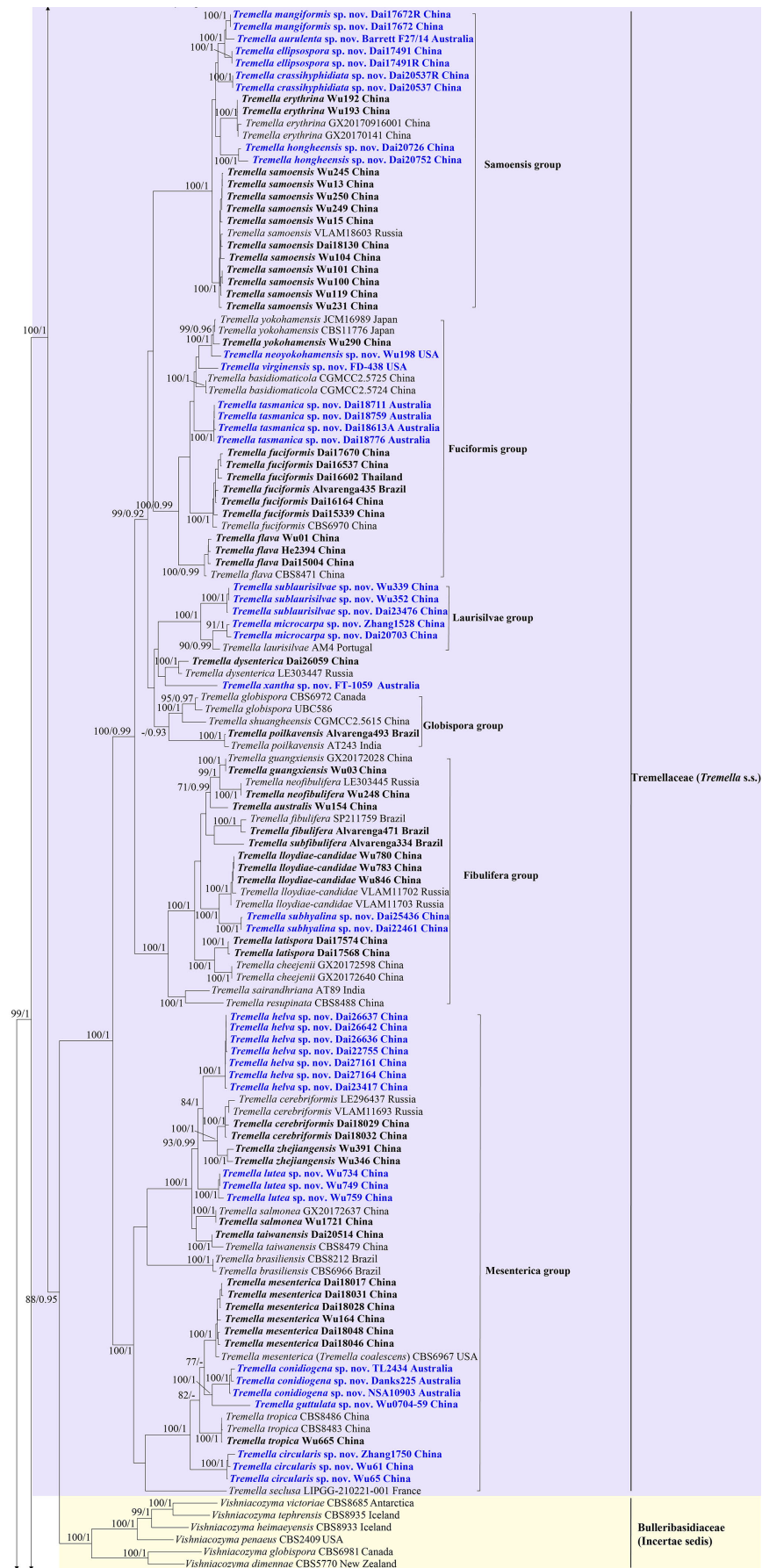


Fig. 3 (continued)

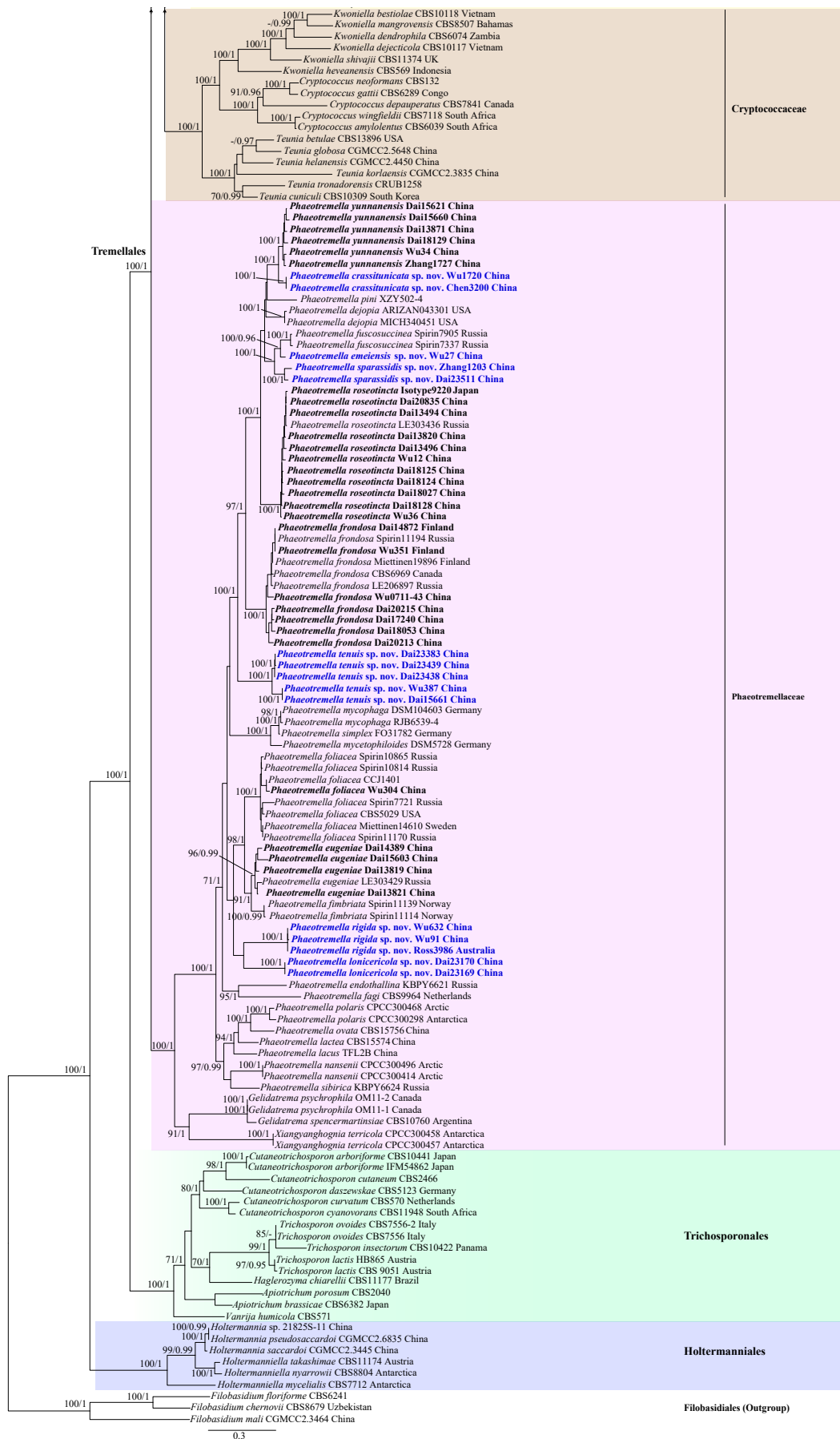


Fig. 3 (continued)

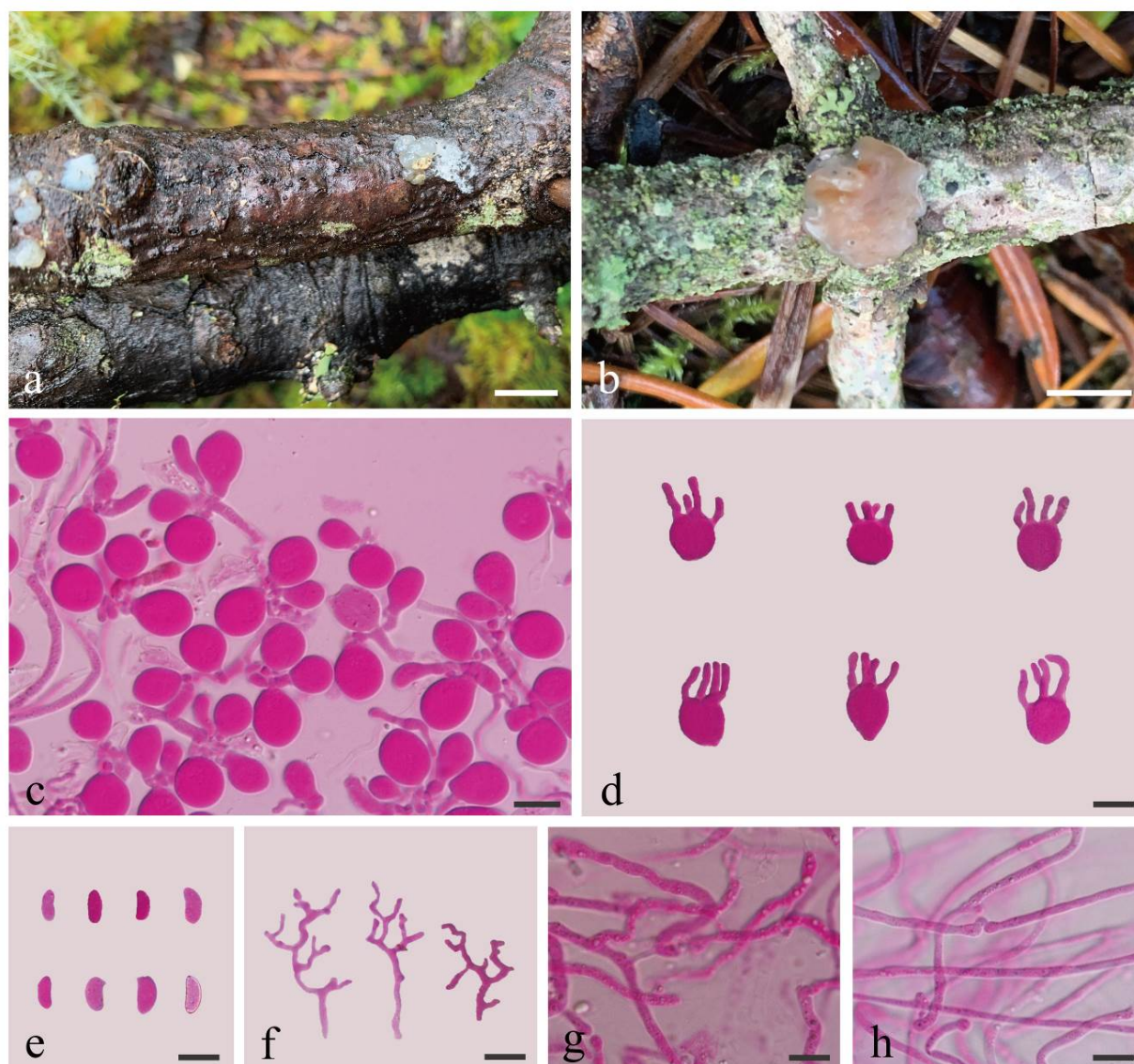


Fig. 4 Photos of basidiomata and microscopic structures of *Exidia abieticola*. a–b Basidiomata. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g–h Hyphae. Scale bars = a–b 1 cm, c–h 10 µm.

Exidia abieticola* F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.

..... Figs. 4, 5

Mycobank: MB 856352

Etymology: *Abieticola* (Lat.): refers to the species growing on *Abies* sp.

Diagnosis: Similar to *Exidia sinothuretiana* but differs in having distinctly smaller basidia and basidiospores, and distinctly branched hyphidia.

Basidiomata: Gelatinous, white to brownish vinaceous when fresh, becoming fuscous when dry; sub-orbicular or slightly cerebriform, sessile, usually remaining separate, occasionally coalescing, up to 3 cm diam. and 5 mm thick, with free margins; hymenial surface smooth and without papillae, slightly ridged; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), simple or branched, hyaline, thin-walled, 0.5–2 µm diam., the ends of hyphae inflated, 2–4.5 µm diam., embedded in a gelatinous matrix. Hyphidia usually distinctly branched, hyaline, thin-walled, dendrite. Basidia longitudinally septate, 4-celled, subglobose to

globose, thin-walled, with a basal clamp connection, 11.0–13.8 × 8.0–11.2 µm. Basidiospores mostly allantoid, hyaline, thin-walled, smooth, usually without oil drop, 8.0–10.2(–10.8) × (3.2–)3.8–4.5 µm, L = 9.36 µm, W = 3.93 µm, Q = 2.38 (n = 10/1).

Known distribution: Southwest China.

Specimens examined: China, Xizang Autonomous Region, Linzhi, Sejilashan, on fallen trunk of *Abies georgei*, 23 Oct 2021, Y.C. Dai, Dai 23333 (BJFC 037904, **holotype**); Yunnan Province, Shangri-la, Pudacuo National Park, on dead branch of *Abies georgei*, 7 Sep 2021, Y.C. Dai, Dai 22961 (BJFC 037524).

Notes: Morphologically, *Exidia abieticola* may be confused with *E. sinothuretiana* by sharing white to brownish, sub-orbicular or slightly cerebriform basidiomata, and growth on *Abies*, but *E. sinothuretiana* has distinctly larger basidia (18.2–23.5 × 16.2–18.2 µm vs. 11–13.8 × 8–11.2 µm) and basidiospores (17.5–22 × 6.2–8 µm vs. 8–10.2 × 3.8–4.5 µm), and apically branched hyphidia. In the phylogenies (Figs. 1, 2), *E. abieticola* forms an independent lineage closely related

to *Exidiopsis grisea* (Bres.) Bourdot & Maire with robust support, but *Exidiopsis grisea* differs from *E. abieticola* by having usually effused or slightly pulvinate, waxy gelatinous, blue-gray basidiomata, slightly branched hyphidia, larger

basidiospores ($11\text{--}13.5 \times 4.5\text{--}5.5\ \mu\text{m}$ vs. $8\text{--}10.2 \times 3.8\text{--}4.5\ \mu\text{m}$), and distribution in Europe (Wells 1961; Roberts 1993; Weiß & Oberwinkler 2001).

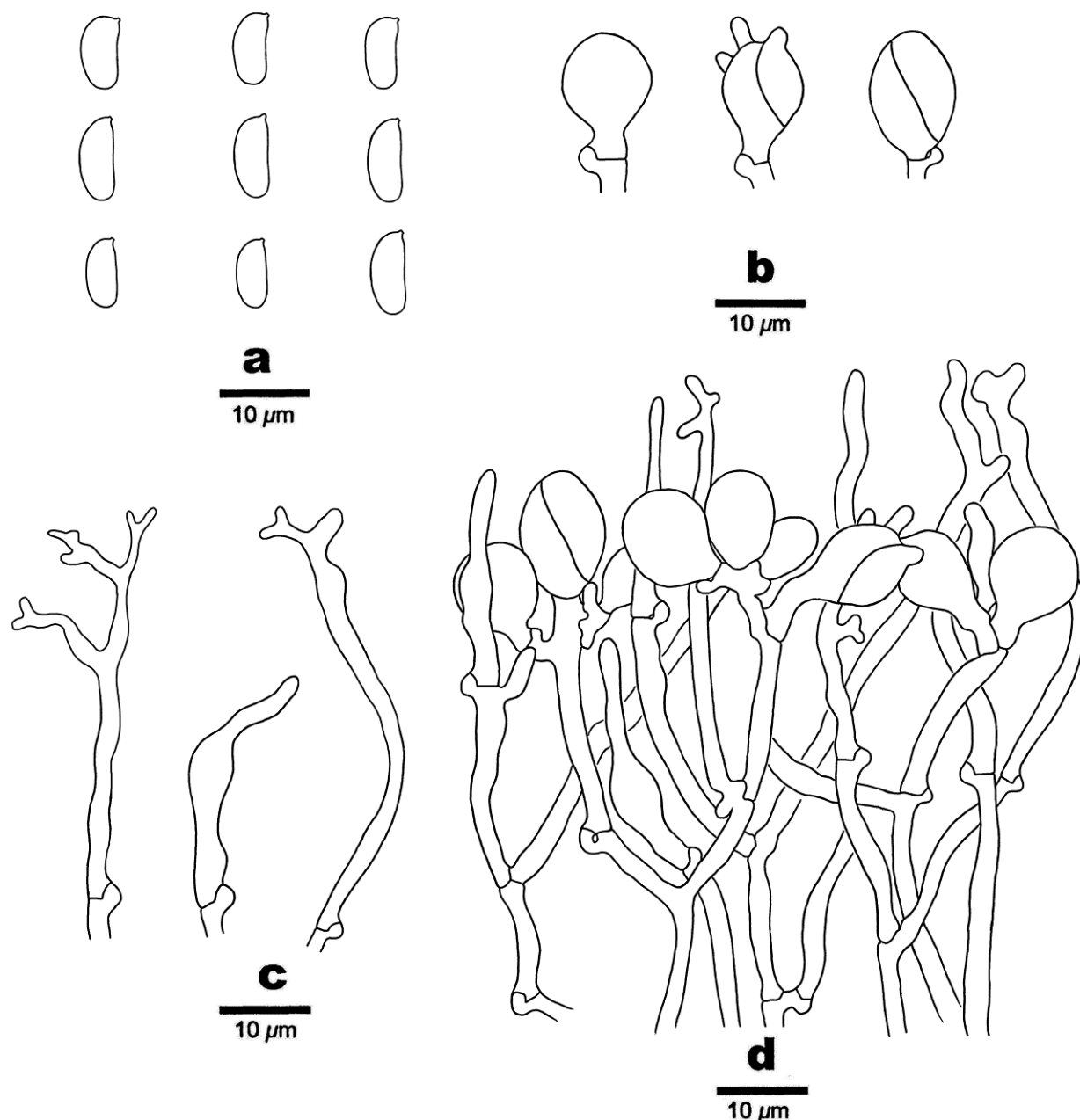


Fig. 5 Line drawings of microscopic structures of *Exidia abieticola*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μm .

Exidia brunnea F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.*

.....Figs. 6, 7

Mycobank: MB 856353

Etymology: *Brunnea* (Lat.): refers to the species having brown to fuscous basidiomata when dry.

Diagnosis: Differs from other species in the genus by having gelatinous, bluish gray and circular margins when juvenile, and waxy, partly gelatinous, brown to fuscous basidiomata when mature.

Basidiomata: Usually waxy, partly gelatinous, bluish gray to fawn when fresh, becoming brown to fuscous when dry; orbicular, with gelatinous circular margins when juvenile, fusing together, becoming effused and up to 15 cm diam. when mature, 1–3 mm thick, with free margins; hymenial surface slightly ridged and without papillae; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped, simple or branched, hyaline, thin-walled, 1–3 μm

diam., embedded in a gelatinous matrix. Hyphidia usually simple, rarely branched at tips, hyaline, thin-walled. Basidia longitudinally septate, 4-celled, ovoid, thin-walled, $12.0\text{--}14.8 \times 7.8\text{--}10.2 \mu\text{m}$. Basidiospores narrowly allantoid, hyaline, thin-walled, smooth, usually with several small oil drops, $(11.5\text{--})11.8\text{--}13.1(15.2) \times 2.8\text{--}3.8(4.2) \mu\text{m}$, $L = 12.52 \mu\text{m}$, $W = 3.16 \mu\text{m}$, $Q = 3.72\text{--}3.95$ ($n = 60/2$).

Known distribution: Southwest China.

Specimens examined: China, Xizang Autonomous Region,

Linshi, Sejilashan, on fallen angiosperm branch, 8 Jul 2023, F. Wu, Wu 733 (BJFC 040726, **holotype**), Wu 751 (BJFC 040744).

Notes: In our phylogenies (Figs. 1, 2), *Exidia brunnea* formed one distinct lineage closely related to taxa in the *Exidia* Clade 1, however the species differs from other *Exidia* species by having gelatinous, bluish gray and circular margins when juvenile, and waxy, partly gelatinous, brown to fuscous basidiomata when mature.

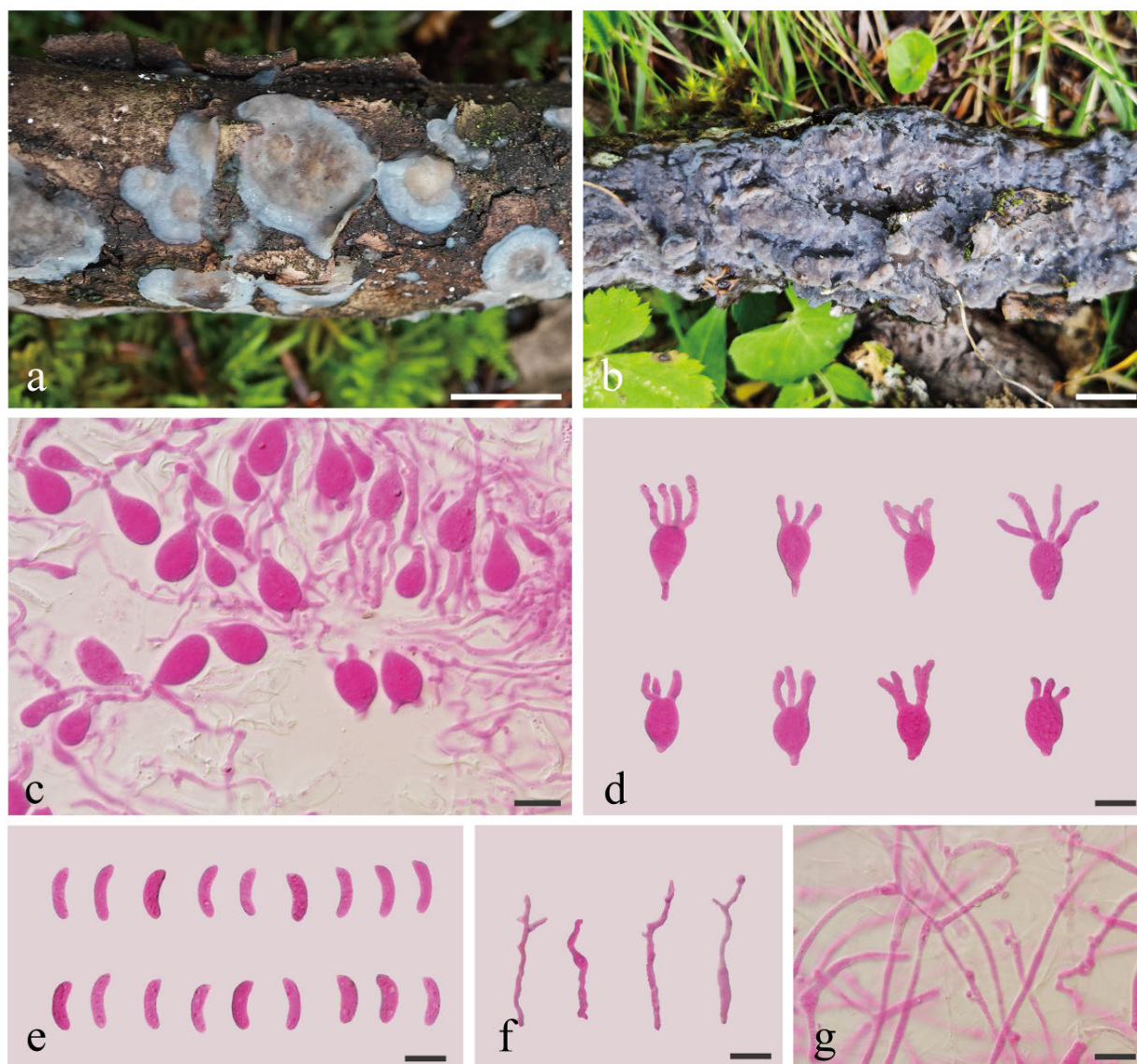


Fig. 6 Photos of basidiomata and microscopic structures of *Exidia brunnea*. a Basidiomata when juvenile. b Basidiomata when mature. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 μm .

Exidia ellipsospora F. Wu, A. Tohtirjap, S.H. He & Y.C. Dai, *sp. nov.*Figs. 8, 9
MycoBank: MB 856368

Etymology: *Ellipsospora* (Lat.): refers to the species usually having ellipsoid basidiospores.

Diagnosis: Similar to *Exidia brunnea* but differs in white to clay buff basidiomata and ellipsoid basidiospores.

Basidiomata: Gelatinous, white to clay buff when fresh, becoming grayish brown to black when dry; effused, adnate, up to 20 cm diam. and 3 mm thick, mostly with free or wavy

margins; hymenial surface usually smooth and without papillae, distinctly ridged; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), usually branched, hyaline, thin-walled, $0.5\text{--}2.5 \mu\text{m}$ diam., embedded in a gelatinous matrix. Hyphidia slightly branched, hyaline, thin-walled, apically forked. Basidia longitudinally septate, 4-celled, ovoid, thin-walled, with a basal clamp connection, $12.5\text{--}15.0 \times 9.2\text{--}10.2 \mu\text{m}$. Basidiospores ellipsoid, hyaline, thin-walled, smooth, usually without oil drop, $(7.8\text{--})8.0\text{--}9.2(9.8) \times$

(5.2–)5.5–6.8(–7.5) μm , $L = 8.44 \mu\text{m}$, $W = 6.18 \mu\text{m}$, $Q = 1.31\text{--}1.42$ ($n = 60/2$).

Known distribution: South China.

Specimens examined: China, Guangxi Autonomous Region, Wuzhou, Tianhongling Forest Farm, on fallen angiosperm branch, 29 Apr 2018, F. Wu, Wu 63 (BJFC 027973, **holotype**); Taiwan Province, Nantou County, Nandongyanshan, on fallen angiosperm branch, 7 Dec 2016, S. H. He, He 4610 (BJFC 024052); Yunnan Province, Puer, Taiyanghe Forest Park, on fallen angiosperm branch, 8 Jul 2021, F. Wu, Wu 567 (BJFC 036422), Wu 570 (BJFC 036425).

Notes: Morphologically, *Exidia ellipsospora* may be confused with *E. brunnea* by sharing effused, adnate basidiomata, but *E. brunnea* differs from *E. ellipsospora* by having bluish gray and circular margins when juvenile, brown to fuscous basidiomata when mature, and allantoid basidiospores. In our phylogenies (Figs. 1, 2), although *E. ellipsospora* formed a single lineage distantly related to other *Exidia* species, its morphological characteristics fit the definition of *Exidia*. Therefore, the above species is proposed in *Exidia*.

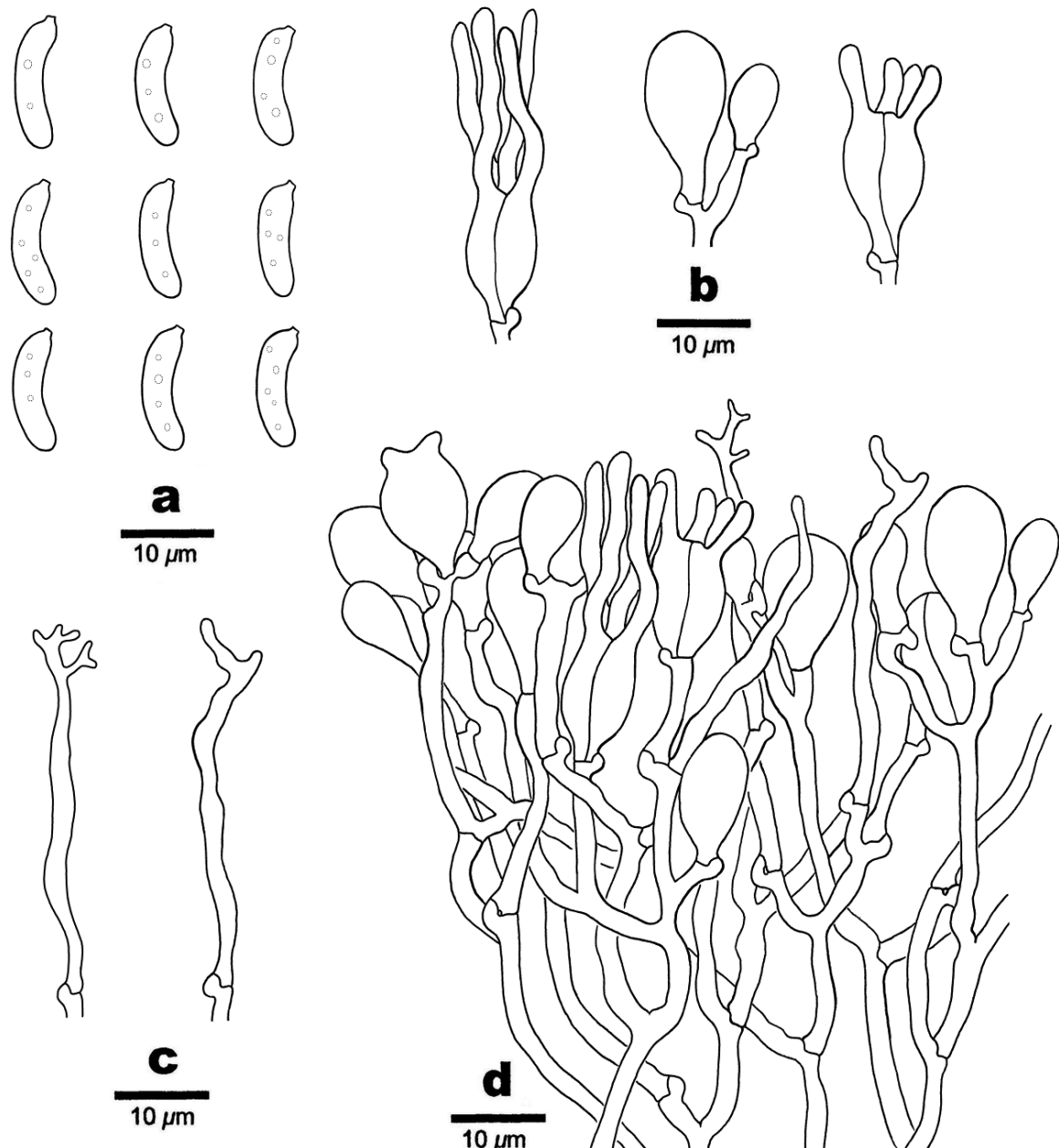


Fig. 7 Line drawings of microscopic structures of *Exidia brunnea*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μm .

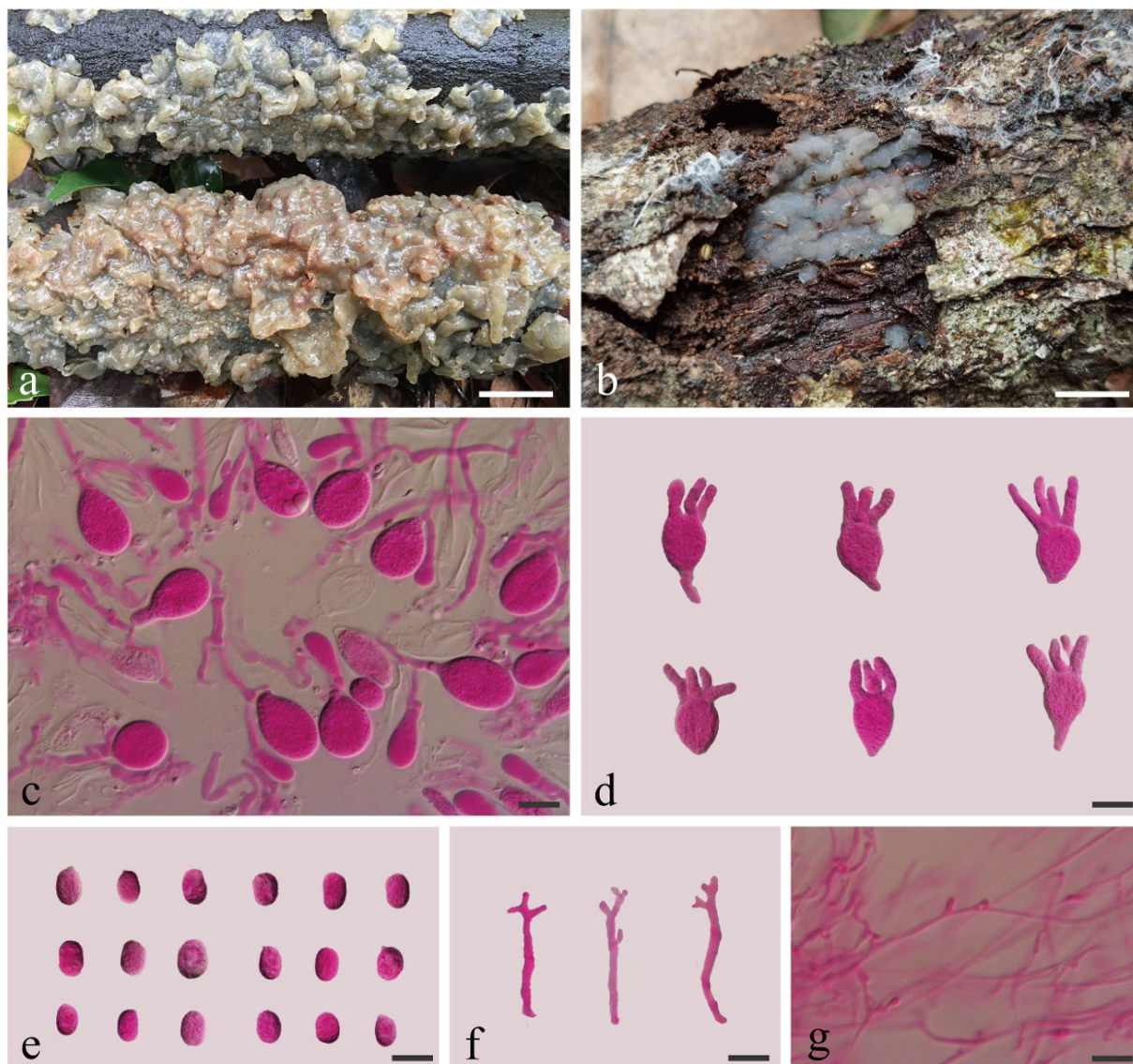


Fig. 8 Photos of basidiomata and microscopic structures of *Exidia ellipsospora*. a–b Basidiomata. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 µm.

Exidia latispora F. Wu, A. Tohtirjap, Yuan Yuan & Y.C. Dai, *sp. nov.* Figs. 10, 11

Mycobank: MB 856355

Etymology: *Latispora* (Lat.): refers to the species having wide basidiospores.

Diagnosis: Similar to *Exidia sinothuretiana* but differs in having smaller basidia, smaller basidiospores, and simple or slightly branched hyphidia.

Basidiomata: Gelatinous, white to fawn when fresh, becoming pale mouse-gray to dark brown when dry; suborbicular to cerebriform, pulvinate, sessile, usually remaining separate, occasionally coalescing, up to 3 cm diam. and 1 cm thick, mostly with lobed margins; hymenial surface usually smooth and without papillae, obviously ridged, occasionally with sparse papillae; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), simple or branched, hyaline, thin-walled, 1.0–3.0 µm diam., embedded in a gelatinous matrix. Hyphidia simple or slightly branched, hyaline, thin-walled, usually apically forked. Basidia longitudinally septate,

4-celled, ellipsoid to subglobose, thin-walled, with a basal clamp connection, 11.0–19.5 × 8.0–15.5 µm. Basidiospores allantoid to broadly allantoid, hyaline, thin-walled, smooth, usually with one big oil drop, (12.0–)12.2–16.2 × (4.2–)4.5–7.8(–8.0) µm, L = 14.55 µm, W = 5.86 µm, Q = 1.82–2.75 (n = 150/5).

Known distribution: Southwest China.

Specimens examined: China, Gansu Province, Tianzhu County, Binggouhe Forest Park, on fallen trunk of *Picea crassifolia*, 17 Aug 2022, Y.C. Dai, Dai 24065 (BJFC 039309, **holotype**), Zhuoni County, Shuihe Nature Reserve, on fallen branch of *Abies* sp., 19 Aug 2022, Y.C. Dai, Dai 24171 (BJFC 039415); Heilongjiang Province, Hegang, Helin Forest Farm, on dead branch of *Picea koraiensis*, 20 Oct 2020, F. Wu, Wu 408 (BJFC 033999), Yichun, Meihuashan Forest Park, on dead branch of *Picea koraiensis*, 20 Oct 2020, F. Wu, Wu 457 (BJFC 034048); Inner Mongolia Autonomous Region, Alxa Left Banner, Helanshan Nature Reserve, on fallen branch of *Picea koraiensis*, 17 Sep 2022, Y.C. Dai, Dai 24510 (BJFC 039752), Dai 24512 (BJFC 039754); Qinghai Province, Zeku County, on fallen branch of *Picea* sp., 13 Jul 2019, F. Wu, Wu 275 (BJFC

031078), Wu 280 (BJFC 031083); Sichuan Province, Daocheng County, Shangri-la, on fallen trunk of *Abies* sp., 10 Oct 2021, F. Wu, Wu 583 (BJFC 036438), Yading National Nature Reserve, on fallen branch of *Larix* sp., 10 Oct 2021, Y.C. Dai, Dai 23176 (BJFC 037747), Dai 23179 (BJFC 037750), Dai 23180 (BJFC 037751), Dai 23181 (BJFC 037752), Dai 23182 (BJFC 037753), Luding County, Hailuoguo Forest Park, on fallen trunk of *Abies* sp., 8 Oct 2021, Y.C. Dai, Dai 23130 (BJFC 037701); Xizang Autonomous Region, Milin, Sejlilashan,

on fallen trunk of *Abies* sp., 23 Oct 2021, Y.C. Dai, Dai 23346 (BJFC 037917, holotype), Nanyigou, on fallen branch of *Picea lingziensis*, 22 Oct 2021, Y.C. Dai, Dai 23240 (BJFC 037811); Yunnan Province, Deqin County, Baimaxueshan National Nature Reserve, on rotten wood of *Picea likiangensis*, 5 Sep 2021, Y.C. Dai, Dai 22823 (BJFC 037396), Dai 22825 (BJFC 037398), Shangri-la, Pudacuo National Park, on dead branch of *Abies* sp., 7 Sep 2021, Y.C. Dai, Dai 22954 (BJFC 037527), Dai 22989 (BJFC 037562).

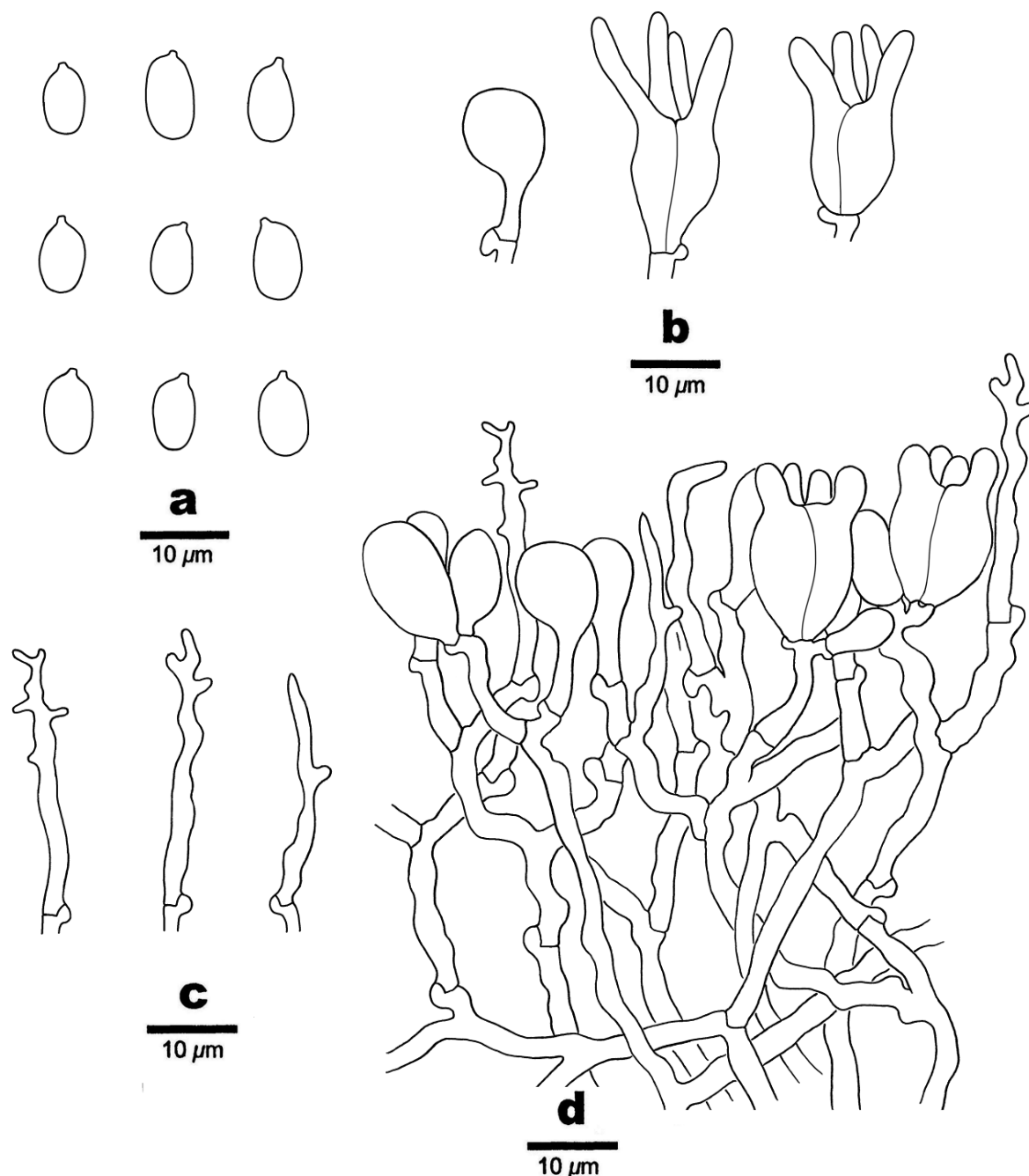


Fig. 9 Line drawings of microscopic structures of *Exidia ellipsospora*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μ m.

Notes: Morphologically, *Exidia latispota* is similar to *E. sinothuretiana* by sharing white, sub-orbicular to cerebriform, pulvinate basidiomata, and growth on gymnosperms, but *E. sinothuretiana* has distinctly larger basidia (18.2–23.5 $\times$ 16.2–

18.2 μ m vs. 11–19.5 $\times$ 8–15.5 μ m) and basidiospores (17.5–22 $\times$ 6.2–8 μ m vs. 12.2–16.2 $\times$ 4.5–7.8 μ m), and distinctly branched hyphidia. In the phylogenies (Figs. 1, 2), four specimens of the species formed one sublineages with

strong support, and there are slight differences in basidiospores size between the four specimens and other four specimens ($13.5\text{--}16 \times 5.2\text{--}6.2 \mu\text{m}$ vs. $12.2\text{--}14 \times 6\text{--}8 \mu\text{m}$), but they look like an infraspecific variation considering the

lack of differences in ITS region (less than 1%, 4/500). Therefore, the specimens of the two sublineages are defined as a single species, *E. latispora*.

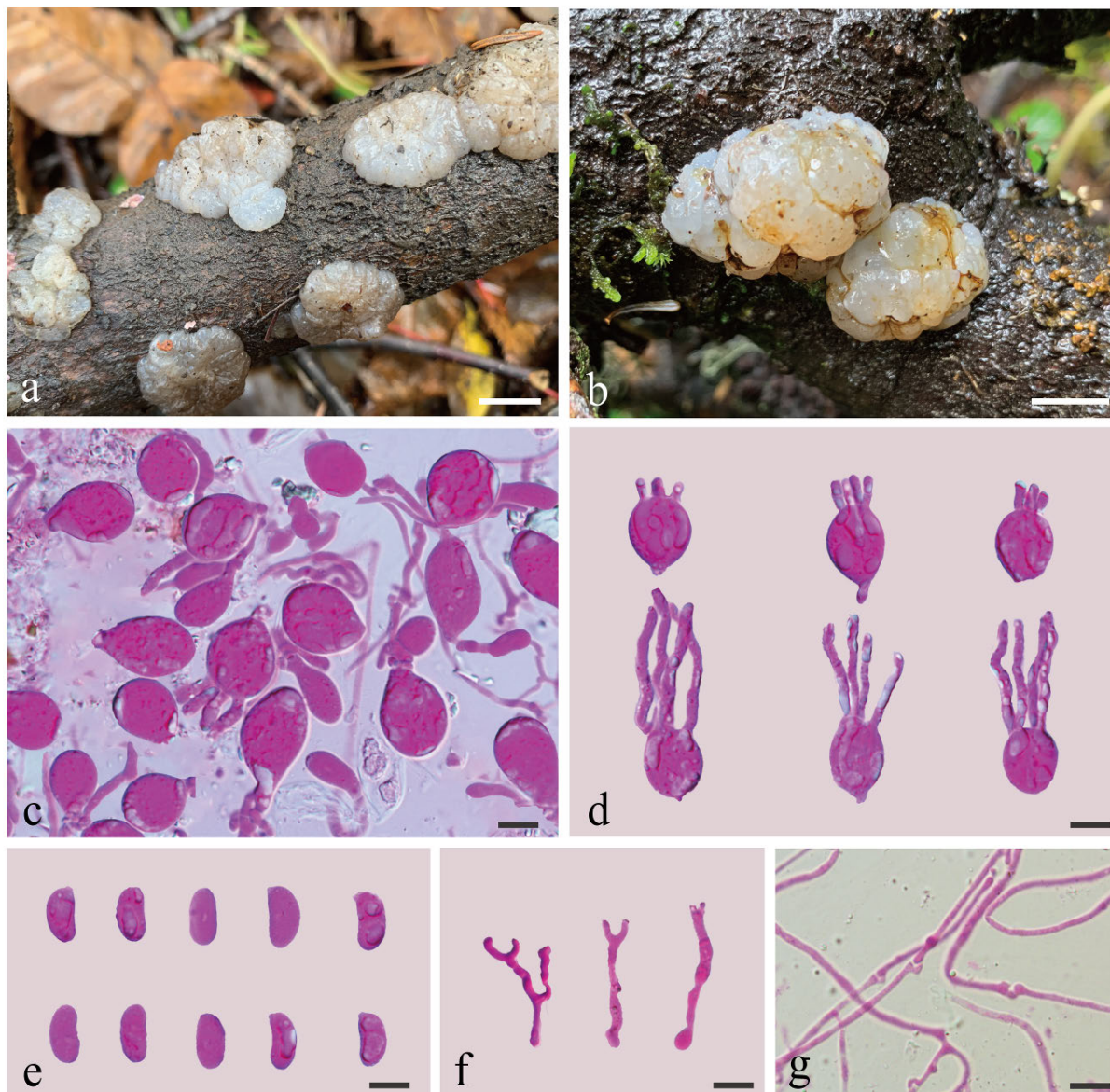


Fig. 10 Photos of basidiomata and microscopic structures of *Exidia latispora*. a–b Basidiomata. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 μm .

Exidia minor F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.*

.....Figs. 12, 13

Mycobank: MB 856357

Etymology: *Minor* (Lat.): refers to the species having very small basidiomata.

Diagnosis: Similar to *Myxarium* spp. but differs in having basidia without an enucleate stalk, and is distinguished from other *Exidia* species by its whitish, pustulate, and continuous basidiomata.

Basidiomata: Gelatinous, translucent to white when fresh, becoming light vinaceous gray when dry, pustulate to slightly pulvinate, continuous, sessile, usually remaining coalescent, occasionally separate, up to 2 mm diam. and 2 mm thick, mostly with wavy margins; hymenial surface smooth or with papillae; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped, simple or branched, hyaline, thin-walled, $0.5\text{--}2.5 \mu\text{m}$ diam., embedded in a gelatinous matrix. Hyphidia distinctly branched, hyaline, thin-walled, apically forked or dendrite. Basidia longitudinally septate, 4-celled, subglobose to globose, thin-walled, with a basal clamp connection, $11.8\text{--}13.8 \times 10.0\text{--}12.5 \mu\text{m}$. Basidiospores allantoid, hyaline, thin-walled, smooth, usually with one or two large oil drops, $(9.0\text{--})10.2\text{--}13.8\text{--}(14.5) \times (3.5\text{--})4.0\text{--}5.2\text{--}(6.2) \mu\text{m}$, $L = 12.20 \mu\text{m}$, $W = 4.60 \mu\text{m}$, $Q = 2.62\text{--}2.66$ ($n = 90/3$).

Known distribution: South China.

Specimens examined: China, Guangdong Province, Guangzhou, Tianluhu Forest Park, on fallen angiosperm branch, 20 Apr 2023, Y.C. Dai, Dai 24712 (BJFC 037726), Dai 24713 (BJFC 037727); Guangxi Autonomous Region, Wuzhou,

Tianhongling Forest Farm, on fallen angiosperm branch, 29 Apr 2018, F. Wu, Wu 68 (BJFC 027978, **holotype**); Yunnan Province, Chuxiong, Lufeng County, Guangtong, Shanjianshan, on fallen angiosperm branch, 9 Jun 2023, F. Wu, Wu 904 (BJFC 040897), Wu 906 (BJFC 040899).

Notes: Morphologically, *Exidia minor* is similar to some species of *Myxarium* with whitish, pustulate, and continuous

basidiomata, but *Myxarium* species have a long enucleate basidial stalk and are distantly related to *Exidia* in the phylogenies (Fig. 1). *Exidia minor* is closely related to *E. uvapassa* Lloyd, but the latter has distinctly larger basidiomata (up to 40 mm diam. vs. up to 2 mm diam.) and basidiospores ($15.5\text{--}18.5 \times 5.2\text{--}6.5 \mu\text{m}$ vs. $10.2\text{--}13.8 \times 4\text{--}5.2 \mu\text{m}$).

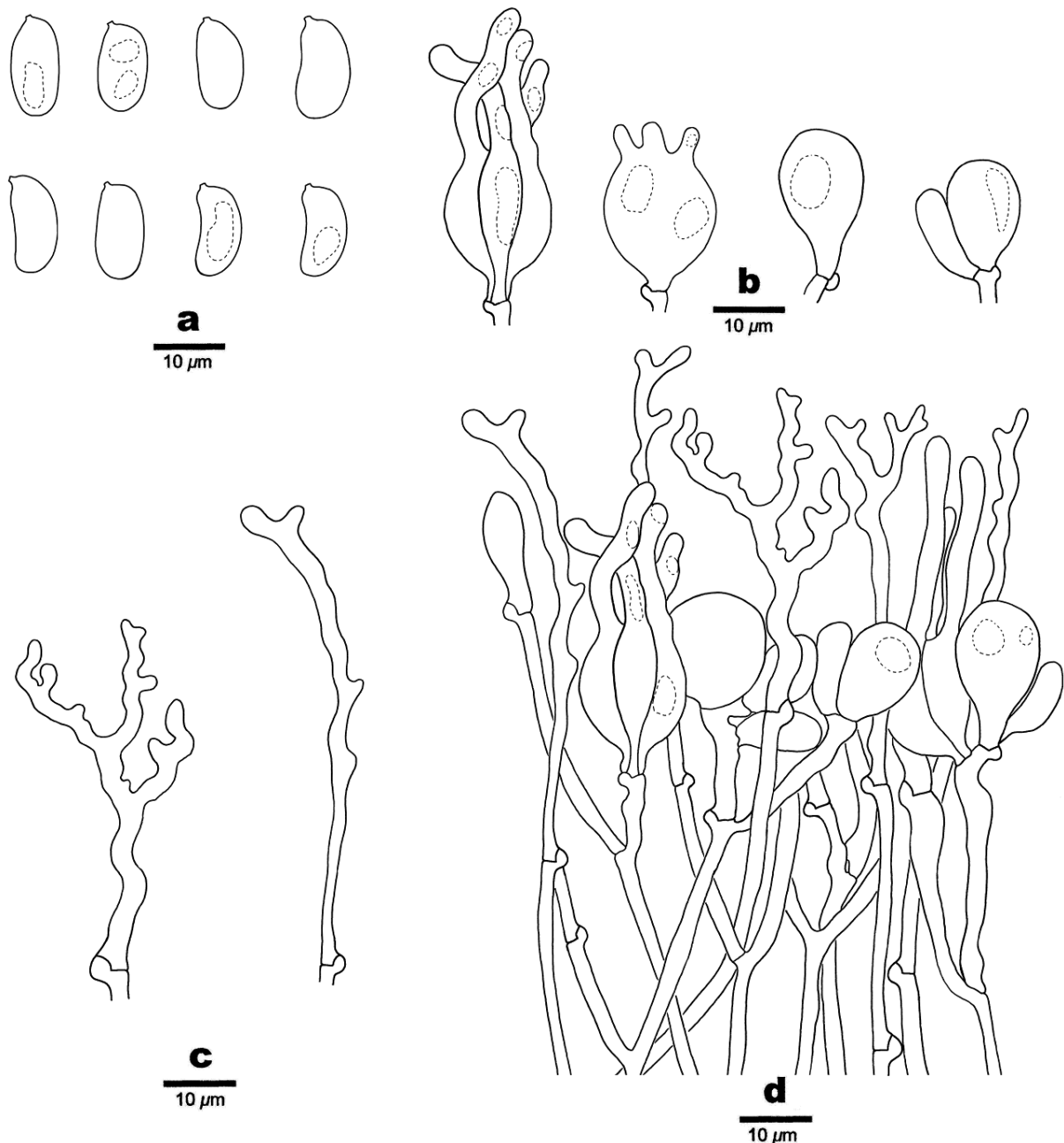


Fig. 11 Line drawings of microscopic structures of *Exidia latispora*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μm .

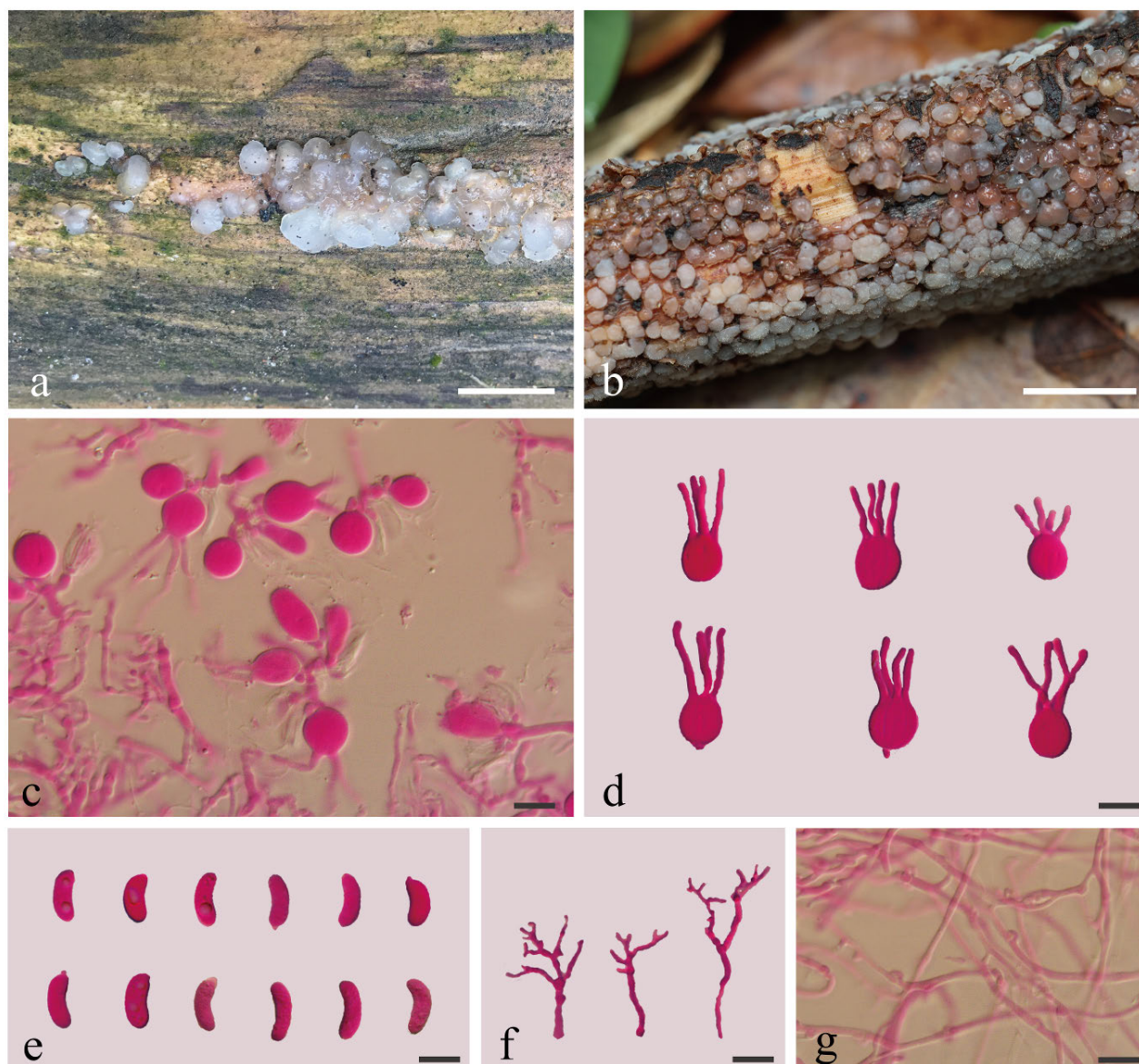


Fig. 12 Photos of basidiomata and microscopic structures of *Exidia minor*. a–b Basidiomata. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 µm.

Exidia ningxiaensis F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.*
.....Figs. 14, 15

Mycobank: MB 856358

Etymology: *Ningxiaensis* (Lat.): refers to the species being found in Ningxia, China.

Diagnosis: Differs from other species in the genus by having light vinaceous gray, sub-orbicular to orbicular basidiomata.

Basidiomata: Gelatinous, light vinaceous gray when fresh, becoming vinaceous gray to black when dry; sub-orbicular to orbicular, pulvinate, sessile, usually remaining separate, occasionally coalescing, up to 3.5 cm diam. and 5 mm thick, mostly with lobed margins; hymenial surface usually smooth and without papillae, slightly ridged; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), simple or branched, hyaline, thin-walled, 0.5–2.8 µm diam., embedded in a gelatinous matrix. Hyphidia distinctly branched, hyaline, thin-walled,

apically forked. Basidia longitudinally septate, 4-celled, ellipsoid to subglobose, thin-walled, with a basal clamp connection, 10.0–12.5 × 9.8–11.0 µm. Basidiospores narrowly allantoid, hyaline, thin-walled, smooth, usually without oil drop, (13.5–)13.8–17.2(–17.5) × 3.2–4.2(–4.8) µm, L = 15.62 µm, W = 3.76 µm, Q = 4.15 (n = 30/1).

Known distribution: North China.

Specimen examined: China, Ningxia Autonomous Region, Jingyuan County, Liupanshan National Forest Park, on fallen angiosperm branch, 4 Aug 2015, Y.C. Dai, Dai 15473 (BJFC 019578, **holotype**).

Notes: Although *Exidia ningxiaensis* formed a single lineage distantly related to other *Exidia* species in the phylogenies (Figs. 1, 2), its morphological characteristics fit the definition of *Exidia*. Therefore, the above species is proposed. The species differs from other *Exidia* species by having usually light vinaceous gray, sub-orbicular to orbicular basidiomata.

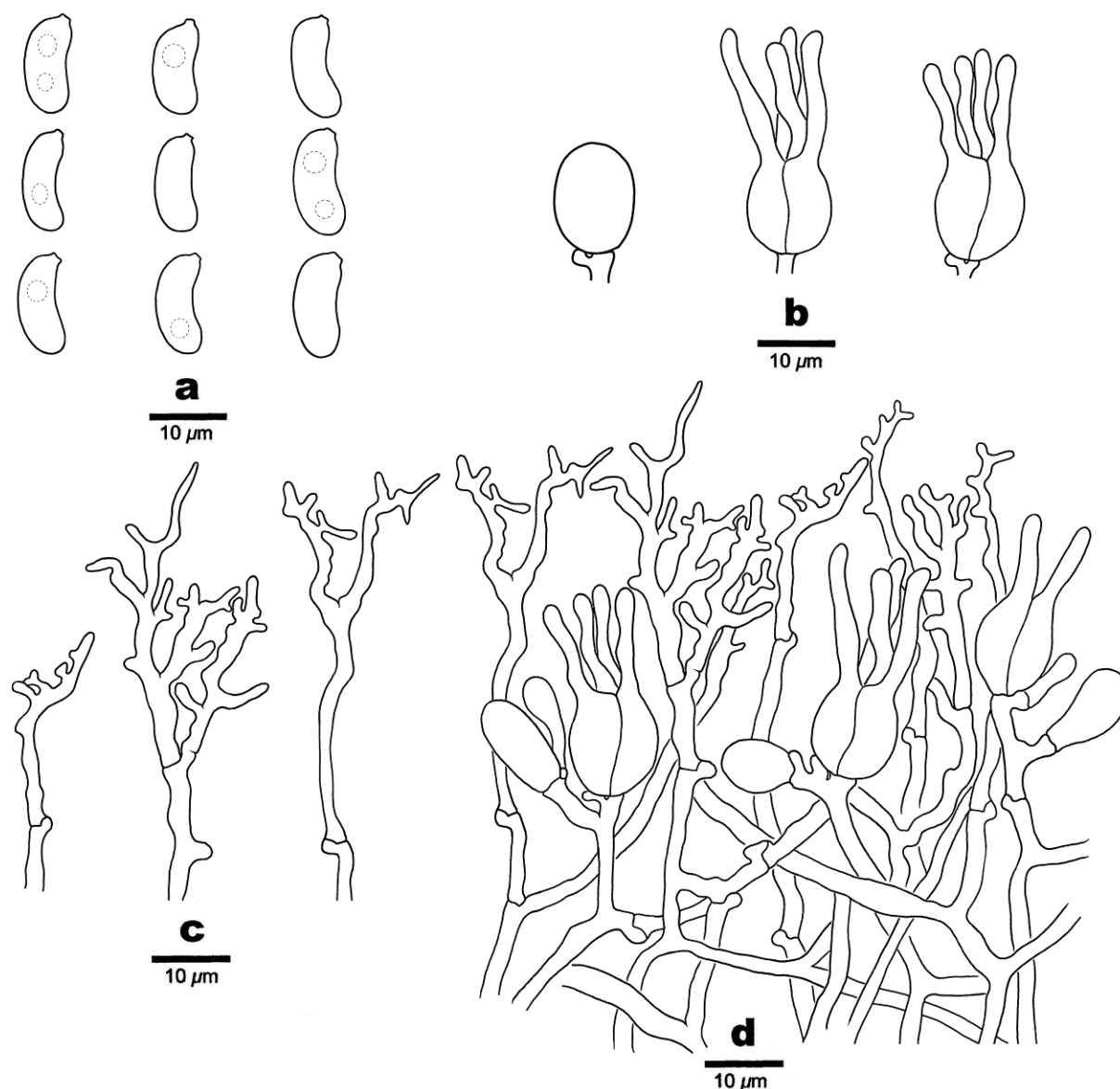


Fig. 13 Line drawings of microscopic structures of *Exidia minor*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 µm.

Exidia nivea F. Wu, A. Tohtirjap, Yuan Yuan & Y.C. Dai, *sp. nov.*

.....Figs. 16, 17

Mycobank: MB 856359

Etymology: *Nivea* (Lat.): Refers to the species having cream to white basidiomata.

Diagnosis: Differs from other species in the genus by having cream to white, sub-orbicular to orbicular, slightly pulvinate, sessile basidiomata.

Basidiomata: Gelatinous, cream to white when fresh, becoming black and very thin when dry; sub-orbicular to orbicular, slightly pulvinate, sessile, usually remaining separate, occasionally coalescing, up to 2.5 cm diam. and 2 mm thick, mostly with lobed margins; hymenial surface smooth and without papillae, slightly ridged; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), usually branched, hyaline, thin-walled, 1.0–2.5 µm diam., embedded in a gelatinous

matrix. Hyphidia usually simple, occasionally slightly branched, hyaline, thin-walled. Basidia longitudinally septate, 4-celled, subglobose to globose, thin-walled, with a basal clamp connection, 12.0–16.5 × 10.2–14.8 µm. Basidiospores allantoid, hyaline, thin-walled, smooth, usually with several oil drops, (12.0–)12.8–16.0(–16.8) × 4.0–5.0(–5.2) µm, L = 14.73 µm, W = 4.60 µm, Q = 3.20–3.42 (n = 60/2).

Known distribution: West China.

Specimens examined: China, Qinghai Province, Ulan County, Harihatu Forest Park, on fallen trunk of *Picea crassifolia*, 3 Aug 2022, Y.C. Dai, Dai 23873 (BJFC 039117), Dai 23875 (BJFC 039119), Dai 23878 (BJFC 039122), Nangqian County, Bai Zha Forest Farm, on fallen trunk of *Picea likiangensis*, 7 Aug 2022, Y.C. Dai, Dai 23978 (BJFC 039222), Dai 23982 (BJFC 039226); Yunnan Province, Deqin County, Baimaxueshan National Nature Reserve, on fallen trunk of *Picea likiangensis*, 5 Sep 2021, Y.C. Dai, Dai 22832 (BJFC 037405), Dai 22863 (BJFC 037436, **holotype**), Shangri-

la, Pudacuo National Park, on dead branch of *Picea likiangensis*, 6 Sep 2021, Y.C. Dai, Dai 22923 (BJFC 037496), on fallen branch of *Abies* sp., Y.C. Dai, Dai 22952 (BJFC 037525).

Notes: In the phylogenies (Figs. 1, 2), *Exidia nivea* is closely related to *E. pithya* Fr., but *E. pithya* has black basidiomata when fresh, and smaller basidiospores ($10.2\text{--}13 \times 3.5\text{--}5 \mu\text{m}$ vs. $12.8\text{--}16 \times 4\text{--}5 \mu\text{m}$; Table 2).

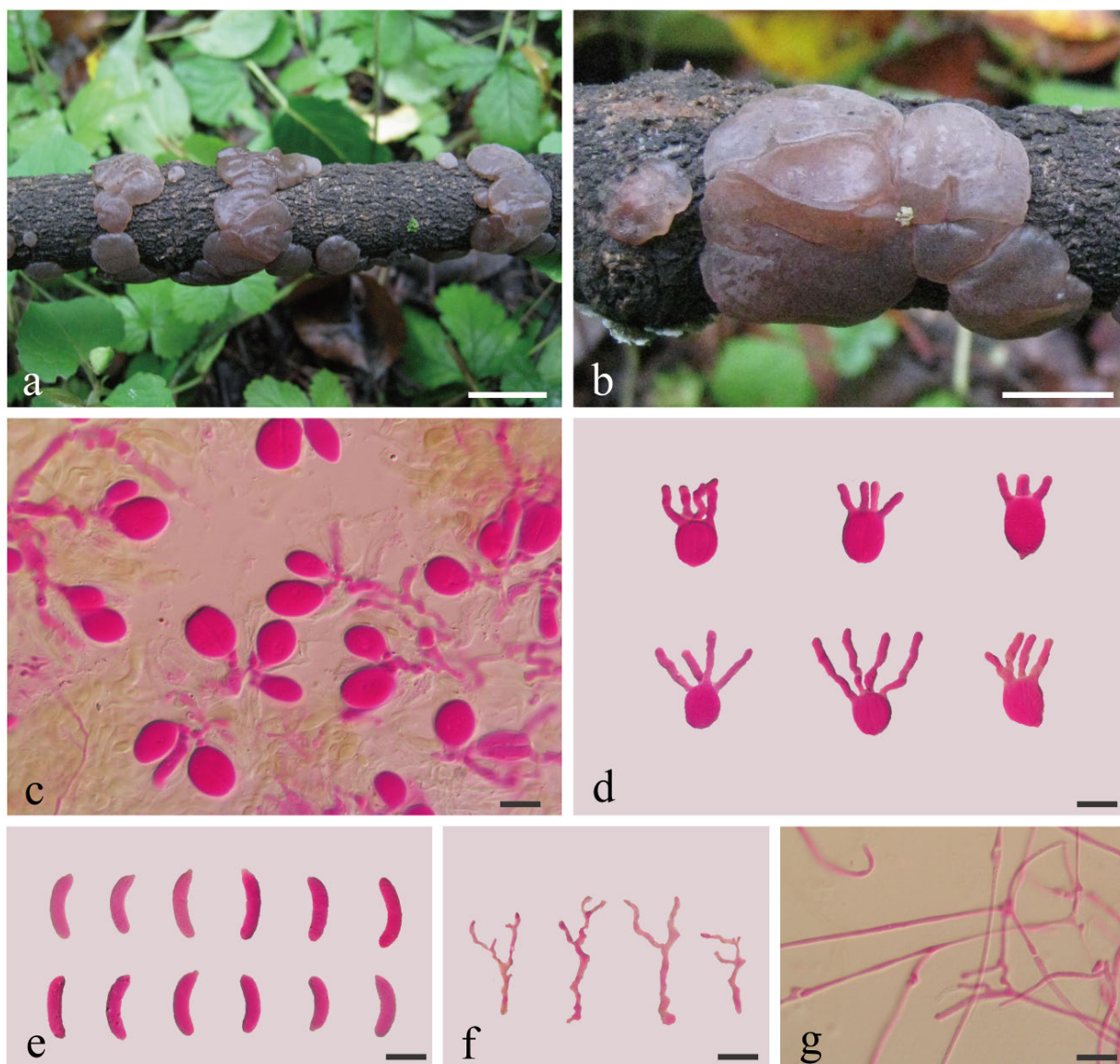


Fig. 14 Photos of basidiomata and microscopic structures of *Exidia ningxiaensis*. a–b Basidiomata. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 μm .

Exidia orientalis* F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.

.....Figs. 18, 19

Mycobank: MB 856360

Etymology: *Orientalis* (Lat.): refers to the species being found in northeast China, East Asia.

