

ARTICLE

Hyperdiverse *Rhytismatales* on twigs of *Rhododendron* spp.**Guo MJ^{1†}, Zhuo L^{1†}, Wang SJ³, Sui XN¹, Zhou H¹, Cai SR¹, Luo JT¹, Lei RH¹, Shen XY^{1,2}, Piepenbring M⁴ and Hou CL^{1,2*}**¹ College of Life Science, Capital Normal University, Xisanhuanbeilu 105, Haidian, Beijing 100048, China² Beijing Key Laboratory of Plant Gene Resources and Biotechnology for Carbon Reduction and Environmental Improvement, Capital Normal University, Xisanhuanbeilu 105, Haidian, Beijing 100048, China³ Anhui Provincial Key Laboratory for microbial Control & School of Forestry & Landscape Architecture, Anhui Agricultural University, West Changjiang Road 130, Hefei, Anhui 230036, China⁴ Mycology Working Group, Goethe University, Biologicum, Max-von-Laue-Str. 13, 60438 Frankfurt am Main, Germany**Citation** – Guo MJ, Zhuo L, Wang SJ, Sui XN, Zhou H, Cai SR, Luo JT, Lei RH, Shen XY, Piepenbring M, Hou CL 2024 – Hyperdiverse *Rhytismatales* on twigs of *Rhododendron* spp. *Mycosphere* 15(1), 764–880, Doi 10.5943/mycosphere/15/1/6**Abstract**

Rhytismatales M.E. Barr ex Minter (*Leotiomyces*, *Ascomycota*) is an order mostly consists of plant-associated ascomycetes with a global distribution. Among host plant taxa in diverse relationships, *Rhododendron* L. is one of the most preferred host genera of *Rhytismatales*. *Rhododendron* is the largest genus of *Ericaceae* Juss. and presents a high species diversity in south-western China. In this study, the species diversity of *Rhytismatales* on twigs of *Rhododendron* spp. is investigated based on over 100 specimens recently collected in China. These were examined morphologically and by multi-gene phylogenetic analyses based on molecular sequence data from the internal transcribed spacer (ITS) region, the large subunit of the ribosomal RNA gene (nrLSU) and the mitochondrial small subunit (mtSSU rDNA). Eight monophyletic groups with strong support and distinct morphological characteristics are proposed as new genera, namely *Lophodermiopsis*, *Neotrybliopsis*, *Occultimyces*, *Rhodohypoderma*, *Septofusella*, *Septomyces*, *Shuqunia*, and *Yingrenia*. Thirty-three new species are recognized, and three new combinations are proposed. Apparently, twigs of *Rhododendron* spp. have been repeatedly colonized during evolution by members of *Rhytismatales* and most of these species specifically develop their ascomata on this substrate. Radiation on this substrate occurred relatively recently leading to species diversity within genera. Information on all 54 species of *Rhytismatales* on twigs of *Rhododendron* spp. are combined in a complete revision of this group of fungi based on morphological characteristics and phylogenetic analyses. Keys to genera and species of *Rhytismatales* on twigs of *Rhododendron* spp. worldwide are provided. The results of the molecular phylogenetic analysis indicate that a natural classification of *Rhytismatales* on genus level cannot be defined based on few morphological characteristics, but a combination of many morphological characteristics together with information derived from molecular sequence data, the host relationship, as well as the organ infected are necessary.

Keywords – 36 new taxa – Host organ specificity – Phylogeny – Taxonomy**INTRODUCTION**

The order *Rhytismatales* M.E. Barr ex Minter belongs to *Leotiomyces* (*Ascomycota*) and

Submitted: 2 November 2023; **Accepted:** 24 April 2024; **Published:** 4 June 2024***Corresponding Author:** Cheng-Lin Hou – e-mail – chenglin-hou@cnu.edu.cn[†]These authors contributed equally to this work.

Accepted by: Nuwanthika Wijesinghe

includes endophytic, saprobic or parasitic species that are widely distributed in temperate and tropical regions (Cannon & Minter 1986, Lantz et al. 2011, Lin 2012, Wang et al. 2023). Species of *Rhytismatales* are associated with a wide range of host plants, including approximately 125 host families and over 380 host genera (Lin 2012). Recent studies have shown that *Rhytismatales* species are mostly host specific, and common on conifers, grasses and members of *Ericaceae* Juss. (Lin 2012, Wang et al. 2023). Most species have immersed ascomata, which are often surrounded by a layer of black stromatic tissues at an early stage and erumpent from the host tissue at the maturity, exposing a hymenium by one longitudinal split or several irregular splits to allow the liberation of ascospores (Cannon & Minter 1986, Lantz et al. 2011, Lin 2012).

Rhytismatales include economically important parasites, particularly on conifers, such as needle and branch diseases of *Pinus* spp. caused by *Elytroderma deformans* (Weir) Darker throughout North America (Darker 1932, 1967); needle dieback and early fall of *Abies* spp. and *Picea* spp. caused by *Lirula* spp. widely distributed in Europe and the United States (Minter & Millar 1984, Cannon & Minter 1986); needle cast and leaf blight of pine seedlings caused by *Lophodermium seditiosum* Minter, Staley & Millar in Europe and North America, resulting in serious losses (Minter & Millar 1978). Members of *Rhytisma*-like species can also cause tar spot diseases on leaves of broadleaf trees around the world, such as *Acer* spp., *Rhododendron* spp., and *Ilex* spp. (Cannon & Minter 1986, Wang et al. 2023).

The historical classification of *Rhytismatales* species changed from a four-family system proposed by Hawksworth et al. (1983) to a two-family system used by Kirk et al. (2001). Later, Lantz et al. (2011) used nuclear nrLSU and mitochondrial SSU rDNA sequences for phylogenetic analyses and defined a core clade of *Rhytismatales* with a single family, *Rhytismataceae* Chevall. In addition, they discovered that some genera traditionally placed within *Rhytismatales* are phylogenetically belong to *Helotiales* Nannf. Other species were later transferred to the *Marthamycetales* (Baral 2015, Johnston et al. 2019). Afterwards, a multigene phylogenetic study of members of *Cudoniaceae* P.F. Cannon revealed that the species belong to *Cudoniaceae* are nested within *Rhytismataceae*. It was suggested to treat the name *Cudoniaceae* as a synonym of *Rhytismataceae* (Gernandt et al. 2001, Lantz et al. 2011, Ge et al. 2014). Karakehian et al. (2019) found that species belonging to *Triblidiaceae* Rehm, which were traditionally placed in *Triblidiales* O.E. Erikss. (Eriksson 1992), are also nested within *Rhytismataceae* according to multi-locus phylogenetic evidence. Recently, based on molecular phylogenetic data, ascomata morphology, and host specificity, *Rhytismataceae sensu stricto* has been proposed, including eight genera (Wang et al. 2023). At present, *Rhytismatales* contains *Cudoniaceae*, *Rhytismataceae* s.str., and *Triblidiaceae*, all nested within *Rhytismataceae* s.l. together with numerous species that are *incertae sedis* concerning the family level (Ge et al. 2014, Karakehian et al. 2019, Wang et al. 2023).

Cudoniaceae was introduced with two genera, namely *Cudonia* Fr. as the type genus and *Spathularia* Pers. Species of these genera develop small and more or less club-shaped ascomata, which are very different from typical rhytismatalean ascomata with black stromatic tissue (Kirk et al. 2001, Lantz et al. 2011, Ge et al. 2014).

According to Karakehian et al. (2019), *Triblidiaceae* contain two genera, namely *Triblidium* Rebent. As the type genus and *Huangshania* O.E. Erikss., while Lv et al. (2019a) treated *Huangshania* as a synonym of *Triblidium*, and documented *Triblidium* as the only genus in *Triblidiaceae*. Species of *Triblidiaceae* are characterized by muriform ascospores with cell walls not reacting in iodine-based reagents (Karakehian et al. 2019).

At present, *Rhytismataceae* s.l. include more than 800 known species in 60 genera (Wijayawardene et al. 2022, Wang et al. 2023), but molecular studies have shown that most of the traditional genera are polyphyletic (Lantz et al. 2011, Wang et al. 2013, Wang et al. 2014b, Lv & Hou 2019, Lv et al. 2019a, Zhang et al. 2020, Wang et al. 2023). The concepts of these genera are based only on morphology and for most of them morphologically and phylogenetically convincing alternatives are not available (Cannon & Minter 1986, Sherwood 1980, Powell 1974, Hou 2004, Lin et al. 2004).

Several recent studies have revealed that host relationships, morphological characteristics, and the localization of the ascomata on leaves or twigs are useful for a natural classification of genera in the taxonomy of *Rhytismatales*. For example, Sherwood (1980) found that *Coccomyces* species typically infect broad-leaved hosts, while *Lophodermium* species are common on conifers and grasses. Lantz et al. (2011) pointed out that several strongly supported clades are restricted to specific plant genera or even species, based on the phylogenetic analysis of nrLSU and mtSSU rDNA sequence data. Wang et al. (2014a) found that *Tryblidiopsis* spp. only occur on species of *Picea*. Recently, Wang et al. (2023) conducted a nrLSU-mtSSU rDNA phylogenetic analysis of *Rhytisma*-like species worldwide, and revealed that these species are divided into nine subclades with high bootstrap support values, each of them shows strong host preference. Host specificity coupled with the characteristics of ascomata has proven to be helpful as a basis to define genera and solved the long-standing confusion concerning *Rhytisma*-like species (Wang et al. 2023).

Among more than 800 known species of *Rhytismatales*, there are 86 species belong to 17 genera occurring on host species of *Ericaceae* worldwide. Among these, 57 species in 13 genera are known on *Rhododendron* spp., the largest genus of *Ericaceae*. These numbers compiled from information on known species provided by the US National Fungus Collections Fungus-Host-Location database (<https://nt.ars-grin.gov/fungalatabases>). The seven genera of *Rhytismatales* were established based on specimens occurring on *Rhododendron* species as holotypes, namely *Densorhytisma* C.L. Hou, Q.T. Wang & P.F. Cannon, *Lophodermium* Höhn., *Myriophacidium* Sherwood, *Nematococcomyces* C.L. Hou, M. Piepenbr. & Oberw., *Neococcomyces* Y.R. Lin, C.T. Xiang & Z.Z. Li, *Placuntium* Ehrenb., and *Shiqia* C.L. Hou, Q.T. Wang & P.F. Cannon (Sherwood 1974, Lin et al. 1999, Hou et al. 2004, Wang et al. 2023).

With more than 1,000 species worldwide, *Rhododendron* L. is the most diverse genus in family *Ericaceae*, with approximately 600 species reported for China (Liu et al. 2021), where *Rhododendron* L. stands as the largest genus among woody angiosperms (Shrestha et al. 2018). The greatest diversity of *Rhododendron* spp. is found in mountains extending from the southern Himalayas to south-western China (Shrestha et al. 2018, Mo et al. 2022). This high diversity of host plants apparently leads to a high diversity of fungi, especially among species of *Rhytismatales*.

For the present study, species diversity, taxonomy and phylogeny of *Rhytismatales* species on twigs of *Rhododendron* spp. have been investigated mainly based on specimens recently collected in southwest China. The phylogeny is reconstructed based on DNA sequences of multiple loci including internal transcribed spacer (ITS) regions, the large subunit nuclear ribosomal RNA gene (nrLSU), and the small subunit mitochondrial rDNA gene sequences (mtSSU). In the course of this study, thirty-six new taxa and eight genera were discovered. Known species found on twigs of *Rhododendron* hosts are revised. Keys are provided for the identification of genera and species of *Rhytismatales* on twigs of *Rhododendron* spp. worldwide.

MATERIALS AND METHODS

Taxon sampling

Fresh specimens were collected by several authors in different Chinese provinces, mostly in Yunnan, and others in Anhui, Guizhou, Hunan, Sichuan, or other provinces. Most of the specimens were collected in June-August, when the ascomata of rhytismatalean fungi are matured. Living or dead and attached or fallen twigs and stems of *Rhododendron* spp. were examined for the presence of fungal fruiting structures. Specimens of rhytismatalean fungi were air-dried, placed in paper bags and stored in a cool, dry location in the laboratory for subsequent studies.

Isolation

The fungal fruiting structures were cut from the twigs of *Rhododendron* spp., and were disinfected in 75% ethanol for 30 s, followed by 10% sodium hypochlorite (NaOCl) for 3 min, washed in sterile water three times, then placed on potato dextrose agar (PDA) and incubated at room temperature (20 °C). The pure fungal colonies were isolated. Living cultures of new species

from this study were deposited in Capital Normal University Culture Collection Center (CNUCC) in China.

Morphological studies

Fungal morphologies were examined by hand sectioning of fruiting bodies. Mature fruiting structures were selected for morphological analyses. External shape, size, color, the opening of the ascomata and conidiomata, as well as the internal micro-morphological characteristics were observed and photographed under a dissecting microscope (Nikon SMZ-1000, Japan), based on the methodologies described for morphological analysis by Hou et al. (2009) and Wang et al. (2023). The specimens are deposited in the Herbarium of the College of Life Science, Capital Normal University, Beijing, China (BJTC). Newly introduced taxa have been registered in the MycoBank database (<http://www.mycobank.org/>).

Molecular techniques

Total genomic DNA was extracted directly from the fruiting bodies and the fresh fungal mycelia using NuClean Plant Genomic DNA Kit (CW BIO, China), and following the protocol of Hou et al. (2009). The ITS regions were amplified with PCR using the primers ITS1/ITS4 (White et al. 1990, Gardes & Bruns 1993), LR0R/LR5 primers were used for nrLSU (White et al. 1990), and mrSSU1/mrSSU3R primers were used for mtSSU (Zoller et al. 1999). PCR was performed in 25 μ L reactions according to Lv (2020). The PCR products were sent to Zhongkexilin Biotechnology Co., Ltd. (Beijing, China) for purifying, sequencing and editing.

Phylogenetic analysis

The new sequences were submitted to the GenBank database and additional sequences of ITS, nrLSU and mtSSU rDNA included in this study were downloaded from GenBank (Table 1). The analysis includes the type species and representative species of all known genera of *Cudoniaceae*, *Triblidiaceae*, and *Rhytismataceae* s. str. For polyphyletic genera of *Rhytismataceae* s.l., such as *Lophodermium* and *Coccomyces*, a representative species was selected from each clade of each genus. Concatenated ITS, nrLSU, and mtSSU rDNA datasets were aligned with MAFFT (<https://www.ebi.ac.uk/Tools/msa/mafft/>), and then manually improved by using Se-Al v.2.03a (Rambaut 2000). Ambiguously aligned regions were not used in the analyses. A combined dataset of ITS, nrLSU, and mtSSU sequences was prepared and analyzed using the maximum parsimony method performed with PAUP* 4.0b10 (Swofford 1998). Maximum parsimony analysis was conducted using heuristic searches with 1,000 replicates of random-addition sequence, tree bisection reconnection (TBR) branch swapping and no maxtree limit. All characteristics were equally weighted and unordered. Gaps were treated as missing characters to minimize homology assumptions. A bootstrap analysis was performed with 1,000 replicates, each with 100 random taxon addition sequences. MAXTREES was set to 1,000, and TBR branch swapping was employed. For the Bayesian inference (BI) analysis, MrModeltest 2.3 with the Akaike information criterion (AIC) served as substitution model for the concatenated dataset. The model GRT + I + G was chosen for the combined three-gene matrices. The Bayesian analysis was performed with MrBayes 3.1.2 (Huelsenbeck et al. 2001, Ronquist & Huelsenbeck 2003). The analyses of four chains were conducted for 100,000,000 generations with the default settings and sampled every 100 generations, halting the analyses at an average standard deviation of split frequencies of 0.01. The first 25% of the trees were removed as burn-in. Bayesian posterior probabilities (PP) were obtained from the 50% majority rule consensus of the remaining trees. Maximum likelihood (ML) analysis was performed with IQ-TREE 2.2.0 (Minh et al. 2020), the substitution model for ITS is TIM2e+R5, for nrLSU TIM3e+I+I+R4, and for mtSSU K3Pu+F+R4. ML bootstrap replicates (1000) were computed in IQ-TREE using a rapid bootstrap analysis and search for the best-scoring ML tree. Bootstrap support values for ML analysis (MLB) $\geq$ 75% (first set), MP analysis (MPB) $\geq$ 75% (second set), and Bayesian inference (PP) $\geq$ 0.95 (third set) are given near the nodes, respectively.

The final alignments and the retrieved topologies were deposited in TreeBASE (<http://www.treebase.org>), under accession ID: 30894.

RESULTS

Molecular phylogeny

Fungi collected on twigs of *Rhododendron* spp. were isolated and DNA barcode regions were amplified. There are 124 new sequences for ITS rDNA, 105 for nrLSU rDNA, and 103 for mtSSU rDNA regions were obtained. These new sequences were combined with corresponding sequences retrieved from GenBank (Table 1). The phylogenetic analyses of *Rhytismatales* were carried out based on a combined ITS, nrLSU, and mtSSU rDNA matrix with *Pezicula carpineae* (Pers.) Tul. ex Fuckel (*Helotiales*, *Dermateaceae*) as well as *Cudoniella clavus* (Alb. & Schwein.) Dennis (*Helotiales*, *Tricladiaceae*) as outgroup. After manual editing of the ambiguously aligned regions, the combined matrix was included 2,070 base positions, and 1,024 of them being phylogenetically informative. The maximum parsimony analysis of the sequences resulted in one most parsimonious tree (Fig. 1) with a length (TL) of 9,976 steps, consistency index (CI) of 0.222, retention index (RI) of 0.750, homoplasy index (HI) of 0.778, and rescaled consistency index (RC) of 0.167. The phylogenetic trees of single loci (Supplementary Figs 1, 2, 3) and the nrLSU-mtSSU phylogenetic tree (Supplementary Fig. 4) show topologies similar to those of the ITS-nrLSU-mtSSU phylogenetic tree.

Taxonomy

In this study, the classification system proposed by Wijayawardene et al. (2022) and the latest phylogenetic study on *Rhytismataceae* s. str. by Wang et al. (2024) were followed to conduct a comprehensive phylogenetic analysis of *Rhytismatales*. Many mycologists have realized that relying solely on a single morphological characteristic or phylogenetic analysis as the species criteria can mask discordances among fungal groups, leading to inaccurately defined species boundaries (Chethana et al. 2021, Wang et al. 2024). Therefore, an integrative taxonomic approach was employed herein, combining evidence from various morphological characteristics, phylogenetic analyses based on multiple loci, host specificity, and the organ infected, to accurately define the taxa within *Rhytismatales*. New sequence data of *Rhytismatales* species found on twigs of *Rhododendron* spp. presented in this study are located in 13 lineages corresponding to the genera (Fig. 1). Five of these genera are already established, viz. *Coccomyces*, *Nematococcomyces*, *Sporomega*, *Terriera*, and *Triblidium*, while the remaining eight monophyletic groups are proposed as genera new to science.

A total of 26 species new to science belong to eight new genera. In addition to these new species, one new species is introduced in *Coccomyces*, four in *Nematococcomyces* C.L. Hou, M. Piepenbr. & Oberw., one in *Sporomega* Corda, one in *Terriera* B. Erikss., and three in *Triblidium* Rebent. Additionally, *Hypoderma cuspidatum* C.L. Hou & M. Piepenbr. and *Hypoderma urniforme* C.L. Hou & M. Piepenbr. are transferred from *Hypoderma* De Not. to *Rhodohypoderma* and *Neococcomyces erumpens* C.L. Hou & M. Piepenbr. is transferred from *Neococcomyces* Y.R. Lin, C.T. Xiang & Z.Z. Li to *Yingrenia*. Based on the molecular phylogenetic evidence, several further samples represent unnamed species, that are not presented in detail because the ascomata of these specimens were immature.

Key to genera of *Rhytismatales* including species on twigs of *Rhododendron* species

1. Ascomata almost round to multi-angular, usually opening by several irregular splits 2
1. Ascomata elliptical to sublinear, usually opening by one longitudinal split 9
2. Ascospores muriform..... *Triblidium*
2. Ascospores not muriform 3

Table 1 Taxa of *Rhytismatales* used for the phylogenetic analysis, GenBank accession numbers, and voucher information. The newly generated sequences in the context of the present study are indicated in **bold**.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Bifusella camelliae</i>	HOU 701B	KF797436	KF797448	KF797459	Wang et al. (2014b)
<i>Bifusella camelliae</i>	HOU 1094	KF797435	KF797447	KF797458	Wang et al. (2014b)
<i>Bifusella linearis</i>	BPI843543	AY465527	–	–	Kirk et al. (2015)
<i>Bifusella linearis</i> ^T	EBJul30-5	KT000193	–	–	Kirk et al. (2015)
<i>Bivallum zelandicum</i> ^T	PDD 112248	MH921846	–	–	Johnston et al. (2019)
<i>Coccomyces anhuiensis</i>	HOU 1325	MK371316	MK371317	MK371318	Lv & Hou (2019)
<i>Coccomyces anhuiensis</i> ^H	HOU 1265	MK371313	MK371314	MK371315	Lv & Hou (2019)
<i>Coccomyces australis</i>	HOU 656	KF797434	KF797446	KF797457	Wang et al. (2014b)
<i>Coccomyces circinatus</i>	T 72	GU138722	–	–	GenBank (2024)
<i>Coccomyces clavatus</i>	PDD 112233	MH578536	–	–	Lv et al. (2019b)
<i>Coccomyces crystalligerus</i>	ICMP 17375	–	HM140501	HM143778	Lantz et al. (2011)
<i>Coccomyces cupressini</i>	ICMP 18318	–	HM140502	HM143779	Lantz et al. (2011)
<i>Coccomyces delta</i>	R 68	GU138731	–	–	Lv et al. (2019b)
<i>Coccomyces dentatus</i>	HOU 1104	KF797433	KF797445	KF797456	Wang et al. (2014b)
<i>Coccomyces fagicola</i> ^H	HOU 1366	MN385774	MN372085	MN385767	Lv et al. (2019b)
<i>Coccomyces fanjingshanensis</i>	HOU 1490A	MT123330	MT122787	MT123017	Zang et al. (2020)
<i>Coccomyces fanjingshanensis</i>	HOU 1493	MT123016	MT122763	MT123012	Zang et al. (2020)
<i>Coccomyces fodingshanensis</i>	HOU 1521	ON887152	ON887154	ON887153	Pu et al. (2022)
<i>Coccomyces globosus</i>	ICMP 17341	–	HM140503	HM143780	Lantz et al. (2011)
<i>Coccomyces huangshanensis</i>	R86c	GU138733	–	–	Lv et al. (2019b)
<i>Coccomyces lauraceus</i>	ICMP 18319	–	HM140504	HM143781	Lantz et al. (2011)
<i>Coccomyces ledi</i>	Lantz 386 (UPS)	–	HM140505	HM143782	Lantz et al. (2011)
<i>Coccomyces leptideus</i>	Lantz 393 (UPS)	–	HM140506	HM143783	Lantz et al. (2011)
<i>Coccomyces libocedri</i>	ICMP 18320	–	HM140507	HM143784	Lantz et al. (2011)
<i>Coccomyces mucronatus</i>	HOU 1497	PP488559	PP488671	PP488766	Guo et al. (2024)
<i>Coccomyces multangularis</i>	W9	GU138728	–	–	Jia (2011)
<i>Coccomyces phyllocladi</i>	ICMP 18321	–	HM140508	HM143785	Lantz et al. (2011)
<i>Coccomyces pinicola</i> ^H	HOU 486A	JX317676	KP322585	KP322592	Lei et al. (2013)
<i>Coccomyces pycnophyllocladi</i>	ICMP 17376	NR_175748	NG_081313	–	Crous et al. (2021)
<i>Coccomyces quercicola</i>	HOU 1367	MN385775	MN372090	MN385765	Lv et al. (2019b)
<i>Coccomyces shennongjiaensis</i>	HOU 1365C.1	MN385776	MN385769	MN385768	Lv et al. (2019b)
<i>Coccomyces shennongjiaensis</i>	HOU 1365C.2	MN385773	MN385770	MN385766	Lv et al. (2019b)
<i>Coccomyces sinensis</i>	Cj02	AB787514	–	–	Matsukura et al. (2017)

Table 1 Continued.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Coccomyces sinensis</i>	Cj01	AB787513	–	–	Matsukura et al. (2017)
<i>Coccomyces strobi</i>	AFTOL-ID 1250	–	DQ470975	FJ190622	Spatafora et al. (2006)
<i>Coccomyces triangularis</i>	MUOB 366039	OK376742	–	–	GenBank (2024)
<i>Coccomyces tumidus</i> ^T	Lantz 396	–	HM140510	HM143787	Lantz et al. (2011)
<i>Coccomyces yunnanensis</i>	HOU 1850B	PP488563	PP488674	PP488770	Guo et al. (2024)
<i>Coccomyces yunnanensis</i>	HOU 1818	PP488562	PP488673	PP488769	Guo et al. (2024)
<i>Coccomyces yunnanensis</i>	CNUCC 1818	PP488546	PP488660	PP488755	Guo et al. (2024)
<i>Coccomyces yunnanensis</i>	HOU 1603A	PP488560	–	PP488767	Guo et al. (2024)
<i>Coccomyces yunnanensis</i>	HOU 1603AY	PP488561	PP488672	PP488768	Guo et al. (2024)
<i>Colpoma juniperi</i>	Lantz 395 (UPS)	–	HM140511	–	Lantz et al. (2011)
<i>Colpoma ledi</i>	Lantz 379	–	HM140512	HM143788	Lantz et al. (2011)
<i>Colpoma quercinum</i> ^T	Lantz 368	–	HM140513	HM143789	Lantz et al. (2011)
<i>Cryptomyces theae</i> ^T	FU30017	KF797432	KF797444	–	Wang et al. (2014b)
<i>Cudonia circinans</i> ^T	Lantz 402	–	HM140515	HM143791	Lantz et al. (2011)
<i>Cudonia lutea</i>	C283	KC833151	KC833187	–	Ge et al. (2014)
<i>Cudoniella clavus</i>	AFTOL-ID 166	DQ491502	DQ470944	FJ713604	Spatafora et al. (2006)
<i>Davisomycella medusa</i>	BPI842078	AY465525	–	–	Ganley et al. (2004)
<i>Densorhytisma anhuiense</i>	HOU 1426	OQ944136	OQ944281	OQ944322	Wang et al. (2023)
<i>Densorhytisma</i> <i>huangshanense</i> ^{T, H}	HOU 564	GQ253101	FJ495192	–	Hou et al. (2010)
<i>Duplicariella phyllodoces</i> ^T	Lantz 389	–	HM140516	–	Lantz et al. (2011)
<i>Elytroderma deformans</i> ^T	–	AF203469	–	–	Ortiz-García et al. (2003)
<i>Fanglania hubeiensis</i> ^{T, H}	HOU 1406	OQ944273	OQ944311	OQ944352	Wang et al. (2023)
<i>Fanglania hubeiensis</i>	HOU 1360A	OQ944139	OQ944284	OQ944324	Wang et al. (2023)
<i>Fanglania parasiticum</i> ^H	HOU 1417	OQ944274	OQ944312	OQ944353	Wang et al. (2023)
<i>Fanglania</i> sp.1	HOU 1357	OQ944141	OQ944286	OQ944326	Wang et al. (2023)
<i>Hypoderma aliforme</i> ^H	ICMP 17379	NR_175749	NG_081314	–	Crous et al. (2021)
<i>Hypoderma aliforme</i>	PDD 64922	MZ702500	MZ702538	MZ702534	Crous et al. (2021)
<i>Hypoderma berberidis</i>	HOU 892	JX232414	JX232420	KF813010	Wang et al. (2013)
<i>Hypoderma berberidis</i>	HOU 942	JX232415	JX232421	KF813009	Wang et al. (2013)
<i>Hypoderma campanulatum</i>	ICMP 17383	–	HM140517	HM143792	Lantz et al. (2011)
<i>Hypoderma caricis</i>	R 17	GU138752	–	–	Wang et al. (2013)
<i>Hypoderma carinatum</i>	ICMP 18322	–	HM140518	HM143793	Lantz et al. (2011)
<i>Hypoderma commune</i>	Hanson 2006-451(UPS)	–	HM140519	HM143794	Lantz et al. (2011)
<i>Hypoderma cordyline</i>	ICMP 17396	–	HM140520	HM143795	Lantz et al. (2011)
<i>Hypoderma cordyline</i>	ICMP 17344	–	HM140521	HM143796	Lantz et al. (2011)

Table 1 Continued.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Hypoderma hederæ</i>	Lantz & Minter 421 (UPS)	–	HM140522	HM143797	Lantz et al. (2011)
<i>Hypoderma junipericola</i>	R104a	GU138754	–	–	GenBank (2024)
<i>Hypoderma liliense</i>	ICMP 18323	–	HM140523	HM143798	Lantz et al. (2011)
<i>Hypoderma liliense</i>	ICMP 18324	–	HM140524	HM143799	Lantz et al. (2011)
<i>Hypoderma minteri</i> ^H	BJTC 201203	NR_120173	NG_068735	–	Wang et al. (2013)
<i>Hypoderma minteri</i>	HOU 275B	JX232416	JX232418	–	Wang et al. (2013)
<i>Hypoderma obtectum</i>	ICMP 17365	–	HM140525	HM143800	Lantz et al. (2011)
<i>Hypoderma paralinderae</i>	GZAAS 19-0104	MN638873	MN638878	—	Zhang et al. (2020)
<i>Hypoderma rubi</i> ^T	ICMP 18325	–	HM140527	HM143802	Lantz et al. (2011)
<i>Hypoderma siculum</i>	PDD 99894	JF683424	–	–	Lantieri et al. (2012)
<i>Hypoderma stephanandrae</i>	R63	GU138753	–	–	Wang et al. (2014b)
<i>Hypoderma sticheri</i>	ICMP 17353	–	HM140529	HM143804	Lantz et al. (2011)
<i>Hypohelion anhuiense</i> ^H	HOU1078	KF797431	KF797443	KF797455	Wang et al. (2014b)
<i>Hypohelion anhuiense</i>	HOU1089	KF797430	KF797442	KF797454	Wang et al. (2014b)
<i>Hypohelion durum</i>	HOU 524	KF797429	KF797441	KF797453	Wang et al. (2014b)
<i>Hypohelion durum</i>	HOU 1079	KF797427	KF797439	KF797451	Wang et al. (2014b)
<i>Hypohelion scirpinum</i> ^T	Lantz 394	–	HM140531	HM143806	Lantz et al. (2011)
<i>Johnstoniella</i> sp.1	HOU 1362	OQ944142	OQ944287	OQ944327	Wang et al. (2023)
<i>Johnstoniella</i> sp.2	HOU 279	OQ944143	OQ944288	OQ944328	Wang et al. (2023)
<i>Johnstoniella yunnanensis</i> ^{T, H}	HOU 943	OQ944275	OQ944313	OQ944354	Wang et al. (2023)
<i>Lirula exigua</i>	HOU 475A	HQ902157	HQ902150	–	Fan et al. (2012)
<i>Lirula exigua</i>	HOU 459	HQ902155	HQ902148	–	Fan et al. (2012)
<i>Lirula macrospora</i>	Lantz 316	–	–	HM143807	Lantz et al. (2011)
<i>Lirula yunnanensis</i>	HOU 464A	HQ902156	HQ902149	–	Fan et al. (2012)
<i>Lophodermella arcuata</i>	RMNP LU16	MT906333	MT906359	–	Ata et al. (2021)
<i>Lophodermella arcuata</i>	RMNP LU1	MN937644	MN937585	–	Ata et al. (2021)
<i>Lophodermella concolor</i>	LP7C	MN937621	MN937588	–	Ata et al. (2021)
<i>Lophodermella concolor</i>	LV8C	MN937615	MN937576	–	Ata et al. (2021)
<i>Lophodermella conjuncta</i>	PHP19-0987	MN937608	MN937603	–	Ata et al. (2021)
<i>Lophodermella conjuncta</i>	PHP19-0986	MN937609	MN937606	–	Ata et al. (2021)
<i>Lophodermella montivaga</i>	TC9M	MN937629	MN937599	–	Ata et al. (2021)
<i>Lophodermella montivaga</i>	TL8M	MN937638	MN937600	–	Ata et al. (2021)
<i>Lophodermella sulcigena</i> ^T	PH18-0656	MN937624	MN937604	–	Ata et al. (2021)
<i>Lophodermiopsis rhododendri</i>	HOU 293B	PP488568	–	–	Guo et al. (2024)

Table 1 Continued.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Lophodermiopsis rhododendri</i>	HOU 1810B	PP488566	PP488677	–	Guo et al. (2024)
<i>Lophodermiopsis rhododendri</i>	HOU 1811	PP488567	PP488678	–	Guo et al. (2024)
<i>Lophodermiopsis rhododendri</i> ^H	HOU 1588A	PP488564	PP488675	–	Guo et al. (2024)
<i>Lophodermiopsis rhododendri</i>	HOU 1588B	PP488565	PP488676	–	Guo et al. (2024)
<i>Lophodermiopsis splendida</i> ^H	HOU 936B	PP488570	PP488680	PP488773	Guo et al. (2024)
<i>Lophodermiopsis splendida</i>	HOU 929A	PP488569	PP488679	PP488772	Guo et al. (2024)
<i>Lophodermiopsis tumida</i>	HOU 1767B	PP488571	PP488681	PP488774	Guo et al. (2024)
<i>Lophodermiopsis tumida</i>	CNUCC 1767B	PP488547	PP488661	PP488756	Guo et al. (2024)
<i>Lophodermiopsis tumida</i> ^H	HOU 1768	PP488572	PP488682	PP488775	Guo et al. (2024)
<i>Lophodermiopsis tumida</i>	CNUCC 1768.1	PP488548	–	–	Guo et al. (2024)
<i>Lophodermiopsis tumida</i>	CNUCC 1768.2	PP488549	–	–	Guo et al. (2024)
<i>Lophodermiopsis tumida</i>	CNUCC 1768.3	PP488550	PP488662	PP488757	Guo et al. (2024)
<i>Lophodermiopsis tumida</i>	CNUCC 1768.4	PP488551	PP488663	PP488758	Guo et al. (2024)
<i>Lophodermiopsis yunnanensis</i> ^H	HOU 438B	PP488577	PP488687	PP488780	Guo et al. (2024)
<i>Lophodermiopsis yunnanensis</i>	HOU 1762A	PP488574	PP488684	PP488777	Guo et al. (2024)
<i>Lophodermiopsis yunnanensis</i>	HOU 1764	PP488575	PP488685	PP488778	Guo et al. (2024)
<i>Lophodermiopsis yunnanensis</i>	HOU 1770	PP488576	PP488686	PP488779	Guo et al. (2024)
<i>Lophodermiopsis yunnanensis</i>	CNUCC 1770	PP488552	PP488664	PP488759	Guo et al. (2024)
<i>Lophodermiopsis yunnanensis</i>	HOU 1596	PP488573	PP488683	PP488776	Guo et al. (2024)
<i>Lophodermium actinothyrium</i>	losa139	AY100663	–	–	Ortiz-García et al. (2003)
<i>Lophodermium arundinaceum</i> ^T	Lantz 323	–	HM140535	HM143811	Lantz et al. (2011)
<i>Lophodermium australe</i>	isolate 24	EU696778	–	–	Toju et al. (2013)
<i>Lophodermium autumnale</i>	HOU 475C	HQ902158	HQ902151	–	Fan et al. (2012)
<i>Lophodermium baculiferum</i>	mon2zem Nuevo Leon	AY100656	–	–	Ortiz-García et al. (2003)
<i>Lophodermium baculiferum</i>	loba1 Oregon	AY100655	–	–	Ortiz-García et al. (2003)
<i>Lophodermium brunneolum</i>	ICMP 17373	–	HM140536	HM143812	Lantz et al. (2011)
<i>Lophodermium cathayae</i>	HOU 837M	HQ992811	–	–	Gao et al. (2013)
<i>Lophodermium cathayae</i>	Hou 831M	HQ992812	–	–	Gao et al. (2013)
<i>Lophodermium cedrinum</i>	BCAB212	MG779472	–	–	GenBank (2024)
<i>Lophodermium cephalotaxi</i>	T15	GU138701	–	–	GenBank (2024)
<i>Lophodermium cf. pinastri</i>	Lantz & Williams 417 (UPS)	–	HM140553	–	Lantz et al. (2011)
<i>Lophodermium conigenum</i>	Lantz 410 (UPS)	–	HM140537	HM143813	Lantz et al. (2011)
<i>Lophodermium corconticum</i>	SY370	OK493168	–	–	Lantz et al. (2011)

Table 1 Continued.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Lophodermium culmigenum</i>	Lantz 430 (UPS)	–	HM140539	HM143815	Lantz et al. (2011)
<i>Lophodermium culmigenum</i>	Lantz 442 (UPS)	–	HM140540	HM143816	Lantz et al. (2011)
<i>Lophodermium eucalypti</i>	ICMP 16796	–	HM140541	HM143817	Lantz et al. (2011)
<i>Lophodermium fissuratum</i>	CA2PM1-19-1	KY576859	–	–	Salas-Lizana & Oono (2018)
<i>Lophodermium fissuratum</i>	CA2PM1-14-1	KY576858	–	–	Salas-Lizana & Oono (2018)
<i>Lophodermium gamundiae</i> ^H	ICMP 16802	NR_119628	–	–	GenBank (2024)
<i>Lophodermium gamundiae</i>	ICMP 16797	EF191239	–	–	GenBank (2024)
<i>Lophodermium gramineum</i>	Lantz 441 (UPS)	–	HM140542	–	Lantz et al. (2011)
<i>Lophodermium hauturuuanum</i>	PDD 112227	MH578524	–	–	Johnston et al. (2019)
<i>Lophodermium herbarum</i>	Lantz 439 (UPS)	–	HM140543	HM143818	Lantz et al. (2011)
<i>Lophodermium implicatum</i>	T9	GU138700	–	–	GenBank (2024)
<i>Lophodermium indianum</i>	CMW 39125	KF636510	–	–	Tanney & Seifert (2017)
<i>Lophodermium indianum</i>	CMW 39126	KF636508	–	–	GenBank (2024)
<i>Lophodermium jiangnanense</i>	Cj12	AB787524	–	–	Matsukura et al. (2017)
<i>Lophodermium jiangnanense</i>	Cj11	AB787523	–	–	Matsukura et al. (2017)
<i>Lophodermium johnstonii</i>	isolate 310	JX232417	–	–	Wang et al. (2013)
<i>Lophodermium juniperinum</i>	Lantz 306 (UPS)	–	HM140544	HM143819	Lantz et al. (2011)
<i>Lophodermium macchi</i>	wxm130	HM037981	–	–	GenBank (2024)
<i>Lophodermium macchi</i>	wxm118	HM037953	–	–	GenBank (2024)
<i>Lophodermium medium</i>	ICMP 17360	–	HM140545	HM143820	Lantz et al. (2011)
<i>Lophodermium melaleucum</i> ^T	Lantz 378 (UPS)	–	HM140546	HM143821	Lantz et al. (2011)
<i>Lophodermium microsporum</i>	MFLU 15-3100	MK584994	–	–	Ekanayaka et al. (2019)
<i>Lophodermium molitoris</i>	CBS 597.84	AY100659	–	–	Ortiz-García et al. (2003)
<i>Lophodermium molitoris</i>	SJV2 10a	KM106818	–	–	Oono et al. (2014)
<i>Lophodermium nitens</i>	Sie1PL2-14-1	MG877536	–	–	Salas-Lizana & Oono (2018)
<i>Lophodermium nitens</i>	Sie1PL2-11-3	MG877535	–	–	Salas-Lizana & Oono (2018)
<i>Lophodermium nitidum</i>	Lantz 435 (UPS)	–	HM140547	HM143822	Lantz et al. (2011)
<i>Lophodermium oxycocci</i>	Lantz 397 (UPS)	–	–	HM143823	Lantz et al. (2011)
<i>Lophodermium paeoniae</i>	Lundqvist 21693	–	HM140549	–	Lantz et al. (2011)
<i>Lophodermium petiolicola</i>	Lantz 385 (UPS)	–	HM140550	HM143824	Lantz et al. (2011)
<i>Lophodermium petrakii</i>	R60	FJ861984	–	–	Tanney & Seifert (2017)
<i>Lophodermium piceae</i>	Lantz 317 (UPS)	–	HM140551	HM143825	Lantz et al. (2011)
<i>Lophodermium pinastri</i>	Lantz 437	–	HM140552	HM143826	Lantz et al. (2011)
<i>Lophodermium pini-bungeanae</i>	R112	FJ861989	–	–	Tanney & Seifert (2017)

Table 1 Continued.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Lophodermium pini-excelsae</i>	R85	FJ861987	–	–	Tanney & Seifert (2017)
<i>Lophodermium pini-mugonis</i>	568M	JF332165	–	–	Hou et al. (2009)
<i>Lophodermium pini-taiwanensis</i>	HOU 1227B	KX443657	–	–	Li et al. (2016)
<i>Lophodermium pini-taiwanensis</i>	HOU 1222B	KX443656	–	–	Li et al. (2016)
<i>Lophodermium platyplacum</i>	Lantz & Minter 419 (UPS)	–	HM140554	HM143827	Lantz et al. (2011)
<i>Lophodermium rectangulare</i>	PDD 112235	MH578540	–	–	Johnston et al. (2019)
<i>Lophodermium resinosum</i> ^H	DAOMC 251482	NR_172257	NG_060349	–	Tanney & Seifert (2017)
<i>Lophodermium resinosum</i>	NB 770.1	KY485129	KY485135	–	Tanney & Seifert (2017)
<i>Lophodermium seditiosum</i>	SY367	OK493166	–	–	GenBank (2024)
<i>Lophodermium seditiosum</i>	SY366	OK493165	–	–	GenBank (2024)
<i>Lophodermium</i> sp.	Lantz 443 (UPS)	–	HM140555	HM143828	Lantz et al. (2011)
<i>Lophodermium sphaerioides</i>	Lantz 382 (UPS)	–	HM140556	HM143829	Lantz et al. (2011)
<i>Lophodermium thailandicum</i>	MFLU 17-0673	MG821634	–	–	Hyde et al. (2018)
<i>Lophodermium tindalii</i>	PDD 92044	MH921867	–	–	Johnston et al. (2019)
<i>Meloderma desmazieri</i>	DAOM:89807	KY485137	–	–	Tanney & Seifert (2017)
<i>Meloderma desmazieri</i> ^T	MD3 (ATCCc)	AF426056	–	–	Deckert et al. (2002)
<i>Meloderma dracophylli</i>	ICMP 17343	–	HM140561	HM143833	Lantz et al. (2011)
<i>Nematococcomyces brunneus</i>	HOU 1766A	PP488579	–	–	Guo et al. (2024)
<i>Nematococcomyces brunneus</i>	HOU 1807B	PP488580	PP488689	–	Guo et al. (2024)
<i>Nematococcomyces brunneus</i>	HOU 1810A	PP488581	–	–	Guo et al. (2024)
<i>Nematococcomyces brunneus</i> ^H	HOU 1610A	PP488578	PP488688	–	Guo et al. (2024)
<i>Nematococcomyces mirabilis</i>	HOU 470B	PP488586	PP488693	PP488785	Guo et al. (2024)
<i>Nematococcomyces mirabilis</i>	HOU 1821	PP488585	PP488692	PP488784	Guo et al. (2024)
<i>Nematococcomyces mirabilis</i>	HOU 1563	PP488582	PP488690	PP488781	Guo et al. (2024)
<i>Nematococcomyces mirabilis</i> ^H	HOU 1564	PP488583	–	PP488782	Guo et al. (2024)
<i>Nematococcomyces mirabilis</i>	HOU 1568	PP488584	PP488691	PP488783	Guo et al. (2024)
<i>Nematococcomyces oberwinkleri</i> ^H	HOU 482B	–	KC312686	KC312689	Tian et al. (2013)
<i>Nematococcomyces rhododendri</i> ^T	HOU 879A	–	KC312685	KC312690	Tian et al. (2013)
<i>Nematococcomyces rhododendri</i>	HOU 1795A	PP488587	PP488694	PP488786	Guo et al. (2024)
<i>Nematococcomyces rhododendri</i>	CNUCC 1795A	PP488553	PP488665	PP488760	Guo et al. (2024)
<i>Nematococcomyces vermiformis</i>	HOU 1857B	PP488588	PP488696	–	Guo et al. (2024)
<i>Nematococcomyces vermiformis</i> ^H	HOU 1840B	–	PP488695	PP488787	Guo et al. (2024)
<i>Nematococcomyces vermiformis</i>	HOU 2053B	PP508357	PP505423	PP505439	Guo et al. (2024)
<i>Nematococcomyces vermiformis</i>	HOU 2115B	PP508358	PP505424	PP505440	Guo et al. (2024)
<i>Nematococcomyces yunnanensis</i> ^H	HOU 1592	PP488589	PP488697	PP488788	Guo et al. (2024)

Table 1 Continued.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Neococcomyces rhododendri</i>	HOU 1918A	PP488590	–	PP488789	Guo et al. (2024)
<i>Neococcomyces rhododendri</i>	HOU 1920A	PP488591	PP488698	PP488790	Guo et al. (2024)
<i>Neococcomyces rhododendri</i>	HOU 1921A	PP488592	PP488699	PP488791	Guo et al. (2024)
<i>Neorhytisma panamense</i>	HOU 601	GQ253102	GQ253099	OQ944337	Hou et al. (2010)
<i>Neorhytisma panamense</i> ^T	UCH 5284	OQ944277	–	OQ944356	Wang et al. (2023)
<i>Neotryblidiopsis polygonalis</i>	HOU 1822A	PP488593	PP488700	PP488792	Guo et al. (2024)
<i>Neotryblidiopsis polygonalis</i> ^{T, H}	HOU 1823	PP488594	PP488701	PP488793	Guo et al. (2024)
<i>Neotryblidiopsis yunnanensis</i> ^H	HOU 366	PP488601	PP488706	PP488800	Guo et al. (2024)
<i>Neotryblidiopsis yunnanensis</i>	HOU 440	PP488602	PP488707	PP488801	Guo et al. (2024)
<i>Neotryblidiopsis yunnanensis</i>	HOU 1753	PP488598	PP488705	PP488797	Guo et al. (2024)
<i>Neotryblidiopsis yunnanensis</i>	HOU 1776	PP488599	–	PP488798	Guo et al. (2024)
<i>Neotryblidiopsis yunnanensis</i>	HOU 1788	PP488600	–	PP488799	Guo et al. (2024)
<i>Neotryblidiopsis yunnanensis</i>	HOU 1591	PP488595	PP488702	PP488794	Guo et al. (2024)
<i>Neotryblidiopsis yunnanensis</i>	HOU 1600	PP488596	PP488703	PP488795	Guo et al. (2024)
<i>Neotryblidiopsis yunnanensis</i>	HOU 1606	PP488597	PP488704	PP488796	Guo et al. (2024)
<i>Occultimycetes fusiformis</i> ^{T, H}	HOU 458A	PP488603	–	–	Guo et al. (2024)
<i>Occultimycetes fusiformis</i>	HOU 877A	PP488604	PP488708	PP488802	Guo et al. (2024)
<i>Parvacoccum pini</i> ^T	TRY	MT707244	–	–	Haelewaters et al. (2020)
<i>Pezicula carpineae</i>	KUS-F51029	JN033388	JN086691	JN086765	Han et al. (2014)
<i>Placuntium andromedae</i> ^T	Lantz 307 (UPS)	–	HM140564	–	Lantz et al. (2011)
<i>Placuntium</i> sp.1	HOU 1106	PP508359	PP505425	PP505441	Guo et al. (2024)
<i>Placuntium</i> sp.2	HOU 1107	PP508360	PP505426	–	Guo et al. (2024)
<i>Ploioderma destruens</i>	T33	GU138756	–	–	GenBank (2024)
<i>Pseudographis elatina</i> ^T	GJO 0090016	MK751794	MK751803	MK751717	Karakehian et al. (2019)
<i>Pseudographis pinicola</i>	FH NB842	MK751796	MK751805	MK751719	Karakehian et al. (2019)
<i>Rhodohypoderma clavatum</i> ^H	HOU 927B	PP488605	–	PP488803	Guo et al. (2024)
<i>Rhodohypoderma cuspidatum</i>	HOU 484A	PP488606	PP488710	PP488804	Guo et al. (2024)
<i>Rhodohypoderma cuspidatum</i>	HOU 895A	PP488607	PP488711	PP488805	Guo et al. (2024)
<i>Rhodohypoderma rhododendri</i> ^{T, H}	HOU 1840A	PP488608	PP488712	PP488806	Guo et al. (2024)
<i>Rhodohypoderma rhododendri</i>	HOU 1840AY	PP488609	PP488713	PP488807	Guo et al. (2024)
<i>Rhodohypoderma rhododendri</i>	HOU 1857	PP488610	PP488714	PP488808	Guo et al. (2024)
<i>Rhodohypoderma urniforme</i>	HOU 1795B	PP488611	–	PP488809	Guo et al. (2024)
<i>Rhodohypoderma urniforme</i>	HOU 879B	PP488612	PP488715	PP488810	Guo et al. (2024)
<i>Rhytisma acerinum</i> ^T	HOU 1058	OQ944148	OQ944295	OQ944332	Guo et al. (2024)
<i>Rhytisma acerinum</i>	HOU 1198	OQ944149	OQ944296	OQ944333	Wang et al. (2023)

Table 1 Continued.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Septofusella</i> sp. 1	HOU 1795C	PP488614	PP488717	PP488812	Guo et al. (2024)
<i>Septofusella</i> sp. 1	HOU 1576B	PP488613	PP488716	PP488811	Guo et al. (2024)
<i>Septofusella triseptate</i> ^{T, H}	HOU 292	PP488615	PP488718	PP488813	Guo et al. (2024)
<i>Septomyces magnus</i> ^T	HOU 368	PP488618	PP488720	–	Guo et al. (2024)
<i>Septomyces magnus</i> ^H	HOU 1593A	PP488616	PP488719	PP488814	Guo et al. (2024)
<i>Septomyces magnus</i>	HOU 1593Azi	PP488617	–	–	Guo et al. (2024)
<i>Shiqia menziesii</i>	HOU 1054	OQ944154	OQ944302	OQ944339	Wang et al. (2023)
<i>Shiqia yuexiense</i> ^T	HOU 521	OQ944155	OQ944303	OQ944340	Wang et al. (2023)
<i>Shuqunia clavata</i> ^H	HOU 1812	PP488619	–	–	Guo et al. (2024)
<i>Shuqunia clavata</i>	HOU 2036	PP508361	PP505427	PP505442	Guo et al. (2024)
<i>Shuqunia longa</i> ^{T, H}	HOU 368B	PP488620	PP488721	PP488815	Guo et al. (2024)
<i>Shuqunia longa</i>	HOU 457A	PP488621	PP488722	PP488816	Guo et al. (2024)
<i>Shuqunia nitens</i> ^H	HOU 1758	PP488622	PP488723	PP488817	Guo et al. (2024)
<i>Shuqunia nitens</i>	HOU 1845	PP488624	PP488725	PP488819	Guo et al. (2024)
<i>Shuqunia nitens</i>	HOU 1758Y	PP488623	PP488724	PP488818	Guo et al. (2024)
<i>Shuqunia nitens</i>	CNUCC 1758	–	PP488666	PP488761	Guo et al. (2024)
<i>Shuqunia rhododendri</i> ^H	HOU 1848D	PP488626	PP488727	PP488821	Guo et al. (2024)
<i>Shuqunia rhododendri</i>	CNUCC 1848C.1	PP488554	PP488667	PP488762	Guo et al. (2024)
<i>Shuqunia rhododendri</i>	CNUCC 1848C.2	PP488625	PP488726	PP488820	Guo et al. (2024)
<i>Shuqunia yunnanensis</i>	HOU 1566	PP488627	PP488728	PP488822	Guo et al. (2024)
<i>Shuqunia yunnanensis</i> ^H	HOU 1567	PP488628	PP488729	PP488823	Guo et al. (2024)
<i>Shuqunia yunnanensis</i>	HOU 1572	PP488629	PP488730	PP488824	Guo et al. (2024)
<i>Shuqunia yunnanensis</i>	HOU 1573	PP488630	–	PP488825	Guo et al. (2024)
<i>Spathularia flavida</i> ^T	CBS 399.52	–	AY541496	AY575101	Lumbsch et al. (2005)
<i>Spathularia rufa</i>	ACD0432	OL756005	OL742449	–	GenBank (2024)
<i>Sporomega degenerans</i> ^T	Lantz 367	–	HM140567	HM143839	Lantz et al. (2011)
<i>Sporomega nodulifera</i> ^H	HOU 1629A	PP488631	PP488731	PP488826	Guo et al. (2024)
<i>Sporomega</i> sp. 1	HOU 1709A	PP488632	PP488732	PP488827	Guo et al. (2024)
<i>Sporomega</i> sp. 1	CNUCC 1709A	PP488555	PP488668	PP488763	Guo et al. (2024)
<i>Terriera camelliicola</i>	L0447	–	KP878552	KP878553	GenBank (2024)
<i>Terriera cladophila</i> ^T	Lantz 423	–	HM140568	HM143840	Lantz et al. (2011)
<i>Terriera elliptica</i> ^H	HOU 327	KP878549	KP878550	KP878551	Zhang et al. (2015)
<i>Terriera guizhouensis</i>	HOU 1528A	MT534526	MT549890	–	Cai et al. (2020)
<i>Terriera guizhouensis</i>	HOU 1528B	MT534528	MT549872	MT549865	Cai et al. (2020)
<i>Terriera</i>				–	
<i>houjiazhuangensis</i> ^H	HOU 1275A	MT549882	MT549889	–	Cai et al. (2020)

Table 1 Continued.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Terriera houjiazhuangensis</i>	HOU 1275B	MT549879	MT549864	MT549884	Cai et al. (2020)
<i>Terriera ilicis</i>	HOU 1360B	MT549861	MT549873	MT549886	Cai et al. (2020)
<i>Terriera ilicis</i>	HOU 1361	MT549877	MT549881	MT549870	Cai et al. (2020)
<i>Terriera illiciicola</i>	R89	FJ861980	–	–	GenBank (2024)
<i>Terriera illiciicola</i>	R84	FJ861979	–	–	GenBank (2024)
<i>Terriera karsti</i> ^H	MFLU 18-2288	MN638876	MN638881	MN638871	Zhang et al. (2020)
<i>Terriera karsti</i>	HOU 1709B	PP488633	PP488733	PP488828	Guo et al. (2024)
<i>Terriera meitanensis</i>	MFLU 18-2301	MN638875	MN638880	MN638870	Zhang et al. (2020)
<i>Terriera meitanensis</i> ^H	MFLU 18-2299	MN638874	MN638879	MN638869	Zhang et al. (2020)
<i>Terriera minor</i>	ICMP 13973	–	HM140570	HM143842	Lantz et al. (2011)
<i>Terriera pandanicola</i> ^H	MFLU 16-1931	–	MH260320	MW334971	Zhang et al. (2020)
<i>Terriera rhododendri</i> ^H	HOU 1122	PP488634	–	PP488829	Guo et al. (2024)
<i>Terriera rhododendri</i>	CNUCC 1736	PP488556	–	–	Guo et al. (2024)
<i>Terriera sigmoideospora</i> ^H	MFLU 18-2297	MN638877	MN638882	MN638872	Zhang et al. (2020)
<i>Terriera thailandica</i> ^H	MFLUCC 14-0818	–	NG_059726	–	Hyde et al. (2016)
<i>Therrya abieticola</i>	HOU 447A	KP322574	KP322580	KP322587	Zhang et al. (2020)
<i>Therrya eucalypti</i>	PRJ AU09-82	KM880188	–	–	GenBank (2024)
<i>Therrya fuckelii</i>	CBS 377.58	JF793672	–	–	Solheim et al. (2013)
<i>Therrya fuckelii</i>	NWFVA4768	MT821241	–	–	Blumenstein et al. (2021)
<i>Therrya pini</i>	CBS 177.56	MH857568	MH869111	KC312688	Vu et al. (2019), Tian et al. (2013)
<i>Triblidium caliciiforme</i> ^T	–	MK751798	MK751807	MK751721	Karakehian et al. (2019)
<i>Triblidium hubeiense</i> ^H	HOU 1350A	MN541813	MN541811	MN541828	Lv et al. (2019a)
<i>Triblidium laojunshanense</i> ^H	HOU 1620	PP488635	PP488734	PP488830	Guo et al. (2024)
<i>Triblidium laojunshanense</i>	HOU 2123	PP508362	PP505428	PP505443	Guo et al. (2024)
<i>Triblidium rhododendri</i> ^H	HOU 326A	PP488637	PP488736	PP488832	Guo et al. (2024)
<i>Triblidium rhododendri</i>	HOU 1848B	PP488636	PP488735	PP488831	Guo et al. (2024)
<i>Triblidium rostriforme</i>	1	–	MN541820	MN541821	Lv et al. (2019a)
<i>Triblidium rostriforme</i>	HOU 1603B	PP488638	PP488737	PP488833	Guo et al. (2024)
<i>Triblidium sichuanense</i> ^H	HOU 295	PP488639	PP488738	PP488834	Guo et al. (2024)
<i>Triblidium sichuanense</i>	HOU 1964	PP508363	PP505429	PP505444	Guo et al. (2024)
<i>Triblidium sichuanense</i>	HOU 1965	PP508364	PP505430	PP505445	Guo et al. (2024)
<i>Triblidium sichuanense</i>	HOU 1971	PP508365	PP505431	PP505446	Guo et al. (2024)

Table 1 Continued.

Species	Voucher specimen	ITS	LSU	mtSSU	References
<i>Triblidium sichuanense</i>	HOU 1977	PP508366	PP505432	PP505447	Guo et al. (2024)
<i>Triblidium verrucosum</i>	UME-29336a	MK751793	MK751802	MK751716	Lv et al. (2019a)
<i>Triblidium yunnanense</i>	HOU 1822B	PP488641	–	–	Guo et al. (2024)
<i>Triblidium yunnanense</i>	HOU 1611	PP488640	PP488739	PP488835	Guo et al. (2024)
<i>Triblidium yunnanense</i>	HOU 1179	MN541814	MN541809	MN541816	Lv et al. (2019a)
<i>Tryblidiopsis magnesii</i> ^H	DAOMC 252096	NR_164611	NG_066463	–	Tanney & Seifert (2019)
<i>Tryblidiopsis magnesii</i>	NB 630	MK748209	MK748168	–	Tanney & Seifert (2019)
<i>Tryblidiopsis pinastri</i> ^T	Lantz 412	–	HM140573	–	Lantz et al. (2011)
<i>Tryblidiopsis sichuanensis</i>	HOU 300	KC312677	KC312679	KC312693	Wang et al. (2014a)
<i>Tryblidiopsis sichuanensis</i> ^H	HOU 306	KC312676	KC312683	KC312692	Wang et al. (2014a)
<i>Tryblidiopsis sinensis</i> ^H	HOU 814	KC312674	KC312681	KC312694	Wang et al. (2014a)
<i>Xyloma filamentosum</i> ^H	HOU 1584	NR154388	NG_060060	–	Masumoto et al. (2015)
<i>Xyloma golobosum</i>	HOU 898	OQ944279	OQ944316	OQ944358	Wang et al. (2023)
<i>Xyloma maximus</i>	Lantz 424	–	HM140514	HM143790	Lantz et al. (2011)
<i>Yingrenia cannonii</i> ^H	HOU 1797	PP488642	PP488740	–	Guo et al. (2024)
<i>Yingrenia debililabiata</i> ^H	HOU 1604B	PP488643	–	PP488836	Guo et al. (2024)
<i>Yingrenia debililabiata</i>	HOU 2073B	PP508367	PP505433	PP505448	Guo et al. (2024)
<i>Yingrenia debililabioides</i> ^H	HOU 444	PP488644	PP488741	PP488837	Guo et al. (2024)
<i>Yingrenia debililabioides</i>	CNUCC 444	PP488557	PP488669	PP488764	Guo et al. (2024)
<i>Yingrenia erumpens</i>	HOU 1844A	PP488646	PP488742	PP488838	Guo et al. (2024)
<i>Yingrenia erumpens</i>	HOU 349	PP488647	PP488743	PP488839	Guo et al. (2024)
<i>Yingrenia erumpens</i> ^T	HOU 438A	PP488648	PP488744	PP488840	Guo et al. (2024)
<i>Yingrenia erumpens</i>	Cerion122 Roki902A	PP488645	–	–	Guo et al. (2024)
<i>Yingrenia laojunshanensis</i>	HOU 1816A	PP488652	PP488746	PP488842	Guo et al. (2024)
<i>Yingrenia laojunshanensis</i>	HOU 1593Bzi	PP488651	PP488745	PP488841	Guo et al. (2024)
<i>Yingrenia laojunshanensis</i>	HOU 1593BY	PP488650	–	–	Guo et al. (2024)
<i>Yingrenia laojunshanensis</i> ^H	HOU 1593B	PP488649	–	–	Guo et al. (2024)
<i>Yingrenia papillata</i> ^H	HOU 845A	PP488654	PP488748	PP488844	Guo et al. (2024)
<i>Yingrenia papillata</i>	HOU 373	PP488653	PP488747	PP488843	Guo et al. (2024)
<i>Yingrenia rhododendri</i> ^H	HOU 1847A	PP488655	PP488749	PP488845	Guo et al. (2024)
<i>Yingrenia rhododendri</i>	HOU 1848A	PP488656	PP488750	PP488846	Guo et al. (2024)
<i>Yingrenia rhododendri</i>	HOU 1850A	PP488657	PP488751	PP488847	Guo et al. (2024)
<i>Yingrenia rhododendri</i>	CNUCC 1850A	PP488558	PP488670	PP488765	Guo et al. (2024)
<i>Yingrenia yunnanensis</i> ^H	HOU 1570	PP488658	PP488752	–	Guo et al. (2024)
<i>Yingrenia yunnanensis</i>	HOU 1570Y	PP488659	PP488753	PP488848	Guo et al. (2024)

Notes: HOU: Collecting number; CNUCC: Isolate number; “–” sequences are not available; Species name^T – Type species; Species name^H – Holotype.

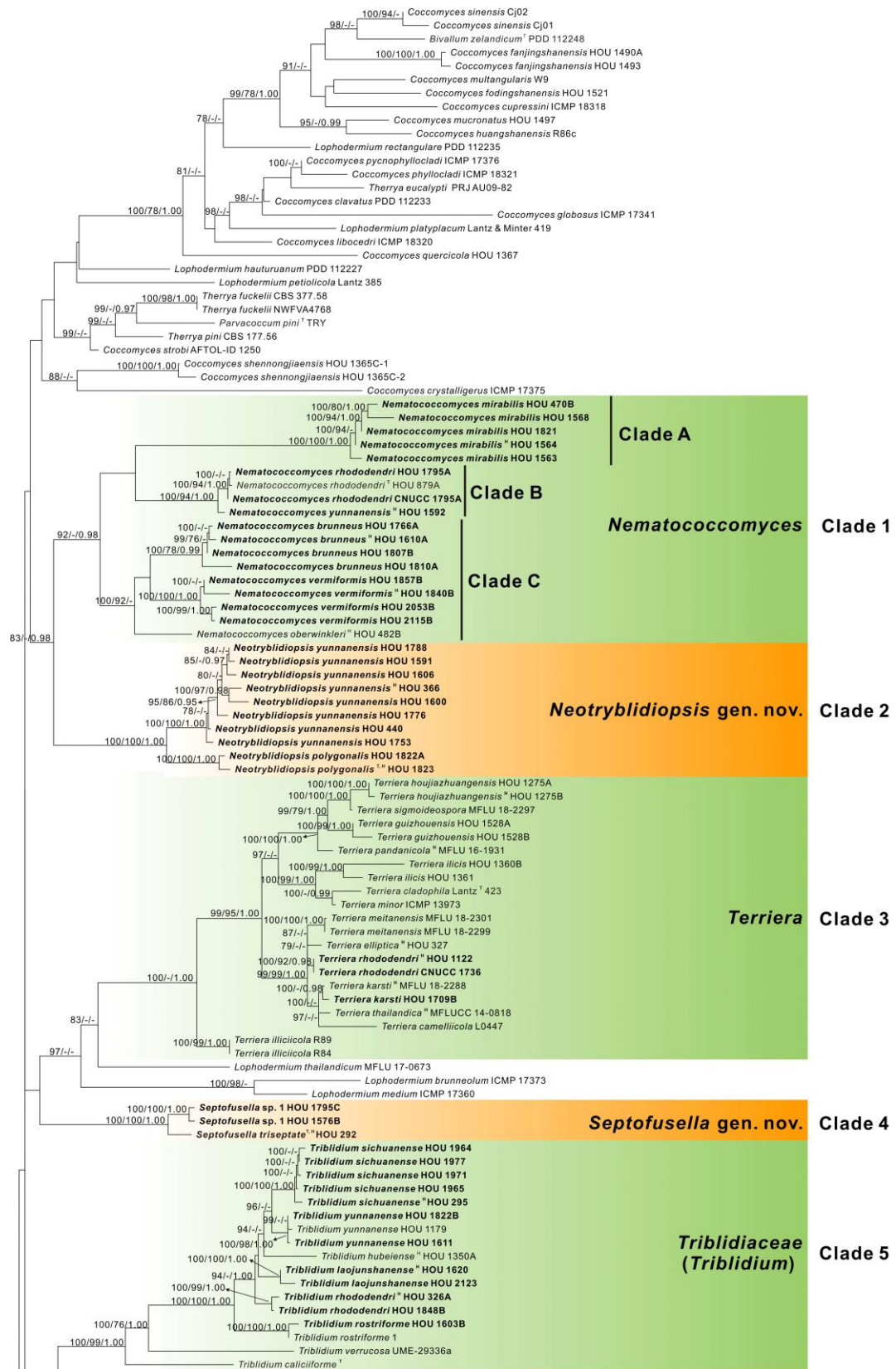


Figure 1 – Phylogenetic tree derived from maximum likelihood analysis of combined ITS, nrLSU, and mtSSU rDNA sequences of *Rhytismatales*, using *Cudoniella clavus* (AFTOL-ID 166) and *Pezicula carpineae* (KUS-F51029) as outgroups. Bootstrap support values for ML analysis (MLB) and MP analysis (MPB) greater than 75% and Bayesian posterior probabilities (PP) greater than 0.95 are given below and above the nodes. Names of new species and a new combination are written in bold. Species name ^T – Type species; Species name ^H – Holotype.

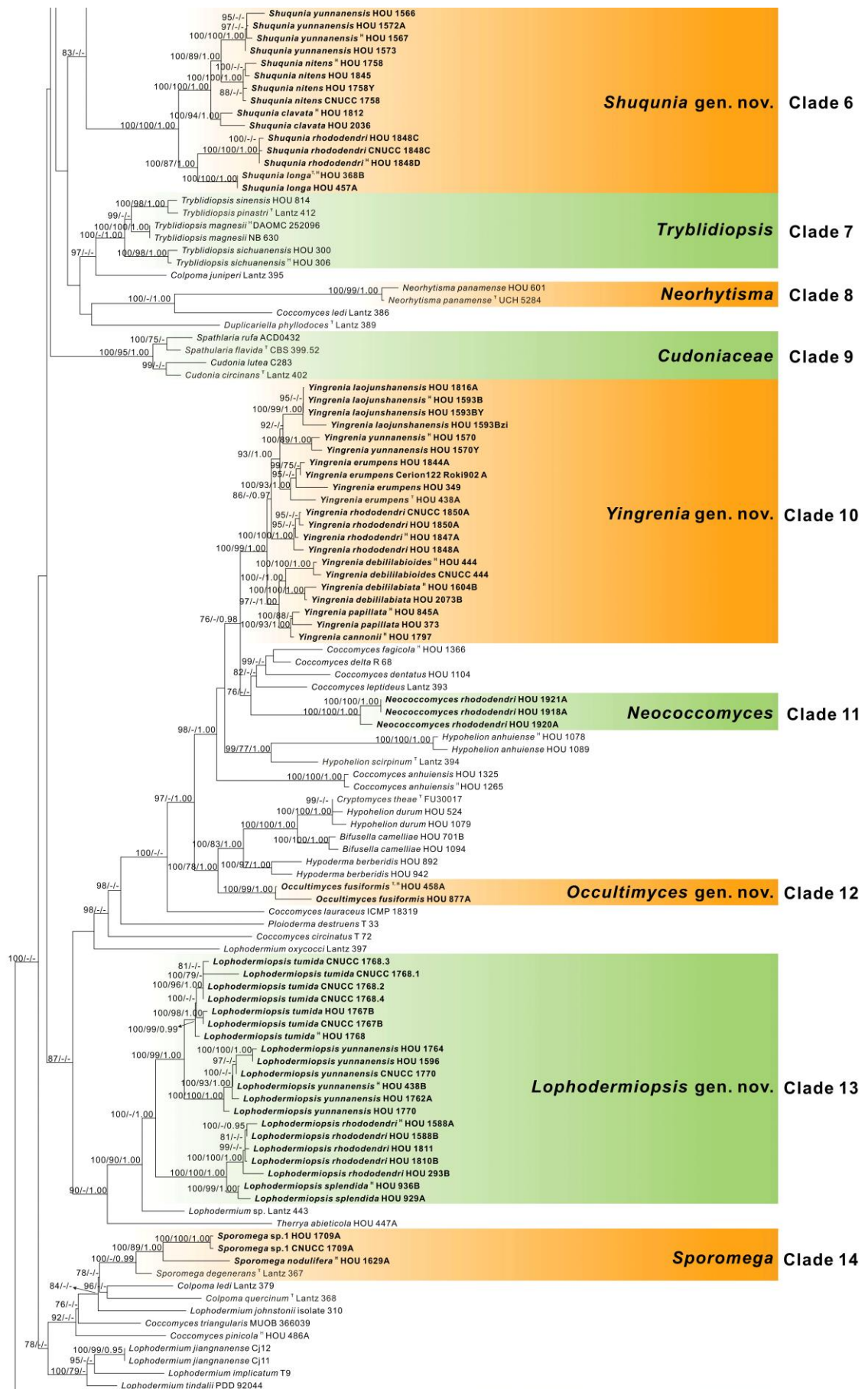


Figure 1 – Continued.