Diagnosis: Similar to *Exidia separata* and *E. subglandulosa* but differs in having smaller basidiospores and simple or occasionally slightly branched hyphidia.

Basidiomata: Gelatinous, black when fresh, becoming dark black when dry; sub-orbicular, pulvinate, sessile, usually remaining separate, occasionally coalescing, up to 2.5 cm diam. and 5 mm thick, mostly with entire margins, occasionally with wavy margins; hymenial surface smooth and without papillae, slightly ridged; mineral inclusions

absent.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), usually branched, hyaline, thin-walled, $1.0\text{--}2.5 \mu\text{m}$ diam., embedded in a gelatinous matrix. Hyphidia usually simple, occasionally slightly branched, hyaline, thin-walled. Basidia longitudinally septate, 4-celled, ovoid to subglobose, thin-walled, $10\text{--}13.2 \times 8.5\text{--}10.5 \mu\text{m}$. Basidiospores narrowly allantoid, hyaline, thin-walled, smooth, usually without oil drop, $(11.0\text{--})12.2\text{--}14.0\text{--}(15.5) \times 3.0\text{--}3.8\text{--}(5.0) \mu\text{m}$, $L = 12.56 \mu\text{m}$, $W = 3.63 \mu\text{m}$, $Q = 3.46\text{--}3.59$ ($n = 60/2$).

Known distribution: Northeast China.

Specimens examined: China, Inner Mongolia Autonomous Region, Arxan, Bailangfeng, on fallen branch of *Betula* sp., 25

Aug 2020, Y.C. Dai, Dai 21677 (BJFC 035577), 1 Sep 2021, Y. Yuan, Yuan 20 (BJFC 038283); Jilin Province, Changbai County, Wangtiane Forest Park, on dead tree of *Salix* sp., 9 Jul 2021, Y.C. Dai, Dai 22532 (BJFC 037111, **holotype**).

Notes: *Exidia orientalis* may be confused with *E. inflata* Cazenave & G. Gruhn, *E. subglandulosa* F. Wu et al. and *E. separata* by sharing black, sub-orbicular basidiomata and smooth hymenial surface, and they are closely related in the

phylogenies (Figs. 1, 2). However, *E. inflata* differs from *E. orientalis* in having distinctly branched hyphidia (dikaryophyses), and *E. subglandulosa* and *E. separata* differs in larger basidiospores ($14.2\text{--}16.5 \times 3.5\text{--}4.5 \mu\text{m}$ in *E. subglandulosa*, $17.2\text{--}21.5 \times 5.0\text{--}6.0 \mu\text{m}$ in *E. separata* vs. $12.2\text{--}14 \times 3\text{--}3.8 \mu\text{m}$), and *E. subglandulosa* is distributed in southwest China, *E. inflata* is distributed in France (Ye et al. 2020; Gruhn et al. 2024).

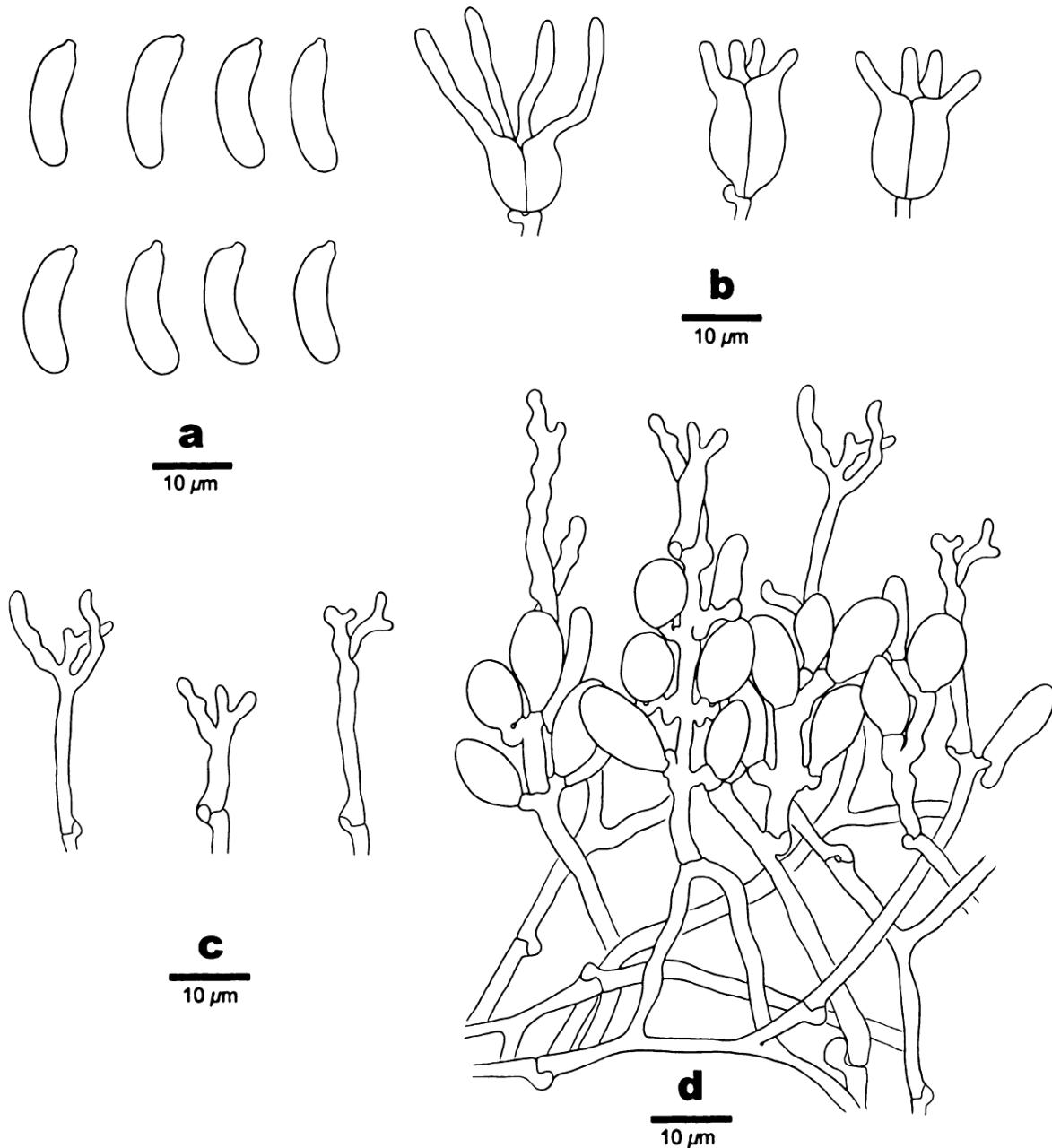


Fig. 15 Line drawings of microscopic structures of *Exidia ningxiaensis*. a Basidiospores. b Basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μm .

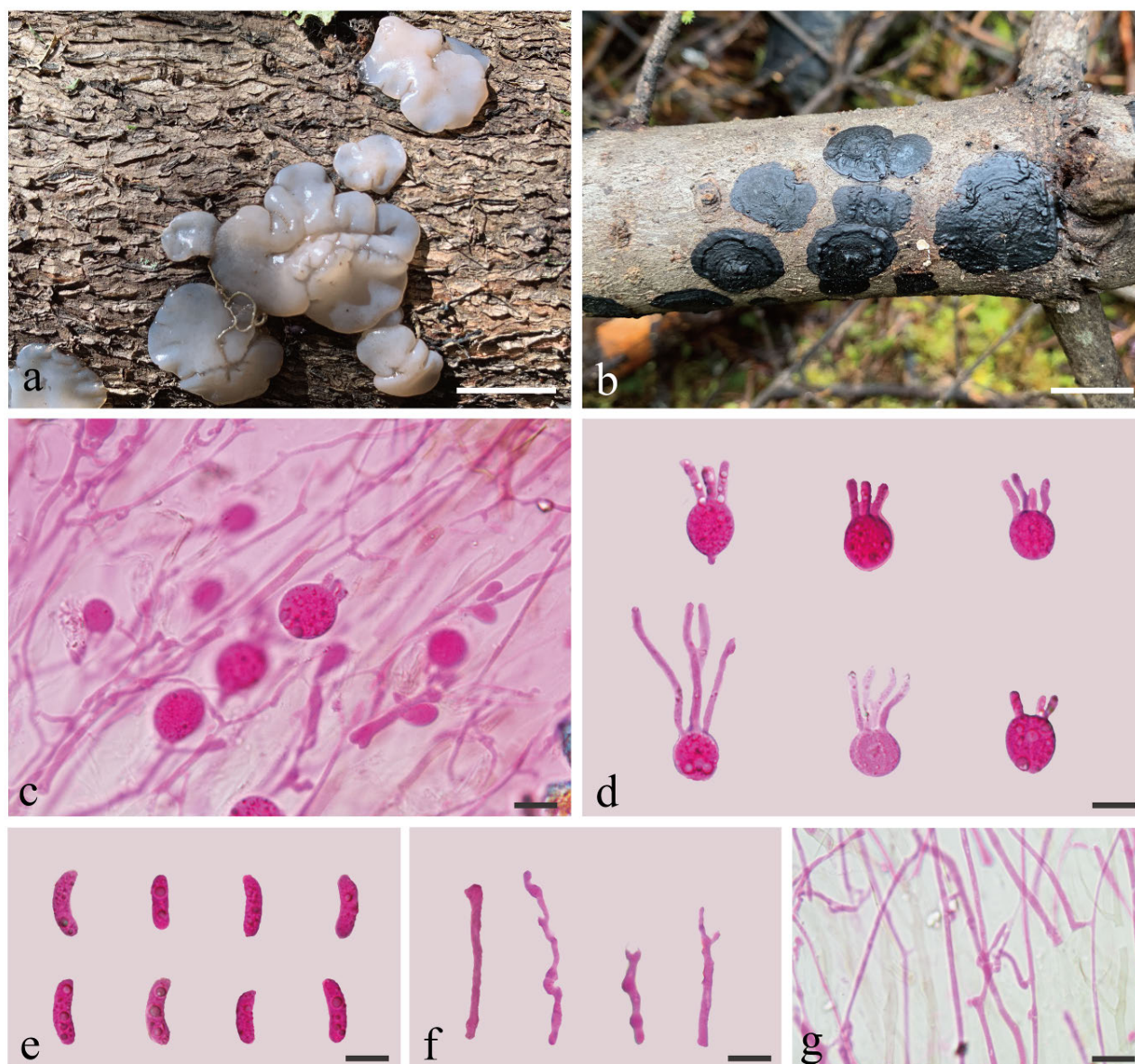


Fig. 16 Photos of basidiomata and microscopic structures of *Exidia nivea*. a–b Basidiomata. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 µm.

Exidia separata* F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.

.....Figs. 20, 21

Mycobank: MB 856362

Etymology: *Separata* (Lat.): refers to the species having separate basidiomata.

Diagnosis: Similar to *Exidia orientalis* and *E. subglandulosa* also from China but differs in having distinctly branched hyphidia, larger basidia and basidiospores.

Basidiomata: Gelatinous, black when fresh, slightly shiny, becoming dark black when dry; sub-orbicular to orbicular, pulvinate, sessile, remaining separate, up to 1.0 cm diam. and 4 mm thick, mostly with wavy margins; hymenial surface smooth and without papillae; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), branched, hyaline, thin-walled, 1.0–2.0 µm diam., embedded in a gelatinous matrix. Hyphidia distinctly branched, hyaline, thin-walled, apically forked or dendrite. Basidia longitudinally septate, 4-celled, subglobose to globose, thin-walled, with a basal clamp

connection, 15.5–20.2 × 13.5–17.0 µm. Basidiospores allantoid, hyaline, thin-walled, smooth, usually without oil drop, (16.5–)17.2–21.5(–21.8) × (4.8–)5.0–6.0(–6.2) µm, L = 19.74 µm, W = 5.38 µm, Q = 3.67 (n=30/1).

Known distribution: Northwest China.

Specimen examined: China, Qinghai Province, Zeku County, on dead branch of *Salix* sp., 14 Jul 2019, F. Wu, Wu 277 (BJFC 031080, **holotype**).

Notes: In the phylogenies (Figs. 1, 2), *Exidia separata* is closely related to *E. subtruncata* and *E. truncata* Fr., but *E. subtruncata* differs from *E. separata* by a hymenial surface with sparse papillae, and distinctly smaller basidia (9.8–13.5 × 9–10.2 µm vs. 15.5–20.2 × 13.5–17 µm) and basidiospores (12.2–15.5 × 3.5–4.2 µm vs. 17.2–21.5 × 5–6 µm); *E. truncata* differs from *E. separata* by its simple hyphidia and smaller basidiospores (13–15.8 × 4.2–5.2 µm vs. 17.2–21.5 × 5–6 µm). Morphologically, the species is similar to *E. orientalis* and *E. subglandulosa* also from China, but *E. orientalis* and *E. subglandulosa* differ from *E. separata* in having simple or

slightly branched hyphidia and distinctly smaller basidia (10–13.2 × 8.5–10.5 µm in *E. orientalis*, 11.8–14.2 × 8.5–10.5 in *E. subglandulosa* vs. 15.5–20.2 × 13.5–17.0 µm) and

basidiospores (12.2–14 × 3–3.8 µm in *E. orientalis*, 14.2–16.5 × 3.5–4.5 µm in *E. subglandulosa* vs. 17.2–21.5 × 5–6 µm).

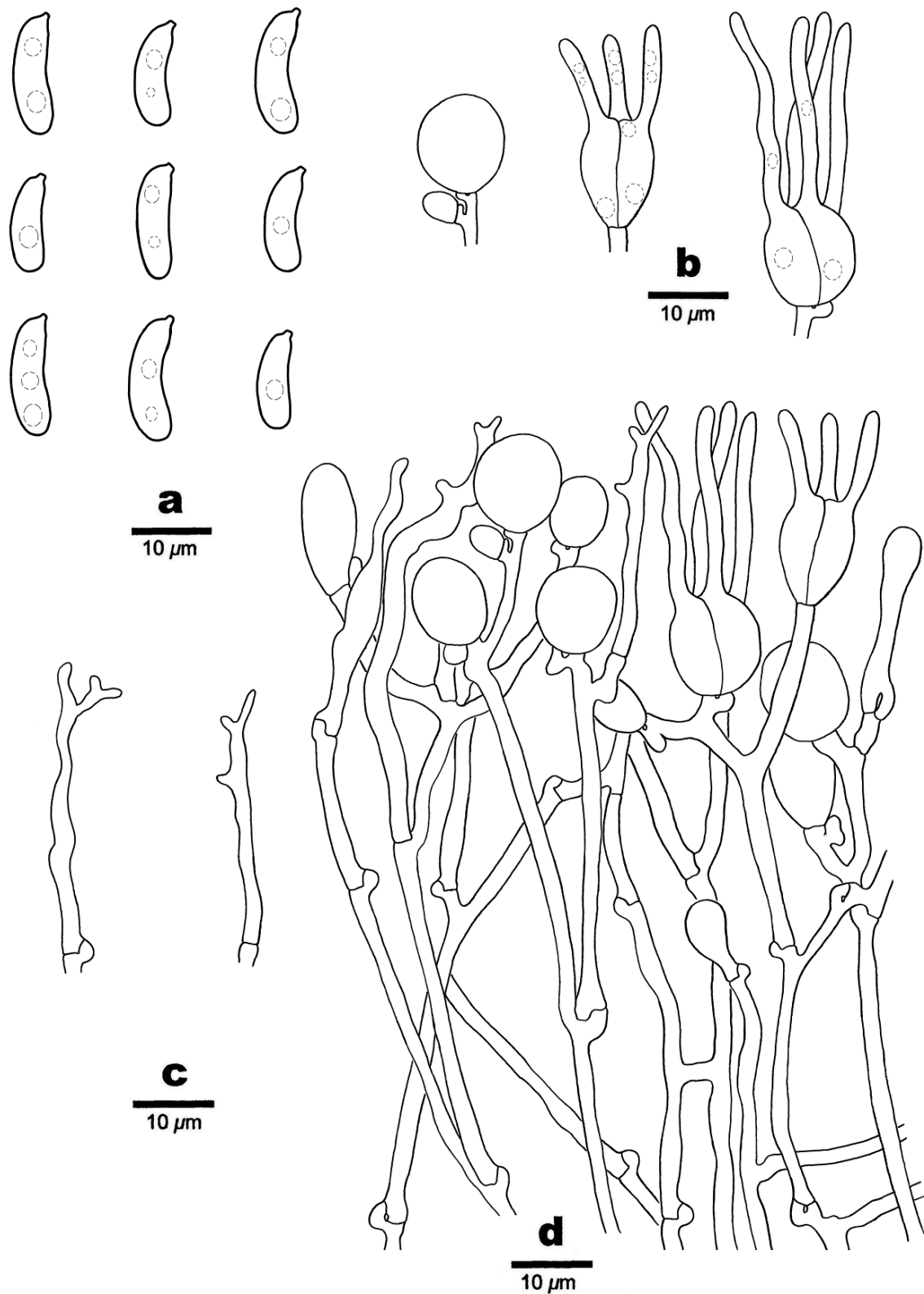


Fig. 17 Line drawings of microscopic structures of *Exidia nivea*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 µm.

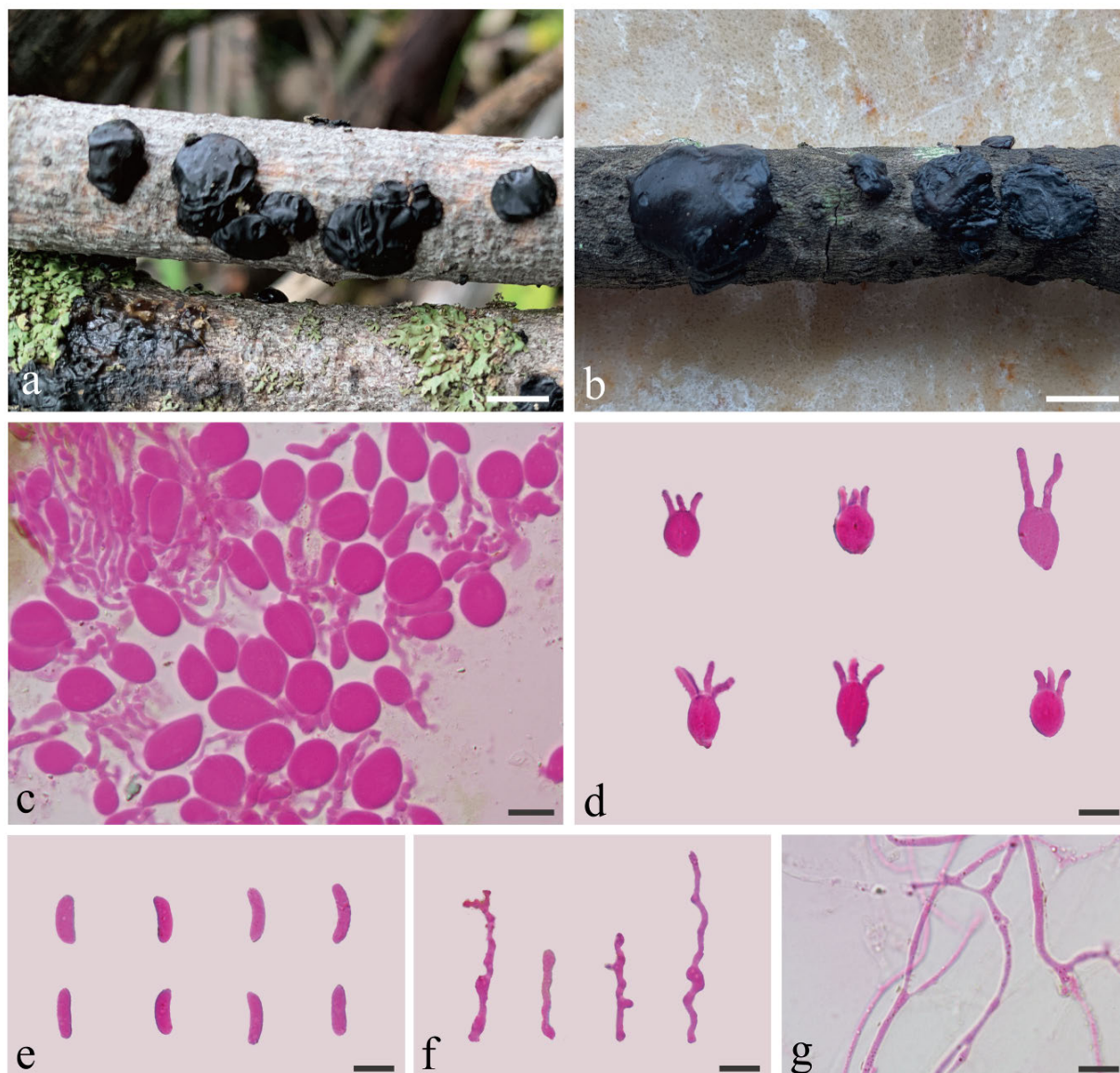


Fig. 18 Photos of basidiomata and microscopic structures of *Exidia orientalis*. a–b Basidiomata. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 µm.

Exidia sinocystidiata F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.*

.....Figs. 22, 23

Mycobank: MB 856363

Etymology: *Sinocystidiata* (Lat.): refers to the species resembling *E. cystidiata* L.S. Olive but distributed in China.

Diagnosis: Similar to *Exidia cystidiata* but differs in having smaller basidia, narrower basidiospores and distinctly branched hyphidia.

Basidiomata: Gelatinous, white to fawn or hyaline when fresh, becoming fuscous when dry; resupinate, adnate, up to 3.0 cm diam. and 0.3 mm thick; hymenial surface smooth and without papillae, slightly ridged; mineral inclusions present in mature basidiomata.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), branched, hyaline, thin-walled, 0.5–2.8 µm diam., embedded in a gelatinous matrix. Hyphidia distinctly branched, with nodules, hyaline, thin-walled, forked or dendrite. Cystidia clavate or fusiform, slightly tapering at tips, hyaline, thin-walled. Basidia

longitudinally septate, 4-celled, ellipsoid to ovoid, thin-walled, with a basal clamp connection, 9.2–14.0 × 9.5–12.0 µm. Basidiospores allantoid, hyaline, thin-walled, smooth, usually with one or two large oil drops, (12.0–)13.0–15.5(–16.8) × 4.5–5.2(–5.5) µm, L = 14.5 µm, W = 4.93 µm, Q = 2.93 (n = 30/1).

Known distribution: South China.

Specimens examined: China, Fujian Province, Wuyishan National Nature Reserve, on fallen angiosperm branch, 17 Jun 2021, F. Wu, Wu 584 (BJFC 036439, **holotype**); Yunnan Province, Chuxiong, Nanhua County, Longchuan, on fallen angiosperm branch, 11 Aug 2022, F. Wu, Wu 623 (BJFC 039971).

Notes: Morphologically, *Exidia sinocystidiata* is similar to *E. cystidiata* by sharing white basidiomata and clavate cystidia, but *E. cystidiata* has larger basidia (16.2–29.7 × 9–13.5 µm vs. 9.2–14 × 9.5–12 µm) and wider basidiospores (11.3–15 × 6.4–9.1 µm vs. 13–15.5 × 4.5–5.2 µm), and simple hyphidia (Olive 1954). In the phylogenies (Figs. 1, 2), *E. sinocystidiata* is closely related to *E. minor*, *E. subtropica*,

and *E. uvapassa*, but the latter three species lack cystidia. In addition, *E. candida* also has cystidia, but *E. candida* differs from *E. sinocystidiata* by having buff yellow to reddish brown,

cerebriform basidiomata and is distantly related to *E. sinocystidiata* in the phylogenies (Figs. 1, 2).

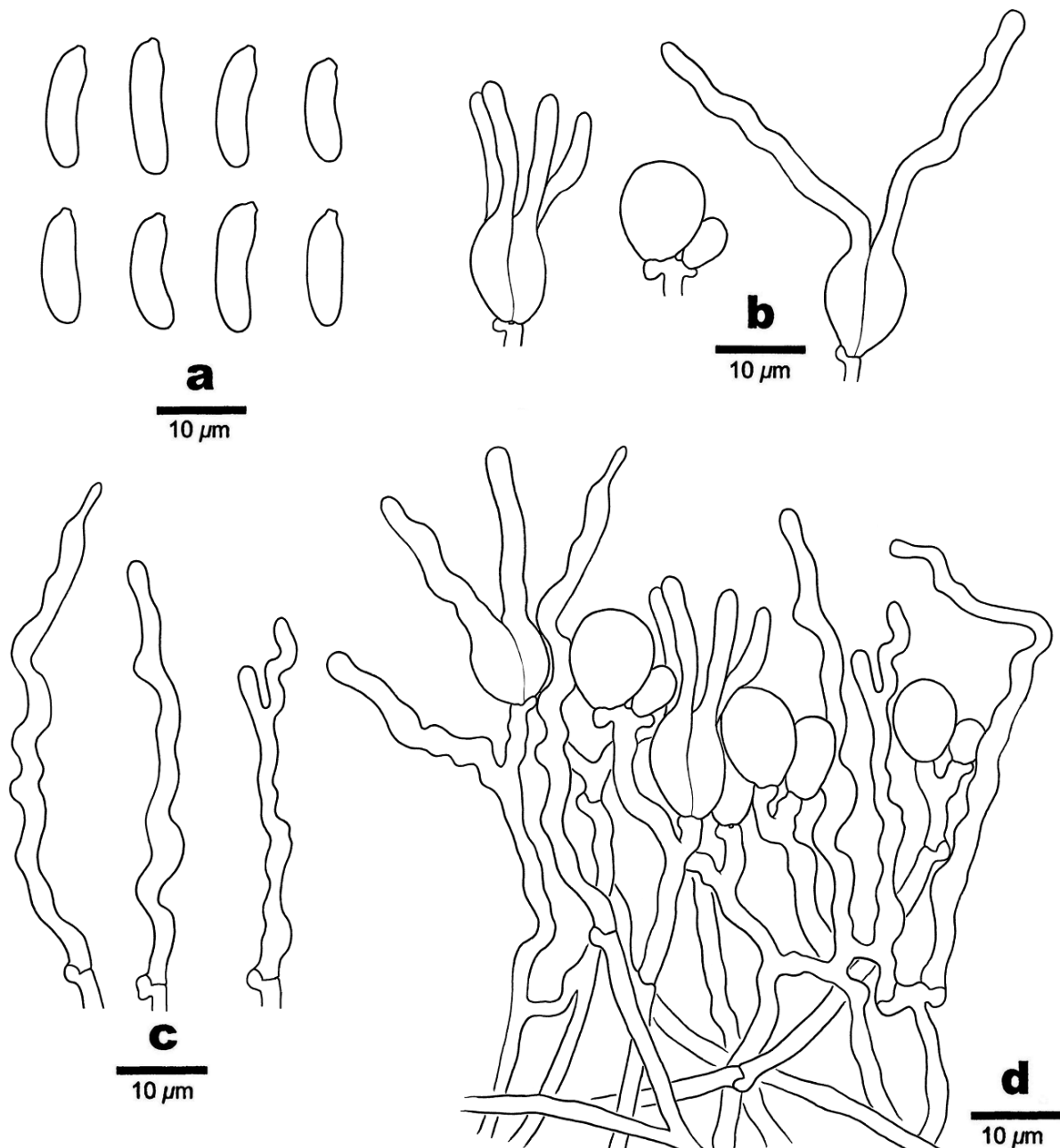


Fig. 19 Line drawings of microscopic structures of *Exidia orientalis*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μ m.

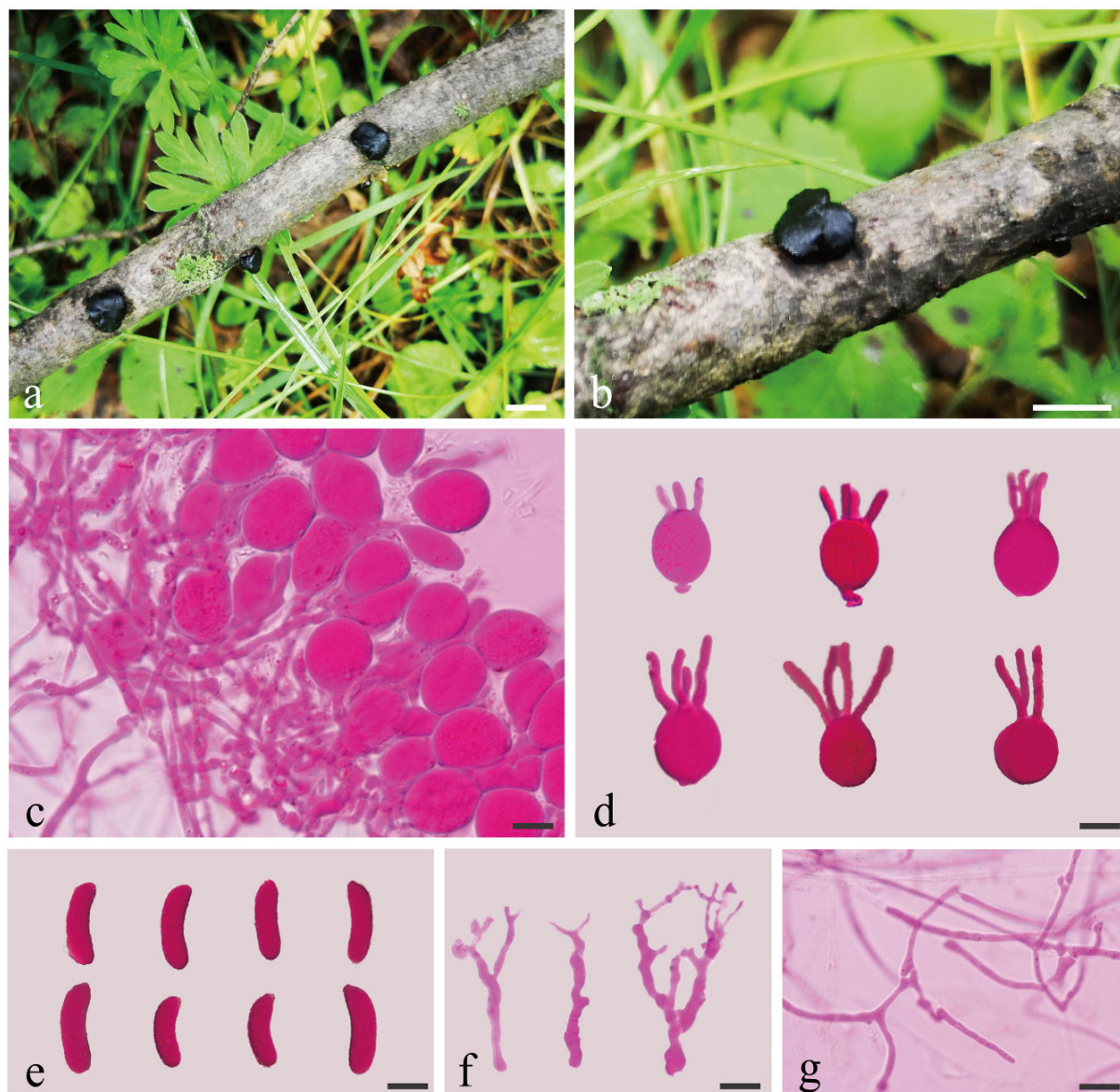


Fig. 20 Photos of basidiomata and microscopic structures of *Exidia separata*. a–b Basidiomata. c A section of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–h 10 µm.

Exidia sinothuretiana* F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.

.....Figs. 24, 25

Mycobank: MB 856364

Etymology: *Sinothuretiana* (Lat.): refers to the species resembling *E. thuretiana* (Lév.) Fr. but distributed in China.

Diagnosis: Similar to *Exidia abieticola* but differs in having distinctly larger basidia and basidiospores.

Basidiomata: Gelatinous, white to clay pink when fresh, becoming darker mouse gray when dry; sub-orbicular to orbicular, or slightly cerebriform, pulvinate, sessile, usually remaining separate, occasionally coalescing, up to 4.0 cm diam. and 5 mm thick, mostly with lobed margins; hymenial surface smooth and without papillae, slightly ridged; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), simple or branched, hyaline, thin-walled, 0.5–3.0 µm diam., embedded in a gelatinous

matrix. Hyphidia distinctly branched, hyaline, thin-walled, apically dendrite. Basidia longitudinally septate, 4-celled, ovoid to subglobose, thin-walled, with a basal clamp connection, 18.2–23.5 × 16.2–18.2 µm. Basidiospores allantoic, hyaline, thin-walled, smooth, usually with one or two large oil drops, (17.0–)17.5–22.0(–23.0) × (5.5–)6.2–8.0(–8.2) µm, L = 19.77 µm, W = 7.12 µm, Q = 2.65–2.77 (n = 60/2).

Known distribution: Southwest China.

Specimens examined: China, Sichuan Province, Luding County, Hailuoguo Forest Park, on fallen trunk of *Abies fabri*, 8 Oct 2021, Y.C. Dai, Dai 23127 (BJFC 037698); Xizang Autonomous Region, Bomi County, on fallen trunk of *Abies* sp., 26 Oct 2021, Y.C. Dai, Dai 23552 (BJFC 038124, **holotype**); Yunnan Province, Shangri-la, Pudacuo National Park, on dead branch of *Abies* sp., 7 Sep 2021, Y.C. Dai, Dai 22966 (BJFC 037539).

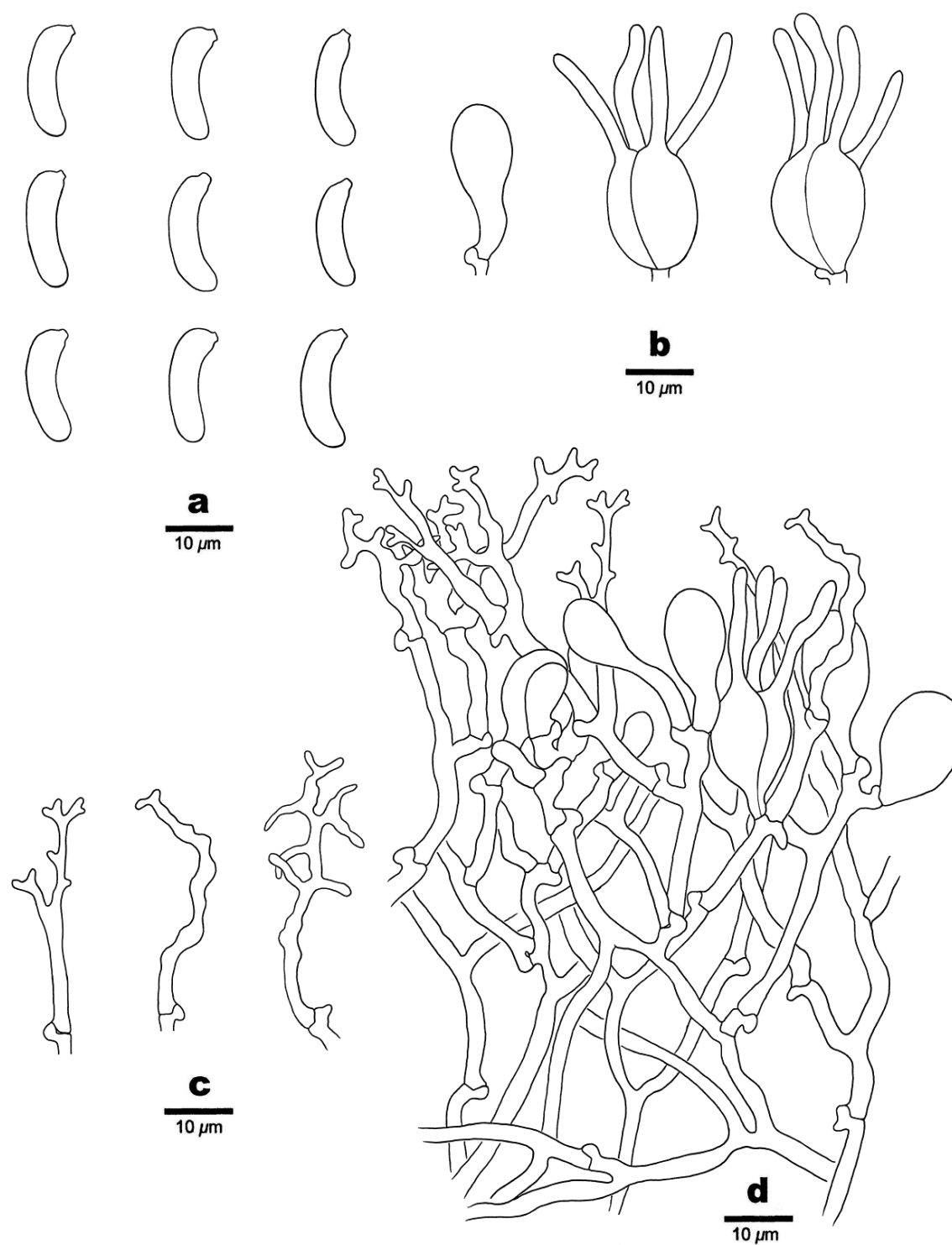


Fig. 21 Line drawings of microscopic structures of *Exidia separata*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μm.

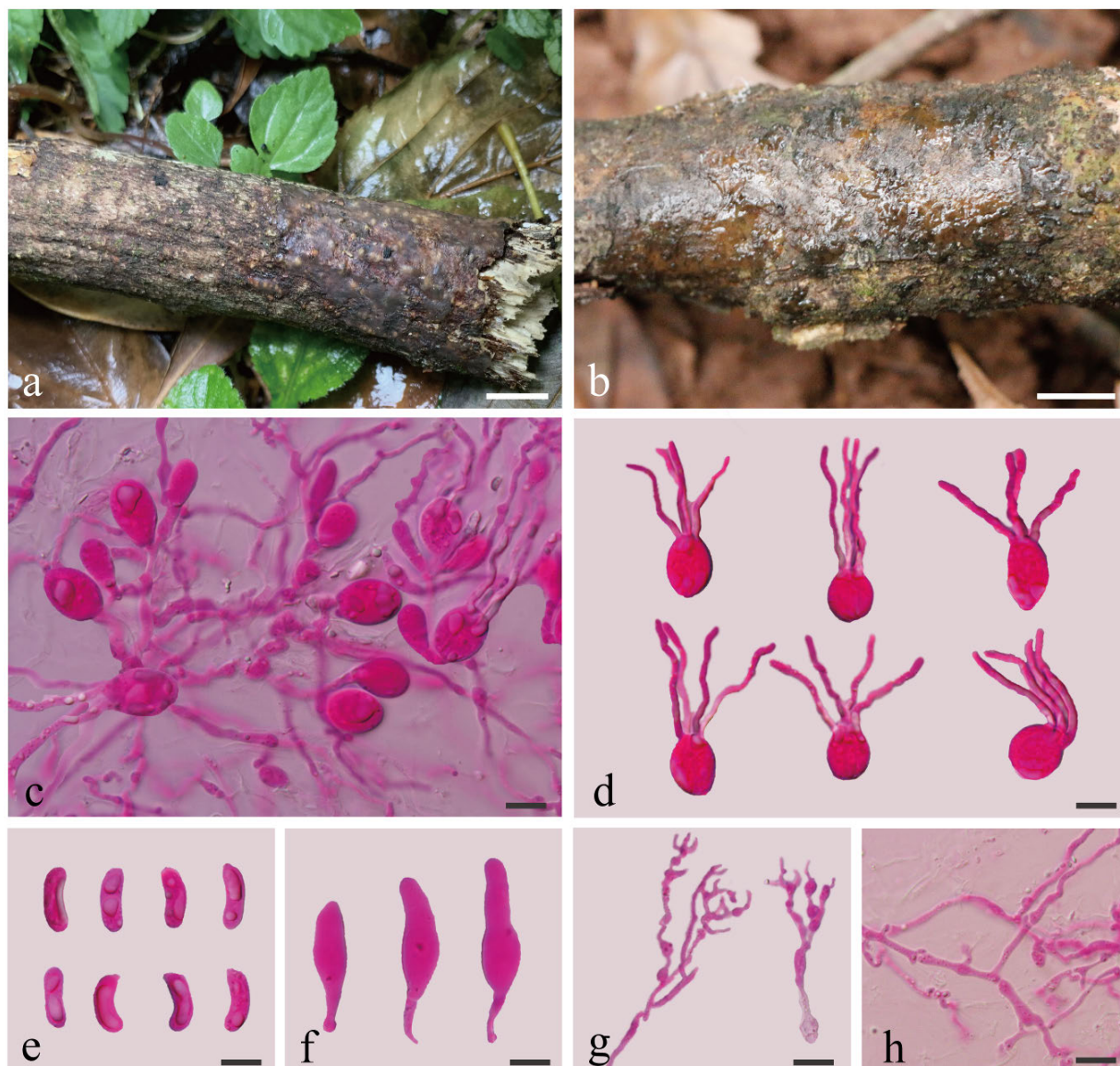


Fig. 22 Photos of basidiomata and microscopic structures of *Exidia sinocystidiata*. a–b Basidiomata. c A section of hymenium. d Basidia. e Basidiospores. f Cystidia. g Hyphidia. h Hyphae. Scale bars = a–b 1 cm, c–h 10 µm.

Notes: Morphologically, *Exidia sinothuretiana* may be confused with *E. abieticola* by sharing white, sub-orbicular basidiomata, and growth on *Abies* sp., but *E. abieticola* has distinctly smaller basidia ($11\text{--}13.8 \times 8\text{--}11.2 \mu\text{m}$ vs. $18.2\text{--}23.5 \times 16.2\text{--}18.2 \mu\text{m}$) and basidiospores ($8\text{--}10.2 \times 3.8\text{--}4.5 \mu\text{m}$ vs. $17.5\text{--}22 \times 6.2\text{--}8 \mu\text{m}$). In the phylogenies (Figs. 1, 2), *E. sinothuretiana* is closely related to *E. thuretiana* and macro-morphologically more or less similar to *E. thuretiana*, but *E. thuretiana* has distinctly smaller basidia ($13\text{--}19 \times 10\text{--}14 \mu\text{m}$ vs. $18.2\text{--}23.5 \times 16.2\text{--}18.2 \mu\text{m}$) and basidiospores ($13\text{--}19 \times 4.5\text{--}6 \mu\text{m}$ vs. $17.5\text{--}22 \times 6.2\text{--}8 \mu\text{m}$), and it grows on angiosperms in Europe (Breitenbach & Kränzlin 1986; Spirin et al. 2018b).

Exidia subtropica F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.* Figs. 26, 27

Mycobank: MB 856365

Etymology: *Subtropica* (Lat.): refers to the species being found in subtropical China.

Diagnosis: Similar to *Exidia minor*, *E. sinocystidiata* and *E. uvapassa* but differs in having distinctly larger basidiospores.

Basidiomata: Gelatinous, fawn to reddish brown when fresh, becoming fuscous to black when dry; sub-orbicular to orbicular, pulvinate, sessile, usually remaining separate, occasionally coalescing, up to 2.5 cm diam. and 4.5 mm thick, mostly with lobed margins; hymenial surface usually with small white papillae, usually not ridged; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), usually branched, hyaline, thin-walled, $0.5\text{--}2.8 \mu\text{m}$ diam., embedded in a gelatinous matrix. Hyphidia distinctly branched, hyaline, thin-walled, distinctly dendrite. Basidia longitudinally septate, 4-celled, ellipsoid to ovoid, thin-walled, with a basal clamp connection, $16.5\text{--}19.8 \times 10.2\text{--}14.5 \mu\text{m}$. Basidiospores allantoid, hyaline, thin-walled, smooth, usually with one or two large oil drops, $(17.2\text{--})18.8\text{--}25.2(\text{--}26.5) \times 4.8\text{--}6.5(\text{--}7.0) \mu\text{m}$, $L = 21.98 \mu\text{m}$, $W = 5.57 \mu\text{m}$, $Q = 3.34\text{--}3.94$ ($n = 60/2$).

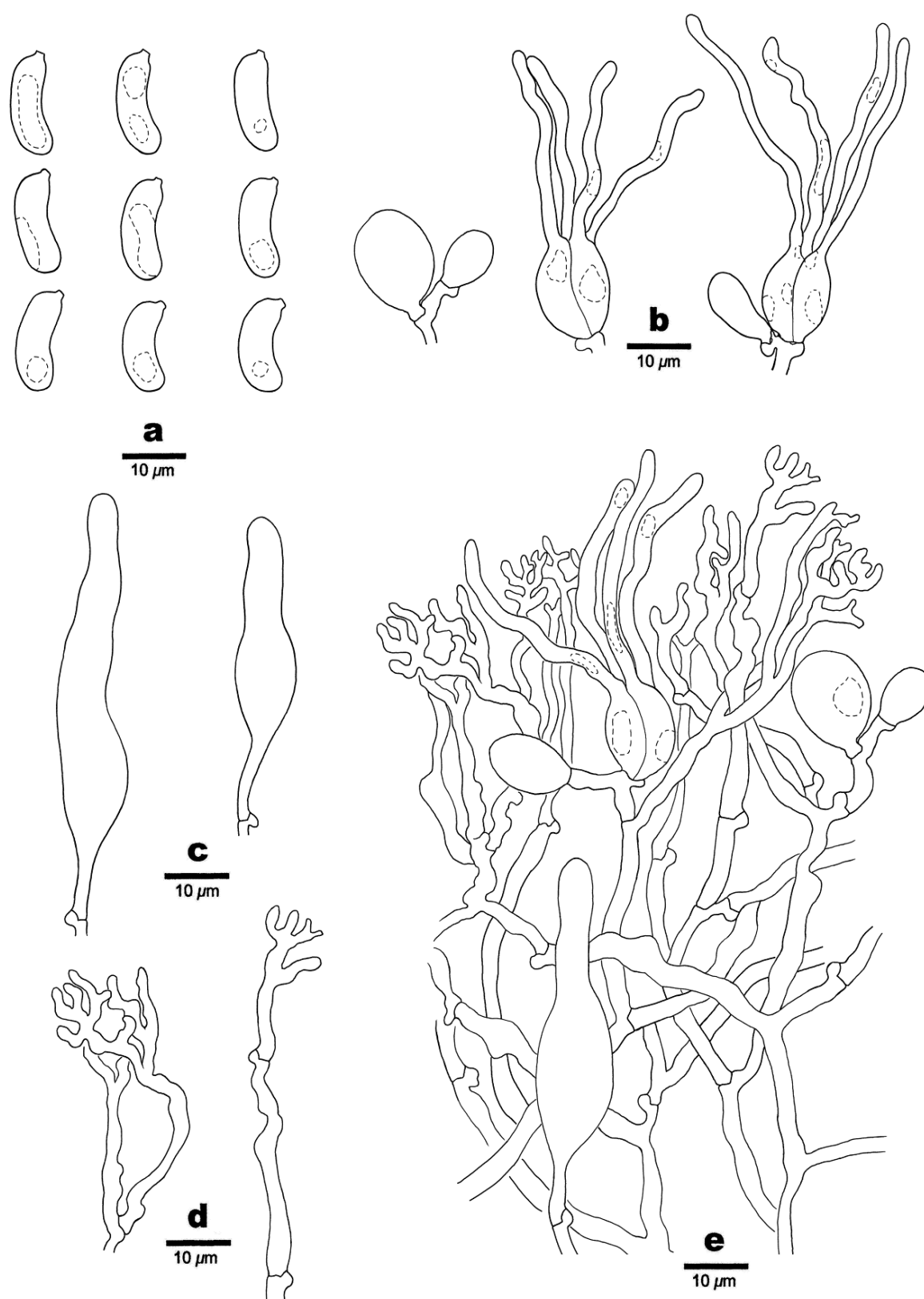


Fig. 23 Line drawings of microscopic structures of *Exidia sinocystidiata*. a Basidiospores. b Probasidia and basidia. c Cystidia. d Hyphidia. e A section of hymenium. Scale bars = a–e 10 µm.



Fig. 24 Photos of basidiomata and microscopic structures of *Exidia sinothuretiana*. a–b Basidiomata. c A section of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–h 10 µm.

Known distribution: Southwest China.

Specimens examined: China, Guizhou Province, Xishui County, Xishui National Nature Reserve, on fallen angiosperm branch, 7 Sep 2020, F. Wu, Wu 375 (BJFC 033971); Yunnan Province, Chuxiong, Lufeng County, Guangtong, Shanjianshan, on fallen angiosperm branch, 9 Jun 2023, F. Wu, Wu 905 (BJFC 040897), Honghe, Pingbian County, Daweishan National Forest Park, on fallen angiosperm branch, 26 Jun 2019, Y.C. Dai, Dai 19823 (BJFC 031498, **holotype**).

Notes: The species is macro-morphologically similar and phylogenetically related to *Exidia uvapassa* (Figs. 1, 2), but *E. uvapassa* differs by its distinctly smaller basidia ($12.5\text{--}16.2 \times 10.5\text{--}13.8 \mu\text{m}$ vs. $16.5\text{--}19.8 \times 10.2\text{--}14.5$) and basidiospores ($15.5\text{--}18.5 \times 5.2\text{--}6.5 \mu\text{m}$ vs. $18.8\text{--}25.2 \times 4.8\text{--}6.5 \mu\text{m}$). *Exidia subtropica* is also closely related to *E. minor* and *E. sinocystidiata* in the phylogenies (Figs. 1, 2), but *E. minor* differs from *E. subtropica* by its hyaline to whitish, distinctly smaller basidiomata (up to 2 mm diam. vs. up to 2.5 cm diam.) and basidiospores ($10.2\text{--}13.8 \times 4\text{--}5.2 \mu\text{m}$ vs. $18.8\text{--}25.2 \times 4.8\text{--}$

$6.5 \mu\text{m}$), and *E. sinocystidiata* is distinguished from *E. subtropica* by clavate cystidia and smaller basidiospores ($9.2\text{--}14 \times 9.5\text{--}12 \mu\text{m}$ vs. $18.8\text{--}25.2 \times 4.8\text{--}6.5 \mu\text{m}$)

Exidia subtruncata F. Wu, A. Tohtirjap & Y.C. Dai, **sp. nov.**
..... Figs. 28, 29

Mycobank: MB 856366

Etymology: *Subtruncata* (Lat.): refers to the species resembling *E. truncata*.

Diagnosis: Similar to *Exidia glandulosa* and *E. truncata*, but differs in having sparse papillae on the hymenial surface, distinctly branched hyphidia, and the size of basidia and basidiospores.

Basidiomata: Gelatinous, black when fresh, becoming black and shiny when dry; sub-orbicular to orbicular, occasionally cerebriform, pulvinate, sessile, usually remaining separate, up to 1.5 cm diam. and 6 mm thick, mostly with entire margins; hymenial surface usually with sparse papillae, distinctly ridged; mineral inclusions absent.

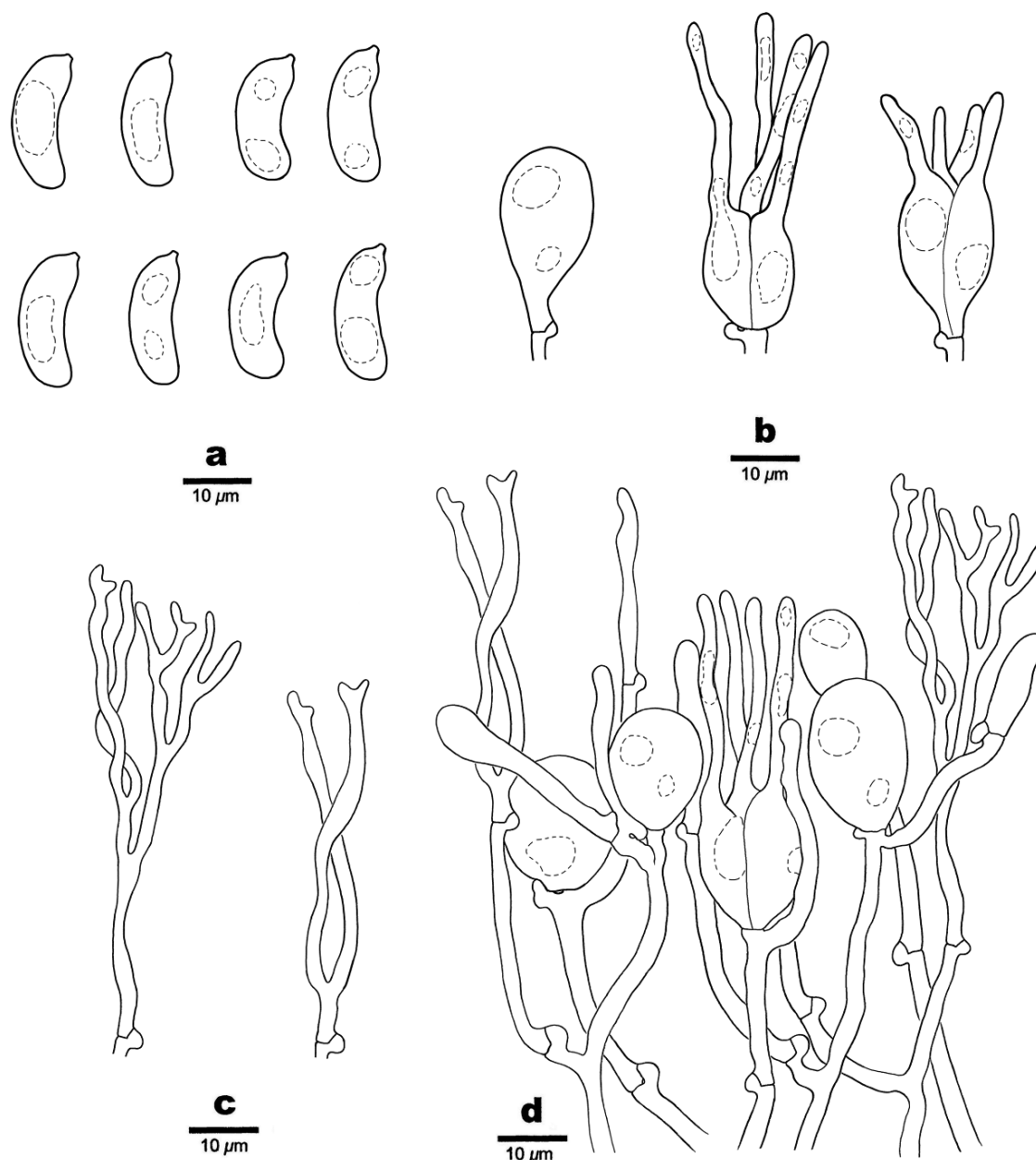


Fig. 25 Line drawings of microscopic structures of *Exidia sinothuretiana*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 µm.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), usually branched, hyaline, thin-walled, 0.5–2.5 µm diam., embedded in a gelatinous matrix. Hyphidia distinctly branched, hyaline, thin-walled, apically forked. Basidia longitudinally septate, 4-celled, subglobose to globose, thin-walled, with a basal clamp connection, 9.8–13.5 × 9.0–10.2 µm. Basidiospores narrowly allantoid, hyaline, thin-walled, smooth, usually without oil drop, (11.0–)12.2–15.5(–16.5) × (3.2–)3.5–4.2(–4.8) µm, L = 13.53 µm, W = 3.90 µm, Q = 3.32–3.46 (n = 60/2).

Known distribution: Southwest and north China.

Specimens examined: China, Hebei Province, Zhuolu County, Xiaowutai Nature Reserve, on fallen angiosperm branch, 7 Jun 2019, Y.C. Dai, Dai 18111 (BJFC 034970); Heilongjiang Province, Hegang, Helin Forest Farm, on fallen

branch of *Quercus* sp., 20 Oct 2020, F. Wu, Wu 400 (BJFC 033991); Inner Mongolia Autonomous Region, Arxan, Bailangfeng, on fallen branch of *Salix* sp., 25 Aug 2020, Y.C. Dai, Dai 21706 (BJFC 035607), Dai 21708 (BJFC 035609); Jilin Province, Changbai County, Wangtiane Forest Park, on dead tree of *Salix* sp., 9 Jul 2021, Y.C. Dai, Dai 22533 (BJFC 037112, **holotype**); Sichuan Province, Li County, Miyalu Forest Park, on dead tree of *Rosa* sp., 22 Aug 2023, Y.C. Dai, Dai 25827 (BJFC 043376), Dai 25828 (BJFC 043376).

Notes: Morphologically, *Exidia subtruncata* may be confused with *E. glandulosa* and *E. truncata* by sharing black, sub-orbicular to cerebriform basidiomata, and growth on angiosperms, but *E. glandulosa* has slightly smaller basidiospores (10.5–14 × 3.5–4.5 µm vs. 12.2–15.5 × 3.5–4.2 µm), and both species are distantly related in the phylogenies

(Figs. 1, 2); *E. truncata* differs from *E. subtruncata* by its larger basidia ($15\text{--}19.5 \times 12.8\text{--}14 \mu\text{m}$ vs. $9.8\text{--}13.5 \times 9\text{--}10.2 \mu\text{m}$) and wider basidiospores ($4.2\text{--}5.2 \mu\text{m}$ vs. $3.5\text{--}4.2 \mu\text{m}$ diam.). In the

phylogenies (Figs. 1, 2), *E. subtruncata* is closely related to *E. separata*. The differences between *E. subtruncata* and *E. separata* are discussed in the notes of *E. separata*.

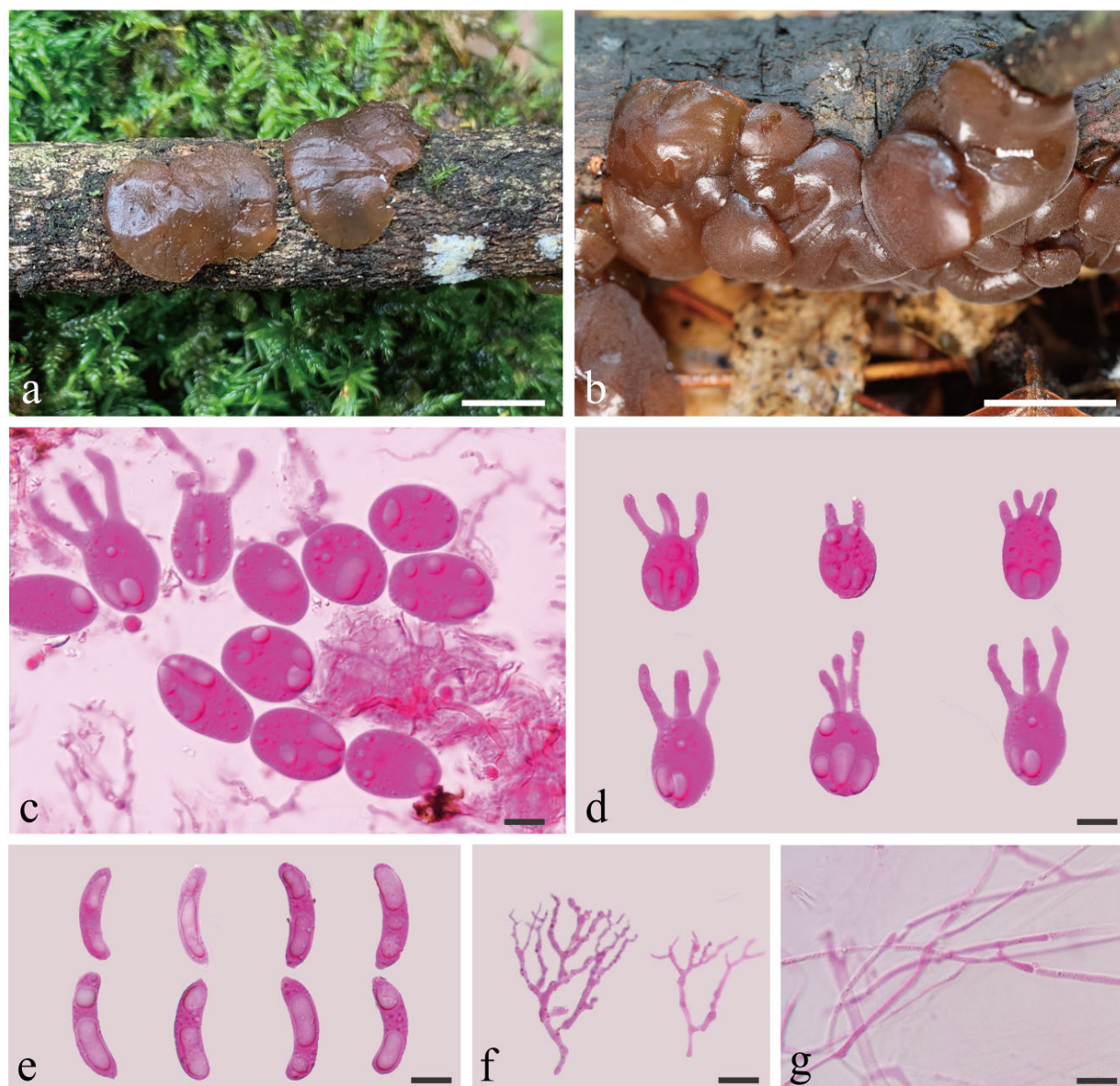


Fig. 26 Photos of basidiomata and microscopic structures of *Exidia subtropica*. a–b Basidiomata. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 μm .

Myxarium Wallr., Flora Cryptogamica Germaniae 2: 260 (1833).

Type species: Myxarium nucleatum Wallr.

Basidiomata gelatinous or waxy when fresh, usually translucent, semi-translucent or variable in color, pustulate, adpressed-orbicular, pulvinate or cerebriform, continuous, fusing together and becoming coalescent or effused in some species; hymenial surface smooth or slightly ridged; mineral inclusions present or not; hyphal structure monomitic; hyphae clamped; hyphidia present or absent; basidia longitudinally septate, 4-celled, ellipsoid to ovoid or subglobose to globose, thin-walled, with a long enucleate stalk; basidiospores cylindrical, allantoid or ovoid, hyaline, thin-walled, smooth.

Notes: *Myxarium* was established to accommodate a single species, *M. nucleatum* from Europe, by Wallroth (1833), and his description contained a reference to *Tremella nucleata* Schwein. However, *T. nucleata* was synonymized with *Exidia nucleata* (Schwein.) Burt (Burt 1921), and *M. nucleatum* was synonymized with *M. hyalinum* (Pers.) Donk derived from an older name, *T. hyalina* Pers. (Donk 1966). Roberts (1998) examined the European specimens of *E. nucleata*, and found that they were identical to the American specimens of *E. nucleata*. So, the European *M. nucleatum* was considered a synonym of the American *E. nucleata*, and the genus *Myxarium* was considered a synonym of *Exidia*.

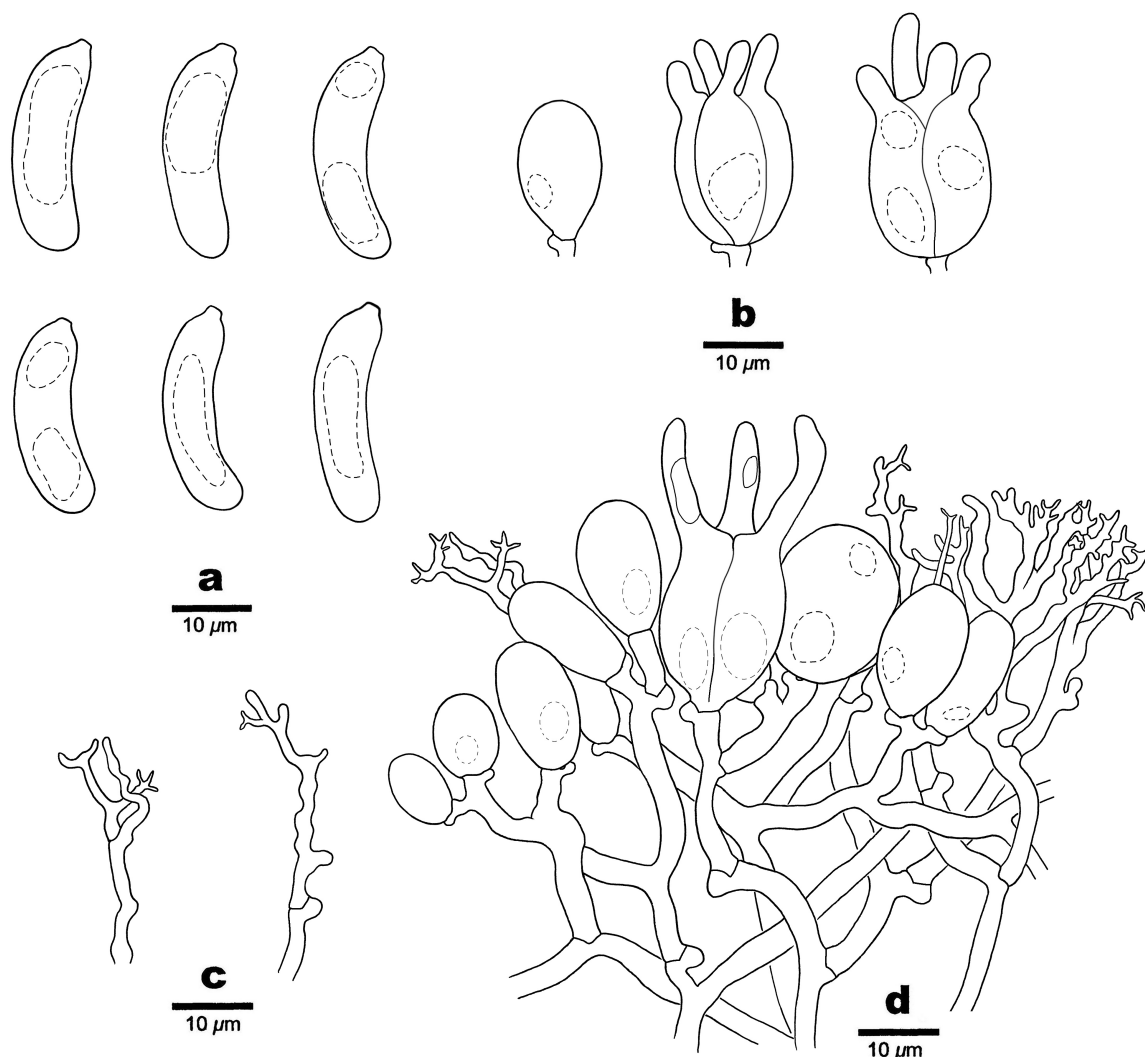


Fig. 27 Line drawings of microscopic structures of *Exidia subtropica*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 µm.

Recently, based on morphological and phylogenetic evidence, *Myxarium* was demonstrated to be an independent genus (Weiß & Oberwinkler 2001; Wells et al. 2004), which differs from *Exidia* by having myxarioid basidia (Spirin et al. 2018a, 2018b, 2019). The traditional concept of *M. nucleatum* covers at least four species including *M. nucleatum* and *M. hyalinum* (Spirin et al. 2018a, 2018b), and some newly described *Myxarium* species (Spirin et al. 2019, 2025). Thirty-one *Myxarium* species have been recorded worldwide, among them, 26 species are confirmed by molecular data. According to our morphological examinations and phylogenetic analysis, six *Myxarium* species were identified based on our samples, of which five are described here as new. The key morphological characteristics of the five new species based on our samples are described in Table 2.

Myxarium atroalbum F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.*

.....Figs. 30, 31

Mycobank: MB 856369

Etymology: *Atroalbum* (Lat.): refers to the species having

white to black basidiomata.

Diagnosis: Similar to *Myxarium subnucleatum* but differs in white to black, sub-orbicular to orbicular, pulvinate basidiomata, and smaller broadly allantoid basidiospores.

Basidiomata: Gelatinous, white to black when fresh, becoming invisible when dry; sub-orbicular to orbicular, pulvinate, usually remaining separate, sometimes coalescing, up to 3 cm diam. and 3 mm thick; hymenial surface smooth; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped, usually branched, hyaline, thin-walled, 0.5–2.8 µm diam., embedded in a gelatinous matrix. Hyphidia distinctly branched, hyaline, thin-walled, dendrite. Basidia longitudinally septate, 4-celled, subglobose to globose, thin-walled, 11.5–12.5 × 10.5–12.0 µm, with enucleate stalk up to 20.0 × 2.5 µm. Basidiospores broadly allantoid, hyaline, thin-walled, smooth, usually with one or two oil drops, (7.2–)9.0–11.5(–12.2) × (4.2–)4.5–5.8(–6.0) µm, L = 10.2 µm, W = 5.1 µm, Q = 2.0–2.15 (n = 60/2).