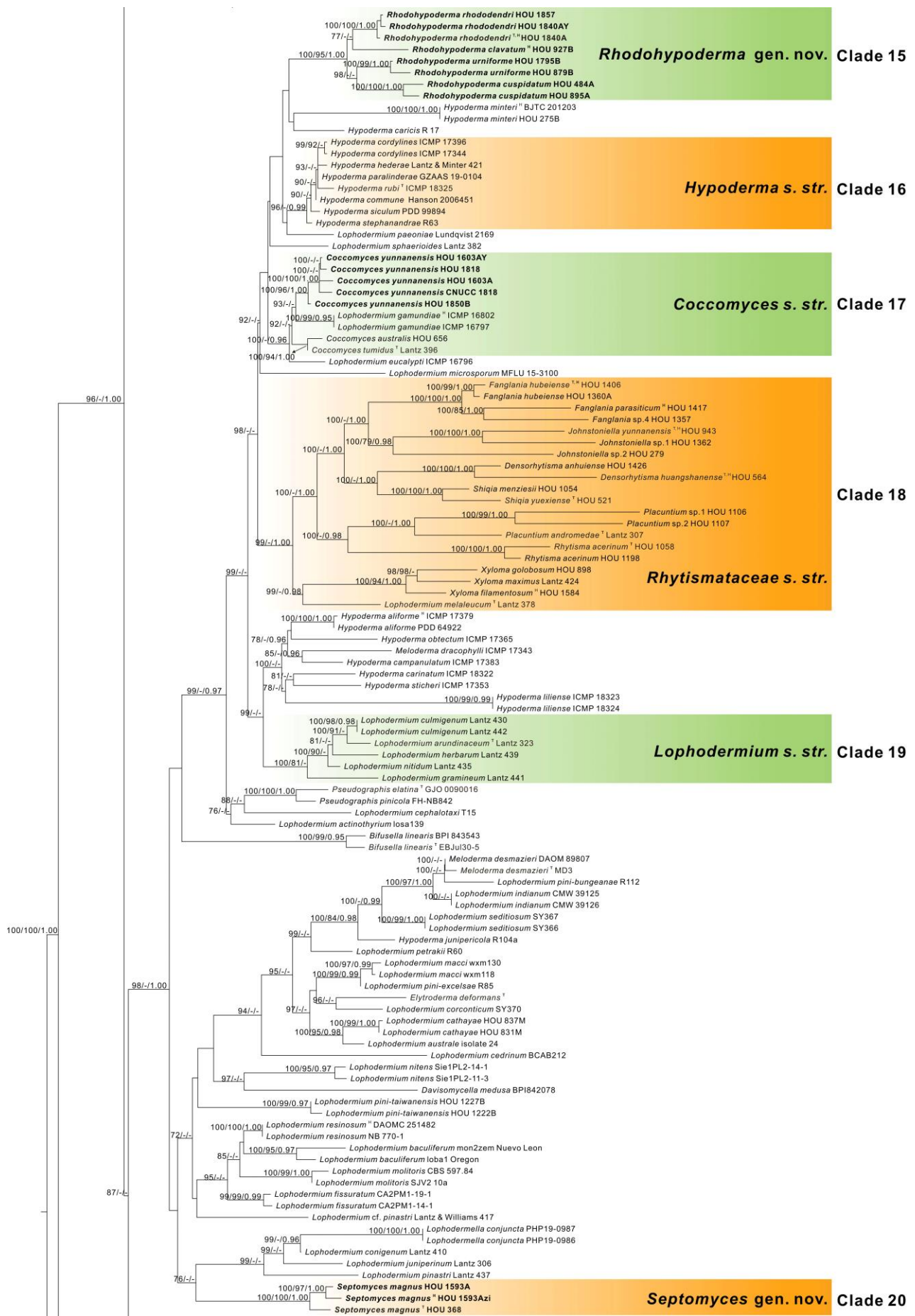


Figure 1 – Continued.

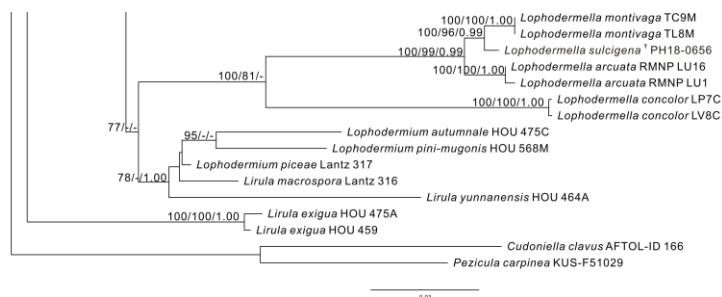


Figure 1 – Continued.

3. Ascospores usually with appendages and usually without a gelatinous sheath..*Nematococcomyces*
3. Ascospores without appendages and covered by a gelatinous sheath 4
4. Ascomata stipitate; basal stroma absent*Neotrybliopsis*
4. Ascomata sessile; basal stroma present 5
5. Periphysoids well-developed; epithecium usually well-developed..... *Shuqunia*
5. Periphysoids absent; epithecium occasionally present 6
6. Ascomata usually angular; asci 4- or 8-spored..... 7
6. Ascomata circular to elliptical; asci 8-spored..... 8
7. Ascomata triangular, quadrate or multi-angular; ascospores ellipsoidal to oval, aseptate.....
.....*Myriophacidium*
7. Ascomata almost round to multi-angular; ascospores variable in shape, aseptate or septate.....
.....*Coccomyces*
8. Ascospores filiform, with multiple septa at the maturity*Septomyces*
8. Ascospores elongated fusiform, aseptate.....*Occultimyces*
9. Ascospores filiform 10
9. Ascospores not filiform 12
10. Asci 4- or 8-spored*Lophodermium*
10. Asci 8-spored 11
11. Ascomata oblong to sublinear; covering stroma with extension tissue at the ascomatal opening ..
.....*Terriera*
11. Ascomata almost round to elliptic; covering stroma without extension tissue ... *Lophodermiopsis*
12. Lips well developed 13
12. Lips absent or poor developed 14
13. Ascomata usually almost round; lips cell usually colorless *Hypoderma*
13. Ascomata intrahypodermal; lips cell reddish brown*Rhodohypoderma*
14. Ascospores fusiform, without a gelatinous sheath*Septofusella*
14. Ascospores shaped otherwise, covered by a gelatinous sheath 15
15. Ascospores more or less filiform..... 16
15. Ascospores variable in shape..... *Yingrenia*
16. Ascomata elongated, often curved, or short and sometimes branched; ascospores filiform or
cylindric, aseptate or septate.....*Colpoma*
16. Ascomata elliptical to elongated; ascospores filiform-clavate, aseptate *Sporomega*

Coccomyces De Not., G. bot. ital. 2(2): 38 (1847)

Sexual morph: *Ascomata* subcircular to polyhedral, concolorous with the surface of the substrate to black, with or without obvious preformed dehiscence lines, opening by three or more teeth, rarely opening by a longitudinal slit (Sherwood 1980). *Covering stroma* and *basal stroma* well developed. *Internal matrix of stroma* sometimes present. *Subhymenium* flat or slightly depressed. *Paraphyses* branched or not branched, with tips that may be swollen or circinate, free or in a gelatinous epithecium. *Asci* cylindrical to clavate, almost sessile or with long stalk, thin-

walled, J–, 4- or 8-spored. *Ascospores* simple or septate, subclavate, cylindrical, fusiform, or filiform, hyaline, usually covered by a gelatinous sheath.

Asexual morph: *Conidiomata*, when present, round to elliptical, small, concolorous with the surface of the substrate or black, with a central ostiole or one to several irregular slits. *Conidia* simple, bacillar, hyaline. (Description based on De Not. 1847 and Sherwood 1980)

Type species – *Coccomyces tumidus* (Fr.) De Not., G. bot. ital. 2(2): 39 (1847).

Notes – Molecular phylogenetic analysis indicate that *Coccomyces* is a polyphyletic genus (Clade 17). Most species of *Coccomyces* do not cluster together with *C. tumidus*, the type species of the genus (Sherwood 1980, Lantz et al. 2011). There are two *Coccomyces* species were described on twigs of *Rhododendron* spp., viz. *Coccomyces ledi* Rehm and *Coccomyces leptideus* (Fr.) B. Erikss.

Key to species of *Coccomyces* on twigs of *Rhododendron* species

1. *Ascospores* subclavate 2
1. *Ascospores* filiform 3
2. *Ascomata* quadrate to hexagonal, shiny black, intraepidermal *C. ledi*
2. *Ascomata* irregularly elliptical, dull black, subcortical *C. yunnanensis*
3. *Ascomata* opening by 8-10 regular triangular dehiscent teeth; *ascospores* 96–100 × 2.5–3.2 µm. ..
..... *C. aurei*
3. *Ascomata* opening by 3-6 (usually 4-5) radial splits; *ascospores* 60–90 × 3–4 µm
..... *C. leptideus*

Coccomyces aurei Lar.N. Vassiljeva, Mikol. Fitopatol. 13(4): 280 (1979)

Holotype – USSR, region of Magadan, neighborhood opp. Magadan (Monticulus Marczekan), in the Institute Edapho-Biologica Centr. Know Far East Acad. Know USSR (Vladivostok) is maintained, on live branches of *Rhododendron aureum*, 25 Aug 1976, Lar. N. Wasilieva.

Notes – This species was described and illustrated by Vassiljeva (1979). There is no molecular data available for this species. Morphologically, *Co. aurei* resembles *Co. leptideus* (Fr.) B. Erikss. by filiform *ascospores*, but differs by *ascomata* with 8-10 regular triangular dehiscent teeth, and longer *ascospores* (96–100 µm).

Coccomyces ledi Rehm, Annls mycol. 11(2): 153 (1913)

Holotype – Vb, Vindeln par., on living twigs of *Rhododendron groenlandicum* (Oeder) Kron & Judd (*Ericaceae*, synonym of *Ledum groenlandicum* Oed.) and *Rhododendron tomentosum* Harmaja, (*Ericaceae*, synonym of *Ledum palustre* L.), Kulbäcksliden VIII.1909 N. Sylvén (!, holotype).

Notes – *Coccomyces ledi* was described and illustrated by Sherwood (1980). Phylogenetically, *Co. ledi* and *Neorhytisma panamense* (C.L. Hou, T. Trampe & M. Piepenbr.) M. Piepenbr., T. A. Hofm. Gronefeld & C. L Hou, the type species of *Neorhytisma* M. Piepenbr., T.A. Hofm., S. Gronefeld & C.L. Hou found on *Comarostaphylis arbutoides* Lindl. (*Arbutoideae*, *Ericaceae*) in Panama (tropical America) (Wang et al. 2023), form a distinct clade with 100% MLB and 1.00 PP support. However, there are no morphological similarities between these two species based on *ascomata* and the *ascospores*. Additional collection, morphological and molecular data analyses are required to understand the accurate placement of this species.

Coccomyces leptideus (Fr.) B. Erikss., Symb. bot. upsal. 19(no. 4): 13 (1970)

Lectotype – On *Vaccinium myrtillus* L. (*Ericaceae*), (no information on locality or date), Fries, Scleromycetes Sueciae 98 (UPS, lectotype).

Notes – This species was described and illustrated by Minter (1996a). The host of the lectotype of *Co. leptideus* is *Vaccinium myrtillus* (Eriksson 1970), but more host species have been

recorded by Sherwood (1980), including living and killed twigs of *Rhododendron macrophyllum* D. Don ex G. Don (*Ericaceae*) and *Gaultheria shallon* Pursh. (*Ericaceae*). Thus, it appears that *Co. leptideus* may be restricted to *Ericaceae*. In the ITS-nrLSU-mtSSU phylogenetic tree, *Co. leptideus*, *Co. delta* (Kunze ex Fr.) Cooke, *Co. fagicola* T. Lv & C.L. Hou, and *Co. dentatus* (J.C. Schmidt & Kunze) Sacc. form a clade with 82% MLB support. These species are morphologically similar and are distantly related to the type species of the genus in the phylogenetic tree. Therefore, this clade may be a potential new genus, but more data are needed to take this decision.

***Coccomyces yunnanensis* M.J. Guo & C.L. Hou, sp. nov.**

Figs 2–3

MycoBank: MB852652; Facesoffungi number: FoF15613

Diagnosis – The ascospore shape in this new species are slightly similar to that of the type species *Coccomyces tumidus*. However, *Coccomyces yunnanensis* differs by its irregularly elliptical ascomata with an irregular single longitudinal split, the presence of lips, and ascospores with no to several septa.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3754 N; 99.4330 E, alt. ca. 3837 m, 17 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, on dead twigs of *Rhododendron* sp. (*Ericaceae*), HOU 1603A (BJTC 2022006, holotype).

Etymology – Referring to the name of the province (Yunnan) where the specimen was collected.

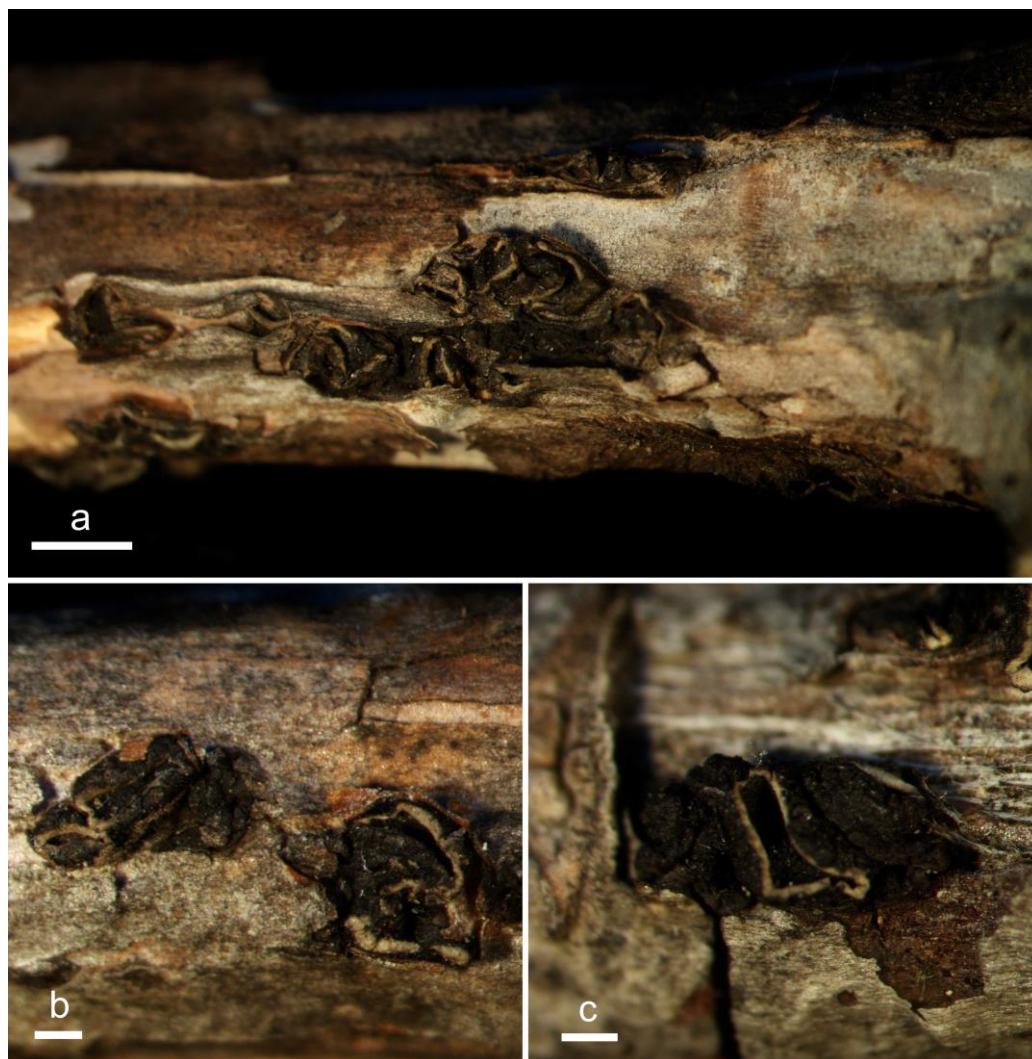


Figure 2 – *Coccomyces yunnanensis* (HOU 1603A/BJTC 2022006, holotype). a Ascomata on a twig of *Rhododendron* sp. b Mature ascomata and immature ascomata. c Mature ascomata. Scale bars: a = 2 mm, b–c = 500 μ m.

Sexual morph: *Ascomata* erumpent from bark, aggregated in groups of two to three ascomata, not associated with pale areas. In surface view, ascomata irregularly elliptical, 940–1440 × 625–1125 µm, black, first embedded in host tissue, strongly raising above the surface of the host tissue at maturity, mostly opening by a distorted longitudinal split to expose the black hymenium. *Lips* present, grey. In median vertical section, ascomata subcortical, 200–300 µm deep. *Covering stroma* 25–125 µm thick near the centre of the ascomata, consisting of carbonized, thick-walled hyphae and more or less isodiametric cells, extending to the basal stroma, remains of host cortex adhering to the base of the covering stroma. *Periphysoids* absent. *Lips* well developed, lip cells septate, cylindrical, 3–5 × 20–55 µm, hyaline, embedded in a hyaline gelatinous matrix. *Basal stroma* 25–30 µm thick, consisting of 3–5 × 4–8 µm, carbonized, thick-walled, angular cells. *Subhymenium* 20–25 µm thick, consisting of 3–4 × 2–3 µm, angular cells. *Paraphyses* filiform, coiled and interwoven at their tips, 250–290 × ca. 1 µm, covered by a thin gelatinous sheath, forming an epithecium by their tips. *Asci* ripening sequentially, clavate, slightly truncate at the apex, 180–230 × 20–26 µm, thin-walled, J–, 8-spored. *Ascospores* mostly with one septum, few aseptate, with up to seven septa at maturity, subclavate, base slightly acute, 36–65 × 2.5–4 µm, hyaline, covered by an 8–10 µm thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

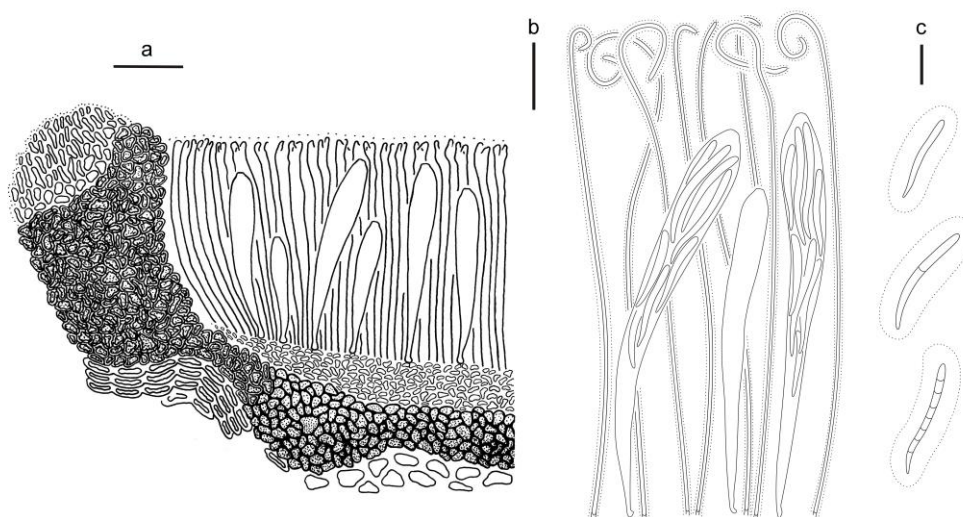


Figure 3 – *Coccomyces yunnanensis* on *Rhododendron* sp. (HOU 1603A/BJTC 2022006, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and an immature ascus. c Liberated ascospores. Scale bars: a–b = 50 µm, c = 20 µm.

Additional specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3754 N; 99.4330 E, alt. ca. 3837 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 17 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1603AY (BJTC 2022007, isotype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3754 N; 99.4329 E, alt. ca. 3860 m, 21 June 2021, on twigs of *Rhododendron* sp. (*Ericaceae*), C.L. Hou, M.J. Guo, and H. Zhou, HOU 1818 (BJTC 2022005, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.0504 N; 102.5054 E, alt. ca. 3808 m, on twigs of *Rhododendron lutescens* Franch. (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1850B (BJTC 2022004, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – Based on the phylogenetic analyses, the molecular sequences of this our species (HOU 1603AY, HOU 1818, HOU 1603A, CNUCC 1818, HOU 1850B) form a well-supported, distinct clade with 100% MLB, 96% MPB, and 1.00 PP, sister to *Lophodermium gamundiae* P.R. Johnst., and appear to be closely related to *Coccomyces australis* P.R. Johnst., *C. tumidus* (Fr.) De Not. (the type species of the genus), and *Lophodermium eucalypti* (Rodway) P.R. Johnst (Clade 17,

Fig. 1). The subclavate ascospores of *Coccomyces yunnanensis* are similar to those of *C. tumidus* and the shrunken ascomata of *C. yunnanensis* are somewhat similar to those of *C. tumidus* and *C. australis*. The single, distorted longitudinal split and the lips, however, are similar to structures of *L. gamundiae* and *L. eucalypti*. Because *C. yunnanensis* is only distantly related to the type species of *Lophodermium*, it is considered as a new species of *Coccomyces*. The presence of *L. gamundiae* and *L. eucalypti* in this clade cannot be explained by morphological characteristics (Lantz et al. 2011).

The sequence similarity of ITS rDNA between *C. yunnanensis* HOU 1850B and other sequences of *C. yunnanensis* (HOU 1603AY, HOU 1818, HOU 1603A, CNUCC 1818) is 97.75–98.24%. Because there are no obvious morphological differences between the specimen HOU 1850B and other specimens of *C. yunnanensis*, this specimen is identified as *C. yunnanensis*.

***Colpoma* Wallr., Fl. crypt. Germ. (Norimbergae) 2: 422 (1833)**

Sexual morph: *Ascomata* underneath the peridermis or breaking through naked wood, elongated, often curved, or short and sometimes branched, opening by a single longitudinal slit. *Covering stroma* and *basal stroma* usually well developed, consisting of carbonized, thick-walled, globose to angular cells or hyphae. *Internal matrix of stroma* usually well developed. *Subhymenium* flat or slightly depressed, consisting of textura intricata, textura porrecta and/or small cells. *Paraphyses* abundant, branched or not branched, swollen or not swollen, often coiled or bent at their tips. *Asci* cylindrical to clavate, thin-walled, 8-spored. *Ascospores* filiform or cylindric, simple or septate, hyaline, usually covered by a gelatinous sheath.

Asexual morph: *Conidiomata* present or absent. (Description based on Johnston (1991) and Raymundo et al. (2017)).

Type species – *Colpoma quercinum* (Pers.) Wallr., Fl. crypt. Germ. (Norimbergae) 2: 423 (1833).

Notes – There are four known species of *Colpoma* growing on twigs of *Rhododendron* sp., viz. *Colpoma azaleae* (Schwein.) Cooke, *Colpoma lacteum* Peck, *Colpoma ledi* (Alb. & Schwein.) B. Erikss., and *Colpoma sinense* C.L. Hou & M. Piepenbr.

Key to species of *Colpoma* on twigs of *Rhododendron* species

- | | |
|---|-------------------|
| 1. Ascospores filiform to clavate | <i>C. sinense</i> |
| 1. Ascospores filiform | 2 |
| 2. Hymenial surface milk-white | <i>C. lacteum</i> |
| 2. Hymenial surface with another color..... | 3 |
| 3. Hymenial surface dark red..... | <i>C. azalea</i> |
| 3. Hymenial surface grey to blueish | <i>C. ledi</i> |

***Colpoma azaleae* (Schwein.) Cooke, Grevillea 17(no. 83): 58 (1889)**

Type – From boreal America, on dead bark of *Rhododendron periclymenoides* (Michx.) Shinnery (no further data) (type specimen not seen).

Notes – This species was described briefly by Cooke (1889), Saccardo (1891), Ellis & Everhart (1892), and Raymundo et al. (2017). It is characterized by linear to elongate ascomata, with flexuous, hymenial surface dark red. Ascospores are aseptate and filiform. There are no molecular data available for this species. Morphologically, *Colpoma azaleae* resembles *Col. guadeticola* Raymundo, Soto-Agud. & R. Valenz. by longer ascospores (than 70 µm), but differs by shorter apothecia (1–3 mm long), a dark red hymenium surface, and *Rhododendron periclymenoides* (Ericaceae) as the host.

***Colpoma lacteum* Peck, Ann. Rep. N.Y. St. Mus. nat. Hist. 28: 69 (1876) [1875]**

Type – USA, N.Y., Sandlake, on dead stems of *Rhododendron groenlandicum* (synonym of *Ledum latifolium*), Jun. (type data not known).

Notes – This species was described briefly by Peck (1876) and it is characterized by scattered, erumpent, thin, black ascomata that are longitudinally ruptured epidermis closely appressed, disk plane, milk-white. Asci are cylindrical or clavate while, ascospores are filiform. *Colpoma lacteum* lacks molecular sequence data, but is morphologically distinct from other species by ascomata with a milk white hymenial surface.

Colpoma ledi (Alb. & Schwein.) B. Erikss., Symb. bot. ups. 19(no. 4): 14 (1970)

Type – Coll. orig. not preserved. Neotype: On twigs of *Rhododendron tomentosum* Harmaja (*Ericaceae*) (synonym of *Ledum palustre* L.) (locality and collection date not known), Lundell & Nannfeldt, Fungi exs. Sues. 2084 (UPS).

Notes – This species was described and illustrated in detail by Eriksson (1970) and Minter (1996b). Lantz et al. (2011) provided molecular data for this species. In the present study, the phylogenetic results show that *Colpoma ledi* (Lantz 379) and *Colpoma quercinum* (Lantz 368), the type species of *Colpoma*, form a distinct clade with 96% MLB support. Morphologically, *Col. ledi* is similar to *Col. quercinum*, but differs by elliptical to elongated elliptical ascomata with a longitudinal split to expose the grey to blueish hymenium, shorter asci (65–105 µm), shorter ascospores (35–55 µm), and *Rhododendron* spp. as the host.

Colpoma sinense C.L. Hou & M. Piepenbr., For. Path. 35(5): 362 (2005)

Holotype – CHINA, Yunnan province, Jianchuan, Laojunshan, alt. 3800 m, on dead or senescent twigs of *Rhododendron* sp. (*Ericaceae*), 26 Jul 2001, C.L. Hou, M. Piepenbring, R. Kirschner, and Z.L. Yang, 122 (HMAS).

Notes – This species was described and illustrated in detail by Hou & Piepenbring (2005). It lacks molecular data. Morphologically, *Col. sinense* is distinct from other known species of *Colpoma* found on twigs of *Rhododendron* sp. by a covering stroma composed of almost hyaline fungal cells except for a thin outer layer of melanized fungal cells, conspicuous, long lip cells which are embedded in a gelatinous matrix, simple paraphyses, and filiform to clavate ascospores. Additional taxa sampling with molecular data is required for better understanding of the placement of *Col. sinense*.

Hypoderma De Not., G. bot. ital. 2(2): 13 (1847)

Sexual morph: *Ascomata* elliptical to elongated elliptical, black, opening by a longitudinal split, usually subcuticular. *Covering stroma* formed by mostly dark brown, thick-walled, angular cells, in young, closed ascomata there is a row of thin-walled, paler cells in the inner half of the wall, along the future line of opening. A layer of hyaline, cylindric or globose, thin-walled cells lines the inner edge of the upper wall in still closed ascomata. In opened ascomata the upper wall is wider towards the edge of the ascomatal opening. The exposed face of the broken upper wall is lined with a palisade of pale, thin-walled, cylindric, usually persistent cells. *Basal stroma* formed prior to the development of the covering stroma or of differentiated asci or paraphyses, comprising several layers of brown, thick-walled, angular cells. Internal matrix of stroma sometimes present. *Subhymenium* consisting of small cells or textura porrecta. *Paraphyses* filiform, branched or not branched, sometimes with swollen tips, usually coiled at the tips. Asci ripening sequentially, cylindrical to clavate, thin-walled, J–, 8-spored. *Ascospores* 0-1 septate, strongly variable in shape, hyaline, covered by a gelatinous sheath.

Asexual morph: *Conidiomata*, when present, small, subcuticular conidiomata which are circular in outline when viewed from above, lenticular when viewed in vertical section. The upper wall may be present or not. The lower wall is lined with cylindric, solitary conidiogenous cells which proliferate either sympodially or percurrently. *Conidia* are small, 0-septate, and hyaline. (Description based on Johnston 1990).

Type species – *Hypoderma rubi* (Pers.) DC., in Lamarck & de Candolle, Fl. franç., Edn 3 (Paris) 2: 304 (1805).

Notes – *Hypoderma* is a large, polyphyletic genus in the *Rhytismataceae*. The concept of the genus *Hypoderma* was redefined by Johnston (Johnston 1990). There is only one known species of the genus that reported on twigs of *Rhododendron* sp., namely *H. shiqii* C.L. Hou & M. Piepenbr.

Hypoderma shiqii C.L. Hou & M. Piepenbr., Nova Hedwigia 82(1-2): 99 (2006)

Holotype – CHINA, Yunnan province, Jianchuan, Laojunshan, alt.ca. 3500 m, on *Rhododendron* sp. (*Ericaceae*), 25 Jul 2001, C.L. Hou, M. Piepenbring, R. Kirschner, and Z.L. Yang, 150b (HMAS).

Notes – This species was described and illustrated in detail by Hou & Piepenbring (2006). *Hypoderma shiqii* differs from other *Hypoderma* species by often opening ascomata with one slit and additional lateral fissures. Despite, *Hypoderma* species usually have subcuticular ascomata with well-developed lips, *H. shiqii* exhibits intraepidermal ascomata without lips. Based on the evidence of morphological characteristics and host relationship, we suspect that *H. shiqii* may not belong to *Hypoderma* s. str. However, due to the lack of molecular data and the absence of a more fitting genus to accommodate *Hypoderma shiqii*, we refrain from changing the nomenclature of this species until more data are available.

Lophodermiopsis M.J. Guo & C.L. Hou, gen. nov.

MycoBank number: MB852650; Facesoffungi number: FoF15599

Etymology – Referring to the morphologically rather similar species of *Lophodermium*.

Sexual morph: Ascomata on twigs of *Rhododendron* spp., scattered, subround to elliptic, black, with an obvious preformed dehiscence line, opening by a longitudinal split to expose the hymenium, intraepidermal. Lips present. Excipulum absent. Covering stroma and basal stroma well developed, consisting of carbonized, thick-walled, angular to globose cells. Internal matrix of stroma sometimes present, consisting of hyaline, thin-walled, angular cells or loosely interwoven hyphae. Subhymenium flat or slightly depressed, consisting of hyaline textura porrecta and/or thin-walled angular cells. Paraphyses filiform, branched or not, sometimes with swollen tips. Asci ripening sequentially, cylindrical, thin-walled, J–, 8-spored. Ascospores aseptate, filiform, hyaline, covered by a thick gelatinous sheath. Zone lines usually frequent, brown to dark brown.

Asexual morph: Conidiomata round to elliptical or slightly irregular, small, dark brown, with a central ostiole. Conidiogenous cells cylindrical and tapering towards the apex, hyaline. Conidia simple, cylindrical, hyaline.

Type species – *Lophodermiopsis tumida* M.J. Guo & C.L. Hou, described below

Notes – Phylogenetically, sequence data of *Lophodermiopsis* clustered together with *Lophodermium* sp. (Lantz 443 – a sequence taken from GenBank), with 100% MLB, 90% MPB, and 1.00 PP bootstrap support (Clade 13, Fig. 1). Some morphological characteristics of *Lophodermiopsis* species are similar to the species of *Lophodermium* (Darker 1967, Cannon & Minter 1986), but according to the phylogenetic evidence they are distantly related only to the type species, *Lophodermium arundinaceum*. *Lophodermium arundinaceum* (Lantz 323) forms a strongly supported clade with the sequence of mostly grass-associated species, corresponding to *Lophodermium* s. str., while species of the new genus *Lophodermiopsis* develop on twigs of *Rhododendron* spp. Thus, we conclude that the specimen called *Lophodermium* sp. Lantz 443 represents a probably undescribed species collected in Sweden on *Rhododendron tomentosum* Harmaja (Lantz et al. 2011) and apparently does not belong to the genus *Lophodermium* s. str. according to molecular data analysis.

Morphologically, all species of *Lophodermiopsis* exhibit subround to elliptic ascomata opening by a longitudinal split and filiform ascospores with gelatinous sheaths, like typical species of *Lophodermium*. However, *Lophodermium arundinaceum* has mostly subepidermal ascomata without zone lines and septate paraphyses while species of *Lophodermiopsis* have intraepidermal ascomata with frequent zone lines as well as aseptate paraphyses. Species of *Lophodermium* have been reported on *Rhododendron* spp. and for which no molecular data are available, viz.

Lophodermium balaramii P.F. Cannon & Minter, *Lophodermium heterocladum* H.L. Gu & Y.R. Lin, *Lophodermium intricatum* Spooner, *Lophodermium lanceolatum* Spooner, *Lophodermium maculare* (Fr.) De Not., *Lophodermium pachychilum* Y.R. Lin & Z.S. Xu, *Lophodermium quadrisporum* D.D. Lu & Y.R. Lin, *Lophodermium rufum* Y.R. Lin & K. Li, *Lophodermium schweinitzii* M. Wilson & N.F. Robertson, *Lophodermium urniforme* S.J. Wang & Y.R. Lin, *Lophodermium vagulum* M. Wilson & N.F. Robertson, and *Lophodermium validum* Y.R. Lin, Z.S. Xu & K. Le., differ from the new species of *Lophodermiopsis* (*Lophodermiopsis tumida*, *Lophodermiopsis yunnanensis*, *Lophodermiopsis rhododendri*, *Lophodermiopsis splendida*) by diverse morphological characteristics (Wilson & Robertson 1947, Cannon & Minter 1986, Spooner 1991, Minter 2005, Lin 2012, Lu et al. 2014, Wang et al. 2014c, Gu et al. 2015). However, with the addition of molecular data for these species, they may have to be transferred to *Lophodermiopsis*.

Key to species of *Lophodermiopsis* on twigs of *Rhododendron* species

1. Lips well developed 2
1. Lips inconspicuous 3
2. Internal matrix of stroma present; paraphyses sometimes branched and with swollen tips
..... *Lo. tumida*
2. Internal matrix of stroma absent; paraphyses not branched, without swollen tips.. *Lo. yunnanensis*
3. Ascomata dull (not shiny) black, round to elliptical; internal matrix of stroma absent
..... *Lo. rhododendri*
3. Ascomata shiny black, elliptical to broadly elliptical; internal matrix of stroma present
..... *Lo. splendida*

Lophodermiopsis rhododendri M.J. Guo & C.L. Hou, sp. nov.

Figs 4–5

MycoBank number: MB852651; Facesoffungi number: FoF15614

Diagnosis – This new species is similar to *Lophodermiopsis yunnanensis*, but the lips of this new species are inconspicuous, the subhymenium is thicker, the asci are larger, and the ascospores are longer.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3753 N; 99.4329 E, alt. ca. 3800 m, on living twigs of *Rhododendron clementinae* (Ericaceae), 17 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1588A (BJTC 2022014, holotype).

Etymology – Referring to the fungal host, a species of *Rhododendron*.

Sexual morph: *Ascomata* on twigs, scattered, associated with pale areas. In surface view ascomata rounded to elliptical, 500–585 × 550–835 µm, black, slightly raising above the surface of the host tissue at maturity, with an obvious preformed dehiscence line, opening by a longitudinal split. *Periphysoids* absent. In median vertical section, ascomata intraepidermal. *Covering stroma* 65–100 µm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of host cuticle and remains of epidermal cells filled with fungal cells, an inner layer of 3–6 µm diam., carbonized, thick-walled, angular cells, with innermost layer of hyaline textura prismatica close to the opening, and of hyaline angular cells towards the margins. *Lips* inconspicuous, consisting of hyaline angular cells. *Basal stroma* 20–25 µm thick, consisting of 3–7 µm diam., carbonized, thick-walled, angular cells. *A space triangular* in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with 4–7 × 7–10 µm, hyaline, thin-walled, angular cells. *Subhymenium* 25–45 µm thick, consisting of hyaline textura porrecta. *Paraphyses* filiform, slightly curved and swollen at the tips, 140–155 × 1–1.5 µm, hyaline, thin-walled, covered by a thin gelatinous sheath. *Asci* ripening sequentially, cylindrical, apex obtuse to acute, 100–125 × 6–8 µm, hyaline, thin-walled, J–, 8-spored. *Ascospores* filiform, 45–65 × ca. 1 µm, hyaline, covered by a thin gelatinous sheath.

Asexual morph: *Conidiomata* scattered, round to elliptical or slightly irregular, 135–265 µm diam., dark brown, opening by an ostiole to liberate the conidia. In vertical section, conidiomata intraepidermal, 80–100 µm deep. *Upper layer* 20–30 µm thick, consisting of host cuticle and

carbonized angular to globose cells. *Basal layer* 8–15 μm thick, consisting of carbonized angular to globose cells. *Conidiogenous cells* cylindrical but tapering towards the apex, 10–15 $\times$ 1–2 μm , hyaline. *Conidia* cylindrical, 4–6 $\times$ 1 μm , hyaline. *Zone lines* frequent, dark brown.

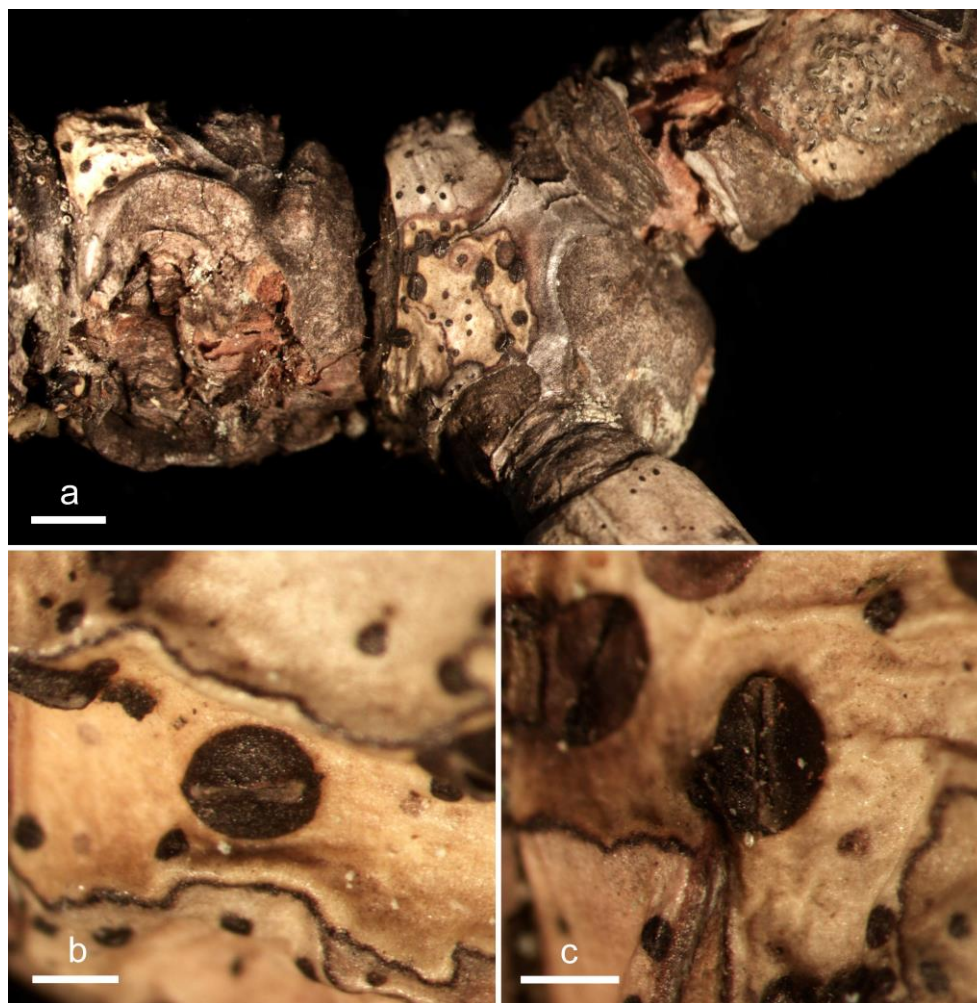


Figure 4 – *Lophodermiopsis rhododendri* (HOU 1588A/BJTC 2022014, holotype). a Ascomata on a twig of *Rhododendron clementinae*. b–c Immature ascomata. Scale bars: a = 2 mm, b–c = 500 μm .

Additional specimens examined – CHINA, Sichuan Province, Xiaojin, Jiajinshan National Forest Park, 30.5014 N; 102.3032 E, alt. ca. 3800 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 25 Jul 2006, C.L. Hou, HOU 293B (BJTC 2022011, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3753 N; 99.4329 E, alt. ca. 3800 m, on living twigs of *Rhododendron clementinae* (*Ericaceae*), 17 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1588B (BJTC 2022015, isotype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3750 N; 99.4332 E, alt. ca. 3858 m, on twigs of *Rhododendron clementinae* (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1810B (BJTC 2022012, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3750 N; 99.4332 E, alt. ca. 3854 m, on twigs of *Rhododendron clementinae* (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1811 (BJTC 2022013, paratype).

Notes – *Lophodermiopsis rhododendri* is similar to *Lophodermiopsis yunnanensis*, but *Lo. yunnanensis* has well developed lips, a thinner subhymenium (6–10 μm), smaller asci (60–84 $\times$ 5–6 μm), and shorter ascospores (26–42 μm).

Lophodermiopsis splendida M.J. Guo & C.L. Hou, sp. nov.

Mycobank number: MB852653; Facesoffungi number: FoF15615

Figs 6–7

Diagnosis – The new species is characterized by a smooth and shiny black surface of the ascomata.

Holotype – CHINA, Yunnan Province, Shangri-la, Shudu Lake, alt. ca. 3952 m, on living twigs of *Rhododendron* sp. (*Ericaceae*), 27 Jun 2011, C.L. Hou, HOU 936B (BJTC 2022009, holotype).

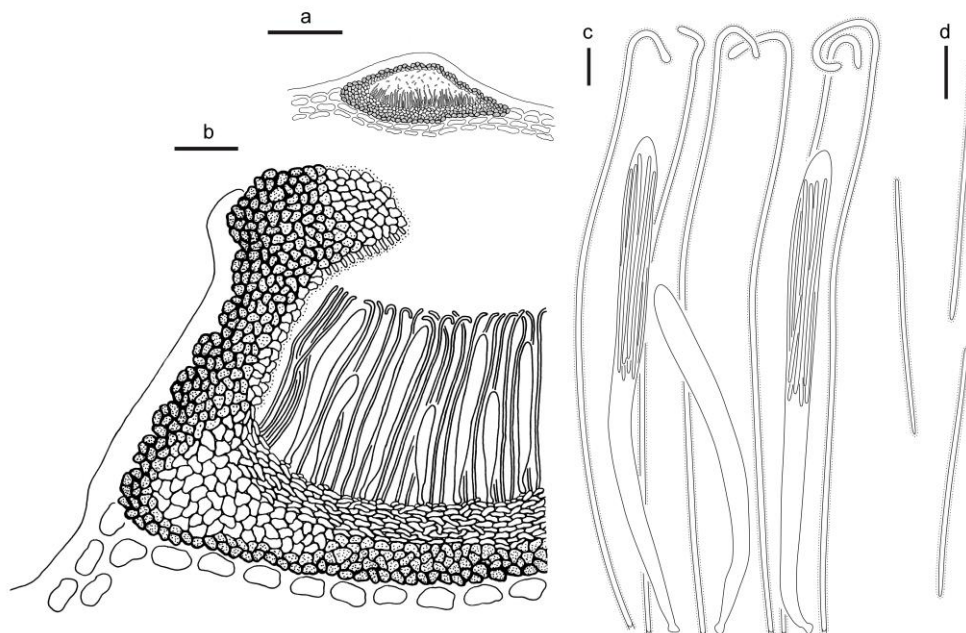


Figure 5 – *Lophodermiopsis rhododendri* on *Rhododendron clementinae* (HOU 1588A/BJTC 2022014, holotype). a Vertical section of a conidioma. b Vertical section part of an ascoma (part). c Paraphyses, mature asci with ascospores, and immature ascus. d Liberated ascospores. Scale bars: a = 100 μm , b = 50 μm , c–d = 10 μm .

Etymology – *splendidus* (lat.) = shiny, referring to the shiny surface of ascomata.

Sexual morph: *Ascomata* on living twigs, scattered, associated with pale areas. In surface view, ascomata elliptical to broadly elliptical, 600–950 $\times$ 450–600 μm , with a shiny black and smooth surface, slightly raising above the surface of the host tissue at maturity, with an obvious preformed dehiscence line, opening by a longitudinal split. *Periphysoids* absent. In median vertical section, ascomata intraepidermal. *Covering stroma* 55–65 μm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of host cuticle, remains of epidermal cells filled with fungal cells, an inner layer of 5–10 μm diam., carbonized, thick-walled, angular cells and an innermost layer of hyaline textura prismatica. *Lips* inconspicuous, consisting of small, hyaline, angular cells. *Basal stroma* 6–12 μm thick, consisting of 3–12 μm diam., carbonized, thick-walled, angular cells. *Internal matrix of stroma* 20–30 μm thick, consisting of hyaline, thin-walled, angular cells. *Subhymenium* 15–20 μm thick, consisting of hyaline textura porrecta and angular cells. *Paraphyses* filiform, slightly curved at the apex, 130–140 $\times$ ca. 2 μm , hyaline, thin-walled, covered by a thin gelatinous sheath. *Asci* ripening sequentially, cylindrical, apex obtuse to acute, 70–115 $\times$ 6–9 μm , hyaline, thin-walled, J–, 8-spored. *Ascospores* filiform, 42–65 $\times$ 1–1.5 μm , hyaline, covered by a 0.5–1 μm thick gelatinous sheath.

Asexual morph: *Conidiomata* scattered, round to elliptical or slightly irregular, 150–300 μm diam., dark brown, opening by an ostiole to liberate the conidia. In vertical section, conidiomata intraepidermal, 80–90 μm deep. *Upper layer* 15–25 μm thick, consisting of host cuticle and carbonized, angular to globose cells. *Basal layer* 20–25 μm thick, consisting of carbonized, angular to globose cells. *Conidiogenous cells* cylindrical but tapering towards the apex, 14–20 $\times$ 1–2 μm , hyaline. *Conidia* cylindrical, 4–8 $\times$ 1 μm , hyaline.

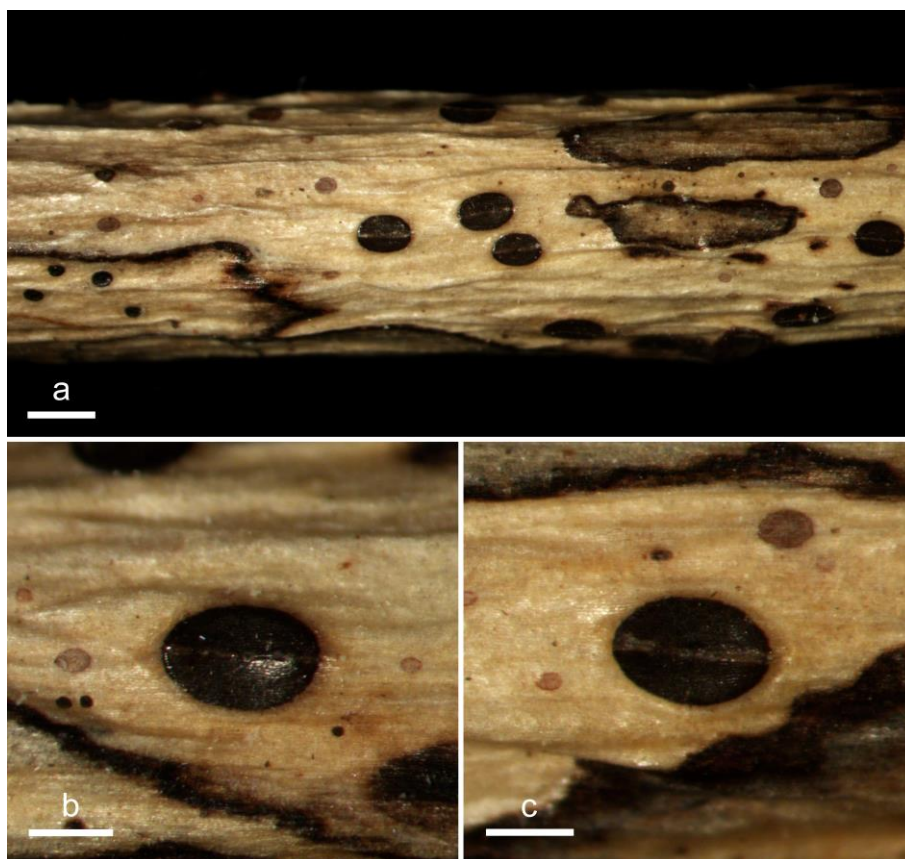


Figure 6 – *Lophodermiopsis splendida* (HOU 936B/BJTC 2022009, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Immature ascomata. Scale bars: a = 1 mm, b–c = 500 μ m.

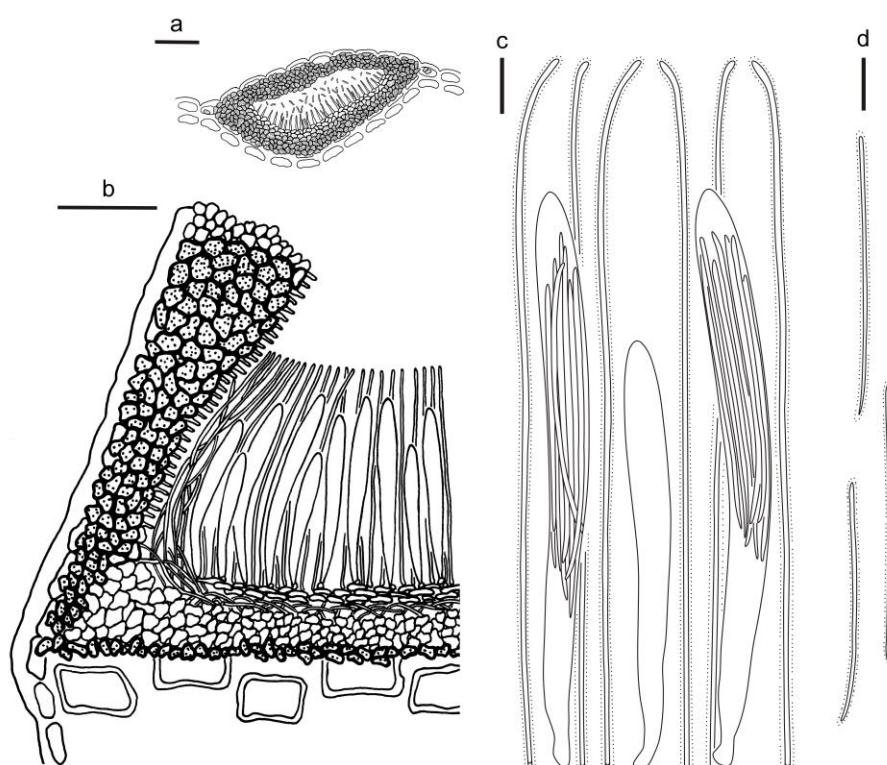


Figure 7 – *Lophodermiopsis splendida* on *Rhododendron* sp. (HOU 936B/BJTC 2022009, holotype). a Vertical section of a conidioma. b Vertical section art of an ascoma (part). c, d Spores or hyphae.

c Paraphyses, mature asci with ascospores, and immature ascus. d Liberated ascospores. Scale bars: a–b = 50 μ m, c–d = 10 μ m.

Zone lines frequent, dark brown.

Additional specimen examined – CHINA, Yunnan Province, Shangri-la, Shudu Lake, alt. ca. 3952 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 27 Jun 2011, C.L. Hou, HOU 929B (BJTC 2022011, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – Sequences of *Lophodermiopsis splendida* form a well-supported clade with *Lophodermiopsis rhododendri*, but the latter has matt ascomata, a thicker covering stroma (65–100 μ m), a thicker basal stroma (20–25 μ m), no internal matrix in the stroma, and a thicker subhymenium (25–45 μ m).

Lophodermiopsis tumida M.J. Guo & C.L. Hou, sp. nov.

Figs 8–9

Mycobank number: MB852654; Facesoffungi number: FoF15616

Diagnosis – The new species is characterized by an internal matrix in the stroma consisting of hyaline, loosely interwoven hyphae and paraphyses that are sometimes branched, and conspicuously swollen at their tips.

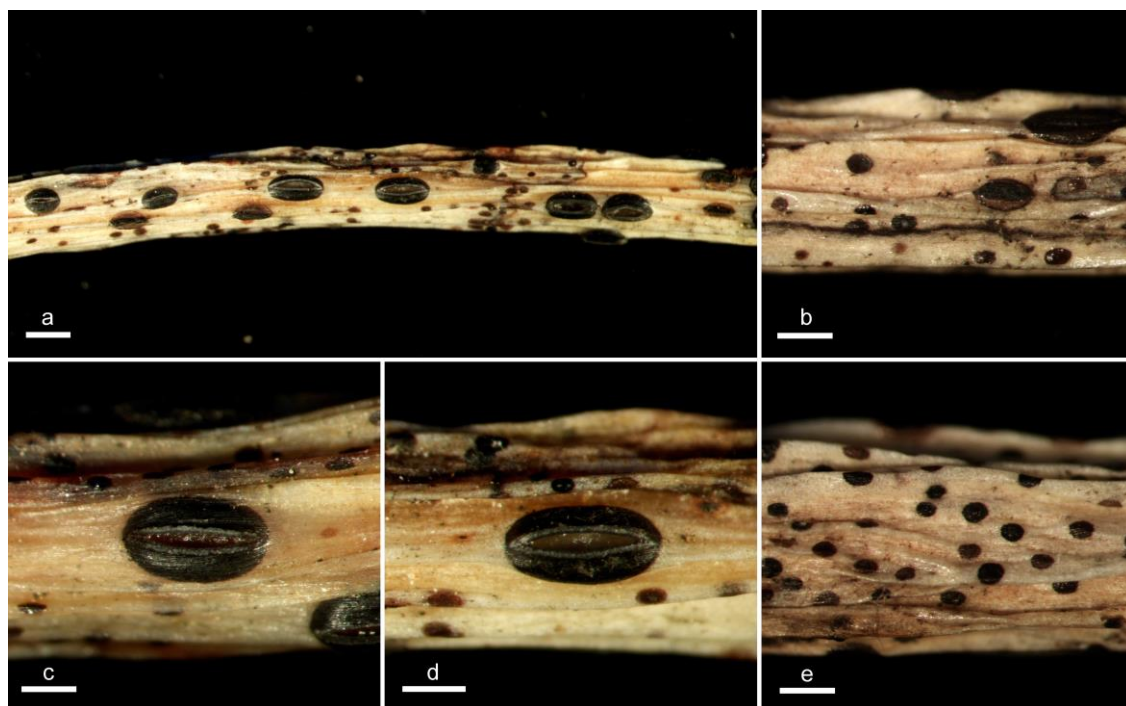


Figure 8 – *Lophodermiopsis tumida* (HOU 1768/BJTC 2022017, holotype). a Ascomata on a twig of *Rhododendron clementinae*. b Zone line. c–d Mature ascomata. e Conidiomata. Scale bars: a = 1 mm, b–e = 500 μ m.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3875 m, on dead twigs of *Rhododendron clementinae* (*Ericaceae*), 20 June 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1768 (BJTC 2022017, holotype).

Etymology – *tumidus* (lat.) = swollen, referring to the conspicuously swollen tips of the paraphyses.

Sexual morph: *Ascomata* on twigs, scattered. In surface view, ascomata elliptical to elongated elliptical, 600–900 $\times$ 1000–1400 μ m, black, with an obvious preformed dehiscence line, opening by a longitudinal split to expose the yellow hymenium. *Lips* present. In median vertical section, ascomata intraepidermal. *Covering stroma* 50–90 μ m thick near the centre of the ascomata,

extending to the basal stroma, consisting of an outermost layer of host cuticle, an outer layer of carbonized, thick-walled, angular to globose cells, and an inner layer of hyaline cells embedded in a hyaline gelatinous matrix. *Lip cells* septate, cylindrical, $10\text{--}20 \times 3\text{--}4\text{ }\mu\text{m}$, hyaline, embedded in a hyaline gelatinous matrix. *Basal stroma* $15\text{--}20\text{ }\mu\text{m}$ thick, consisting of carbonized, thick-walled, angular to globose cells. *Internal matrix of stroma* $20\text{--}30\text{ }\mu\text{m}$ thick, consisting of hyaline, loosely interwoven hyphae. *Subhymenium* $8\text{--}15\text{ }\mu\text{m}$ thick, consisting of thin-walled, angular cells. *Paraphyses* filiform, sometimes branched, curved, with tips conspicuously swollen to $2\text{--}3\text{ }\mu\text{m}$ diam., $118\text{--}130 \times 1\text{--}1.5\text{ }\mu\text{m}$, covered by a thin gelatinous sheath. *Asci* ripening sequentially, cylindrical, with slightly acute apex, $65\text{--}85 \times 5\text{--}7\text{ }\mu\text{m}$, thin-walled, J-, 8-spored. *Ascospores* aseptate, filiform, $38\text{--}45 \times 1\text{ }\mu\text{m}$, hyaline, covered by a thin gelatinous sheath.

Asexual morph: *Conidiomata* round to elliptical, $200\text{--}250\text{ }\mu\text{m}$ diam., brown to dark brown, opening by an ostiole to liberate the conidia. In vertical section, conidiomata intraepidermal, $50\text{--}70\text{ }\mu\text{m}$ deep. *Upper layer* $10\text{--}15\text{ }\mu\text{m}$ thick, consisting of host cuticle and carbonized angular to globose cells. *Basal layer* $10\text{--}15\text{ }\mu\text{m}$ thick, consisting of carbonized, angular to globose cells. *Conidiogenous cells* cylindrical but tapering towards the apex, $10\text{--}22 \times 1\text{--}2\text{ }\mu\text{m}$, hyaline. *Conidia* cylindrical, $4\text{--}8 \times 1\text{ }\mu\text{m}$, hyaline.

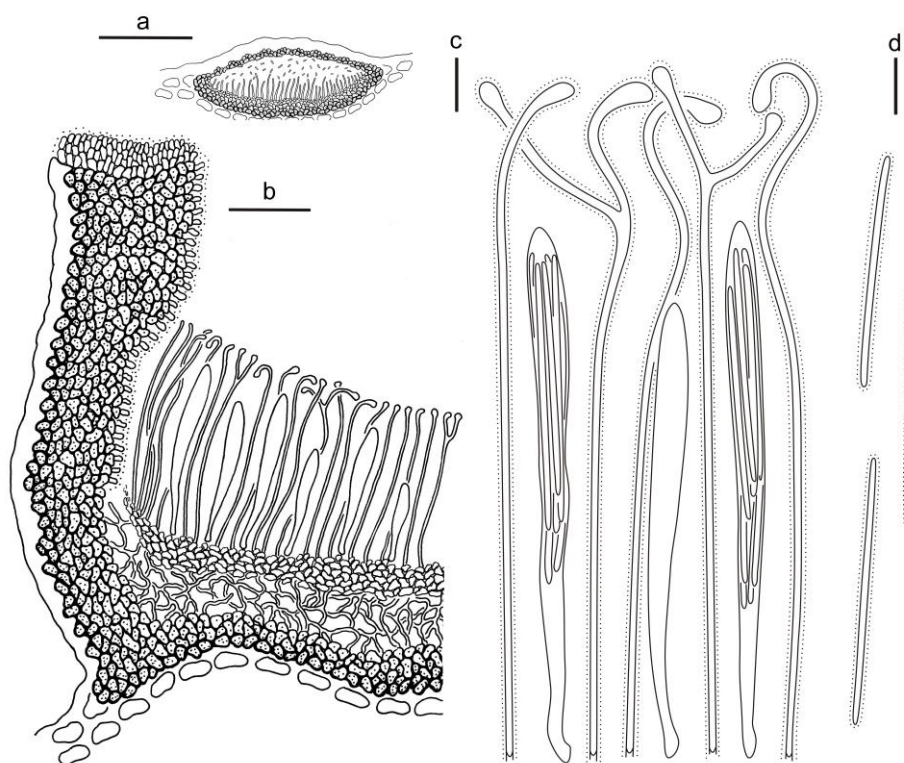


Figure 9 – *Lophodermiopsis tumida* on *Rhododendron clementinae* (HOU 1768/BJTC 2022017, holotype). a Vertical section of a conidioma. b Vertical section art of an ascoma (part). c Paraphyses, mature asci with ascospores, and immature ascus. d Liberated ascospores. Scale bars: a = $100\text{ }\mu\text{m}$, b = $50\text{ }\mu\text{m}$, c–d = $10\text{ }\mu\text{m}$.

Zone lines infrequent, brown to dark brown.

Additional specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3875 m, on twigs of *Rhododendron clementinae* (Ericaceae), 20 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1767B (BJTC 2022016, paratype) – living culture CNUCC 1767B (ex-type); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3875 m, 20 Jun 2021, on dead twigs of *Rhododendron clementinae* (Ericaceae), C.L. Hou, M.J. Guo, and H. Zhou – living cultures from the holotype specimen CNUCC 1768.1, CNUCC 1768.2, CNUCC 1768.3, CNUCC 1768.4.

Known distribution – Known only from Yunnan Province, China.

Notes – The new species differs from the other species presented in this genus by an internal matrix in the stroma consisting of hyaline, loosely interwoven hyphae, as well as sometimes branched paraphyses with conspicuously swollen tips.

Lophodermiopsis yunnanensis M.J. Guo & C.L. Hou, sp. nov.

Figs 10–11

MycoBank number: MB852655; Facesoffungi number: FoF15617

Diagnosis – This new species is similar to *Lophodermiopsis tumida*, but it has no internal matrix in the basal stroma, the subhymenium consists of textura porrecta, and the paraphyses are not branched and not swollen at their tips.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3920 N; 99.4630 E, alt. ca. 3500 m, on living twigs of *Rhododendron decorum* Franch. (*Ericaceae*), 11 Jul 2007, C.L. Hou, HOU 438B (BJTC 2022200, holotype).

Etymology – Referring to the name of the province (Yunnan) where the specimen was collected.

Sexual morph: *Ascomata* on twigs, scattered, associated with pale areas. In surface view, ascomata elliptical to elongated elliptical, 850–1100 × 500–550 µm, black, with an obvious preformed dehiscence line, opening by a longitudinal split. *Lips* present, grey. In median vertical section, ascomata intraepidermal. *Covering stroma* 35–90 µm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outermost layer of host cuticle, an outer layer of carbonized, thick-walled, angular to globose cells, and an inner layer of hyaline cells embedded in a hyaline gelatinous matrix. *Lips* well developed, lip cells septate, cylindrical, 3–5 × 10–24 µm, hyaline, embedded in a hyaline gelatinous matrix. *Basal stroma* 10–16 µm thick, consisting of carbonized, thick-walled, angular to globose cells. *Subhymenium* 6–10 µm thick, consisting of textura porrecta. *Paraphyses* filiform, not branched, slightly curved at the apex, 75–100 × 1–1.5 µm, covered by a thin gelatinous sheath. *Asci* ripening sequentially, cylindrical, with a slightly acute apex, 60–84 × 5–6 µm, thin-walled, J–, 8-spored. *Ascospores* aseptate, filiform, 26–42 × 1 µm, hyaline, covered by a thin gelatinous sheath.

Asexual morph: *Conidiomata* round to subround, 150–350 µm diam., brown to dark brown, opening by an ostiole to liberate the conidia. In vertical section, conidiomata intraepidermal, 40–50 µm deep. *Upper layer* 8–10 µm thick, consisting of host cuticle and carbonized, angular to globose cells. *Basal layer* 15–20 µm thick, consisting of carbonized, angular to globose cells. *Conidiogenous cells* cylindrical but tapering towards the apex, 10–16 × 1–2 µm, hyaline. *Conidia* cylindrical, 4–8 × 1 µm, hyaline.

Zone lines frequent, brown to dark brown.

Additional specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3836 N; 99.4603 E, alt. ca. 3492 m, on twigs of *Rhododendron decorum* (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1596 (BJTC 2022201, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3905 N; 99.4627 E, alt. ca. 3504 m, on twigs of *Rhododendron decorum* (*Ericaceae*), 20 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1762A (BJTC 2022202, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3903 N; 99.4626 E, alt. ca. 3495 m, 20 Jun 2021, on twigs of *Rhododendron decorum* (*Ericaceae*), C.L. Hou, M.J. Guo, and H. Zhou, HOU 1764 (BJTC 2022203, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3866 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 20 June 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1770 (BJTC 2022018, paratype) – living culture from the same specimen CNUCC 1770 (ex-type).

Known distribution – Known only from Yunnan Province, China.

Notes – The phylogenetic analysis shows that the new species is closely related to *Lophodermiopsis tumida* (Clade 13, Fig. 1), but the latter has an internal matrix of stroma consisting of hyaline, loosely interwoven hyphae, a subhymenium consisting of angular cells, paraphyses that are sometimes branched and have swollen tips, and infrequent zone lines.

Additionally, the sequence similarity of ITS rDNA between these species is only 92%, so they are considered distinct species.

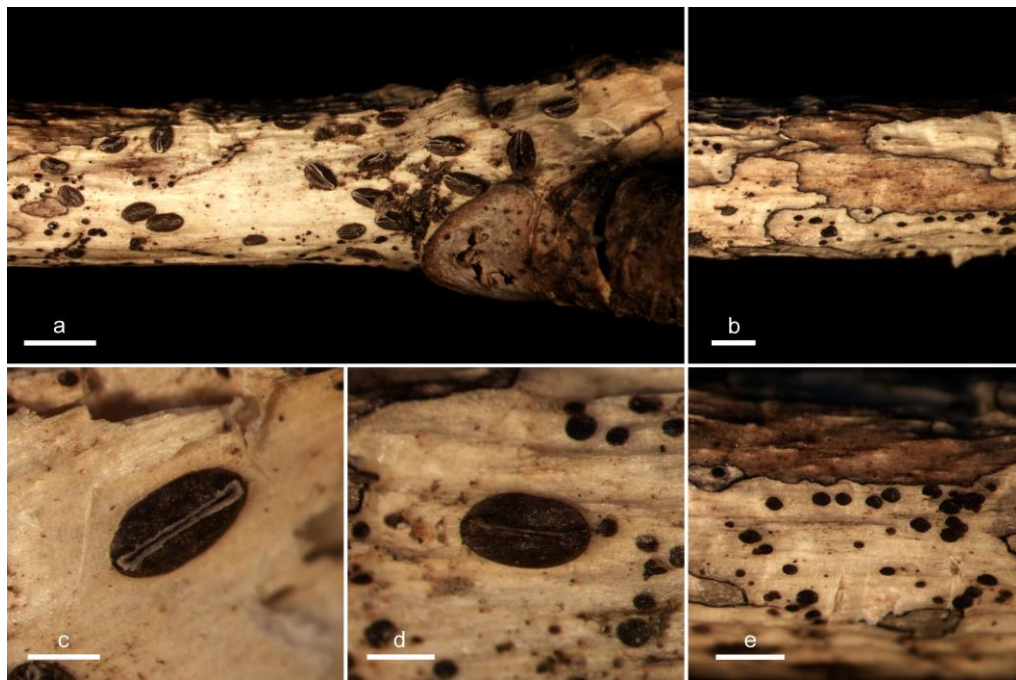


Figure 10 – *Lophodermiopsis yunnanensis* (HOU 438B/BJTC 2022200, holotype). a Ascomata on a twig of *Rhododendron decorum*. b Conidiomata and zone lines. c–d Mature ascomata. e Conidiomata. Scale bars: a = 2 mm, b = 1 mm, c–d = 500 μ m, e = 1 mm.

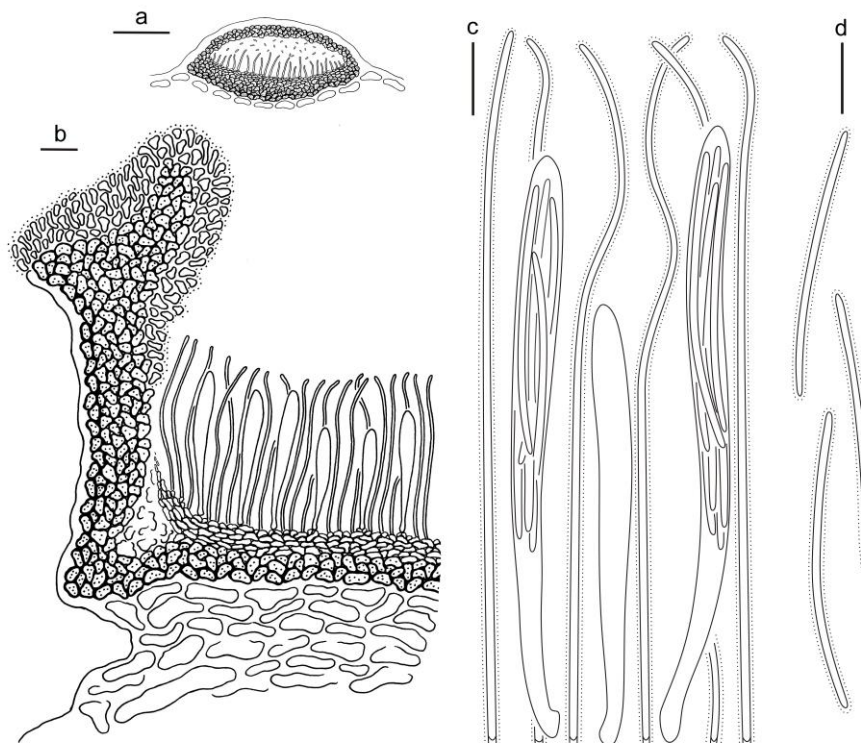


Figure 11 – *Lophodermiopsis yunnanensis* on *Rhododendron decorum* (HOU 438B/BJTC 2022200, holotype). a Vertical section of a conidioma. b Vertical section of an ascoma (part). c Paraphyses, mature asci with ascospores, and immature ascus. d Liberated ascospores. Scale bars: a = 50 μ m, b = 20 μ m, c–d = 10 μ m.

Lophodermium Chevall., Fl. gén. env. Paris (Paris) 1: 435 (1826)

Sexual morph: *Ascomata* erumpent, elliptical to elongated elliptical or irregular, dull to shiny black, opening by a longitudinal slit. *Hymenium* more or less flat. *Paraphyses* simple, filiform. *Asci* narrowly cylindric to cylindric clavate, mostly subacute at the tips, 8-spored, occasionally 4-spored with 4 aborted spores. *Ascospores* simple, unicellular, more or less uniformly filiform, hyaline, surrounded by a thin gelatinous sheath.

Asexual morph: *Conidiomata*, when present, round, small, concolorous with host tissue or black. *Conidia* simple, cylindrical. (Description based on Johnston 1989)

Type species – *Lophodermium arundinaceum* (Schr.) Chevall., Fl. gén. env. Paris (Paris) 1: 435 (1826).

Notes – *Lophodermium* is the largest genus in the *Rhytismataceae*, and it is polyphyletic (Clade 19, Fig. 1). There is only one known species of *Lophodermium*, *Lophodermium vagulum* M. Wilson & N.F. Robertson, which grows on twigs of *Rhododendron* sp., and surprisingly, it also appears on leaves of *Rhododendron* sp.

Lophodermium vagulum M. Wilson & N.F. Robertson, Trans. R. Soc. Edinb. 61: 524 (1947)

Holotype – Scotland, Peebles, Dawyck, on leaves and bark of *Rhododendron croceum* Balf. f. & W.W. Sm. (*Ericaceae*), May 1944, N. Robertson (E! – holotype).

Notes – This species was described and illustrated in detail by Cannon & Minter (1986). No molecular data are available for this species. Morphologically, *Lophodermium vagulum* is similar to *Lophodermium schweinitzii* M. Wilson & N.F. Robertson, but the asci and ascospores of *Lophodermium vagulum* are only about one-half the size of those of *Lophodermium schweinitzii*, and ascospores are less than 1 µm in thickness, without a mucous sheath (Wilson & Robertson 1947). Due to *Lophodermium* s. str. corresponding to mostly grass-associated species, we suggest that *Lophodermium vagulum* may not belong to *Lophodermium*. Fresh specimens are needed to obtain molecular sequence data and to further determine its phylogenetic position.

Myriophacidium Sherwood, Mycologia 66(4): 691 (1974)

Sexual morph: *Ascomata* triangular, quadrate or multi-angular, opening with 3–4 teeth. *Covering stroma* and *basal stroma* well developed, consisting of carbonized, thick-walled, globose and angular cells. *Subhymenium* flat or slightly depressed. *Paraphyses* aseptate or septate, filiform, not branched or 3–4 times branched at their tips, not swollen. *Asci* ripening sequentially, cylindrical to cylindric-clavate, thin-walled, J–, 4- or 8-spored. *Ascospores* aseptate, ellipsoidal to oval, hyaline, covered by a gelatinous sheath. *Epithecium* occasionally present. (Description based on Sherwood 1974)

Type species – *Myriophacidium aphyophyllicum* Sherwood, Mycologia 66(4): 691 (1974).