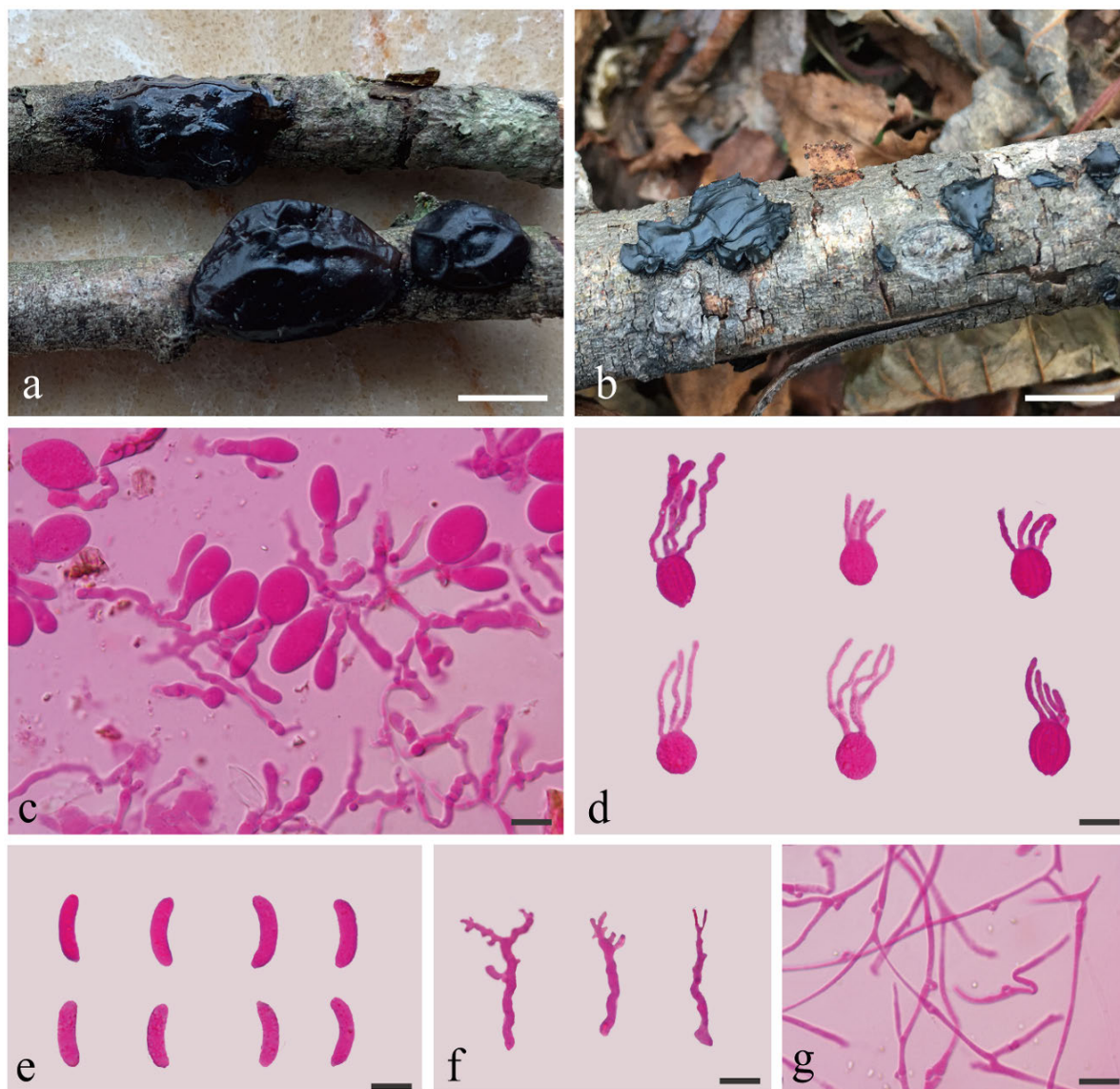


Fig. 28 Photos of basidiomata and microscopic structures of *Exidia subtruncata*. a–b Basidiomata. c Sections of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 µm.

Known distribution: North and southwest China.

Specimens examined: China, Beijing, Mentougou District, Xiaolongmen Forest Park, on fallen angiosperm branch, 7 Jul 2022, F. Wu, Wu 613 (BJFC 039961); Guizhou Province, Xishui County, Xishui National Nature Reserve, on branch of Fagaceae, 9 Sep 2020, F. Wu, Wu 380 (BJFC 033976), Wu 381 (BJFC 033977, **holotype**); Xizang Autonomous Region, Milin, Sejilashan, on fallen branch of *Rosa* sp., 23 Oct 2021, Y.C. Dai, Dai 23344 (BJFC 037915).

Notes: Morphologically, *Myxarium atroalbum* may be confused with *M. subnucleatum* by sharing orbicular to slightly orbicular basidiomata, but *M. subnucleatum* has white, translucent basidiomata, and larger basidiospores ($11.5\text{--}13.2 \times 6.2\text{--}7.8$ µm vs. $9\text{--}11.5 \times 4.5\text{--}5.8$ µm). In the phylogeny (Fig. 1), *Myxarium atroalbum* is closely related to *M. cinnamomescens* Raitv., but the latter has semi-translucent, cerebriform basidiomata when fused together, larger basidia ($11\text{--}17.5 \times 7\text{--}13$ µm vs. $11.5\text{--}12.5 \times 10.5\text{--}12$ µm) and basidiospores ($11.2\text{--}14 \times 4.1\text{--}5.7$ µm vs. $9\text{--}11.5 \times 4.5\text{--}5.8$

µm), and a distribution in Europe (Spirin et al. 2018a, 2018b). In addition, there is more than 1% sequence difference in the ITS sequences between the two species.

Myxarium miniatum F. Wu, A. Tohtirjap & Y.C. Dai, **sp. nov.**
..... Figs. 32, 33

Mycobank: MB 856370

Etymology: *Miniatum* (Lat.): refers to the species having very small basidiomata.

Diagnosis: Differs from other species in the genus by having small fawn to fuscous, sub-orbicular to orbicular, pustulate basidiomata, smaller basidia and narrowly allantoid basidiospores.

Basidiomata: Gelatinous, fawn to fuscous when fresh, becoming invisible when dry; sub-orbicular to orbicular, pustulate, usually remaining separate, up to 1.5 mm diam. and 2 mm thick; hymenial surface smooth and without papillae; mineral inclusions absent.

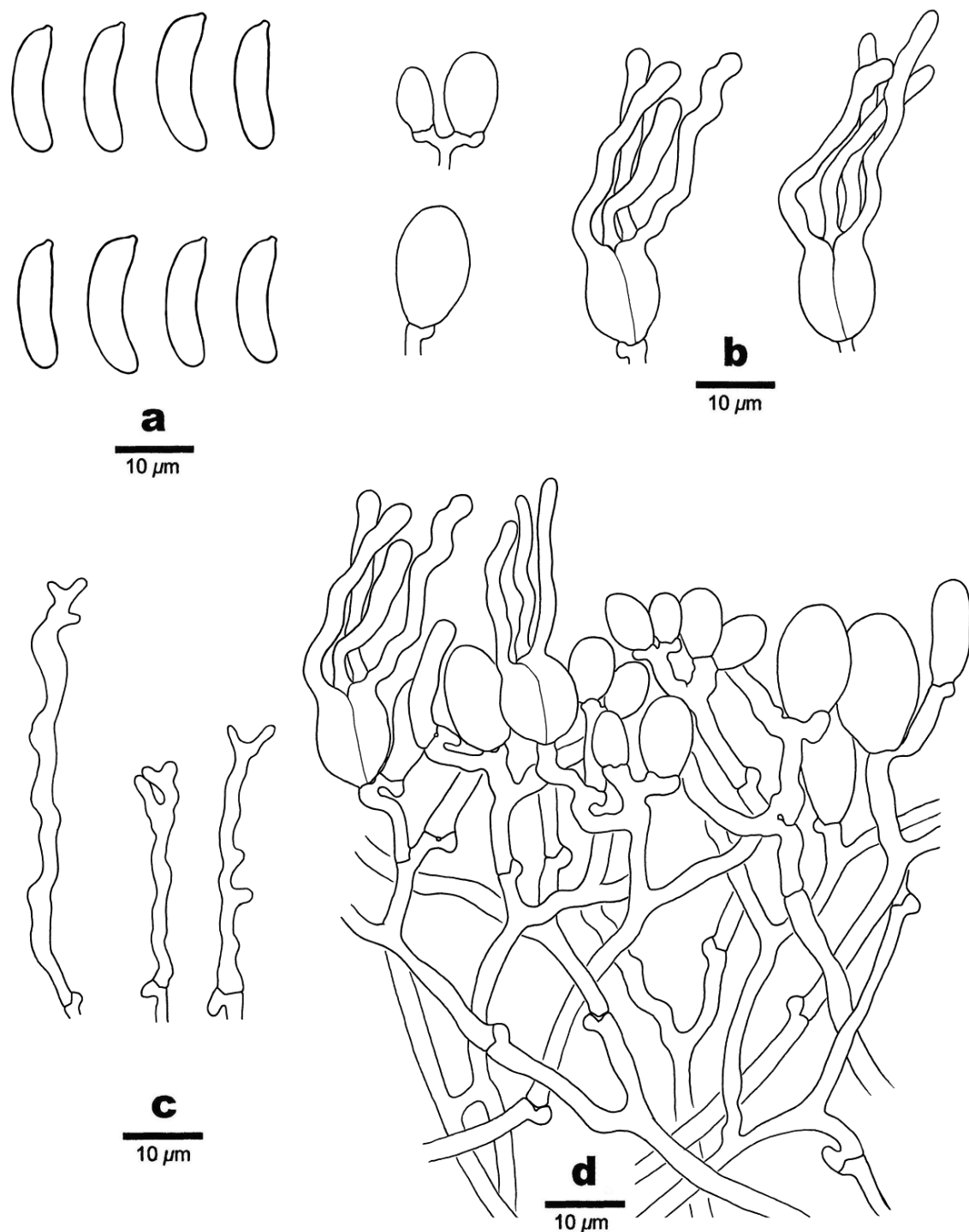


Fig. 29 Line drawings of microscopic structures of *Exidia subtruncata*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μ m.

Internal features: Hyphal structure monomitic; hyphae clamped, usually branched, hyaline, thin-walled, and 1–3 μ m diam., embedded in a gelatinous matrix. Hyphidia distinctly branched, hyaline, thin-walled, forked or dendrite. Basidia longitudinally septate, 4-celled, ovoid to subglobose, thin-walled, 9.2–10.2 $\times$ 8.0–8.8 μ m, with enucleate stalk up to 25.5 $\times$ 2.5 μ m. Basidiospores narrowly allantoid, hyaline, thin-

walled, smooth, usually with several small oil drops, (8.5–)9.8–11.5(–12.8) $\times$ (2.5–)2.8–3.2 μ m, L = 10.5 μ m, W = 2.9 μ m, Q = 3.57 (n = 30/1).

Known distribution: Northeast China.

Specimen examined: China, Heilongjiang Province, Harbin, Maoershan, on fallen branch of *Fraxinus mandshurica*, 23 Oct 2020, F. Wu, Wu 479 (BJFC 034070, **holotype**).

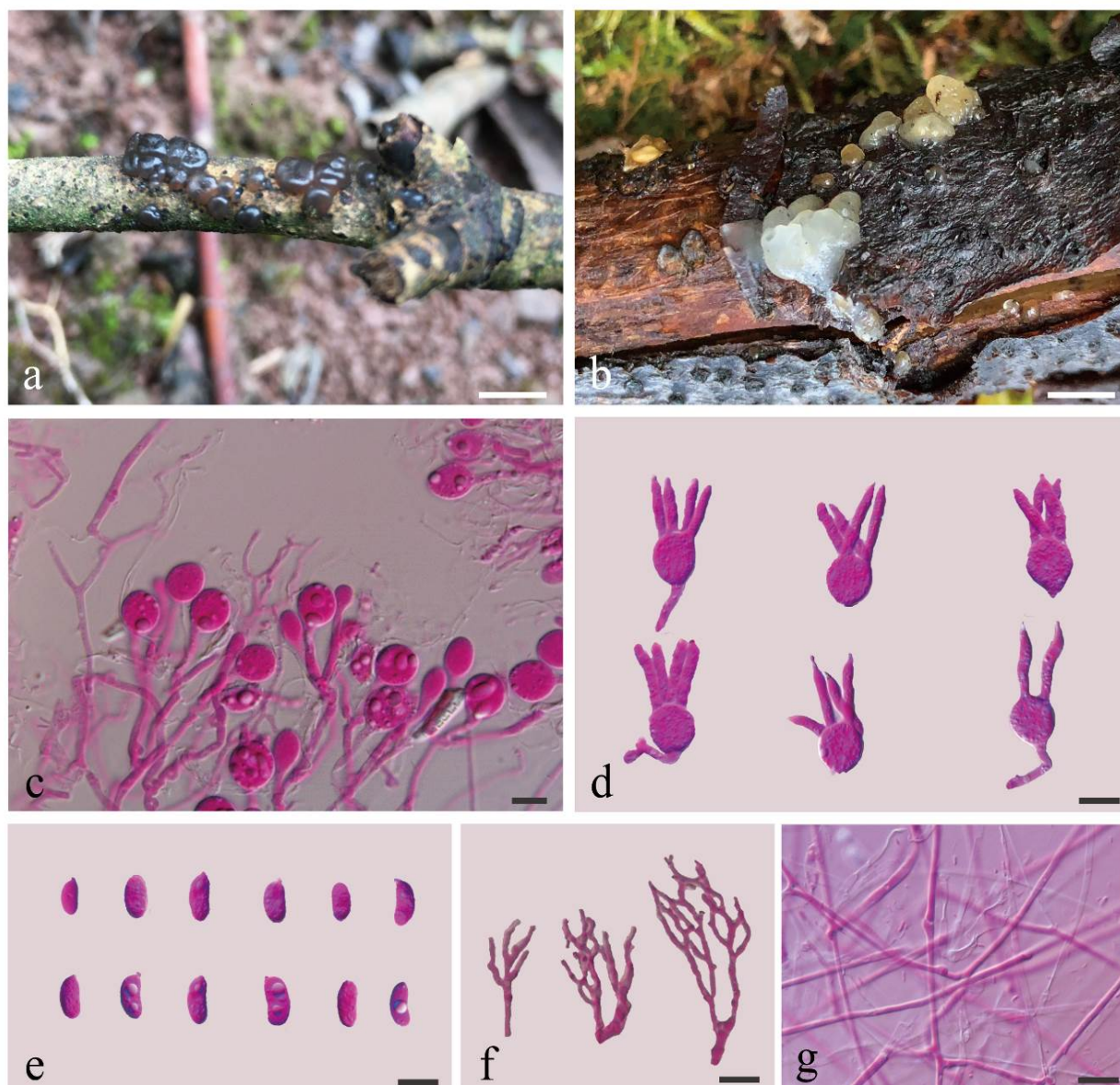


Fig. 30 Photos of basidiomata and microscopic structures of *Myxarium atroalbum*. a–b Basidiomata. c A section of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 µm.

Notes: In the phylogeny (Fig. 1), *Myxarium miniatum* formed one lineage closely related to *M. atroalbum*, *M. boreale* Bau T. & Wang X., and *M. cinnamomescens*, but *M. atroalbum* and *M. boreale* differ from *M. miniatum* by their larger cerebriform basidiomata (up to 3 cm diam. in *M. boreale* and *M. atroalbum* vs. up to 1.5 mm diam.) and basidiospores ($9\text{--}11.5 \times 4.5\text{--}5.8$ µm in *M. atroalbum*, $11.5\text{--}13.2 \times 3.4\text{--}4.4$ µm in *M. boreale* vs. $9.8\text{--}11.5 \times 2.8\text{--}3.2$ µm; Wang & Bau 2023); *M. cinnamomescens* differs from *M. miniatum* by having semi-translucent, cerebriform basidiomata when coalesced, larger basidia ($11\text{--}17.5 \times 7\text{--}13$ µm vs. $9.2\text{--}10.2 \times 8\text{--}8.8$ µm) and basidiospores ($11.2\text{--}14 \times 4.1\text{--}5.7$ µm vs. $9.8\text{--}11.5 \times 2.8\text{--}3.2$ µm), and a distribution in Europe (Spirin et al. 2018a, 2018b)

Myxarium resupinatum F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.*

.....Figs. 34, 35

Mycobank: MB 856371

Etymology: *Resupinatum* (Lat.): refers to the species

having resupinate basidiomata.

Diagnosis: Similar to *Myxarium cinnamomescens* but differs in having ash gray basidiomata, distinctly smaller basidia and basidiospores.

Basidiomata: Gelatinous, semi-translucent, ash gray when fresh, becoming dark ash gray when dry; resupinate, slightly cerebriform when coalesced, up to 3 cm diam. and 2 mm thick, with free or wavy margins; hymenial surface usually smooth and without papillae; mineral inclusions absent.

Internal features: Hyphal structure monomitic; hyphae clamped, hyaline, thin-walled, $1\text{--}2.8$ µm diam., embedded in a gelatinous matrix. Hyphidia branched, hyaline, thin-walled, forked. Basidia longitudinally septate, 4-celled, ovoid to subglobose, thin-walled, $8.2\text{--}10.5 \times 7.5\text{--}10.2$ µm, with enucleate stalk up to 26.5×2.2 µm. Basidiospores broadly ellipsoid to ellipsoid, hyaline, thin-walled, smooth, usually with one large oil drop, $(6.0\text{--})6.5\text{--}7.8\text{--}(8.6) \times (3.8\text{--})4.0\text{--}4.6\text{--}(5.0)$ µm, $L = 7.33$ µm, $W = 4.21$ µm, $Q = 1.74$ ($n = 30/1$).

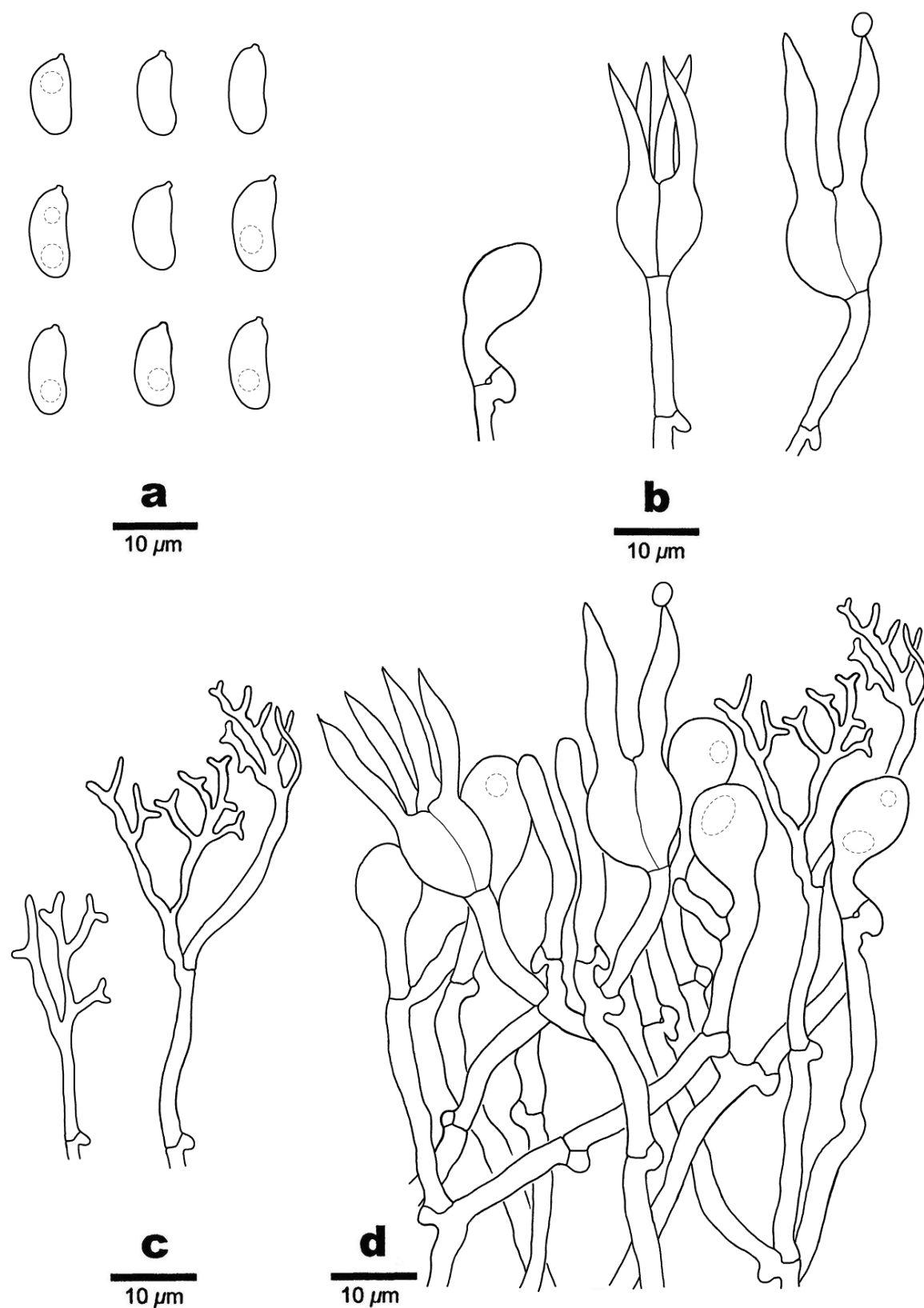


Fig. 31 Line drawings of microscopic structures of *Myxarium atroalbum*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μm.

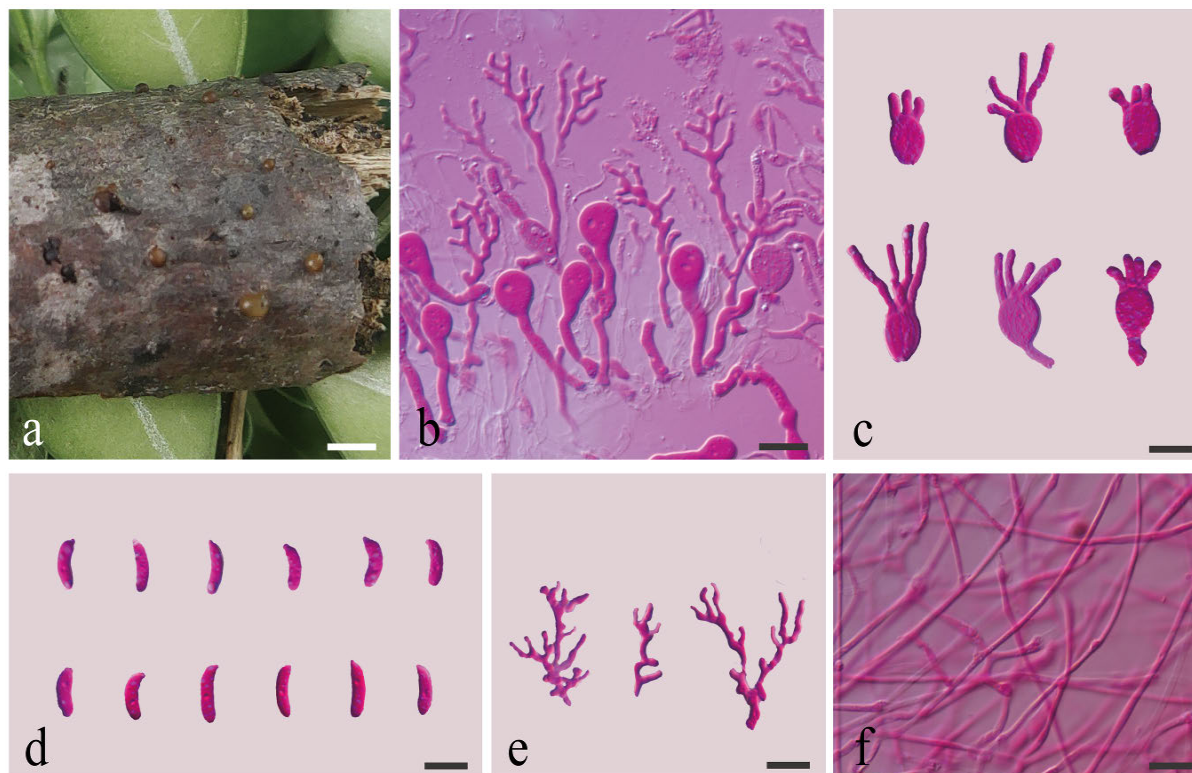


Fig. 32 Photos of basidiomata and microscopic structures of *Myxarium miniatum*. a Basidiomata. b A section of hymenium. c Basidia. d Basidiospores. e Hyphidia. f Hyphae. Scale bars = a 1 cm, b–f 10 μ m.

Known distribution: Northeast China.

Specimen examined: China, Liaoning Province, Anshan, Qianshan, on fallen angiosperm branch, 11 Jul 2023, F. Wu, Wu 822 (BJFC 040815, **holotype**).

Notes: Morphologically, *Myxarium resupinatum* may be confused with *M. cinnamomescens* by sharing whitish and cerebriform basidiomata, but *M. cinnamomescens* has distinctly larger basidia ($11\text{--}17.5 \times 7\text{--}13 \mu\text{m}$ vs. $8.2\text{--}10.5 \times 7.5\text{--}10.2 \mu\text{m}$) and basidiospores ($10.2\text{--}14 \times 4.1\text{--}5.7 \mu\text{m}$ vs. $6.5\text{--}7.8 \times 4\text{--}4.6 \mu\text{m}$). In the phylogeny (Fig. 1), *M. resupinatum* formed one distinct lineage distantly related to other taxa of *Myxarium*.

Myxarium subnucleatum F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.* Figs. 36, 37

Mycobank: MB 856372

Etymology: *Subnucleatum* (Lat.): refers to the species resembling *M. nucleatum*.

Diagnosis: Similar to *Myxarium nucleatum* but differs in having white, translucent, orbicular to slightly cerebriform basidiomata, wider basidiospores and the very small mineral inclusions.

Basidiomata: Gelatinous, translucent, white when fresh, slightly shiny, becoming almost invisible when dry; orbicular to slightly cerebriform, usually remaining separate, up to 1 cm diam. and 5 mm thick, with free or wavy margins; hymenial

surface smooth and without papillae; mineral inclusions very small, embedded in hymenial layer and being observed under lens.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), usually branched, hyaline, thin-walled, $1\text{--}2.8 \mu\text{m}$ diam., embedded in a gelatinous matrix. Hyphidia absent. Basidia longitudinally septate, 4-celled, ovoid to subglobose, thin-walled, $11.5\text{--}13.2 \times 7.8\text{--}9.5 \mu\text{m}$, with enucleate stalk up to $30.2 \times 3.0 \mu\text{m}$. Basidiospores cylindrical, slightly curved to oblong-ellipsoid, hyaline, thin-walled, smooth, usually without oil drop, $(10.0\text{--})11.5\text{--}13.2\text{--}13.5 \times (5.5\text{--})6.2\text{--}7.8\text{--}(8.2) \mu\text{m}$, $L = 12.15 \mu\text{m}$, $W = 6.75 \mu\text{m}$, $Q = 1.79$ ($n = 30/1$).

Known distribution: Southwest China.

Specimen examined: China, Xizang Autonomous Region, Motuo County, on fallen branch of *Betula* sp., 17 Jul 2019, Y.C. Dai, Dai 20173 (BJFC 031844, **holotype**).

Notes: In the phylogeny (Fig. 1), *Myxarium subnucleatum* is closely related to *M. mesomorphum* (Bourdot & Galzin) K. Hauerslev and *M. nucleatum*, but *M. mesomorphum* differs from *M. subnucleatum* by its hyaline to grayish-bluish, effused, distinctly thinner basidiomata (up to 0.3 mm thick vs. up to 5 mm thick; Spirin et al. 2019), and *M. nucleatum* differs from the new species by its mineral inclusions, easily visible with the naked eye, and narrower basidiospores ($3.5\text{--}5.2 \mu\text{m}$ vs. $6.2\text{--}7.8 \mu\text{m}$ diam.).

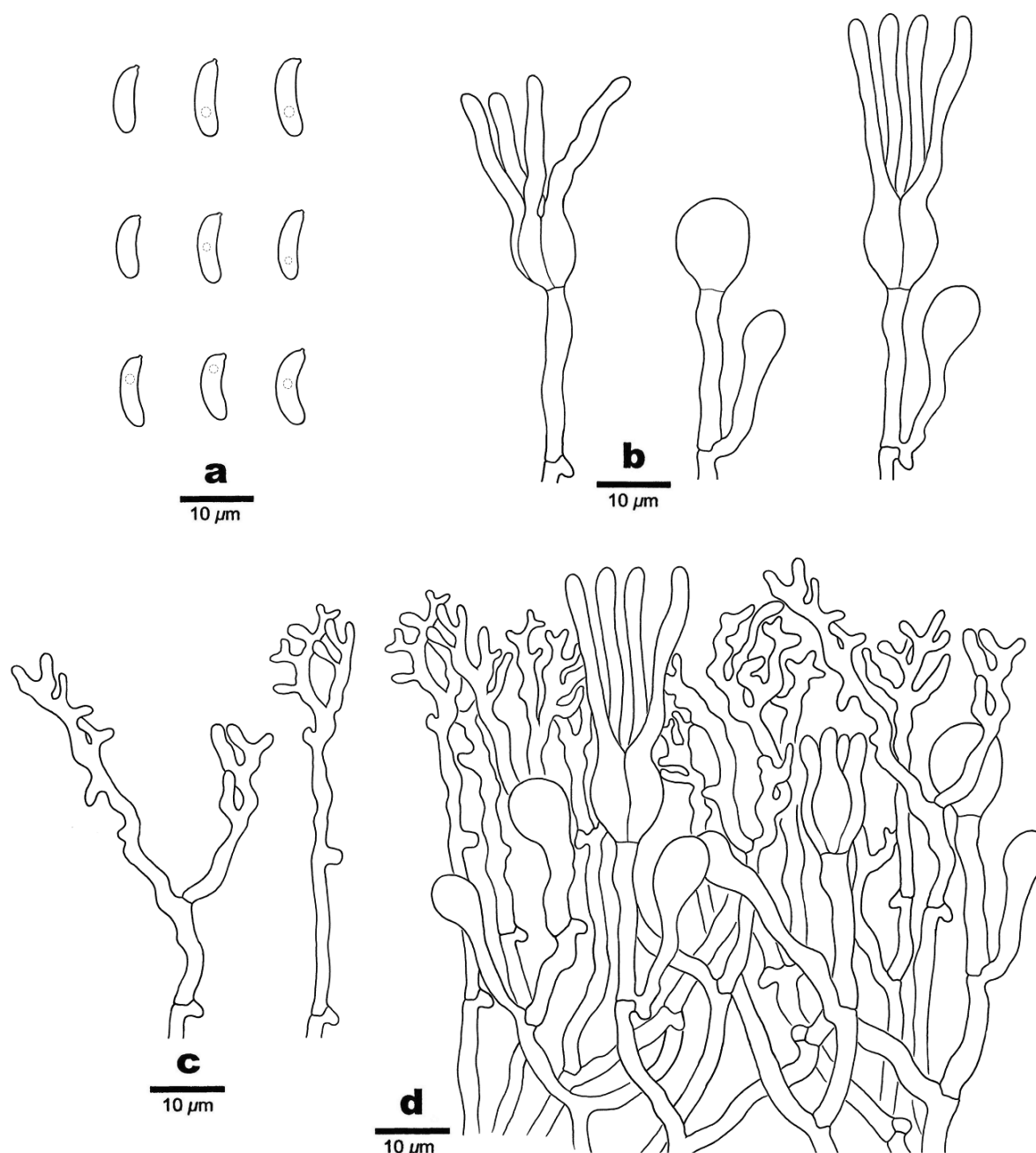


Fig. 33 Line drawings of microscopic structures of *Myxarium miniatum*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 µm.

Myxarium yunnanense F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.*
.....Figs. 38, 39

Mycobank: MB 856373

Etymology: *Yunnanense* (Lat.): refers to the species being found in Yunnan, China.

Diagnosis: Similar to *Myxarium frumentaceum* A. Savchenko & Malysheva but differs in having larger basidia and basidiospores, and a distribution in southwest China.

Basidiomata: Gelatinous, translucent, white when fresh, slightly shiny, becoming white and not translucent when dry; resupinate to effused, becoming cerebriform when coalesced, up to 5 cm diam. and 3 mm thick, with free margins; hymenial

surface smooth and without papillae; mineral inclusions abundant, easily visible with the naked eye.

Internal features: Hyphal structure monomitic; hyphae clamped, usually branched, hyaline, thin-walled, 0.5–2.8 µm diam., embedded in a gelatinous matrix. Hyphidia slightly branched, hyaline, thin-walled, apically forked. Basidia longitudinally septate, 4-celled, subglobose to globose, thin-walled, 11.0–12.5 × 11.0–12.0 µm, with enucleate stalk up to 17.2 × 2.2 µm. Basidiospores ellipsoid to oblong-ellipsoid, hyaline, thin-walled, smooth, usually with one large oil drop, (7.2–)9.0–10.8(–11.8) × (4.8–)5.0–6.2(–6.5) µm, L = 9.5 µm, W = 5.59 µm, Q = 1.58–1.69 (n = 60/2).

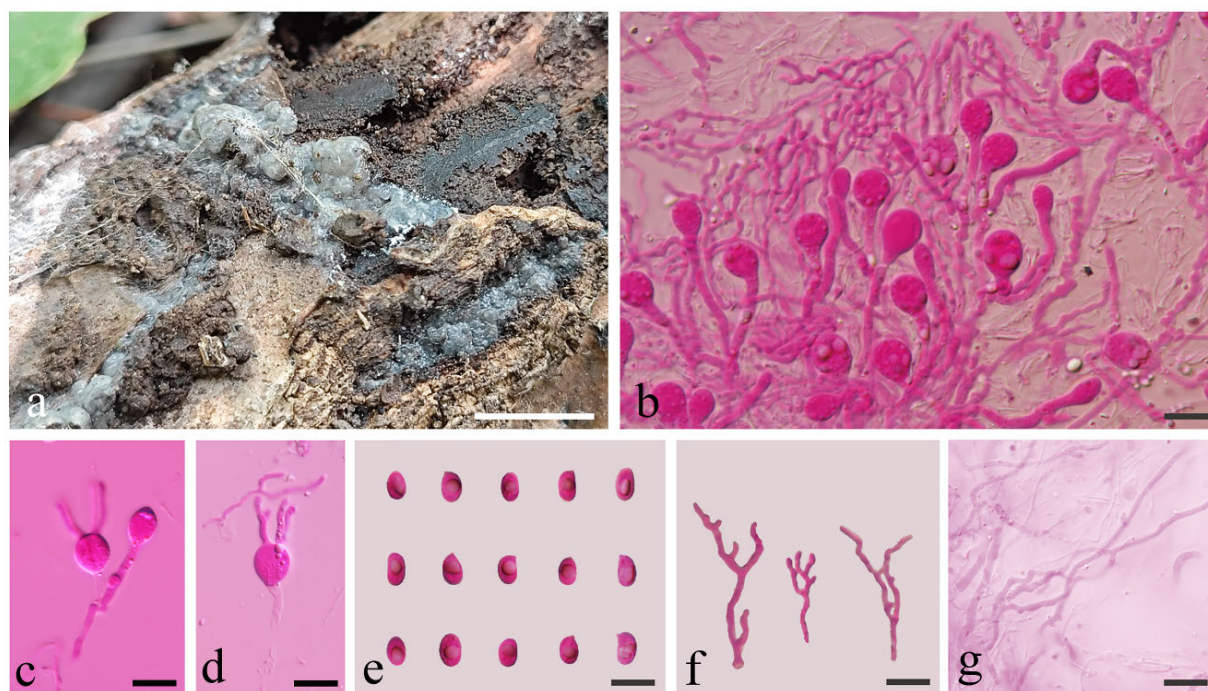


Fig. 34 Photos of basidiomata and microscopic structures of *Myxarium resupinatum*. a Basidiomata. b A section of hymenium. c–d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a 1 cm, b–g 10 µm.

Known distribution: Southwest China.

Specimens examined: China, Yunnan Province, Jinping County, Banbanqiao, on fallen angiosperm branch, 15 Aug 2019, Y.C. Dai, Dai 20721 (BJFC 032388, **holotype**), Dai 20727 (BJFC 032392); Yuxi, Xinping County, Jinshan Forest Park, on fallen angiosperm branch, 15 Aug 2023, F. Wu, Wu 873 (BJFC 040866), Wu 876 (BJFC 040869).

Notes: Morphologically, *Myxarium yunnanense* may be confused with *M. frumentaceum* by sharing white and cerebriform basidiomata, and abundant mineral inclusions, but *M. frumentaceum* has smaller basidia ($8\text{--}10.4 \times 5.9\text{--}7\text{ }\mu\text{m}$ vs. $11\text{--}12.5 \times 11\text{--}12\text{ }\mu\text{m}$) and basidiospores ($6.3\text{--}10.1 \times 3.2\text{--}5\text{ }\mu\text{m}$ vs. $9\text{--}10.8 \times 5\text{--}6.2\text{ }\mu\text{m}$), and a distribution in Africa (Spirin et al. 2019). In the phylogeny (Fig. 1), *M. yunnanense* is closely related to *M. guianense* G. Gruhn & Spirin, but the latter species is distinguished from *M. yunnanense* by adnate, thinner basidiomata, rare distinctly tapering to almost subulate cystidia, and smaller basidia ($7.8\text{--}9.4 \times 6.6\text{--}7.2\text{ }\mu\text{m}$ vs. $11.0\text{--}12.5 \times 11.0\text{--}12.0\text{ }\mu\text{m}$) and basidiospores ($5.6\text{--}7.3 \times 3.1\text{--}4.1\text{ }\mu\text{m}$ vs. $9.0\text{--}10.8 \times 5.0\text{--}6.2\text{ }\mu\text{m}$; Spirin et al. 2025).

Protohydnum Möller, Bot. Mitt. Trop. 8: 131, 173 (1895).

Type species: *Protohydnum cartilagineum* Möller.

Basidiomata gelatinous or waxy-gelatinous when fresh, cream, grayish or brown, tuberculate, pulvinate, cerebriform, fusing together and becoming coalescent or effused in some species; hymenial surface smooth or slightly ridged; hyphal structure monomitic; hyphae clamped; gloeocystidia present in most species; hyphidia present or not; basidia longitudinally septate, 4-celled, ovoid, ellipsoid or subglobose; basidiospores ovoid, ellipsoid or cylindrical, hyaline, thin-walled.

Notes: *Protohydnum* was recently amended to encompass several species formerly assigned to *Bourdolia* (Bres.) Bres. & Torrend, *Ductifera* Lloyd, and *Exidiopsis* (Bref.) Möller, and *Bourdolia* and *Ductifera* were merged into *Protohydnum* (Spirin et al. 2025) because the generic type of *Protohydnum*, *P. cartilagineum*, clustered into the same monophyletic clade with the species in *Bourdolia* and *Ductifera* (Malysheva et al. 2018; Spirin et al. 2025), and they share gelatinous basidiomata different from the waxy-arid basidiomata of *Basidioidendron* spp. (Spirin et al. 2025). Our phylogenetic analysis showed the same result as previous studies (Fig. 1), and our three specimens formed a distinct small lineage within the *Protohydnum* clade, so we accept the proposal in Spirin et al. (2025) and our three specimens are described as a new species of *Protohydnum* in the following.

Protohydnum translucidum F. Wu, A. Tohtirjap & Y.C. Dai, **sp. nov.** Figs. 40, 41

MycoBank: MB 856351

Etymology: *Translucidum* (Lat.): refers to the species usually having translucent to white basidiomata.

Diagnosis: Differs from other species in the genus by its translucent to white, larger, cerebriform, separate basidiomata, and differences in the size of gloeocystidia, basidia, and basidiospores.

Basidiomata: Gelatinous, translucent to white when fresh, becoming brown when dry; sub-orbicular to cerebriform, sessile, usually remaining separate, occasionally coalescing, up to 3.0 cm diam. and 1 cm thick, with free and determinate margins; hymenial surface smooth and without papillae; mineral inclusions abundant, detectable with the naked eye.

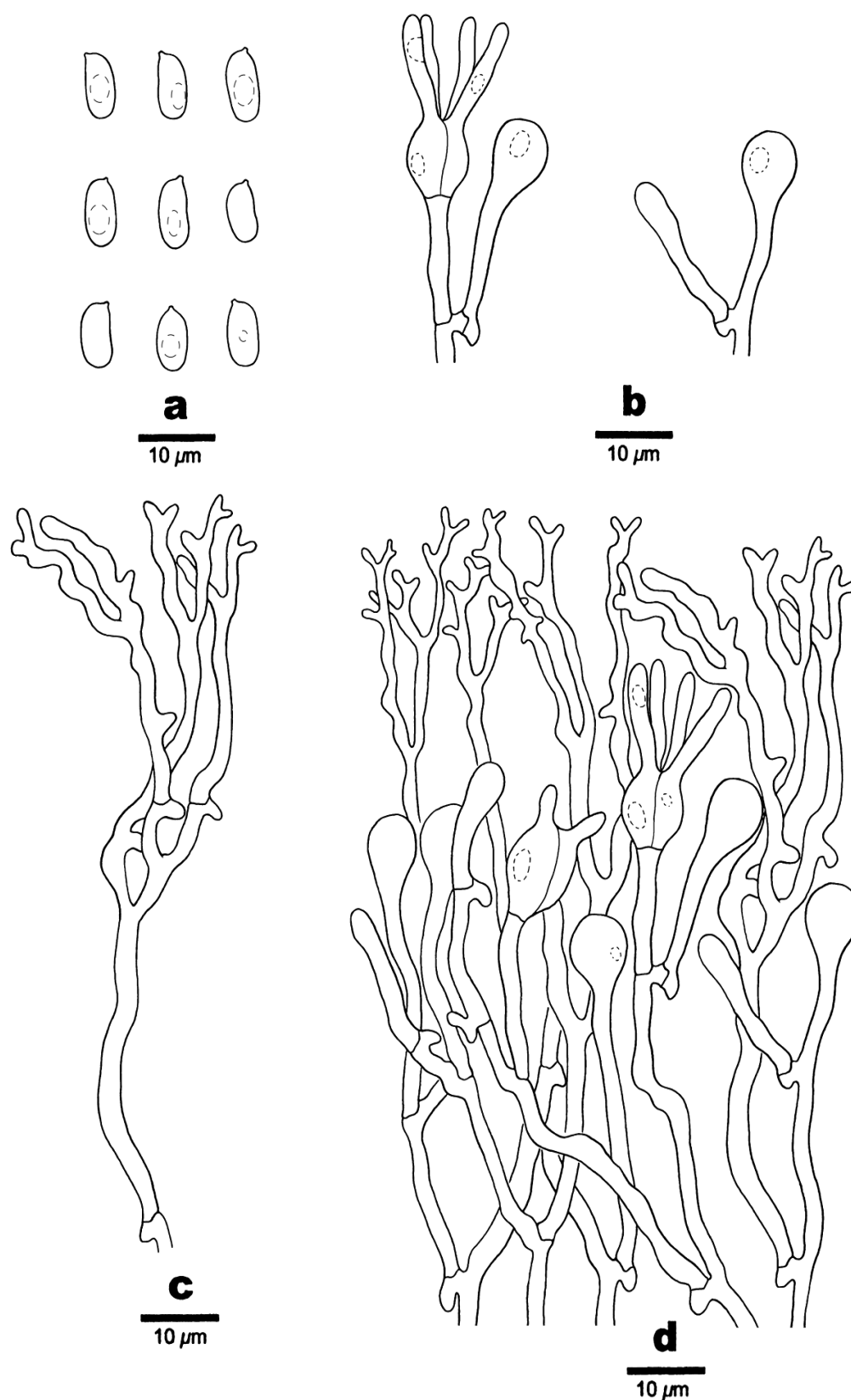


Fig. 35 Line drawings of microscopic structures of *Myxarium resupinatum*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μm.

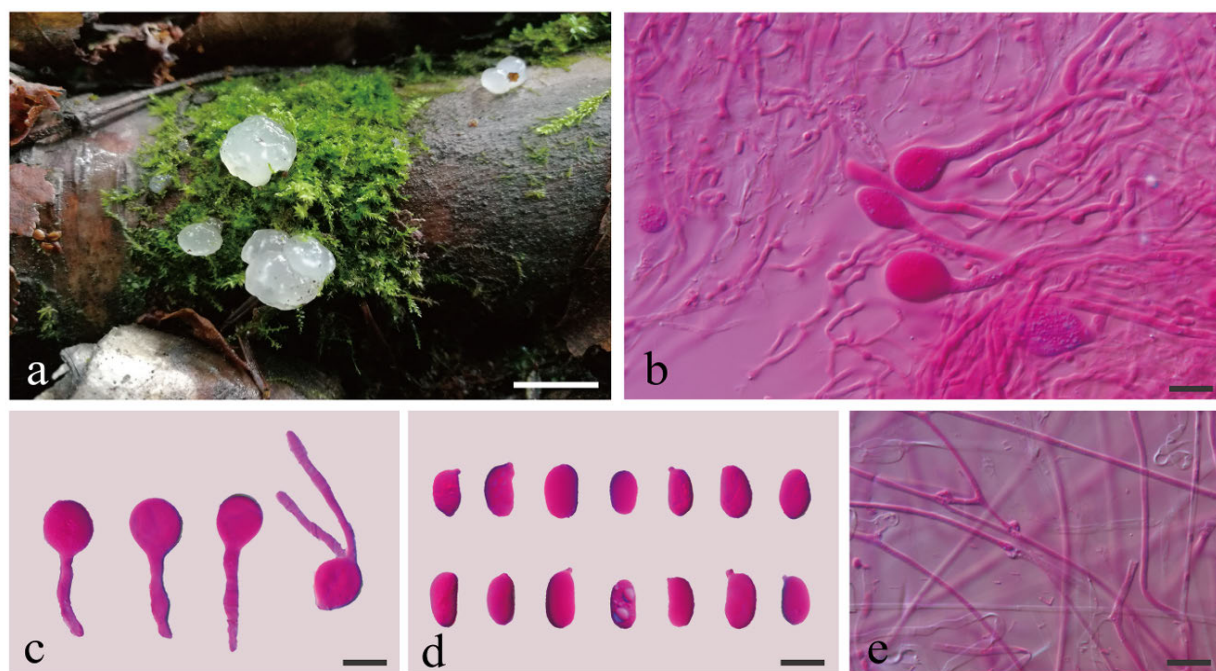


Fig. 36 Photos of basidiomata and microscopic structures of *Myxarium subnucleatum*. a Basidiomata. b A section of hymenium. c Basidia and basidioles. d Basidiospores. e Hyphae. Scale bars = a 1 cm, b–e 10 μ m.

Internal features: Hyphal structure monomitic; hyphae clamped (clamps usually open), simple or branched, hyaline, thin-walled, 1.0–2.5 μ m diam., embedded in a gelatinous matrix. Hyphidia simple, hyaline, thin-walled. Gloeocystidia subclavate to clavate, sometimes irregular, with yellow-orange granules, hyaline, thin-walled, 37.0–55.5 $\times$ 3.5–5.5 μ m. Basidia longitudinally septate, 4-celled, ellipsoid to ovoid, thin-walled, with a basal clamp connection, 17.2–24.5 $\times$ 14.5–18.8 μ m. Basidiospores ellipsoid to oblong-ellipsoid, hyaline, thin-walled, smooth, usually with one oil drop, (12.8–)13.0–15.0(–15.5) $\times$ (7.0–)7.2–9.0(–9.5) μ m, L = 13.65 μ m, W = 8.30 μ m, Q = 1.45–1.77 (n = 60/2).

Known distribution: Southwest China.

Specimens examined: China, Yunnan Province, Yuxi, Xinping County, Jinshan Forest Park, on rotten angiosperm branch, 28 Jun 2023, F. Wu, Wu 875 (BJFC 040868, **holotype**), Wu 879 (BJFC 040872), Wu 880 (BJFC 040873).

Notes: In our phylogeny (Fig. 1), the species is closely related to *Protohydnum elevatum* Malysheva & Spirin and *P. lactescens* (Burt) Spirin & Malysheva. However, *P. elevatum* differs from *P. translucidum* by its smaller basidiomata (up to 0.5 cm diam. vs. up to 3.0 cm diam.), wider gloeocystidia (26–46 $\times$ 5.3–7.8 μ m vs. 37–55.5 $\times$ 3.5–5.5 μ m), longer basidia (24–34 $\times$ 12–15.9 μ m vs. 17.2–24.5 $\times$ 14.5–18.8 μ m; Spirin et al. 2025); *Protohydnum lactescens* differs by whitish to brown basidiomata, distinctly larger gloeocystidia (48–112 $\times$ 5–11 μ m vs. 37.0–55.5 $\times$ 3.5–5.5 μ m) and a distribution in America (Spirin et al. 2025).

Pseudohydnum P. Karst., Not. Sällsk. Fauna et Fl. Fenn. Förh. 9: 374 (1868).

Type species: *Pseudohydnum gelatinosum* (Scop.) P. Karst.

Basidiomata gelatinous when fresh, pileate, sessile or laterally stipitate; pilei dimidiated to flabelliform or shell-

shaped; pileal surface tomentose, strigose, papillate, or smooth, variable in color, mostly grayish-brownish; pileal edge sharp or blunt; spines sharp-tipped, usually whitish; hyphal structure monomitic; hyphae clamped; hyphidia present or absent; basidia longitudinally septate, 2–4 celled, barrel-shaped, ellipsoid, subglobose or globose, thin-walled; basidiospores broadly ellipsoid, ovoid, subglobose or globose, hyaline, thin-walled.

Notes: *Pseudohydnum* is typified by *P. gelatinosum* from Europe by Karsten (1868). The genus was addressed in the Tremellales because of its longitudinally septate basidia (Courtecuisse & Lowy 1990). However, Bandoni (1984) redefined Auriculariales and Tremellales and placed *Pseudohydnum* in Auriculariales based on morphological examinations. Weiß & Oberwinkler (2001) verified that *Pseudohydnum* species always nested in the Auriculariales in the phylogenies, and the same results were concluded by later studies (Zhou & Dai 2013; Sotome et al. 2014; Yuan et al. 2018; Spirin et al. 2019). The genus was widely accepted under the Auriculariales, and some species were recently described in the genus (Chen et al. 2020; Zhou et al. 2022, 2023a; Spirin et al. 2023; Coelho-Nascimento et al. 2024; Lei et al. 2025; Wang et al. 2025).

Approximately 27 legitimate names of *Pseudohydnum* are recorded according to Index Fungorum (<http://www.indexfungorum.org>) and MycoBank (<https://www.mycobank.org>), and eight species were recently described (Coelho-Nascimento et al. 2024; Lei et al. 2025; Wang et al. 2025), so 24 species have been confirmed by molecular data. According to our studies, 10 *Pseudohydnum* species were identified based on our samples, of which six species were described in our previous publications (Zhou et al. 2022, 2023a), while one new is described here.

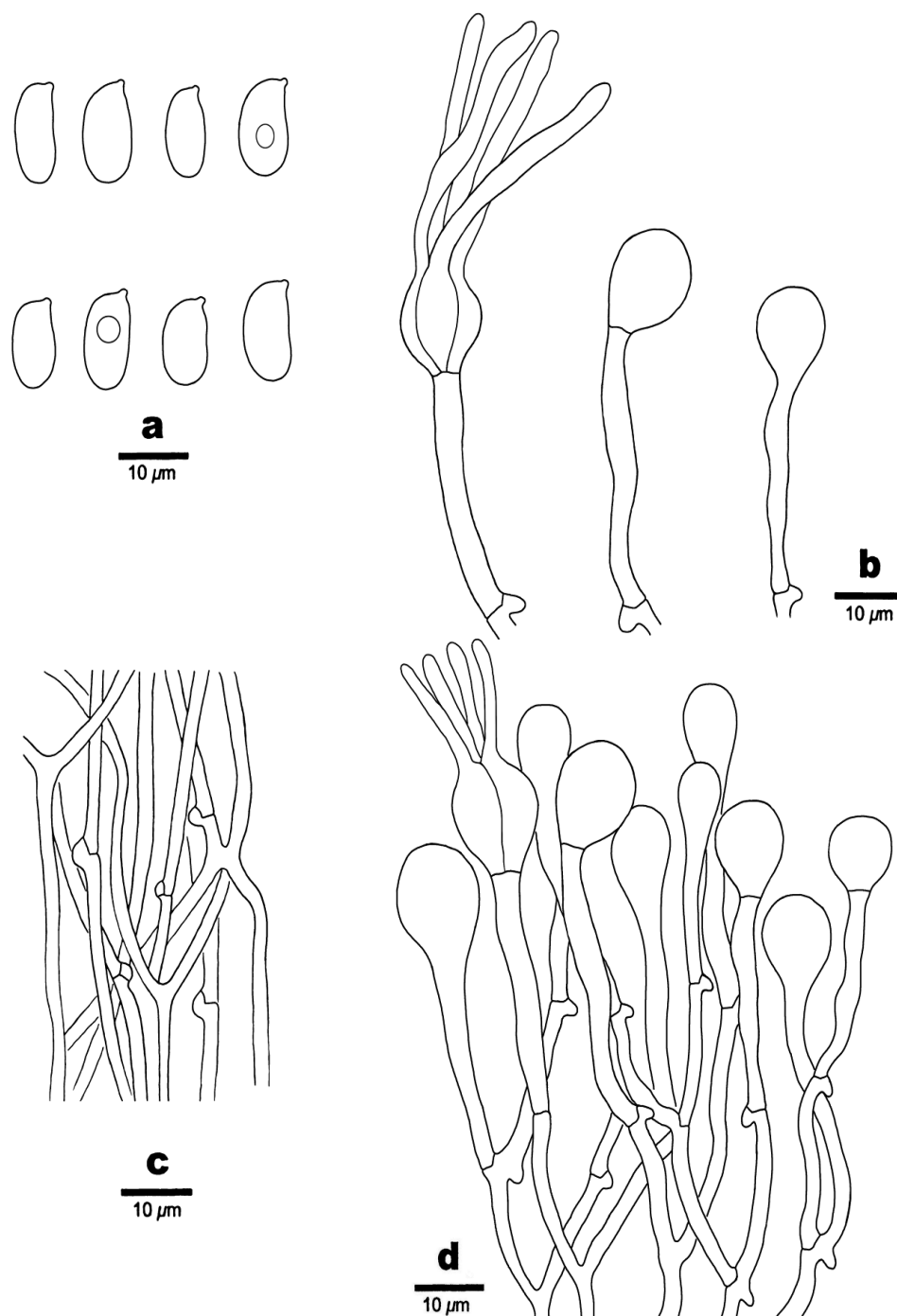


Fig. 37 Line drawings of microscopic structures of *Myxarium subnucleatum*. a Basidiospores. b Probasidia and basidia. c Hyphae. d A section of hymenium. Scale bars = a–d 10 μ m.

Pseudohydnum incarnatum F. Wu, A. Tohtirjap, H.M. Zhou & Y.C. Dai, **sp. nov.**.....Figs. 42, 43
Mycobank: MB 856374

Etymology: *Incarnatum* (Lat.): refers to the species having flesh pink pileal surface when fresh.

Diagnosis: Similar to *Pseudohydnum abietinum* but differs in having fusiform cystidia, larger basidia, and a distribution in southwest China.

Basidiomata: Gelatinous when fresh, pileal surface flesh pink, becoming clay pink when dry; usually solitary, pileate, laterally stipitate; pilei flabelliform, projecting up to 2.3 cm, 3.5 mm diam. and 3 mm thick; context translucent; spines sharp-tipped, white, up to 1.2 mm long, 2–3 per mm at base, becoming pale cream when dry; stipe concolorous with pileal surface, up to 1.25 cm long and 0.9 cm diam., usually covered by spines up to the base, sometimes rudimentary.

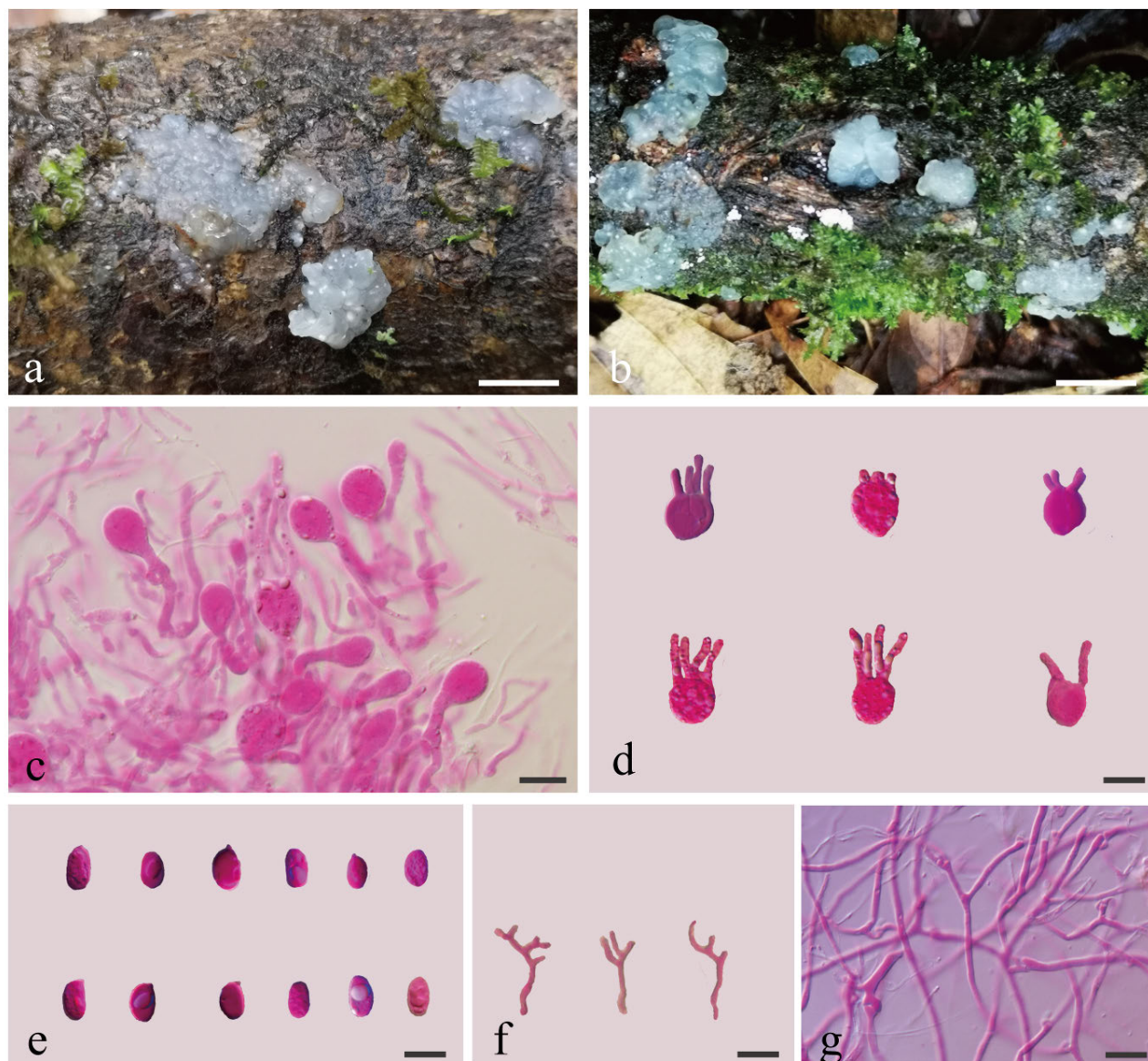


Fig. 38 Photos of basidiomata and microscopic structures of *Myxarium yunnanense*. a–b Basidiomata. c A section of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Hyphae. Scale bars = a–b 1 cm, c–g 10 µm.

Internal features: Hyphal structure monomitic; hyphae clamped; contextual hyphae hyaline, thin- to slightly thick-walled, frequently branched, interwoven, 3–8 µm diam; tramal hyphae hyaline, thin-walled, frequently branched, interwoven, 2.5–3.5 µm diam. Hyphidia simple, occasionally branched. Cystidia fusiform, hyaline, 18.5–36.0 × 6.5–10.2 µm. Basidia longitudinally septate, 4-celled, ovoid, thin-walled, 12.2–15.0 × 9.0–12.5 µm. Basidiospores broadly ellipsoid to subglobose, hyaline, thin-walled, smooth, usually with one large oil drop, (5.5–)6.0–8.2 × 5.0–6.2(–7.0) µm, $L = 6.92$ µm, $W = 5.80$ µm, $Q = 1.19$ –1.24 ($n = 60/2$).

Known distribution: Southwest China.

Specimens examined: China, Xizang Autonomous Region, Bomi County, on rotten wood of *Abies* sp., 26 Oct 2021, Y.C. Dai, Dai 23579 (BJFC 038151, **holotype**), 8 Aug 2023, F. Wu, Wu 791 (BJFC 040784).

Notes: Morphologically, *Pseudohydnum incarnatum* may be confused with *Ps. abietinum* H.M. Zhou & Jing Si by sharing a flesh pink pileal surface, white spines, and growth on *Abies* sp., but *Ps. abietinum* lacks cystidia and has a distribution in northwest China rather than southwest China. In the phylogeny (Fig. 1), *Ps. incarnatum* formed one distinct lineage related to *Ps. alienum*, *Ps. himalayanum* Y.C. Dai et al., *Ps. laricicola* Zhu L. Yang, Q. Cai & B. Feng, *Ps. omnipavum* Spirin & Miettinen, *Ps. sinobisporum* T. Bau et al., and *Ps. translucens* Lloyd, but the latter six species are distinguished from *Ps. incarnatum* by the absence of cystidia (Zhou et al. 2022, 2023a; Spirin et al. 2023).

Tremellochaete (Yasuda) Raitv., *Izv. Akad. Nauk Estonsk. SSR* 13: 30 (1964).

Type species: *Tremellochaete japonica* (Yasuda) Raitv.

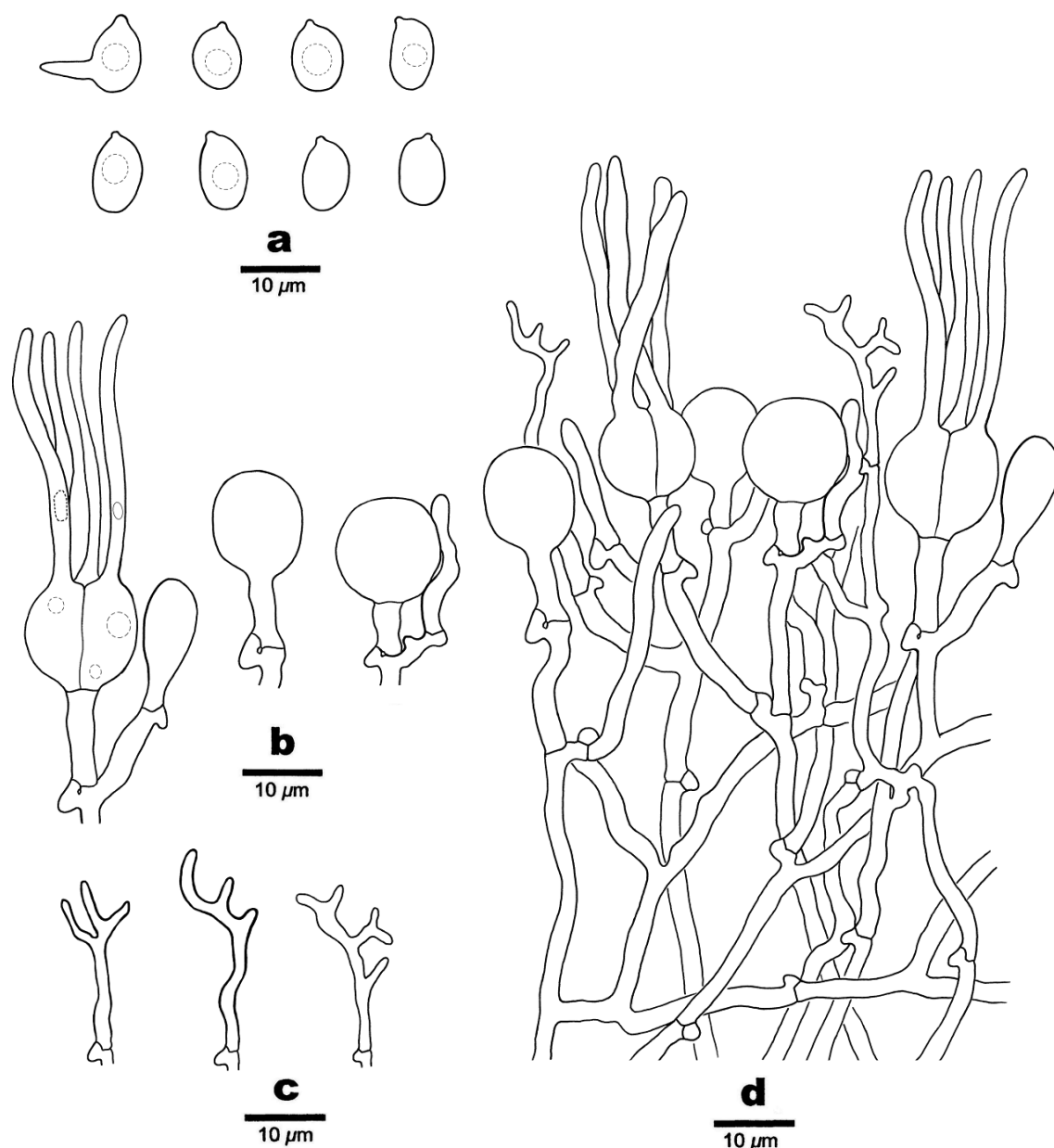


Fig. 39 Line drawings of microscopic structures of *Myxarium yunnanense*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μ m.

Basidiomata tough-gelatinous or gelatinous when fresh, semi-translucent, first almost white, then yellowish or brownish, resupinate or sub-orbicular to cerebriform; hymenial surface densely papillate, cartilaginous; hyphidia present, simple or branched; basidia longitudinally septate, 4-celled, ellipsoid to ovoid or subglobose to globose; basidiospores allantoid or broadly cylindrical.

Notes: *Tremellochaete* was described by Raitviir (1964), with *T. japonica* (= *Exidia japonica* Yasuda) as the type species, because it has distinctly denser papillae than *Exidia*. However, the genus was considered a synonym of *Exidia* (Roberts & Spooner 1998; Kirk et al. 2008) until Malysheva & Spirin (2017) reinstated it based on phylogenetic analyses. Nowadays, *Tremellochaete* has been accepted by most researchers, and four species were recently described in this

genus (Alvarenga et al. 2019; Phookamsak et al. 2019; Tohtirjap et al. 2023).

Currently, eight legitimate names of *Tremellochaete* are recorded according to Index Fungorum (<http://www.indexfungorum.org>) and MycoBank (<https://www.mycobank.org>), among them, five species have been confirmed by molecular data. According to our studies, three *Tremellochaete* species were identified based on our samples, of which *T. australiensis* F. Wu et al. was described in our previous publication (Tohtirjap et al. 2023), and *T. atlantica* Alvarenga and *T. japonica* were identified as known species (Ye et al. 2020; Tohtirjap et al. 2023; Figs. 1, 44), furthermore, the key morphological characteristics of the three species based on our samples are described in Table 2.

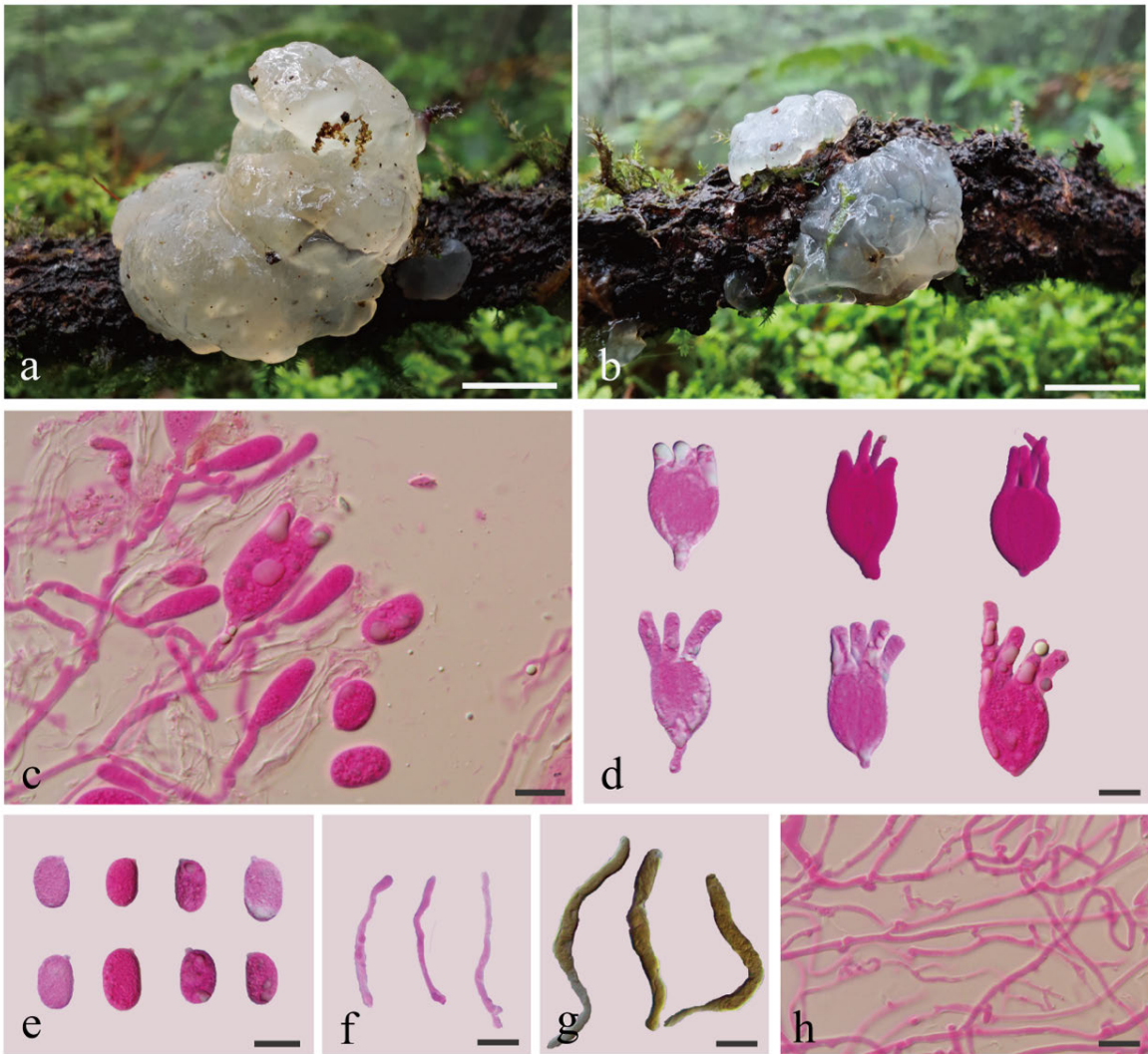


Fig. 40 Photos of basidiomata and microscopic structures of *Protohydnum translucidum*. a–b Basidiomata. c A section of hymenium. d Basidia. e Basidiospores. f Hyphidia. g Gloeocystidia. h Hyphae. Scale bars = a–b 1 cm, c–h 10 µm.