Notes – There is only one known species of *Myriophacidium* growing on twigs of *Rhododendron* sp., namely *Myriophacidium ramosum* C.L. Hou & M. Piepenbr.

Myriophacidium ramosum C.L. Hou & M. Piepenbr., Mycologia 101(3): 383 (2009)

Holotype – CHINA, Yunnan Province, Lijiang, Baishui, alt. ca. 3000 m, on *Rhododendron* sp. (*Ericaceae*), 30 Jul 2001, C.L. Hou, M. Piepenbring, Z.L. Yang and R. Kirschner, 147a (AAUFP 900067!).

Notes – This species was described and illustrated in detail by Hou & Piepenbring (2009). Morphologically, the shape of the ascomata of *Myriophacidium ramosum* is similar to that of *M. aphyophyllicum* (type species), but *M. ramosum* differs by 8-spored asci, fusiform or clavate-ellipsoidal ascospores, paraphyses that are 3–4 times branched and embedded in a brown epithecium at their tips, and growing on twigs (Hou & Piepenbring 2009). *Myriophacidium ramosum* is placed in *Myriophacidium*, but this species may not be related to *Myriophacidium* because leaf-inhabiting species usually do not cluster with twig-inhabiting species in phylogenetic trees. However, due to the lack of molecular data and the absence of a more suitable genus for

Myriophacidium ramosum, we do not make any changes to this species name until more data are available.

Nematococcomyces C.L. Hou, M. Piepenbr. & Oberw., *Mycologia* 96(6): 1381 (2004)

Sexual morph: *Ascomata* on twigs of *Rhododendron* spp., variable in shape, elliptical to triangular, quadrate or pentagonal, or slightly irregular, dark brown, opening by teeth or a longitudinal split. *Covering stroma* and *basal stroma* usually well developed, consisting of carbonized, thick-walled, globose to angular cells, or hyphae. *Internal matrix of stroma* occasionally present, consisting of hyaline angular cells. *Subhymenium* flat or slightly depressed, consisting of *textura intricata*, *textura porrecta* or/and small cells. *Paraphyses* filiform, simple or branched. *Asci* ripening sequentially, broadly clavate, thin-walled, without circumapical thickening, J-, 4- or 8- spored. *Ascospores* aseptate, elliptical to fusiform, hyaline, pluriguttulate or without guttulate, mostly with filiform, hyaline appendages at apex and base, and without a gelatinous sheath.

Asexual morph: *Conidiomata* present or absent. (Description based on Hou et al. 2004).

Type species – *Nematococcomyces rhododendri* C.L. Hou, M. Piepenbr. & Oberw., *Mycologia* 96(6): 1381 (2004).

Notes – Two species of *Nematococcomyces* are known, viz. *N. rhododendri* and *N. oberwinkleri* M. Piepenbr. & C.L. Hou, both with *ascomata* on twigs of *Rhododendron* spp. In this study, four new species that growing on twigs of *Rhododendron* sp. are described based on molecular data, morphological characteristics, and the host relationship. Three of them morphologically fit into the concept of *Nematococcomyces*, which is presented with minor emendations. *Nematococcomyces mirabilis*, however, is morphologically different and might represent a separate genus in the future.

Phylogenetically, the monophyletic genus *Nematococcomyces* is divided into three well-supported, relatively independent clades (Clade 1, Fig. 1), each of them with distinct morphological characteristics. Clade A with 100% MLB, 100% MPB, and 1.00 PP bootstrap support, contains only one new species, *Nematococcomyces mirabilis*, which occurs on thick and dead branches of *Rhododendron* sp., has 8-spored *asci* and *ascospores* without appendages. Clade B with 100% MLB, 94% MPB, and 1.00 PP bootstrap support, contains two species, the type species of *Nematococcomyces*, *Nematococcomyces rhododendri*, and the new species *Nematococcomyces yunnanensis*, which are characterized by 4-spored *asci* and *ascospores* with conspicuous appendages. Clade C with 100% MLB and 92% MPB bootstrap support, contains *Nematococcomyces oberwinkleri* and two new species, namely *Nematococcomyces brunneus* and *Nematococcomyces vermiformis*. This clade is characterized by 8-spored *asci* and *ascospores* with conspicuous appendages. These three independent clades may represent three genera. However, to avoid excessive splitting on the level of genera we place these three clades into the genus *Nematococcomyces*.

Key to species of *Nematococcomyces* on twigs of *Rhododendron* species

- | | |
|---|------------------------|
| 1. <i>Ascospores</i> with appendages | 2 |
| 1. <i>Ascospores</i> without appendages | <i>N. mirabilis</i> |
| 2. <i>Asci</i> 4-spored | 3 |
| 2. <i>Asci</i> 8-spored | 4 |
| 3. <i>Asci</i> 15–20 µm wide; paraphyses not swollen or slightly swollen at the tips | <i>N. rhododendri</i> |
| 3. <i>Asci</i> 10–13 µm wide; paraphyses swollen to 2.5–3 µm diam. at the tips..... | <i>N. yunnanensis</i> |
| 4. <i>Ascomata</i> intrahypodermal; <i>ascospores</i> with appendages at both ends and sides..... | <i>N. vermiformis</i> |
| 4. <i>Ascomata</i> intraepidermal; <i>ascospores</i> with appendages only at both ends | 5 |
| 5. <i>Ascomata</i> quadrate or pentagonal, opening by 4-5 teeth..... | <i>N. oberwinkleri</i> |
| 5. <i>Ascomata</i> elliptical to triangular, opening by 3 teeth | <i>N. brunneus</i> |

Nematococcomyces brunneus L. Zhuo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 12–13

Mycobank number: MB852656; Facesoffungi number: FoF15618

Diagnosis – The new species resembles *Nematococcomyces rhododendri*, but differs by ascomata with a brown epithecium, longer asci, and longer ascospores with 2–3 filiform appendages at both ends.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.6323 N; 99.7252 E, alt. ca. 3877 m, on living twigs of *Rhododendron clementinae* (Ericaceae), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1610A (BJTC 2022022).

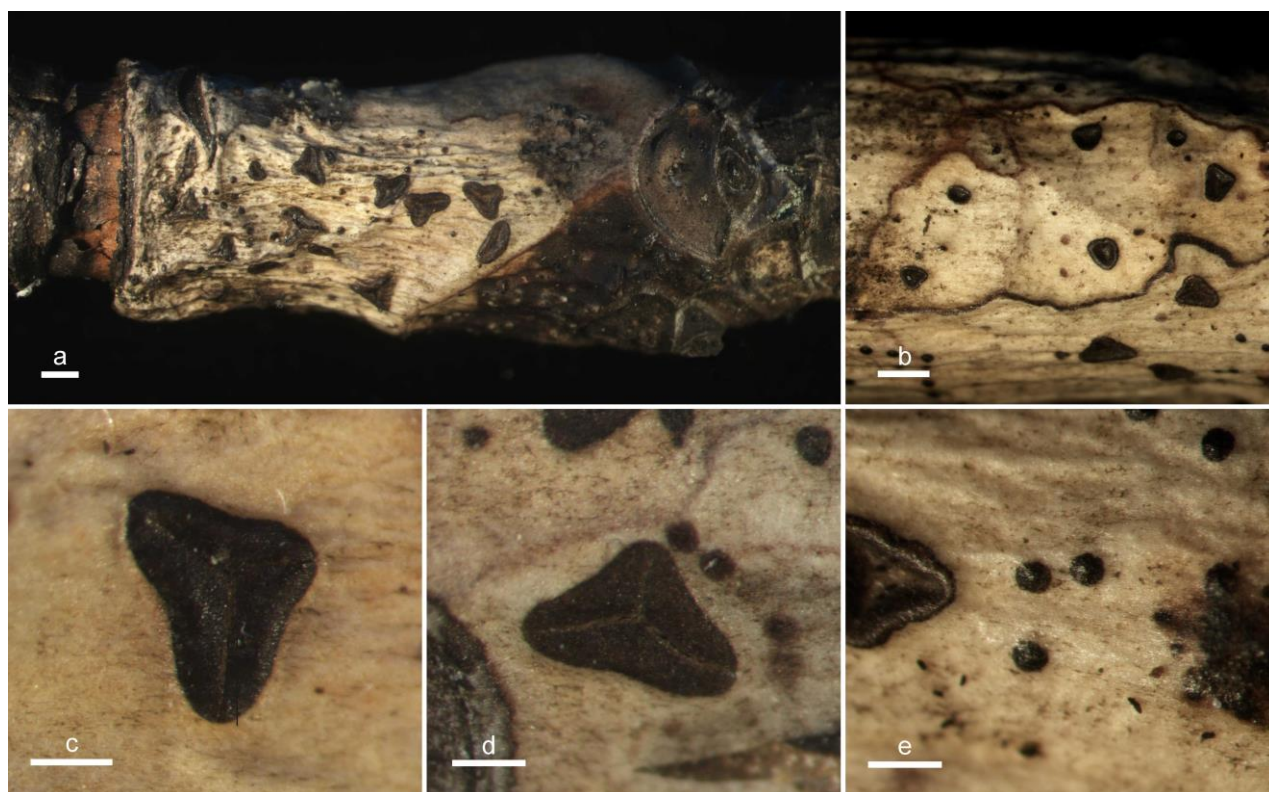


Figure 12 – *Nematococcomyces brunneus* (HOU 1610A/BJTC 2022022, holotype). a Ascomata on a twig of *Rhododendron clementinae*. b Ascomata with zone lines. c–d Immature ascomata. e Conidiomata. Scale bars: a–b = 1 mm, c–e = 500 μ m.

Etymology – *brunneus* (lat.) = brown, referring to the brown epithecium.

Sexual morph: *Ascomata* on twigs, scattered, associated with pale areas. In surface view ascomata elliptical to triangular, 750–2000 μ m diam., dark brown, raising above the surface of the host tissue at maturity, with obvious preformed dehiscence lines, opening by three radiate slits to expose the hymenium. *Lip cells* absent. In median vertical section, ascomata intraepidermal. *Covering stroma* 40–65 μ m thick near the centre of the ascomata, slightly thinner toward the edges, consisting of the outer remains of the epidermis with the cuticula, and an inner layer of carbonized, thick-walled angular cells. *Basal stroma* 30–45 μ m thick, flat, consisting of 4–8 μ m diam., carbonized, thick-walled angular cells. *Subhymenium* 12–20 μ m thick, consisting of hyaline angular cells. *Excipulum* absent. *Paraphyses* filiform, sometimes branched, slightly swollen at the tips, 180–220 $\times$ 1.5–2.0 μ m, covered by a thin gelatinous sheath, tips of paraphyses embedded in the hyaline gelatinous matrix and forming the brown epithecium. *Asci* ripening sequentially, broadly cylindric, apex obtuse to round, 175–190 $\times$ 12–18 μ m, thin-walled, J–, 8-spored. *Ascospores* aseptate, elongated elliptical to fusiform, both ends slightly acute, 28–42 $\times$ 6–9 μ m, hyaline, without a gelatinous sheath, with 2–3 filiform appendages at each end. *Appendages* aseptate, less than 1 μ m wide, 5–25 μ m long, hyaline.

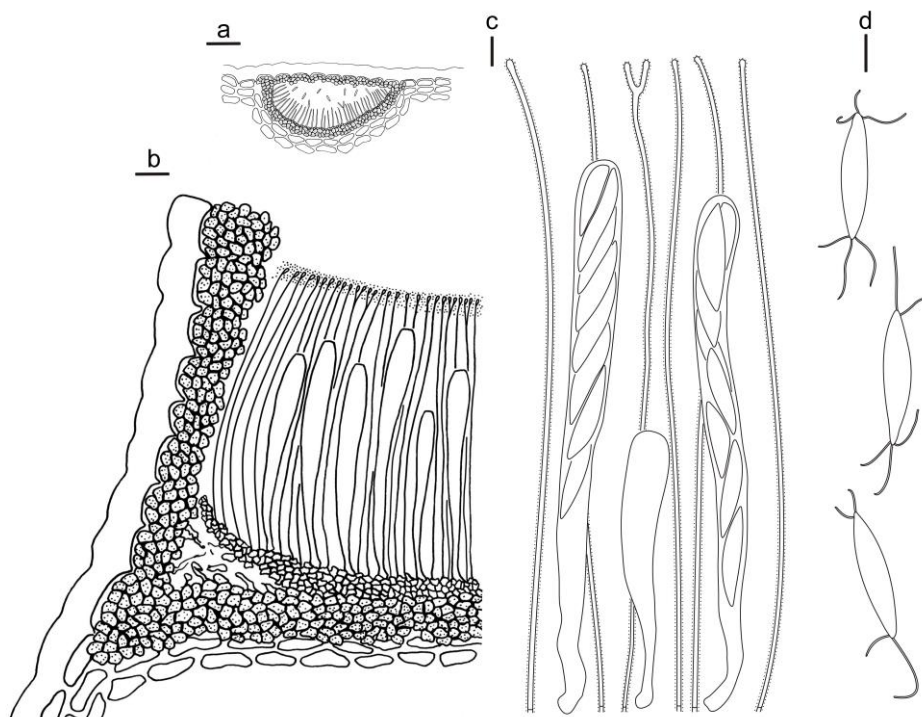


Figure 13 – *Nematococcomyces brunneus* on *Rhododendron clementinae* (HOU 1610A/BJTC 2022022, holotype). a Vertical section of a conidioma. b Vertical section part of an ascoma (part). c Paraphyses, mature asci with ascospores, and immature ascus. d Liberated ascospores. Scale bars: a = 50 μ m, b = 20 μ m, c–d = 10 μ m.

Asexual morph: *Conidiomata* round or slightly irregular, 200–250 μ m diam., dark brown, scattered, opening by an ostiole to liberate the conidia. In vertical section, conidiomata intraepidermal, 70–85 μ m deep. *Upper layer* 7–14 μ m thick, consisting of host cuticle and carbonized angular cells. *Basal layer* 10–20 μ m thick, consisting of carbonized angular cells. *Conidiogenous cells* cylindrical but tapering towards the apex, 6–13 $\times$ 1–1.5 μ m, hyaline. *Conidia* cylindrical, 5–7 $\times$ 1 μ m, hyaline.

Zone lines frequent, dark brown.

Additional specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.6323 N; 99.7251 E, alt. ca. 3877 m, on twigs of *Rhododendron clementinae* (Ericaceae), 20 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1766A (BJTC 2022019, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.6311 N; 99.7262 E, alt. ca. 3855 m, on twigs of *Rhododendron clementinae* (Ericaceae), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1807B (BJTC 2022020, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3750 N; 99.4332 E, alt. ca. 3858 m, on twigs of *Rhododendron clementinae* (Ericaceae), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1810A (BJTC 2022021, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – *Nematococcomyces brunneus* is assigned to *Nematococcomyces* because it is morphologically close to *Nematococcomyces rhododendri* (the type species). *Nematococcomyces rhododendri*, however, has quadrate, triangular, elliptical, or slightly irregular ascomata without an epithecium, a subhymenium consisting of textura intricata, shorter asci [75–110(–130) μ m], shorter ascospores (18–25 μ m) with appendages, 2(–3) attached to one end and 1(–2) to the other end (Hou et al. 2004). According to molecular phylogenetic analysis, *N. brunneus* forms a highly supported clade with *Nematococcomyces oberwinkleri*, but *N. oberwinkleri* has quadrate or pentagonal ascomata without epithecium, opening by 4–5 teeth to expose the hymenium, and a subhymenium consisting of textura intricata. The similarity of nrLSU and mtSSU rDNA of *N. oberwinkleri* with *N. brunneus* is 97%.

Nematococcomyces mirabilis M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 14–15

MycoBank number: MB852657; Facesoffungi number: FoF15619

Diagnosis – Ascomata subcortical, excipulum well-developed. Ascospores without appendages, but with a thin gelatinous sheath.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3752 N; 99.4327 E, alt. ca. 3497 m, on dead branches of *Rhododendron* sp. (*Ericaceae*), 17 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1564 (BJTC 2022026, holotype).

Etymology – *mirabilis* (lat.) = astonishing, referring to the unique morphological characteristics of ascomata and ascospores.

Sexual morph: *Ascomata* on relatively thick, dead branches, scattered. In surface view ascomata subcircular to elliptical, 1250–3100 × 1880–4300 µm, concolorous with the surface of the bark, opening by irregular splits to expose the yellow hymenium. *Lips* absent. In median vertical section, ascomata subcortical. *Covering stroma* 200–380 µm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outermost layer of host cortex, an outer layer of strongly carbonized fungal hyphae, and an inner layer of hyaline, angular cells. *Basal stroma* 70–100 µm thick, consisting of carbonized fungal hyphae with a pigmentation that gradually becomes lighter towards the hymenium. *Subhymenium* 25–35 µm thick, consisting of hyaline textura porrecta. *Excipulum* 10–15 µm thick, formed by marginal paraphyses. *Paraphyses* filiform, often branched, slightly curved and swollen at the tips, 285–355 × ca. 2 µm, guttulate, covered by a thin gelatinous sheath, forming an epithecium by their tips. *Asci* ripening sequentially, cylindrical, slightly round to subtruncate at the apex, 225–300 × 12–16 µm, thin-walled, J–, 8-spored. *Ascospores* aseptate, elliptical, 20–28 × 10–15 µm, hyaline, pluriguttulate, without gelatinous sheaths.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, on branches of *Rhododendron* sp. (*Ericaceae*), 11 Jul 2007, C.L. Hou, HOU 470B (BJTC 2022023, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3753 N; 99.4329 E, alt. ca. 3867 m, on branches of *Rhododendron* sp. (*Ericaceae*), 17 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1563 (BJTC 2022025, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3944 N; 99.4722 E, alt. ca. 3047 m, on branches of *Rhododendron campylocarpum* Hook. f. (*Ericaceae*), 16 June 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1568 (BJTC 2022027, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3751 N; 99.4259 E, alt. ca. 4004 m, on branches of *Rhododendron* sp. (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1821 (BJTC 2022024, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – Morphologically, *Nematococcomyces mirabilis* differs from other species of *Nematococcomyces* by having larger (1300–3100 × 1880–4300 µm), subcortical ascomata and wider ascospores (10–15 µm) without appendages. Although the morphological characteristics of this new species are not conforming with typical species of *Nematococcomyces*, this species is accommodated in *Nematococcomyces* based on the results of the phylogenetic analyses and the host relationship, in order to ensure the monophyly of *Nematococcomyces*. As more specimens and molecular data become available, this clade may be treated as a distinct genus in future.

Nematococcomyces oberwinkleri M. Piepenbr. & C.L. Hou, Botany 91(9): 595 (2013)

Holotype – CHINA, Yunnan Province, Jianchuang, Laojunshan, alt. ca. 3200 m, on living twigs of *Rhododendron* sp. (*Ericaceae*), 11 Jul 2007, C.L. HOU 482 (BJTC 201205).

Notes – This species was described and illustrated in detail by Tian et al. (2013). According to molecular phylogenetic analyses, *Nematococcomyces oberwinkleri* is closely related to *Nematococcomyces brunneus*, but in contrast to *N. brunneus*, *N. oberwinkleri* has quadrate or pentagonal ascomata without epithecium, and open by 4–5 radiate slits to expose the hymenium.

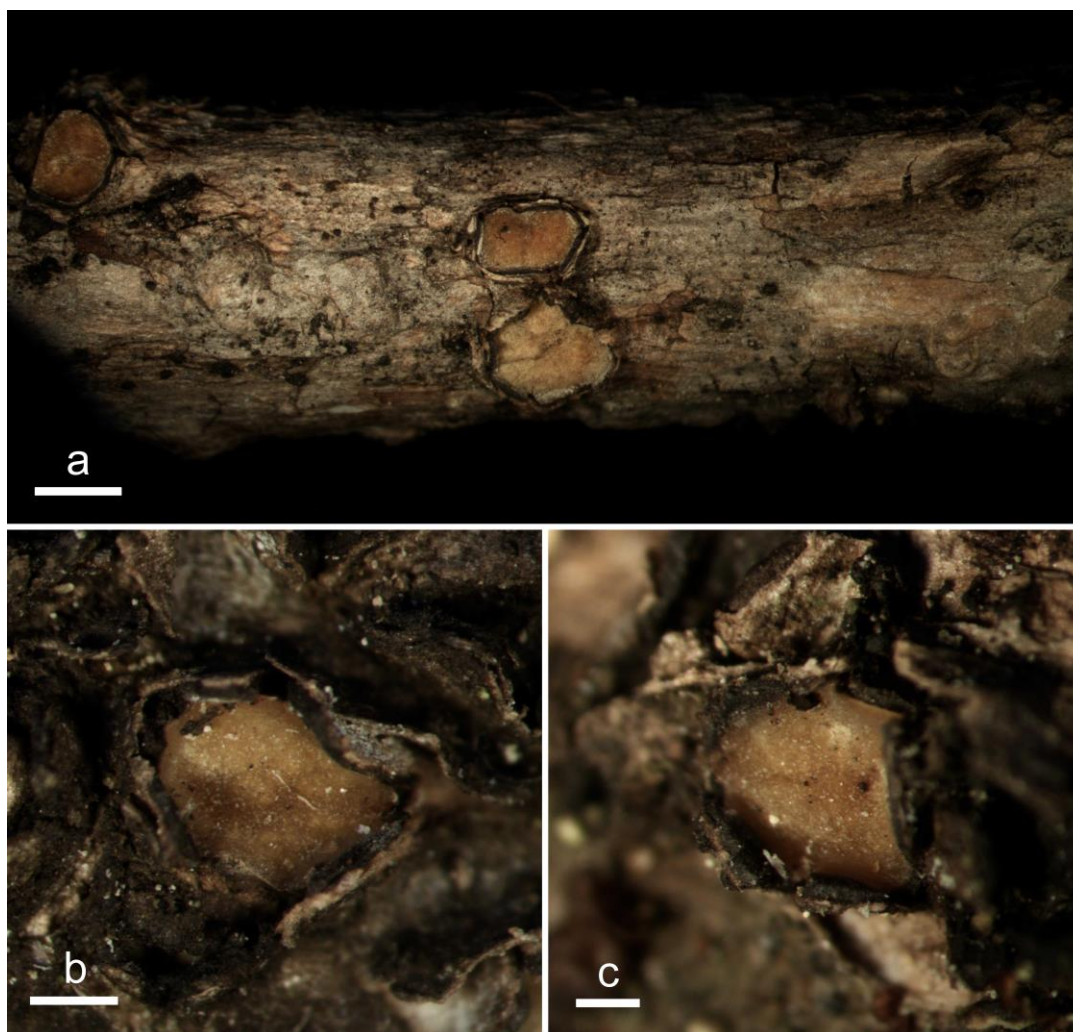


Figure 14 – *Nematococcomyces mirabilis* (HOU 1564/BJTC 2022026, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 2 mm, b–c = 500 μ m.

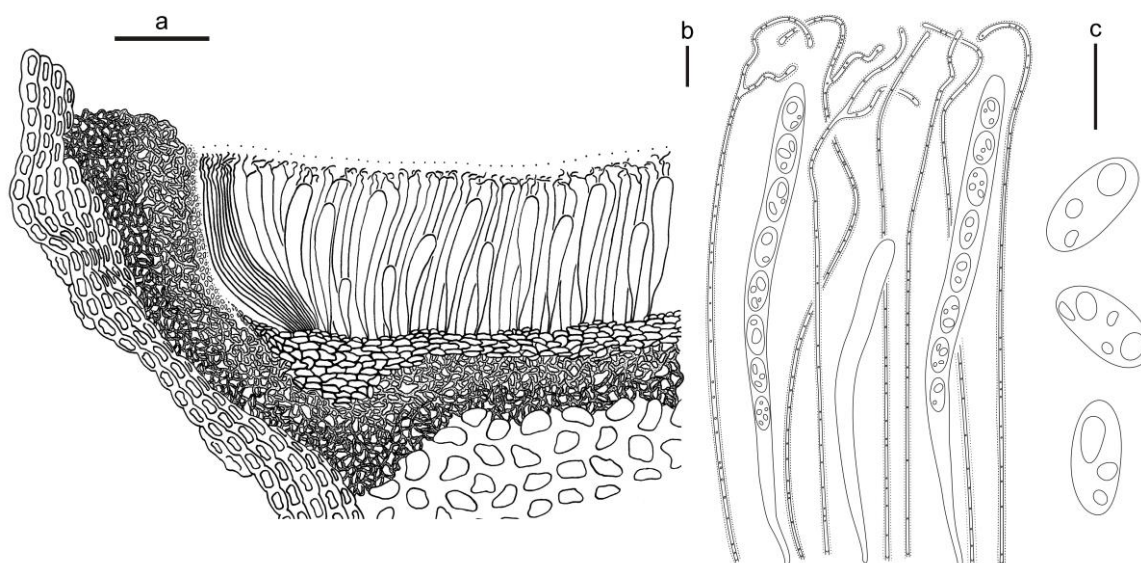


Figure 15 – *Nematococcomyces mirabilis* on *Rhododendron* sp. (HOU 1564/BJTC 2022026, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores with guttulae. Scale bars: a = 200 μ m, b–c = 20 μ m.

Nematococcomyces rhododendri C.L. Hou, M. Piepenbr. & Oberw., Mycologia 96(6): 1381 (2004)

Holotype – CHINA, Yunnan Province, Jianchuang, Laojunshan, alt. ca. 3400 m, on *Rhododendron lutescens* (Ericaceae). 25 Jul 2001, C.L. Hou, M. Piepenbring, Z.L. Yang & R. Kirschner, 112 (HOLOTYPE HMAS).

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3751 N; 99.4337 E, alt. ca. 3856 m, on living twigs of *Rhododendron clementinae* (Ericaceae), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1795A (BJTC 2022028) – living culture CNUCC 1795A.

Notes – This species was described and illustrated in detail by Hou et al. (2004). According to molecular phylogenetic analysis, *Nematococcomyces rhododendri* forms a highly supported clade together with *N. yunnanensis*. In contrast to *N. yunnanensis*, *N. rhododendri* has paraphyses that are not swollen or slightly swollen at their tips, wider asci (15–20 μm), and 2(–3) filiform, hyaline, aseptate appendages on one end of the ascospores and 1(–2) on the other end.

Nematococcomyces vermiformis M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 16–17

MycoBank number: MB852658; Facesoffungi number: FoF15620

Diagnosis – The new species is characterized by elongated elliptical to vermiform ascomata, a well-developed, brown epithecium, and elliptical ascospores with long appendages at their tips and short appendages mostly on the entire surface.



Figure 16 – *Nematococcomyces vermiformis* (HOU 1840B/BJTC 2022029, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 2 mm, b–c = 500 μm .

Holotype – CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0504 N; 102.5053 E, alt. ca. 3823 m, on living twigs of *Rhododendron* sp. (*Ericaceae*), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1840B (BJTC 2022029, holotype).

Etymology – *vermis* (lat.) = worm, *forma* (lat.) = shape, referring to the morphology of ascomata reminiscent of worms.

Sexual morph: *Ascomata* on twigs, scattered, associated with pale areas. In surface view ascomata elongated elliptical to worm form, often curved, $1570\text{--}2500 \times 500\text{--}700\ \mu\text{m}$, dark brown, often strongly raising above the surface of the host tissue at maturity, opening by a longitudinal split to expose the claret hymenium. *Lips* absent. In median vertical section, ascomata intrahypodermal. *Covering stroma* $50\text{--}80\ \mu\text{m}$ thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of host cuticle, epidermal and split hypodermal cells filled with carbonized, thick-walled, angular to globose cells, and an inner layer of moderately carbonized, thick-walled, angular to globose cells. *Basal stroma* $20\text{--}25\ \mu\text{m}$ thick, consisting of carbonized, thick-walled, angular to globose cells. A space triangular in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with hyaline angular cells. *Subhymenium* $10\text{--}15\ \mu\text{m}$ thick, consisting of hyaline textura porrecta. *Paraphyses* filiform, often with 2–3 branches over the top of the asci, not swollen at their tips, $200\text{--}230 \times 1\text{--}1.5\ \mu\text{m}$, pluriguttulate, covered by a thin gelatinous sheath. Tips of paraphyses and mature asci are embedded in a gelatinous matrix and form a $50\text{--}60\ \mu\text{m}$ thick, brown epithecium. *Asci* ripening sequentially, clavate, apex obtuse to round, $135\text{--}182 \times 12\text{--}20\ \mu\text{m}$, short-stalked, thin-walled, J–, 8-spored. *Ascospores* aseptate, fusiform or elongated elliptical, $22\text{--}28 \times 8\text{--}12\ \mu\text{m}$, hyaline, with 1–3 filiform, aseptate, $6\text{--}12 \times \text{ca. } 1\ \mu\text{m}$, hyaline appendages at both tips and numerous, short ($2\text{--}5 \times \text{ca. } 1\ \mu\text{m}$), hyaline appendages on the entire cell surface, that may be missing in some spores.

Asexual morph: *Conidiomata* not seen.

Zone lines rare, brown.

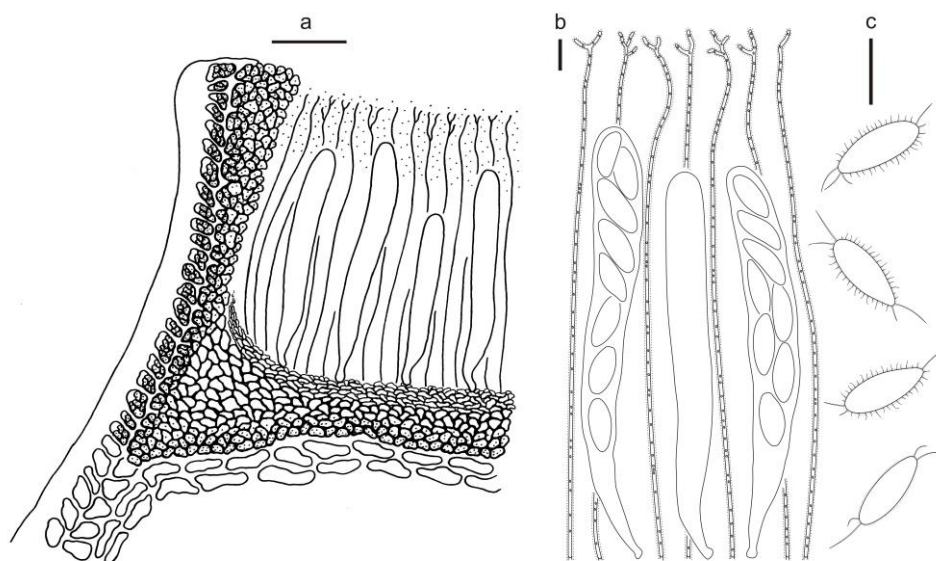


Figure 17 – *Nematococcomyces vermiformis* on *Rhododendron* sp. (HOU 1840B/BJTC 2022029, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = $50\ \mu\text{m}$, b–c = $20\ \mu\text{m}$.

Additional specimens examined – CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0509 N; 102.5059 E, alt. ca. 3830 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1857B (BJTC 2022030, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.6322 N; 99.7246 E, alt. ca. 3875 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 17 Aug 2023, C.L. Hou, L. Zhuo, and S.Y. Zhao, HOU 2053B (BJTC 2022124,

paratype); CHINA, Yunnan Province, Dali Bai Autonomous Prefecture, Mount Cangshan, 25.6645 N; 100.1024 E, alt. ca. 3827 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 18 Aug 2023, C.L. Hou, L. Zhuo, and S.Y. Zhao, HOU 2115B (BJTC 2022126, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – According to the phylogenetic analysis, the new species is closely related to *Nematococcomyces brunneus* (HOU 1610A, HOU 1766A, HOU 1807B, HOU 1810A) and *Nematococcomyces oberwinkleri* (HOU 482B). However, our collection is distinct to those species by its elongated elliptical to vermiform ascomata, paraphyses that often carry 2–3 branches, a well-developed, brown epithecium, and ascospore surfaces covered by numerous short appendages in addition to longer appendages at their tips.

Nematococcomyces yunnanensis M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 18–19

Mycobank number: MB852659; Facesoffungi number: FoF15621

Diagnosis – The new species resembles *Nematococcomyces rhododendri*, but differs by the presence of an internal matrix in the basal stroma, narrower asci, and ascospores with 2–3 appendages at both tips.



Figure 18 – *Nematococcomyces yunnanensis* (HOU 1592/BJTC 2022032, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 1 mm, b–c = 500 μ m.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3757 N; 99.4332 E, alt. ca. 3877 m, on living twigs of *Rhododendron* sp. (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1592 (BJTC 2022032, holotype).

Etymology – Referring to the name of the province (Yunnan) where the specimen was collected.

Sexual morph: *Ascomata* on twigs, scattered, associated with pale areas. In surface view ascomata quadrate or triangular, $450\text{--}600 \times 500\text{--}700\text{ }\mu\text{m}$, black, strongly raising above the surface of the host tissue at maturity, with obvious preformed dehiscence lines, opening by 3–4 radiate slits to expose the yellow hymenium. *Lip cells* absent. In median vertical section, ascomata intraepidermal. *Covering stroma* $20\text{--}32\text{ }\mu\text{m}$ thick near the centre of the ascomata, slightly thinner towards the edges, consisting of the outer remains of the epidermis with the cuticula, an inner layer of $3\text{--}5\text{ }\mu\text{m}$ diam., carbonized, thick-walled, angular to globose cells, and an innermost layer of $3\text{--}4\text{ }\mu\text{m}$ diam., hyaline, angular to globose cells. *Basal stroma* $15\text{--}25\text{ }\mu\text{m}$ thick, flat, consisting of $3\text{--}6\text{ }\mu\text{m}$ diam., carbonized, thick-walled angular cells. Internal matrix of stroma $25\text{--}30\text{ }\mu\text{m}$ thick, consisting of thin-walled, hyaline angular cells. *Subhymenium* $8\text{--}12\text{ }\mu\text{m}$ thick, consisting of hyaline angular cells and some *textura porrecta*. *Excipulum* absent. *Paraphyses* filiform, often branched, swollen to $2.5\text{--}3\text{ }\mu\text{m}$ at the tips, $90\text{--}120 \times \text{ca } 1.5\text{ }\mu\text{m}$, covered by a thin gelatinous sheath. *Asci* ripening sequentially, broadly clavate, apex obtuse to round, $75\text{--}110 \times 10\text{--}13\text{ }\mu\text{m}$, thin-walled, without circumapical thickening, liberating spores through a small apical hole, J–, 4-spored. *Ascospores* aseptate, elliptical to elongated elliptical, both ends slightly acute, $17\text{--}21 \times 7\text{--}8\text{ }\mu\text{m}$, hyaline, without a gelatinous sheath, both ends of ascospores with 2–3 filiform, hyaline, aseptate appendages. *Appendages* less than $1\text{ }\mu\text{m}$ diam., $8\text{--}25\text{ }\mu\text{m}$ long, tapering apically.

Asexual morph: *Conidiomata* not observed.