Table 2 A comparison of morphology of jelly fungi of Auriculariales with longitudinally septate basidia based on our samples.						
Species	Basidiomata color	Papilla	Basidia (µm)	Spores (µm)	Hyphidia	Cystidia
<i>Exidia abieticola</i>	white to brownish vinaceous	absent	11–13.8 × 8–11.2	8–10.2 × 3.8–4.5	distinctly branched	absent
<i>E. brunnea</i>	bluish gray to fawn	absent	12–14.8 × 7.8–10.2	11.8–13.1 × 2.8–3.8	simple	absent
<i>E. candida</i>	buff yellow to reddish brown	absent	10.5–16.2 × 8.5–11.2	12.2–15.5 × 4–5.5	distinctly branched	present
<i>E. crenata</i>	reddish brown to fuscous	absent	14.2–18.5 × 8–12.5	12–14 × 3–4	branched	absent
<i>E. ellipsospora</i>	white to clay buff	absent	12.5–15 × 9.2–10.2	8–9.2 × 5.5–6.8	slightly branched	absent
<i>E. glandulosa</i>	vinaceous gray to black or white	sparse	11.5–14.5 × 11.2–13	10.5–14 × 3.5–4.5	simple or branched	absent
<i>E. latispora</i>	white to fawn	absent	11–19.5 × 8–15.5	12.2–16.2 × 4.5–7.8	simple or branched	absent
<i>E. minor</i>	translucent to white	sparse	11.8–13.8 × 10–12.5	10.2–13.8 × 4–5.2	distinctly branched	absent
<i>E. ningxiaensis</i>	light vinaceous gray	absent	10–12.5 × 9.8–11	13.8–17.2 × 3.2–4.2	distinctly branched	absent
<i>E. nivea</i>	cream to white	absent	12–16.5 × 10.2–14.8	12.8–16 × 4–5	simple	absent

Species	Basidiomata color	Papilla	Basidia (μm)	Spores (μm)	Hyphidia	Cystidia
<i>E. orientalis</i>	black	absent	10–13.2 × 8.5–10.5	12.2–14 × 3–3.8	simple	absent
<i>E. pithya</i>	black	sparse	15.5–19 × 9.5–14	10.2–13 × 3.5–5	simple	absent
<i>E. qinghaiensis</i>	fawn to orange-brown	absent	8.8–12.5 × 8.2–11.2	12.3–14.3 × 2.6–3.5	branched	absent
<i>E. recisa</i>	reddish brown	absent	8.5–15.5 × 7.5–11.5	13–15.5 × 2.8–3.8	simple	absent
<i>E. reflexa</i>	black	absent	9.2–11.5 × 7.2–10.2	9.2–10.5 × 2–2.8	branched	absent
<i>E. repanda</i>	orange-brown to reddish brown	absent	10–16 × 7–10	12.7–15.7 × 2.8–3.7	simple	absent
<i>E. saccharina</i>	fawn to orange-brown	sparse	12–15.2 × 8–12	10–14.2 × 3.5–4.5	simple	absent
<i>E. separata</i>	black	absent	15.5–20.2 × 13.5–17	17.2–21.5 × 5–6	distinctly branched	absent
<i>E. sinocystidiata</i>	white to fawn or hyaline	absent	9.2–14 × 9.5–12	13–15.5 × 4.5–5.2	distinctly branched	present
<i>E. sinothuretiana</i>	white to clay pink	absent	18.2–23.5 × 16.2–18.2	17.5–22 × 6.2–8	distinctly branched	absent
<i>E. subglandulosa</i>	black	absent	11.8–14.2 × 8.5–10.5	14.2–16.5 × 3.5–4.5	branched	absent
<i>E. subsaccharina</i>	reddish brown to vinaceous brown	sparse	13–15.5 × 8.5–11.8	10–14.2 × 3.2–4.5	simple	absent
<i>E. subtropica</i>	fawn to reddish brown	sparse	16.5–19.8 × 10.2–14.5	18.8–25.2 × 4.8–6.5	distinctly branched	absent
<i>E. subtruncata</i>	black	sparse	9.8–13.5 × 9–10.2	12.2–15.5 × 3.5–4.2	distinctly branched	absent
<i>E. truncata</i>	black	sparse	15.0–19.5 × 12.8–14	13.0–15.8 × 4.2–5.2	simple	absent
<i>E. uvapassa</i>	clay pink to cinnamon	sparse	12.5–16.2 × 10.5–13.8	15.5–18.5 × 5.2–6.5	simple or branched	absent
<i>E. yadongensis</i>	reddish brown to fuscous	absent	11.8–17.8 × 8.5–11.5	12.5–15.8 × 3.5–4.2	simple or branched	absent
<i>Myxarium atroalbum</i>	white to black	absent	11.5–12.5 × 10.5–12	9–11.5 × 4.5–5.8	distinctly branched	absent
<i>M. boreale</i>	yellowish white	absent	10–11 × 9–10	11.5–13.2 × 3.4–4.4	branched	absent
<i>M. miniatum</i>	fawn to fuscous	absent	9.8–10.2 × 8–8.8	9.8–11.5 × 2.8–3.2	distinctly branched	absent
<i>M. resupinatum</i>	semi-translucent, ash gray	absent	8.2–10.5 × 7.5–10.2	6.5–7.8 × 4–4.6	branched	absent
<i>M. subnucleatum</i>	translucent, white	absent	11.5–13.2 × 7.8–9.5	11.5–13.2 × 6.2–7.8	absent	absent
<i>M. yunnanense</i>	translucent, white	absent	11–12.5 × 11–12	9–10.8 × 5–6.2	slightly branched	absent
<i>Protohydnum translucidum</i>	translucent to white	absent	17.2–24.5 × 14.5–18.8	13–15 × 7.2–9	simple	present
<i>Pseudohydnum abietinum</i>	pale clay pink	absent	9.5–12 × 7.5–12	6–7.5 × 5–6.3	simple	absent
<i>Ps. gelatinosum</i>	white to cream	absent	9.2–13 × 8.5–12	5–6 × 4.5–5.5	simple	absent
<i>Ps. himalayanum</i>	clay pink to cinnamon	absent	12–17.5 × 6–13.5	7–8.5 × 6–7.2	simple	absent
<i>Ps. incarnatum</i>	flesh pink	absent	12–15 × 9–12	6–8.2 × 5–6.2	branched	present
<i>Ps. orbiculare</i>	grayish brown to reddish brown	absent	10–14 × 10	6.5–7.9 × 5.6–6.8	simple	absent
<i>Ps. sinobisporum</i>	ivory	absent	11–11.5 × 9–12	7.5–9.5 × 5.8–7.2	simple	absent
<i>Ps. sinogelatinosum</i>	pinkish buff to cinnamon buff	absent	12–15 × 10–12	7–9 × 6–7.2	simple	absent
<i>Ps. tasmanicum</i>	vinaceous gray to smoke gray	absent	12–15 × 10–11	7.2–9 × 6–7.2	simple	absent
<i>Ps. totarae</i>	grayish brown to	absent	9–13 × 8	5.5–6.5 × 4.8–5.7	simple	absent

	reddish brown					
<i>Ps. translucens</i>	white	absent	11–14 × 10.5–13	7.2–8.5 × 6–7	simple	absent
<i>Tremellochaete atlantica</i>	white to ash gray or brownish	dense	10–12.8 × 9–10.8	10–11.8 × 4–4.8	distinctly branched	absent
<i>T. australiensis</i>	white to grayish blue	dense	13–15.8 × 11.5–15	13.8–16.2 × 4.8–6.5	simple	absent
<i>T. japonica</i>	white to ash gray or brownish	dense	9.2–12.5 × 9–11.8	10.2–13.8 × 3.5–4.2	branched	absent

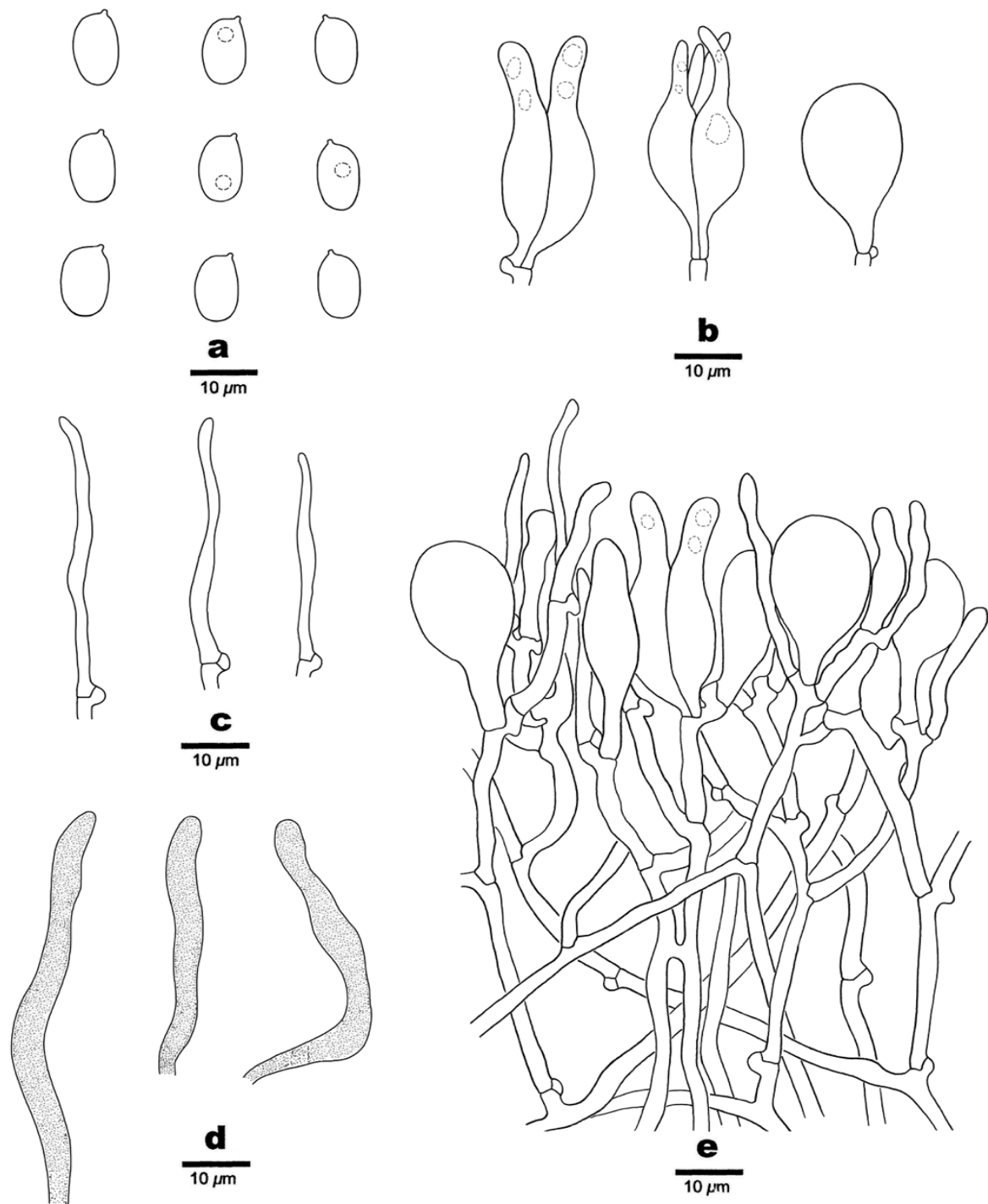


Fig. 41 Line drawings of microscopic structures of *Protohydnum translucidum*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d Gloeocystidia. e A section of hymenium. Scale bars = a–e 10 μm.

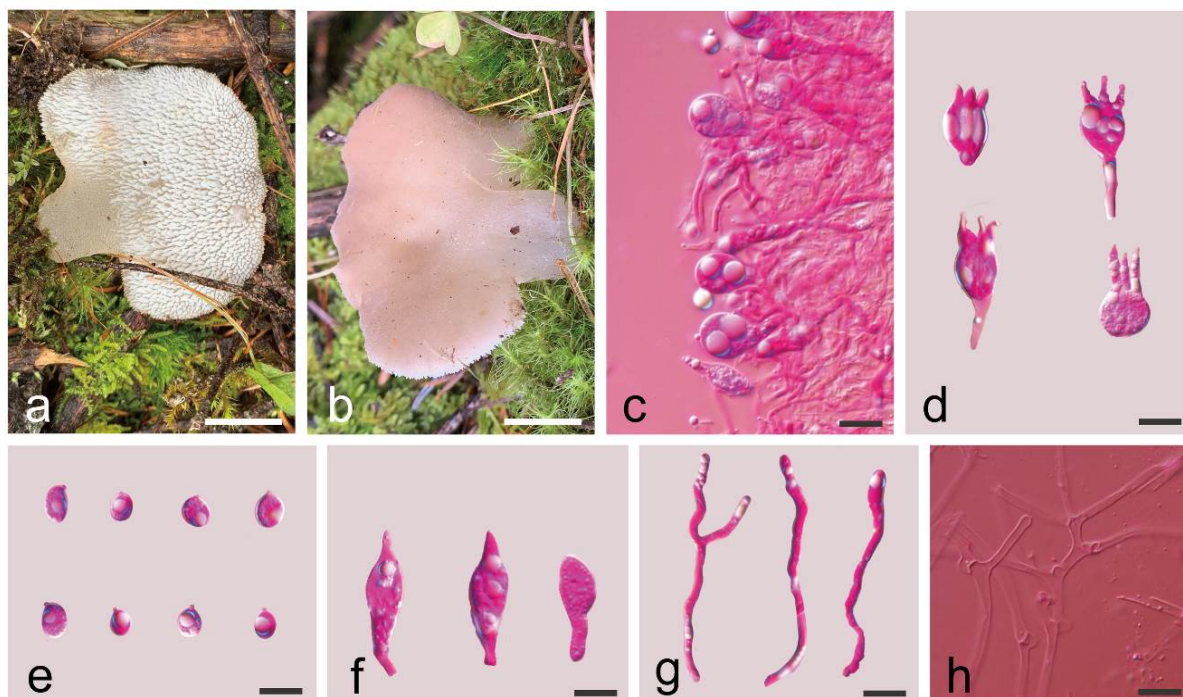


Fig. 42 Photos of basidiomata and microscopic structures of *Pseudohydnum incarnatum*. a–b Basidiomata. c A section of hymenium. d Basidia. e Basidiospores. f Cystidia. g Hyphidia. h Hyphae. Scale bars = a–b 1 cm, c–h 10 μ m.

Tremellales Fr. [as 'Tremellinae'], Syst. mycol. (Lundae) 1: 2 (1821).

The order was established by Fries (1821) based on Tremellaceae. Most of the teleomorphic species in the order have gelatinous basidiomata with longitudinally, obliquely, or transversely septate basidia (Bandoni 1987; Chen 1998; Weiss et al. 2014; Liu et al. 2015b), but some are invisible and parasitic on other fungi, and most species grow as yeasts in the haploid stages (Weiss et al. 2014; Liu et al. 2015b; Jiang et al. 2024; Feng et al. 2025). Recently, some teleomorphic species were newly described in the order, but most of them are lichenicolous species (Spirin et al. 2018c; Zhao et al. 2019; Fan et al. 2021a; Thomas & Kumar 2023; Pérez et al. 2024). Non-lichenicolous jelly fungi of the order usually have large gelatinous basidiomata with tremelloid basidia, and they are the important group with edible and medicinal values (Wu et al. 2019; Geng et al. 2020). However, the species diversity of the jelly fungi in Tremellales is not well known, only a few species were recently described (Spirin et al. 2018c; Zhao et al. 2019; Fan et al. 2021a; Thomas & Kumar 2023).

In this study, jelly fungi of Tremellales with tremelloid basidia were studied based on our samples. A total of 55 species belonging to five genera of the order was identified. We provide a brief introduction of these five genera (*Naematelia*, *Phaeotremella*, *Pseudotremella*, *Sirobasidium*, and *Tremella*), propose one new combination and describe 26 new species.

Naematelia Fr., Observ. mycol. 2: 370 (1818).

Type species: Naematelia encephala (Pers.) Fr.

Basidiomata gelatinous when fresh, pale yellow, golden yellow, bright orange or reddish, subglobose, tuberculate or

cerebriform, separate or caespitose; hyphae with clamp connections; hyphidia present or absent; haustoria usually present; basidia globose to subglobose or ellipsoid to pyriform, longitudinally or obliquely septate, 2–4-celled; basidiospores usually globose to subglobose, hyaline, thin-walled.

Notes: *Naematelia* is characterized by having usually gelatinous, subglobose or tuberculate, yellowish basidiomata, clamped hyphae, tremelloid basidia and globose to subglobose basidiospores. The genus was established by Fries (1818) and typified by *N. encephala* that was transferred from *Tremella encephala* Pers. However, the position of *T. encephala* was restored by some researchers (Chen 1998; Millanes et al. 2011; Liu et al. 2015a). Liu et al. (2015b) proposed a new family Naemateliaceae to accommodate *Naematelia* and *Dimennazyma* Xin Zhan Liu et al., and four species previously classified as *Tremella*, including *T. encephala*, were transferred to *Naematelia* because they formed a strongly supported monophyletic clade in the phylogeny.

Currently, 20 legitimate names of *Naematelia* are recorded according to Index Fungorum (<http://www.indexfungorum.org>) and MycoBank (<https://www.mycobank.org>), among them, eight species have been confirmed by molecular data. According to our studies, two species were identified as *Naematelia* based on our samples, viz., *N. nodulosa* Zhu L. Yang & J.Y. Tang and *N. encephala* (Figs. 3, 45). The descriptions of *N. nodulosa* and *N. encephala* refer to Chen (1998) and Tang & Yang (2024), and the key morphological characteristics of the two species based on our samples can be seen in Table 3.

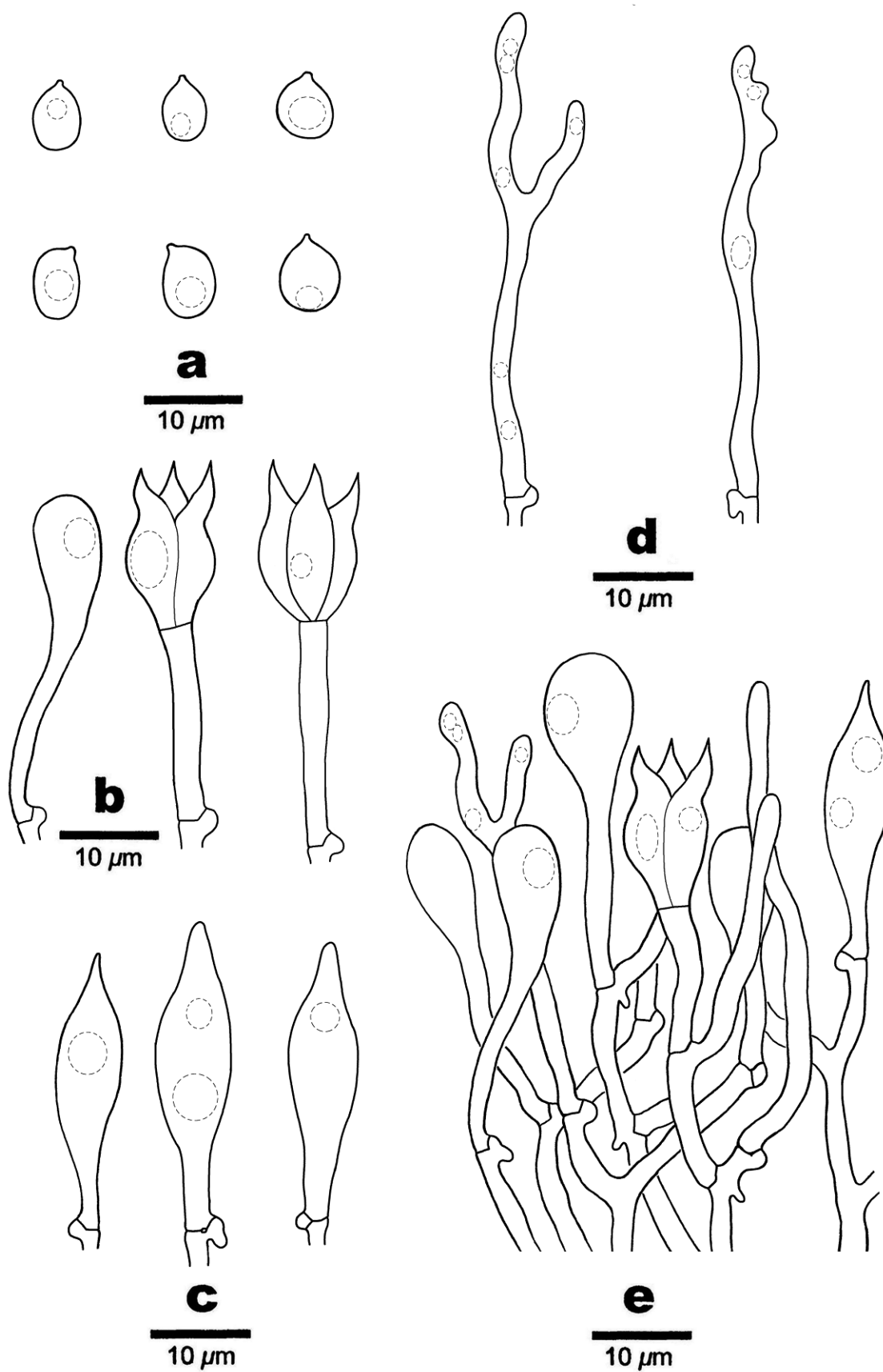


Fig. 43 Line drawings of microscopic structures of *Pseudohydnum incarnatum*. a Basidiospores. b Probasidia and basidia. c. Cystidia. d Hyphidia. e A section of hymenium. Scale bars = a–e 10 µm.



Fig. 44 Photos of basidiomata of known species in the Auriculariales. a *Exidia candida*. b *E. glandulosa*. c *E. qinghaiensis*. d *E. reflexa*. e *E. saccharina*. f *E. subglandulosa*. g *E. uvapassa*. h *E. yadongensis*. i *Myxarium boreale*. j *Pseudohydnum abietinum*. k *Ps. gelatinosum*. l *Ps. himalayanum*. m *Ps. sinogelatinosum*. n *Tremellochaete atlantica*. o *T. japonica*. Scale bars = a–o 1 cm.



Fig. 45 Photos of basidiomata of known species in the Tremellales. a *Naematelia encephala*. b *N. nodulosa*. c *Phaeotremella eugeniae*. d *P. foliacea*. e *P. frondosa*. f *P. roseotincta*. g *P. yunnanensis*. h *Pseudotremella nivalis*. i *Sirobasidium magnum*. j *Tremella cerebriformis*. k *T. dysenterica*. l *T. erythrina*. Scale bars = a–l 1 cm.

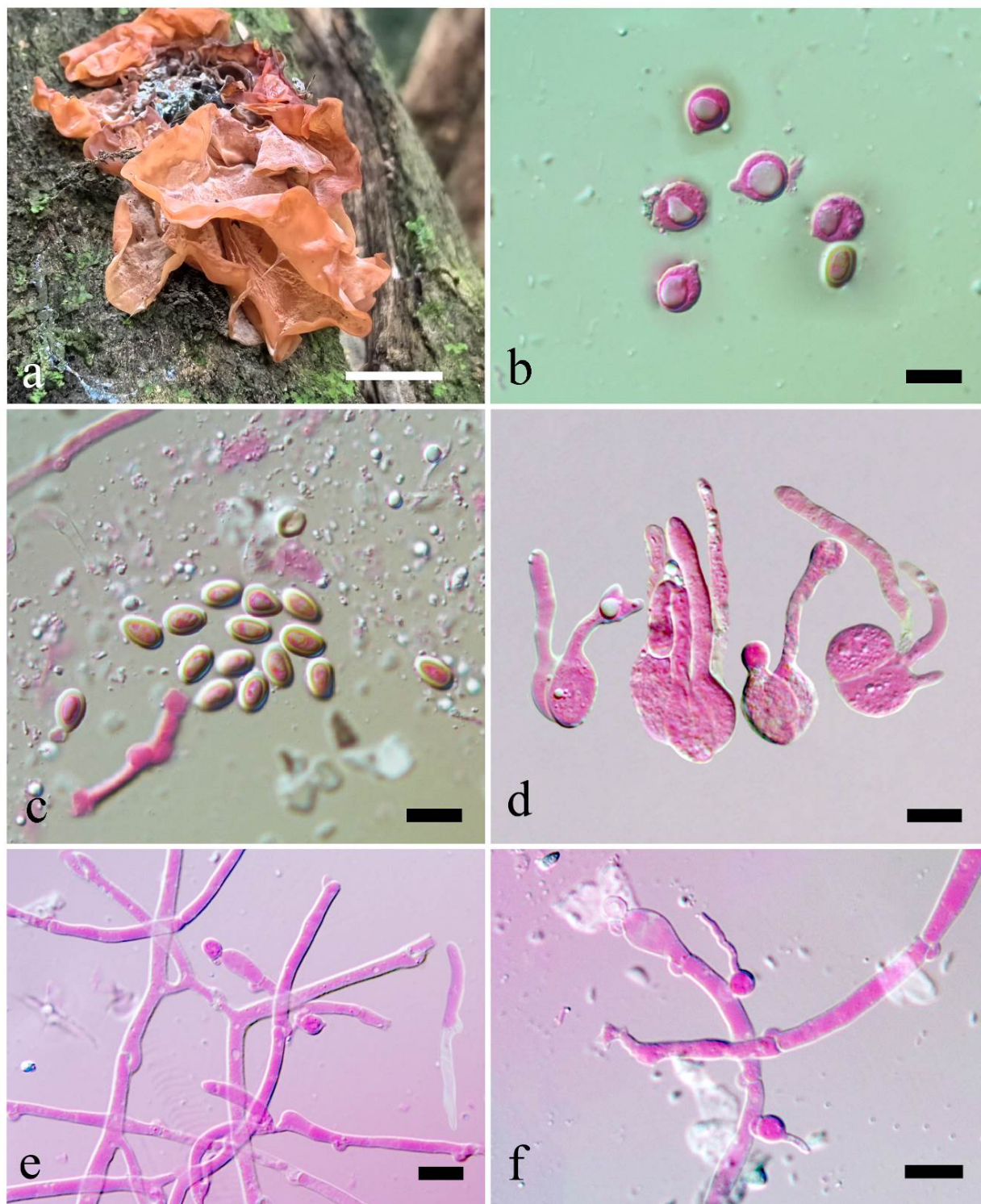


Fig. 46 Photos of basidiomata and microscopic structures of *Phaeotremella crassitunicata*. a Basidiomata. b Basidiospores. c Conidia. d Basidia. e Hyphidia and hyphae. f A swollen cell and haustoria. Scale bars = a 1 cm, b–f 10 μ m.

Phaeotremella Rea, Trans. Br. mycol. Soc. 3: 377 (1912).

Type species: Phaeotremella frondosa (Fr.) Spirin & V. Malysheva.

If present, basidiomata, gelatinous or soft gelatinous when fresh, yellowish brown, reddish brown, cream to buff, black, usually foliaceous, sessile, caespitose, sometimes pulvinate; hyphae with abundant clamp connections and sometimes with circular clamp connections; haustoria

present or not; basidia globose, subglobose, ellipsoid, ovoid, barrel-shaped or pyriform, longitudinally septate, 2–4-celled; basidiospores ellipsoid, ovoid, subglobose or globose; conidia present or not.

Notes: The genus was emended to contain two yeast species and five teleomorphic tremelloid species; *Phaeotremella pseudofoliacea* Rea was defined as the type species of the genus by Liu et al. (2015b). Tsuji et al. (2018)

revised the taxonomy of the *Phaeotremella foliacea* complex using morphological characters and molecular data and considered *P. pseudofoliacea* as a synonym of *P. frondosa*. Meanwhile, one new species was described, and two combinations were proposed by Tsuji et al. (2018). Recently, two jelly fungi (Yuan et al. 2020; Lebeuf et al. 2023) and eight yeast species were newly described (Li et al. 2020; Jiang et

al. 2024; Kachalkin et al. 2024; Feng et al. 2025). Today, the genus includes 26 species, and only nine species are jelly fungi. Our jelly samples were identified as 11 *Phaeotremella* species, of which six new species are described and illustrated in the following. The key morphological characteristics of the 11 species based on our samples are described in Table 3.

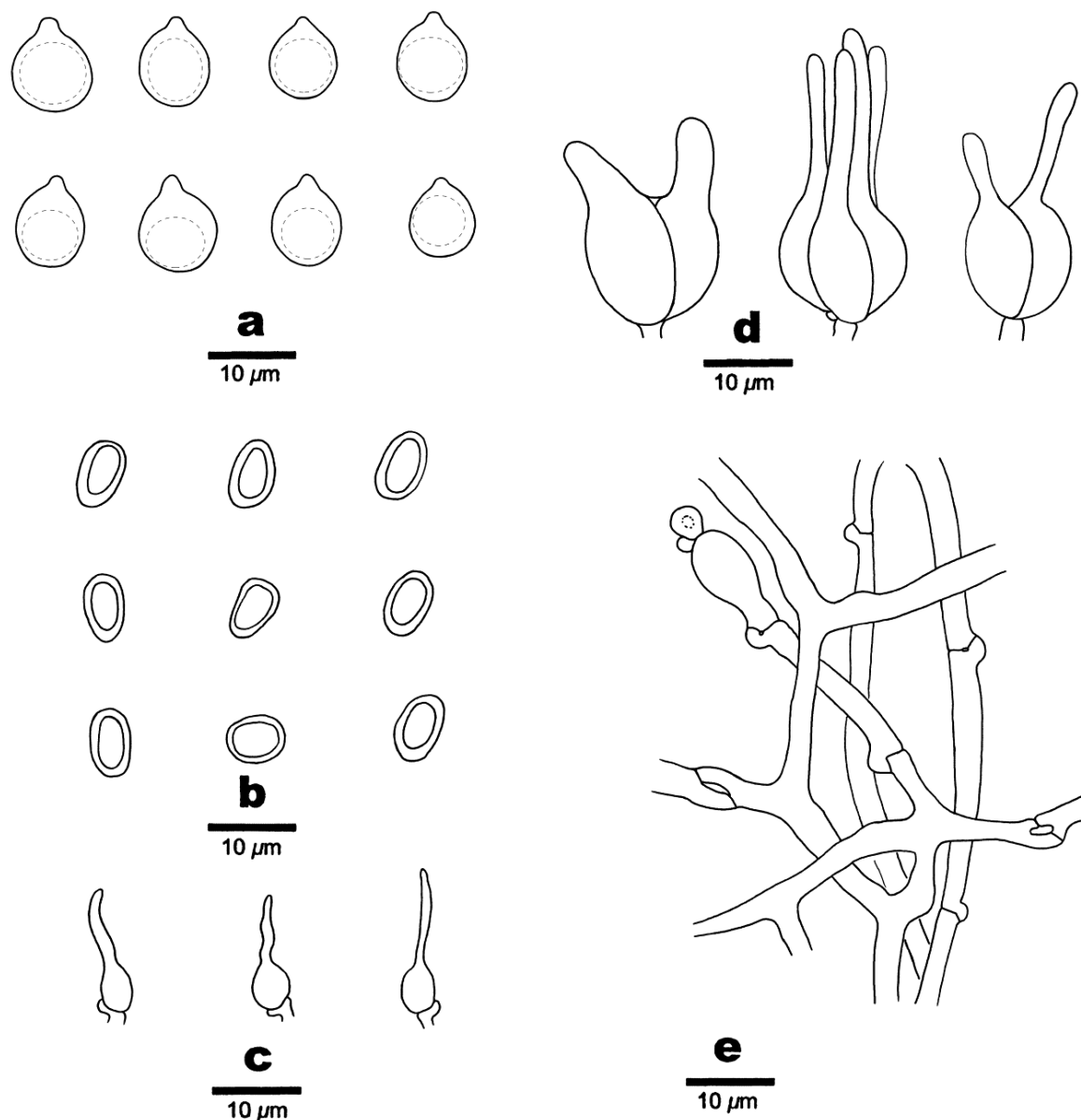


Fig. 47 Line drawings of microscopic structures of *Phaeotremella crassitunicata*. a Basidiospores. b Conidia. c Haustoria. d Probasidia and basidia. e A swollen cell and hyphae. Scale bars = a–e 10 µm.

Phaeotremella crassitunicata F. Wu, L.F. Fan & Y.C. Dai, *sp. nov.*Figs. 46, 47

Mycobank: MB 856377

Etymology: *Crassitunicata* (Lat.): refers to the species having thick-walled conidia.

Diagnosis: Similar to *Phaeotremella roseotincta* (Lloyd) Malysheva and *P. yunnanensis* L.F. Fan, F. Wu & Y.C. Dai but differs in clay pink to cinnamon, foliaceous basidiomata,

globose to subglobose haustoria, larger basidiospores, and thick-walled conidia.

Basidiomata: Gelatinous, clay pink to cinnamon when fresh, becoming fawn to fuscous when dry; foliaceous, sessile, caespitose, up to 4.5 cm long, 3.0 cm diam. and 2.0 cm high from base, with undulate lobes (not hollow), attached to substratum by a central point.

Internal features: Hyphae hyaline, thin-walled, smooth,

sometimes with a small bubble bulge, 1.0–2.5 μm diam., partly inflated in KOH, branched, interwoven, with abundant clamp connections. Hyphidia occasionally present, hyaline, thin-walled, smooth, usually derived from terminal hyphae; swollen cells rarely present and variable in shape; vesicles absent; haustoria globose to subglobose, rarely branched, derived from hyphae. Probasidia ovoid to ellipsoid; mature basidia thin-walled, ovoid to subglobose, with a basal clamp connection, sometimes diameter greater than length, 13.0–

16.2 $\times$ 11.0–15.2 μm , longitudinally septate, 2–4-celled, usually without oil drop; sterigmata up to 46.0 μm long, 2.0–5.0 μm diam., sometimes with slightly swollen apex. Basidiospores hyaline, thin-walled, smooth, ovoid to subglobose, apiculate, with one large oil drop, (8.2–)10.0–14.0 $\times$ 7.0–9.0(–10.0) μm , $L = 10.9 \mu\text{m}$, $W = 8.2 \mu\text{m}$, $Q = 1.29$ ($n = 30/1$), occasionally germinating by germ tubes. Conidia abundant, hyaline, thick-walled, smooth, ellipsoid to ovoid, variable in size, 6.4–9.2 $\times$ 4.8–6.6 μm .

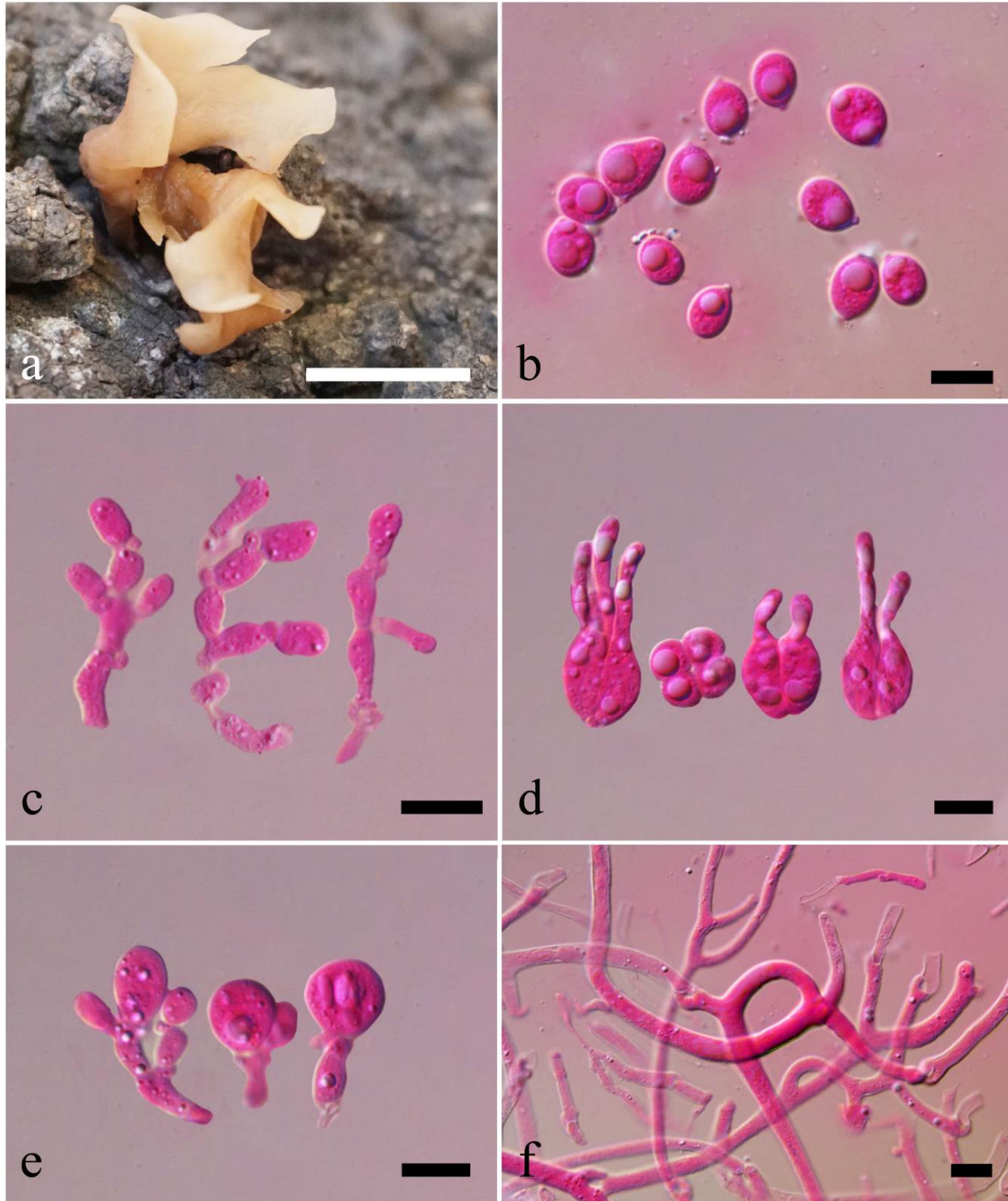


Fig. 48 Photos of basidiomata and microscopic structures of *Phaeotremella emeiensis*. a Basidiomata. b Basidiospores. c Conidial mother cells. d Basidia. e Probasidia. f Hyphae. Scale bars = a 1 cm, b–f 10 μm .

Known distribution: South China.

Specimens examined: China, Taiwan Province, Nantou County, Southern Tungyenshan, on angiosperm branch, 28 Mar 2016, C.C. Chen, Chen 3200 (TNM-F30058, **holotype**); Fujian Province, Yong'an, on angiosperm wood, F. Wu, Wu 1720 (BJFC 044768).

Notes: *Phaeotremella crassitunicata* may be confused with *P. yunnanensis* and *P. roseotincta* sharing the brownish basidiomata when dry, but *P. yunnanensis* differs from *P. crassitunicata* by its distinctly smaller basidiospores ($7.0\text{--}8.0 \times 6.0\text{--}7.3 \mu\text{m}$ vs. $10.0\text{--}14.0 \times 7.0\text{--}9.0 \mu\text{m}$) and the absence of haustoria, while *P. roseotincta* is readily distinguished from *P. crassitunicata* by its pink-tinted fresh basidiomata, the absence of haustoria and thin-walled conidia.

Phaeotremella emeiensis F. Wu, L.F. Fan & Y.C. Dai, **sp. nov.**
..... Figs. 48, 49

Mycobank: MB 856378

Etymology: *Emeiensis* (Lat.): refers to the species being found on Emei Mountain, China.

Diagnosis: Similar and phylogenetically close to *Phaeotremella fuscossuccinea* (Chee J. Chen) Spirin & Yurkov but differs in having wider basidia and basidiospores, and the absence of haustoria.

Basidiomata: Gelatinous, cream to buff when fresh, becoming tough gelatinous (leathery) and fawn to dark brown when dry; foliaceous, sessile, caespitose, up to 4.0 cm long, 2.0 cm diam. and 2.0 cm high from base, with undulate and broad lobes (not hollow), attached to substratum by a central point.

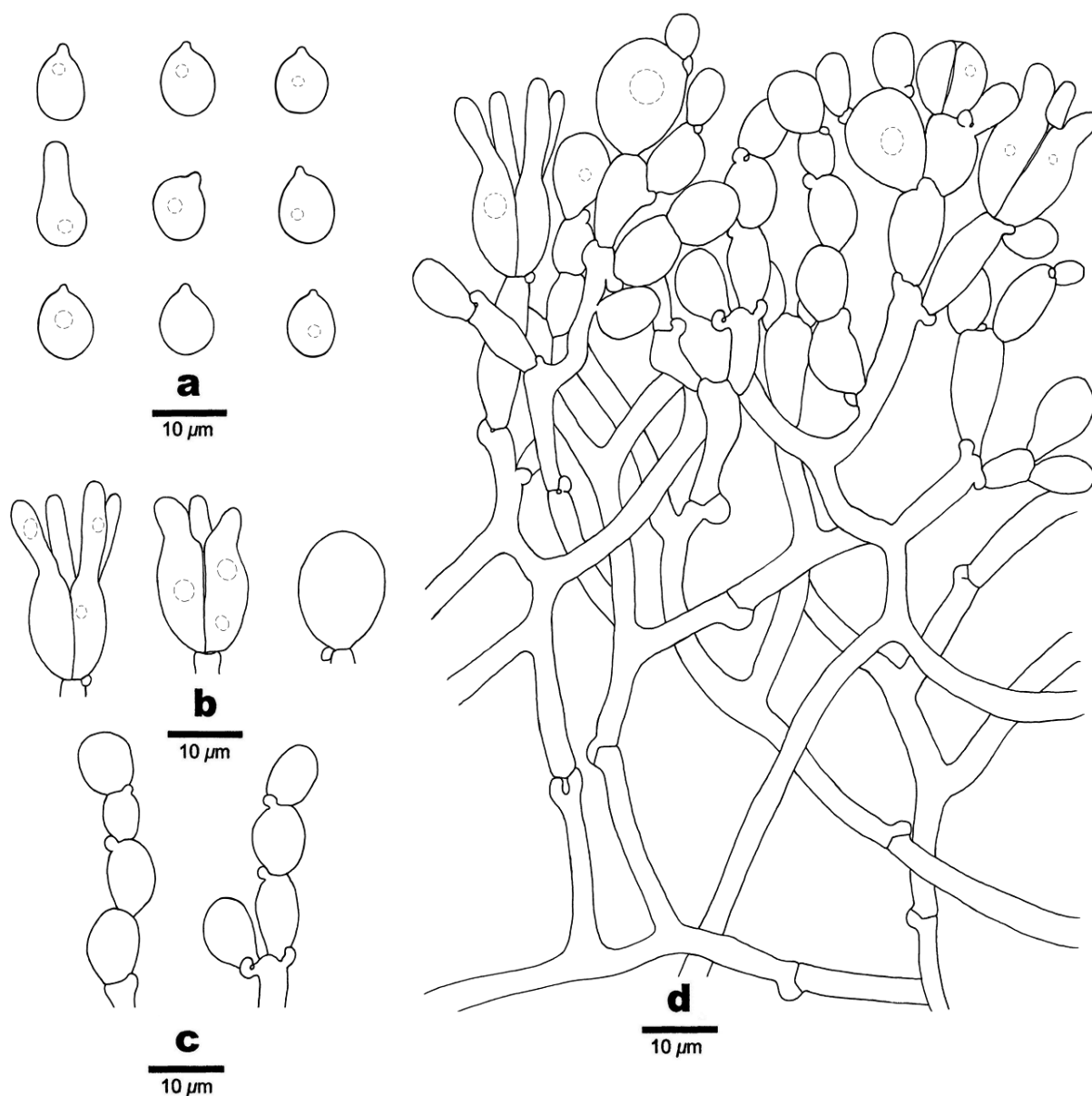


Fig. 49 Line drawings of microscopic structures of *Phaeotremella emeiensis*. a Basidiospores. b Basidia. c Conidial mother cells. d A section of hymenium. Scale bars = a–d 10 μm .

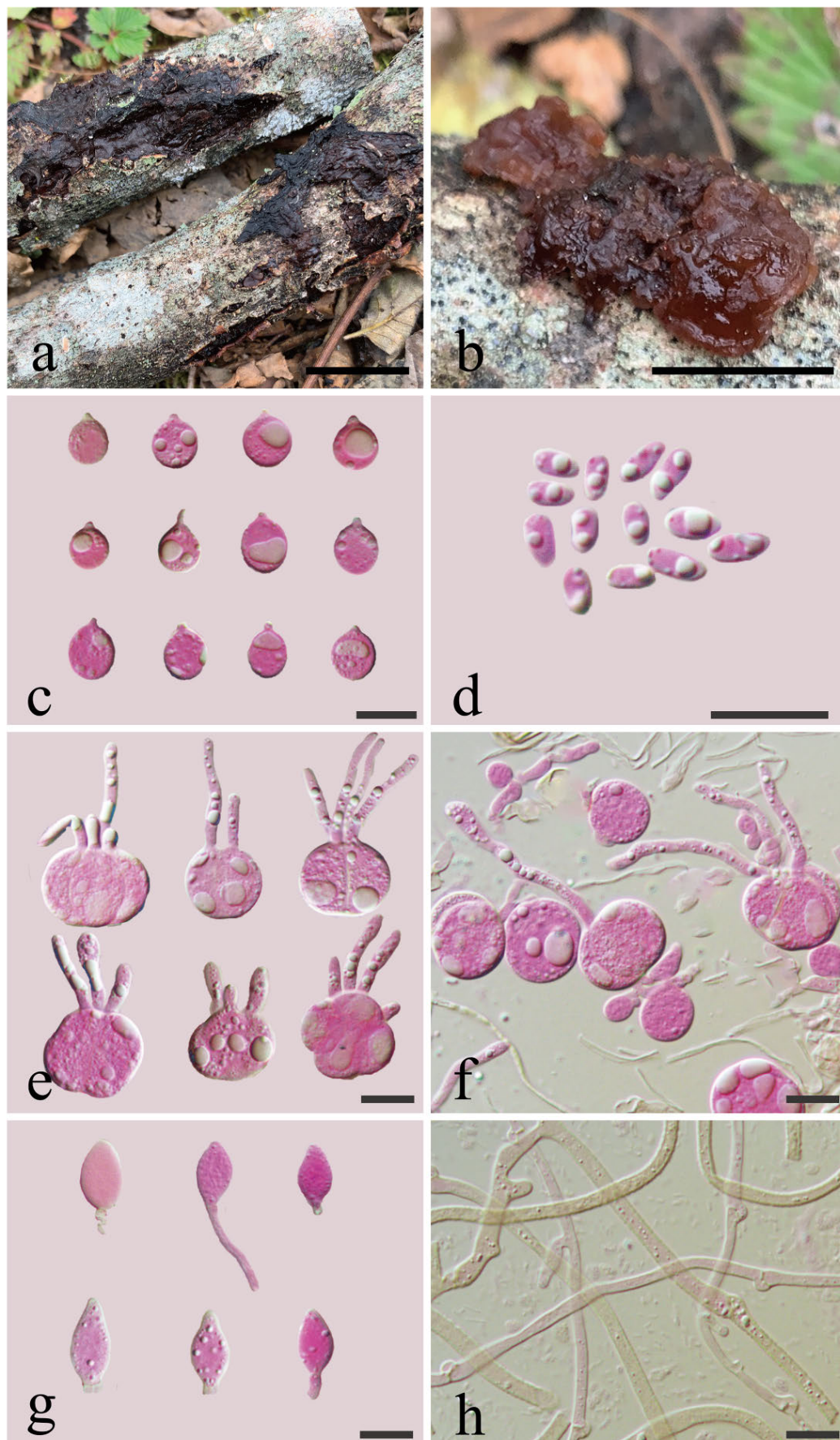


Fig. 50 Photos of basidiomata and microscopic structures of *Phaeotremella lonicericola*. a–b Basidiomata. c Basidiospores. d Conidia. e Basidia. f Basidia and probasidia. g Vesicles. h Hyphae. Scale bars = a–b 1 cm, c–h 10 μ m.

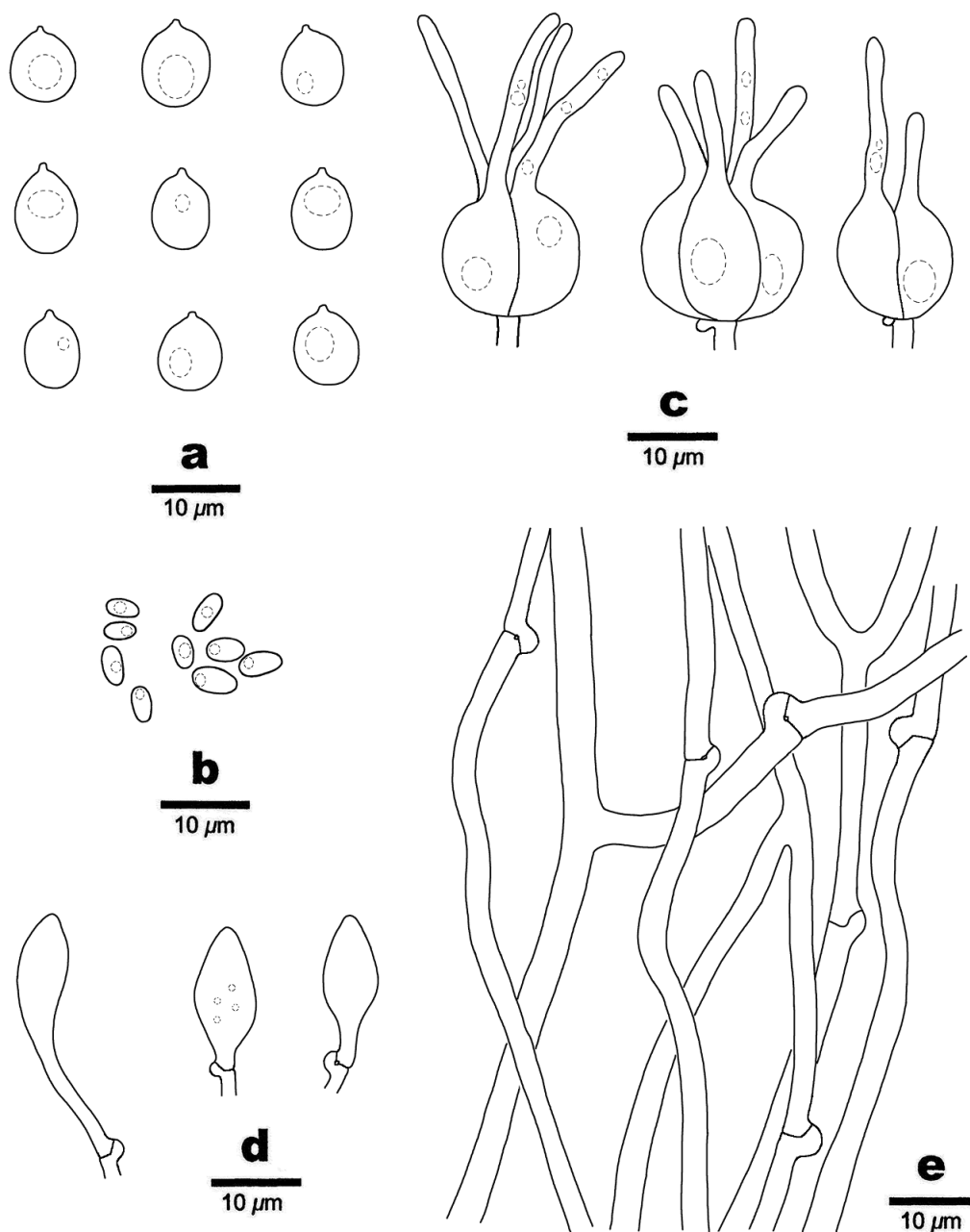


Fig. 51 Line drawings of microscopic structures of *Phaeotremella lonicericola*. a Basidiospores. b Conidia. c Basidia. d Vesicles. e Hyphae. Scale bars = a–e 10 µm.

Internal features: Hyphae hyaline, thin-walled, smooth, 2.5–8.2 µm diam., sometimes swollen up to 8.5 µm diam. in KOH, branched, interwoven, with abundant clamp connections. Hyphidia rarely present, hyaline, thin-walled, smooth, usually derived from terminal hyphae; swollen cells, vesicles and haustoria absent. Probasidia ovoid, subglobose or ellipsoid; mature basidia thin-walled, ellipsoid to barrel-shaped, with a basal clamp connection, 12.3–16.3 × 10.4–14.9 µm, usually longitudinally septate, 2–4-celled, with obvious oil drops; sterigmata up to 25.0 µm long, 2.5–5.9 µm diam., with slightly swollen apex. Basidiospores hyaline, thin-walled, smooth, broadly ellipsoid to ovoid, apiculate, with one to a

few oil drops, 8.0–10.9 × 6.7–9.3 µm, $L = 9.46$ µm, $W = 7.72$ µm, $Q = 1.23$ ($n = 60/1$), occasionally germinating by germ tubes. Conidia hyaline, thin-walled, smooth, cylindrical or allantoid to oblong-ellipsoid, originating from conidial mother cells, 3.1–6.8 × 3.2–5.5 µm.

Known distribution: Southwest China.

Specimen examined: China, Sichuan Province, Leshan, Emei Mountain, on living gymnosperm tree, 22 Aug 2017, F. Wu, Wu 27 (BJFC 026033, **holotype**).

Notes: *Phaeotremella emeiensis* is closely related to *P. fuscusuccinea* and *P. sparassidis* in our phylogeny (Fig. 3), however, *P. fuscusuccinea* differs from *P. emeiensis* by its

thinner basidia (8.0–10.5 μm vs. 10.4–14.9 μm diam.) and basidiospores (5.0–7.0 μm vs. 6.7–9.3 μm diam.) and the presence of haustoria (Chen 1998), while *P. sparassidis* differs by its *Sparassis*-like basidiomata when fresh, distinctly larger basidia (17.3–20.0 $\times$ 12.7–18.7 μm vs. 12.3–16.3 $\times$ 10.4–14.9 μm) and the absence of conidia.

Phaeotremella lonicericola F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.*Figs. 50, 51

Mycobank: MB 856381

Etymology: *Lonicericola* (Lat.): refers to the species that grows on *Lonicera*.

Diagnosis: Differs from other species in the genus by orange-brown to fuscous, cerebriform to foliaceous basidiomata, abundant spindle-shaped vesicles, and growth on *Lonicera* sp.

Basidiomata: Gelatinous, orange-brown to fuscous when fresh, becoming fragile and vinaceous brown to black when dry; cerebriform to foliaceous, sessile, caespitose, up to 2.0 cm long, 1.5 cm diam. and 0.5 cm high from base, with undulate lobes (not hollow), attached to substratum by a central point.

Internal features: Hyphae hyaline, thin-walled to slightly thick-walled, smooth or with bubble bulge, 2.5–5.0 μm diam., uninflated in KOH, branched, interwoven, with abundant clamp connections. Hyphidia absent; spindle-shaped vesicles frequent; swollen cells occasionally present, thick-walled, ellipsoid; haustoria absent. Probasidia mostly globose; mature basidia thin-walled, globose to oblate globose, with a basal clamp connection, 13.0–17.0 $\times$ 14.5–20.0 μm , usually diameter greater than length, longitudinally septate, 2–4-celled, with obvious oil drops; sterigmata up to 60.0 μm long, 2.0–3.5 μm diam., sometimes with swollen apex. Basidiospores hyaline, thin-walled, smooth, ovoid to subglobose, apiculate, usually with one or two oil drops, (8.5–)8.8–11.2(–11.8) $\times$ (6.5–)6.8–8.8(–9.2) μm , $L = 9.92 \mu\text{m}$, $W = 7.64 \mu\text{m}$, $Q = 1.28\text{--}1.31$ ($n = 60/2$), germinating by budding or germination tubes. Conidia abundant, hyaline, thin-walled, smooth, variable in shape, mostly ellipsoid, cylindrical, or ovoid, 3.2–5.5 $\times$ 2.2–3.0 μm , probably originating from hyphae, because conidial mother cells not observed.

Known distribution: Southwest China.

Specimens examined: China, Sichuan Province, Luding County, Hailuoguo Forest Park, on dead tree of *Lonicera* sp., 8 Oct 2021, Y.C. Dai, Dai 23169 (BJFC 037740, **holotype**), Dai 23170 (BJFC 037741).

Notes: In the phylogeny (Fig. 3), the species formed one independent lineage. Morphologically, the species differs from other species in the genus by orange-brown to fuscous, cerebriform to foliaceous basidiomata, abundant spindle-shaped vesicles, and growth on *Lonicera* sp.

Phaeotremella rigida F. Wu, G.M. Gates & Y.C. Dai, *sp. nov.*Figs. 52, 53

Mycobank: MB 856382

Etymology: *Rigida* (Lat.): refers to the species having very rigid basidiomata when dry.

Diagnosis: Similar to *Naematelia nodulosa* and *Tremella mesenterica* but differs in having very hard basidiomata when dry, smaller basidia and basidiospores, abundant haustoria, and lacking swollen cells and vesicles.

Basidiomata: Gelatinous, white to cream when fresh, becoming very hard and buff yellow when dry; cerebriform,

sessile, separate or coalesced when mature, up to 5.1 cm long, 3.8 cm diam. and 1.2 cm high from base, with undulate lobes (not hollow), attached to substratum by a central point.

Internal features: Hyphae hyaline, thin- to slightly thick-walled, smooth, 0.8–5.4 μm diam., slightly inflated in KOH, branched, interwoven, with abundant clamp connections. Hyphidia present but not in clusters, hyaline, thin-walled, smooth, some terminally tenuous, usually derived from terminal hyphae; swollen cells and vesicles absent; haustoria abundant, variable in shape, branched. Probasidia ovoid to subglobose, sometimes produced from the same normal hyphae or swollen hyphae with clamps in chains and close to each other; mature basidia thin-walled, subglobose, with a basal clamp connection, 10.3–19.0 $\times$ 9.0–18.0 μm , usually longitudinally septate, 2–4-celled, with obvious oil drops; sterigmata up to 50.0 μm long, 1.6–2.5 μm diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, globose to subglobose, apiculate, without oil drop, 6.0–9.2(–10.0) $\times$ 6.0–9.0 μm , $L = 7.5 \mu\text{m}$, $W = 7.23 \mu\text{m}$, $Q = 1.08\text{--}1.12$ ($n = 60/2$), occasionally germinating by germ tubes or budding; conidia hyaline, thin-walled, smooth, cylindrical to oblong-ellipsoid or ovoid, originating from conidiophores interspersed in the inner part of the basidiomata and in a pile, 3.0–6.0 $\times$ 1.8–3.0 μm .

Known distribution: Australia and south China.

Specimens examined: Australia, Victoria, Midlands, southwest of Hepburn, Tipperary Track, south of Bryces Flat, on dead tree of *Eucalyptus* sp., 26 Sep 1997, J.H. Ross, Ross 3986 (MEL 2041099). China, Jiangxi Province, Jiujiang, Lushan, on fallen angiosperm branch, 17 Aug 2018, F. Wu, Wu 91 (BJFC 028001); Zhejiang Province, Hangzhou, Huanggongwang Forest Park, on fallen angiosperm branch, 23 Mar 2023, F. Wu, Wu 632 (BJFC 040628, **holotype**).

Notes: Morphologically, *Phaeotremella rigida* is very similar to *Tremella mesenterica* and *Naematelia nodulosa* in color when dry, but *T. mesenterica* differs from *P. rigida* by its softer basidiomata when dry, distinctly larger basidia (17.0–26.0 $\times$ 15.0–21.0 μm vs. 10.3–19.0 $\times$ 9.0–18.0 μm), longer basidiospores (9.0–11.0 μm vs. 6.0–9.2 μm in length) and the presence of swollen cells and vesicles. *Naematelia nodulosa* differs from *P. rigida* by its pale yellow to lemon yellow basidiomata when fresh and distinctly larger basidiospores (8.8–13.5 $\times$ 8.0–13.0 μm vs. 6.0–9.2 $\times$ 6.0–9.0 μm). *Tremella australiensis* Lloyd was also described from Victoria and reported to have a distribution in southern China, but *T. australiensis* has deep yellow basidiomata when fresh, big and thick, yellowish to rust-colored basidiomata when dry (up to 10 cm diam.), larger oval to pyriform and clavate basidia with irregular septae (14–23 $\times$ 12–15 μm , often two basidia in chains), swollen cells in juvenile basidiomata, and hyphidia are absent (Chen 1998). We did not collect any samples morphologically similar to *T. australiensis*, and DNA sequences of *T. australiensis* are unavailable. So, the taxonomy of *T. australiensis* is uncertain, but it probably belongs to *Phaeotremella* because of its morphological similarities with *P. rigida* or *Sirobasidium* species by sharing basidia in chains and rust-colored basidiomata. In addition, this species has abundant haustoria, and it was found on dead tree of *Eucalyptus* sp. in Australia, and on angiosperm wood in China, suggesting that this species may be parasitic on other fungi and mainly grow on angiosperm wood, but we have not observed the obvious fruiting body of the host fungi, so the host fungi can not be confirmed.

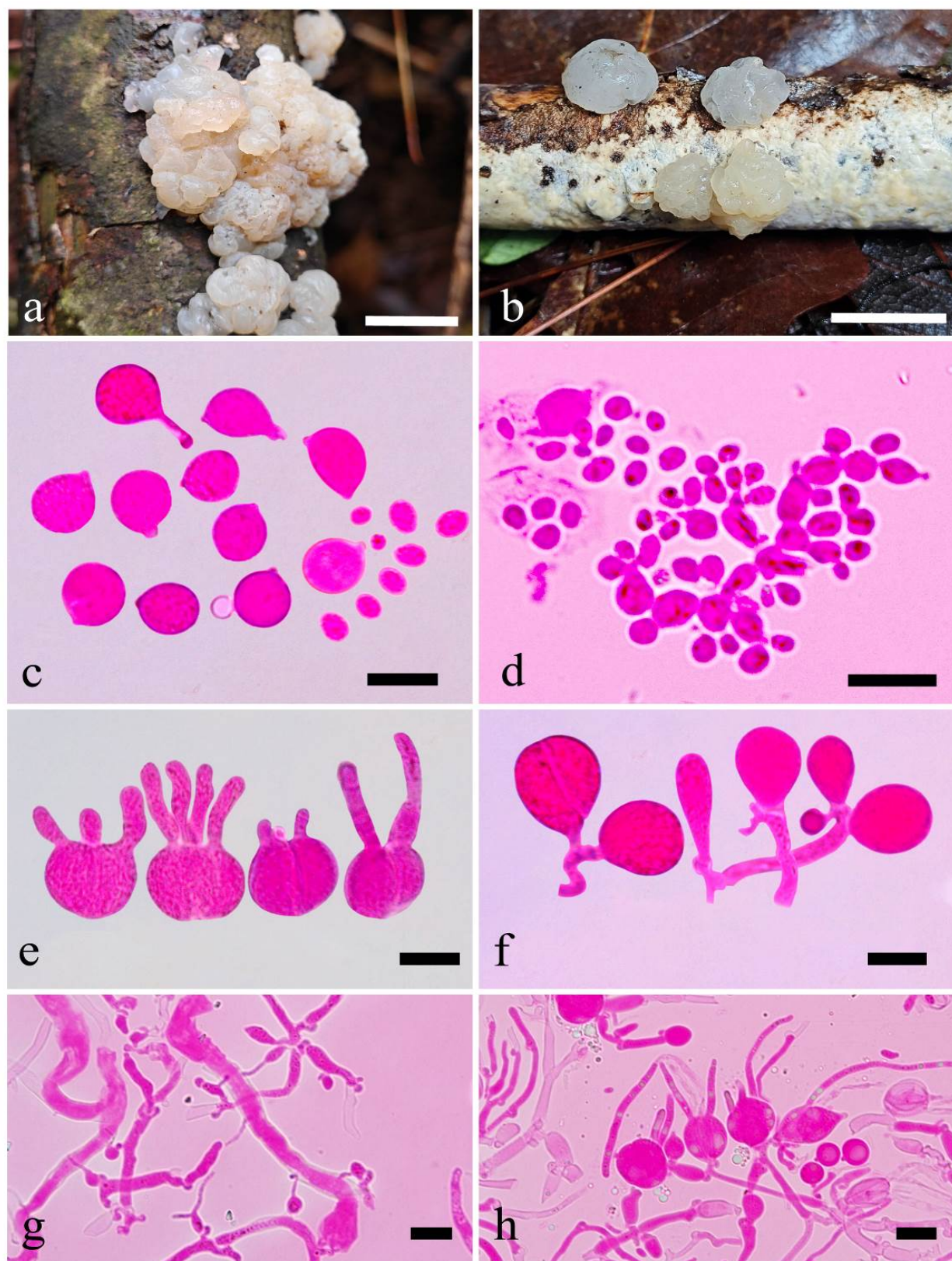


Fig. 52 Photos of basidiomata and microscopic structures of *Phaeotremella rigida*. a–b Basidiomata. c Basidiospores and secondary spores. d Conidia. e Basidia. f Probasidia. g Haustoria. h A section of hymenium. Scale bars = a–b 1 cm, c–h 10 µm.

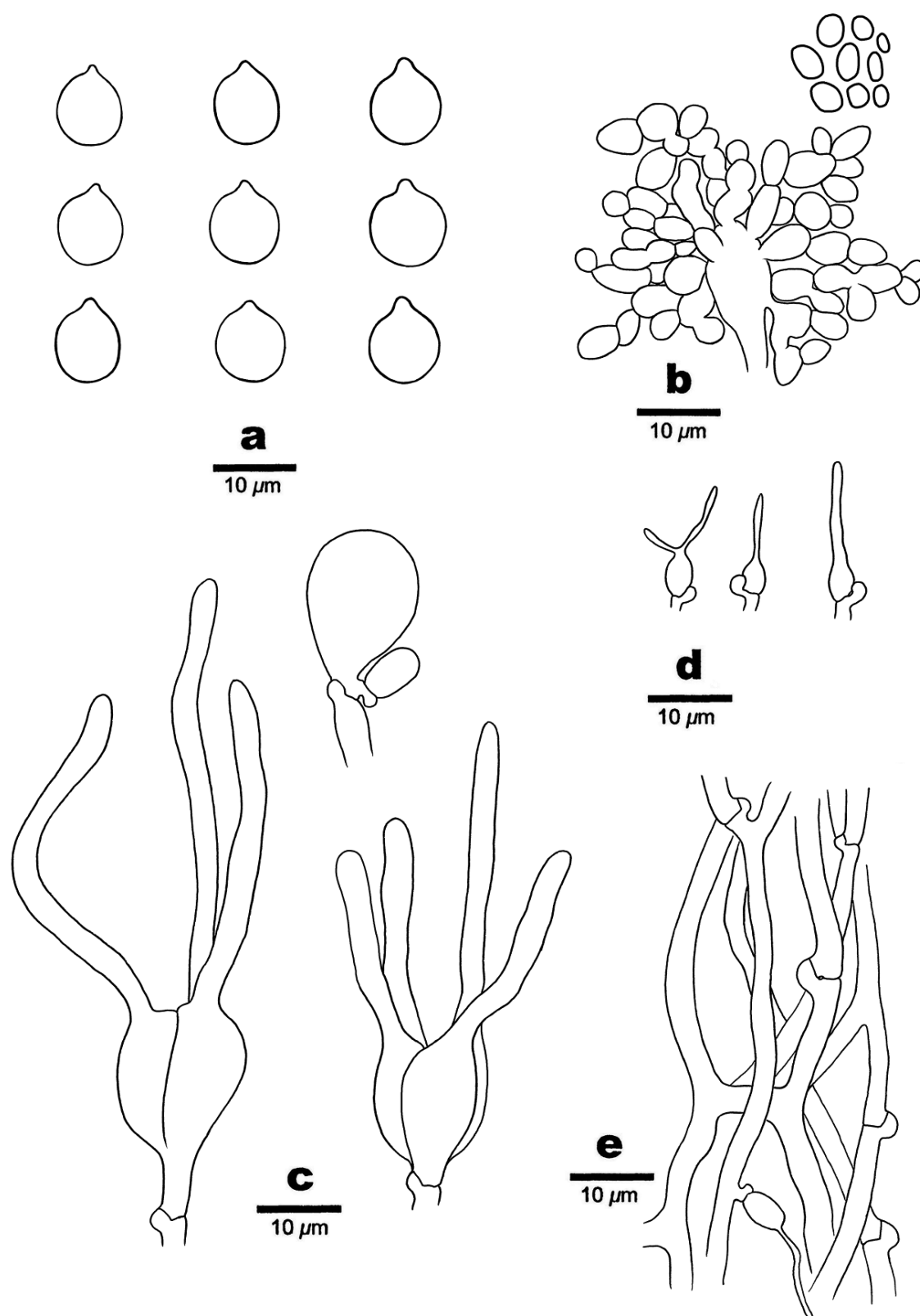


Fig. 53 Line drawings of microscopic structures of *Phaeotremella rigida*. a Basidiospores. b Conidia and conidiophores. c Probasidia and basidia. d Haustoria. e Hyphae. Scale bars = a–e 10 μm.