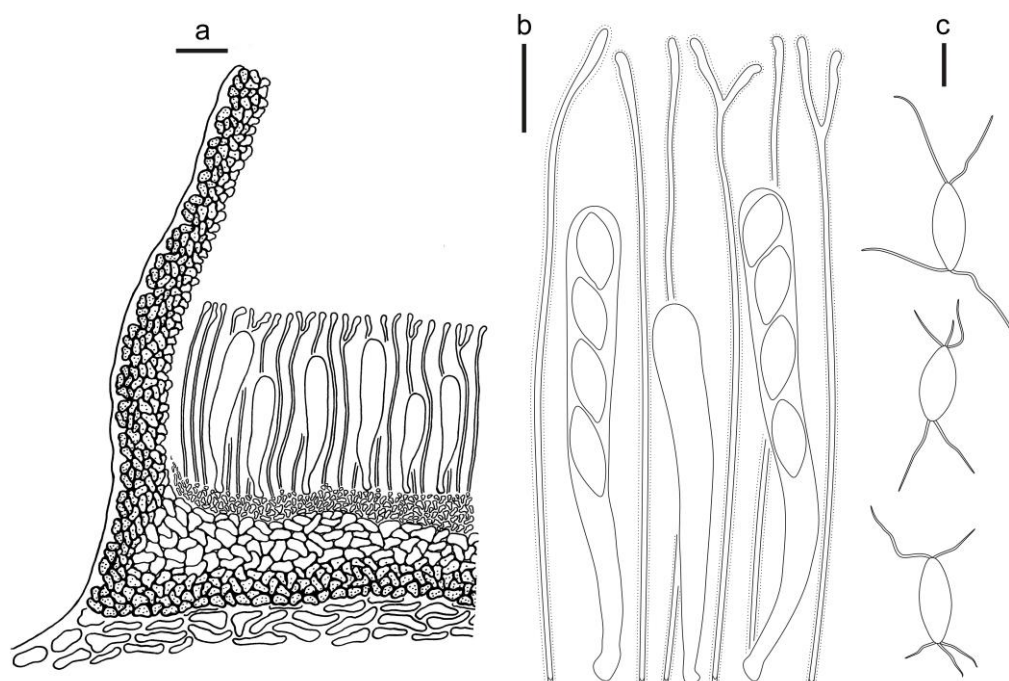


Figure 19 – *Nematococcomyces yunnanensis* on *Rhododendron* sp. (HOU 1592/BJTC 2022032, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a–b = $20\text{ }\mu\text{m}$, c = $10\text{ }\mu\text{m}$.

Zone lines frequent, dark brown.

Known distribution – Known only from Yunnan Province, China.

Notes – Molecular sequences of the new species form a clade together with the molecular sequences of the type species, *Nematococcomyces rhododendri*, but *N. yunnanensis* differs from *N. rhododendri* morphologically, because *N. rhododendri* has not swollen or slightly swollen paraphyses, wider asci ($15\text{--}20\text{ }\mu\text{m}$), and ascospores with a lower number of appendages, 2(–3) at one tip and 1(–2) at the other tip. The similarity of ITS rDNA sequence data of the two species is 97%. Therefore, it is considered as a new species.

Neotrybliopsis M.J. Guo & C.L. Hou, gen. nov.

Mycobank number: MB852660; Facesoffungi number: FoF15600

Etymology – Referring to some morphological similarities with species of the genus *Trybliopsis* P. Karst.

Sexual morph: *Ascomata* erumpent from bark of *Rhododendron* spp., scattered, stipitate, ascomata more than 1 mm diam., variable in shape, opening by irregular splits to expose the hymenium. *Lips* absent. *Covering stroma* well developed, consisting of carbonized, thick-walled, globose to angular cells. *Basal stroma* absent. Internal matrix of stroma well developed, consisting of hyaline hyphae. *Subhymenium* flat or slightly depressed, consisting of textura intricata. *Paraphyses* filiform, simple or branched, swollen at the tips. *Asci* ripening sequentially, cylindric or clavate, thin-walled, J–, 8-spored. *Ascospores* fusiform to elliptical, both ends slightly acute, covered by a thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not seen.

Type species – *Neotrybliopsis polygonalis* M.J. Guo & C.L. Hou, described below

Notes – Species of the *Neotrybliopsis* correspond to an independent clade with high support values in the phylogenetic tree with 100% MLB, 100% MPB, and 1.00 PP bootstrap support (Clade 2, Fig. 1). Morphologically, they are characterized by relatively large, protuberant ascomata with a conspicuous stalk similar to ascomata of species of *Trybliopsis*. Species of *Trybliopsis*, however, occur on twigs of conifers, have circular ascomata, and ascospores that can be septated (Livsey & Minter 2011, Wang et al. 2014a, Tanney & Seifert 2019). Based on the separate phylogenetic positions, morphological characteristics and the host relationship, we propose *Neotrybliopsis* as a separate genus.

Key to species of *Neotrybliopsis* on twigs of *Rhododendron* species

1. Ascomata polygonal or slightly irregular; Asci < 200 µm long, clavate..... *Ne. polygonalis*
1. Ascomata triangular to quadrangular; Asci > 200 µm long, cylindrical-clavate..... *Ne. yunnanensis*

Neotrybliopsis polygonalis M.J. Guo & C.L. Hou, sp. nov.

Figs 20–21

Mycobank number: MB852661; Facesoffungi number: FoF15622

Diagnosis – The new species is characterized by polygonal or slightly irregular ascomata as seen from above and a well-developed excipulum.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3751 N; 99.4259 E, alt. ca. 4004 m, on dead bark of *Rhododendron* sp. (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1823 (BJTC 2022040, holotype).

Etymology – *polygonum* (lat.) = polygonal, referring to the polygonal or slightly irregular ascomata as seen from above.

Sexual morph: *Ascomata* erumpent from bark, scattered. As seen from above, ascomata polygonal or slightly irregular, 1500–2700 × 1500–3750 µm, black, tortoise crack, opening by irregular splits to expose the hymenium. *Lip cells* absent. In median vertical section, ascomata 1200–1400 µm high. *Covering stroma* 120–360 µm thick near the centre of the ascomata, slightly thinner towards the edges, consisting of an outer layer of carbonized, thick-walled, angular to globose cells, and an inner layer formed by clusters of slightly longer, pale brown, globose cells. The stalk of the ascomata is formed by an outer layer of carbonized, thick-walled, angular to globose cells with remains of host tissue adhering to its surface, and an inner layer of hyaline hyphae with some irregular crystalloids. *Periphysoids* absent. *Excipulum* well-developed, formed by marginal paraphyses. *Basal stroma* absent. *Internal matrix of stroma* 850–1000 µm thick, consisting of hyaline hyphae with some irregular crystalloids. *Subhymenium* 160–200 µm thick, consisting of textura intricata. *Paraphyses* aseptate, filiform, not branched, swollen to 3–4 µm diam. at their tips, 240–270 × 1–2 µm, covered by a thin gelatinous sheath. *Asci* ripening sequentially, clavate, apex obtuse to round, 130–200 × 15–23 µm, hyaline, thin-walled, long-stalked, without circumapical thickening, J–, 8-spored. *Ascospores* aseptate, elliptical to elongated

elliptical, both ends slightly acute, $25\text{--}30 \times 8\text{--}10 \mu\text{m}$, hyaline, covered by a $3\text{--}5 \mu\text{m}$ thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

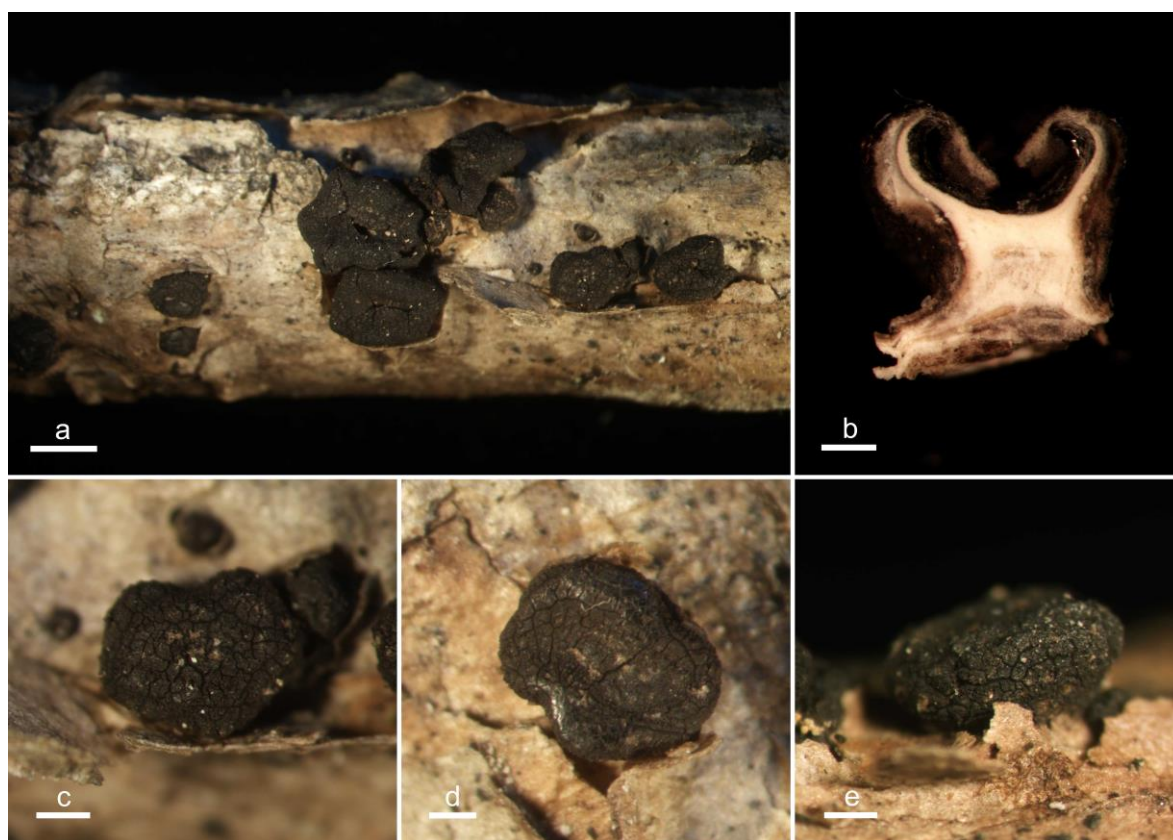


Figure 20 – *Neotrybliopsis polygonalis* (HOU 1823/BJTC 2022040, holotype). a Ascomata on a twig of *Rhododendron* sp. b Ascoma in median vertical section. c–d Immature ascomata. e Side view of ascoma. Scale bars: a = 2 mm, b–e = $500 \mu\text{m}$.

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3751 N ; 99.4259 E , alt. ca. 4004 m, on bark of *Rhododendron* sp. (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1822A (BJTC 2022039, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – The new species is closely related to *Neotrybliopsis yunnanensis*, but *Ne. yunnanensis* has triangular to quadrangular ascomata, no excipulum, a thinner subhymenium ($80\text{--}120 \mu\text{m}$), paraphyses that are sometimes branched, as well as cylindrical-clavate and longer ($200\text{--}350 \mu\text{m}$) asci. The sequence similarity of ITS rDNA between these two species is 90%.

Neotrybliopsis yunnanensis M.J. Guo & C.L. Hou, sp. nov.

Figs 22–23

Mycobank number: MB852662; Facesoffungi number: FoF15623

Diagnosis – This new species is similar to *Neotrybliopsis polygonalis*, but differs by triangular to quadrangular ascomata, no excipulum, a thinner subhymenium, paraphyses that are sometimes branched, and cylindrical-clavate, longer asci.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, alt. ca. 3400 m, on dead bark of *Rhododendron clementinae* (*Ericaceae*), 4 Aug 2006, C.L. Hou, HOU 366 (BJTC 2022041, holotype).

Etymology – Referring to the name of the province (Yunnan) where the specimen was collected.

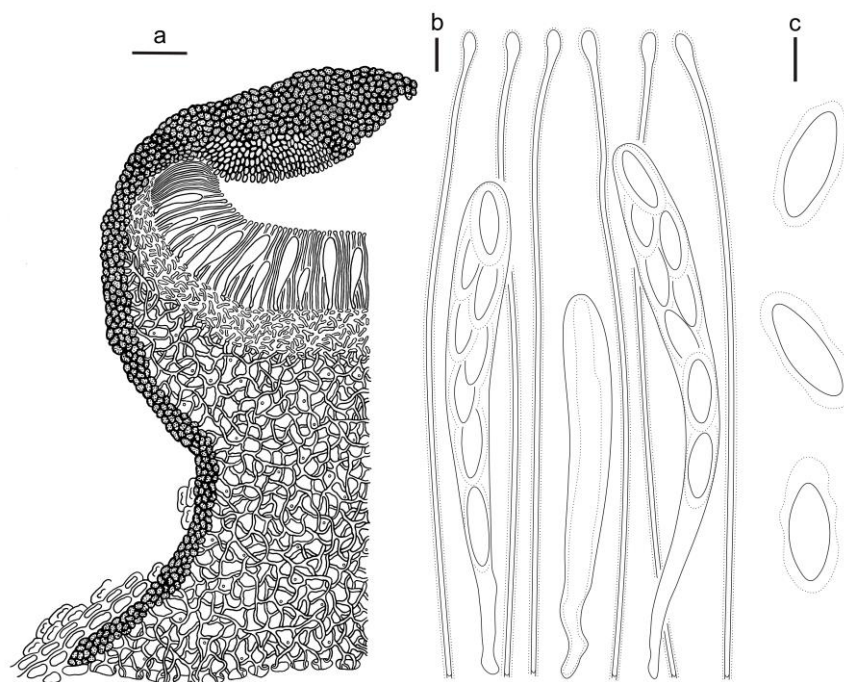


Figure 21 – *Neotrybliopsis polygonalis* on *Rhododendron* sp. (HOU 1823/BJTC 2022040, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 200 μ m, b–c = 10 μ m.

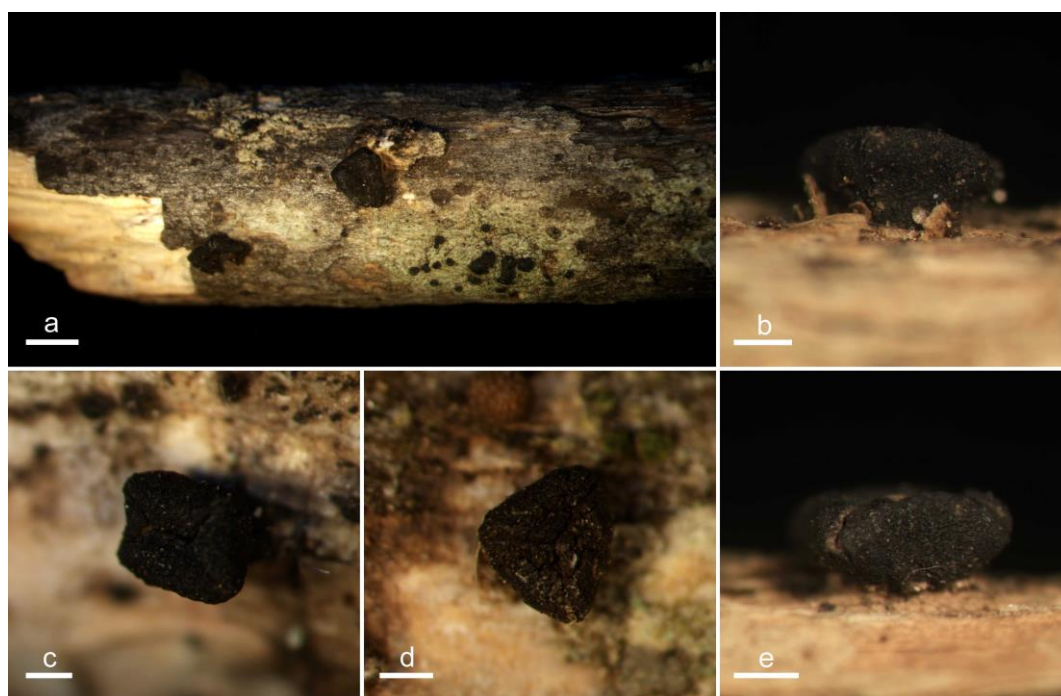


Figure 22 – *Neotrybliopsis yunnanensis* (HOU 366/BJTC 2022041, holotype). a Ascoma on a twig of *Rhododendron clementinae*. b Side view of ascoma. c–d Mature ascomata. e Side view of ascoma. Scale bars: a = 2 mm, b–e = 500 μ m.

Sexual morph: *Ascomata* erumpent from bark. As seen from above, ascomata triangular to quadrangular, 1250–1700 $\times$ 1100–1400 μ m, dark brown to black, opening by three to four teeth or irregular splits to expose the hymenium. *Lip cells* absent. In median vertical section, ascomata 900–1300 μ m high. *Covering stroma* 150–200 μ m thick near the centre of the ascomata, slightly thinner

toward the edges, consisting of carbonized, thick-walled, angular to globose cells, remains of host tissue adhering to the stalk of the ascomata. *Periphysoids* absent. *Basal stroma* absent. *Internal matrix of stroma* 560–610 μm thick, consisting of pale brown to hyaline hyphae. *Subhymenium* 80–120 μm thick, consisting of *textura intricata*. *Excipulum* absent. *Paraphyses* aseptate, filiform, sometimes branched, swollen to 4–6 μm diam. at their tips, 350–400 $\times$ 1–2.5 μm , covered by a thin gelatinous sheath. *Asci* ripening sequentially, cylindrical-clavate, apex obtuse to round, 200–350 $\times$ 17–28 μm , thin-walled, long-stalked, without circumapical thickening, J–, 8-spored. *Ascospores* aseptate, elliptical, both ends slightly acute, 26–35 $\times$ 6–14 μm , hyaline, covered by a 4–7 μm thick gelatinous sheath.

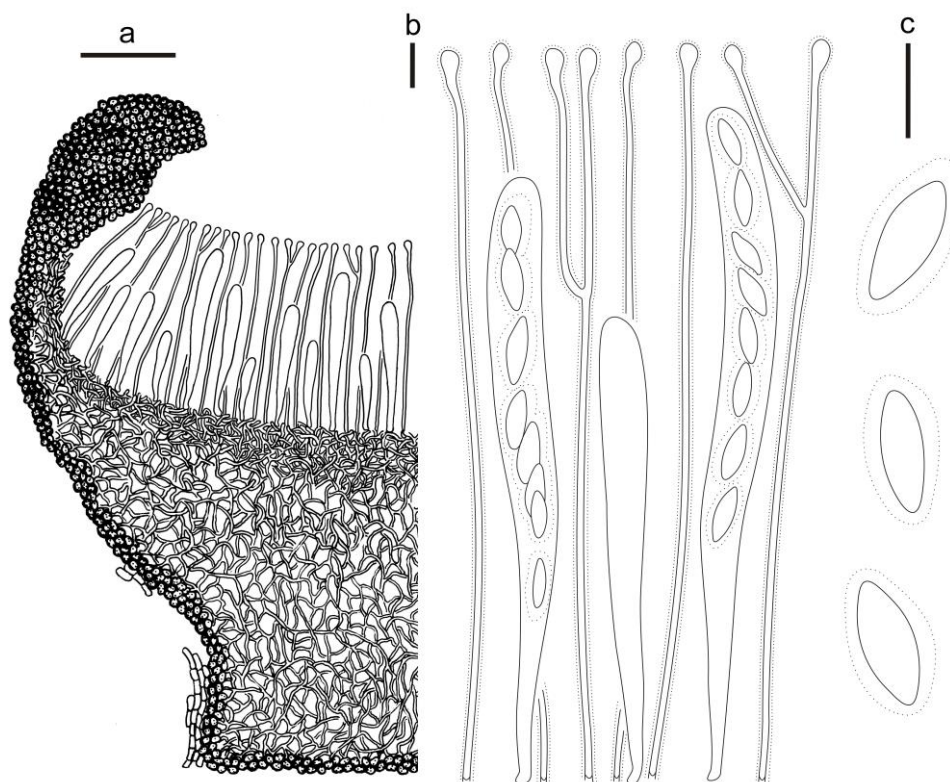


Figure 23 – *Neotrybliopsis yunnanensis* on *Rhododendron clementinae* (HOU 366/BJTC 2022041, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 200 μm , b–c = 20 μm .

Asexual morph: *Conidiomata* and *zone line* not observed.

Additional specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, alt. ca. 3500 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 11 Jul 2007, C.L. Hou, HOU 440 (BJTC 2022042, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3750 N; 99.4327 E, alt. ca. 3852 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 17 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1591 (BJTC 2022046, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3877 m, on bark of *Rhododendron* sp. (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1600 (BJTC 2022047, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3754 N; 99.4330 E, alt. ca. 3837 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 17 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1606 (BJTC 2022048, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3905 N; 99.4632 E, alt. ca. 3505 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 20 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1753 (BJTC 2022043, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3755 N; 99.4330 E, alt. ca. 3869 m, on bark of *Rhododendron clementinae* (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1776 (BJTC 2022044, paratype); CHINA, Yunnan Province,

Lijiang, Laojunshan, 26.3754 N; 99.4332 E, alt. ca. 3843 m, on bark of *Rhododendron clementinae* (Ericaceae), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1788 (BJTC 2022045, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – The new species is similar to *Neotrybliopsis polygonalis*, but the latter is characterized by polygonal or slightly irregular ascomata, the presence of an excipulum, a thicker internal matrix in the stroma (850–1000 µm) of hyaline hyphae with some irregular crystalloids, a thicker subhymenium (160–200 µm), not branched paraphyses, and shorter (130–200 µm) as well as narrower (12–23 µm) asci.

***Occultimyces* M.J. Guo & C.L. Hou, gen. nov.**

Mycobank number: MB852663; Facesoffungi number: FoF15601

Etymology – *occultus* (lat.) = hidden, referring to the inconspicuous ascomata.

Sexual morph: *Ascomata* on living twigs of *Rhododendron* sp., circular to elliptical, dark brown, scattered, opening by irregular splits. *Lip cells* absent. *Ascomata* intraepidermal. *Covering stroma* and *basal stroma* well developed, consisting of carbonized, thick-walled, globose to angular cells. *Internal matrix of stroma* well developed, consisting of thin-walled angular to globose cells. *Subhymenium* flat, consisting of textura intricata. *Paraphyses* filiform, swollen at their tips. *Asci* ripening sequentially, cylindrical to clavate, J–, 8-spored. *Ascospores* aseptate, elongated fusiform, without a gelatinous sheath.

Type species – *Occultimyces fusiformis* M.J. Guo & C.L. Hou, described below

Notes – Molecular sequences of ITS, nrLSU, and mtSSU rDNA of *Occultimyces fusiformis* form a distinct lineage with high support in the phylogenetic tree with 100% MLB, 99% MPB, and 1.00 PP bootstrap support (Clade 12, Fig. 1). The sister clade is formed by sequences from species of diverse genera, namely *Bifusella*, *Cryptomyces*, *Hypoderma*, and *Hypohelion*. In morphology, *Occultimyces* differs from these and other genera of *Rhytismatales* by inconspicuous ascomata on twigs of *Rhododendron* spp. and elongated fusiform ascospores without a gelatinous sheath.

***Occultimyces fusiformis* M.J. Guo & C.L. Hou, sp. nov.**

Figs 24–25

Mycobank number: MB852664; Facesoffungi number: FoF15624

Diagnosis – This new species is characterized by inconspicuous ascomata and elongated fusiform ascospores without a gelatinous sheath.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, alt. ca. 4200 m, on living twigs of *Rhododendron* sp. (Ericaceae), 11 Jul 2007, C.L. Hou, HOU 458A (BJTC 2022049, holotype).

Etymology – *fusus* (lat.) = spindle, referring to the shape of the ascospores.

Sexual morph: *Ascomata* on living twigs of *Rhododendron* sp., scattered. In surface view, ascomata difficult to see, circular to elliptical or slightly irregular and crinkled, 600–1000 µm diam., dark brown, concolorous with the surface of the twig when young, slightly erumpent from the surface of the host tissue at maturity, without obvious preformed lines of dehiscence, opening by irregular splits to expose a pale-yellow hymenium. *Lip cells* absent. In median vertical section, ascomata intraepidermal. *Covering stroma* 40–85 µm thick near the center of the ascomata, slightly thinner towards the edges, consisting of the outer remains of the host epidermis with cuticle and an inner layer of carbonized, thick-walled, angular to globose cells. *Periphysoids* absent. *Basal stroma* 10–20 µm thick, flat, consisting of 4–12 µm diam., carbonized, thick-walled, angular to globose cells. *Internal matrix of the stroma* 50–90 µm thick, consisting of 6–15 µm diam., hyaline, thin-walled, angular to globose cells. *Subhymenium* 35–45 µm thick, consisting of textura intricata. *Excipulum* absent. *Paraphyses* aseptate, filiform, swollen to 3–4 µm diam. at their tips, 150–200 × 1–2 µm, usually covered by a thin gelatinous sheath. *Asci* ripening sequentially, cylindrical to clavate, apex obtuse to round, 75–120 × 9–15 µm, thin-walled, J–, 8-spored. *Ascospores* aseptate, elongated fusiform, slightly curved, both ends acute, 25–45 × 3–6 µm, hyaline.

Asexual morph: *Conidiomata* and *zone lines* not seen.

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, alt. ca. 4000 m, on twigs of *Rhododendron clementinae* (Ericaceae), 25 Jun 2011, C.L. Hou, HOU 877A (BJTC 2022050, paratype).

Known distribution – Known only from Yunnan Province, China.

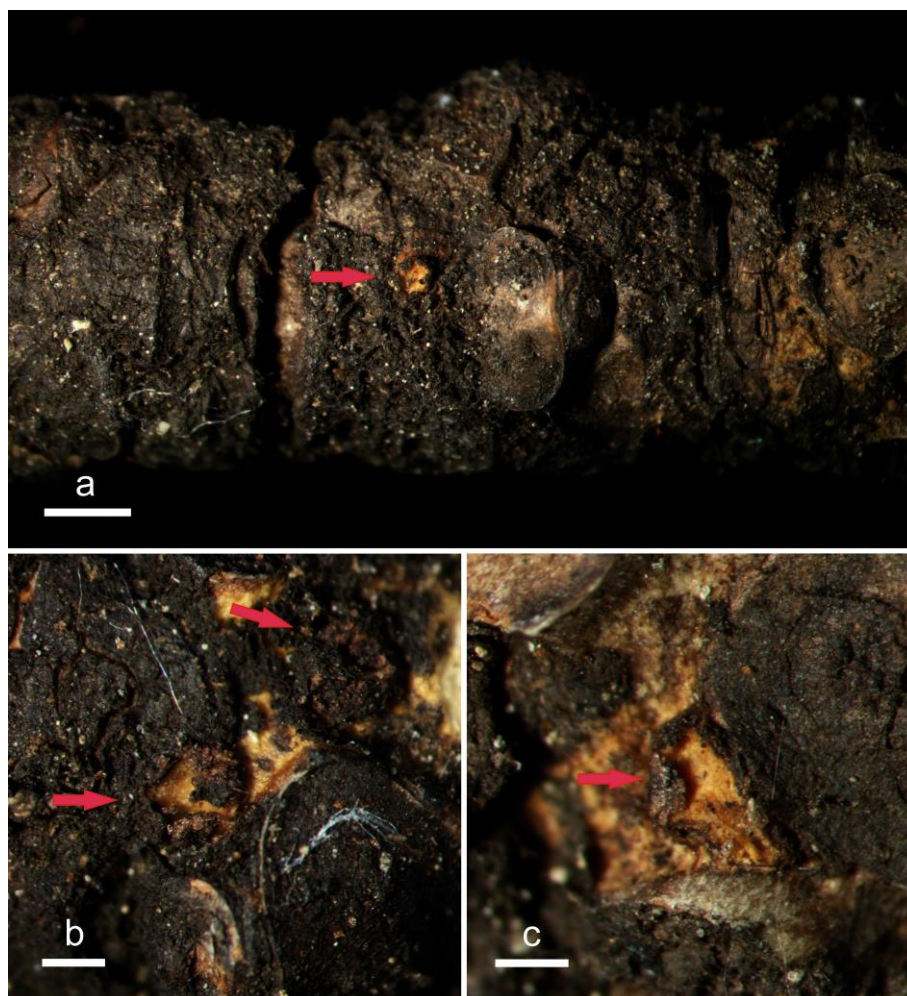


Figure 24 – *Occultimyces fusiformis* (HOU 458A/BJTC 2022049, holotype). a Ascoma on a twig of *Rhododendron* sp. b One mature and one immature ascoma. c Mature ascoma. Ascomata are indicated by red arrows. Scale bars: a = 2 mm, b–c = 500 µm.

Notes – The shape of the ascospores of *Occultimyces fusiformis* is similar to the shape of the ascospores of *Therrya abieticola* C. L. Hou & M. Piepenbr. and *Coccomyces guizhouensis* Y.R. Lin & B.F. Hu, but *Occultimyces fusiformis* is only distantly related to these species in the phylogenetic tree. *Therrya abieticola* grows on twigs of *Abies* sp. and has a basal stroma consisting of short, hyaline hyphae and small cells as well as a subhymenium consisting of small, hyaline cells. *Coccomyces guizhouensis* grows on twigs of *Pinus armandii* Franch. and has filiform-fusiform ascospores with a 1–2 µm thick gelatinous sheath.

Rhodohypoderma M.J. Guo, M. Piepenbr. & C.L. Hou, gen. nov.

Mycobank number: MB852665; Facesoffungi number: FoF15602

Etymology – *rhodo-* (lat.) = rose-, referring to the reddish-brown lips; *-hypoderma*, referring to some morphological similarities with species of the genus *Hypoderma*.

Sexual morph: *Ascomata* on living twigs of *Rhododendron* sp., scattered, usually associated with pale areas, subround to elliptical, black to dark brown, opening by a longitudinal split. *Lips* well-developed, reddish brown. *Ascomata* intraepidermal. *Epithecium* occasionally present.

Covering stroma well developed, consisting of carbonized, thick-walled, angular cells, aliform cells or textura epidermoidea. Basal stroma well developed, consisting of carbonized, thick-walled, angular cells or textura epidermoidea. Internal matrix of stroma absent. Subhymenium flat or slightly depressed, consisting of textura intricata, textura porrecta or thin-walled, angular cells. Paraphyses filiform, simple or branched, not swollen at their tips. Asci ripening sequentially, cylindrical or clavate, thin-walled, J-, 8-spored. Ascospores aseptate, elliptical to elongated elliptical or clavate, hyaline, covered by a gelatinous sheath.

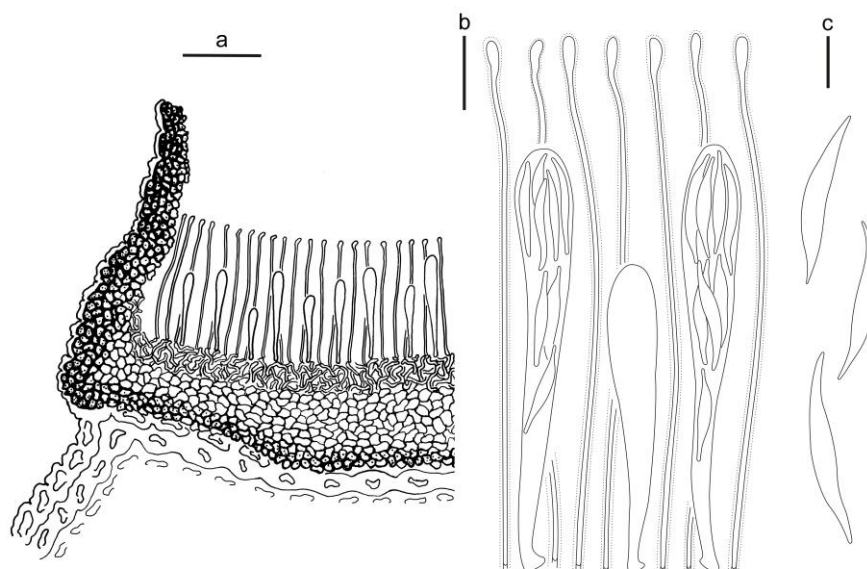


Figure 25 – *Occultimyces fusiformis* on *Rhododendron* sp. (HOU 458A/BJTC 2022049, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and an immature ascus. c Liberated ascospores. Scale bars: a = 100 μ m, b = 20 μ m, c = 10 μ m.

Asexual morph: *Conidiomata* scattered, round to elliptical or slightly irregular, brown to dark brown, opening by an ostiole to liberate the conidia. In vertical section, conidiomata intraepidermal. *Conidiogenous cells* cylindrical but tapering towards the apex, hyaline. *Conidia* cylindrical, hyaline.

Type species – *Rhodohypoderma rhododendri* M.J. Guo & C.L. Hou, described below

Notes – The species of *Rhodohypoderma* correspond to an independent clade with high support values with 100% MLB, 95% MPB, and 1.00 PP bootstrap support (Clade 15, Fig. 1). This group is only distantly related to *Hypoderma rubi*, the type species of *Hypoderma*, according to results in the phylogenetic tree. Morphologically, *Rhodohypoderma* is similar to *Hypoderma*, but *Rhodohypoderma* spp. occur on living twigs of *Rhododendron* spp., have intraepidermal ascomata, and well-developed, reddish-brown lip cells, while typical species of *Hypoderma* are usually saprotrophic, develop on a large number of species of herbs and woody plants belonging to diverse genera, and have elongated-elliptical to linear, subcuticular ascomata, with well-developed lip cells that are variable in colour but often pale, and a covering stroma that is abruptly thinner at the contact line with the basal stroma (Powell 1974, Johnson 1990, Lin 2012, Pastirčák & Pastirčáková 2017).

Key to species of *Rhodohypoderma* on twigs of *Rhododendron* species

1. Ascomata often slightly acute at both ends 2
1. Ascomata more or less round at both ends 3
2. Asci clavate, with slightly truncate apex; ascospores clavate *Rh. clavatum*
2. Asci cylindrical, with obtuse apex; ascospores ellipsoidal..... *Rh. cuspidatum*

3. Ascomata matt black; asci clavate*Rh. rhododendri*
 3. Ascomata shiny black; asci cylindrical.....*Rh. urniforme*

Rhodohypoderma clavatum M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 26–27

Mycobank number: MB852793; Facesoffungi number: FoF15625

Diagnosis – The new species is characterized by clavate ascospores with slightly acute base.

Holotype – CHINA, Yunnan Province, Shangri-la, Shudu Lake, alt. ca. 3538 m, on living twigs of *Rhododendron campylocarpum* (Ericaceae), 27 Jun 2011, C.L. Hou, HOU 927B (BJTC 2022051, holotype).

Etymology – *clavatus* (lat.) = clavate, referring to its clavate ascospores.

Sexual morph: *Ascomata* on twigs, scattered, associated with pale areas. In surface view ascomata elliptical to broadly elliptical, often slightly acute at both ends, 550–1100 × 450–700 µm, shiny black, slightly raising above the surface of the host tissue at maturity, with an obvious preformed dehiscence line, opening by a longitudinal split. *Lips* present. In median vertical section, ascomata intraepidermal. *Covering stroma* 35–70 µm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of host cuticle, an inner layer of 3–6 µm diam., carbonized, thick-walled, angular and aliform cells. *Lip cells* septate, cylindrical, 10–25 × 2 µm, reddish brown to hyaline, embedded in a hyaline gelatinous matrix. *Basal stroma* 15–22 µm thick, consisting of 3–6 µm diam., carbonized, thick-walled, angular cells. *Subhymenium* 10–18 µm thick, consisting of hyaline textura porrecta. *Paraphyses* filiform, 170–200 × ca. 1 µm, hyaline, thin-walled, covered by a 1–1.5 µm thick gelatinous sheath. *Asci* ripening sequentially, clavate, with a slightly truncate apex, 90–150 × 10–16 µm, hyaline, thin-walled, J–, 8-spored. *Ascospores* clavate, slightly acute at the base, 25–32 × 4–6 µm, hyaline, covered by a thin gelatinous sheath.