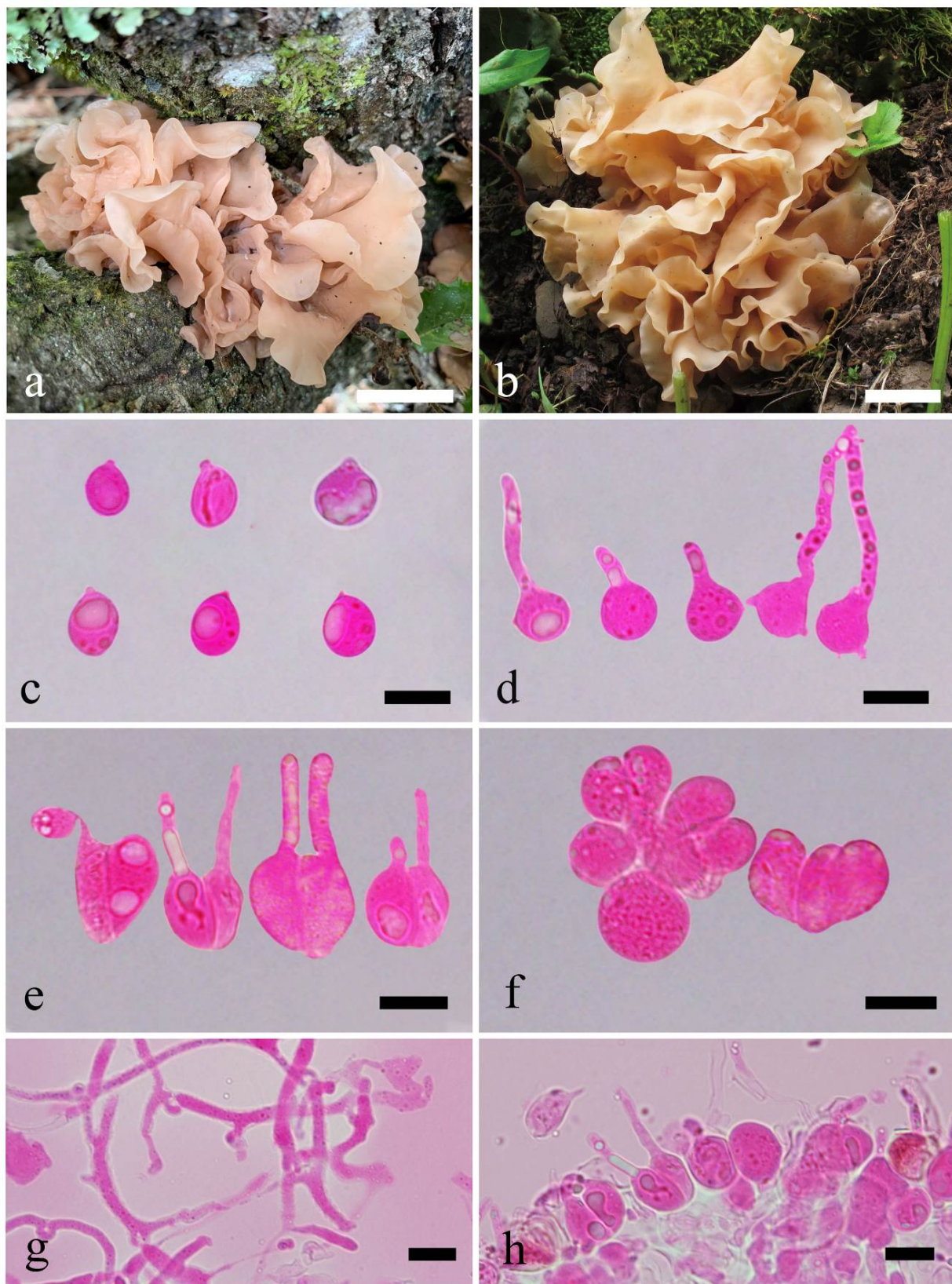


Fig. 54 Photos of basidiomata and microscopic structures of *Phaeotremella sparassidis*. a–b Basidiomata. c Basidiospores. d Germinating basidiospores. e Basidia. f Probasidia. g Hyphae. h A section of hymenium. Scale bars = a–b 1 cm, c–h 10 μ m.

Phaeotremella sparassidis F. Wu, L.F. Fan & Y.C. Dai, *sp. nov.*

.....Figs. 54, 55

MycoBank: MB 856383

Etymology: *Sparassidis* (Lat.): refers to the species having *Sparassis*-like basidiomata.

Diagnosis: Similar to *Phaeotremella roseotincta* but differs

in having pinkish buff to brownish vinaceous, foliaceous and *Sparassis*-like basidiomata, and lacking conidia.

Basidiomata: Gelatinous, pinkish buff to brownish vinaceous when fresh, becoming cinnamon to yellowish brown when dry; foliaceous and *Sparassis*-like, sessile, caespitose, up to 4.0 cm long, 4.0 cm diam. and 3.0 cm high from base, with undulate broad lobes (not hollow), attached to substratum by a central point.

Internal features: Hyphae hyaline, thin-walled, smooth, 2.0–4.8 μm diam., sometimes swollen up to 7.0 μm diam. in KOH, branched, interwoven, with abundant clamp connections, and sometimes with circular clamp connections. Hyphidia, swollen cells, vesicles and haustoria absent. Probasidia ovoid to globose; mature basidia thin-walled, barrel-shaped, with a basal clamp connection, 17.3–20.0 $\times$ 12.7–18.7 μm , usually longitudinally septate, 2–4-celled, with obvious oil drops; sterigmata up to 18.5 μm long, 1.0–3.0 μm diam., with obviously swollen apex. Basidiospores hyaline, thin-walled, smooth, broadly ellipsoid, apiculate, usually with one oil drop, (7.5–)8.0–10.5(–11.0) $\times$ 6.7–8.7 μm , $L = 9.27 \mu\text{m}$, $W = 7.68 \mu\text{m}$, $Q = 1.21$ ($n = 60/2$), germinating by germ tubes. Conidia absent.

Known distribution: Southwest China.

Specimens examined: China, Sichuan Province, Kangding, Gongga Mountain, Moxigou, on angiosperm stump, 10 Oct 2019, P. Zhang, Zhang 1203 (BJFC 028142, **holotype**); Xizang Autonomous Region, Bomi County, on living tree of *Quercus* sp., 25 Oct 2021, Y.C. Dai, Dai 23511 (BJFC 038083).

Notes: *Phaeotremella sparassidis* is similar to *P. roseotincta* by sharing yellowish brown basidiomata when dry and similar basidia and basidiospores, but *P. roseotincta* is differentiated from the new species by its foliaceous, clay pink to clay buff basidiomata when fresh, and the presence of conidia. In the phylogeny, our new species is closely related to *P. emeiensis* and *P. fuscossuccinea*, but the latter two species differ from *P. sparassidis* by their distinctly smaller basidia (12.3–16.3 $\times$ 10.4–14.9 μm in *P. emeiensis*, 11–15 $\times$ 8–10.5 μm in *P. fuscossuccinea* vs. 17.3–20.0 $\times$ 12.7–18.7 μm), furthermore, *P. emeiensis* has hyphidia, whereas *P. fuscossuccinea* has haustoria (Chen 1998).

Phaeotremella tenuis F. Wu, L.F. Fan & Y.C. Dai, **sp. nov.**
..... Figs. 56, 57

Mycobank: MB 856384

Etymology: *Tenuis* (Lat.): refers to the species having very thin basidiomata when dry.

Diagnosis: Similar to *Phaeotremella yunnanensis* but differs in having distinctly smaller basidia and basidiospores, longer sterigmata, and rare conidia.

Basidiomata: Soft gelatinous, white to cream or orange-yellow when fresh, distinctly shrinking to a film and becoming grayish brown to deep olive (the margin paler than center) when dry; foliaceous, sessile, caespitose, up to 5.0 cm long, 3.0 cm diam. and 1.5 cm high from base, with undulate broad lobes (sometimes hollow), attached to substratum by a central point.

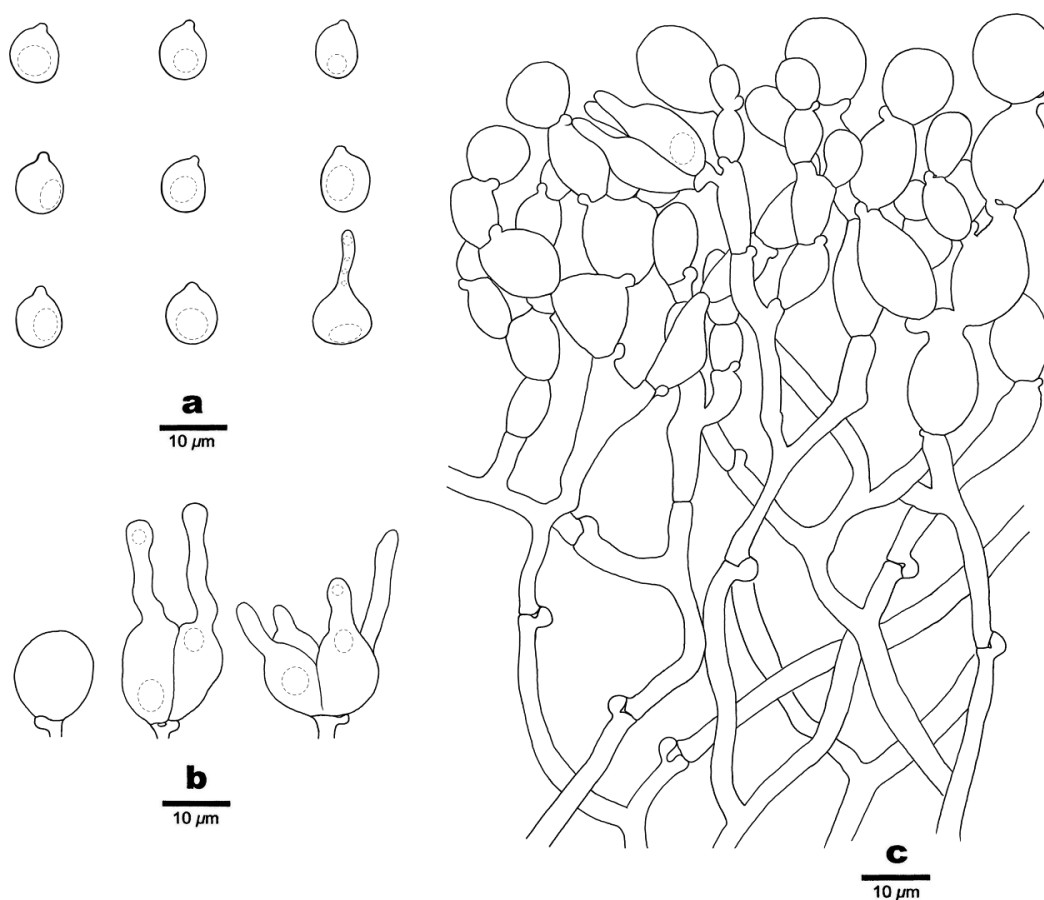


Fig. 55 Line drawings of microscopic structures of *Phaeotremella sparassidis*. a Basidiospores. b Probasidia and basidia. c A section of hymenium. Scale bars = a–c 10 μm .

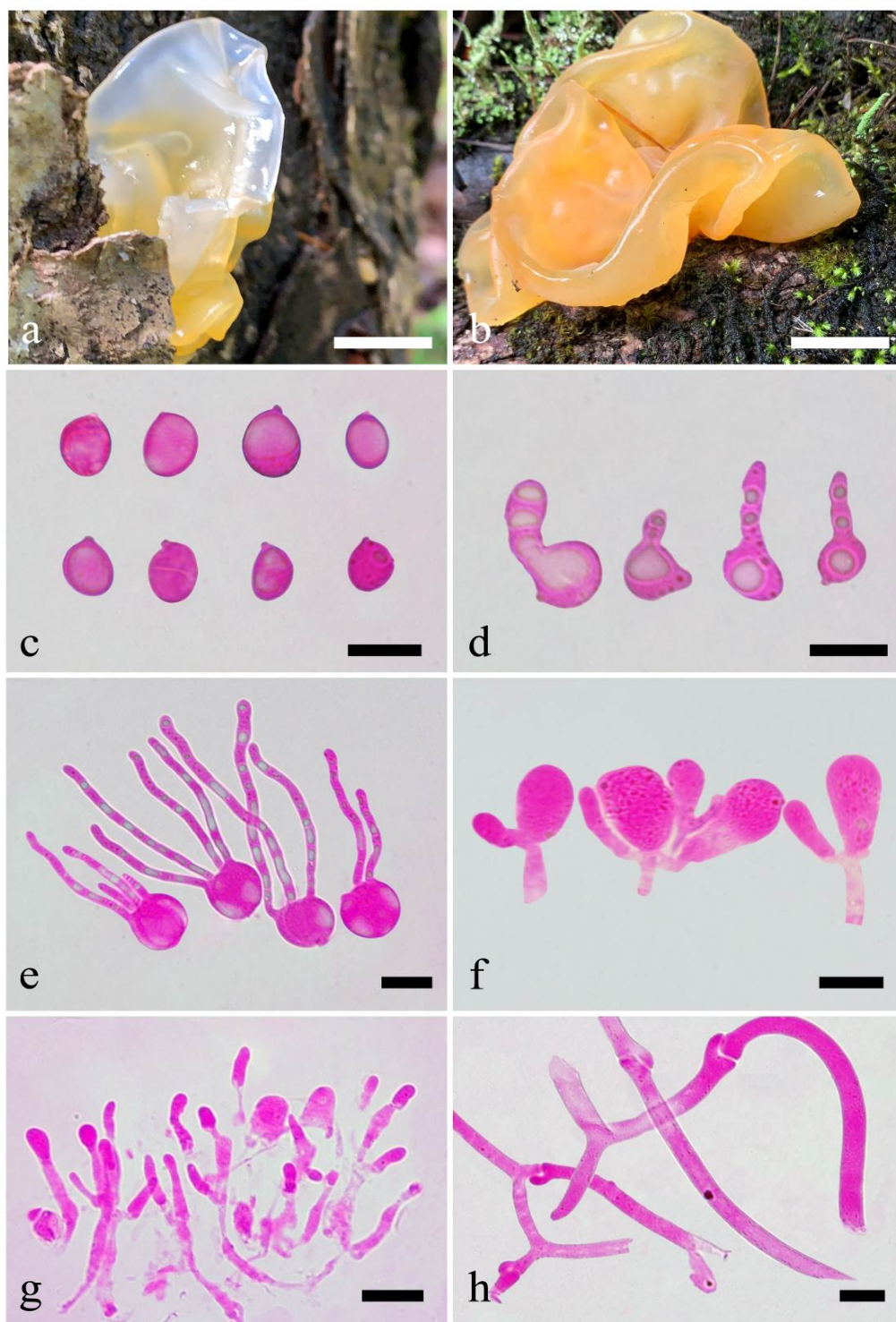


Fig. 56 Photos of basidiomata and microscopic structures of *Phaeotremella tenuis*. a–b Basidiomata. c Basidiospores. d Germinating basidiospores. e Basidia. f Probasidia. g Hyphidia. h Hyphae. Scale bars = a–b 1 cm, c–h 10 μ m.

Internal features: Hyphae hyaline to brownish, thin-walled, smooth, 1.0–4.5 μ m diam., sometimes swollen up to 6.5 μ m diam. in KOH, frequently branched, slightly interwoven, with frequent clamp connections. Hyphidia hyaline, thin-walled, smooth, usually derived from terminal hyphae; swollen cells, vesicles and haustoria absent. Probasidia pyriform; mature basidia thin-walled, globose to subglobose, with a basal clamp connection, 9.0–11.0 $\times$ 9.0–11.0 μ m, longitudinally

septate, 2–4-celled, with one or two oil drops; sterigmata up to 100 μ m long, 1.0–4.0 μ m diam., sometimes with swollen apex. Basidiospores hyaline, thin-walled, smooth, ellipsoid to broadly ellipsoid, apiculate, sometimes with one or two oil drops, 6.0–7.5(–8.0) $\times$ 5.0–6.5 μ m, L = 6.8 μ m, W = 5.8 μ m, Q = 1.13–1.20 (n = 60/2), germination by germ tubes. Conidia rarely observed.

Known distribution: Southwest China.

Specimens examined: China, Yunnan Province, Yongde,

Daxueshan Nature Reserve, on stump of *Lithocarpus* sp., 27 Aug 2015, Y.C. Dai, Dai 15661 (BJFC 019765, **holotype**), on angiosperm stump, 20 Aug 2020, F. Wu, Wu 387 (BJFC 033387); Xizang Autonomous Region, Bomi County, on angiosperm stump, 23 Oct 2021, Y.C. Dai, Dai 23383 (BJFC 037954), Dai 23438 (BJFC 038010), Dai 23439 (BJFC 038011).

Notes: *Phaeotremella tenuis* is distinguished from other *Phaeotremella* species by the white to cream or orange-yellow basidiomata when fresh, and it may be confused with *P. yunnanensis* that sometimes has cream basidiomata when fresh, but *P. yunnanensis* is distinguished from *P. tenuis* by its distinctly larger basidia ($11.0\text{--}22.0 \times 11.0\text{--}18.0\ \mu\text{m}$ vs. $9.0\text{--}11.0 \times 9.0\text{--}11.0\ \mu\text{m}$) and basidiospores ($7.0\text{--}8.0 \times 6.0\text{--}7.3\ \mu\text{m}$ vs. $6.0\text{--}7.5 \times 5.0\text{--}6.5\ \mu\text{m}$), thick-walled conidia and distinctly shorter sterigmata (up to $15.0\ \mu\text{m}$ long vs. up to $100\ \mu\text{m}$ long). In the phylogeny (Fig. 3), the new species formed one distinct lineage with robust support, but five specimens representing *P. tenuis* formed two sublineages. However, we did not find morphological differences among these specimens, and there are only 1% sequence differences in the ITS sequences between the two sublineages. Therefore, the five specimens are considered to belong to one new species, *P. tenuis*.

Pseudotremella Xin Zhan Liu et al., in Liu et al., Stud. Mycol. 81: 130 (2015).

Type species: *Pseudotremella moriformis* (Sm. & Sowerby) Xin Zhan Liu et al.

Basidiomata gelatinous when fresh, white, cream to pinkish buff, pale mouse gray to fawn or black, pulvinate to cerebriform or subglobose, with uncracked lobes; hyphae with clamp connections; branched haustoria occasionally present; basidia pyriform to capitate or globose to subglobose, longitudinally or obliquely septate, 2–4-celled; basidiospores globose to broadly ellipsoid, hyaline, thin-walled.

Notes: The genus was established to accommodate the ‘moriformis’ lineage including *Tremella moriformis* and *T. nivalis* Chee J. Chen (Liu et al. 2015b). *Cryptococcus allantoinivorans* Middelhoven and *C. lacticolor* Satoh & Makimura were transferred to *Pseudotremella* based on the analysis of the LSU rRNA gene dataset (Liu et al. 2015b), but *C. lacticolor* is an invalid name and its relationships with *Pseudotremella* or any other genera are uncertain according to our phylogenetic analysis. Therefore, *C. lacticolor* is excluded from our studies. Recently, four yeast species were newly described in the genus (Jiang et al. 2024; Pérez et al. 2024; Feng et al. 2025). Currently, eight species are accepted in the genus, including two jelly fungi, viz., *P. moriformis* and *P. nivalis* (Chee J. Chen) Xin Zhan Liu et al. (Liu et al. 2015b; Jiang et al. 2024).

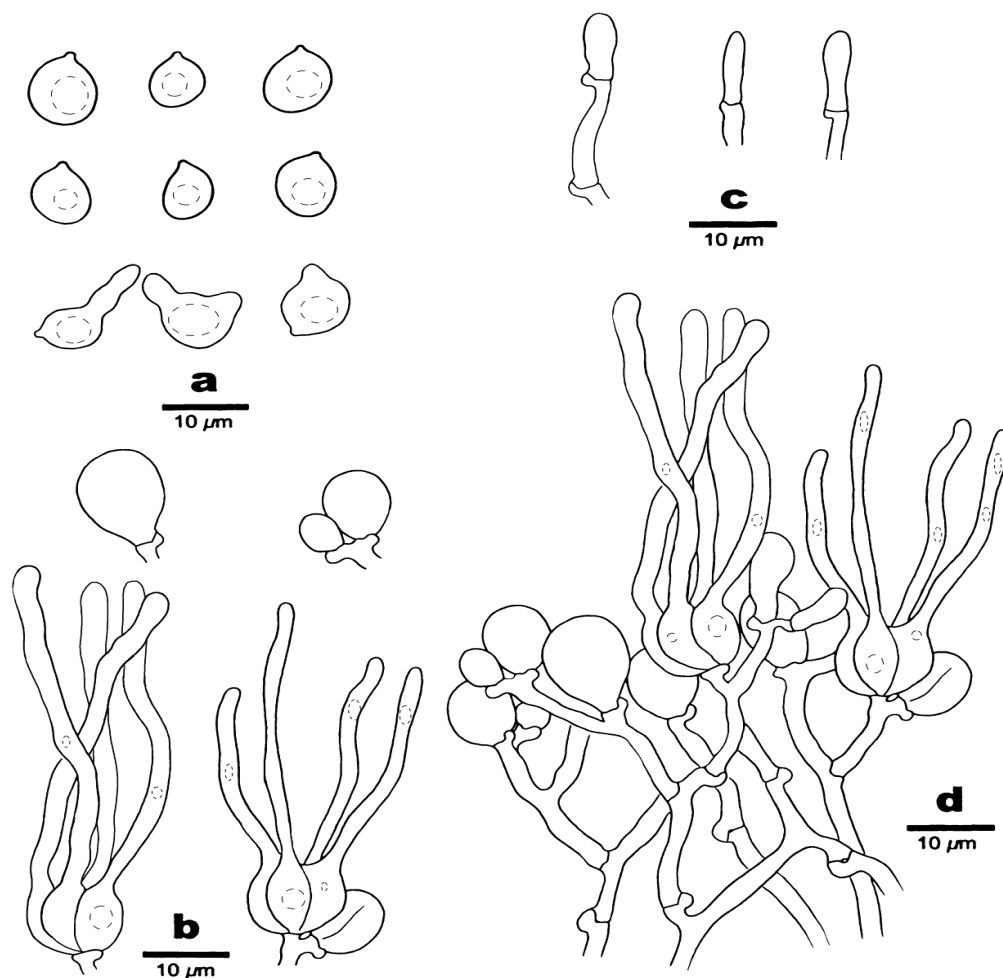


Fig. 57 Line drawings of microscopic structures of *Phaeotremella tenuis*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d $10\ \mu\text{m}$.

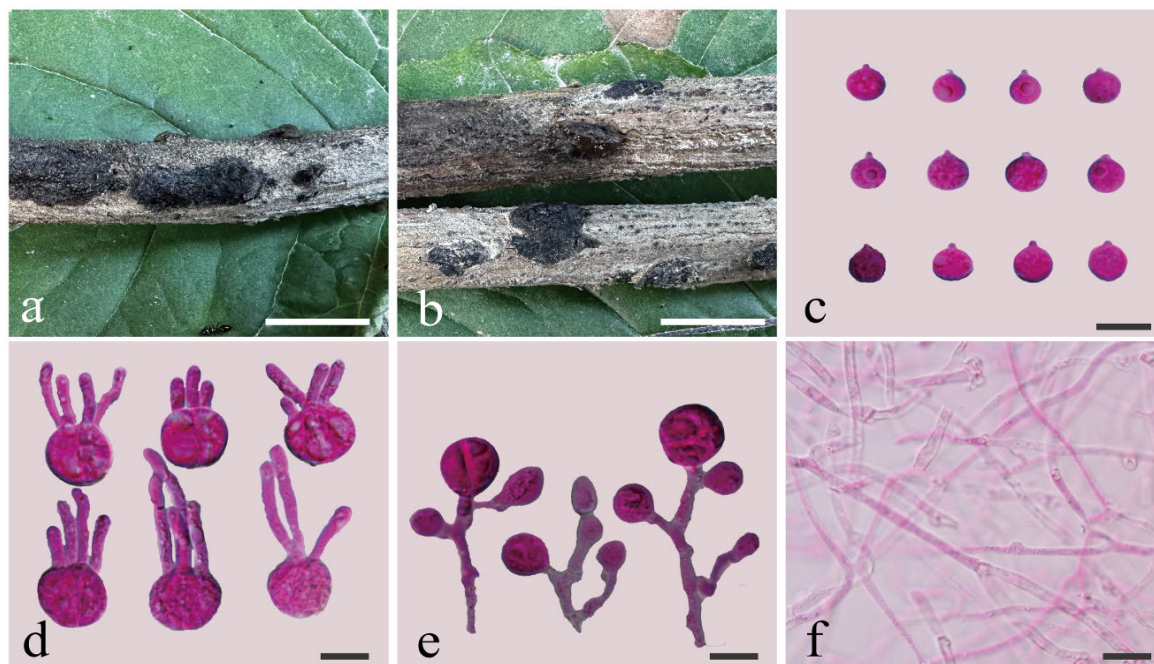


Fig. 58 Photos of basidiomata and microscopic structures of *Pseudotremella chayuensis*. a–b Basidiomata. c Basidiospores. d Basidia. e Probasidia. f Hyphae. Scale bars = a–b 1 cm, c–f 10 µm.

According to our studies, four *Pseudotremella* species were identified based on our samples, of which three are described as new in the following. In addition, the jelly fungus, *Tremella indecorata* Sommerf. is group with the other *Pseudotremella* species with strong support in our phylogeny (Fig. 3). So, the species is combined to *Pseudotremella*. The key morphological characteristics of the four species based on our samples are described in Table 3.

Pseudotremella chayuensis F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.* Figs. 58, 59

Mycobank: MB 856376

Etymology: *Chayuensis* (Lat.): refers to the species being found in Chayu County, China.

Diagnosis: Similar to *Pseudotremella pulvinata* and several *Exidia* species, but differs by having uninflated tissue and unchanged color in KOH, smaller basidia and subglobose to globose basidiospores.

Basidiomata: Gelatinous, mouse gray to black when fresh, becoming absolutely black when dry; pulvinate, sessile, coalescing with maturity, up to 1.0 cm long, 0.5 cm diam. and 0.3 cm high from base, with undulate lobes (not hollow), broadly attached to substratum.

Internal features: Hyphae hyaline, thin-walled, smooth, 2.0–4.5 µm diam., uninflated in KOH, branched, interwoven, with abundant clamp connections. Hyphidia occasionally present, hyaline, thin-walled, smooth, usually derived from terminal hyphae; vesicles occasionally present; swollen cells and haustoria absent. Probasidia globose or pyriform to ovoid, a large number of globose probasidia of different sizes present in hymenium; mature basidia thin-walled, ovoid to subglobose, with a basal clamp connection, 14.0–16.0 × 12.0–15.0 µm, usually longitudinally septate, 2–4-celled; sterigmata up to 35.0 µm long, 2.0–3.0 µm diam., sometimes with slightly swollen apex; probasidia and basidia sometimes stalked. Basidiospores hyaline, thin-walled, smooth, subglobose to

globose, apiculate, usually with one oil drop, (7.0–)7.5–8.8(–9.0) × (6.2–)6.8–8.5 µm, L = 7.99 µm, W = 7.73 µm, Q = 1.03 (n = 15/2), spore germination not observed. Conidia absent.

Known distribution: Southwest China.

Specimens examined: China, Xizang Autonomous Region, Chayu County, on rotten angiosperm branch, 27 Oct 2023, Y.C. Dai, Dai 27041 (BJFC 044593), Dai 27042 (BJFC 044594, *holotype*).

Notes: Morphologically, *Pseudotremella chayuensis* similar to *P. pulvinata* and several *Exidia* species by the black and pulvinate basidiomata when fresh. However, *P. pulvinata* differs from the new species by having larger basidia (15–20 × 15–20 µm vs. 14–16 × 12–15 µm), basidiospores (9–11.2 × 8–10.8 µm vs. 7.5–8.8 × 6.8–8.5 µm), and the presence of ellipsoid or subglobose conidia. In our phylogenies (Fig. 3), although *P. chayuensis* formed a single lineage distantly related to other *Pseudotremella* species, its morphological characteristics fit the definition of *Pseudotremella* better than those of other jelly fungus genera. Therefore, the above species is proposed in *Pseudotremella*.

Pseudotremella pulvinata F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.* Figs. 60, 61

Mycobank: MB 856385

Etymology: *Pulvinata* (Lat.): refers to the species usually having pulvinate basidiomata when fresh.

Diagnosis: Similar to *Pseudotremella chayuensis* with black basidiomata but differs in having distinctly larger basidia and basidiospores, and abundant hyphidia and swollen cells.

Basidiomata: Gelatinous, black when fresh, becoming fragile and darker black when dry; pulvinate to cerebriform, tuberculate on wood surface, sessile, separate or coalescing when mature, up to 1.8 cm long, 1.2 cm diam. and 0.3 cm high from base, with uncracked lobes (not hollow), broadly attached to substratum.

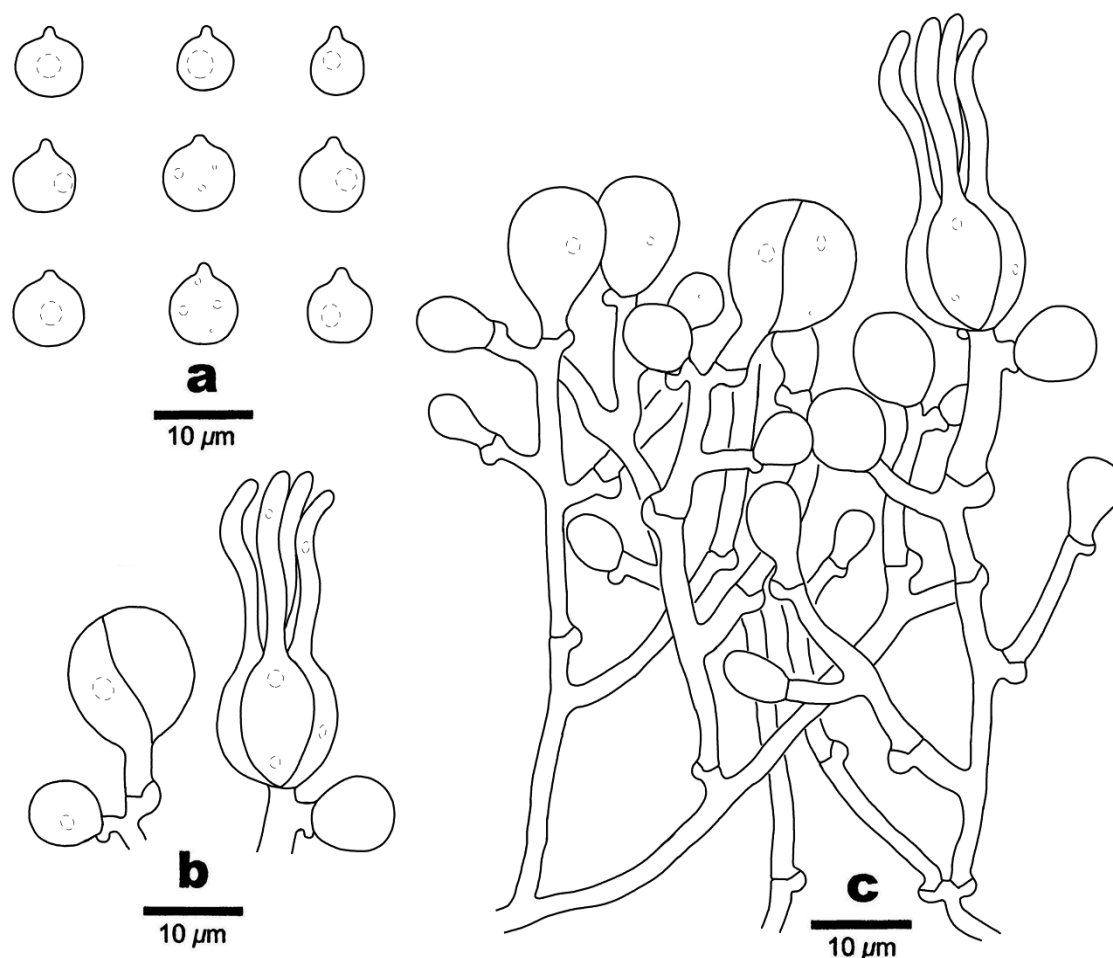


Fig. 59 Line drawings of microscopic structures of *Pseudotremella chayuensis*. a Basidiospores. b Probasidia and basidia. c A section of hymenium. Scale bars = a–c 10 μ m.

Internal features: All tissues becoming dark violet to black when in KOH. Hyphae reddish brown, thin-walled, with bubble bulge or smooth, 2.0–5.0 μ m diam., uninflated in KOH, branched, interwoven, with abundant clamp connections. Hyphidia abundant, reddish brown, thin-walled to slightly thick-walled, smooth, usually composed of variably-shaped swollen clamped hyphae in chains or derived from the same hyphae with probasidia; spindle-shaped vesicles occasionally present; swollen cells abundant, thin-walled or slightly walled, subglobose or fusiform; haustoria rarely present. Probasidia ovoid to subglobose, often produced from the same normal hyphae or swollen hyphae with clamps in chains; mature basidia thin-walled, mostly globose, with a basal clamp connection, 15.0–20.0 $\times$ 15.0–20.0 μ m, sometimes diameter greater than length, longitudinally septate, 2–4-celled, with obvious oil drops; sterigmata up to 70.0 μ m long, 2.0–4.0 μ m diam., usually with distinctly swollen apex. Basidiospores hyaline, thin-walled, smooth, subglobose to globose, apiculate, usually with one large oil drop, (8.2–)9.0–11.2(–11.8) $\times$ 8.0–10.8(–11.2) μ m, L = 9.78 μ m, W = 9.23 μ m, Q = 1.06 (n = 30/1), germinating by budding or germination tubes. Conidia absent, but some conidioid secondary spores present, hyaline, thin-walled, smooth, variable in shape, mostly ellipsoid or subglobose.

Known distribution: South China.

Specimens examined: China, Hainan Province, Lingshui County, Diaoluoshan National Forest Park, on living angiosperm tree, 1 Apr 2021, F. Wu, Wu 489 (BJFC 036344, **holotype**); Zhejiang Province, Hangzhou, Chaoshan, on dead angiosperm tree, 23 Mar 2023, F. Wu, Wu 648 (BJFC 040643), Wu 660 (BJFC 040653).

Notes: The species is similar to other *Pseudotremella* species with very small, pulvinate to cerebriform basidiomata when fresh, but the latter taxa (except *P. chayuensis*) never have black basidiomata and the color is unchanged in KOH (Malysheva et al. 2015). Morphologically, our new species may be confused with *P. chayuensis* or some species of *Exidia* with black basidiomata when fresh, but *P. chayuensis* differs from *P. pulvinata* by its smaller basidia (14.0–16.0 $\times$ 12.0–15.0 μ m vs. 15.0–20.0 $\times$ 15.0–20.0 μ m) and basidiospores (7.5–8.8 $\times$ 6.8–8.5 μ m vs. 9.0–11.2 $\times$ 8.0–10.8 μ m), and the absence of swollen cells, *Exidia* species differ from our new species by their allantoid basidiospores. In the phylogeny (Fig. 3), our new species formed one distinct lineage closely related to one yeast species, *P. laticolor* Satoh & Makimura ex Yurkov, and it clustered in the same clade with other jelly fungi of *Pseudotremella*. Therefore, the species is placed in *Pseudotremella*.

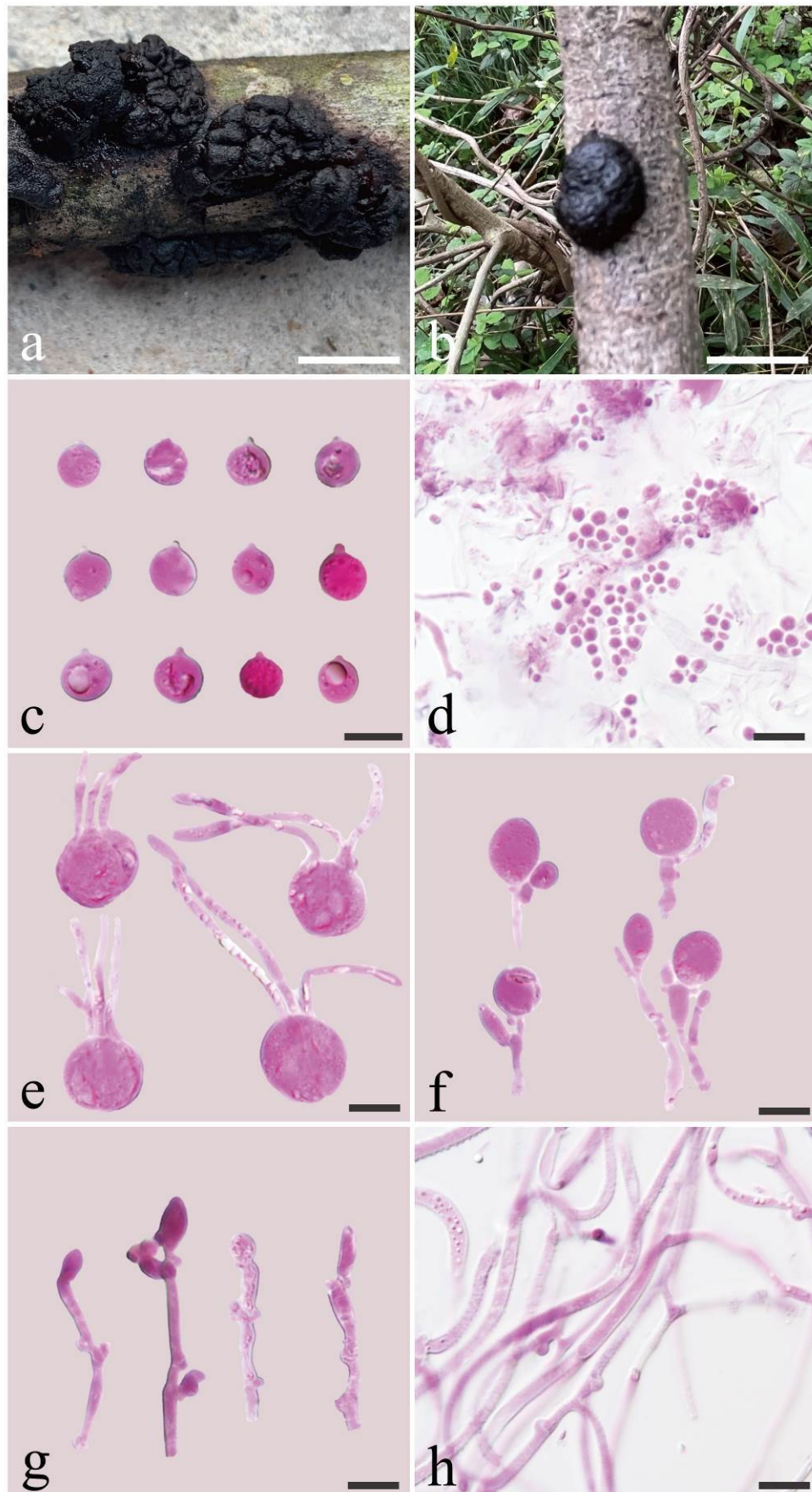


Fig. 60 Photos of basidiomata and microscopic structures of *Pseudotremella pulvinata*. a–b Basidiomata. c Basidiospores. d Conidioid secondary spores. e Basidia. f Probasidia. g Hyphidia. h Hyphae. Scale bars = a–b 1 cm, c–h 10 µm.

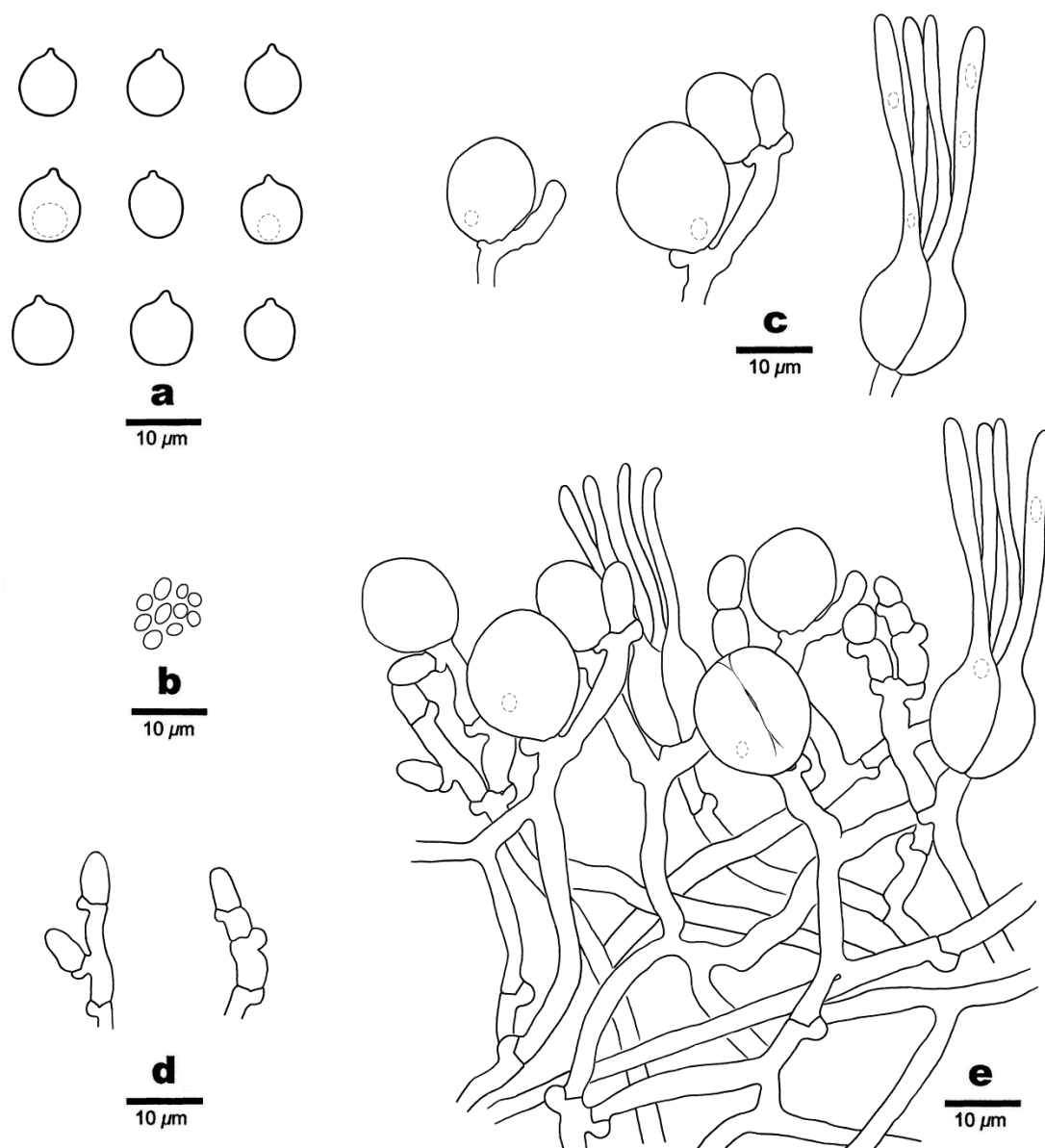


Fig. 61 Line drawings of microscopic structures of *Pseudotremella pulvinata*. a Basidiospores. b Conidioid secondary spores. c Probasidia and basidia. d Hyphidia. e A section of hymenium. Scale bars = a–e 10 µm.

Pseudotremella subnivalis F. Wu, A. Tohtirjap & Y.C. Dai, *sp. nov.*Figs. 62, 63

Mycobank: MB 856386

Etymology: *Subnivalis* (Lat.): refers to the species' similarity to *Pseudotremella nivalis*.

Diagnosis: Similar to *Pseudotremella nivalis* but differs in having smaller pulvinate to slightly cerebriform basidiomata, and larger basidia.

Basidiomata: Gelatinous, white or pale mouse gray to fawn when fresh, becoming fragile and dark black when dry; pulvinate to slightly cerebriform, tuberculate on wood surface, sessile, separate or coalescing when mature, up to 1.0 cm long, 0.8 cm diam. and 0.5 cm high from base, with uncracked lobes (not hollow), broadly attached to substratum.

Internal features: Hyphae hyaline, thin-walled, smooth, 2.0–4.5 µm diam., slightly inflated in KOH, branched, interwoven, with abundant clamp connections. Hyphidia

abundant, hyaline, thin-walled, smooth, sometimes apically tapered, usually derived from terminal hyphae or swollen clamped hyphae in chains; spindle-shaped vesicles frequent; swollen cells and absent. Probasidia pyriform to subglobose, often produced from the same normal hyphae or swollen clamped hyphae and close to each other; mature basidia thin-walled, subglobose to globose, with a basal clamp connection, 14.5–20.0 × 13.0–20.0 µm, sometimes diameter greater than length, longitudinally septate, 2–4-celled, with obvious oil drops; sterigmata up to 50.0 µm long, 2.0–3.0 µm diam., sometimes with swollen apex. Basidiospores hyaline, thin-walled, smooth, subglobose to globose, ap. haustoria iculate, usually with one large oil drop, (6.3–)6.8–9.6(–10.2) × (6.2–)6.5–9.5(–10.0) µm, L = 8.03 µm, W = 7.88 µm, Q = 1.02 (n = 30/1), germinating by budding or germination tubes. Conidia absent.

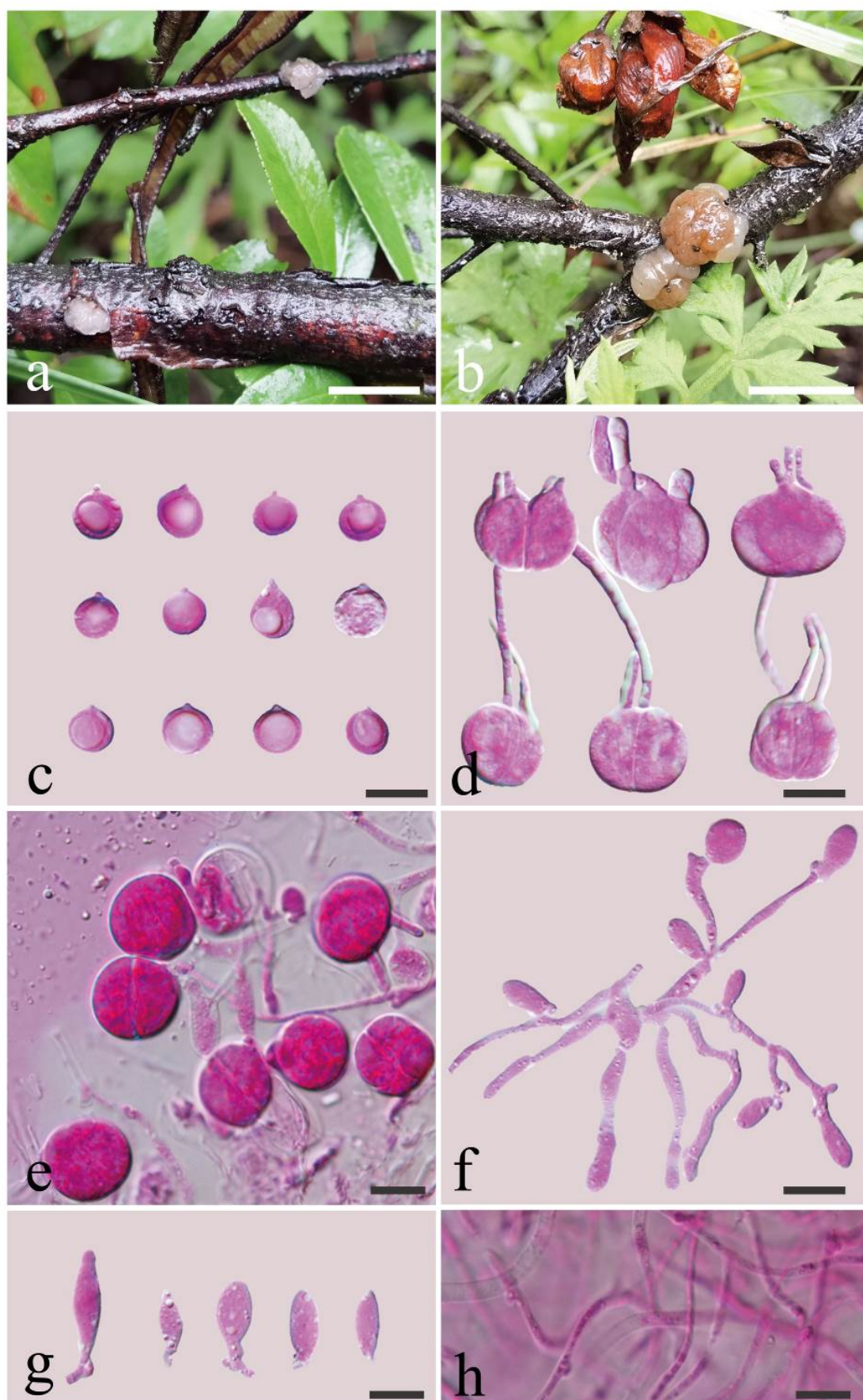


Fig. 62 Photos of basidiomata and microscopic structures of *Pseudotremella subnivalis*. a–b Basidiomata. c Basidiospores. d Basidia. e Probasidia. f Hyphidia. g Vesicles. h Hyphae. Scale bars = a–b 1 cm, c–h 10 μ m.

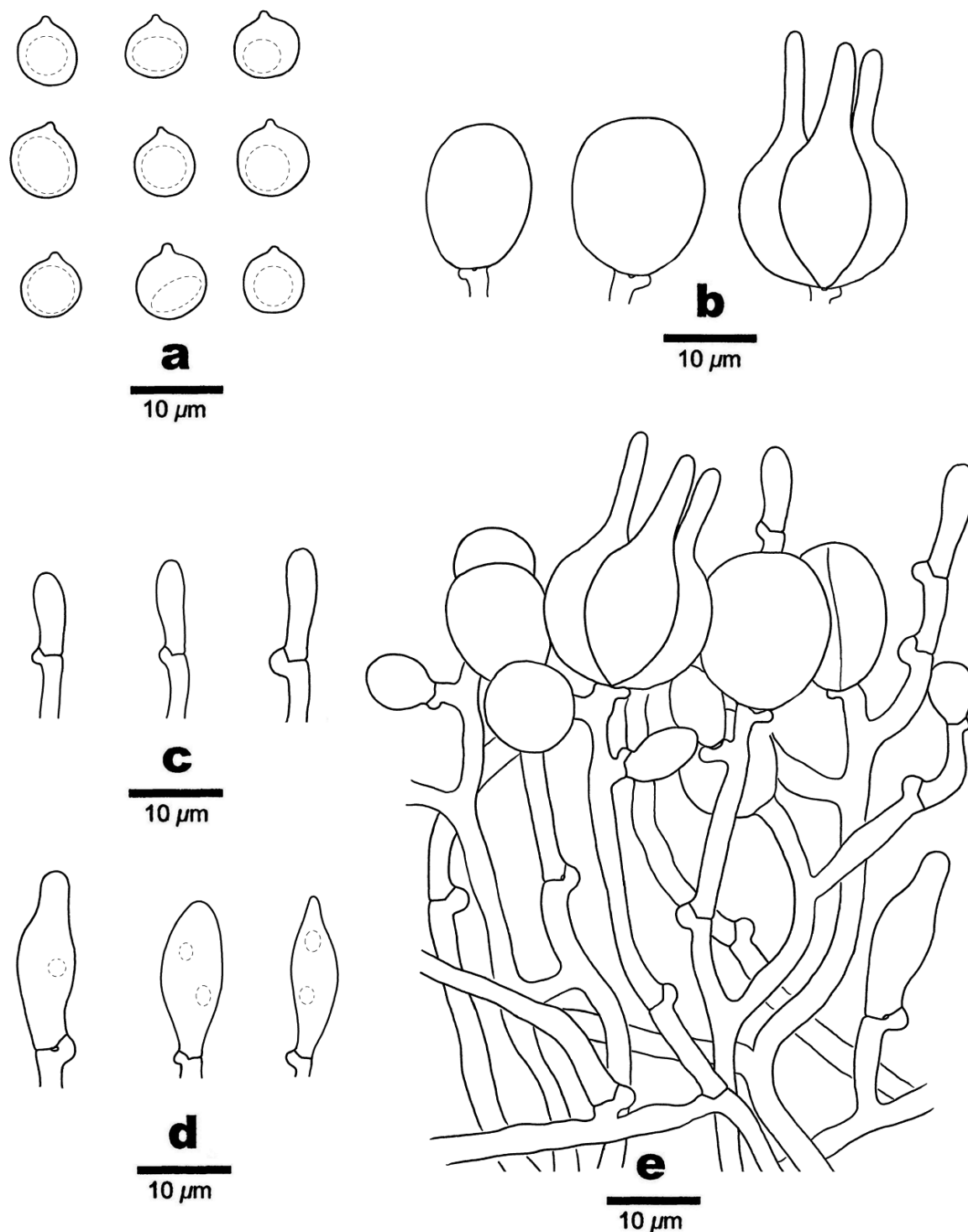


Fig. 63 Line drawings of microscopic structures of *Pseudotremella subnivalis*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d Vesicles. e A section of hymenium. Scale bars = a–e 10 μ m.

Known distribution: Southwest China.

Specimens examined: China, Yunnan Province, Zhaotong County, Fenghuangshan, on fallen branch of *Cotoneaster* sp., 29 Jun 2021, Y.C. Dai, Dai 22440 (BJFC 037024, **holotype**), Dai 22441 (BJFC 037025).

Notes: *Pseudotremella subnivalis* formed one distinct lineage with robust support, and it was closely related to three jelly fungi (*P. nivalis*, *P. moriformis* and *P. indecorata*),

and two yeast species (*P. navarinensis* Y. Pérez et al. and *P. rhododendri* Q.M. Wang) in the phylogeny (Fig. 3). However, *P. nivalis* differs from *P. subnivalis* by its larger basidiomata (up to 3.8 cm long vs. up to 1 cm long) and smaller basidia (12.0–16.0 $\times$ 13.0–16.0 μ m vs. 14.5–20.0 $\times$ 13.0–20.0 μ m); *P. moriformis* differs from *P. subnivalis* by having reddish brown to almost black basidiomata (Chen 1998); *P. indecorata* differs from *P. subnivalis* by the absence of abundant swollen

clamped hyphae in chains and a distribution in Europe (Malysheva et al. 2015).

Pseudotremella indecorata (Sommerf.) F. Wu, L.F. Fan & Y.C. Dai, **comb. nov.**

Mycobank: MB 856387

Basionym: *Tremella indecorata* Sommerf.

Notes: Liu et al. (2015b) noted that the nLSU sequences of one specimen (AM5) and three strains (CBS 6976, HBZ194, DSM 5727) were respectively clustered into two distantly separate lineages in the phylogeny. The two lineages respectively were defined as *Tremella* 'indecorata' I pro tem and *Tremella* 'indecorata' II pro tem. Malysheva et al. (2015) provided detailed descriptions and molecular data (ITS and nLSU sequences) of five specimens of *T. indecorata*, and these specimens distinctly formed one monophyletic lineage together with AM5. The same lineage formed in our phylogeny (Fig. 3), and, therefore, it is proposed as *Pseudotremella indecorata*. The species has irregularly pustulate basidiomata, which fit the key characteristics of *Pseudotremella*. Another lineage represented by CBS 6976 was nested in the *Naematelia encephala* clade in our phylogeny (Fig. 3). So, this lineage, '*Tremella indecorata*', is treated as an uncertain lineage in the present study.

Sirobasidium Lagerh. & Pat., J. Bot., 6: 465 (1892).

Type species: *Sirobasidium sanguineum* Lagerh. & Pat.

Basidiomata inconspicuous to large, soft gelatinous or gelatinous when fresh, whitish, brownish to reddish, pulvinate to cerebriform, or foliaceous; hyphae with clamp connections; hyphidia present or not; basidia subglobose to globose arranged in chains, longitudinally or obliquely septate, producing passively dispersed basidiospores; basidiospores fusiform or subglobose to globose.

Notes: *Sirobasidium* was established by Lagerheim & Patouillard (1892) to accommodate *Sirobasidium sanguineum* and *S. albidum* Lagerh. & Pat. A few more species have been described in this genus (Möller 1895; Boedijn 1934; Kisimova-Horovitz et al. 2000; Yamada et al. 2022). Twelve species are currently accepted in the genus according to Index Fungorum (<http://www.indexfungorum.org>) and MycoBank (<https://www.mycobank.org>), among them, six species were confirmed by molecular data. However, *Sirobasidium* species formed several divergent lineages in the Tremellales (Bandoni et al. 2011; Liu et al. 2015b; Wang & Bau 2024; Fig. 3), and sequences of the type species, *S. sanguineum* are unavailable, therefore, *Sirobasidium* is still polyphyletic as mentioned in a previous study (Liu et al. 2015b; Wang & Bau 2024). In this study, our four specimens were identified as *S. magnum* (Figs. 3, 45), and the key morphological characteristics of the species based on our samples can be seen in Table 3.

Tremella Pers., Neues Mag. Bot. 1: 111 (1794).

Type species: *Tremella mesenterica* Retz.

Basidiomata gelatinous or soft gelatinous when fresh, variable in color, such as whitish, cream, yellow or pale yellow, reddish, orange or tan to dark brown, usually foliaceous to cerebriform, sometimes pustulate or pulvinate; hyphae thin- or slightly thick-walled with clamp connections, branched, interwoven; hyphidia, swollen cells, vesicles and haustoria present or not; basidia pyriform, barrel-shaped, ovoid,

broadly ellipsoid, subglobose, or globose, usually longitudinally septate, rarely obliquely septate, 2–4-celled; basidiospores ellipsoid, broadly ellipsoid, subglobose, or globose, thin-walled, apiculate; conidia present or not.

Notes: *Tremella* was originally established to include 12 teleomorphic species with gelatinous macro-basidiomata, and then some lichenicolous and yeast species were described in this genus (Kobayasi 1939; Bandoni 1958, 1984; Millanes et al. 2012; Diederich et al. 2014). The lichenicolous species accounted for 50% of *Tremella* species until Liu et al. (2015a, 2015b) emended *Tremella* s.s. to include two phylogenetic clades representing the Mesenterica and Fuciformis groups defined by Chen (1998), while other non-lichenicolous species were transferred to *Carcinomyces*, *Naematelia*, *Phaeotremella*, and *Pseudotremella* (Liu et al. 2015b; Spirin et al. 2018c; Yamada et al. 2022). However, the taxonomy of lichenicolous *Tremella* clades in Tremellales were not well resolved, and a lot of lichenicolous species were still being described in *Tremella* s.l. (Zamora et al. 2016, 2017; Diederich et al. 2022), which resulted in a more confused taxonomy and phylogeny of *Tremella* s.l.

In this study, we focus on the jelly fungi of *Tremella* s.l., accept the previous emendations and definitions of *Tremella* s.s., and advise to transfer those lichenicolous *Tremella* to other families or genera, because they clustered in some dispersed clades or lineages distantly related to *Tremella* s.s. (Fig. 3). However, we did not deal with those dispersed clades or lineages because we did not examine the samples of those species, so, *Tremella* s.l. is still polyphyletic but *Tremella* s.s. is monophyletic (Fig. 3). A total of 37 jelly species in *Tremella* s.s. was identified based on our samples, of which five species were described in our previous publications (Fan et al. 2021a, b), and 17 are described as new and illustrated in this article. The key morphological characteristics of the 17 new species based on our samples are described in Table 3.

Tremella aurulenta F. Wu, G.M. Gates & Y.C. Dai, **sp. nov.**
..... Figs. 64, 65

Mycobank: MB 856390

Etymology: *Aurulenta* (Lat.): refers to the species having cinnamon to orange-brown basidiomata when fresh.

Diagnosis: Similar to *Tremella erythrina* Xin Zhan Liu & F.Y. Bai and *T. samoensis* Lloyd but differs in having distinctly larger basidia and its distribution in Australia.

Basidiomata: Gelatinous, cinnamon to orange-brown when fresh, becoming firmly gelatinous and orange-brown to reddish brown when dry; foliaceous, sessile, caespitose, up to 1.2 cm long, 1.0 cm diam. and 0.5 cm high from base, with small undulate lobes (not hollow), broadly attached to substratum.

Internal features: Hyphae hyaline, thin- to slightly thick-walled, smooth, 1.0–2.0 µm diam., branched, interwoven, with abundant clamp connections and circular clamp connections. Hyphidia hyaline, thin-walled, smooth, usually derived from the same hyphae with probasidia or the terminal hyphae; swollen cells, vesicles and haustoria absent. Probasidia ovoid to pyriform; mature basidia thin-walled, broadly ellipsoid to subglobose, with a basal clamp connection, 14.6–21.5 × 14.0–22.0 µm, usually longitudinally septate, 2–4-celled, usually with a few small oil drops; sterigmata up to 11.5 µm long, 0.5–1.5 µm diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, broadly ellipsoid to subglobose, apiculate, with numerous small oil drops, 6.8–8.8(–10.0) × 4.3–

7.6(–8.6) μm , $L = 7.80 \mu\text{m}$, $W = 5.70 \mu\text{m}$, $Q = 1.23$ ($n = 60/1$). Conidia rarely present, variable in shape, $3.8\text{--}5.2 \times 3.2\text{--}4.1 \mu\text{m}$.

Known distribution: Australia.

Specimen examined: Australia, Northern Territory, Holmes Jungle, Darwin, on rotten fallen log in rainforest, 22 October 2014, M.D. Barrett, Barrett F27/14 (MEL2382619, **holotype**).

Notes: *Tremella aurulenta* may be confused with *T. erythrina* and *T. samoensis* by sharing orange-brown basidiomata when dry, but the latter two species differ from *T. aurulenta* by their distinctly smaller basidia ($12.0\text{--}18.0 \times 12.0\text{--}19.0 \mu\text{m}$ in *T. erythrina* vs. $13.2\text{--}18.0 \times 9.3\text{--}12.0 \mu\text{m}$ in *T. samoensis* vs. $14.6\text{--}21.5 \times 14.0\text{--}22.0 \mu\text{m}$) and a distribution in Asia.

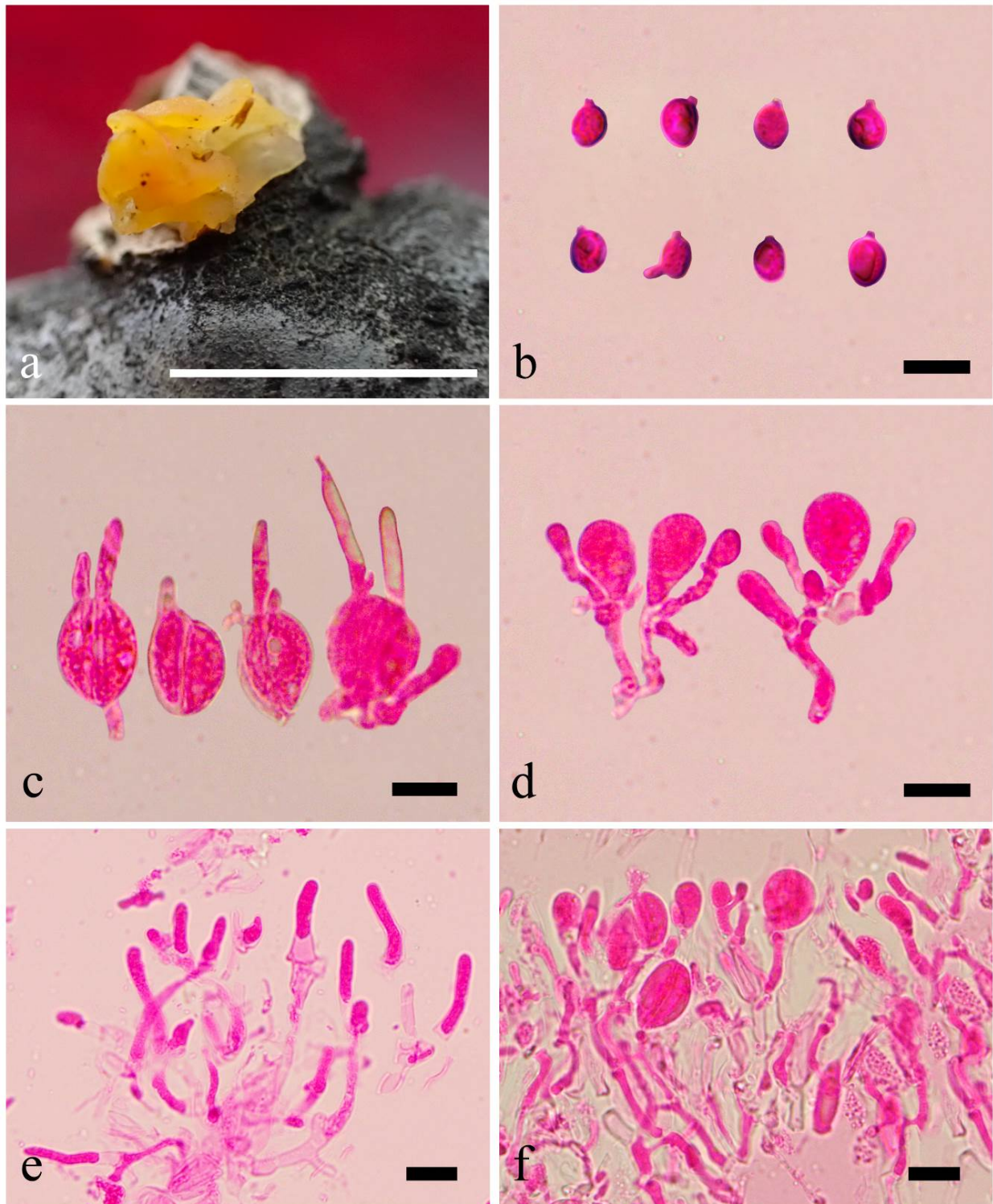


Fig. 64 Photos of basidiomata and microscopic structures of *Tremella aurulenta*. a Basidiomata. b Basidiospores. c Basidia. d Probasidia. e Hyphidia. f A section of hymenium. Scale bars = a 1 cm, b–f 10 μm .

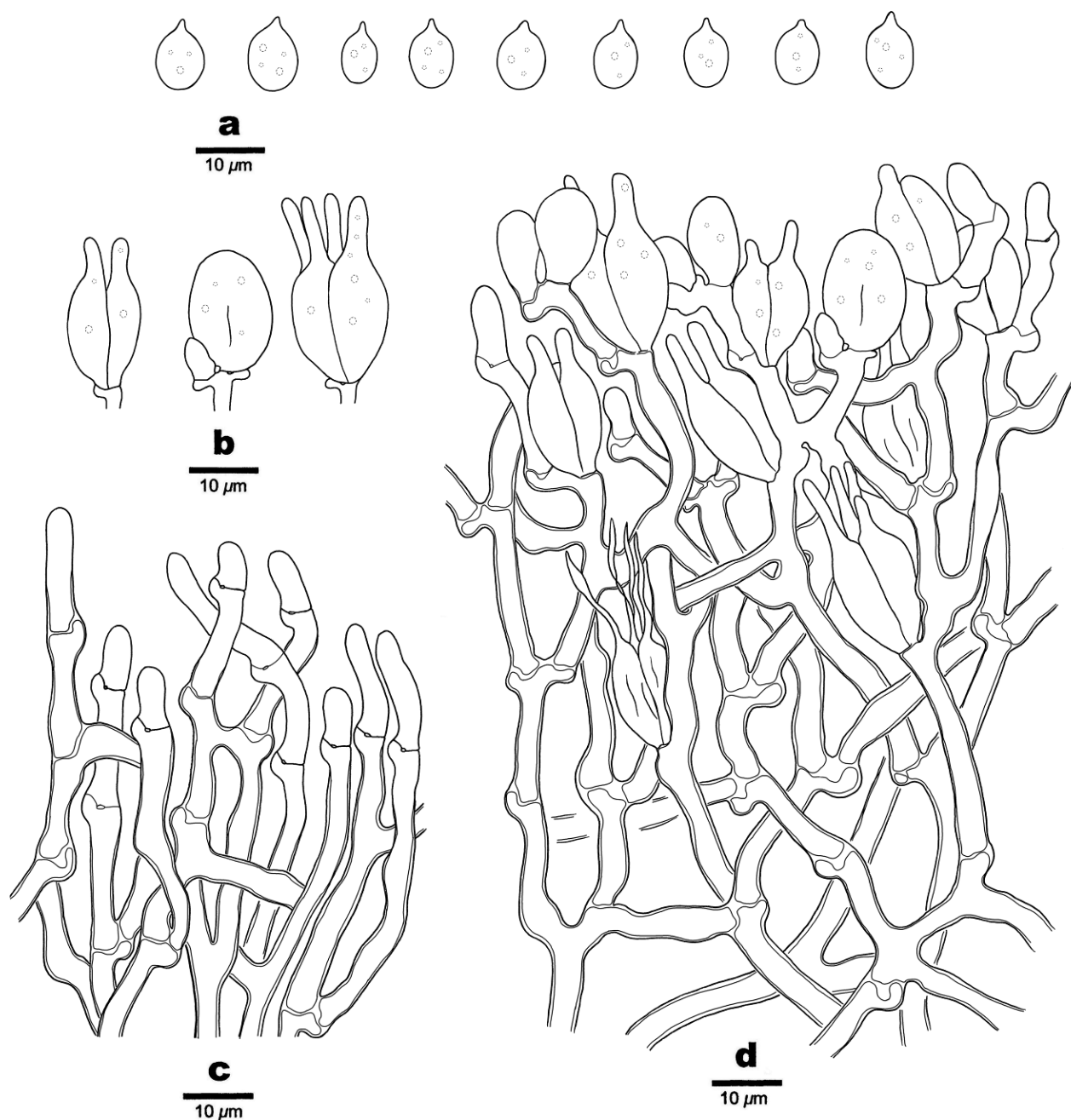


Fig. 65 Line drawings of microscopic structures of *Tremella aurulenta*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μ m.

In the phylogeny (Fig. 3), *Tremella aurulenta* is closely related to *T. mangiformis* and *T. ellipsospora*, but *T. mangiformis* differs from the new species by distinctly larger basidiomata (up to 4.0 cm long vs. up to 1.2 cm long), smaller basidia ($13.0\text{--}17.0 \times 10.0\text{--}12.0 \mu\text{m}$ vs. $14.6\text{--}21.5 \times 14.0\text{--}22.0 \mu\text{m}$), longer sterigmata (up to 27.0 μm long vs. up to 11.5 μm long), and a distribution in south China; *T. ellipsospora* differs from *T. aurulenta* by its distinctly smaller basidia ($12.5\text{--}15.0 \times 9.0\text{--}11.0 \mu\text{m}$ vs. $14.6\text{--}21.5 \times 14.0\text{--}22.0 \mu\text{m}$) and basidiospores ($6.0\text{--}7.4 \times 3.9\text{--}5.5 \mu\text{m}$ vs. $6.8\text{--}8.8 \times 4.3\text{--}7.6 \mu\text{m}$), and a distribution in southwest China. In addition, there are more than 3% sequence differences in the ITS sequences between the three species. Therefore, the three new species are

accepted in this study.

Tremella circularis F. Wu, L.F. Fan & Y.C. Dai, *sp. nov.*

..... Figs. 66, 67

Mycobank: MB 856391

Etymology: *Circularis* (Lat.): refers to the species having distinctly circular clamp connection.

Diagnosis: Similar to *Tremella mesenterica* but differs in having pale yellow to buff yellow basidiomata, shorter basidia, and abundant circular clamp connections.

Basidiomata: Gelatinous, pale yellow to buff yellow when fresh, becoming firmly gelatinous and dark straw yellow when dry; foliaceous, sessile, caespitose, up to 3.0 cm long, 2.0 cm

diam. and 2.5 cm high from base, with undulate-plicate lobes (not hollow, single-layer with entire margin); attached to substratum by a central point.

Internal features: Hyphae hyaline, thin- to slightly thick-walled, smooth, 0.8–3.4 μm diam., uninflated in KOH, frequently branched, interwoven, with abundant clamp connections and circular clamp connections. Hyphidia hyaline, thin-walled, smooth, usually derived from the same hyphae with probasidia or terminal hyphae; swollen cells abundant, slightly thick-walled, variable in shape and size; vesicles thick-walled; haustoria present, spherical to oval, branched. Probasidia broadly ellipsoid to subglobose; mature basidia thin-walled, subglobose to globose, with a basal clamp connection, 16.3–20.0 $\times$ 16.8–22.0 μm , longitudinally septate, 2–4-celled, with several small oil drops; sterigmata up to 27.0 μm long, 3.0–4.0 μm diam., sometimes with slightly swollen apex. Basidiospores hyaline, thin-walled, smooth, ellipsoid to broadly ellipsoid, apiculate, with one or two oil drops, 8.6–11.3 $\times$ 6.7–8.6(–8.8) μm , $L = 10.06 \mu\text{m}$, $W = 7.59 \mu\text{m}$, $Q = 1.21\text{--}1.32$ ($n = 60/2$), germinating by germ tubes

or budding. Conidia present in clusters, hyaline, thin-walled, smooth, cylindrical to ellipsoid, originating from conidiophores interspersed in the hymenium, occasionally among the hymenium and existing as a pile, 2.5–6.4 $\times$ 1.7–3.6 μm ; conidial mother cells in chains of different lengths joined with clamp connections.

Known distribution: South China.

Specimens examined: China, Guangxi Autonomous Region, Wuzhou, Tianhongling Forest Farm, on fallen angiosperm branch, 29 Apr 2018, F. Wu, Wu 61 (BJFC 027971, **holotype**), Wu 65 (BJFC 027975); Hunan Province, Yongshun County, Xiaoxi Nature Reserve, on rotten wood, 28 Aug 2014, P. Zhang, Zhang 1750 (BJFC 028153).

Notes: *Tremella circularis* may be confused with *T. mesenterica* by sharing yellowish basidiomata when fresh, the presence of swollen cells and vesicles. However, *T. mesenterica* differs from *T. circularis* by its longer basidia (17.0–26.0 μm vs. 16.3–20.0 μm in length) and the absence of circular clamp connections.

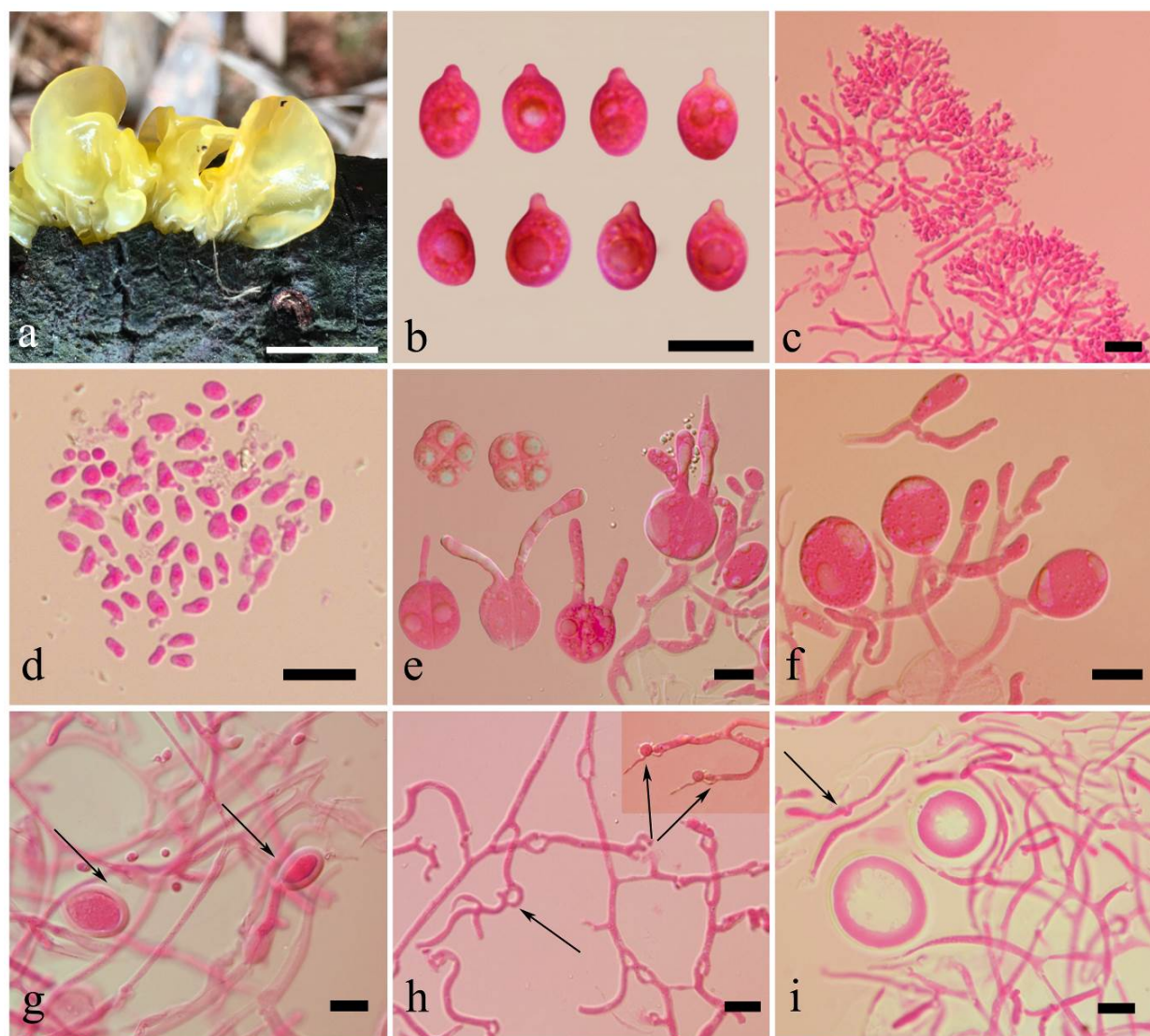


Fig. 66 Photos of basidiomata and microscopic structures of *Tremella circularis*. a Basidiomata. b Basidiospores. c Conidiophores. d Conidia. e Basidia. f Probasidia. g Vesicles (arrows). h Circular clamp connections (arrows) and haustoria (an arrow). i Swollen cells and hyphidia (an arrow). Scale bars = a 1 cm, b–i 10 μm .

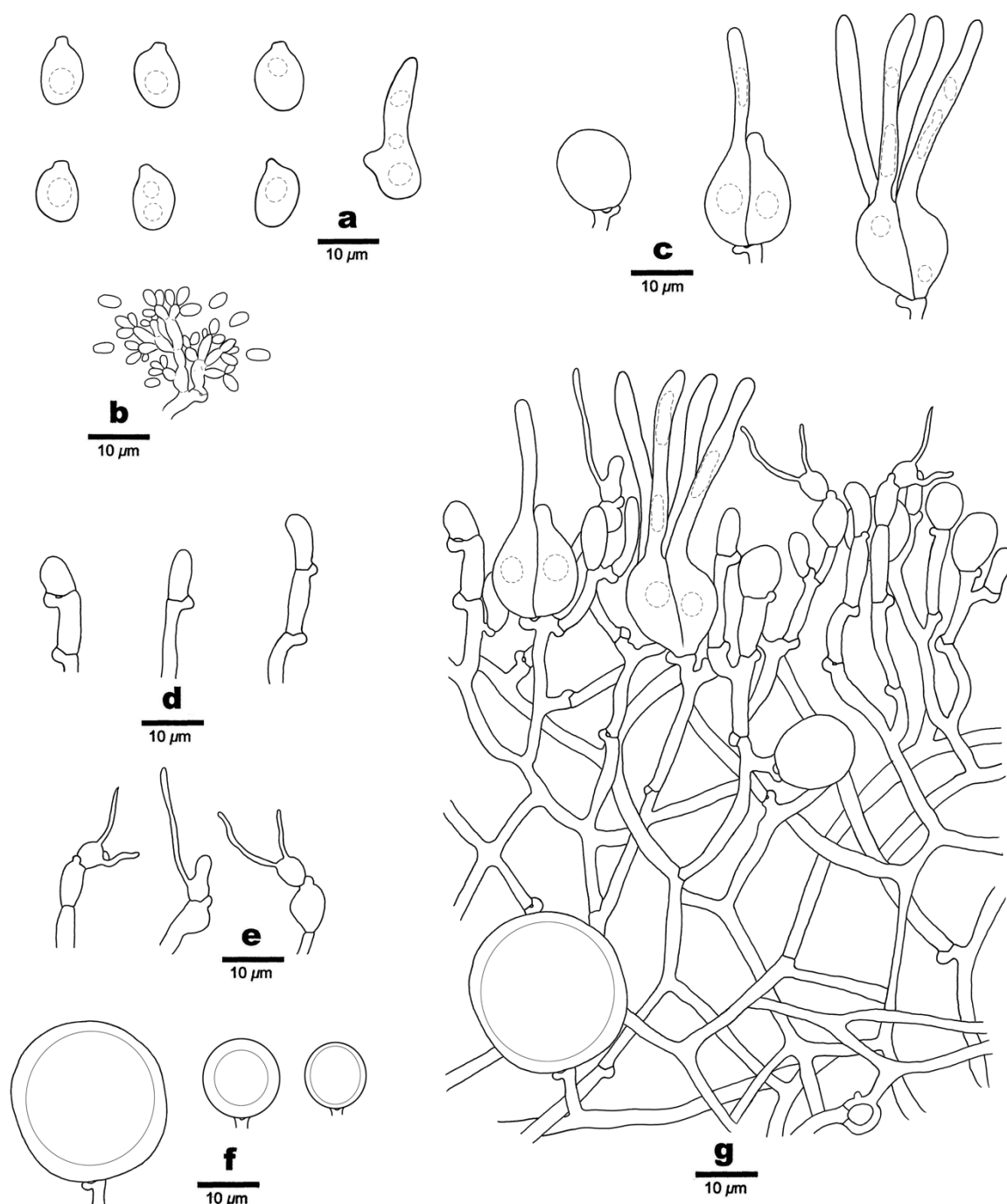


Fig. 67 Line drawings of microscopic structures of *Tremella circularis*. a Basidiospores. b Conidiophores and conidia. c Probasidia and basidia. d Hyphidia. e Haustoria. f Vesicles. g A section of hymenium. Scale bars = a–g 10 µm.

Tremella conidiogena F. Wu, G.M. Gates & Y.C. Dai, *sp. nov.*
.....Figs. 68, 69

Mycobank: MB 856392

Etymology: *Conidiogena* (Lat.): refers to the species producing plenty of conidia.

Diagnosis: Similar to *Tremella circularis* and *T. mesenterica* but differs in having smaller basidiospores, and lacking swollen cells, vesicles, and haustoria.

Basidiomata: Gelatinous, lemon yellow when fresh, becoming buff yellow when dry; foliaceous, sessile, caespitose, up to 2.0 cm long, 2.0 cm diam. and 1.0 cm high from base, with crumpled lobes (not hollow, with single

structures), attached to substratum by a central point.

Internal features: Hyphae hyaline, thin- to slightly thick-walled, smooth, 0.3–4.3 µm diam., slightly inflated in KOH, branched, interwoven, with clamp connections. Hyphidia rarely present in terminal hyphae; swollen cells, vesicles and haustoria absent. Hymenium degenerating or at the stage of asexual reproduction; probasidia oblong-ellipsoid to subglobose with golden oil drops and a clamp connection at the base, hyaline, thin-walled, smooth; mature basidia not observed. Basidiospores hyaline, thin-walled, smooth, ellipsoid, apiculate, with oil drops, (5.2–)6.0–7.2 × (4.2–)4.5–6.0 µm, L = 6.77 µm, W = 5.01 µm, Q = 1.35 (n = 30/1),

germinating and producing secondary spores by budding or germ tubes. Conidia hyaline, thin-walled, smooth, mostly cylindrical to ellipsoid or subglobose, variable in shape and size, originating from conidiophores interspersed in the inner part of the basidiomata and in a pile, $3.0\text{--}7.0 \times 3.0\text{--}6.0 \mu\text{m}$; conidial mother cells in chains with clamp connections.

Known distribution: Australia.

Specimens examined: Australia, New South Wales, near Canegrass Tank, on fallen dead wood, Jun 2014, I.D. NSA, NSA10903 (MEL 2392685, **holotype**); Victoria, Corner Station, homestead at river's edge, 25 Nov 2011, B. Barr, TL2434 (MEL 2358015); near second sink hole along vehicle track from southwest entry point, Muldoon's IPA, on dead branches of

Acacia sp., 22 Mar 2011, M. Danks, Danks 225 (MEL 2353129).

Notes: *Tremella conidiogena* macro-morphologically is similar to *T. mesenterica* and *T. circularis* by sharing yellowish and foliaceous basidiomata when fresh, but the latter two species differ from *T. conidiogena* by their larger basidiospores ($9.0\text{--}11.0 \times 6.0\text{--}8.0 \mu\text{m}$ in *T. mesenterica*, $8.6\text{--}11.3 \times 6.7\text{--}8.6 \mu\text{m}$ in *T. circularis* vs. $6.0\text{--}7.2 \times 4.5\text{--}6.0 \mu\text{m}$), and abundant swollen cells and branched haustoria. In the phylogeny (Fig. 3), the species is closely related to *T. guttulata*, but *T. guttulata* differs from the species by the presence of swollen cells, vesicles and haustoria, distinctly larger basidiospores ($9.0\text{--}12.0 \times 6.0\text{--}9.8 \mu\text{m}$ vs. $6.0\text{--}7.2 \times 4.5\text{--}6.0 \mu\text{m}$), and a distribution in China.

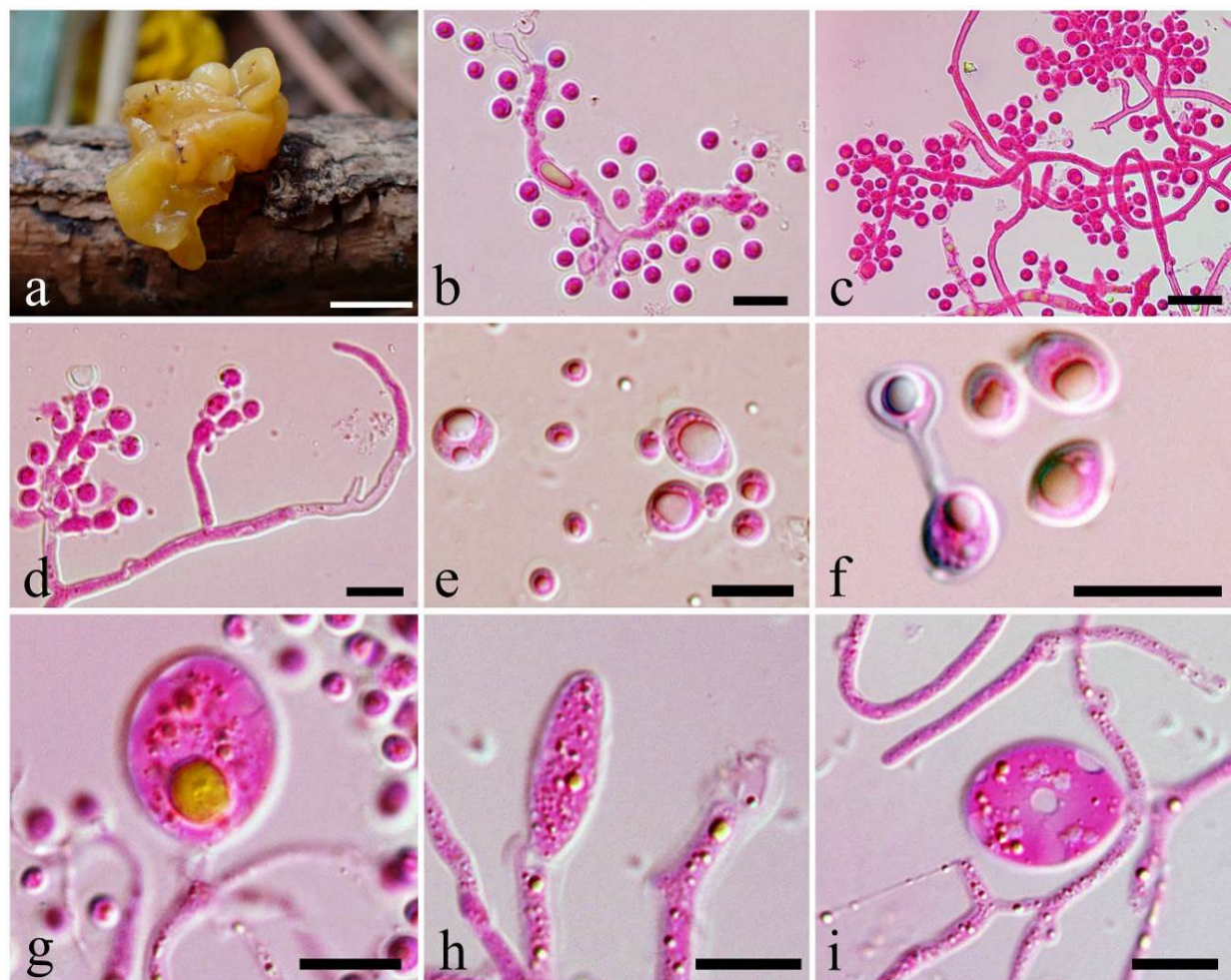


Fig. 68 Photos of basidiomata and microscopic structures of *Tremella conidiogena*. a Basidiomata. b–d Conidia and conidiophores. e Basidiospores and secondary spores. f Germinating basidiospores and secondary spores. g–h Probasidia. i A probasidium and hyphidia. Scale bars = a 1 cm, b–i 10 μm .

Tremella crassihyphidiata F. Wu, L.F. Fan & Y.C. Dai, *sp. nov.*
.....Figs. 70, 71

Mycobank: MB 856393

Etymology: *Crassihyphidiata* (Lat.): refers to the species having thick-walled hyphidia.

Diagnosis: Similar to *Tremella erythrina* but differs in having thick-walled hyphidia, and abundant umbelliform conidiophores and conidia.

Basidiomata: Soft gelatinous, lemon yellow to brownish red when fresh, becoming firmly gelatinous and brownish orange when dry; irregularly cerebriform to more or less

foliaceous, sessile, caespitose, up to 4.0 cm long, 2.0 cm diam. and 0.5 cm high from base, with small undulate lobes (hollow); broadly attached to substratum.

Internal features: Hyphae hyaline, thin- to thick-walled, smooth, $1.0\text{--}3.3 \mu\text{m}$ diam., uninflated in KOH, branched, interwoven, with abundant clamp connections and circular clamp connections. Hyphidia present in clusters, hyaline, thick-walled, smooth, usually derived from the same hyphae with probasidia or terminal hyphae; swollen cells, vesicles and haustoria absent. Probasidia pyriform, ovoid to subglobose; mature basidia thin-walled, ovoid, pyriform to

subglobose, with a basal clamp connection, $14.0\text{--}19.0 \times 12.0\text{--}16.8\ \mu\text{m}$, usually longitudinally septate, rarely obliquely septate, 2–4-celled, without oil drop; sterigmata up to $9.7\ \mu\text{m}$ long, $1.2\text{--}2.0\ \mu\text{m}$ diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, ellipsoid to oblong-ellipsoid, apiculate, without oil drop, $7.0\text{--}9.0 \times 5.0\text{--}7.0\ \mu\text{m}$, $L = 8.06\ \mu\text{m}$,

$W = 5.50\ \mu\text{m}$, $Q = 1.20\text{--}1.47$ ($n = 60/2$), occasionally germinating by germ tubes. Conidia hyaline, thin-walled, smooth, cylindrical or allantoid to oblong-ellipsoid, usually originating from umbelliform conidiophores, $2.4\text{--}3.6 \times 1.9\text{--}2.4\ \mu\text{m}$.

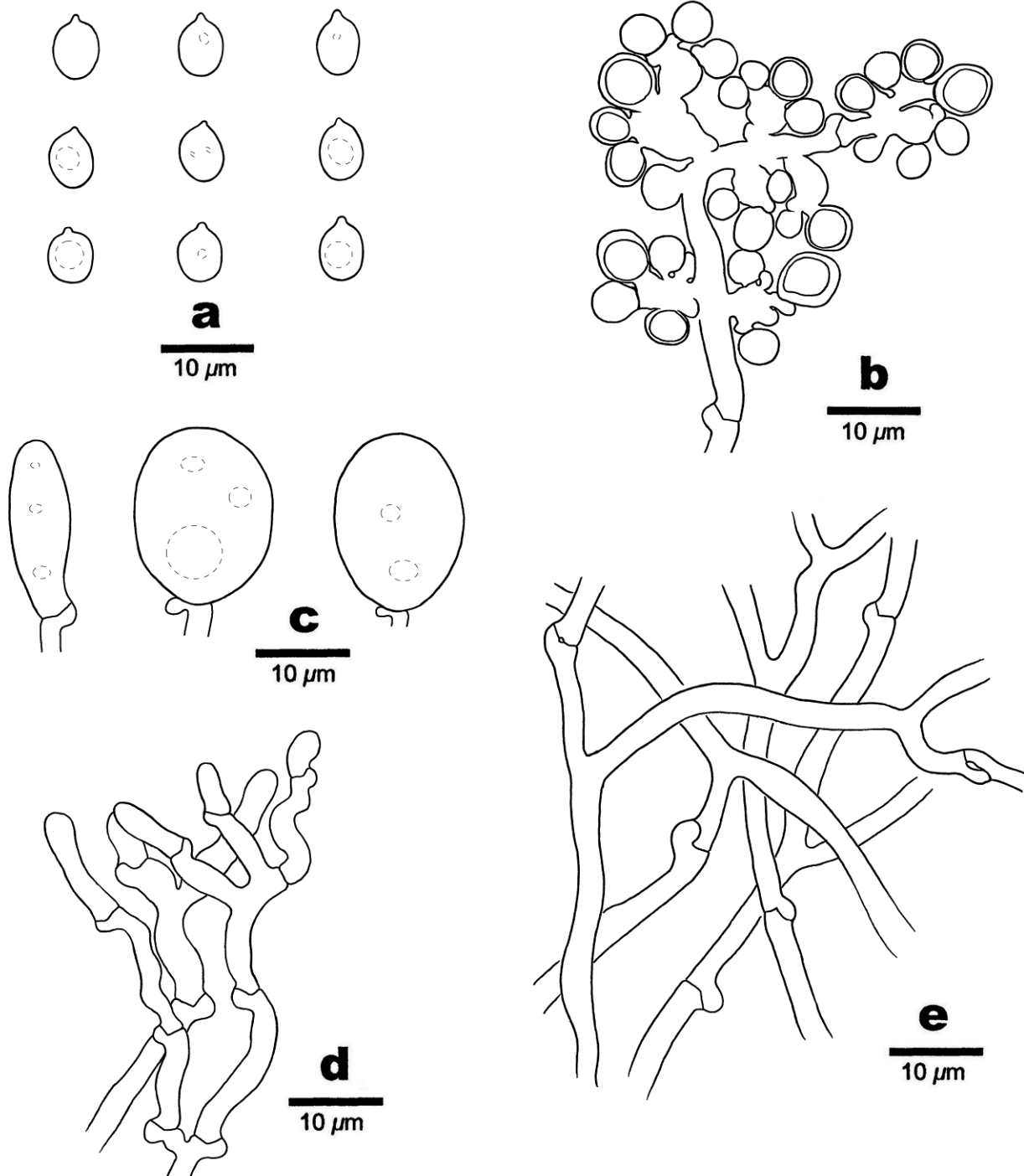


Fig. 69 Line drawings of microscopic structures of *Tremella conidiogena*. a Basidiospores. b Conidia and conidiophores. c Probasidia. d Hyphidia. e Hyphae. Scale bars = a–e $10\ \mu\text{m}$.

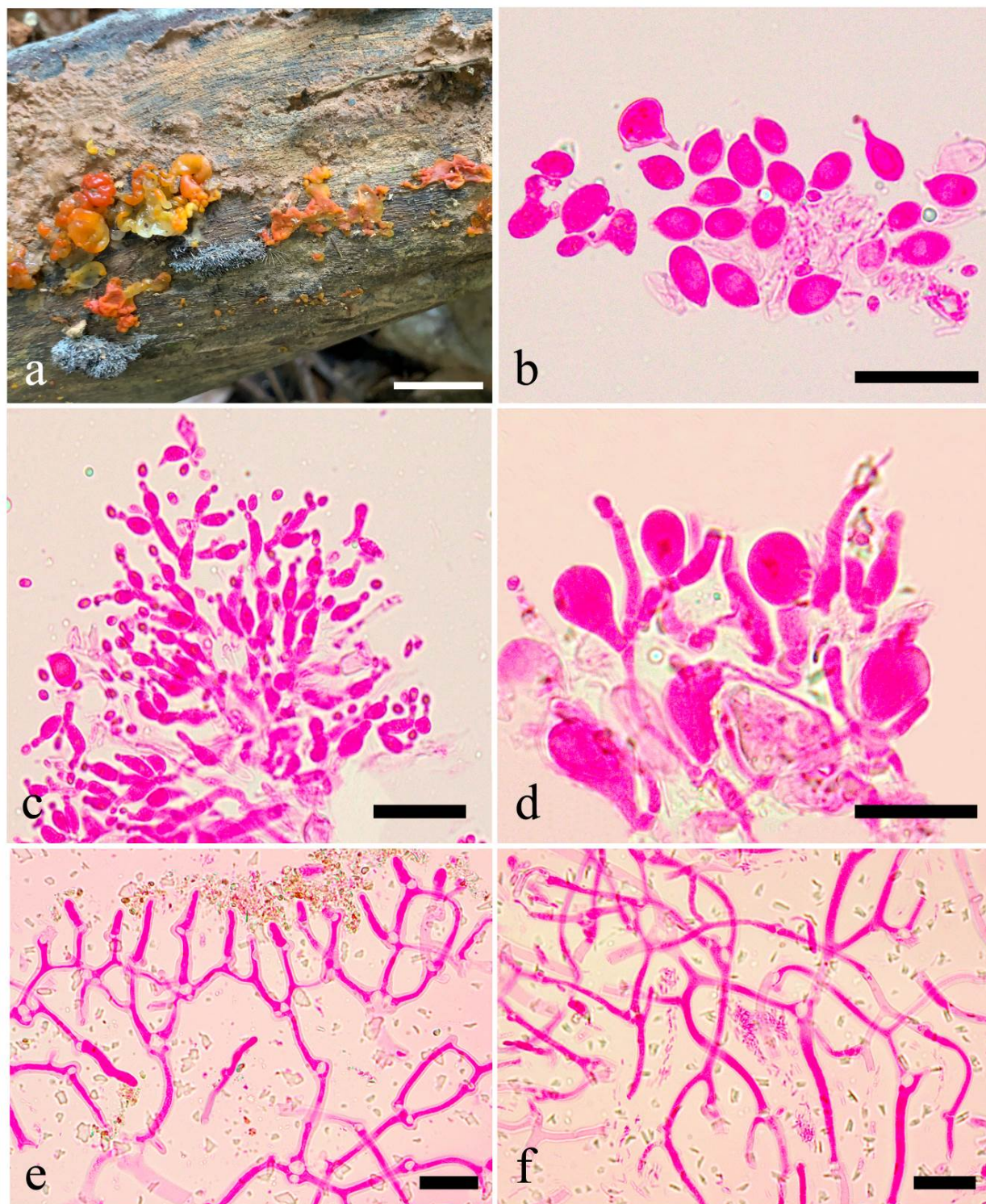


Fig. 70 Photos of basidiomata and microscopic structures of *Tremella crassihyphidiata*. a Basidiomata. b Basidiospores. c Conidial mother cells. d Probasidia and Basidia. e Hyphidia. f Hyphae. Scale bars = a 1 cm, b–f 10 μ m.

Known distribution: Southwest China.

Specimens examined: China, Yunnan Province, Xishuangbanna, Mengla County, Tropical Botanic Park, on rotten angiosperm wood, 18 Aug 2019, Y.C. Dai, Dai 20537 (BJFC 032205, **holotype**), Dai 20537R (BJFC 033386).

Notes: *Tremella crassihyphidiata* may be confused with *T. erythrina* by sharing brownish red basidiomata when fresh, but *T. erythrina* differs from *T. crassihyphidiata* by thin-walled

hyphidia and the absence of conidia. In addition, *T. menglunensis* Peng was also originally described from Yunnan Province, China and we have checked the type of *T. menglunensis*, but the DNA sequences were not generated because of the poor condition of the type. *T. menglunensis* differs from *T. crassihyphidiata* by having white to brownish white basidiomata, distinctly smaller basidiospores ($5.0\text{--}7.5 \times 3.5\text{--}5.0 \mu\text{m}$ vs. $7.0\text{--}9.0 \times 5.0\text{--}7.0 \mu\text{m}$), and growth on

Hypoxyton chalybaeum Berk. & Broome (Peng 1984). In the phylogeny, the species formed one independent lineage with

strong support (Fig. 3).

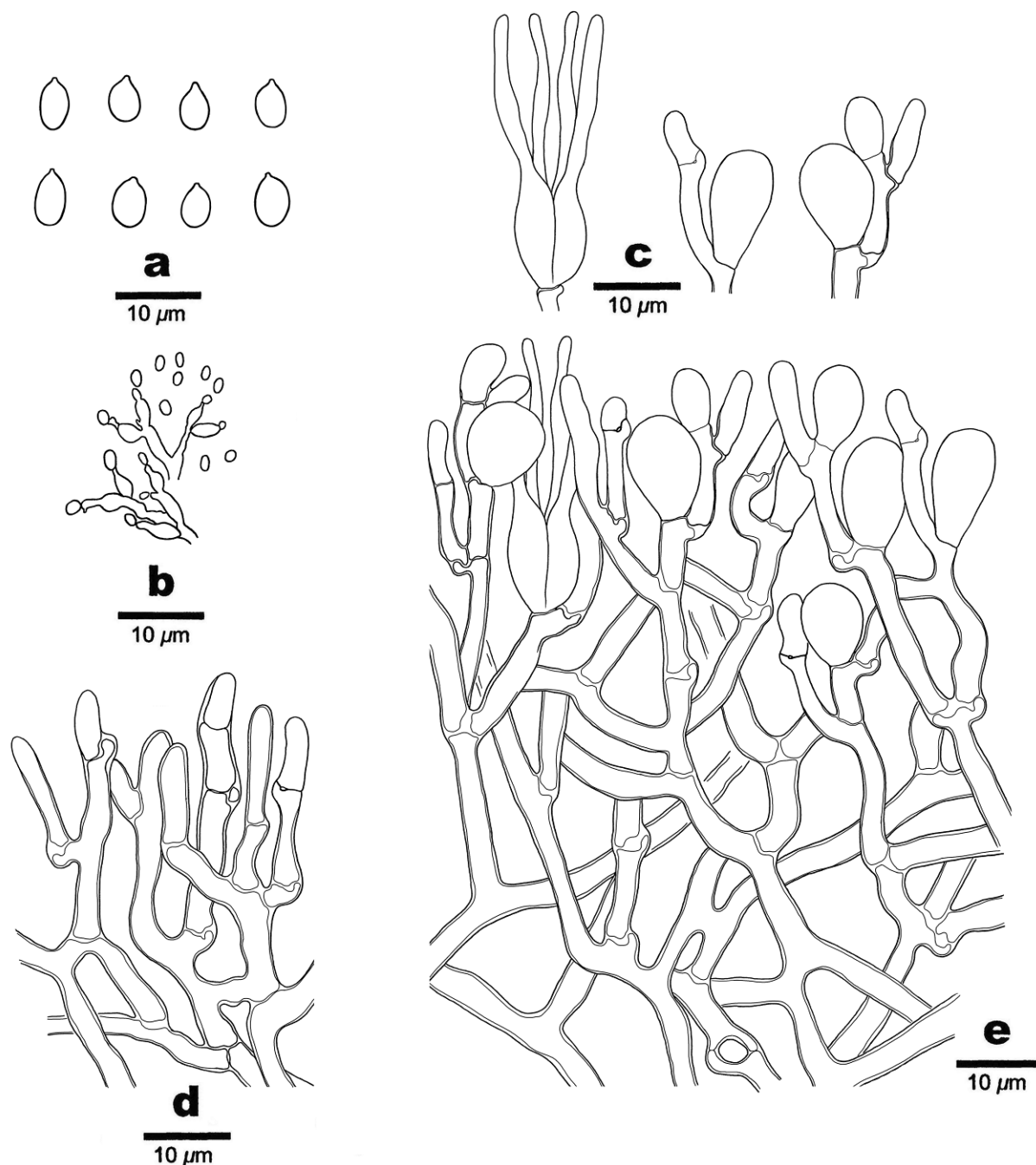


Fig. 71 Line drawings of microscopic structures of *Tremella crassihyphidiata*. a Basidiospores. b Conidial mother cells. c Probasidia and Basidia. d Hyphidia. e A section of hymenium. Scale bars = a–e 10 μ m.

Tremella ellipsospora F. Wu, L.F. Fan & Y.C. Dai, *sp. nov.*
Figs. 72, 73
Mycobank: MB 856394

Etymology: *Ellipsospora* (Lat.): refers to the species having oblong-ellipsoid to ellipsoid basidiospores.

Diagnosis: Similar to *Tremella hongheensis* but differs in having distinctly smaller basidia and basidiospores.

Basidiomata: Soft gelatinous, curry yellow to cinnamon buff when fresh, becoming firmly gelatinous and honey yellow to orange-brown when dry; irregularly foliaceous, sessile,

caespitose, up to 2.0 cm long, 1.0 cm diam. and 0.5 cm high from base, with small undulate lobes (not hollow), broadly attached to substratum.

Internal features: Hyphae hyaline, thin- to thick-walled, smooth, 2.0–4.0 μ m diam., uninflated in KOH, branched, interwoven, with abundant clamp connections. Hyphidia hyaline, thin-walled, smooth, usually derived from the same hyphae with probasidia or terminal hyphae; swollen cells, haustoria and vesicles absent. Probasidia ovoid to pyriform; mature basidia thin-walled, ovoid to broadly ellipsoid, with a

basal clamp connection, $12.5\text{--}15.0 \times 9.0\text{--}11.0 \mu\text{m}$, longitudinally septate, rarely obliquely septate, 2–4-celled, usually with a few small oil drops; sterigmata up to $40 \mu\text{m}$ long, $1.2\text{--}2.0 \mu\text{m}$ diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, oblong-ellipsoid to ellipsoid,

apiculate, usually with one oil drop, $6.0\text{--}7.4 \times 3.9\text{--}5.5 \mu\text{m}$, $L = 6.82 \mu\text{m}$, $W = 4.69 \mu\text{m}$, $Q = 1.36\text{--}1.45$ ($n = 60/2$), occasionally germinating by germ tubes. Conidia uncertain, conidia-like cells present, very small.

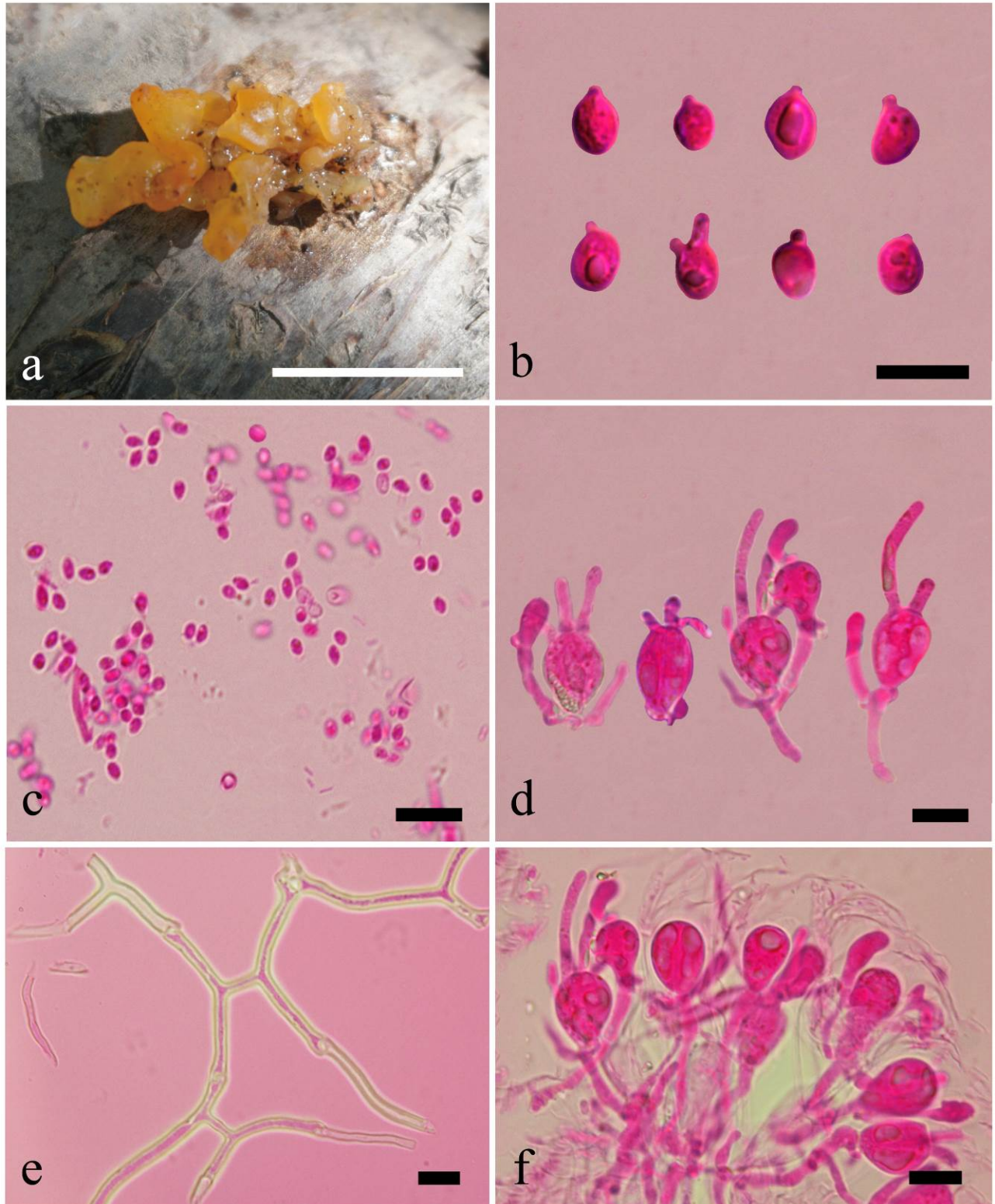


Fig. 72 Photos of basidiomata and microscopic structures of *Tremella ellipsospora*. a Basidiomata. b Basidiospores. c Conidia-like cells or secondary spores. d Probasidia, Basidia and Hyphidia. e Hyphae. f A section of hymenium. Scale bars = a 1 cm, b–f 10 μm .

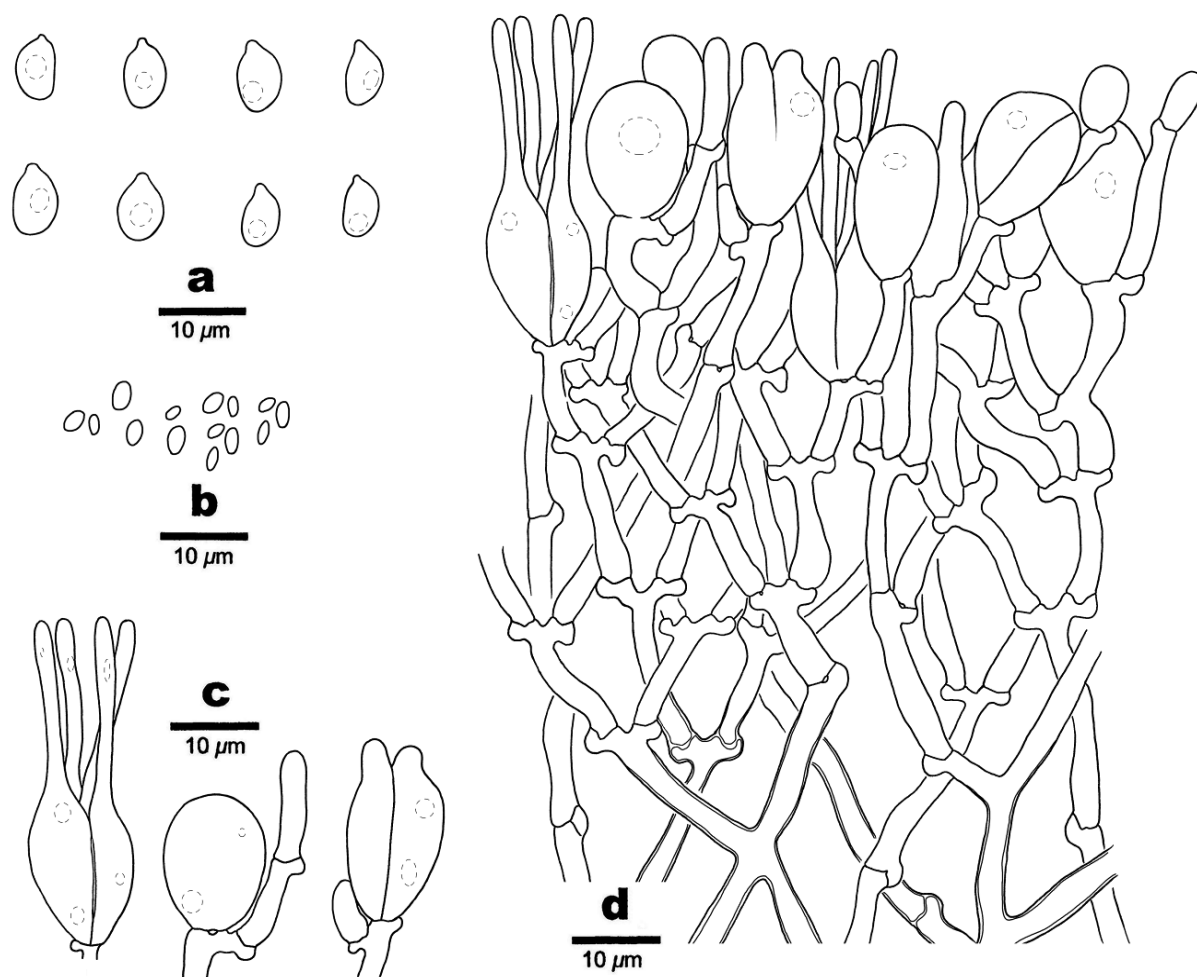


Fig. 73 Line drawings of microscopic structures of *Tremella ellipsospora*. a Basidiospores. b Conidia-like cells or secondary spores. c Probasidia, basidia and hyphidia. d A section of hymenium. Scale bars = a–d 10 µm.

Known distribution: Southwest China.

Specimens examined: China, Yunnan Province, Mengla County, Wangtianshu Nature Reserve, on fallen angiosperm trunk, 18 Jun 2017, Y.C. Dai, Dai 17491 (BJFC 025024, **holotype**), Dai 17491R (BJFC 033385).

Notes: *Tremella ellipsospora* resembles *T. hongheensis* by sharing curry yellow to cinnamon buff basidiomata when fresh, but *T. hongheensis* is differentiated from *T. ellipsospora* by distinctly larger basidia (12.5–20.0 × 9.0–16.3 µm vs. 12.5–15.0 × 9.0–11.0 µm) and basidiospores (7.0–10.0 × 5.0–7.8 µm vs. 6.0–7.4 × 3.9–5.5 µm). In addition, *T. menglunensis*, also described from Yunnan, China, differs from *T. ellipsospora* by having white to brownish white basidiomata and growth on *Hypoxylon chalybaeum* (Peng 1984). In the phylogeny, the species formed one distinct lineage closely related to *T. mangiformis* and *T. aurulenta* (Fig. 3). However, *T. mangiformis* can be distinguished from *T. ellipsospora* by buff to brownish orange basidiomata, rare haustori, and slightly larger basidia (13.0–17.0 × 10.0–12.0 µm vs. 12.5–15.0 × 9.0–11.0 µm) and basidiospores (6.0–8.0 × 5.0–6.0 µm vs. 6.0–7.4 × 3.9–5.5 µm). The differences between *T. aurulenta* and *T. ellipsospora* are discussed in the notes of *T. aurulenta*.

Tremella guttulata F. Wu, L.F. Fan & Y.C. Dai, *sp. nov.*
..... Figs. 74, 75

Mycobank: MB 856395

Etymology: *Guttulata* (Lat.): refers to the species having basidiospores with abundant small guttules.

Diagnosis: Similar to *Tremella mesenterica* but differs in having thick-walled hyphidia and shorter sterigmata.

Basidiomata: Gelatinous, pale yellow to buff when fresh, becoming firmly gelatinous and yellow when dry; foliaceous, sessile, caespitose, up to 3.0 cm long, 2.0 cm diam. and 1.0 cm high from base, with undulate lobes (not hollow), broadly attached to substratum.

Internal features: Hyphae hyaline, thin- to slightly thick-walled, smooth, 1.0–2.0 µm diam., uninflated in KOH, frequently branched, interwoven, with abundant clamp connections. Hyphidia hyaline, thin- to slightly thick-walled, smooth, usually derived from the same hyphae with probasidia or terminal hyphae; swollen cells thin- to thick-walled, variable in size and shape, with clamp connections; vesicles rarely present; haustoria abundant, globose to cylindrical, occasionally branched. Probasidia narrowly ovoid to ellipsoid; mature basidia thin-walled, broadly ellipsoid to subglobose, with a basal clamp connection, 18.0–26.0 × 11.0–23.0 µm, longitudinally septate, 2–4-celled, with a few small oil drops; sterigmata up to 30.0 µm long, 2.0–3.0 µm diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, broadly ellipsoid to subglobose, apiculate, with

abundant small oil drops, $9.0\text{--}12.0 \times 6.0\text{--}9.8 \mu\text{m}$, $L = 10.6 \mu\text{m}$, $W = 8.5 \mu\text{m}$, $Q = 1.25$ ($n = 30/1$), germinating by budding. Conidia abundant, occasionally in clusters, hyaline, thin-walled, smooth, spherical or ovoid to ellipsoid, rarely cylindrical, originating from branched conidiophores, $2.0\text{--}3.5 \times 2.0\text{--}4.0 \mu\text{m}$; conidial mother cells in chains with clamp connections.

Known distribution: East China.

Specimens examined: China, Taiwan Province, Pingtung County, Jinshueiyang National Trail, on angiosperm branch, S.H. Wu, Wu 0704-59 (TNM, F21023, **holotype**).

Notes: *Tremella guttulata* may be confused with *T. mesenterica* by sharing yellow and foliaceous basidiomata, variable swollen cells and rare vesicles, but *T. mesenterica* differs from *T. guttulata* by having thin-walled hyphidia and longer sterigmata (up to $106 \mu\text{m}$ long vs. up to $30.0 \mu\text{m}$ long). In addition, the two species formed two different lineages with robust support in our phylogeny (Fig. 3). *Tremella guttulata* is closely related to *T. conidiogena* in the phylogeny, the morphological differences between the two species are in the notes of *T. conidiogena*.

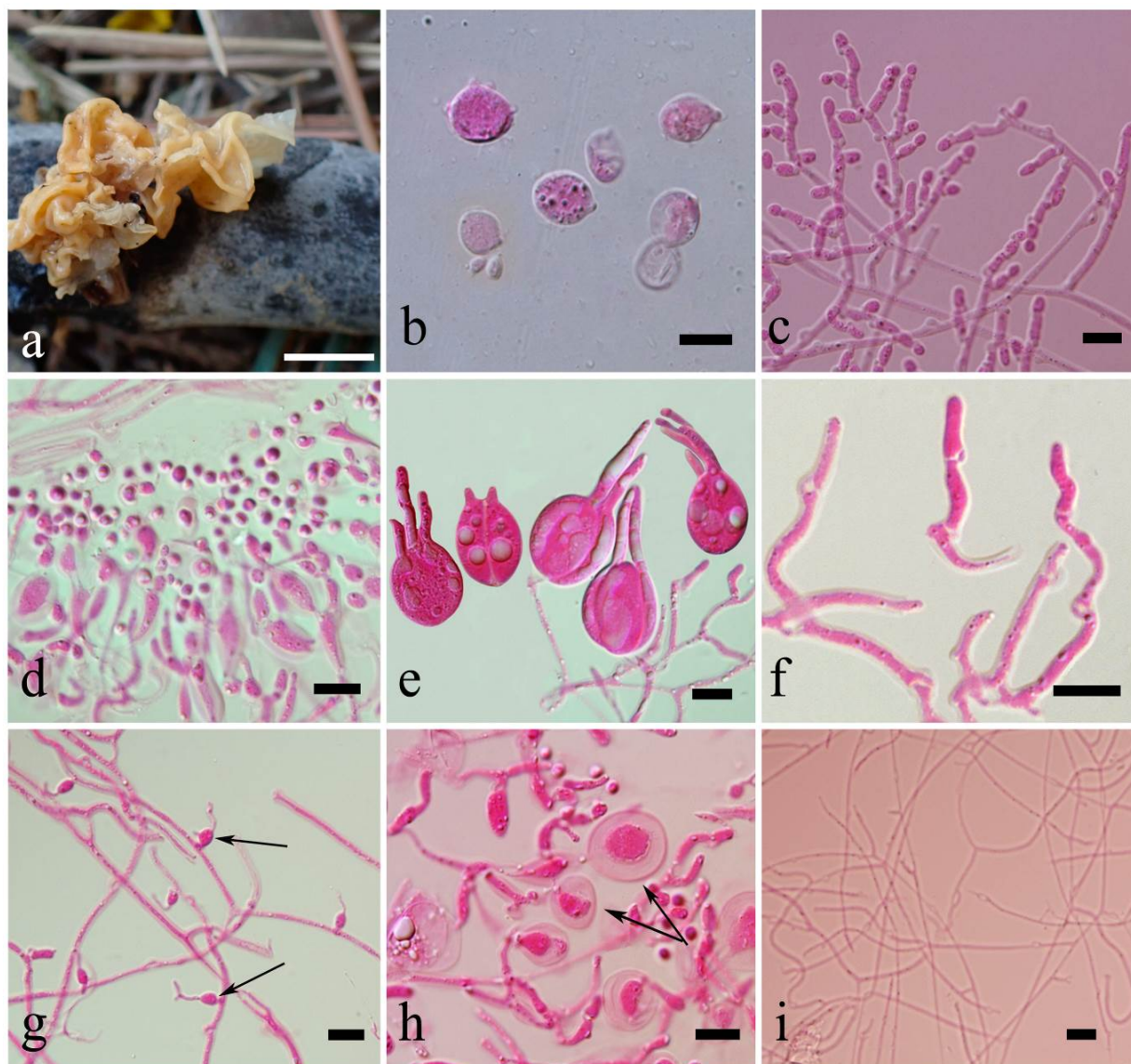


Fig. 74 Photos of basidiomata and microscopic structures of *Tremella guttulata*. a Basidiomata. b Basidiospores. c Conidiophores. d Conidia. e Basidia. f Hyphidia. g Haustoria (arrows). h Swollen cells (arrows). i Hyphae. Scale bars = a 1 cm, b–i $10 \mu\text{m}$.

Tremella helva F. Wu, A. Tohtirap & Y.C. Dai, **sp. nov.**

.....Figs. 76, 77

Mycobank: MB 856396

Etymology: *Helva* (Lat.): refers to the species having pale yellow to orange-yellow basidiomata when fresh.

Diagnosis: Similar to *Tremella cerebriformis* Chee J. Chen and *T. zhejiangensis* F. Wu et al. but differs in having pale yellow to orange-yellow basidiomata, slightly smaller

basidiospores, and abundant fusiform vesicles.

Basidiomata: Gelatinous, pale yellow to orange-yellow when fresh, distinctly shrinking to a film and becoming pale white and transparent when dry; pulvinate to irregularly cerebriform, sessile, caespitose, up to 2.5 cm long, 1.5 cm diam. and 1.0 cm high from base, with thick and undulate lobes (not hollow), usually attached to substratum by a central point.

Internal features: Hyphae hyaline, thin-walled to slightly thick-walled, smooth, 1.5–2.5 μm diam., uninflated in KOH, branched, interwoven, with abundant clamp connections and circular clamp connections. Hyphidia abundantly present in clusters, hyaline, thin-walled, smooth, usually branched from the clamp connections of the hymenial hyphae, sometimes derived from the same hyphae with probasidia; fusiform vesicles abundant; swollen cells and haustoria absent. Probasidia pyriform to ovoid; mature basidia thin-walled, subglobose to globose, with a basal clamp connection, 21.0–32.0 $\times$ 20.0–29.0 μm , sometimes diameter greater than length, longitudinally septate, 2–4-celled, usually with oil drops; sterigmata up to 62.0 μm long, 5.0–6.0 μm diam., usually with slightly swollen apex. Basidiospores hyaline, thin-walled, smooth, subglobose to globose, apiculate, usually with small oil drops, 12.2–16.0(–16.2) $\times$ (12.0–)12.2–16.0(–17.2), $L = 14.16 \mu\text{m}$, $W = 13.79 \mu\text{m}$, $Q = 1.01\text{--}1.04$ ($n = 46/2$), sometimes

diameter greater than length, usually germinating and producing secondary spores by germ tubes. Conidia absent, but some secondary spores resembling conidia, hyaline, thin-walled, smooth, mostly ovoid, subglobose, 5.0–6.0 $\times$ 4.0–5.0 μm .

Known distribution: Southwest China.

Specimens examined: China, Yunnan Province, Lanping County, Luogujing Nature Reserve, on fallen trunk of *Juglans* sp., 30 Jun 2021, Y.C. Dai, Dai 22755 (BJFC 037328, **holotype**); Xizang Autonomous Region, Bomi County, Yigong, Tea Plantation, on fallen angiosperm branch, 24 Oct 2021, Y.C. Dai, Dai 23417 (BJFC 037989), on fallen branch of *Populus* sp., 23 Oct 2023, Y.C. Dai, Dai 26636 (BJFC 044186), Dai 26637 (BJFC 044187), on fallen branch of *Alnus nepalensis*, 23 Oct 2023, Y.C. Dai, Dai 26642 (BJFC 044192), on fallen angiosperm branch, 29 Oct 2023, Y.C. Dai, Dai 27161 (BJFC 044714), Dai 27164 (BJFC 044717).

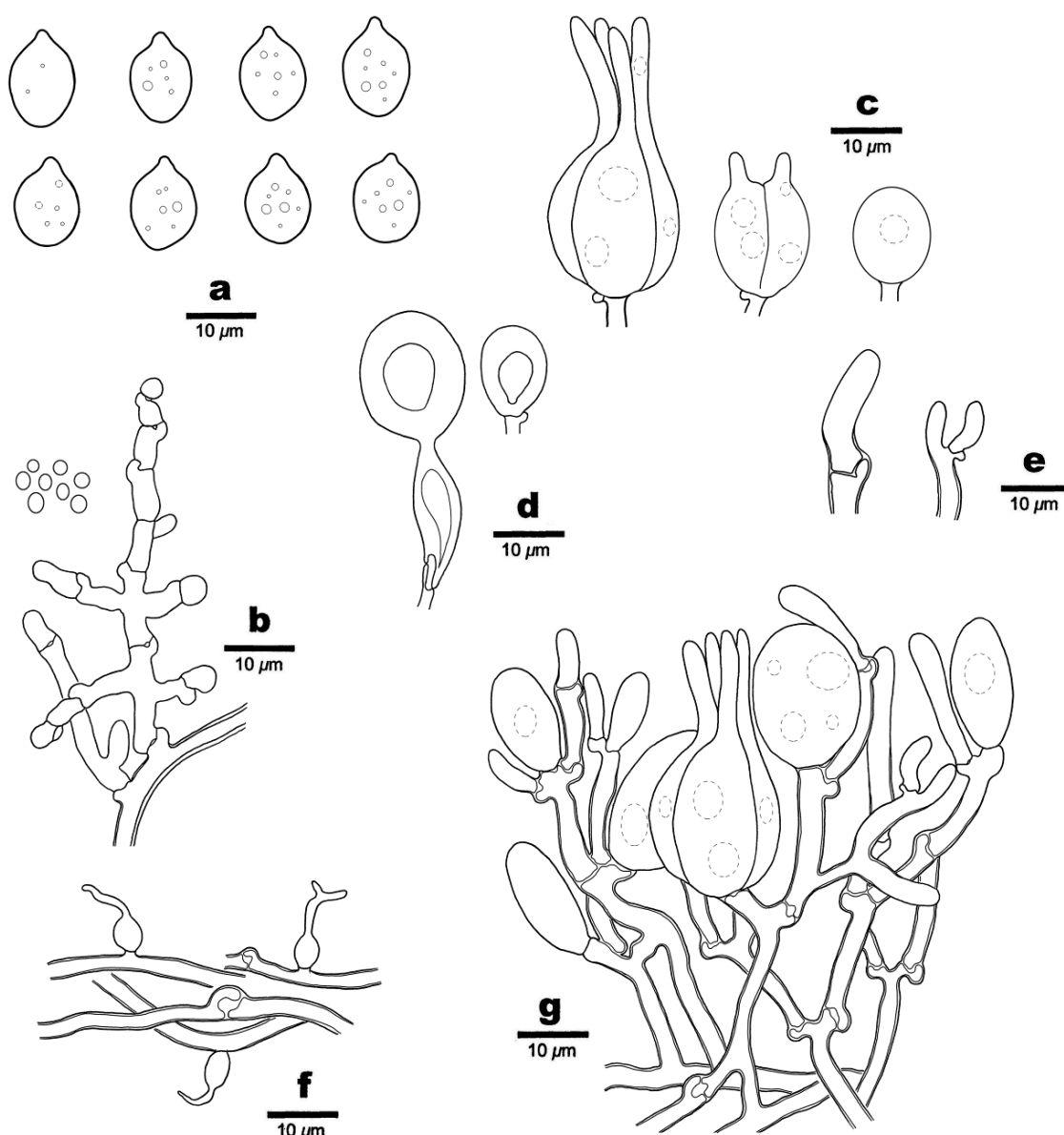


Fig. 75 Line drawings of microscopic structures of *Tremella guttulata*. a Basidiospores. b Conidiophores and conidia. c Probasidia and basidia. d Swollen cells. e Hyphidia. f Haustoria. g A section of hymenium. Scale bars = a–g 10 μm .

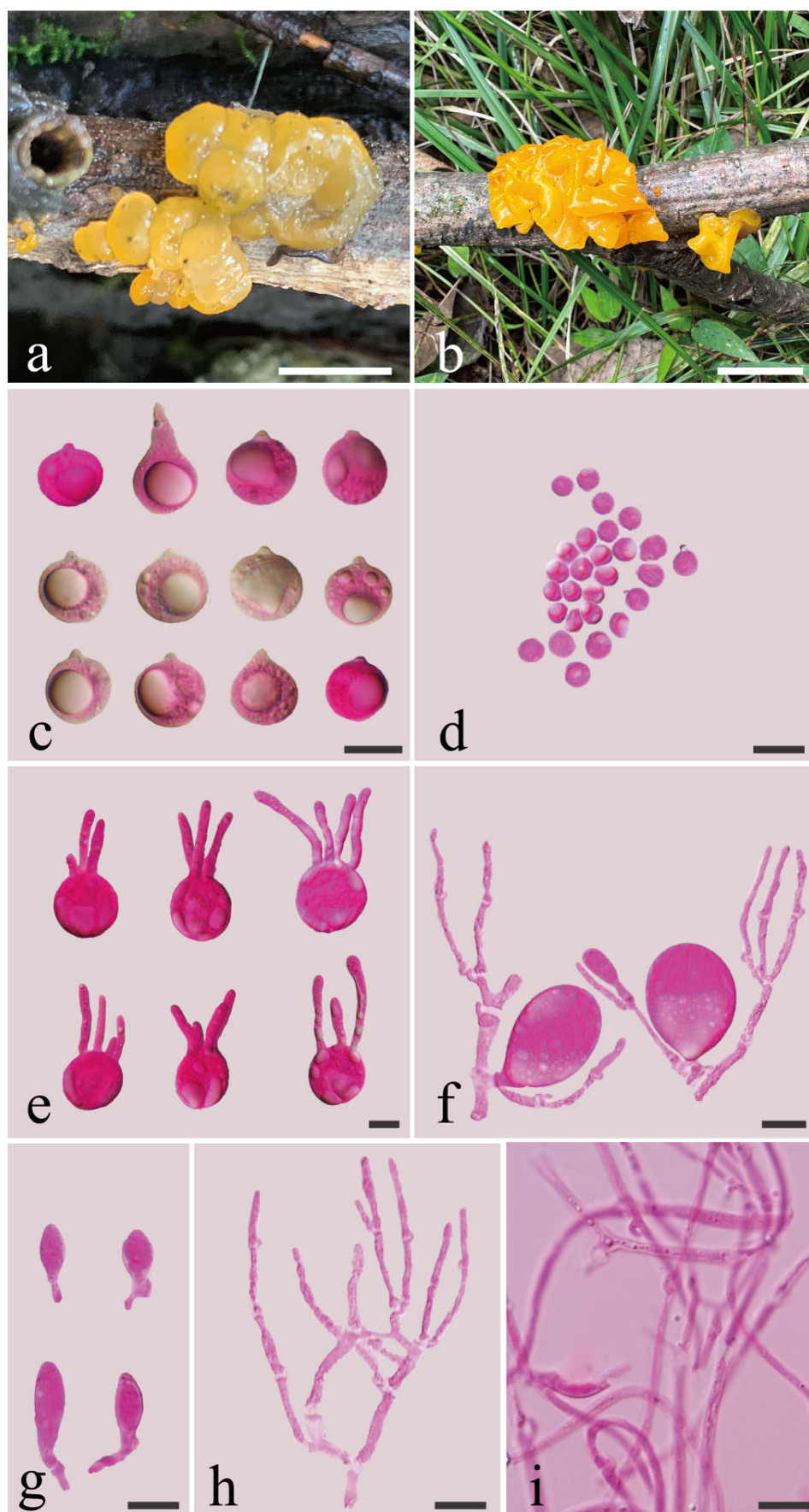


Fig. 76 Photos of basidiomata and microscopic structures of *Tremella helva*. a–b Basidiomata. c Basidiospores. d Conidia. e Basidia. f Probasidia and Hyphidia. g Vesicles. h Hyphidia. i Hyphae. Scale bars = a–b 1 cm, c–i 10 µm.

Notes: *Tremella helva* may be confused with *T. cerebriformis* and *T. zhejiangensis* by sharing yellowish and cerebriform basidiomata, but *T. cerebriformis* differs from *T. helva* by having usually white to cream, sometimes orange-yellow basidiomata and the absence of fusiform vesicles; *T. zhejiangensis* differs from *T. helva* by having rare hyphidia derived from terminal hyphae, the absence of fusiform vesicles, and slightly larger basidiospores ($15.0\text{--}19.0 \times 14.0\text{--}17.5 \mu\text{m}$ vs. $12.2\text{--}16.0 \times 12.2\text{--}16.0 \mu\text{m}$).

In the phylogeny, *Tremella helva* clustered in the same clade with *T. cerebriformis*, *T. zhejiangensis*, *T. taiwanensis* Chee J. Chen, *T. lutea* and *T. salmonea* Xin Zhan Liu & F.Y.

Bai with robust support (Fig. 3). However, *T. taiwanensis* differs from our new species by having snow white to white basidiomata when fresh, abundant haustoria, conidia in clusters and conidial mother cells in chains, *T. lutea* differs from *T. helva* by the absence of fusiform vesicles, and cylindrical or ellipsoid conidia, and *T. salmonea* differs from *T. helva* by distinctly larger basidiospores ($14.5\text{--}19.5 \times 14.7\text{--}18.5 \mu\text{m}$ vs. $12.2\text{--}16.0 \times 12.2\text{--}16.0 \mu\text{m}$), and the presence of swollen cells and conidia (Zhao et al. 2019; Table 3). In addition, the ITS sequences of *T. helva* are less than 95.8% identical to other five species.

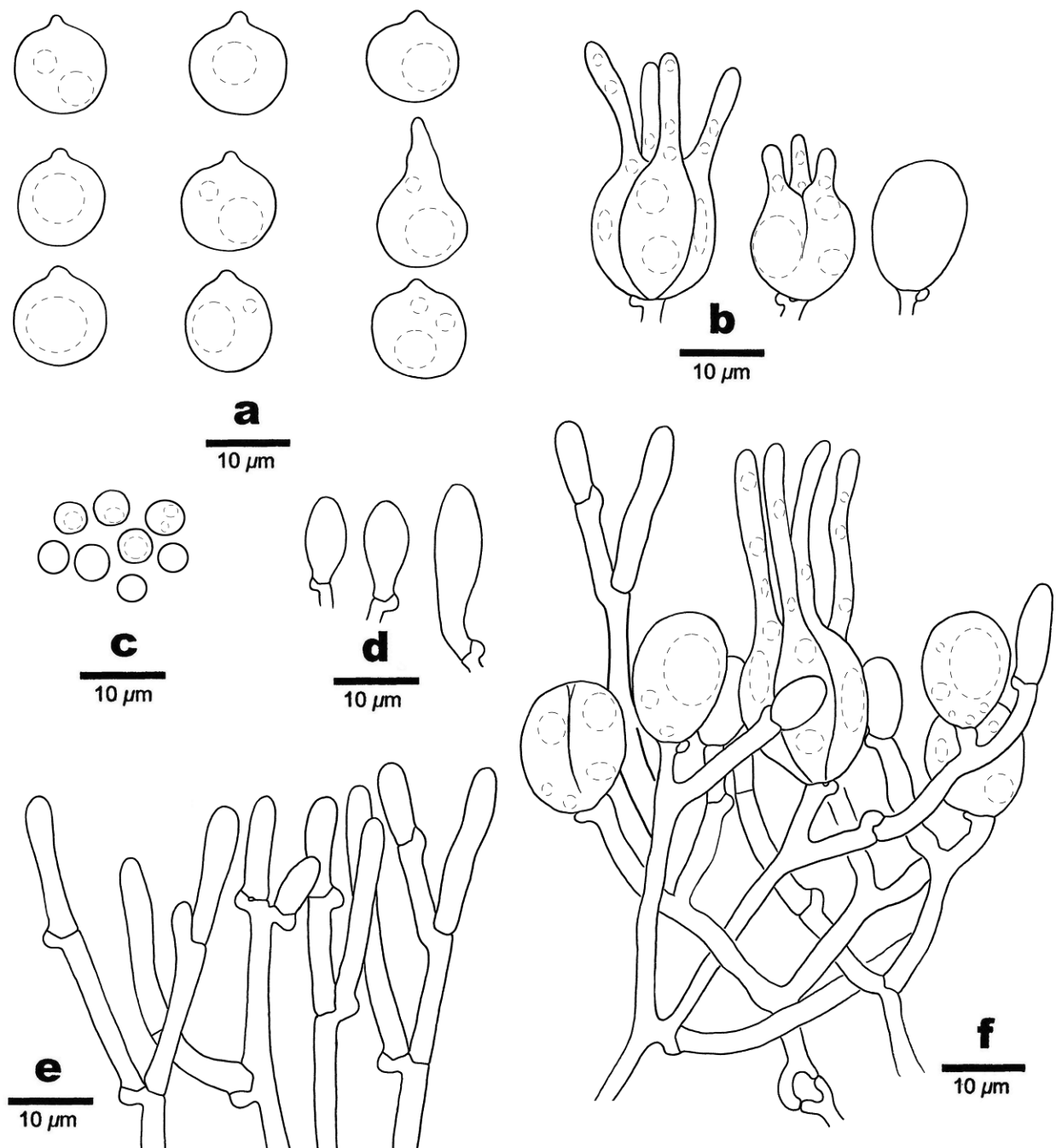


Fig. 77 Line drawings of microscopic structures of *Tremella helva*. a Basidiospores. b Probasidia and basidia. c Conidia. d Vesicles. e Hyphidia. f A section of hymenium. Scale bars = a–f 10 μm .

Tremella hongheensis F. Wu, L.F. Fan & Y.C. Dai, **sp. nov.**
.....Figs. 78, 79

Mycobank: MB 856397

Etymology: *Hongheensis* (Lat.): refers to the species being found in Honghe, China.

Diagnosis: Similar to *Tremella ellipsospora*, *T. erythrina*, and *T. samoensis*, but differs from *T. ellipsospora* in having larger basidia and basidiospores, and differs from *T. erythrina*

and *T. samoensis* in having curry yellow to cinnamon buff, not hollow basidiomata when fresh.

Basidiomata: Soft gelatinous, curry yellow to cinnamon buff when fresh, becoming firmly gelatinous and apricot orange to lemon yellow at base when dry; more or less foliaceous, sessile, caespitose, up to 3.0 cm long, 3.0 cm diam. and 1.5 cm high from base, with small undulate lobes (not hollow), broadly attached to substratum.