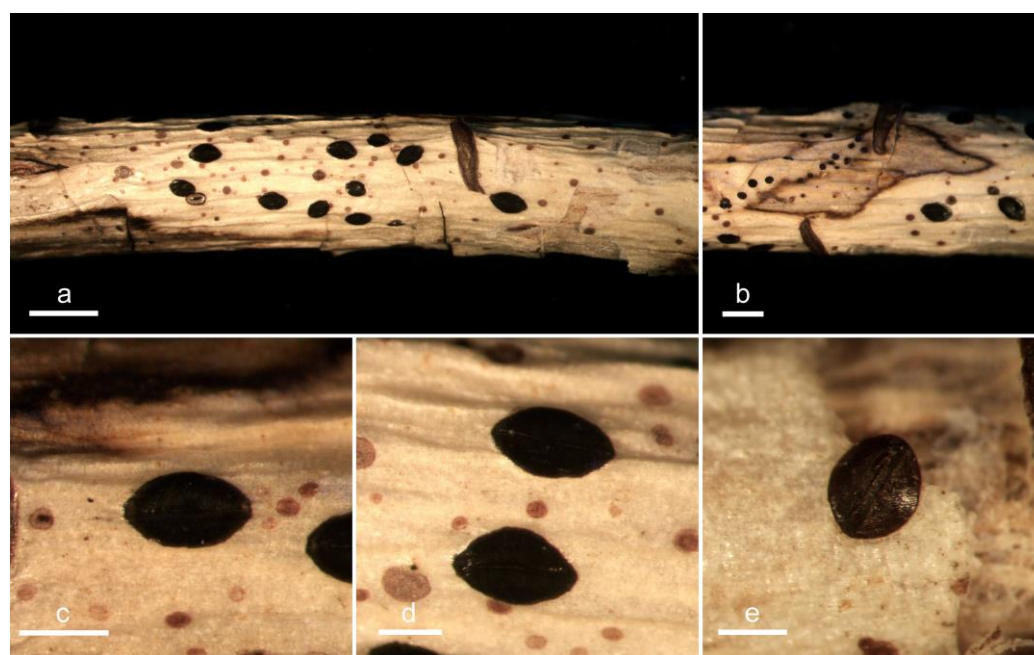


Figure 26 – *Rhodohypoderma clavatum* (HOU 927B/BJTC 2022051, holotype). a Ascomata on a twig of *Rhododendron campylocarpum*. b Conidiomata and zone lines. c–d Immature ascomata. e Mature ascoma. Scale bars: a = 2 mm, b = 1 mm, c–e = 500 µm.

Asexual morph: *Conidiomata* scattered, round to elliptical or slightly irregular, 150–275 µm diam., brown to dark brown, opening by an ostiole to liberate the conidia. In vertical section, conidiomata intraepidermal, 50–60 µm deep. *Upper layer* 5–8 µm thick, consisting of host cuticle and carbonized angular to globose cells. *Basal layer* 10–16 µm thick, consisting of carbonized angular to globose cells. *Conidiogenous cells* cylindrical but tapering towards the apex, 15–26 × 1–2 µm, hyaline. *Conidia* cylindrical, 5–9 × 1 µm, hyaline.

Zone lines infrequent, dark brown.

Known distribution – Known only from Yunnan Province, China.

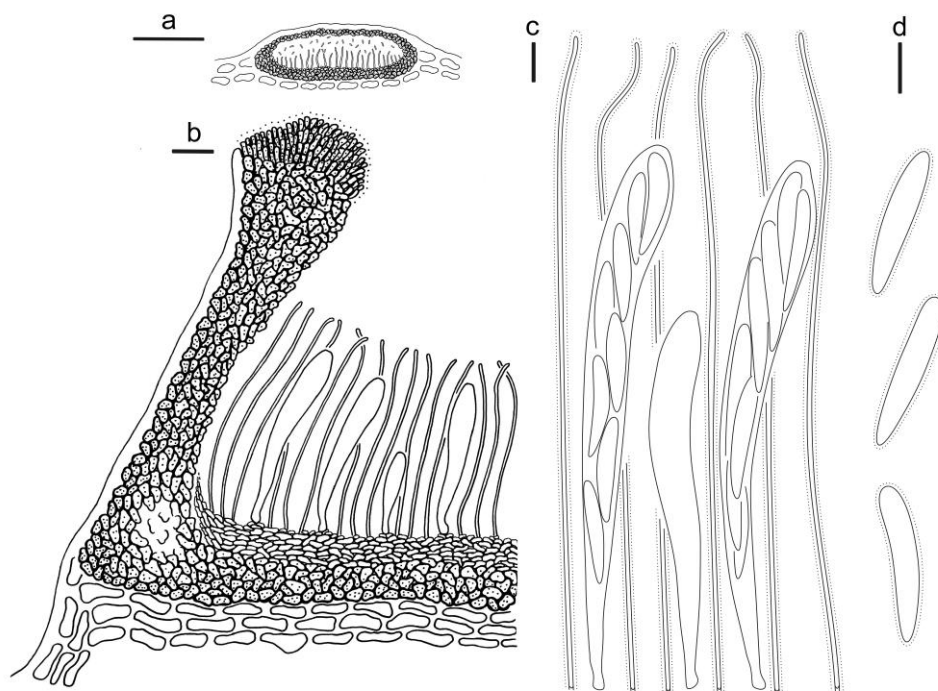


Figure 27 – *Rhodohypoderma clavatum* on *Rhododendron campylocarpum* (HOU 927B/BJTC 2022051, holotype). a Vertical section of a conidioma. b Vertical section part of an ascoma (part). c Paraphyses, mature asci with ascospores, and immature ascus. d Liberated ascospores. Scale bars: a = 100 μ m, b = 20 μ m, c–d = 10 μ m.

Notes – The phylogenetic analysis shows that *Rhodohypoderma clavatum* (HOU 927B) is closely related to *Rhodohypoderma cuspidatum* (C.L. Hou & M. Piepenbr.) M.J. Guo & C.L. Hou (HOU 484A, HOU 895A) and *Rhodohypoderma urniforme* (C.L. Hou & M. Piepenbr.) M.J. Guo & C.L. Hou (HOU 879B, HOU 1795B). *Rhodohypoderma cuspidatum*, however, has ascomata with more acute ends, a covering stroma consisting of somewhat disorganized textura epidermoidea, a basal stroma of textura epidermoidea, a subhymenium of textura intricata, cylindrical asci, as well as ellipsoidal ascospores containing two guttules of different size and covered by a 4–9 μ m thick gelatinous sheath. *Rhodohypoderma urniforme* has elliptical ascomata, a covering stroma consisting of somewhat disorganized textura epidermoidea, a thicker basal stroma (30–45 μ m), a subhymenium consisting of textura intricata, cylindrical asci, as well as shorter (14–20 μ m) and wider (7–10 μ m) ascospores often with an irregular gelatinous sheath.

Rhodohypoderma cuspidatum (C.L. Hou & M. Piepenbr.) M.J. Guo, M. Piepenbr. & C.L. Hou, comb. nov.

≡ *Hypoderma cuspidatum* C.L. Hou & M. Piepenbr., Nova Hedwigia. 82(1–2): 95. 2006

Mycobank: MB852692; Facesoffungi number: FoF15626

Holotype – CHINA, Yunnan province, Lijiang, Baishui, alt. ca. 3000 m, on *Rhododendron* sp. (*Ericaceae*), 25 Jul 2001, C.L. Hou, M. Piepenbring, R. Kirschner, and Z.L. Yang, 150a (HMAS).

Specimen examined – CHINA, Yunnan province, Lijiang, Baishui, alt. ca. 3000 m, on *Rhododendron* sp. (*Ericaceae*), 25 Jul 2001, C.L. HOU, HOU 150a (BJTC 2022250). CHINA, Yunnan province, Lijiang, Baishui, alt. ca. 3000 m, on *Rhododendron* sp. (*Ericaceae*), 25 Jul 2001, C.L. HOU, HOU 147 (BJTC 2022251).

Notes – For a detailed description and illustrations of this species see Lin (2012) and Hou & Piepenbring (2006). Molecular sequence data of *Hypoderma cuspidatum* (HOU 484A, HOU 895A) clusters together with those of other *Rhodohypoderma* species in the phylogenetic analysis, and its morphological characteristics are completely consistent with the concept of *Rhodohypoderma*, so it is transferred to *Rhodohypoderma*.

Rhodohypoderma rhododendri M.J. Guo & C.L. Hou, sp. nov.

Figs 28–29

MycoBank number: MB852667; Facesoffungi number: FoF15627

Diagnosis – *Rhodohypoderma rhododendri* is similar to *Rhodohypoderma urniforme*, but differs significantly from the latter by a thinner covering stroma consisting of angular and aliform cells, a thinner basal stroma and a subhymenium, clavate asci, and ascospores with thicker gelatinous sheaths.

Holotype – CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0504 N; 102.5053 E, alt. ca. 3823 m, on living twigs of *Rhododendron clementinae* (Ericaceae), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1840A (BJTC 2022054, holotype).

Etymology – Referring to the host, *Rhododendron clementinae*.

Sexual morph: *Ascomata* on twigs, scattered, associated with pale areas. In surface view ascomata subround to elliptical, 350–700 × 500–1000 µm, black, slightly raising above the surface of the host tissue at maturity, with an obvious preformed dehiscence line, opening by a longitudinal split. *Lips* present. In median vertical section, ascomata intraepidermal. *Covering stroma* 40–56 µm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of host cuticle, an inner layer of 3–5 µm diam., carbonized, thick-walled angular and aliform cells, covering stroma often split parallel to the surface (paradermally) close to the dehiscence line. *Lip cells* septate, cylindrical, 10–30 × 2 µm, with wine red color. *Basal stroma* 14–18 µm thick, consisting of 3–6 µm diam., carbonized, thick-walled, angular cells. *Subhymenium* 8–10 µm thick, consisting of hyaline, angular cells. *Paraphyses* filiform, often branched, 180–200 × ca. 1 µm, hyaline, thin-walled, covered by a 1–2 µm thick gelatinous sheath. *Asci* ripening sequentially, clavate, slightly truncate at the apex, 105–175 × 12.5–17.5 µm, hyaline, thin-walled, J–, 8-spored. *Ascospores* elliptical, 14–18 × 6–8 µm, hyaline, covered by a 3–6 µm thick gelatinous sheath.

Asexual morph: *Conidiomata* scattered, round to subround or slightly irregular, 125–250 µm diam., dark brown, opening by an ostiole to liberate the conidia. In vertical section, conidiomata intraepidermal, 55–85 µm deep. *Upper layer* 15–20 µm thick, consisting of host cuticle and carbonized angular to globose cells. *Basal layer* 8–15 µm thick, consisting of carbonized angular to globose cells. *Conidiogenous cells* and *conidia* not seen.

Zone lines infrequent, dark brown.

Additional specimen examined – CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0509 N; 102.5059 E, alt. ca. 3830 m, on twigs of *Rhododendron* sp. (Ericaceae), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1857 (BJTC 2022055, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – *Rhodohypoderma rhododendri* is similar to *Rh. urniforme*, but *Rh. urniforme* has a thicker covering stroma (70–90 µm) consisting of somewhat disorganized textura epidermoidea, a thicker basal stroma (30–45 µm), a thicker subhymenium (10–15 µm), cylindrical asci, and ascospores with a thin gelatinous sheath.

Rhodohypoderma urniforme (C.L. Hou & M. Piepenbr.) M.J. Guo, M. Piepenbr. & C.L. Hou, comb. nov.

≡ *Hypoderma urniforme* C.L. Hou & M. Piepenbr., Nova Hedwigia 84(3-4): 488. 2007

MycoBank number: MB852693; Facesoffungi number: FoF15628

Holotype – CHINA, Yunnan province, Lijiang, Baishui, alt. ca. 3000 m, on *Rhododendron* sp. (Ericaceae). 25 Jul 2001, C.L. Hou, M. Piepenbring, R. Kirschner, and Z.L. Yang, 147a (HMAS).

Specimens examined – CHINA, Yunnan province, Lijiang, Baishui, alt. ca. 3000 m, on *Rhododendron* sp. (*Ericaceae*), 25 Jul 2001, C.L. Hou, HOU 147a (BJTC 2022252). CHINA, Yunnan province, Lijiang, Baishui, alt. ca. 3000 m, on *Rhododendron* sp. (*Ericaceae*), 25 Jul 2001, C.L. Hou, HOU 147d (BJTC 2022252); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3751 N; 99.4337 E, alt. ca. 3856 m, on living twigs of *Rhododendron clementinae* (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1795B (BJTC 2022056).

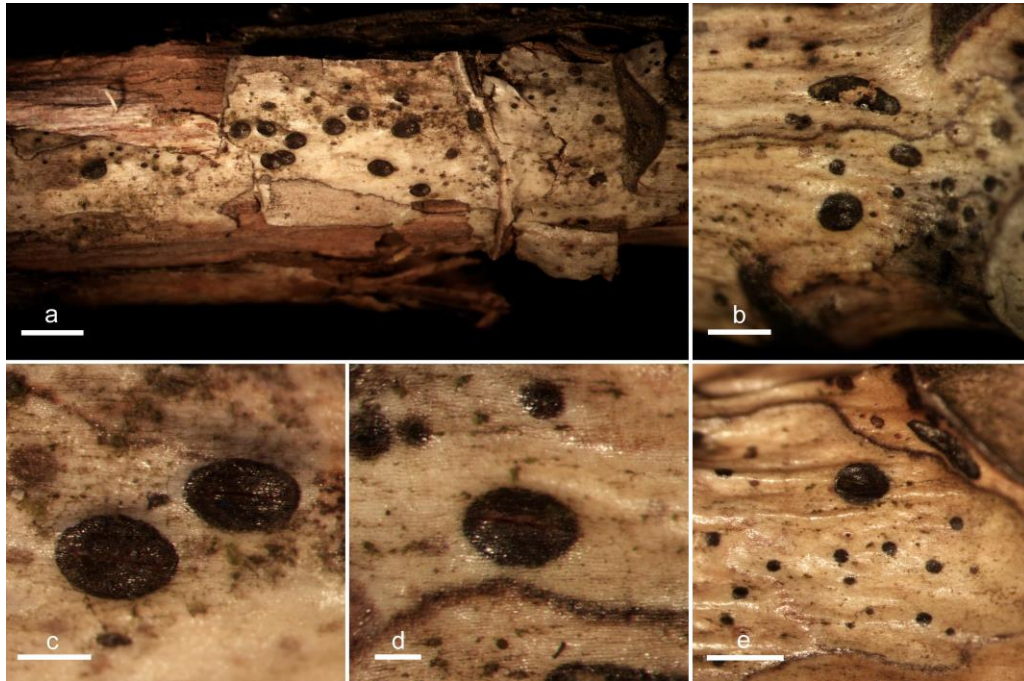


Figure 28 – *Rhodohypoderma rhododendri* (HOU 1840A/BJTC 2022054, holotype). a Ascomata on a twig of *Rhododendron clementinae*. b Zone lines. c Immature ascomata. d Mature ascomata. e Conidiomata and zone lines. Scale bars: a = 2 mm, b = 1 mm, c = 500 μm , d = 200 μm , e = 1 mm.

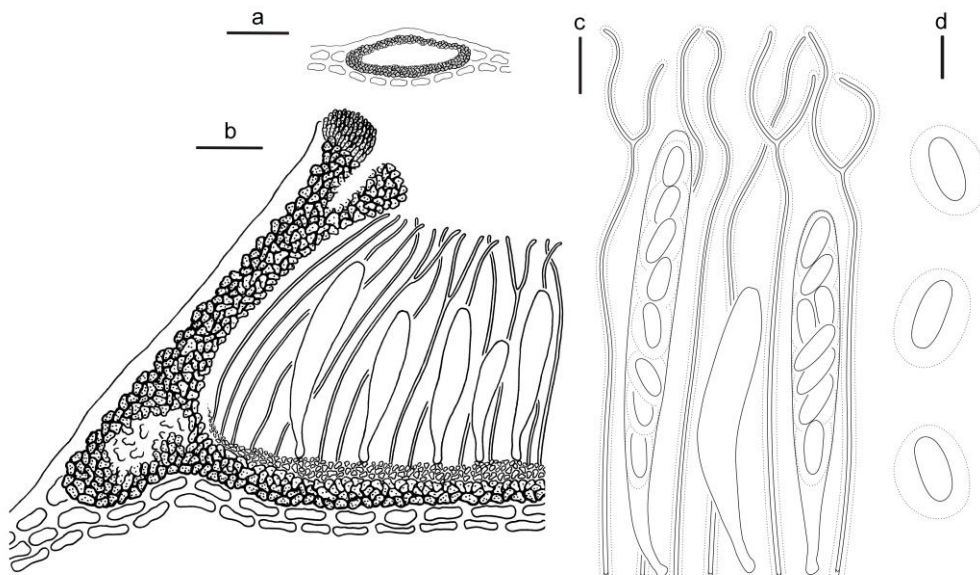


Figure 29 – *Rhodohypoderma rhododendri* on *Rhododendron clementinae* (HOU 1840A/BJTC 2022054, holotype). a Vertical section of a conidioma. b Vertical section part of an ascoma. c Paraphyses, mature asci with ascospores, and immature ascus. d Liberated ascospores. Scale bars: a = 100 μm , b = 50 μm , c = 20 μm , d = 10 μm .

Notes – For a detailed description and illustrations of this species see Lin (2012) and Hou & Piepenbring (2007). Molecular sequence data of *Hypoderma urniforme* (HOU 879B, HOU 1795B) clusters together with those of other species of *Rhodohypoderma* in the phylogenetic analysis, and its morphological characteristics are completely consistent with the concept of *Rhodohypoderma*, so it is transferred to *Rhodohypoderma*.

Septofusella M.J. Guo & C.L. Hou, gen. nov.

MycoBank number: MB852668; Facesoffungi number: FoF15603

Etymology – *septum* (lat.) = partition, and *fusus* (lat.) = spindle, referring to the shape of ascospores.

Sexual morph: *Ascomata* on living twigs of *Rhododendron* sp., more or less elliptical, black, scattered, associated with pale areas, opening by a longitudinal split. *Lips* absent. *Ascomata* intraepidermal. *Covering stroma* and *basal stroma* well developed, consisting of carbonized, thick-walled, globose to angular cells. Internal matrix of stroma well developed, consisting of thin-walled, hyaline, globose to angular cells. *Subhymenium* flat, consisting of hyaline textura intricata. *Paraphyses* filiform, not branched and not swollen at their tips. *Asci* ripening sequentially, clavate, thin-walled, J–, 8-spored. *Ascospores* 3-septate, fusiform, without a gelatinous sheath.

Asexual morph: *Conidiomata* round to elliptical or slightly irregular, dark brown, opening by an ostiole. In vertical section, conidiomata intraepidermal. *Conidiogenous cells* cylindrical but tapering towards the apex, hyaline. *Conidia* cylindrical, hyaline.

Type species – *Septofusella triseptata* M.J. Guo & C.L. Hou, described below

Notes – Phylogenetically, the molecular sequences of *Septofusella* species growing on living twigs of *Rhododendron* sp. form a distinct lineage with 100% MLB, 100% MPB, and 1.00 PP bootstrap support (Clade 4, Fig. 1). Morphologically, species of *Septofusella* are probably characterized by 3-septate, fusiform ascospores without a gelatinous sheath.

Septofusella triseptata M.J. Guo & C.L. Hou, sp. nov.

Figs 30–31

MycoBank number: MB852669; Facesoffungi number: FoF15629

Diagnosis – This new species is unique by 3-septate, fusiform ascospores without a gelatinous sheath.

Holotype – CHINA, Sichuan Province, Xiaojin, Jiajinshan, alt. ca. 4000 m, on living twigs of *Rhododendron* sp. (*Ericaceae*), 25 Jul 2006, C.L. Hou, HOU 292 (BJTC 2022060, holotype).

Etymology – *tres*, *tria* (lat.) = three, referring to the 3-septate ascospores.

Sexual morph: *Ascomata* on living twigs, scattered, associated with pale areas. In surface view, ascomata more or less elliptical, 950–1500 × 500–750 µm, black, raising above the surface of the host tissue at maturity, opening by a longitudinal split to expose the yellow hymenium. *Lip cells* absent. In median vertical section, ascomata intraepidermal, 350–450 µm deep. *Covering stroma* 50–110 µm thick, consisting of an outer layer of host cuticle and remains of epidermal cells filled with fungal cells, and an inner layer of 4–8 µm diam., carbonized, thick-walled, angular to globose cells. *A space triangular* in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with 7–14 µm diam., thin-walled, hyaline, angular to globose cells. *Basal stroma* 15–25 µm thick, almost flat, consisting of carbonized, thick-walled, angular to globose cells. *Internal matrix of stroma* 35–70 µm thick, consisting of thin-walled, hyaline, angular to globose cells. *Subhymenium* 15–25 µm thick, consisting of hyaline textura intricata. *Paraphyses* aseptate, filiform, not branched, curved at the tips, 200–260 × 2–2.5 µm, covered by a thin gelatinous sheath. *Asci* ripening sequentially, clavate, 165–220 × 20–26 µm, often with a short stalk, thin-walled, J–, 8-spored. *Ascospores* 3-septate at maturity, fusiform, 37–48 × 8–13 µm, hyaline, without a gelatinous sheath.

Asexual morph: *Conidiomata* round to elliptical or slightly irregular, 125–250 × 150–375 µm, dark brown, opening by an ostiole to liberate the conidia. In vertical section, conidiomata intraepidermal, 45–50 µm deep. *Upper layer* 10–15 µm thick, consisting of host cuticle and carbonized, angular to globose cells. *Basal layer* 10–25 µm thick, consisting of carbonized, angular

to globose cells. *Conidiogenous cells* cylindrical but tapering towards the apex, $15\text{--}20 \times 1\text{--}2 \mu\text{m}$, hyaline. *Conidia* cylindrical, $4\text{--}9 \times 1 \mu\text{m}$, hyaline.

Zone lines frequent, dark brown.

Known distribution – Known only from Sichuan Province, China.

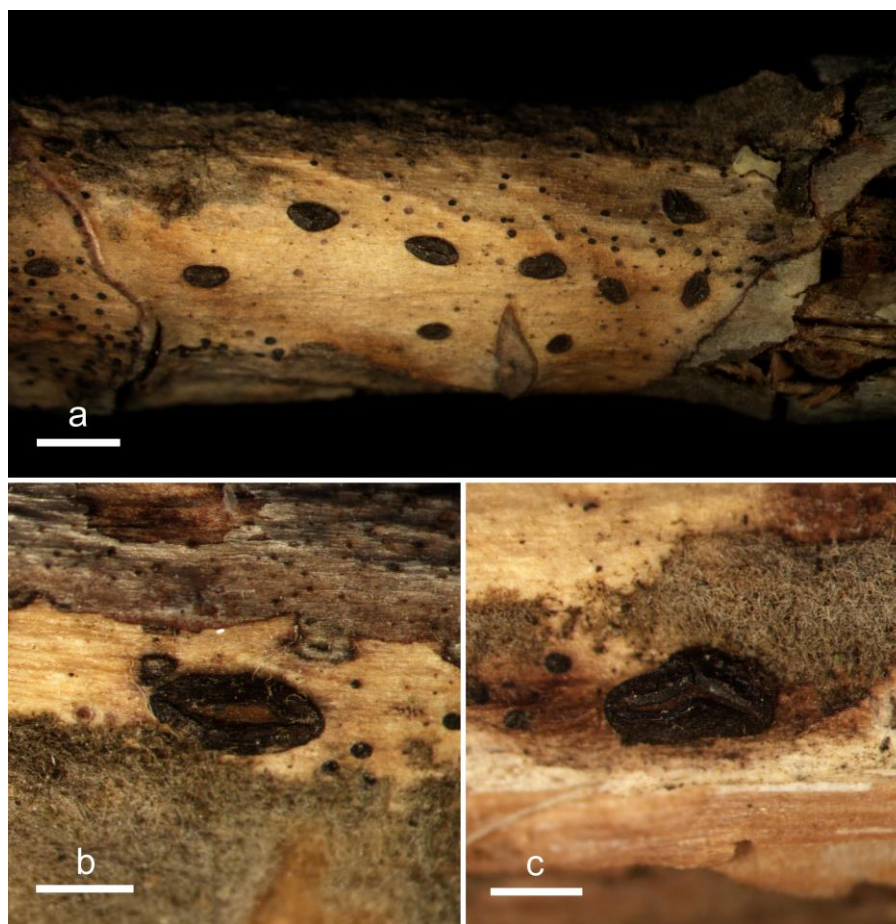


Figure 30 – *Septofusella triseptata* (HOU 292/BJTC 2022060, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 2 mm, b–c = 1 mm.

Notes – The shape of the ascospores of *Septofusella triseptata* is similar only to *Colpoma intermedium* C.L. Hou & M. Piepenbr. *Colpoma intermedium*, however, occurs on twigs of *Pinus armandii* Franch. and has ascomata with slightly dark hymenium, paraphyses with slightly swollen tips, and 3-septate, filiform to fusiform, ascospores with a thick gelatinous sheath. Additionally, *Septofusella triseptata* is distantly related to *Co. intermedium* in the ITS-nrLSU-mtSSU rDNA phylogenetic tree.

***Septofusella* sp. 1**

Fig. 32

Specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3836 N; 99.4603 E, alt. ca. 3492 m, on living twigs of *Rhododendron* sp. (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1576B (BJTC 2022059); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3751 N; 99.4337 E, alt. ca. 3856 m, on living twigs of *Rhododendron clementinae* (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1795C (BJTC 2022058).

Notes – In the multigene phylogenetic analyses, the molecular data of *Septofusella* sp. 1 (HOU 1795C and HOU 1576B) form a sister group to *Septofusella triseptata* with 100% MLB, 100% MPB, and 1.00 PP bootstrap support (Clade 4, Fig. 1), and the ITS rDNA sequence similarity of these two species is 95%. Because the two specimens are immature, they are tentatively presented as *Septofusella* sp. 1.

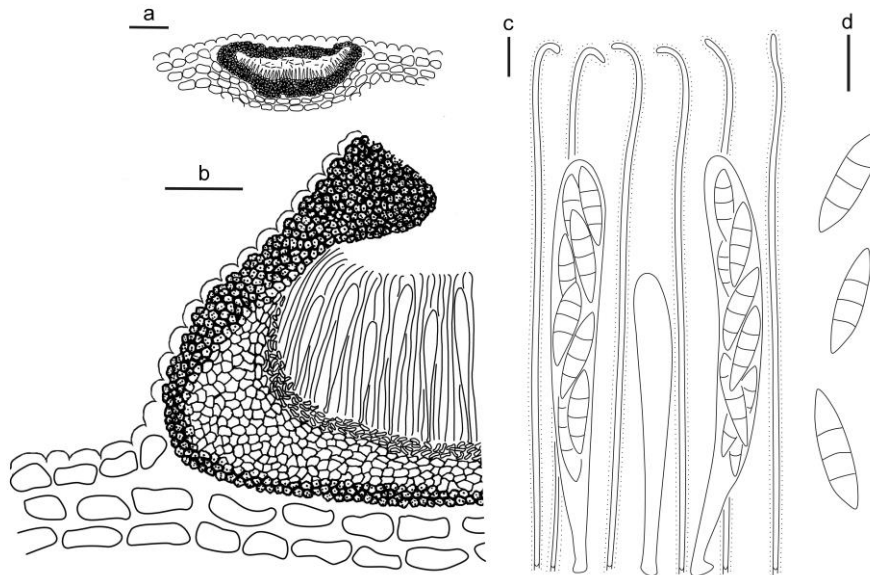


Figure 31 – *Septofusella triseptata* on *Rhododendron* sp. (HOU 292/BJTC 2022060, holotype). a Vertical section of a conidioma. b Vertical section art of an ascoma (part). c Paraphyses, mature asci with ascospores, and immature ascus. d Liberated ascospores. Scale bars: a = 50 µm, b = 100 µm, c–d = 20 µm.

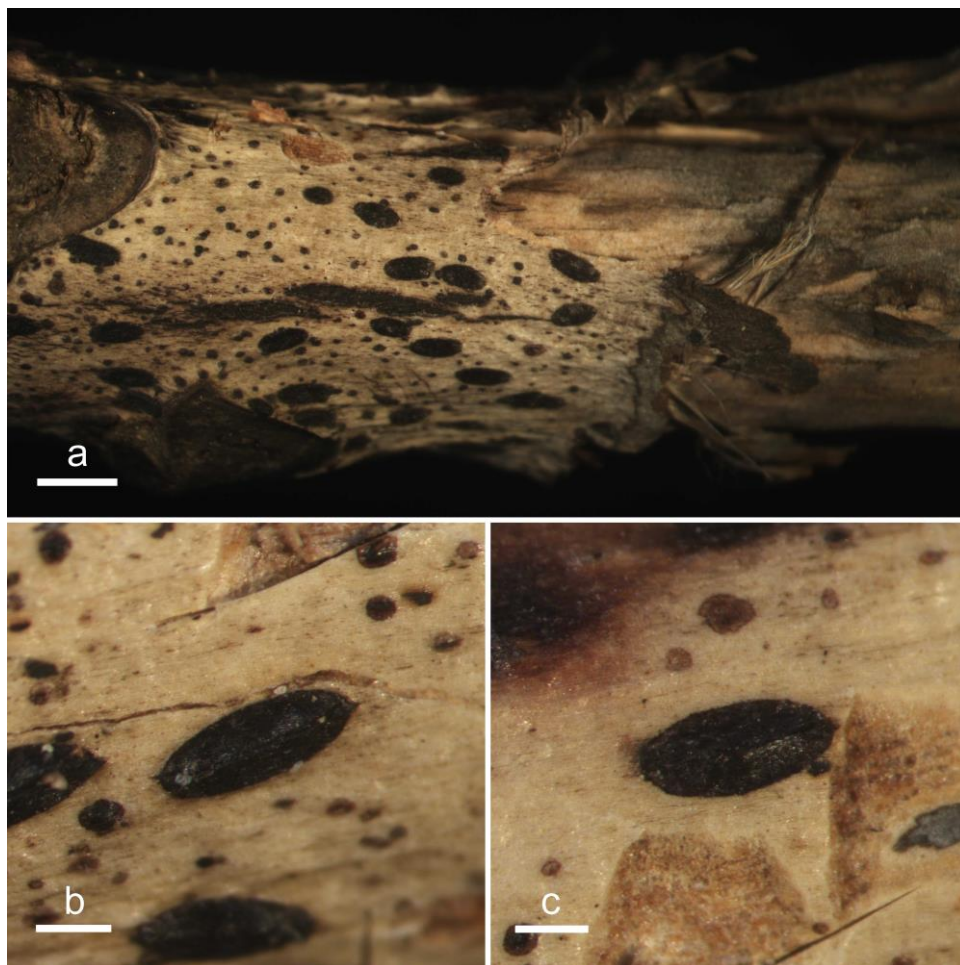


Figure 32 – *Septofusella* sp. 1 (HOU 1576B/BJTC 2022059). a Ascomata on a twig of *Rhododendron* sp. b–c Immature ascomata. Scale bars: a = 2 mm, b–c = 500 µm

Septomyces M.J. Guo & C.L. Hou, gen. nov.

MycoBank number: MB852670; Facesoffungi number: FoF15604

Etymology – Referring to the ascospores with multiple septae.

Sexual morph: *Ascomata* embedded in bark of *Rhododendron* sp., larger than 1 mm diam., widely elliptical, scattered, with a cracked cortex attached to the covering stroma, opening by irregular splits. *Lips* absent. *Ascomata* intracortical. *Covering stroma* and *basal stroma* well developed, consisting of carbonized, interwoven hyphae. *Subhymenium* flat, consisting of hyaline textura porrecta. *Paraphyses* filiform, not branched and not swollen at their tips. *Asci* ripening sequentially, cylindrical, thin-walled, J–, 8-spored. *Ascospores* with multiple septae at maturity, filiform, slightly acute at the base, covered by a thick gelatinous sheath.

Type species – *Septomyces magnus* M.J. Guo & C.L. Hou, described below

Notes – Molecular sequences of *Septomyces magnus* (HOU 368, HOU 1593A, HOU 1593Azi) cluster in a clade separated from other clades in the multiple-gene phylogenetic tree with 100% MLB, 100% MPB, and 1.00 PP bootstrap support (Clade 20, Fig. 1). The sister clade includes species of *Lophodermium* which develop smaller ascomata as well as unicellular, filiform ascospores (Johnston 1988, Lin 2012), and *Lop. conjuncta* (Darker) Darker which develops subhypodermal ascomata as well as filiform-clavate ascospores (Darker 1932). The new genus is characterized by large ascomata with a cracked cortex attached to the covering stroma and filiform ascospores with multiple septae.

Septomyces magnus M.J. Guo & C.L. Hou, sp. nov.

Figs 33–34

MycoBank number: MB852671; Facesoffungi number: FoF15630

Diagnosis – The new species is characterized by large ascomata and filiform ascospores with multiple septae.

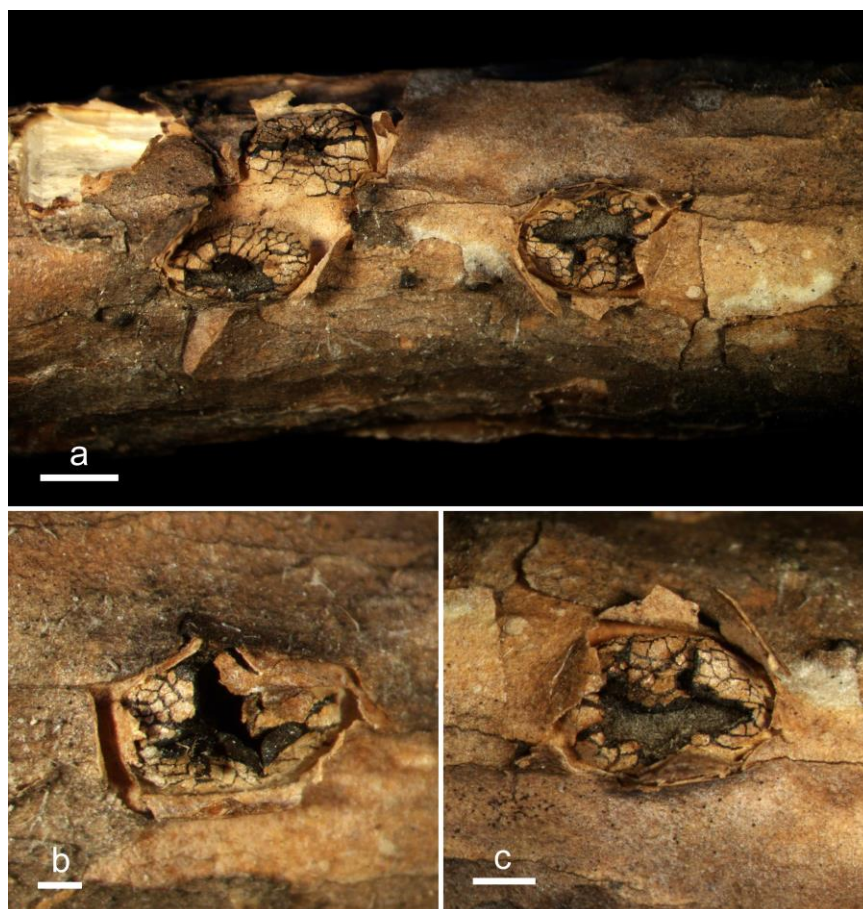


Figure 33 – *Septomyces magnus* (HOU 1593A/BJTC 2022062, holotype). a Ascomata on bark of *Rhododendron decorum*. b–c Mature ascomata. Scale bars: a = 1 mm, b = 500 µm, c = 1 mm.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3877 m, on dead bark of *Rhododendron decorum* (Ericaceae), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1593A (BJTC 2022062, holotype).

Etymology – *magnus* (lat.) = big, referring to the large ascomata.