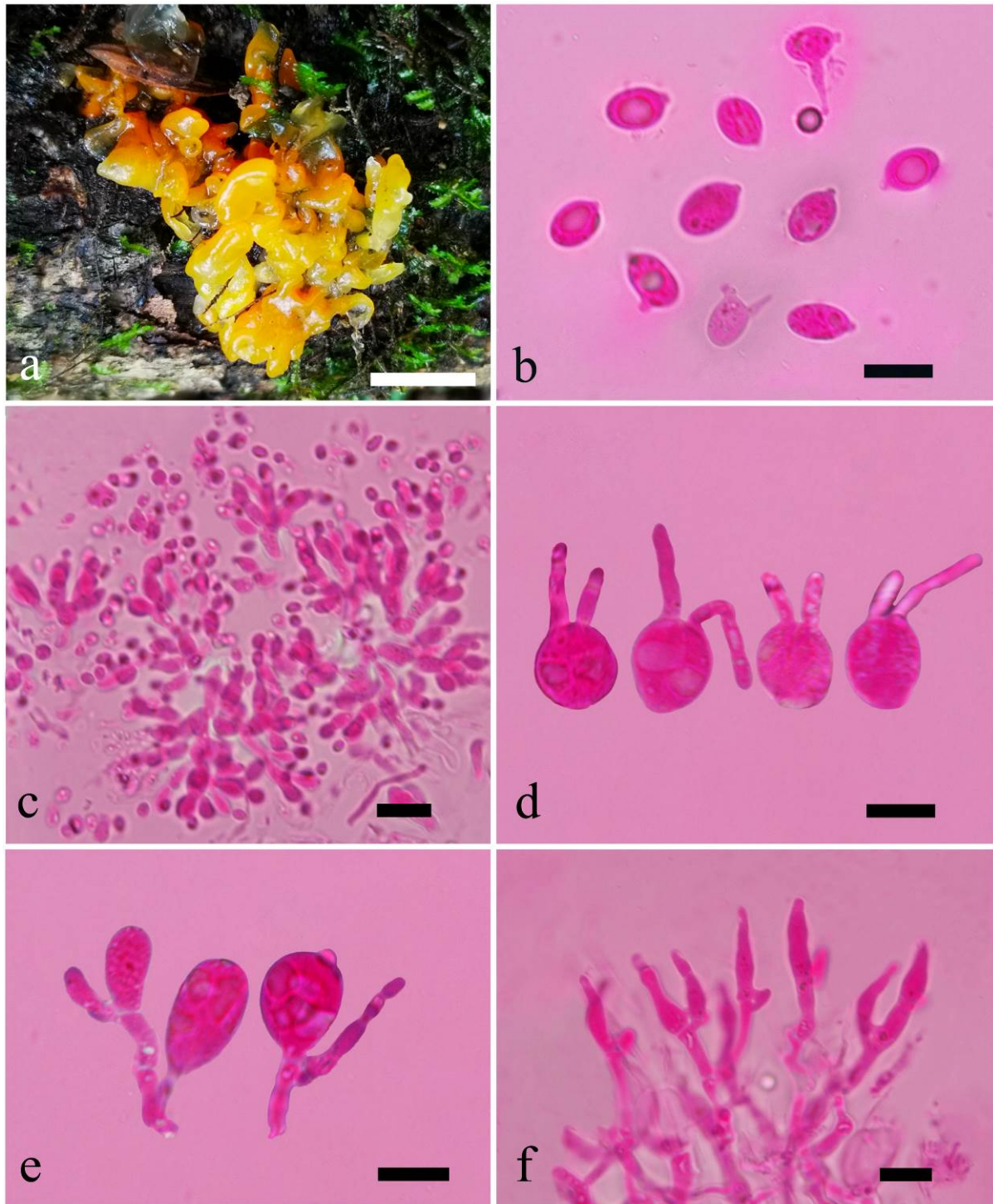


Fig. 78 Photos of basidiomata and microscopic structures of *Tremella hongheensis*. a Basidiomata. b Basidiospores. c Conidia and conidiophores. d Basidia. e Probasidia and hyphidia. f Hyphidia. Scale bars = a 1 cm, b–f 10 µm.

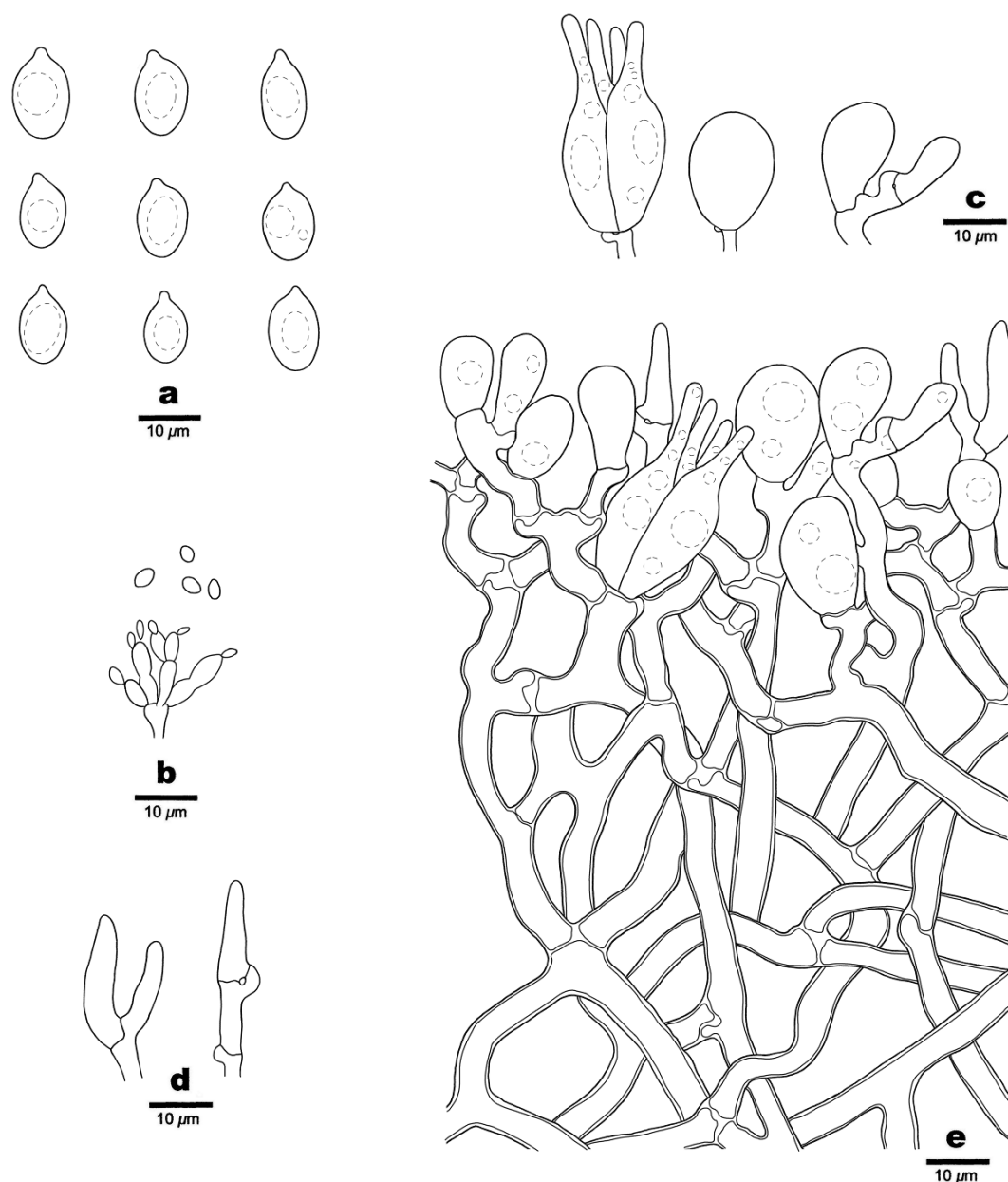


Fig. 79 Line drawings of microscopic structures of *Tremella hongheensis*. a Basidiospores. b Conidia and conidiophores. c Probasidia and basidia. d Hyphidia. e A section of hymenium. Scale bars = a–e 10 µm.

Internal features: Hyphae hyaline, thin- to slightly thick-walled, smooth, 2.0–4.0 µm diam., uninflated in KOH, branched, interwoven, with abundant clamp connections and circular clamp connections. Hyphidia hyaline, thin-walled, smooth, terminally tenuous, usually derived from the same hyphae with probasidia or terminal hyphae; swollen cells, vesicles and haustoria absent. Probasidia ovoid to pyriform; mature basidia thin-walled, broadly ellipsoid to subglobose, with a basal clamp connection, 12.5–20.0 × 9.0–16.3 µm, usually longitudinally septate, 2–4-celled, with obvious oil drops; sterigmata up to 25.0 µm long, 1.9–3.1 diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, oblong-ellipsoid to ellipsoid, apiculate, some with one large oil drop, 7.0–10.0 × 5.0–7.8 µm, $L = 8.2$ µm, $W = 6.2$ µm, $Q = 1.33–1.37$ ($n = 60/2$), occasionally germinating by germ tubes. Conidia abundant, variable in size and shape, usually

originating from umbelliform conidiophores, 2.2–3.4 × 1.6–2.6 µm.

Known distribution: Southwest China.

Specimens examined: China, Yunnan Province, Honghe, Jinping County, Banbanqiao Village, on fallen angiosperm branch, 15 Aug 2019, Y.C. Dai, Dai 20726 (BJFC 032393, **holotype**), Dai 20722 (BJFC 032389), Dai 20724 (BJFC 032391), Dai 20725 (BJFC 032392), Dai 20752 (BJFC 032419).

Notes: *Tremella hongheensis* may be confused with *T. ellipsospora*, *T. erythrina*, *T. samoensis* by sharing brownish orange basidiomata when dry, but *T. ellipsospora* differs from *T. hongheensis* by distinctly smaller basidia (12.5–15.0 × 9.0–11.0 µm vs. 12.5–20.0 × 9.0–16.3 µm) and basidiospores (6.0–7.4 × 3.9–5.5 µm vs. 7.0–10.0 × 5.0–7.8 µm); *T. erythrina* differs from *T. hongheensis* by its hollow basidiomata, slightly wider basidia (12.0–19.0 µm vs. 9.0–16.3 µm diam.) and the absence

of conidia; *T. samoensis* differs from *T. hongheensis* by having smaller basidiospores ($6.0\text{--}8.3 \times 5.0\text{--}6.3 \mu\text{m}$ vs. $7.0\text{--}10.0 \times 5.0\text{--}7.8 \mu\text{m}$) and hollow basidiomata. In the phylogeny,

T. hongheensis formed one independent lineage with robust support (Fig. 3).

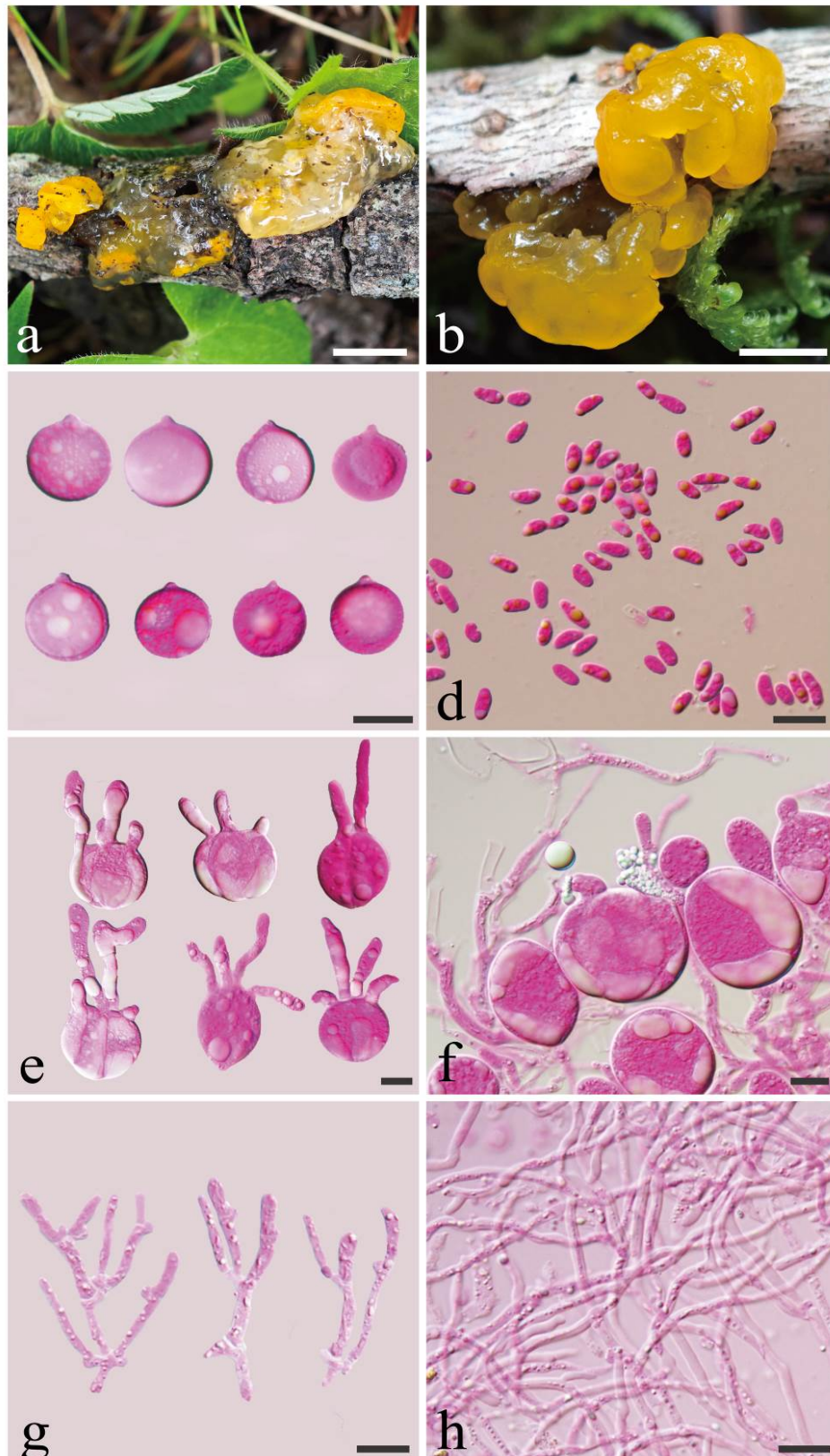


Fig. 80 Photos of basidiomata and microscopic structures of *Tremella lutea*. a–b Basidiomata. c Basidiospores. d Conidia. e Basidia. f Probasidia. g Hyphidia. h Hyphae. Scale bars = a–b 1 cm, c–h 10 μm.

Tremella lutea F. Wu, A. Tohtirap & Y.C. Dai, **sp. nov.**
.....Figs. 80, 81

MycoBank: MB 856398

Etymology: *Lutea* (Lat.): refers to the species having orange-yellow basidiomata when fresh.

Diagnosis: Similar to *Tremella helva* but differs in having slightly larger basidia, longer sterigmata, and the presence of conidia.

Basidiomata: Soft gelatinous, orange-yellow when fresh, distinctly shrinking to a film and becoming buff yellow when dry; pulvinate to irregularly cerebriform, sessile, caespitose, up to 2.0 cm long, 1.5 cm diam. and 1.2 cm high from base, with thick and undulate lobes (not hollow), broadly attached to substratum.

Internal features: Hyphae hyaline, thin-walled to slightly thick-walled, smooth, 1.5–3.0 μm diam., slightly inflated in KOH, branched, interwoven, with abundant clamp connections. Hyphidia abundantly present in clusters, hyaline, thin-walled, smooth, usually branched from the clamp connections of the hymenial hyphae, sometimes derived from

the same hyphae with probasidia; fusiform vesicles occasionally present; swollen cells and haustoria absent. Probasidia pyriform to subglobose; mature basidia thin-walled, ovoid to subglobose, with a basal clamp connection, 27.0–32.0 $\times$ 26.0–36.0 μm , sometimes diameter greater than length, longitudinally septate, rarely obliquely septate, 2–4-celled, usually with oil drops; sterigmata up to 95.0 μm long, 7.0–10.0 μm diam., with obviously swollen apex. Basidiospores hyaline, thin-walled, smooth, subglobose to globose, apiculate, usually with one large oil drop, (11.5–)12–17.1(–17.2) $\times$ 11.5–16.5(–17.0) μm , $L = 15.05 \mu\text{m}$, $W = 14.12 \mu\text{m}$, $Q = 1.07$ ($n = 30/1$), germinating by budding or germination tubes. Conidia abundant, hyaline, thin-walled, smooth, cylindrical, ellipsoid, 5.0–7.0 $\times$ 3.0–3.5 μm .

Known distribution: Southwest China.

Specimens examined: China, Xizang Autonomous Region, Linzhi, Sejilashan, on fallen angiosperm branch, 8 Aug 2023, F. Wu, Wu 749 (BJFC 040742), Wu 734 (BJFC 040727), Wu 759 (BJFC 040752, **holotype**).

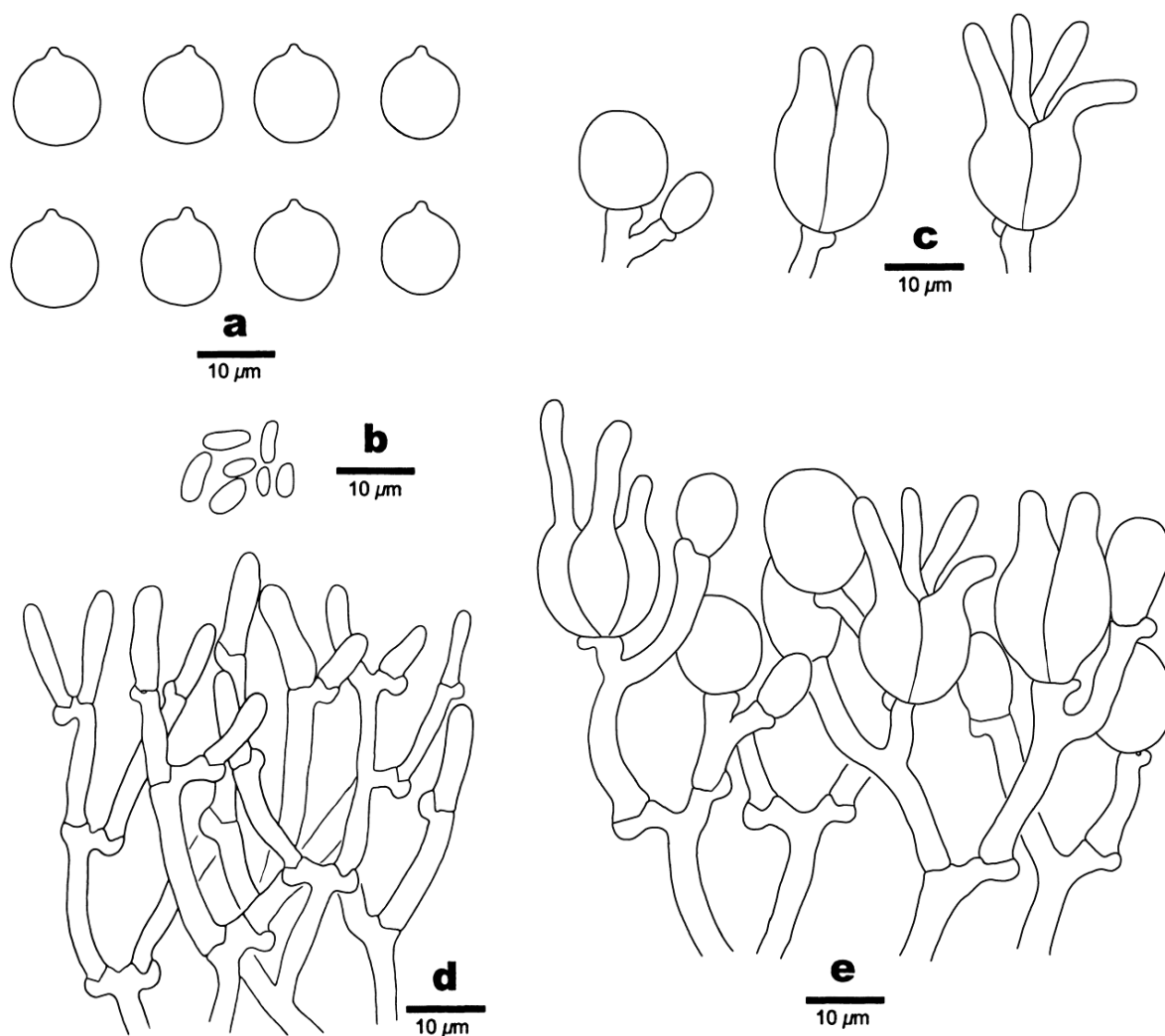


Fig. 81 Line drawings of microscopic structures of *Tremella lutea*. a Basidiospores. b Conidia. c Probasidia and basidia. d Hyphidia. e A section of hymenium. Scale bars = a–e 10 μm .

Notes: *Tremella lutea* is morphologically similar to *T. helva* by sharing pulvinate to irregularly cerebriform and orange-yellow basidiomata, and overlapping distribution, but *T. helva* differs from *T. lutea* by having slightly smaller basidia ($21.0\text{--}32.0 \times 20.0\text{--}29.0 \mu\text{m}$ vs. $27.0\text{--}32.0 \times 26.0\text{--}36.0 \mu\text{m}$) and sterigmata (up to $62.0 \mu\text{m}$ vs. up to $95.0 \mu\text{m}$ long, $5.0\text{--}6.0 \mu\text{m}$ vs. $7.0\text{--}10.0 \mu\text{m}$ diam.), and the absence of conidia.

In the phylogeny, *Tremella lutea* is closely related to *T. cerebriformis* and *T. zhejiangensis*, but *T. cerebriformis*

differs from *T. lutea* by its usually white to cream basidiomata when fresh, hyphae with circular clamp connections, smaller sterigmata (up to $50.0 \mu\text{m}$ long, $3.0\text{--}6.0 \mu\text{m}$ diam.), larger basidiospores ($15.3\text{--}19.0 \times 15.7\text{--}20.0 \mu\text{m}$ vs. $12\text{--}17.1 \times 11.5\text{--}16.5 \mu\text{m}$), and the absence of conidia; *T. zhejiangensis* differs from *T. lutea* by its cinnamon buff to honey yellow, irregularly cerebriform basidiomata, rare hyphidia, smaller sterigmata (up to $45.0 \mu\text{m}$ long, $4.0\text{--}6.0 \mu\text{m}$ diam.), larger basidiospores ($15.0\text{--}19.0 \times 14.0\text{--}17.5 \mu\text{m}$).

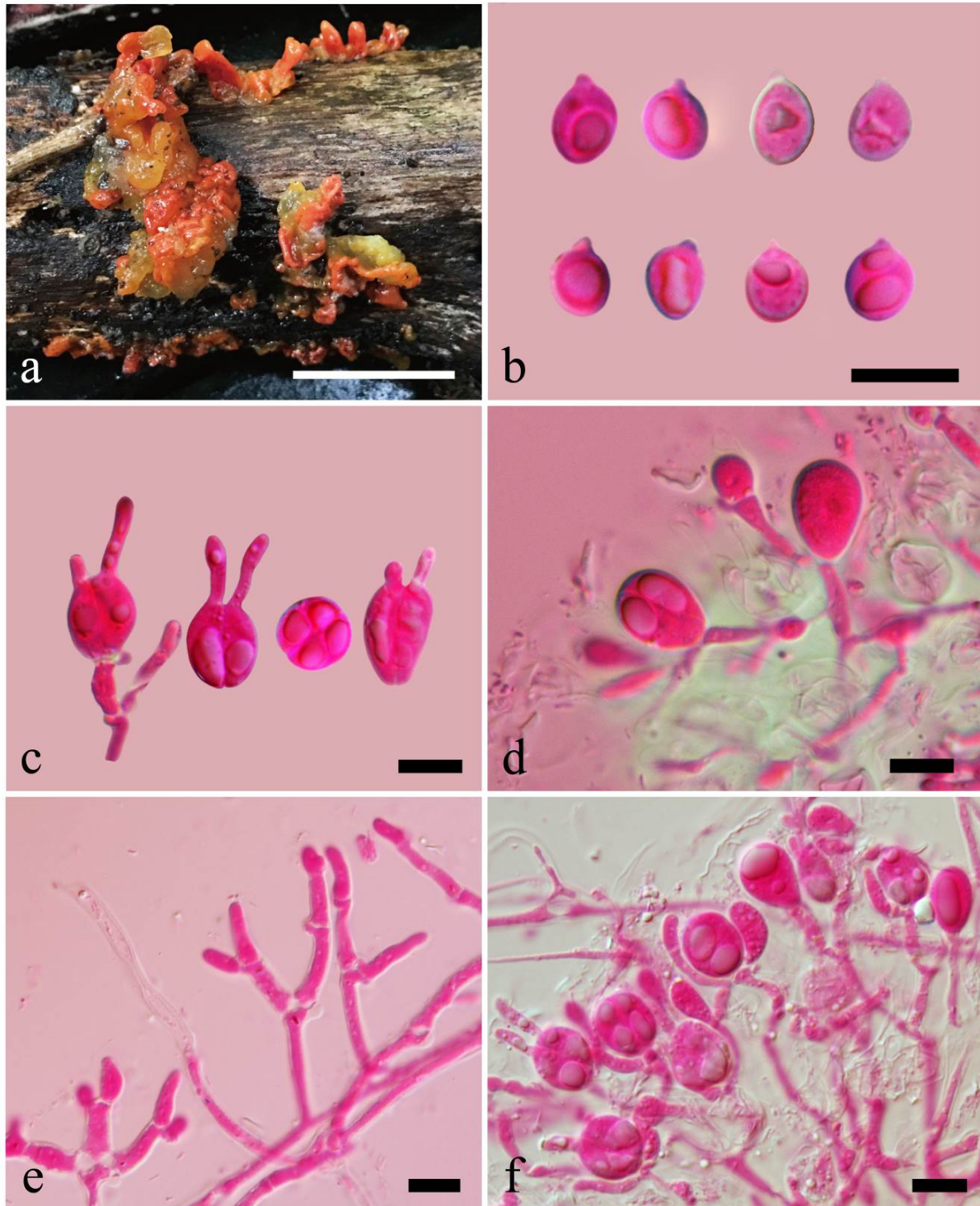


Fig. 82 Photos of basidiomata and microscopic structures of *Tremella mangiformis*. a Basidiomata. b Basidiospores. c Basidia. d Probasidia. e Hyphidia. f A section of hymenium. Scale bars = a 1 cm, b–f 10 μm .

Tremella mangiformis F. Wu, L.F. Fan & Y.C. Dai, *sp. nov.*
.....Figs. 82, 83

MycoBank: MB 856399

Etymology: *Mangiformis* (Lat.): refers to the species having mango-shaped basidiospores.

Diagnosis: Similar to *Tremella erythrina* and *T. samoensis* but differs in having not hollow basidiomata with small vesicular to undulate lobes, branched hyphidia and mango-shaped basidiospores.

Basidiomata: Soft gelatinous, buff to brownish orange when fresh, becoming firmly gelatinous and dark reddish brown when dry; irregularly cerebriform to foliaceous, sessile, caespitose, up to 4.0 cm long, 3.0 cm diam. and 1.5 cm high from base, with small vesicular to undulate lobes (not hollow, with single-layer structure), broadly attached to substratum.

Internal features: Hyphae hyaline, thin- to slightly thick-walled, smooth, 0.8–6.0 μm diam., slightly inflated in KOH, branched, interwoven, with abundant clamp connections. Hyphidia present in clusters, hyaline, thin- to slightly thick-

walled, smooth, branched, usually derived from the same hyphae with probasidia or terminal hyphae, also branched from the clamp connections; swollen cells and vesicles absent; haustoria rarely present. Probasidia ovoid; mature basidia thin-walled, subglobose to barrel-shaped, with a basal clamp connection, 13.0–17.0 $\times$ 10.0–12.0 μm , longitudinally septate, rarely obliquely septate, 2–4-celled, usually with obvious oil drops; sterigmata up to 27.0 μm long, 1.2–2.0 μm diam., sometimes with swollen apex. Basidiospores hyaline, thin-walled, smooth, mostly mango-shaped, occasionally ellipsoid, apiculate, usually with one or two oil drops, 6.0–8.0 $\times$ 5.0–6.0 μm , $L = 6.85 \mu\text{m}$, $W = 5.58 \mu\text{m}$, $Q = 1.16\text{--}1.23$ ($n = 60/2$), germinating by germ tubes. Conidia absent.

Known distribution: South China.

Specimens examined: China, Hainan Province, Baoting County, Qixianling Forest Park, on rotten angiosperm wood, 8 Jun 2007, Y.C. Dai, Dai 17672 (BJFC 025204, **holotype**), Dai 17672R (BJFC 033384).

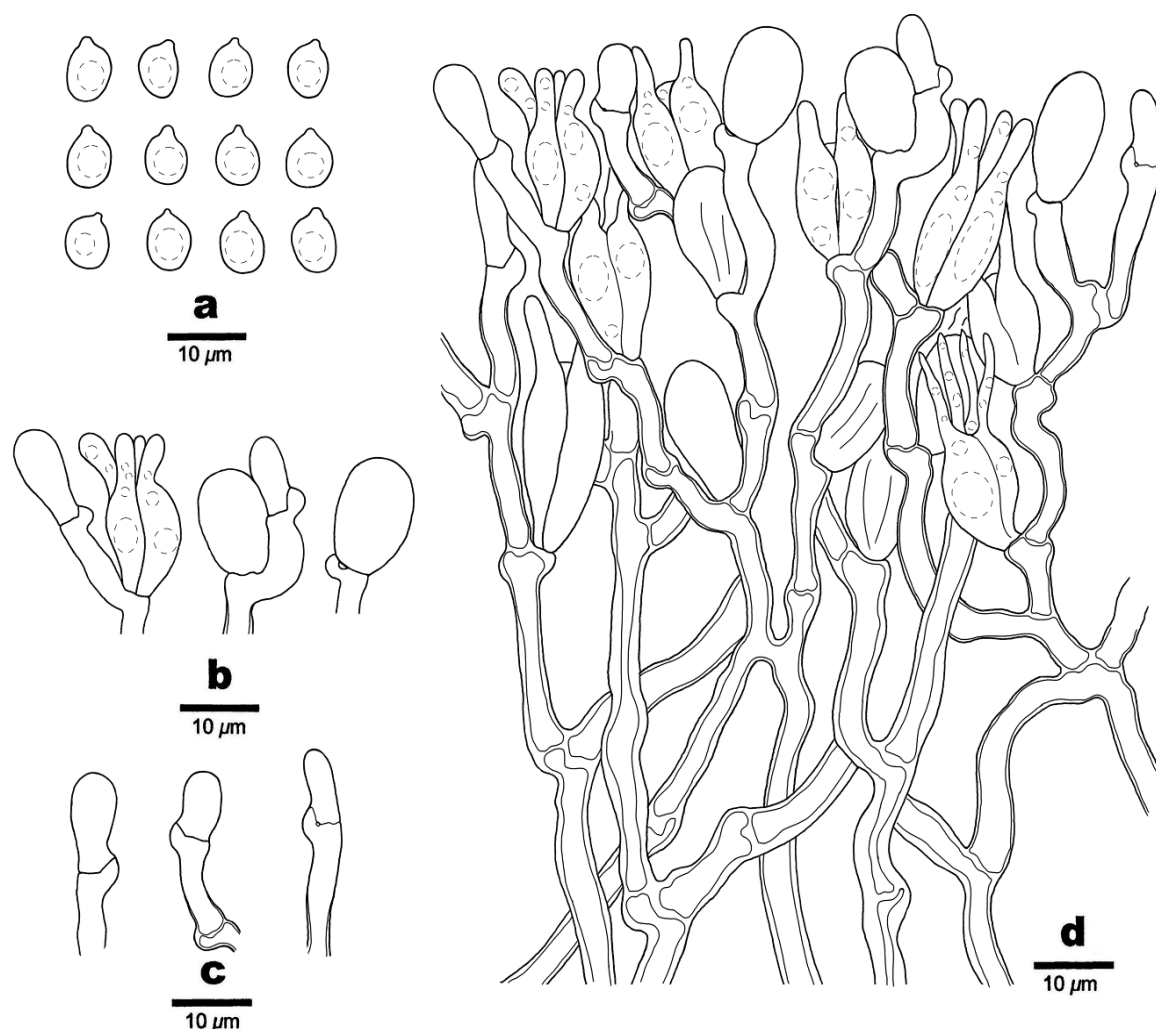


Fig. 83 Line drawings of microscopic structures of *Tremella mangiformis*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 μm .

Notes: *Tremella mangiformis* is similar to *T. samoensis* and *T. erythrina* by sharing brownish orange, irregularly cerebriform to foliaceous basidiomata when fresh and

hyphidia usually derived from the same hyphae with probasidia or the terminal hyphae. However, *T. samoensis* differs from *T. mangiformis* by having hollow basidiomata, the

absence of branched hyphidia, ellipsoid to broadly ellipsoid basidiospores, and abundant conidia; *T. erythrina* differs from *T. mangiformis* by having hollow basidiomata, distinctly wider basidia (12.0–19.0 μm vs. 10.0–12.0 μm diam.) and ellipsoid, broadly ellipsoid to subglobose basidiospores. In the phylogeny (Fig. 3), the three species formed three independent lineages. In addition, *T. hainanensis* Peng, also described from Hainan, China, is differentiated from *T. mangiformis* by its whitish to cream, subglobose and firm-gelatinous basidiomata (Peng 1982). We have checked the type of *T. hainanensis*, but the DNA sequences of the type were not generated because the specimen was in poor condition.

Tremella microcarpa F. Wu, L.F. Fan & Y.C. Dai, *sp. nov.*.....

..... Figs. 84, 85

Mycobank: MB 856400

Etymology: *Microcarpa* (Lat.): refers to the species having very small basidiomata.

Diagnosis: Similar to *Tremella laurisilvae* Kout but differs in having shorter basidia, and lacking ellipsoid conidia.

Basidiomata: Gelatinous, sienna to fulvous when fresh, becoming vinaceous brown to black when dry; finger-shaped to slightly foliaceous, sessile, caespitose, up to 1.3 cm long, 0.8 cm diam. and 0.8 cm high from base, with finger-like lobes (not hollow), attached to substratum by a central point.

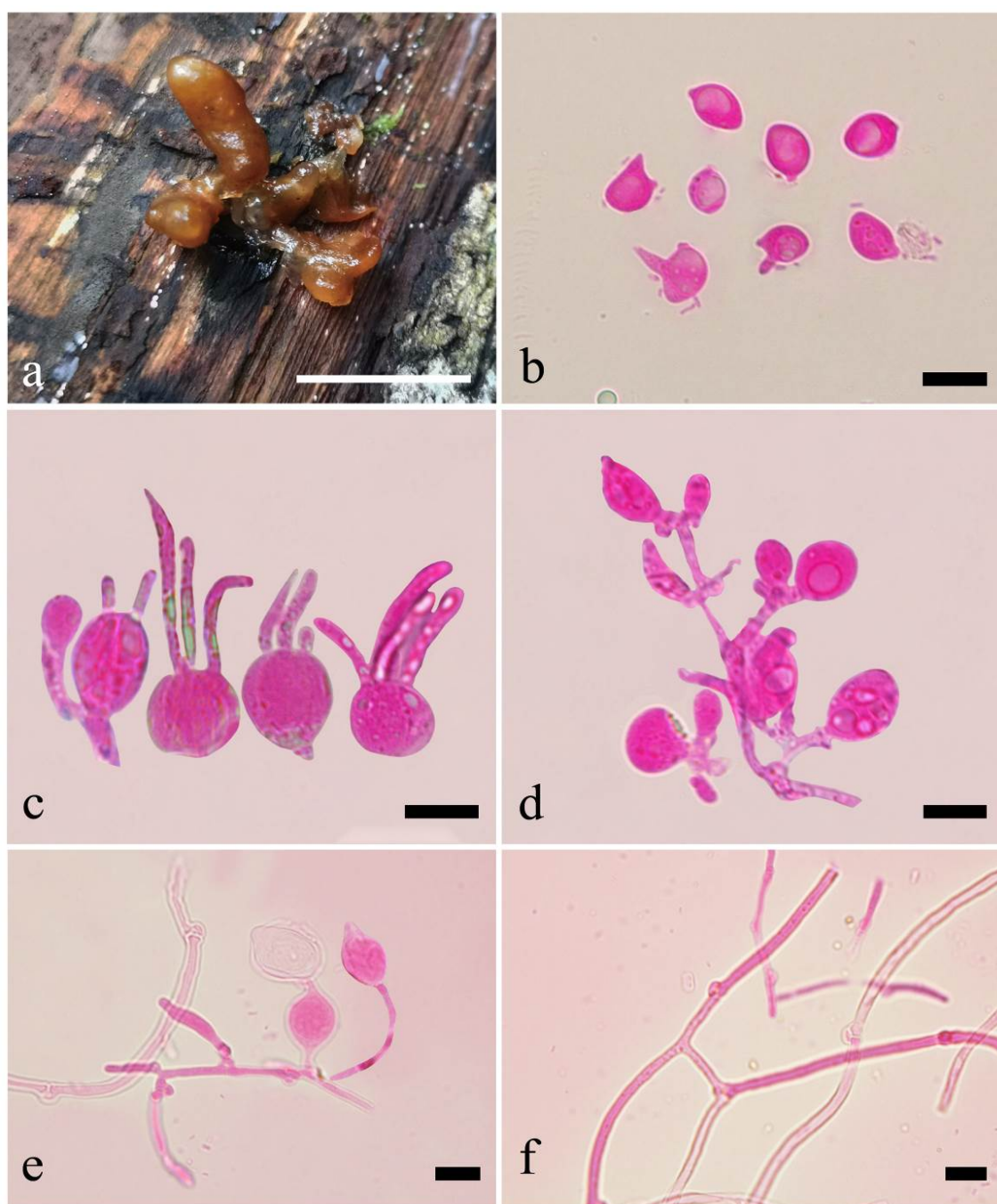


Fig. 84 Photos of basidiomata and microscopic structures of *Tremella microcarpa*. a Basidiomata. b Basidiospores. c Basidia. d Probasidia. e Swollen cells and hyphidia. f Hyphae. Scale bars = a 1 cm, b–f 10 μm .

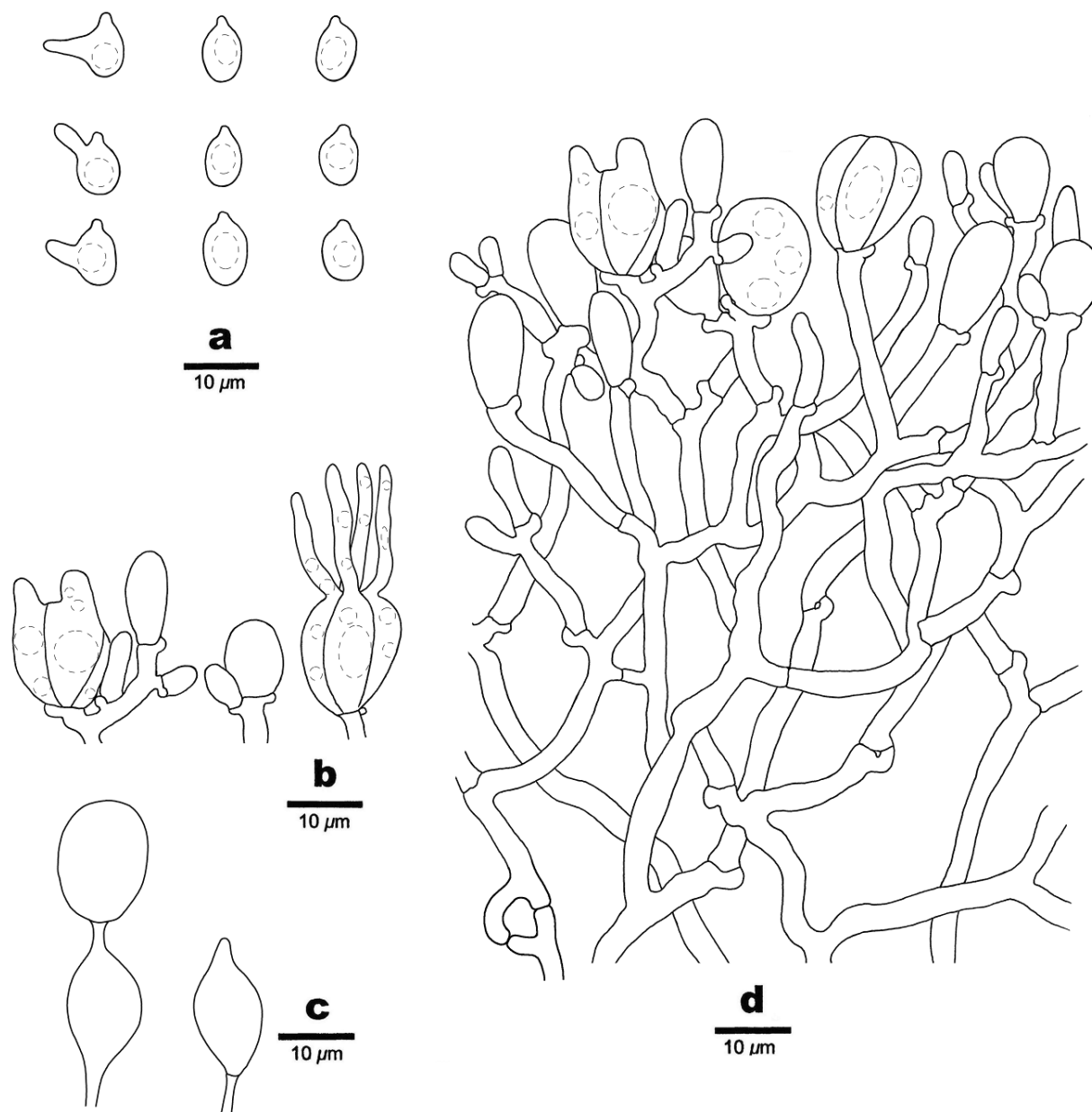


Fig. 85 Line drawings of microscopic structures of *Tremella microcarpa*. a Basidiospores. b Probasidia, basidia and hyphidia. c Swollen cells. d A section of hymenium. Scale bars = a–d 10 µm.

Internal features: Hyphae hyaline, thin- to thick-walled, smooth, 0.9–5.3 µm diam., slightly inflated in KOH, branched, interwoven, with abundant clamp connections and circular clamp connections. Hyphidia present but not in clusters, hyaline, thin-walled, smooth, usually derived from terminal hyphae; swollen cells abundant, thick-walled, variable in shape, with a clamp connection at base; vesicles and haustoria absent. Probasidia ellipsoid to subglobose; mature basidia thin-walled, broadly ellipsoid to subglobose, with a basal clamp connection, 11.0–18.0 × 10.0–14.0 µm, longitudinally septate, 2–4-celled, occasionally with oil drops; sterigmata up to 32.0 µm long, 1.8–2.5 µm diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, ovoid to broadly ellipsoid, apiculate, with obvious oil drops, (6.0–)7.0–9.1(–10.0) × 5.0–7.0(–7.5) µm, $L = 8.09$ µm, $W = 6.24$

µm, $Q = 1.28$ ($n = 60/1$), germinating by germ tubes. Conidia absent.

Known distribution: South China.

Specimens examined: China, Hunan Province, Yongshun County, Xiaoxi Nature Reserve, on rotten wood, 24 Jun 2014, P. Zhang, Zhang 1528 (BJFC 028143, **holotype**); Yunnan Province, Honghe, Lvchun County, Huanglian Mountain Forest Park, on dead angiosperm tree, 24 May 2013, Y.C. Dai, Dai 20703 (BJFC 032370).

Notes: *Tremella microcarpa* resembles *T. laurisilvae* by sharing finger-like or wavy basidiomata and is closely related to *T. laurisilvae* and *T. sublaurisilvae* in our phylogeny (Fig. 3). However, *T. laurisilvae* differs from *T. microcarpa* by having longer basidia (14.3–20.2 µm vs. 11.0–18.0 µm in length) and the presence of ellipsoid conidia (Kout et al. 2015); *T.*

sublaurisilvae differs from *T. microcarpa* by the absence of hyphidia and longer sterigmata (up to 70 µm long vs. up to 32.0 µm long). In addition, the ITS sequences of *T. microcarpa* are less than 97% identical to the latter two species.

Tremella neoyokohamensis F. Wu, L.F. Fan & Y.C. Dai, *sp. nov.*
.....Figs. 86, 87

Mycobank: MB 856401

Etymology: *Neoyokohamensis* (Lat.): refers to the species being similar to *Tremella yokohamensis* (Alshahni et al.)

Yurkov.

Diagnosis: Similar to *Tremella yokohamensis* but differs in having slightly smaller basidia, distinctly smaller basidiospores, thick-walled swollen cells, and a distribution in USA.

Basidiomata: Gelatinous, snow white to white when fresh, becoming firmly gelatinous and whitish yellow when dry; foliaceous, sessile, caespitose, up to 2.0 cm long, 2.0 cm diam. and 1.0 cm high from base, with undulate lobes (not hollow), attached to substratum by a central point.



Fig. 86 Photos of basidiomata and microscopic structures of *Tremella neoyokohamensis*. a Basidiomata. b Basidiospores. c Germinating basidiospores and secondary spores. d Probasidia and hyphidia. e Probasidia and basidia. f Swollen cells. Scale bars = a 1 cm, b–f 10 µm.

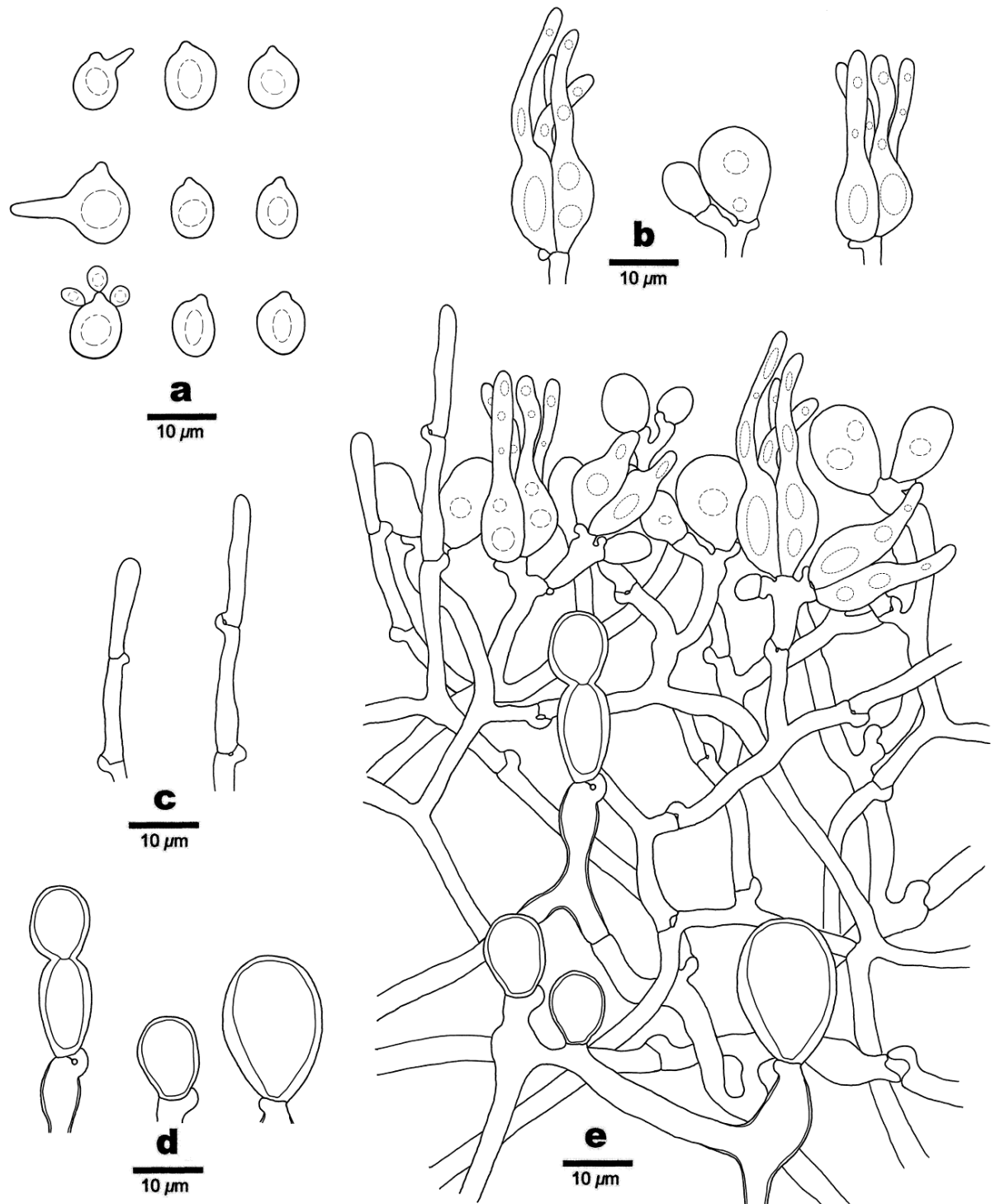


Fig. 87 Line drawings of microscopic structures of *Tremella neoyokohamensis*. a Basidiospores and secondary spores. b Probasidia and basidia. c hyphidia. d Swollen cells. e A section of hymenium. Scale bars = a–e 10 µm.

Internal features: Hyphae hyaline, thin- to thick-walled, smooth, 1.0–4.8 µm diam., sometimes inflated in KOH, branched, interwoven, with abundant clamp connections, especially close to the substrate. Hyphidia abundantly present in clusters, hyaline, thin-walled, smooth, sometimes branched, usually derived from terminal hyphae or branching from clamp connections; swollen cells variable in size and shape, thick-walled; vesicles and haustoria absent. Probasidia ovoid to pyriform; mature basidia thin-walled,

mostly barrel-shaped, with a basal clamp connection, 10.0–13.0 × 10.0–13.0 µm, sometimes diameter greater than length, longitudinally septate, rarely obliquely septate, 2–4-celled, with obvious oil drops; sterigmata up to 30.0 µm long, 1.0–2.0 diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, ellipsoid to broadly ellipsoid, apiculate, with oil drops, (6.0–)6.5–7.5(–8.0) × 5.0–7.0 µm, $L = 7.2$ µm, $W = 5.7$ µm, $Q = 1.26$ ($n = 30/1$), germinating and producing secondary spores by germination tubes or budding. Conidia absent, but

some secondary spores and small cells in the hymenium resembling conidia, hyaline, thin-walled, smooth, mostly

ellipsoid, ovoid, subglobose, $2.0\text{--}4.2 \times 2.0\text{--}3.5 \mu\text{m}$.

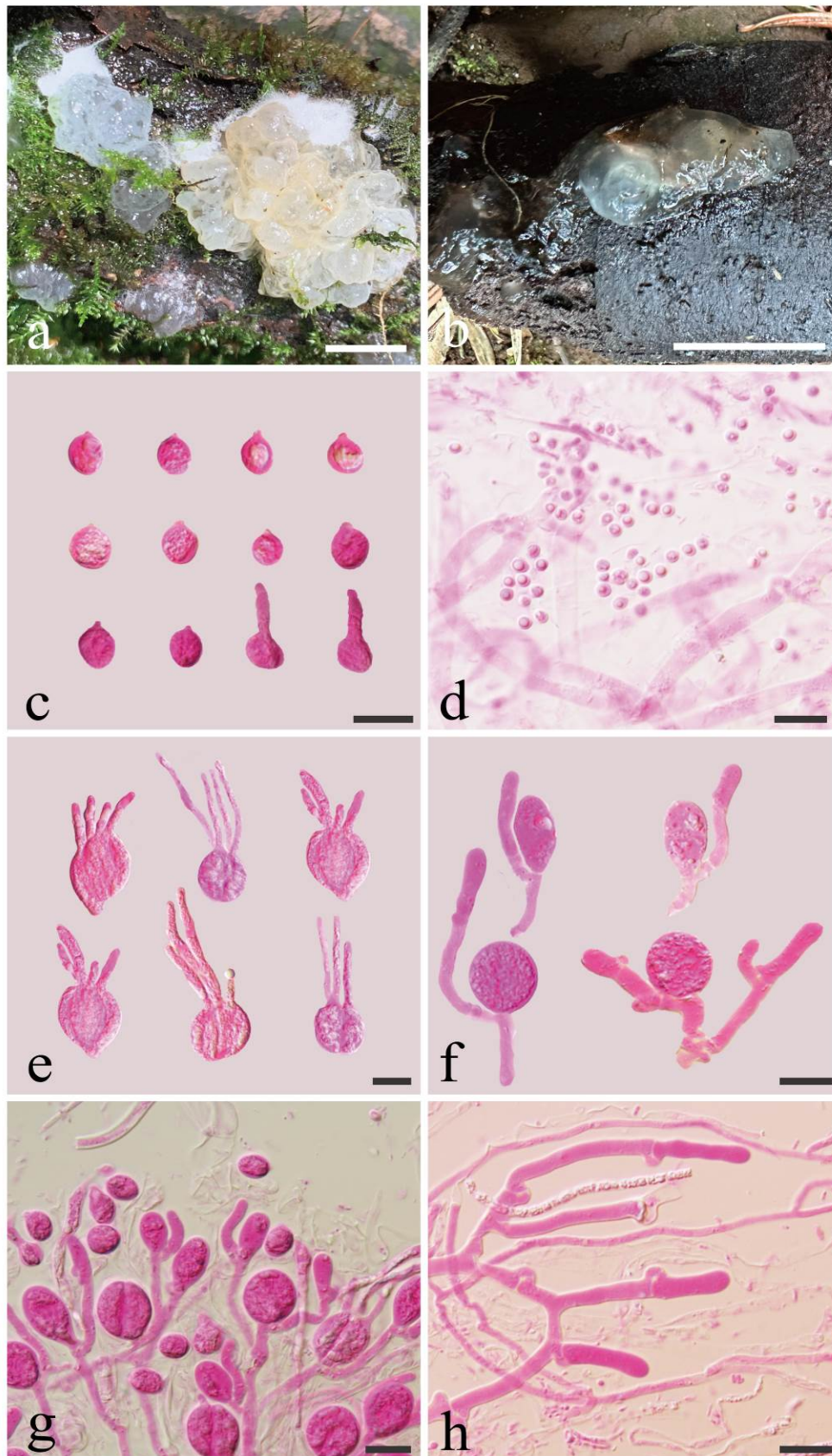


Fig. 88 Photos of basidiomata and microscopic structures of *Tremella subhyalina*. a–b Basidiomata. c Basidiospores. d Secondary spores. e Basidia. f Probasidia and hyphidia. g A section of hymenium. h Hyphidia. Scale bars = a–b 1 cm, c–h 10 μm .

Known distribution: USA.

Specimen examined: USA, Arkansas, Searcy, Harriet, Shepherd of the Ozarks, Jake Falls, associated with *Hypoxylon* sp., 24 May 2013, F. Wu, Wu 198 (BJFC 028107, **holotype**).

Notes: *Tremella neoyokohamensis* is similar to *T. yokohamensis* by sharing whitish basidiomata and it is also closely related to the latter species in the phylogeny (Fig. 3), but *T. yokohamensis* differs from *T. neoyokohamensis* by having slightly larger basidia (11.0–14.8 × 9.2–11.7 µm vs. 10.0–13.0 × 10.0–13.0 µm), distinctly larger basidiospores (7.5–10.1 × 6.0–8.1 µm vs. 6.5–7.5 × 5.0–7.0 µm; Table 3), the presence of hyphidia but not in clusters, the absence of thick-walled swollen cells, and a distribution in Asia. In addition, there are more than 2% sequence differences in the ITS

sequences between the two species.

Tremella subhyalina F. Wu, A. Tohtirjap & Y.C. Dai, **sp. nov.**
..... Figs. 88, 89

Mycobank: MB 856402

Etymology: *Subhyalina* (Lat.): refers to the species having semi-transparent basidiomata when fresh.

Diagnosis: Similar to *Tremella latispora* F. Wu et al. and *T. taiwanensis* but differs in having distinctly smaller basidia and basidiospores, and lacking conidia.

Basidiomata: Gelatinous, cream to white, semi-transparent when fresh, distinctly shrinking to a film and becoming pale white when dry; pulvinate to irregularly cerebriform, sessile, caespitose, up to 3.5 cm long, 2.0 cm diam. and 1.5 cm high from base, with thick and undulate lobes (not hollow), broadly attached to substratum.

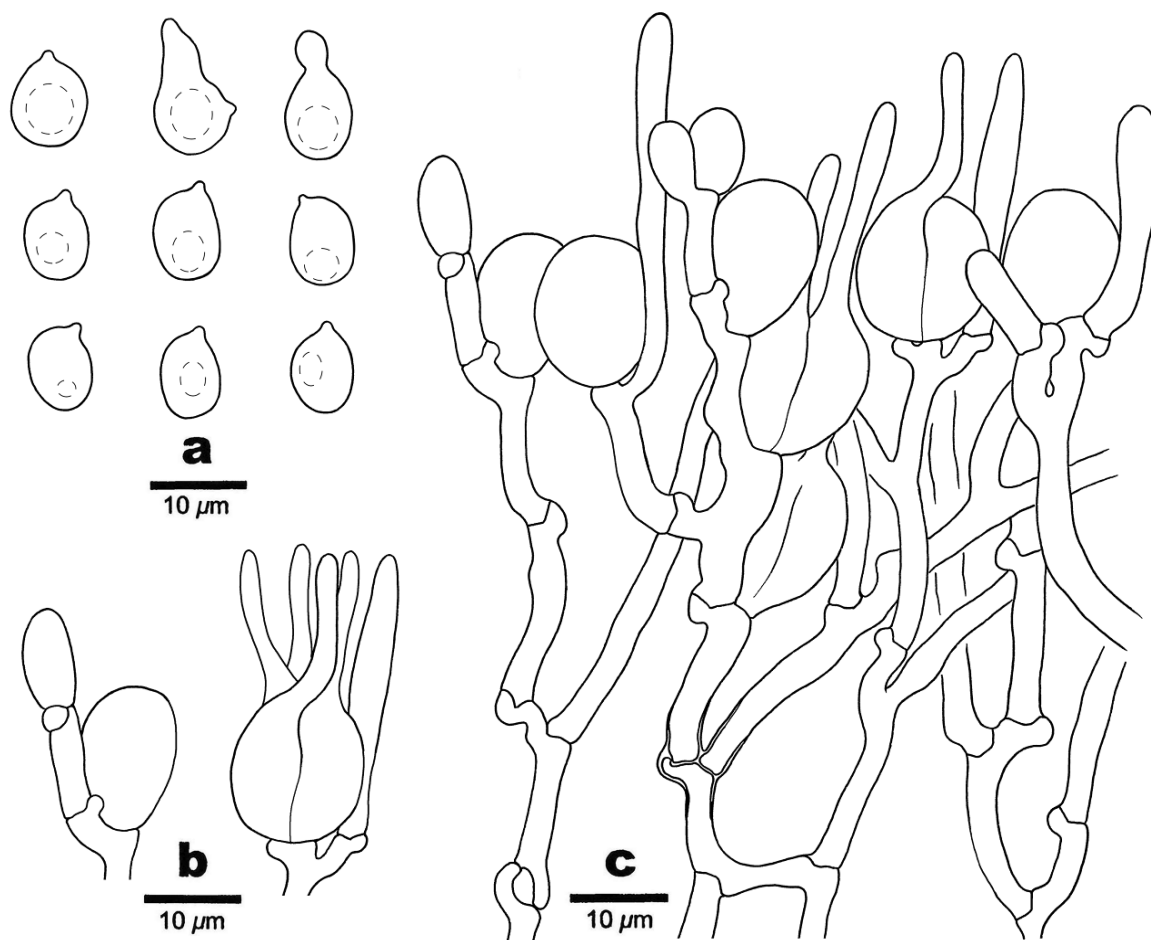


Fig. 89 Line drawings of microscopic structures of *Tremella subhyalina*. a Basidiospores. b Probasidia and basidia. c A section of hymenium. Scale bars = a–c 10 µm.

Internal features: Hyphae hyaline, thin-walled, smooth, 2.0–5.0 µm diam., slightly inflated in KOH, branched, interwoven, with abundant clamp connections and circular clamp connection. Hyphidia hyaline, thin-walled, smooth, usually derived from terminal hyphae, sometimes from the same hyphae with probasidia; vesicles, swollen cells and haustoria absent. Probasidia pyriform to subglobose; mature basidia thin-walled, ovoid to subglobose, with a basal clamp connection, 14.0–20.0 × 12.0–18.0 µm, sometimes diameter greater than length, longitudinally septate, 2–4-celled,

sometimes with oil drops; sterigmata up to 66.0 µm long, 2.0–3.0 µm diam., with tapered or slightly swollen apex. Basidiospores hyaline, thin-walled, smooth, broadly ellipsoid to ovoid, apiculate, usually with one large oil drop, (7.0–)7.2–9.5(–9.8) × 5.0–8.0(–8.2) µm, L = 8.5 µm, W = 6.05 µm, Q = 1.19–1.47 (n = 40/2), germinating by budding or germination tubes. Conidia absent, but some secondary spores resembling conidia, hyaline, thin-walled, smooth, mostly ovoid, subglobose, ellipsoid, 2.0–4.0 × 2.0–3.0 µm.

Known distribution: Southwest China.

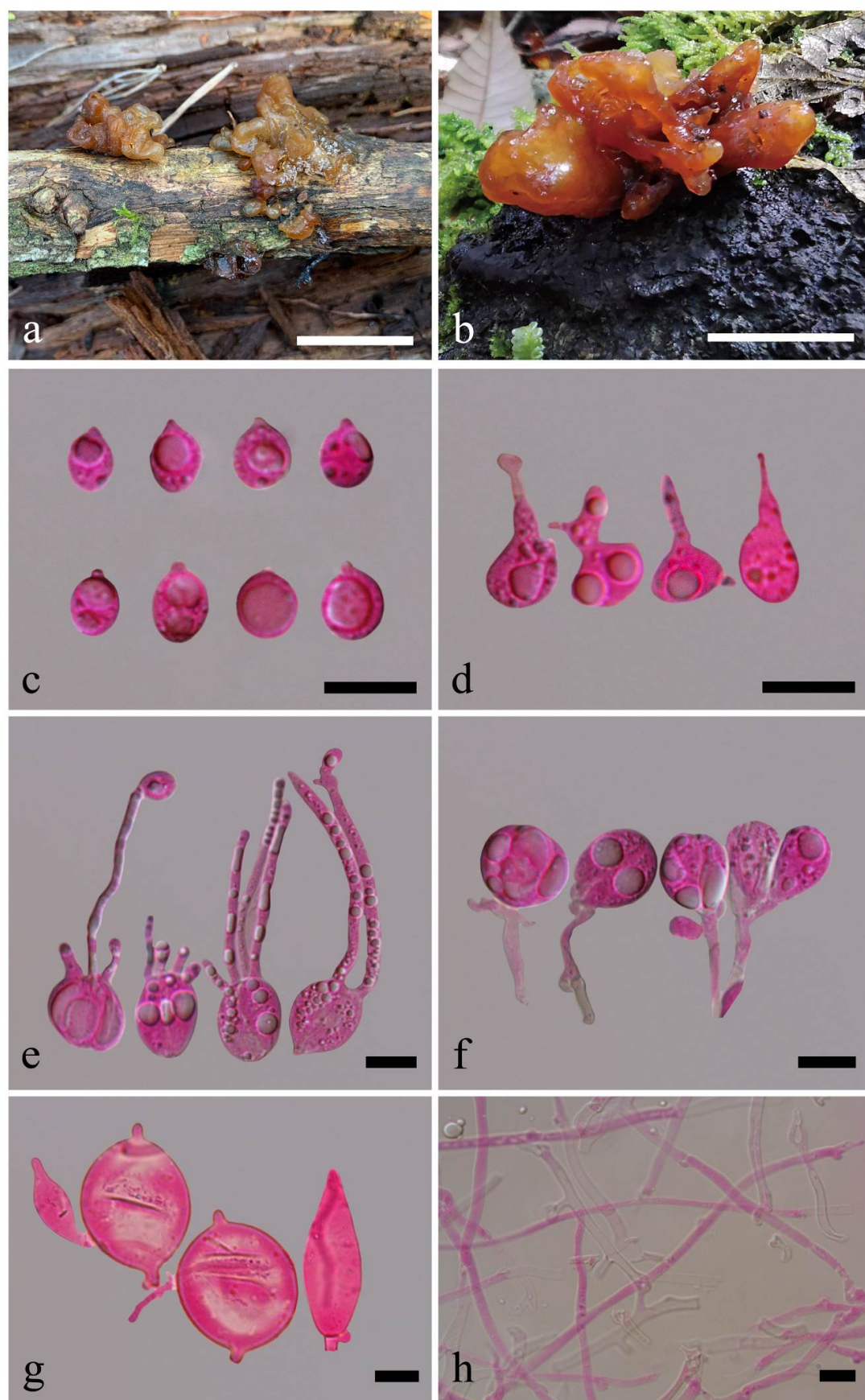


Fig. 90 Photos of basidiomata and microscopic structures of *Tremella sublaevisilvae*. a–b Basidiomata. c Basidiospores. d Germinating basidiospores. e Basidia. f Probasidia. g Swollen cells. h Hyphae. Scale bars = a–b 1 cm, c–h 10 µm.

Specimens examined: China, Yunnan Province, Dagan County, Huanglianhe Forest Park, on rotten angiosperm wood, 30 Jun 2021, Y.C. Dai, Dai 22461 (BJFC 037045, **holotype**), 5 Jun 2023, F. Wu, Wu 854 (BJFC 040847), 30 Jul 2023, Y.C. Dai, Dai 25436 (BJFC 042987).

Notes: *Tremella subhyalina* is morphologically similar to *T. latispora* and *T. taiwanensis* by sharing pulvinate to cerebriform and whitish basidiomata, but *T. latispora* differs from *T. subhyalina* by its obviously thick-walled hyphae near the base of the basidiomata, larger basidia ($17.2\text{--}27.0 \times 17.0\text{--}24.3\ \mu\text{m}$ vs. $14.0\text{--}20.0 \times 12.0\text{--}18.0\ \mu\text{m}$) and basidiospores ($10.1\text{--}11.8 \times 9.9\text{--}11.4\ \mu\text{m}$ vs. $7.2\text{--}9.5 \times 5.0\text{--}8.0\ \mu\text{m}$), and conidia originating from umbelliform conidiophores; *T. taiwanensis* differs from *T. subhyalina* by its snow white to white basidiomata, abundant haustoria, distinctly larger basidia ($23.0\text{--}34.0 \times 23.0\text{--}34.0\ \mu\text{m}$) and basidiospores ($11.0\text{--}17.0 \times 12.0\text{--}17.0\ \mu\text{m}$), and conidial mother cells in chains.

In the phylogeny (Fig. 3), the species is closely related to *T. lloydiae-candidae* Wojewoda with robust support, but *T. lloydiae-candidae* has globose to subglobose basidiospores, and the absence of circular clamp connection (Malysheva et al. 2015), and the ITS sequences of *T. subhyalina* are only 90% identical to *T. lloydiae-candidae*.

Tremella sublaurisilvae F. Wu, L.F. Fan & Y.C. Dai, **sp. nov.**

.....Figs. 90, 91

MycoBank: MB 856403

Etymology: *Sublaurisilvae* (Lat.): refers to the species being morphologically and phylogenetically close to *Tremella*

laurisilvae.

Diagnosis: Similar to *Tremella laurisilvae* and *T. microcarpa*, but differs from *T. laurisilvae* in having slightly shorter basidia and lacking conidia, and differs from *T. microcarpa* in having longer sterigmata and lacking hyphidia.

Basidiomata: Gelatinous, buff to brownish orange when fresh, becoming dark vinaceous gray when dry; finger-shaped to irregularly cerebriform, sessile, caespitose, up to 2.3 cm long, 1.6 cm diam. and 1.0 cm high from base, with thick finger to broadly finger-like and undulate lobes (not hollow), attached to substratum by a central point.

Internal features: Hyphae hyaline, thin- to thick-walled, smooth, $2.0\text{--}4.8\ \mu\text{m}$ diam., sometimes swollen up to $8.0\ \mu\text{m}$ diam. in KOH, branched, interwoven, with abundant clamp connections and circular clamp connection. Hyphidia, vesicles and haustoria absent; swollen cells abundant, variable in shape, hyaline, thin- to thick-walled, smooth, with a clamp connection at base. Probasidia ovoid to pyriform; mature basidia thin-walled, broadly ellipsoid to barrel-shaped, with a basal clamp connection, $12.0\text{--}17.0 \times 10.0\text{--}15.0\ \mu\text{m}$, longitudinally septate, 2–4-celled, with a few small oil drops; sterigmata up to $70\ \mu\text{m}$ long, $1.6\text{--}2.2\ \mu\text{m}$ diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, broadly ellipsoid to subglobose, apiculate, usually with one large oil drop, $(6.2\text{--})7.0\text{--}9.0 \times 5.0\text{--}8.0\text{--}(8.5)\ \mu\text{m}$, $L = 7.64\ \mu\text{m}$, $W = 6.59\ \mu\text{m}$, $Q = 1.16\text{--}1.20$ ($n = 60/2$), germinating by germ tubes. Conidia absent.

Known distribution: Southwest China.

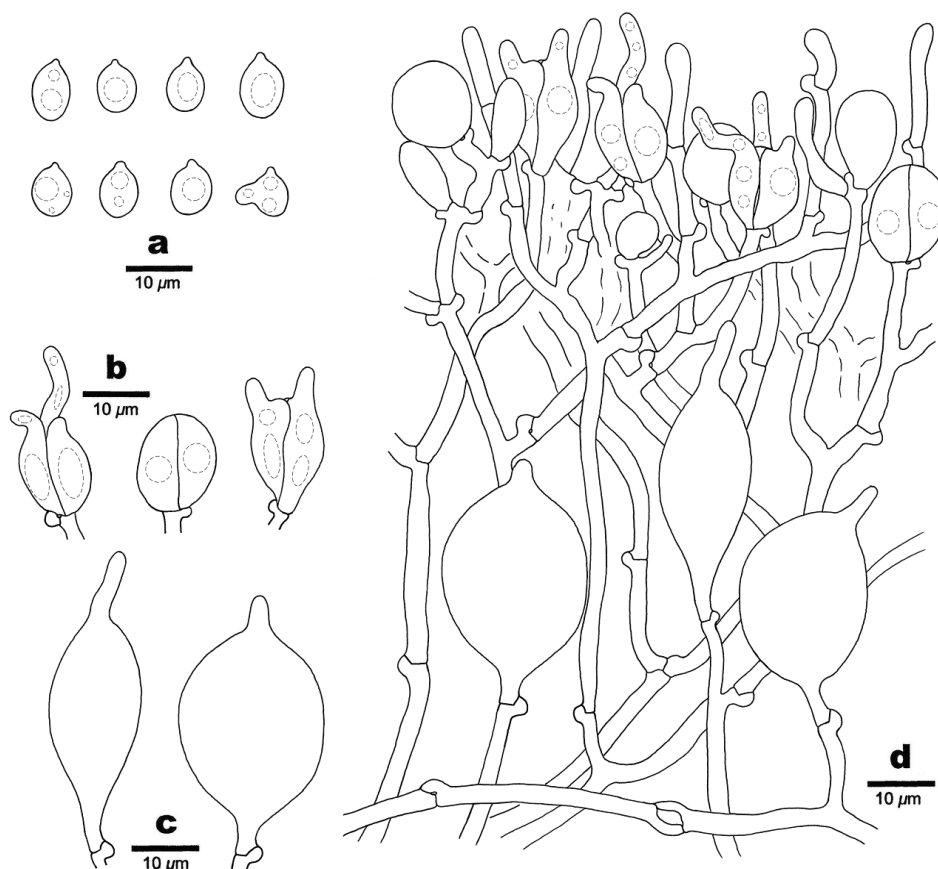


Fig. 91 Line drawings of microscopic structures of *Tremella sublaurisilvae*. a Basidiospores. b Probasidia and basidia. c Swollen cells. d A section of hymenium. Scale bars = a–d $10\ \mu\text{m}$.

Specimens examined: China, Yunnan Province, Honghe, Daweishan Nature Reserve, on fallen angiosperm trunk, 11 Nov 2019, F. Wu, Wu 339 (BJFC 031142, **holotype**), Wu 352 (BJFC 033070); Xizang Autonomous Region, Bomi County, Yigong, Tea Plantation, on dead branch of *Prinsepia utilis*, 24 Oct 2021, Y.C. Dai, Dai 23476 (BJFC 038048).

Notes: *Tremella sublaurisilvae* resembles *T. laurisilvae* and *T. microcarpa* by gelatinous, finger-shaped to slightly cerebriform basidiomata, but *T. laurisilvae* differs from *T. sublaurisilvae* by having thin-walled hyphae, the presence of haustoria, slightly longer basidia (14.3–20.2 µm vs. 12.0–17.0 µm in length) and abundant conidia (Kout et al. 2015); *T. microcarpa* differs from *T. sublaurisilvae* by the presence of hyphidia and shorter sterigmata (up to 32.0 µm long vs. up to 70 µm long). In addition, the three species formed three independent lineages in our phylogeny (Fig. 3).

Tremella tasmanica F. Wu, G.M. Gates & Y.C. Dai, **sp. nov.** Figs. 92, 93

MycoBank: MB 856404

Etymology: *Tasmanica* (Lat.): refers to the species mainly distributed in Tasmania, Australia.

Diagnosis: Similar to *Tremella fuciformis* and *T. yokohamensis*, but differs from *T. fuciformis* in having distinctly larger basidia and abundant hyphidia, and lacking swollen cells, and differs from *T. yokohamensis* in having distinctly smaller basidiospores and abundant hyphidia.

Basidiomata: Soft gelatinous to gelatinous, sulphur yellow to cream when fresh, becoming whitish to pale yellow when dry; translucent, foliaceous, sessile, caespitose, up to 5.2 cm long, 4.5 cm diam. and 3.0 cm high from base, with undulate-plicate and thick lobes (margin incised, not hollow), attached to substratum by a central point.

Internal features: Hyphae hyaline, thin-walled, smooth, 1.0–4.8 µm diam., sometimes swollen up to 6.5 µm diam. in KOH, branched, interwoven, with abundant clamp connections. Hyphidia abundant, hyaline, thin-walled, smooth, usually derived from terminal hyphae, sometimes branching from clamp connections; swollen cells, vesicles and haustoria absent. Probasidia ovoid to ellipsoid; mature basidia thin-walled, subglobose, with a basal clamp connection, 10.0–14.0 × 10.0–15.0 µm, sometimes diameter greater than length, longitudinally septate, rarely obliquely septate, 2–4-celled, some with a few obvious oil drops; sterigmata up to 50.0 µm long, 2.0–3.0 µm diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, ellipsoid, broadly ellipsoid to ovoid, apiculate, usually with one large oil drop, 6.0–7.5(–8.0) × (5.0–)5.5–6.5 µm, L = 6.9 µm, W = 6.0 µm, Q = 1.15–1.20 (n = 60/2), germinating by repetition. Conidia absent.

Known distribution: Australia.

Specimens examined: Australia, Tasmania, Mount Field National Park, on fallen trunk of *Nothofagus cunninghamii*, 14 May 2018, Y.C. Dai, Dai 18759 (BJFC 027227, **holotype**), Dai 18776 (BJFC 027244), 13 May 2018, Y.C. Dai, Dai 18711 (BJFC 027180); Victoria, Yarra Ranges National Park, on dead tree of *Eucalyptus* sp., 10 May 2018, Y.C. Dai, Dai 18613A (BJFC 027082).

Notes: *Tremella tasmanica* may be confused with *T. fuciformis* and *T. yokohamensis* by sharing whitish

basidiomata with undulate-plicate lobes when fresh, but *T. fuciformis* differs from *T. tasmanica* by its distinctly smaller basidia (9.0–12.0 × 9.0–11.0 µm vs. 10.0–14.0 × 10.0–15.0 µm), narrower basidiospores (4.0–5.2 µm vs. 5.5–6.5 µm diam.), the absence of hyphidia and the presence of swollen cells; *T. yokohamensis* differs from *T. tasmanica* by the absence of hyphidia, narrower basidia (9.2–11.7 µm vs. 10.0–15.0 µm diam.), distinctly larger basidiospores (7.5–10.1 × 6.0–8.1 µm vs. 6.0–7.5 × 5.5–6.5 µm), and a distribution in Asia. In the phylogeny, *T. tasmanica* formed one independent lineage with strong support (Fig. 3).

Tremella virginensis F. Wu, L.F. Fan, Vlasák & Y.C. Dai, **sp. nov.** Figs. 94, 95

MycoBank: MB 856405

Etymology: *Virginensis* (Lat.): refers to the species being found in the Virgin Islands, USA.

Diagnosis: Similar to *Tremella fuciformis* and *T. neoyokohamensis* but differs in having distinctly larger basidiospores.

Basidiomata: Gelatinous, cream to straw yellow when fresh, pale yellow (base darker than margin) when dry; more or less foliaceous, sessile, caespitose, up to 2.0 cm long, 1.0 cm diam. and 0.5 cm high from base, with small lobes (not hollow), attached to substratum by a central point.

Internal features: Hyphae hyaline, thin- to slightly thick-walled, smooth, 1.0–4.5 µm diam., sometimes swollen up to 7.0 µm diam. in KOH, frequently branched, interwoven, with abundant clamp connections and circular clamp connections. Hyphidia and vesicles absent; swollen cells frequent in the inner part of basidiomata close to the substrate and variable in shape; haustoria often branched, rarely present. Probasidia ovoid to pyriform; mature basidia thin-walled, subglobose to barrel-shaped, with a basal clamp connection, 9.0–12.0 × 9.0–11.0 µm, longitudinally septate, 2–4-celled, with obvious oil drops; sterigmata up to 40.0 µm long, 1.5–3.0 diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, mostly ellipsoid, apiculate, with one or two oil drops, 8.2–10.8(–11.2) × 6.0–8.0(–8.5) µm, L = 9.58 µm, W = 8.23 µm, Q = 1.36 (n = 30/1), germinating by germ tubes or budding. Conidia absent, but some cells with clamp connections resembling conidia.

Known distribution: USA.

Specimen examined: USA, Virgin Islands, St. John, L'Esperance trail, 9 Feb 2012, J. Vlasák, FD-438 (JV, **holotype**).

Notes: *Tremella virginensis* may be confused with *T. fuciformis* and *T. neoyokohamensis* by sharing whitish to yellowish basidiomata especially when dry, and the three species have a distribution in America. However, *T. fuciformis* differs from *T. virginensis* by its undulate caespitose lobes with crenate or notched margins and distinctly smaller basidiospores (6.8–7.3 × 4.0–5.2 µm vs. 8.2–10.8 × 6–8.0 µm); *T. neoyokohamensis* differs from *T. virginensis* by the presence of hyphidia, thick-walled swollen cells, slightly larger basidia (10.0–13.0 × 10.0–13.0 µm vs. 9.0–12.0 × 9.0–11.0 µm), and distinctly smaller basidiospores (6.5–7.5 × 5.0–7.0 µm vs. 8.2–10.8 × 6.0–8.0 µm). In the phylogeny (Fig. 3), our new species formed one independent lineage with strong support.

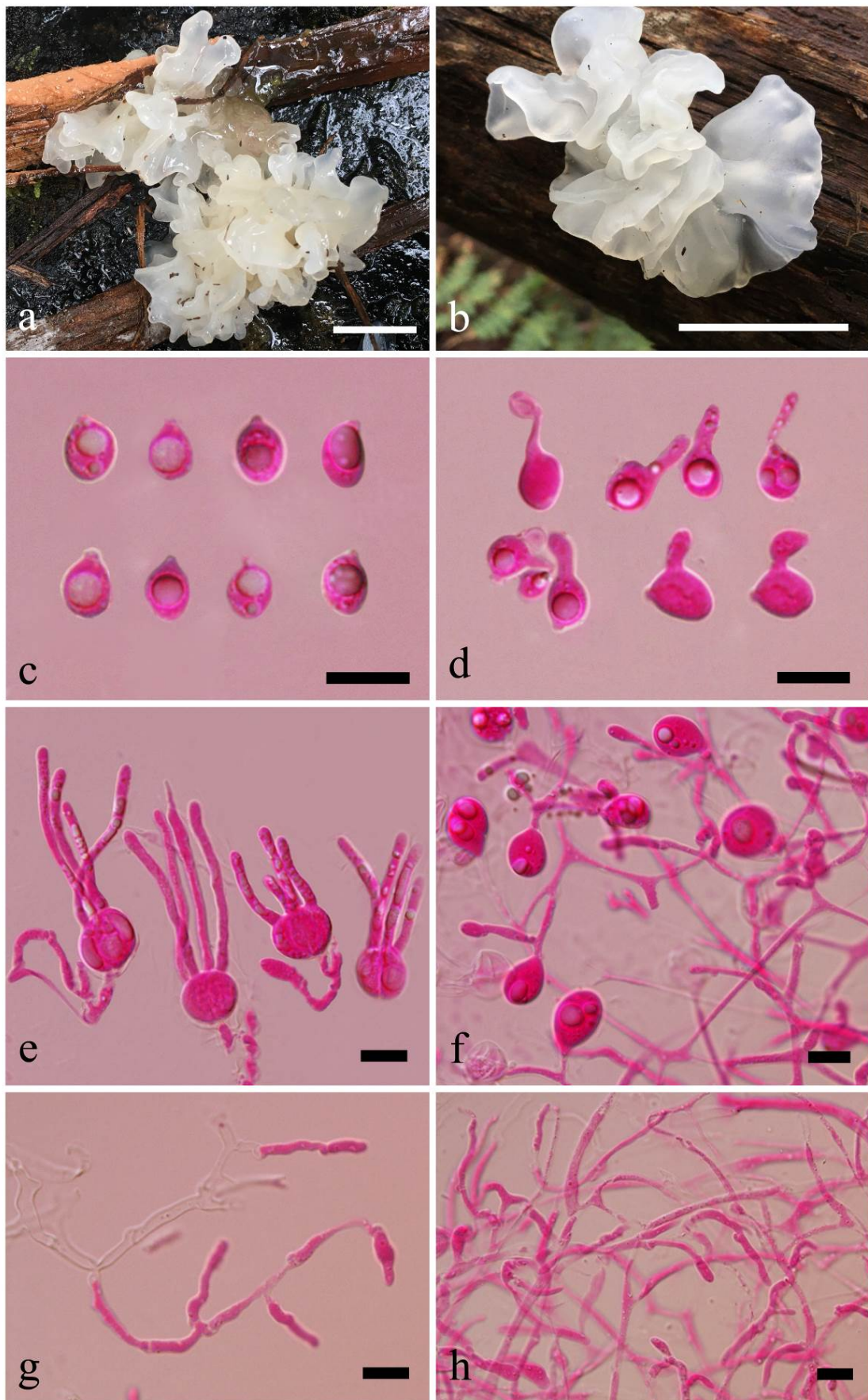


Fig. 92 Photos of basidiomata and microscopic structures of *Tremella tasmanica*. a–b Basidiomata. c Basidiospores. d Germinating basidiospores and secondary spores. e Basidia. f Probasidia. g Hyphidia. h Hyphae. Scale bars = a–b 1 cm, c–h 10 μm.

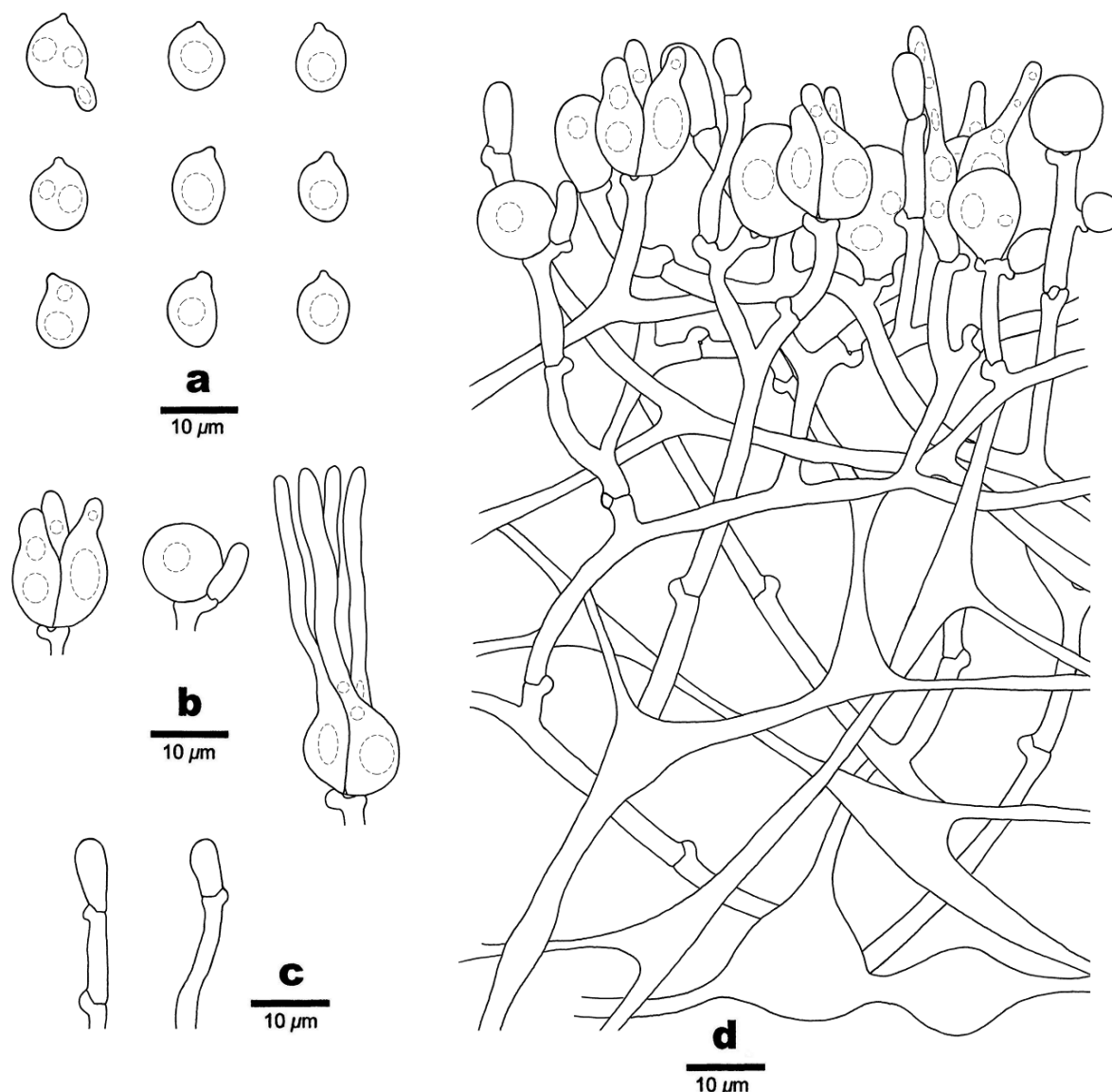


Fig. 93 Line drawings of microscopic structures of *Tremella tasmanica*. a Basidiospores. b Probasidia and basidia. c Hyphidia. d A section of hymenium. Scale bars = a–d 10 µm.

Tremella xantha F. Wu, G.M. Gates & Y.C. Dai, *sp. nov.*

.....Figs. 96, 97

Mycobank: MB 856406

Etymology: *Xantha* (Lat.): refers to the species having yellow basidiomata when fresh.

Diagnosis: Similar to *Tremella globispora* D.A. Reid and *T. poilkavensis* A. Thomas & T.K.A. Kumar but differs in having cream to straw yellow, more or less foliaceous basidiomata and a distribution in Australia.

Basidiomata: Gelatinous, cream to straw yellow when fresh, becoming firmly gelatinous and dark yellow when dry; more or less foliaceous, sessile, caespitose, up to 3.0 cm long, 2.5 cm diam. and 2.0 cm high from base, with undulate lobes (not hollow), attached to substratum by a central point.

Internal features: Hyphae hyaline, smooth or with small bulbous structure, thin- to slightly thick-walled, 1.0–4.0 µm diam., sometimes swollen up to 6.5 µm diam. in KOH,

frequently branched, interwoven, with frequent clamp connections and circular clamp connections. Hyphidia hyaline, thin-walled, smooth, usually derived from terminal hyphae; swollen cells, vesicles and haustoria absent. Probasidia capitate, pyriform to subglobose; mature basidia thin-walled, pyriform to subglobose, stalked, with a basal clamp connection, 13.8–17.8 × 12.6–16.3 µm, longitudinally septate, occasionally obliquely septate, 2–4-celled, sometimes with one to a few oil drops; sterigmata up to 45.0 µm long, 2.0–3.0 diam., without swollen apex. Basidiospores hyaline, thin-walled, smooth, broadly ellipsoid to subglobose, apiculate, with one large oil drop, 7.2–8.5 × 5.1–6.8 µm, L = 7.8 µm, W = 6.1 µm, Q = 1.28 (n = 30/1), germination by germ tubes. Conidia present in abundance, hyaline, thin-walled, variable in shape, mostly ovoid to oblong-ellipsoid, originating from conidiophores or sterigmata, 1.8–4.2 × 1.5–3.2 µm.

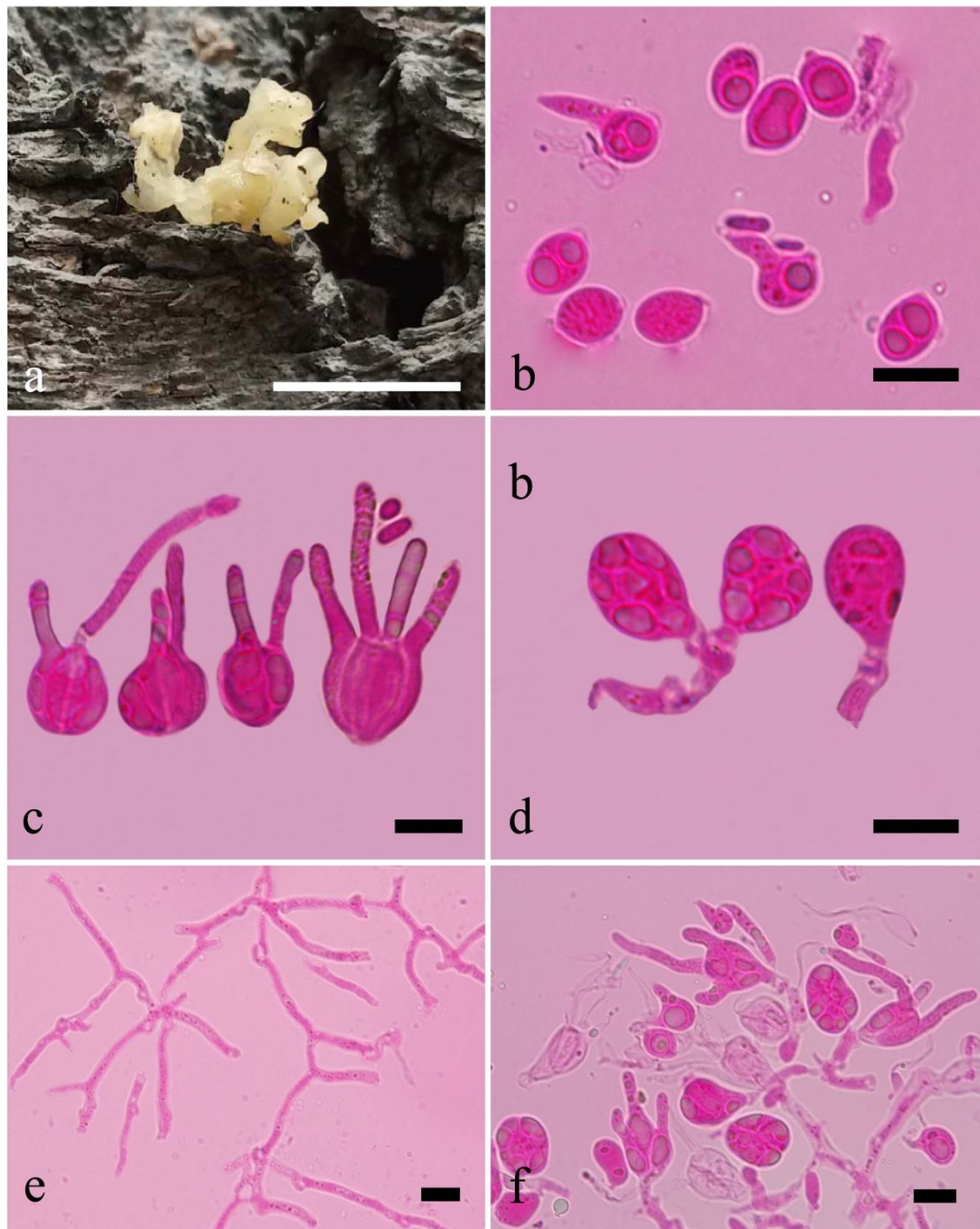


Fig. 94 Photos of basidiomata and microscopic structures of *Tremella virginensis*. a Basidiomata. b Basidiospores. c Basidia. d Probasidia. e Hyphidia. f A section of hymenium. Scale bars = a 1 cm, b–f 10 μ m.

Known distribution: Australia.

Specimen examined: Australia, Tasmania, Savage River crossing, *Nothofagus cunninghamii* rainforest with *Acacia* sp., associated with some hyphomycetous-like fungi, 24 Apr 2006, Fungimap Tarkine Expedition, FT-1059 (MEL 2321998, **holotype**).

Notes: *Tremella xantha* microscopically resembles *T. globispora* and *T. poilkavensis* by having stalked basidia. However, *T. globispora* differs from *T. xantha* by the very

small (up 3 mm diam.), hyaline to pale brown, pustulate to cerebriform basidiomata, and distinctly wider basidiospores (7.0–9.0 μ m vs. 5.1–6.8 μ m diam.; Chen 1998); *T. poilkavensis* differs from *T. xantha* by its snuff brown to umber, cerebriform basidiomata (Fig. 98), abundant swollen cells and haustoria, and smaller basidia (9.0–13.0 $\times$ 6.0–9.8 μ m vs. 13.8–17.8 $\times$ 12.6–16.3 μ m; Table 3). In the phylogeny (Fig. 3), our new species formed one independent lineage.

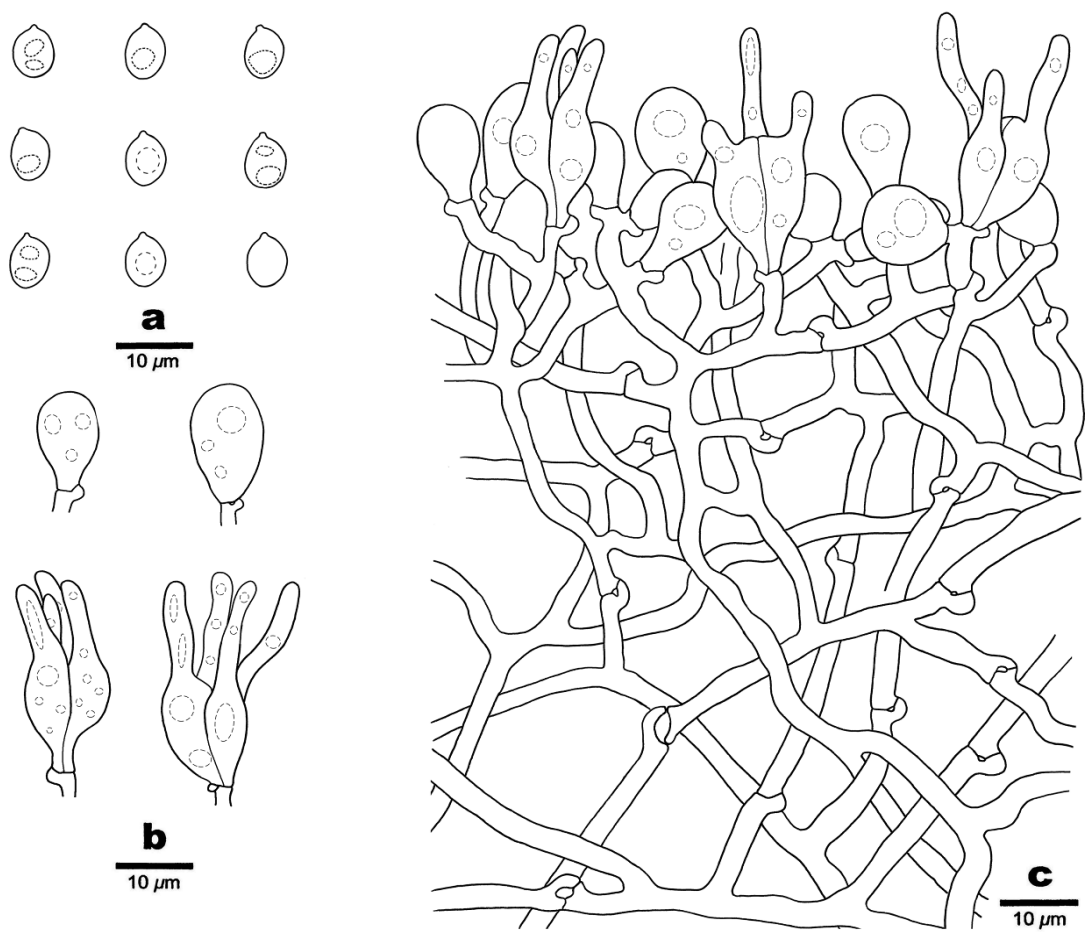


Fig. 95 Line drawings of microscopic structures of *Tremella virginensis*. a Basidiospores. b Probasidia and basidia. c A section of hymenium. Scale bars = a–c 10 µm.

Table 3 A comparison of morphology of jelly fungi of Tremellales with tremelloid basidia based on our samples.

Species	Basidiomata color	Hyphidia	Swollen cells	Vesicles	Haustoria	Basidia (µm)	Spores (µm)	Conidia (µm)
<i>Naematelia encephala</i>	cream to buff yellow	rare	abundant	abundant	absent	13–15 × 11–15	8–10 × 6–7.5	absent
<i>N. nodulosa</i>	pale yellow to lemon yellow	occasional	absent	absent	abundant	12–15 × 13–17	8.8–13.5 × 8–12	3–5 × 3–4
<i>Phaeotremella crassitunicata</i>	clay pink to cinnamon	occasional	rare	absent	present	13–16.2 × 11–15.2	10–14 × 7–9	6.4–9.2 × 4.8–6.6
<i>P. emeiensis</i>	cream to buff	rare	absent	absent	absent	12.3–16.3 × 10.4–14.9	8–10.9 × 6.7–9.3	3.1–6.8 × 3.2–5.5
<i>P. eugeniae</i>	blackish brown or fuscous black to olivaceous black	absent	absent	absent	absent	12–19 × 9.6–15.5	8–9 × 6.7–8.5	absent
<i>P. foliacea</i>	orange-brown to reddish brown	absent	absent	absent	absent	11–16.1 × 10.3–14	6.3–8.5 × 5.1–7.3	absent
<i>P. frondosa</i>	fawn, fuscous to vinaceous brown	absent	absent	absent	absent	9.6–18.5 × 10–15.3	5–8 × 5–7	absent

Species	Basidiomata color	Hyphidia	Swollen cells	Vesicles	Haustoria	Basidia (µm)	Spores (µm)	Conidia (µm)
<i>P. lonicericola</i>	orange-brown to fuscous	absent	occasional	frequent	absent	13–17 × 14.5–20	8.8–11.2 × 6.8–8.8	3.2–5.5 × 2.2–3
<i>P. rigida</i>	white to cream	present	absent	absent	abundant	10.3–19 × 9–18	6–9.2 × 6–9	3–6 × 1.8–3
<i>P. roseotincta</i>	clay pink to clay buff	absent	absent	absent	absent	15–21 × 14–18	9–11 × 8–9.5	4–8 × 3–4
<i>P. sparassidis</i>	pinkish buff to brownish vinaceous	absent	absent	absent	absent	17.3–20 × 12.7–18.7	8–10.5 × 6.7–8.7	absent
<i>P. tenuis</i>	white to cream or orange-yellow	present	absent	absent	absent	9–11 × 9–11	6–7.5 × 5–6.5	rare
<i>P. yunnanensis</i>	buff to cinnamon buff	absent	rarely	absent	absent	11–22 × 11–18	7–8 × 6–7.3	3–6 × 2–4
<i>Pseudotremella chayuensis</i>	mouse gray to black	occasional	absent	occasional	absent	14–16 × 12–15	7.5–8.8 × 6.8–8.5	absent
<i>P. nivalis</i>	cream to pinkish buff	present	absent	frequent	rare	12–16 × 13–16	7–9 × 6–9	absent
<i>P. pulvinata</i>	black	abundant	abundant	occasional	rare	15–20 × 15–20	9–11.2 × 8–10.8	absent
<i>P. subnivalis</i>	white or pale mouse gray to fawn	abundant	absent	frequent	absent	14.5–20 × 13–20	6.8–9.6 × 6.5–9.5	absent
<i>Sirobasidium magnum</i>	curry yellow to cinnamon buff	present	absent	absent	absent	11–19 × 9–12	17–23 × 5–7	absent
<i>Tremella aurulenta</i>	cinnamon to cinnamon buff	present	absent	absent	absent	14.6–21.5 × 14–22	6.8–8.8 × 4.3–7.6	rare
<i>T. australis</i>	white to creamy white	present	absent	absent	absent	14–19 × 13–17	8–10 × 6–8	absent
<i>T. cerebriformis</i>	white to cream	abundant	absent	absent	absent	23–34 × 26–35	15.3–19 × 15.7–20	absent
<i>T. circularis</i>	pale yellow to buff yellow	present	abundant	present	present	16.3–20 × 16.8–22	8.6–11.3 × 6.7–8.6	2.5–6.4 × 1.7–3.6
<i>T. conidiogena</i>	lemon chrome	rare	absent	absent	absent	not observed	6–7.2 × 4.5–6	3–7 × 3–6
<i>T. crassihyphidiata</i>	lemon yellow to brownish red	present	absent	absent	absent	14–19 × 12–16.8	7–9 × 5–7	2.4–3.6 × 1.9–2.4
<i>T. dysenterica</i>	brownish to coral	present	absent	absent	absent	12.5–16.5 × 11–15	7.5–8.2 × 6.2–7.5	2.5–5 × 1.5–4.5
<i>T. ellipsospora</i>	curry yellow to cinnamon buff	present	absent	absent	absent	12.5–15 × 9–11	6–7.4 × 3.9–5.5	absent
<i>T. erythrina</i>	lemon yellow to brownish red	present	rare	absent	rare	13–18 × 12–19	6–9 × 5–7	absent
<i>T. fibulifera</i>	pale whitish	present	absent	absent	absent	13–22 × 9–16	7–10 × 6–7	2–3 × 1–2.5
<i>T. flava</i>	yellowish green to sulphur yellow	present	present	absent	frequent	13–17 × 10–13	7–8 × 6–8	absent
<i>T. fuciformis</i>	snow white to white	absent	frequent	absent	rare	9–12 × 9–11	6.8–7.3 × 4–5.2	absent
<i>T. quangxiensis</i>	snow white to white	present	present	absent	absent	14–17 × 13.6–17	8–9.5 × 6–7.5	2–3.2 × 1.8–3

Species	Basidiomata color	Hyphidia	Swollen cells	Vesicles	Hauustoria	Basidia (µm)	Spores (µm)	Conidia (µm)
<i>T. guttulata</i>	pale yellow to buff	present	present	rare	abundant	18–26 × 11–23	9–12 × 6–9.8	2–3.5 × 2–4
<i>T. helva</i>	pale yellow to orange-yellow	abundant	absent	abundant	absent	21–32 × 20–29	12.2–16 × 12.2–16	absent
<i>T. hongheensis</i>	curry yellow to cinnamon buff	present	absent	absent	absent	12.5–20 × 9–16.3	7–10 × 5–7.8	2.2–3.4 × 1.6–2.6
<i>T. latispora</i>	snow white to white	present	absent	absent	absent	17.2–27 × 17–24.3	10.1–11.8 × 9.9–11.4	2.8–3.6 × 1.8–3
<i>T. lloydiae-candidae</i>	white to cream	present	absent	absent	absent	19–25 × 16.2–20	7–10.5 × 6.8–9.2	2.5–4.5 × 2–3.2
<i>T. lutea</i>	orange-yellow	abundant	absent	occasional	absent	27–32 × 26–36	12–17.1 × 11.5–16.5	5–7 × 3–3.5
<i>T. mangiformis</i>	buff to brownish orange	present	absent	absent	rare	13–17 × 10–12	6–8 × 5–6	absent
<i>T. mesenterica</i>	lemon yellow to chrome	abundant	present	rare	present	17–26 × 15–21	9–11 × 6–8	2.8–4 × 2.3–3.5
<i>T. microcarpa</i>	sienna to fulvous	present	abundant	absent	absent	11–18 × 10–14	7–9.1 × 5–7	absent
<i>T. neofibulifera</i>	yellowish green or white	present	absent	rare	absent	14–16 × 13–17	8–10 × 6–8	absent
<i>T. neoyokohamensis</i>	snow white to white	abundant	present	absent	absent	10–13 × 10–13	6.5–7.5 × 5–7	2–4.2 × 2–3.5
<i>T. poilkavensis</i>	snuff brown to umber	absent	abundant	absent	present	9–13 × 6–9.8	4.9–10 × 3.9–6.4	1–4 × 0.5–3.8
<i>T. salmonea</i>	buff yellow to orange-yellow	present	present	absent	absent	29–32 × 27–29	14.5–19.5 × 14.7–18.5	4.5–10.2 × 4.2–10
<i>T. samoensis</i>	saffron orange to cream	present	absent	absent	absent	13.2–18 × 9.3–12	6–8.3 × 5–6.3	2.7–4.5 × 1.8–2.5
<i>T. subfibulifera</i>	cream to straw yellow	absent	absent	absent	absent	14–21 × 9–17.8	5.4–9.8 × 4.2–6	2–3 × 0.5–1
<i>T. subhyalina</i>	cream to white	present	absent	absent	absent	14–20 × 12–18	7.2–9.5 × 5–8	absent
<i>T. sublaurisilvae</i>	buff to brownish orange	absent	abundant	absent	absent	12–17 × 10–15	7–9 × 5–8	absent
<i>T. taiwanensis</i>	snow white to white	abundant	absent	rare	abundant	23–34 × 23–34	11–17 × 12–17	4.2–6.8 × 4.8–7
<i>T. tasmanica</i>	sulphur yellow to cream	abundant	absent	absent	absent	10–14 × 10–15	6–7.5 × 5.5–6.5	absent
<i>T. tropica</i>	pale yellow to lemon yellow	abundant	absent	absent	rare	14–22 × 14–18	8–12 × 7.5–9.8	3–5 × 2.5–4.5
<i>T. virginensis</i>	cream to straw yellow	absent	frequent	absent	rare	9–12 × 9–11	8.2–10.8 × 6–8	absent
<i>T. xantha</i>	cream to straw yellow	present	absent	absent	absent	13.8–17.8 × 12.6–16.3	7.2–8.5 × 5.1–6.8	1.8–4.2 × 1.5–3.2
<i>T. yokohamensis</i>	snow white to white	absent	absent	absent	absent	11–14.8 × 9.2–11.7	7.5–10.1 × 6–8.1	absent
<i>T. zhejiangensis</i>	cinnamon buff to honey yellow	occasional	absent	absent	absent	27–38 × 24–34	15–19 × 14–17.5	absent

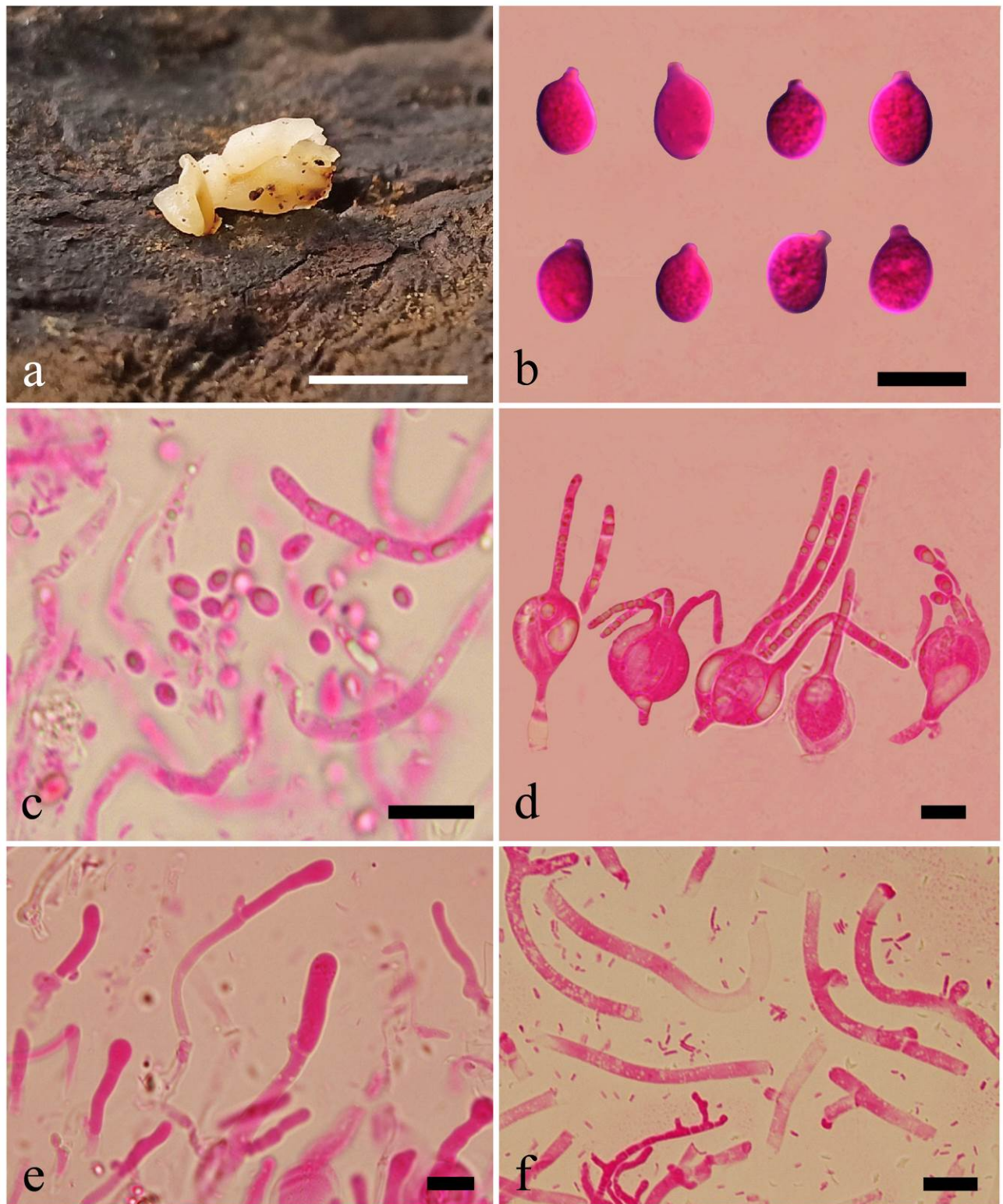


Fig. 96 Photos of basidiomata and microscopic structures of *Tremella xantha*. a Basidiomata. b Basidiospores. c Conidia. d Basidia. e Hyphidia. f Hyphae. Scale bars = a 1 cm, b–f 10 µm.

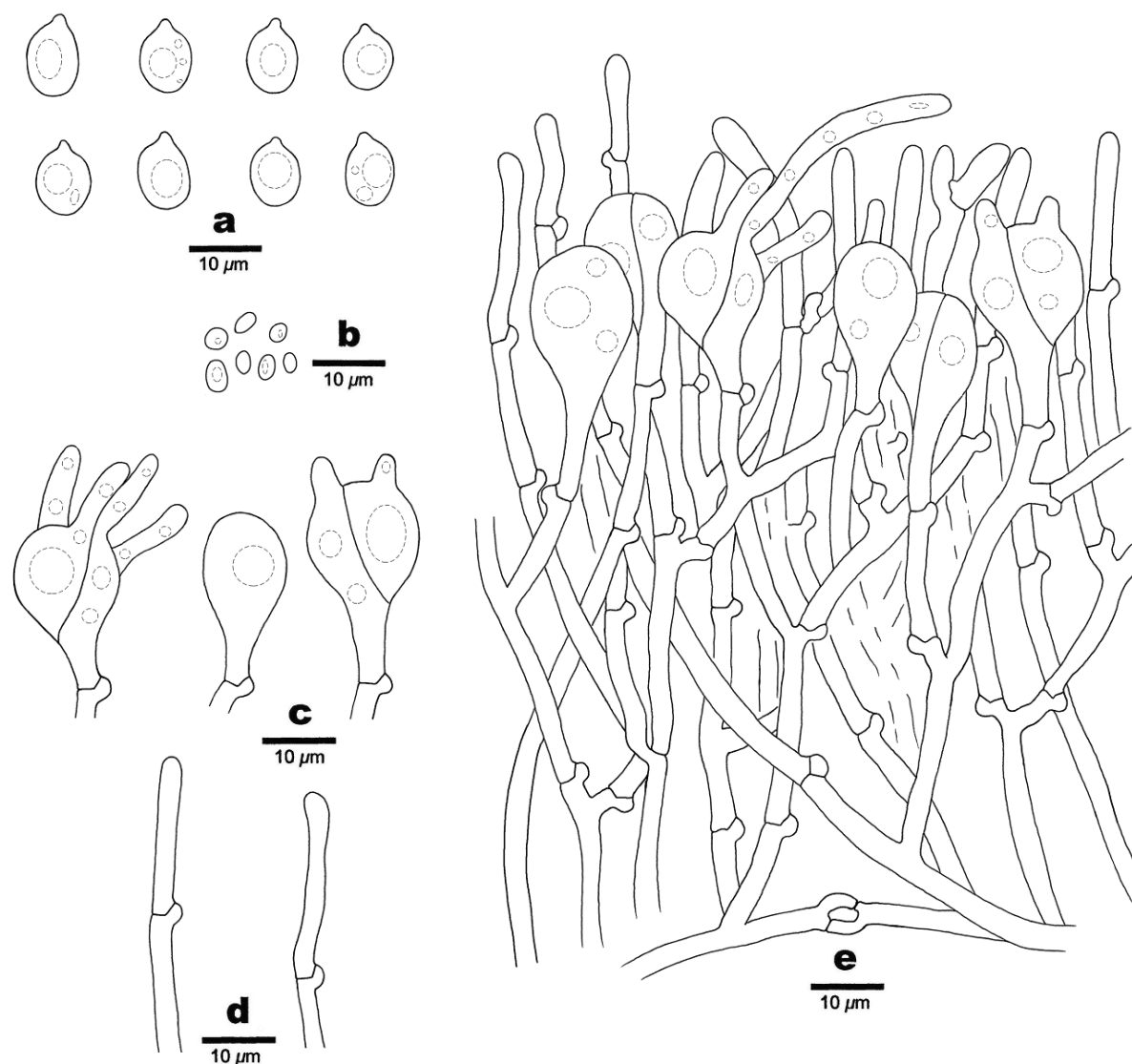


Fig. 97 Line drawings of microscopic structures of *Tremella xantha*. a Basidiospores. b Conidia. c Probasidia and basidia. d Hyphidia. e A section of hymenium. Scale bars = a–e 10 µm.

Discussion

Macro-morphologically, jelly fungi in Auriculariales and Tremellales are sometimes confused, e.g., *Myxarium subnucleatum* or *Protohydnum translucidum* are macro-morphologically similar to *Phaeotremella rigida* or *Tremella subhyalina* by sharing whitish and cerebriform basidiomata when fresh (Figs. 36, 40, 54, 88). Therefore, based on the macro-morphology, it is difficult to determine if the sample belongs to Auriculariales or Tremellales. However, although they usually share longitudinally septate basidia, they are distinguished by their other micro-structures. Jelly fungi of the Auriculariales usually have auricularioid, tremelloid, myxarioid, petiolate, or aseptate basidia, allantoid or cylindrical basidiospores, and very long, simple or branched hyphidia, while jelly fungi of the Tremellales usually have tremelloid or sirobasioid basidia and subglobose to globose or broadly ellipsoid basidiospores that producing secondary spores, and some specialized structures such as swollen cells, vesicles, and haustoria (Malysheva 2012; Spirin

et al. 2018b, 2019; Wu et al. 2019, 2020; Fan et al. 2021a; Lebeuf et al. 2023; Thomas & Kumar 2023). In addition, they belong to different classes and are distantly related in the phylogeny (He et al. 2019, 2024).

According to our studies, our jelly fungal samples with longitudinally septate basidia were identified as 47 species belonging to five genera of the Auriculariales, viz., *Exidia*, *Myxarium*, *Protohydnum*, *Pseudohydnum*, and *Tremellochaete*, and 55 species belonging to five genera of the Tremellales, viz., *Naematelia*, *Phaeotremella*, *Pseudotremella*, *Sirobasidium* and *Tremella*.

Notes on the clades within the Auriculariales

Those 47 species clustered in four main clades of the Auriculariales, viz., the Auriculariaceae clade, the Hyaloriaceae clade, the Protohydnum clade, and the Pseudohydnum clade in the phylogeny (Fig. 1), which is basically consistent with previous phylogenetic analyses (Weiß & Oberwinkler 2001; Spirin et al. 2019).



Fig. 98 Photos of basidiomata of known species in the Tremellales. a *Tremella flava*. b *T. fuciformis*. c *T. lloydiae-candidae*. d–e *T. mesenterica*. f *T. poilkavensis*. g *T. salmonea*. h–i *T. samoensis*. j *T. taiwanensis*. k *T. tropica*. l *T. yokohamensis*.

Among these species clustered in the Auriculariaceae clade, 30 species belong to Auriculariaceae, including 13 new species (Fig. 1). *Exidia* usually has gelatinous, orbicular or

sub-orbicular basidiomata, 4-celled basidia and allantoid basidiospores, and it was shown to be polyphyletic in previous phylogenies (Spirin et al. 2019; Ye et al. 2020;

Tohtirjap et al. 2023). According to our studies, 27 species corresponding to the typical morphology of *Exidia* were identified, except that *E. ellipsospora*, *E. brunnea*, and *E. sinocystidiata* usually have waxy and resupinate basidiomata, respectively. However, *E. brunnea* and *E. sinocystidiata* clustered in two clades with other known *Exidia* species, and *E. ellipsospora* formed a single lineage distantly related to other *Exidia* species in our phylogenies (Figs. 1, 2; Supplementary Figs. 1–3). The three species are tentatively placed in *Exidia*, although they are most likely to be treated as new genera from the morphology. Actually, *Exidia* is always polyphyletic in our phylogenies (Figs. 1, 2; Supplementary Figs. 1–3), which is the same with previous studies (Spirin et al. 2019; Ye et al. 2020; Tohtirjap et al. 2023). *Exidia* species clustered in 11 monophyletic clades in our phylogeny (Fig. 2).

The *Exidia* clade 1 comprises seven species, including *E. glandulosa*, the type species of the genus. The species in this clade mostly have blackish basidiomata, except *E. nivea* and *E. brunnea* that have whitish basidiomata (Table 2). The *Exidia* clade 2 includes four species mostly with white or brown basidiomata. Among them, *E. uvapassa* is a first record from China, and it is widely distributed all around China. The *Exidia* clade 3 includes four species usually having reddish brown basidiomata. Among them, *E. recisa* (Ditmar) Fr. and *E. repanda* Fr. are distributed in Europe, *E. crenata* (Schwein.) Fr. is distributed in North America, and *E. yadongensis* is distributed in China (Wu et al. 2020). Although *E. crenata* and *E. yadongensis* have high sequence similarity from the phylogeny based on the concatenated ITS+nLSU dataset of Auriculariales (Fig. 1), they can form two distinct lineages from the phylogeny based on the ITS sequences of Auriculariaceae (Supplementary Fig. 1) and the concatenated five-gene or four-gene dataset of Auriculariaceae (Fig. 2; Supplementary Fig. 3), and there is a more than 1% sequence difference in the ITS region between the two species. In addition, *E. crenata* usually has cespitose and coalescing basidiomata with obvious lobed edges when mature, whereas *E. yadongensis* has cupulate to discoid basidiomata, and *E. yadongensis* is distributed in China, while *E. crenata* is found in North America. The *Exidia* clade 4, clade 5, clade 8, clade 10, and clade 11 include one species only, *E. candida*, *E. latisporea*, *E. abieticola*, *E. ningxiaensis*, and *E. ellipsospora*, respectively. *Exidia candida* is always related to *Tremellochaete* in the phylogenies (Spirin et al. 2019; Liu et al. 2022; Figs. 1, 2), but it has a smooth hymenial surface without papillae different from *Tremellochaete*. *Exidia abieticola* is always closely related to *Exidiopsis grisea* with strong support in our phylogenies (Figs. 1, 2), but *Exidiopsis* usually has effused, corticioid or wax-gelatinous basidiomata (Roberts 2003b; Liu et al. 2022), and the genus is polyphyletic in the phylogenies (Yuan et al. 2018; Liu et al. 2022; Figs. 1, 2). Until now, there has been no comprehensive study on the diversity and phylogeny of *Exidiopsis*, and its taxonomy is outdated for lack of molecular data. The *Exidia* clade 6 includes three species with black basidiomata, among them, *E. truncata* is distributed in Europe (Fries 1822; Wu et al. 2020); the others are all distributed in China. The *Exidia* clade 7 includes *E. saccharina* and *E. subsaccharina* with reddish brown basidiomata, and the two species grow on coniferous wood (Tohtirjap et al. 2023). *Exidia saccharina* is widely distributed in Europe and north China, but *E. subsaccharina* is found so far only in Europe. The *Exidia* clade 9 includes

three species having whitish or brownish basidiomata, among them, *E. thurettiana* and *E. sinothurettiana* grow on coniferous wood, and *E. qinghaiensis* grows on *Betula* sp. or other angiosperms. Overall, the 11 *Exidia* clades cannot be classified into 11 different genera based on their morphology or ecology, although they are strongly supported by phylogenetic analyses (Figs. 1, 2). Of course, it is possible to treat these clades as different genera by adding more evidence because molecular data are occupying a dominant position in modern fungal taxonomy, and some polyphyletic genera have been divided into several monophyletic genera when morphology is ignored (Ji et al. 2023; Zhao et al. 2023; Zhou et al. 2023b).

Tremellochaete is very similar to *Exidia* by the morphology, and it was derived from *Exidia* (Raitviir 1964). Eight species are addressed in the genus, and five species with molecular data are added in our phylogenetic analyses (Figs. 1, 2; Supplementary Figs. 1–3). The five species always cluster in different clades in our phylogenies (Figs. 1, 2). *Tremellochaete* clade 1, with *T. japonica* as the type species, is strongly supported in our phylogenies (Figs. 1, 2), but *Tremellochaete* clade 2 is weakly supported, especially in the phylogeny of Auriculariales based on combined ITS+nLSU (Fig. 1). It is most likely that *Tremellochaete* clade 1 represents *Tremellochaete* s.s. and the species of *Tremellochaete* clade 2 will be possibly transferred into another genus when more samples and molecular data are added in any future study of *Tremellochaete*.

The Hyaloriaceae clade (Fig. 1) includes our six species in China, and they are strongly supported by phylogenetic analyses. It is worth mentioning that *Myxarium atroalbum* is hard to differentiate from *M. cinnamomescens* because of about 1% differences in the ITS sequences, but *M. cinnamomescens* is distinguished from *M. atroalbum* by different morphology and distribution (Spirin et al. 2018b). *Myxarium* is characterized by its gelatinous basidiomata, and longitudinally septate basidia with enucleate stalk (Spirin et al. 2018b, 2019), and these characteristics fit the definition of *Hyaloria*. *Hyaloria* was established to accommodate the sole species, *H. pilacre*, with stipitate basidiomata (Möller 1895). However, *Hyaloria pilacre* always nested in the same clade with *Myxarium* (Weiß & Oberwinkler 2001; Kirschner & Chen 2004). So, it was transferred into *Myxarium*, and *Hyaloria* was considered a synonym of *Myxarium* as result of priority nomenclature (Stalpers et al. 2021). We accept this proposition because the same phylogenetic relationship between *H. pilacre* and *Myxarium* species is shown in our phylogeny (Fig. 1). Hyaloriaceae is accept to include *Myxarium* species since *H. pilacre* has been moved to *Myxarium*.

The *Protohydnum* clade includes nine *Protohydnum* species, of which two species were originally from *Ductifera*, one from *Bourdotia*, and one from *Exidiopsis* (Spirin et al. 2025). Therefore, the species in this clade morphologically are diverse having pulvinate, cerebriform, or completely resupinate basidiomata with nearly smooth or distinctly hydroid hymenial surface. However, this clade always was strongly supported (Weiß & Oberwinkler 2001; Malysheva et al. 2018; Spirin et al. 2025; Fig. 1) and they share gelatinous basidiomata, similar longitudinally septate basidia and basidiospores in shape. Therefore, we accept this clade as *Protohydnum*.

The *Pseudohydnum* clade includes our 10 *Pseudohydnum*

species, which form ten small lineages with robust support except for *Ps. translucens* Lloyd (Fig. 1). The sample Dai 23740 was published as one new species *Ps. candidissimum* H.M. Zhou et al. (Zhou et al. 2023a), however, Spirin et al. (2023) examined the holotype of *Ps. translucens* from Japan, and considered *Ps. candidissimum* as a synonym of *Ps. translucens*, because their voucher samples clustered in one lineage. In our phylogeny, sample Dai 23740 also clusters in the *Ps. translucens* lineage with strong bootstrap support (Fig. 1), and we follow the proposition by Spirin et al. (2023). In addition, although *Ps. abietinum* and *Ps. sinogelatinosum* have high sequence similarity from the phylogeny based on the concatenated ITS+nLSU dataset of Auriculariales (Fig. 1), there is more than 1.4% sequence difference in the ITS region between the two species, and morphologically, *Ps. abietinum* differs from *Ps. sinogelatinosum* by its smaller basidia ($9.5\text{--}12 \times 7.5\text{--}12 \mu\text{m}$ vs. $12\text{--}15 \times 10\text{--}12 \mu\text{m}$) and basidiospores ($6\text{--}7.5 \times 5\text{--}6.3 \mu\text{m}$ vs. $7\text{--}9 \times 6\text{--}7.2 \mu\text{m}$).

Notes on the clades within the Tremellales

The 55 species that clustered in five main clades of Tremellales, viz., the Bulleraceae clade, the Sirobasidiaceae clade, the Naemateliaceae clade, the Tremellaceae clade, and the Phaeotremellaceae clade in the phylogeny (Figs. 3), is a result basically consistent with previous phylogenetic analyses (Liu et al. 2015b; Li et al. 2020; He et al. 2024).

The species of *Pseudotremella*, *Genolevuria*, the *Tremella* clade I, the *Tremella* clade III previously were classified in Bulleraceae (Liu et al. 2015b; He et al. 2024; Feng et al. 2025). In our phylogenies (Fig. 3), these species clustered into one large clade, but there is no support value, so the Bulleraceae clade remain highly polyphyletic. Our four *Pseudotremella* species, including three new species, that clustered in the Bulleraceae clade, are temporarily placed in the Bulleraceae referring to the previous classification system (Liu et al. 2015b; He et al. 2024; Feng et al. 2025), because there is no better family to accommodate these species. The new species *Pseudotremella chayensis* formed one independent lineage, which is not related to any other genera whether in the multi-gene phylogenies (Fig. 3; Supplementary Fig. 5) or the single-gene phylogeny (Supplementary Fig. 4). Morphologically, the species is most similar to *Pseudotremella* species (e.g. *P. pulvinata*) by sharing gelatinous, pulvinate, black basidiomata, similar basidia and basidiospores, and we didn't find key characteristics to support it as an independent new genus. In addition, although *Tremella* s.l. is still polyphyletic, non-lichenicolous jelly *Tremella* species all clustered into the Tremellaceae (*Tremella* s.s.) clade. We advise to transfer those lichenicolous *Tremella* species to other families or genera because they were scattered into different clades in the phylogenies (Fig. 3; Supplementary Figs. 4, 5), which will be demonstrated in the next notes of Tremellaceae in detail. Therefore, the new species is proposed in *Pseudotremella* rather than other jelly genera (e.g. *Tremella*).

The family Sirobasidiaceae was proposed by Möller (1895) and validated by Lindau (1897) to accommodate the genus *Sirobasidium*, and now contains two genera *Fibulobasidium* Bandoni and *Sirobasidium* (Liu et al. 2015b; He et al. 2024). *Fibulobasidium* formed a well-supported monophyletic clade, but as in previous studies (Bandoni et al. 2011; Liu et al. 2015b) species of *Sirobasidium* always formed several divergent lineages in Tremellales (Fig. 3), and sequences of the type

species, *S. sanguineum*, are unavailable. Therefore, the clade including species of *Sirobasidium* and *Fibulobasidium* is defined as Sirobasidiaceae, and other *Sirobasidium* species are advised to be transferred into other family. We collected four specimens of *Sirobasidium magnum* which is macro-morphologically very similar to some species of *Phaeotremella*, but *S. magnum* has catenulate basidia and this readily distinguishes it from *Phaeotremella* species (Chen 1998).

The family Naemateliaceae was proposed by Liu et al. (2015b) to include *Naematelia* and *Dimennazyma*. The two genera clustered in one monophyletic clade with robust support in our phylogenies. So, the family is reconfirmed according to our studies, and our samples were identified as *N. nodulosa* and *N. encephala* with support by morphological characteristics and phylogenetic analyses (Fig. 3). The two species are closely related to *N. sinensis*, which is widely cultivated in China and contains abundant polysaccharides possessing anti-inflammatory, anticancer, antioxidant, and immunomodulatory functions (Sun et al. 2024). Therefore, the two species seem to be edible and medicinal mushrooms.

Tremellaceae is the most diverse family in number of species of jelly fungi. The family was emended to include only *Tremella* s.s. by Liu et al. (2015b). However, according to Index Fungorum (<http://www.indexfungorum.org>) and MycoBank (<https://www.mycobank.org>), a large number of lichenicolous *Tremella* species are classified in Tremellaceae, although they did not cluster in the Tremellaceae/*Tremella* s.s. clade in the phylogeny (Fig. 3). Liu et al. (2015b) advised to transfer those lichenicolous *Tremella* species to other families, e.g. species in *Tremella* clade I and clade III to Bulleraceae, species in *Tremella* clade II to Carcinomycetaceae. We would like to accept their proposal that Tremellaceae only includes *Tremella* s.s. because the Tremellaceae clade only with *Tremella* s.s. was also strongly supported in our phylogeny (Fig. 3), and those lichenicolous *Tremella* species can be transferred to other families or genera because they were scattered into different clades based on our phylogeny (Fig. 3). However, although species in *Tremella* clade I and clade III clustered into the Bulleraceae clade, the Bulleraceae clade was not strongly supported. The current Bulleraceae is highly polyphyletic and there will be some new families separated from the Bulleraceae clade. In addition, the species in *Tremella* clade II were classified into Carcinomycetaceae by Liu et al. (2015b), but this clade is distantly related to the core group of Carcinomycetaceae. This clade may be a potential new family containing lichenicolous species only, but we are not willing to do so until more data is available. Some lichenicolous *Tremella* species clustered into other monophyletic clades including the Cuniculitremaeae and the Trimorphomycetaceae clade, we also suggest these species as the members of Cuniculitremaeae or Trimorphomycetaceae based on their phylogenetic relationship. In addition, we suggest those subclades or single-species lineages with lichenicolous *Tremella* species, e.g., *Tremella* clade I and *Tremella* clade II defined by Millanes et al. (2011) be new genera, but we did not define these genera because we focused on jelly fungi and did not examine any samples of lichenicolous species.

The jelly fungi of Tremellaceae/*Tremella* s.s. were divided into six clades and two single lineages because the two lineages were not clustered into any other clades. The six

clades are defined as six *Tremella* groups based on their morphology and phylogeny: Samoensis, Laurisilvae, Globispora, Fuciformis, Fibulifera and Mesenterica groups, and the two single lineages represent *T. dysenterica* and *T. xantha*. These clades/lineages are well supported in our phylogeny (Fig. 3).

The large clade with the Samoensis, Laurisilvae, Globispora and Fuciformis groups was previously defined as the Fuciformis group by Chen (1998). The current Fuciformis group includes seven jelly fungi that we have studied and one yeast species, *T. basidiomaticola* Xin Zhan Liu & F.Y. Bai (Li et al. 2020). The jelly fungi of this group usually have white and foliaceous basidiomata when fresh, except for *T. flava* Chee J. Chen that has yellow basidiomata (Fig. 55). The Samoensis group includes our five new species, and two known species, *T. erythrina* described by Zhao et al. (2019) and *T. samoensis*. Those six species actually are separated from the *T. samoensis* species complex by sharing yellowish brown and scattered basidiomata when fresh. The Laurisilvae group includes our two new species and *T. laurisilvae*, and the group differs from other groups by brownish orange, finger-shaped to slightly cerebriform smaller and thicker basidiomata (Kout et al. 2015). The Globispora group differs from other groups by stalked basidia, but stalked basidia also were observed in *T. xantha*. However, *Tremella xantha* differs from the Globispora group by more or less foliaceous basidiomata.

The Fibulifera group is a new *Tremella* group and usually has whitish to whitish yellow, irregularly cerebriform basidiomata and complex hyphal clamps (medallion clamps) (Fan et al. 2021a). The species of this group were mostly separated from the *T. fibulifera* complex, except for *T. resupinata* Chee J. Chen and *T. sairandhriana* A. Thomas & T.K.A. Kumar. *Tremella resupinata* was assigned to the Fuciformis group by Chen (1998) and *T. sairandhriana* was recently described by Liu et al. (2024). The two species are closely related to the *T. fibulifera* complex, so they also are placed in the Fibulifera group, and they are distinguished from other *Tremella* species by having resupinate basidiomata.

Currently, 13 jelly fungi are accepted in the Mesenterica group including five species described in the present study and eight known species, and these species were well-supported in our phylogeny (Fig. 3). The specimen of *T. coalescens* L.S. Olive clustered in the same lineage with *T. mesenterica*, so the specimen was assigned to *T. mesenterica* because *T. mesenterica* has priority. The Mesenterica group differs from other groups by having white or pale yellow, foliaceous to cerebriform basidiomata, and distinctly larger basidiospores (Table 3).

The genus *Vishniacozyma* Xin Zhan Liu et al. was proposed to accommodate some *Cryptococcus* yeast species and the teleomorphs of the two mycoparasitic *Trimorphomyces* species. It was placed in Bulleribasidiaceae by Liu et al. (2015b), because of its close relationship with species of Bulleribasidiaceae in the phylogeny, however, it actually always forms a sister group of the Tremellaceae in the phylogenies based on more samples and molecular data in more recent studies (Li et al. 2020; Chang et al. 2021; Jiang et al. 2024; Fig. 3). So, the genus may either be retained in Tremellaceae, or a new family may be proposed to accommodate the genus based only on phylogenetic analysis. Based on the morphology, the *Vishniacozyma* clade may be

a potential new family because most *Vishniacozyma* species are yeast taxa except for *V. nebularis* (Vishniac) A.M. Yurkov and *V. indica* Anjitha Thomas & T.K.A. Kumar, which have very small gelatinous basidiomata, and *V. nebularis* has zygoconidia and *V. indica* has no clamp connections which have never been found in *Tremella* species (Kirschner & Chen 2008; Chang et al. 2021; Crous et al. 2025).

The family Phaeotremellaceae was established to accommodate the Foliacea group of *Tremella* s.l., which was transferred to *Phaeotremella*, and a single-species lineage of *Cryptococcus spencermartinsiae* V. de García et al., which was transferred to *Gelidatrema* by Liu et al. (2015b). The revision was widely accepted by researchers, and some species were since described in these two genera, and several combinations were proposed from *Tremella* s.l. (Spirin et al. 2018c; Tsuji et al. 2018; Li et al. 2019, 2020; Yuan et al. 2020; Lebeuf et al. 2023; Jiang et al. 2024; Kachalkin et al. 2024; Feng et al. 2025). However, the family was ever suggested to be removed from the order Tremellales because the family did not cluster in the Tremellales based on single-copy ortholog genes, and it was not placed in any one order (He et al. 2024). In later studies, the family clustered in Tremellales based on multi-gene sequences by Feng et al. (2025) and it is still placed in the Tremellales (Jiang et al. 2024; Feng et al. 2025). In our study, we accept the family as a member of Tremellales because it clustered in the Tremellales in our phylogeny with high support (Fig. 3) and its type genus, *Phaeotremella*, was separated from *Tremella*, the core genus of Tremellales.

Our samples were identified as 11 *Phaeotremella* species including six new species, and these species were well-supported by phylogenetic analyses (Fig. 3). Currently, *Phaeotremella* includes 32 species mostly with foliaceous macro-basidiomata inhabiting rotten wood (Spirin et al. 2018c; Tsuji et al. 2018), and also several species growing on the hymenia of other fungi, e.g., *P. mycophaga* (G.W. Martin) Millanes & Wedin, *P. simplex* (H.S. Jacks. & G.W. Martin) Millanes & Wedin and *P. mycetophiloides* (Kobayasi) Millanes & Wedin (Kobayasi 1939; Martin 1940), and some anamorphic yeast species, e.g., *P. fagi* (Middelhoven & Scorzetti) Yurkov & Boekhout, *P. lacus* A.H. Li et al., and *P. ovata* Q.M. Wang et al. (Li et al. 2020). Mycoparasitic *Phaeotremella* species may be confused with species of *Carcinomyces* in the morphology, but they grow on different host fungi and are distantly related in the phylogeny (Fig. 3).

In addition, according to our phylogenetic analyses, some *Phaeotremella* species, e.g., *P. fimbriata*, *P. eugeniae*, and *P. foliaceae* could not be differentiated by the phylogeny based on ITS and nLSU sequences, but they clustered in three distinct lineages in the phylogeny based on a dataset of five genes (Fig. 3). The phylogeny of *Phaeotremella* based on two genes is not presented here because the phylogeny based on five genes is better to distinguish different species of *Phaeotremella*. Therefore, the protein-coding genes should be included to identify different *Phaeotremella* species, and *TEF1* is a more sensitive gene. A similar result was observed by Spirin et al. (2018c).

Future research prospects for jelly fungi

In general, we performed a comprehensive study on the species diversity, taxonomy, and phylogeny of jelly fungi with longitudinally septate basidia in the Auriculariales and the

Tremellales. We propose one new combination, describe 46 new species, reconfirm 14 known families. These results greatly increase the known species diversity of jelly fungi. Although we have tried our best to collect jelly fungal samples for ten years, our collections are mostly from China, Brazil or Australia. More samples from other areas such as Europe, and Africa are needed for further studies to obtain a more comprehensive worldwide view on the species diversity of these jelly fungi.

In recent years, jelly fungi have been gradually attracting attention of mycologists (Spirin et al. 2018a, 2018b, 2019; Fan et al. 2021a, 2021b; Wang & Thorn 2021; Wu et al. 2021; Thomas & Kumar 2023; Wang & Bau 2023; Zhou et al. 2023a; Liu et al. 2024), but their diversity and taxonomy are still poorly known. Although we have done some investigations on the jelly fungi of the Auriculariales and Tremellales, such as *Auricularia*, *Exidia*, *Phaeotremella*, *Tremella*, some genera, e.g., *Stypella* Möller, *Hormomyces* Bonord etc. are without available molecular data, and we will focus on these fungi in the coming years. In addition, species of *Guepinia* Fr. also were reported as having gelatinous basidiomata with longitudinally septate myxarioid basidia (Shen & Fan 2020; Cui et al. 2024), but they are more fragile and grow on the ground. Therefore, they are not added in this study although we have collected a few samples of *Guepinia*.

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Author contributions

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Conflict of interest statement

The author list includes members of the Editorial Board of Fungal Diversity. They were not involved in the journal's review of, or decisions related to, this manuscript. The authors declare no competing interests.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Supplemental Information

The online version contains supplemental information available at <https://doi.org/10.65390/fdiv.2026.136014>.

Supplementary Table 1. Requests for materials can be made to the corresponding authors.

Supplementary Figure 1. Maximum likelihood (ML) tree of Auriculariaceae based on ITS sequences.

Supplementary Figure 2. Maximum likelihood (ML) tree of Auriculariaceae based on the concatenated ITS+nLSU dataset.

Supplementary Figure 3. Maximum likelihood (ML) tree of Auriculariaceae based on the concatenated ITS+nLSU+RPB1+RPB2 dataset.

Supplementary Figure 4. Maximum likelihood (ML) tree of Tremellales based on ITS sequences.

Supplementary Figure 5. Maximum likelihood (ML) tree of Tremellales based on the concatenated ITS+nLSU dataset.

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