Sexual morph: *Ascomata* embedded in bark of *Rhododendron* sp., scattered. In surface view, ascomata widely elliptical, $2.6\text{--}3.2 \times 1.5\text{--}2.2$ mm, breaking through the outer layer of the bark, concolorous with the inner surface of the bark, with cracked cortex attached to the covering stroma, strongly raising above the surface of the host tissue at maturity, opening by irregular splits to expose the black hymenium. *Lips* absent. In median vertical section, ascomata intracortical. *Covering stroma* 90–220 μm thick near the centre of ascomata, consisting of carbonized, interwoven hyphae, extending to the basal stroma, covered by tissue of the and an outer layer of remains of host cortex. *Periphysoids* absent. *Basal stroma* 180–300 μm thick, consisting of carbonized, interwoven hyphae. A *space triangular* in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with hyaline hyphae. *Subhymenium* 30–40 μm thick, consisting of textura porrecta. *Excipulum* absent. *Paraphyses* filiform, not branched, curved and not swollen at their tips, $400\text{--}450 \times \text{ca. } 1$ μm , covered by a thin gelatinous sheath, forming a poorly developed epithecium. *Asci* ripening sequentially, cylindrical, with slightly acute apex, $330\text{--}360 \times 20\text{--}25$ μm , thin-walled, J–, 8-spored. *Ascospores* first aseptate, with multiple septae at maturity, filiform, slightly acute at the base, $75\text{--}140 \times 4\text{--}5$ μm , covered by a 3–4 μm thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

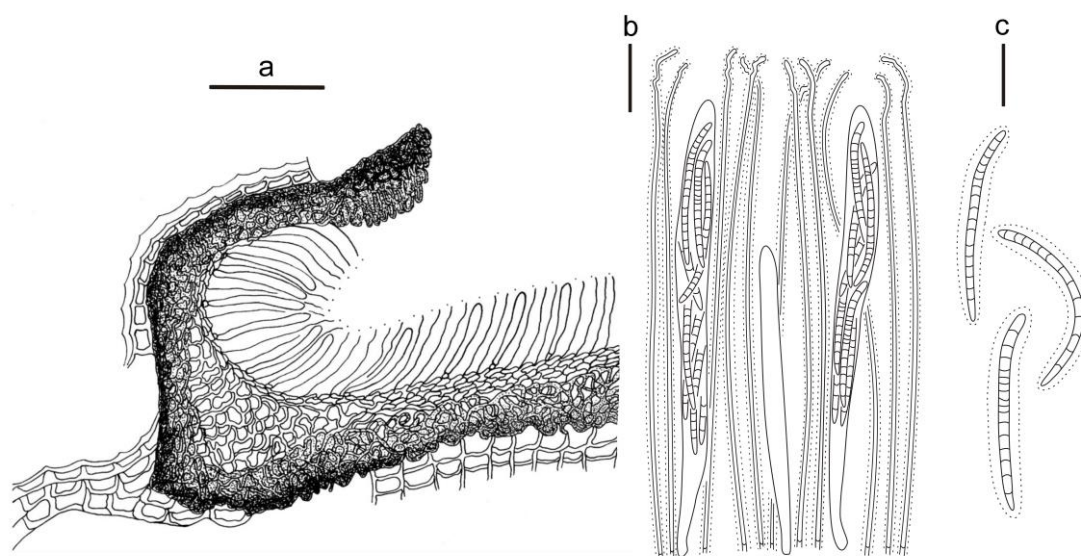


Figure 34 – *Septomyces magnus* on *Rhododendron decorum* (HOU 1593A/BJTC 2022062, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 500 μm , b–c = 50 μm .

Additional specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3750 N; 99.4259 E, alt. ca. 4450 m, on bark of *Rhododendron decorum* (Ericaceae), 4 Aug 2006, C.L. Hou, HOU 368 (BJTC 2022061, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3877 m, on bark of *Rhododendron decorum* (Ericaceae), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1593Azi (BJTC 2022063, isotype).

Known distribution – Known only from Yunnan Province, China.

Notes – The new species differs from species of other genera by larger ascomata with cracked cortex attached to the covering stroma and filiform ascospores with multiple septae.

Shuqunia M.J. Guo, M. Piepenbr. & C.L. Hou, gen. nov.

Mycobank number: MB852672; Facesoffungi number: FoF15605

Etymology – To commemorate the famous Chinese mycologists, the author of *Fungi of China*, Shuqun Teng (1902–1970).

Sexual morph: *Ascomata* on dead twigs of *Rhododendron* spp., subround to elliptic, more than 1 mm diam., scattered, opening first by a short longitudinal split, later by more or less irregular splits to expose the black hymenium. *Lips* absent. *Ascomata* intracortical or subcortical. *Periphysoids* on the inner surface of the covering stroma well-developed. *Excipulum* usually well-developed. *Covering stroma* tightly fixed to the host cortex, well developed, consisting of carbonized, thick-walled, globose to angular cells or carbonized hyphae. *Basal stroma* well developed, consisting of carbonized hyphae. *Internal matrix of stroma* well developed, consisting of hyaline textura intricata or hyphae. *Subhymenium* flat or slightly depressed, consisting of thin-walled angular cells. *Paraphyses* filiform, usually branched and swollen at the tips. *Asci* ripening sequentially, cylindric or clavate, thin-walled, J–, 8-spored. *Ascospores* aseptate, elliptical to elongated elliptical, fusiform, or cylindric like a femur, hyaline, covered by a thick gelatinous sheath. *Epithecium* usually well-developed.

Type species – *Shuqunia longa* M.J. Guo & C.L. Hou, described below

Notes – In the phylogenetic analysis, the molecular data of *Shuqunia* form a distinct clade with 100% MLB, 100% MPB, and 1.00 PP bootstrap support, and it is sister to *Triblidium* (Clade 6, Fig. 1). *Shuqunia* differs from other genera in *Rhytismatales* by ascomata with a black hymenium and well-developed periphysoids. Therefore, based on morphological characteristics, phylogenetic analyses, and the host relationship, *Shuqunia* is proposed as a new genus in *Rhytismataceae* s. l.

Key to species of *Shuqunia* on twigs of *Rhododendron* species

1. *Ascomata* intracortical 2
1. *Ascomata* subcortical 4
2. On the inner surface of the covering layer, on the exposed surface close to the opening, there is a layer formed by paraphysoid-like elements with dark reddish-brown tips embedded in gelatinous matrix 3
2. Not so *S. yunnanensis*
3. Hymenium dull black; paraphyses not branched, swollen to 3–4 µm diam. at the tips, forming a 20–25 µm thick epithecium *S. longa*
3. Hymenium shiny black; paraphyses occasionally branched, not swollen at their tips, forming a well-developed, 80–120 µm thick, reddish-brown epithecium *S. nitens*
4. *Asci* clavate; epithecium well developed *S. clavata*
4. *Asci* cylindric; epithecium absent *S. rhododendri*

Shuqunia clavata M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 35–36

Mycobank number: MB852673; Facesoffungi number: FoF15631

Diagnosis – This new species differs from other species in this genus by clavate asci and a relatively high ascospore L/W average ratio (4.8).

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3750 N; 99.4342 E, alt. ca. 3855 m, on dead twigs of *Rhododendron* sp. (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1812 (BJTC 2022064, holotype).

Etymology – *clavatus* (lat.) = clavate, referring to the clavate asci.

Sexual morph: *Ascomata* on bark, scattered. In surface view ascomata subround to elliptical, 1150–3700 × 2000–4000 µm, concolorous with the surface of the twig at immaturity, erumpent from the surface of the bark at maturity, opening by more or less irregular splits to expose the dull

black hymenium. *Lips* absent. In median vertical section, ascomata subcortical. *Covering stroma* 80–180 μm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of remains of host cortex, an inner layer of carbonized, angular to globose cells, an innermost layer of hyaline periphysoids. *Excipulum* well-developed, formed by marginal paraphyses. *Basal stroma* 100–150 μm thick, consisting of carbonized hyphae. Internal matrix of stroma 190–290 μm thick, consisting of hyaline hyphae. *Subhymenium* 30–45 μm thick, consisting of angular cells. *Paraphyses* aseptate, filiform, $320\text{--}350 \times 1 \mu\text{m}$, occasionally branched, slightly curved and swollen to 2–5 μm at the tips, covered by a thin gelatinous sheath, forming a well-developed epithecium at the tip, 50–70 μm thick, slightly brown. *Asci* ripening sequentially, clavate, slightly round to subtruncate at the apex, $270\text{--}300 \times 25\text{--}35 \mu\text{m}$, thin-walled, J–, 8-spored. *Ascospores* aseptate, elongated elliptical to fusiform, $26\text{--}42 \times 6\text{--}8 \mu\text{m}$, L/W ratio of 3.4–6.4 (average ratio of 4.8), hyaline, pluriguttulate, covered by a 7–10 μm thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.6315 N; 99.7249 E, alt. ca. 3861 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 16 Aug 2023, C.L. Hou, L. Zhuo, and S.Y. Zhao, HOU 2036 (BJTC 2022123, paratype).

Known distribution – Known only from Yunnan Province, China.

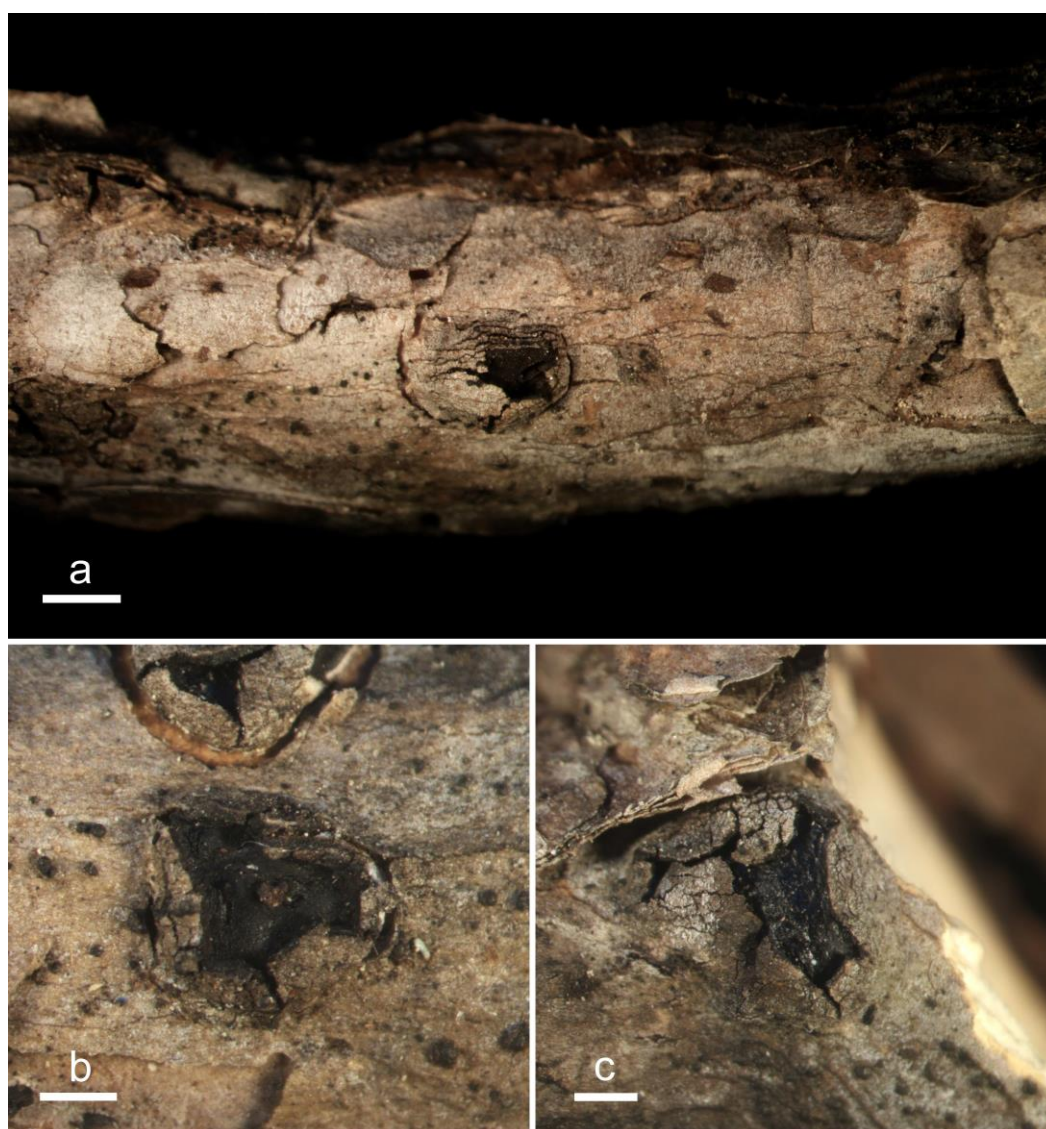


Figure 35 – *Shuqunia clavata* (HOU 1812/BJTC 2022064, holotype). a Ascoma on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 2 mm, b–c = 1 mm.

Notes – The new species is morphologically similar to *Shuqunia nitens*, but *S. nitens* has intracortical ascomata with a shiny black hymenium, a layer formed by paraphysoid-like elements with dark reddish-brown tips embedded in gelatinous matrix on the inner surface of the covering layer on the exposed surface close to the opening, paraphyses not swollen at their tips, cylindric asci, as well as a thicker, reddish-brown epithecium (80–120 μm). The multi-locus phylogenetic analysis indicates that the sequences of *Shuqunia clavata* (HOU 1812 and HOU 2036) form a clade with 100% MLB, 100% MPB, and 1.00 PP bootstrap support, sister to the sequences of *Shuqunia nitens* (HOU 1758, HOU 1758Y, HOU 1845, and CNUCC 1845) and *Shuqunia yunnanensis* (HOU 1572A, HOU 1573, HOU 1566, and HOU 1567). However, the sequence similarity of ITS rDNA between *S. clavata* and *S. nitens* is 94%, between *S. clavata* and *S. yunnanensis* is 95%. Therefore, *S. clavata* is considered as a new species.

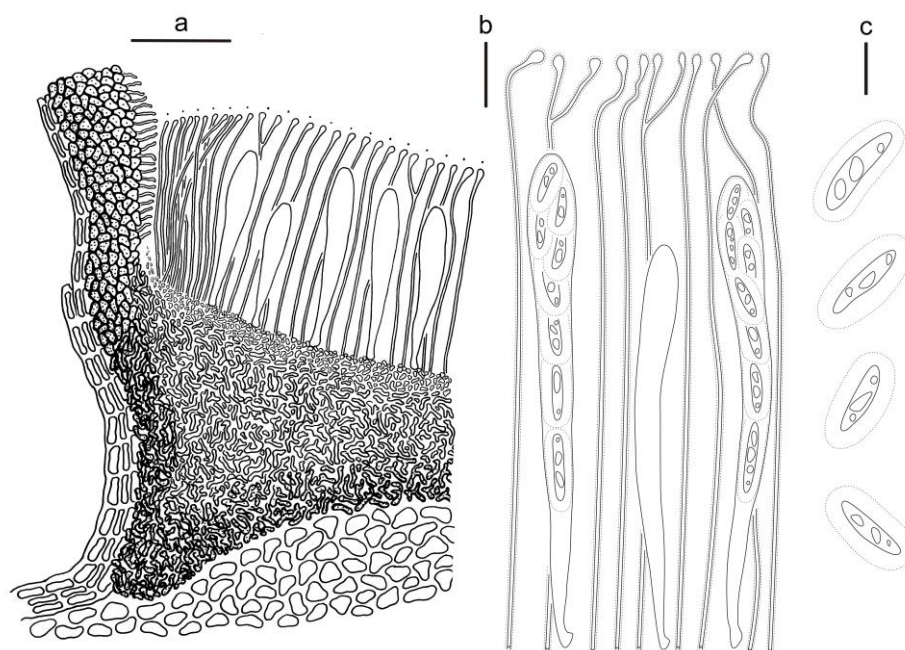


Figure 36 – *Shuqunia clavata* on *Rhododendron* sp. (HOU 1812/BJTC 2022064, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 200 μm , b = 50 μm , c = 20 μm .

Shuqunia longa M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 37–38

MycoBank number: MB852674; Facesoffungi number: FoF15638

Diagnosis – The new species is similar to *Shuqunia rhododendri*, but differs by intracortical ascomata with epithecium, a thicker covering stroma, a thicker basal stroma, and longer paraphysoids close to the surface of the hymenium.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3750 N; 99.4259 E, alt. ca. 4450 m, on dead twigs of *Rhododendron* sp. (*Ericaceae*), 4 Aug 2006, C.L. Hou, HOU 368B (BJTC 2022065, holotype).

Etymology – *longa* (lat.) = long, referring to the longer paraphysoids.

Sexual morph: *Ascomata* on bark, scattered. In surface view ascomata subround to elliptical, 1250–2050 $\times$ 1325–2500 μm , concolorous with the surface of the twig at immaturity, erumpent from the surface of the bark at maturity, opening first by a longitudinal split, later by more or less irregular splits to expose the black hymenium. *Lips* absent. In median vertical section, ascomata intracortical. *Covering stroma* 130–200 μm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of remains of host cortex, an inner layer of carbonized, angular to globose cells, an innermost layer of hyaline, angular to globose cells. *Paraphysoids* present. On the

inner surface of the covering layer, on the exposed surface close to the opening, there is a layer formed by short paraphysoid-like elements with dark reddish-brown tips embedded in gelatinous matrix. Close to the surface of the hymenium, there are hyaline periphysoids up to 220 μm long in contact with the marginal paraphyses. *Excipulum* present, 20–25 μm thick, formed by marginal paraphyses. *Basal stroma* 170–290 μm thick, consisting of carbonized hyphae. *Internal matrix of stroma* 50–80 μm thick, consisting of hyaline hyphae. *Subhymenium* 20–35 μm thick, consisting of angular cells. *Paraphyses* aseptate, filiform, 360–400 $\times$ 1 μm , not branched, slightly curved and swollen to 3–4 μm at their tips, covered by a thin gelatinous sheath, forming an epithecium at the tip. *Asci* ripening sequentially, cylindric, slightly round to subtruncate at the apex, 300–330 $\times$ 20–25 μm , short-stalked, thin-walled, J–, 8-spored. *Ascospores* aseptate, elongated elliptic, fusiform, or cylindric like a femur, often rhomboid in the ascus, 21–36 $\times$ 6–9 μm , L/W ratio of 2.8–5.6 (average ratio of 3.8), hyaline, covered by a 5–7 μm thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3754 N; 99.4329 E, alt. ca. 4200 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 11 Jul 2007, C.L. Hou, HOU 457A (BJTC 2022066, paratype).

Known distribution – Known only from Yunnan Province, China.

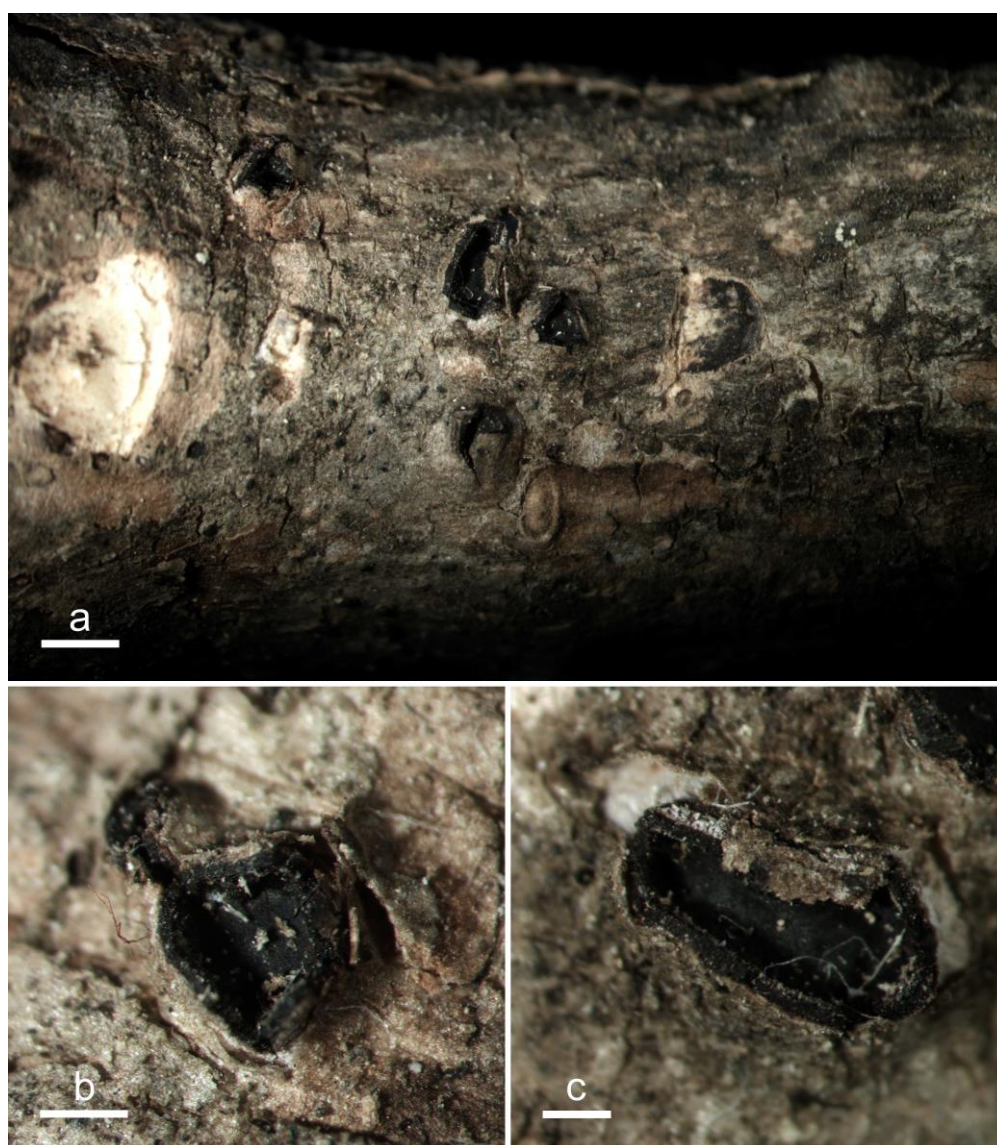


Figure 37 – *Shuqunia longa* (HOU 368B/BJTC 2022065, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 2 mm, b–c = 500 μm .

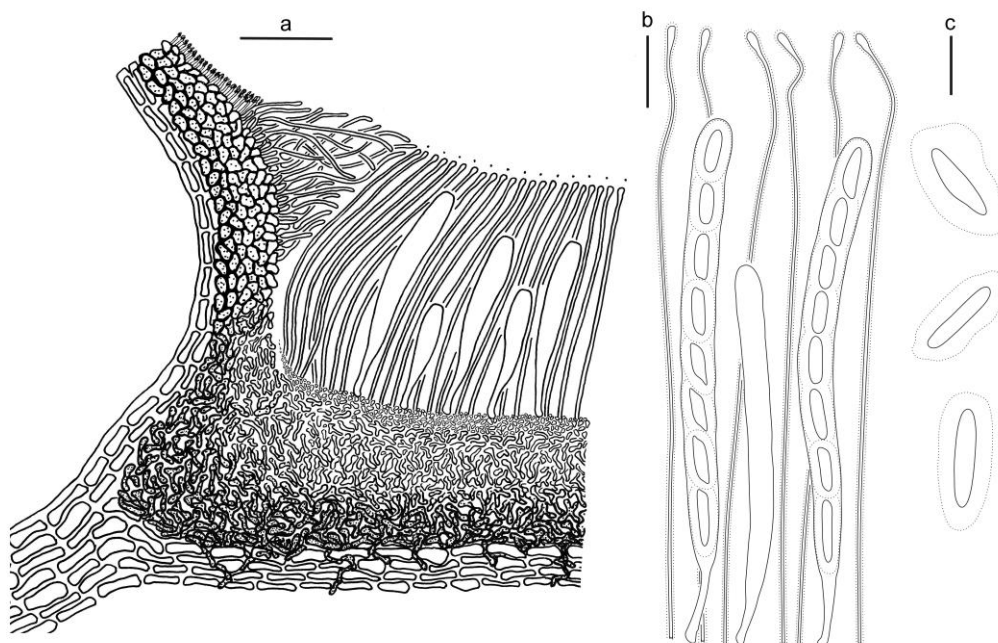


Figure 38 – *Shuqunia longa* on *Rhododendron* sp. (HOU 368B/BJTC 2022065, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 200 μm , b = 50 μm , c = 20 μm .

Notes – The multi-locus phylogenetic analysis indicates that the sequences of *Shuqunia longa* (HOU 368B and HOU 457A) form a well-supported clade sister to the sequences of *Shuqunia rhododendri* (HOU 1848C, CNUCC 1849C, and HOU 1848D). *Shuqunia longa* is morphologically similar to *S. rhododendri*, but the latter has subcortical ascomata without an epithecium, a thinner covering stroma (70–130 μm thick), and a thinner basal stroma (75–120 μm thick). The sequence similarity of ITS rDNA between *S. longa* and *S. rhododendri* is 91%. Therefore, *S. longa* is considered to be a distinct species. It is the type species of the genus *Shuqunia* because it presents well developed periphysoids.

Shuqunia nitens M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 39–40

Mycobank number: MB852675; Facesoffungi number: FoF15639

Diagnosis – The new species is characterized by a shiny black hymenium, a layer formed by paraphysoid-like elements with dark reddish-brown tips embedded in gelatinous matrix on the inner surface of the covering layer, on the exposed surface close to the opening, paraphyses not swollen at their tips, and a well-developed, reddish-brown epithecium.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3905 N; 99.4633 E, alt. ca. 3516 m, on dead twigs of *Rhododendron* sp. (*Ericaceae*), 20 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1758 (BJTC 2022067, holotype).

Etymology – *nitens* (lat.) = bright, referring to the shiny black hymenium.

Sexual morph: *Ascomata* on bark, scattered. In surface view, ascomata subround to elliptical, 1250–3125 $\times$ 2250–3750 μm , concolorous with the surface of the twig at immaturity, erumpent from the surface of the bark at maturity, opening first by a short longitudinal split, later by more or less irregular splits to expose the shiny black hymenium. *Lips* absent. In median vertical section, ascomata intracortical. *Covering stroma* 110–230 μm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of remains of the host cortex, an inner layer of carbonized, angular to globose cells, an innermost layer of hyaline periphysoids. On the exposed inner surface of the covering stroma close to the opening, there is a layer formed by paraphysoid-like elements with dark reddish-brown tips embedded in gelatinous matrix. *Excipulum* present, formed by marginal paraphyses. *Basal stroma* 100–150 μm thick, consisting of carbonized

hyphae. Internal matrix of stroma 200–280 μm thick, consisting of hyaline hyphae. *Subhymenium* 25–40 μm thick, consisting of angular cells. *Paraphyses* aseptate, filiform, occasionally branched, slightly curved at the apex, $380\text{--}420 \times 1\text{--}1.5 \mu\text{m}$, covered by a thin gelatinous sheath, forming a reddish-brown, 80–120 μm thick epithecium by their tips. *Asci* ripening sequentially, cylindric, slightly round to subtruncate at their apex, $280\text{--}350 \times 20\text{--}25 \mu\text{m}$, short-stalked, thin-walled, J–, 8-spored. *Ascospores* aseptate, elliptical to elongated elliptical, $17\text{--}37 \times 7\text{--}14 \mu\text{m}$, L/W ratio of 1.9–3.5 (average ratio of 2.6), hyaline, covered by a 4–6 μm thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3905 N; 99.4633 E, alt. ca. 3516 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 20 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1758Y (BJTC 2022069, isotype) – living culture CNUCC 1758; CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0550 N; 102.5051 E, alt. ca. 3802 m, on twigs of *Rhododendron lacteum* Franch. (*Ericaceae*), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1845 (BJTC 2022068, paratype).

Known distribution – Known only from Yunnan Province, China.

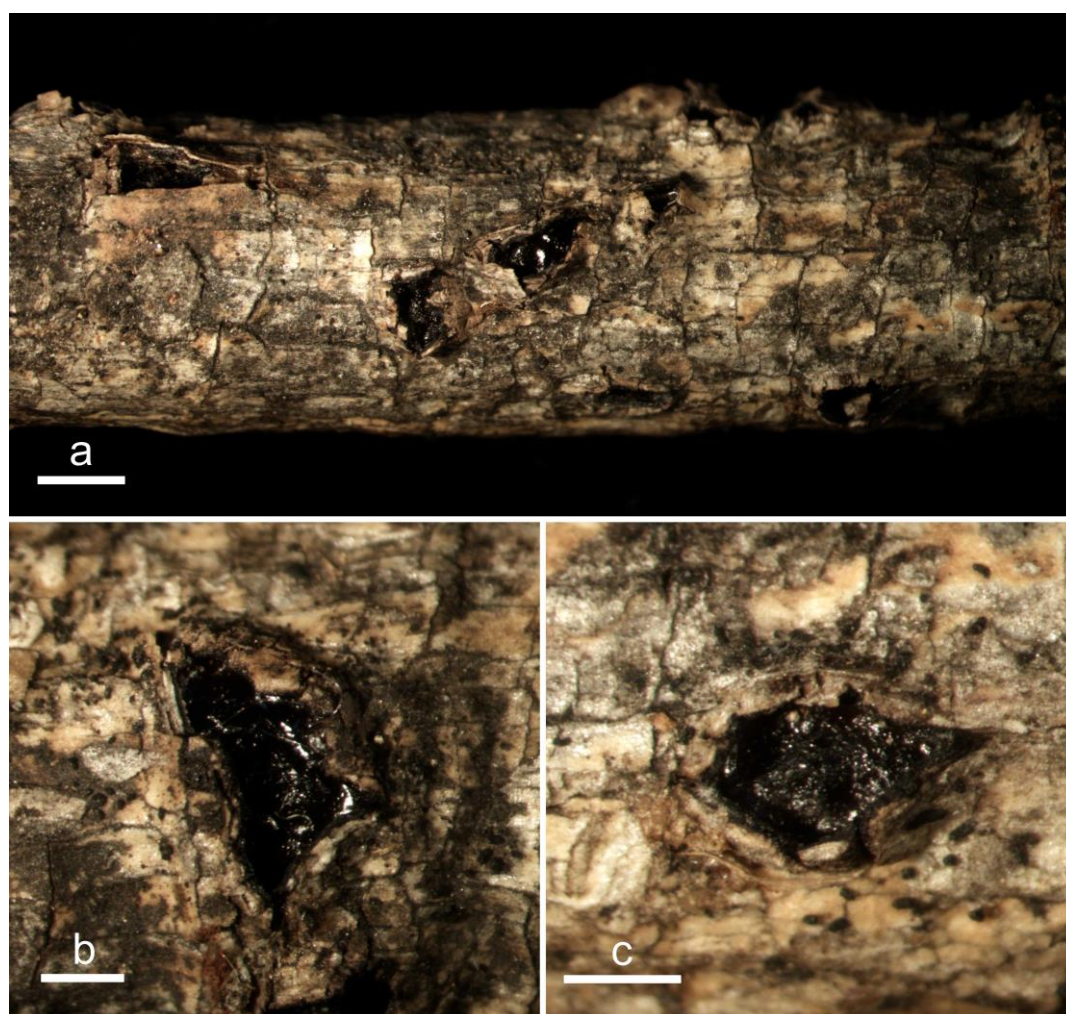


Figure 39 – *Shuqunia nitens* (HOU 1758/BJTC 2022067, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 2 mm, b–c = 1 mm.

Notes – This new species is morphologically similar to *Shuqunia yunnanensis* and *S. clavata*, and closely related to them in the ITS-nrLSU-mtSSU rDNA phylogenetic tree. However, *S. nitens* differs from these two species by having a shiny black hymenium, a layer formed by paraphysoid-like elements with dark reddish-brown tips embedded in gelatinous matrix on the inner surface of the covering stroma, on the exposed surface close to the opening, paraphyses not swollen at their

tips, as well as a thicker (80–120 μm), reddish-brown epithecium. The sequence similarity of ITS rDNA between *S. nitens* and *S. clavata* is 94%, between *S. nitens* and *S. yunnanensis* 95%. Therefore, *S. nitens* is considered as a new species.

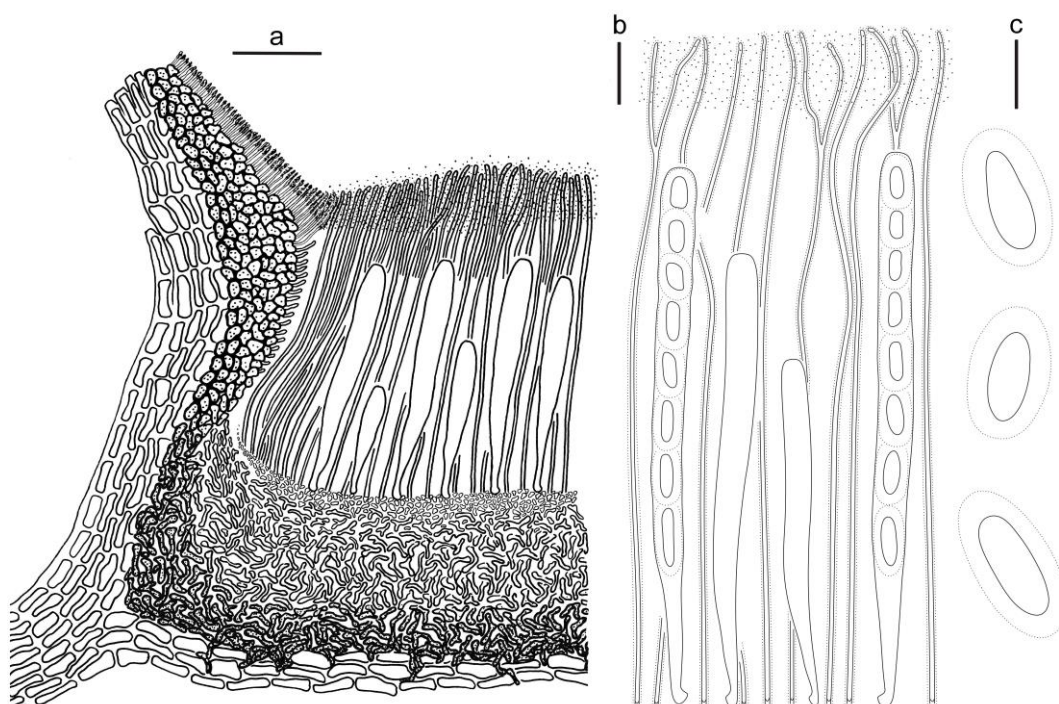


Figure 40 – *Shuqunia nitens* on *Rhododendron* sp. (HOU 1758/BJTC 2022067, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 200 μm , b–c = 50 μm .

Shuqunia rhododendri M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 41–42

Mycobank number: MB852676; Facesoffungi number: FoF15640

Diagnosis – The new species is similar to *Shuqunia longa*, but *Shuqunia rhododendri* has subcortical ascomata without an epithecium, up to 95 μm long periphysoids on the surface of the covering stroma adjacent to the hymenium, a thinner covering stroma and basal stroma.

Holotype – CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0504 N; 102.5053 E, alt. ca. 3823 m, on dead twigs of *Rhododendron lutescens* (Ericaceae), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1848D (BJTC 2022071, holotype).

Etymology – Referring to the host, a species of *Rhododendron*.

Sexual morph: *Ascomata* on bark of twigs, not associated with pale areas or zone lines, scattered. In surface view, ascomata subround to elliptic, 1500–2500 $\times$ 1000–2100 μm , concolorous with the surface of the twig at immaturity, erumpent from the surface of the bark at maturity, opening first by a longitudinal split, later by more or less irregular splits to expose the black hymenium. *Lips* absent. In median vertical section, ascomata subcortical. *Covering stroma* 70–130 μm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of remains of the host cortex, an inner layer of carbonized hyphae, and an innermost layer of hyaline cells which are embedded in a gelatinous matrix. *Excipulum* present, formed by marginal paraphyses. *Periphysoids* present on the inner surface of the covering stroma adjacent to the hymenium, up to 95 μm long. *Basal stroma* 75–120 μm thick, consisting of carbonized hyphae. *A space triangular* in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with hyaline textura intricata. *Subhymenium* 25–40 μm thick, consisting of angular cells. *Paraphyses* aseptate, filiform, 320–480 $\times$ 1–1.5 μm , occasionally

branched, slightly curved and swollen at their tips. *Asci* ripening sequentially, cylindric, slightly round to subtruncate at the apex, $250\text{--}340 \times 20\text{--}23\ \mu\text{m}$, conspicuously long-stalked, thin-walled, J–, 8-spored. *Ascospores* aseptate, elongated elliptic, fusiform, or cylindric like femur, often rhomboid in the ascus, $20\text{--}32 \times 4\text{--}9\ \mu\text{m}$, L/W ratio of 2.5–7.2 (average ratio of 3.59), hyaline, pluriguttulate, covered by a 5–6 μm thick gelatinous sheath.

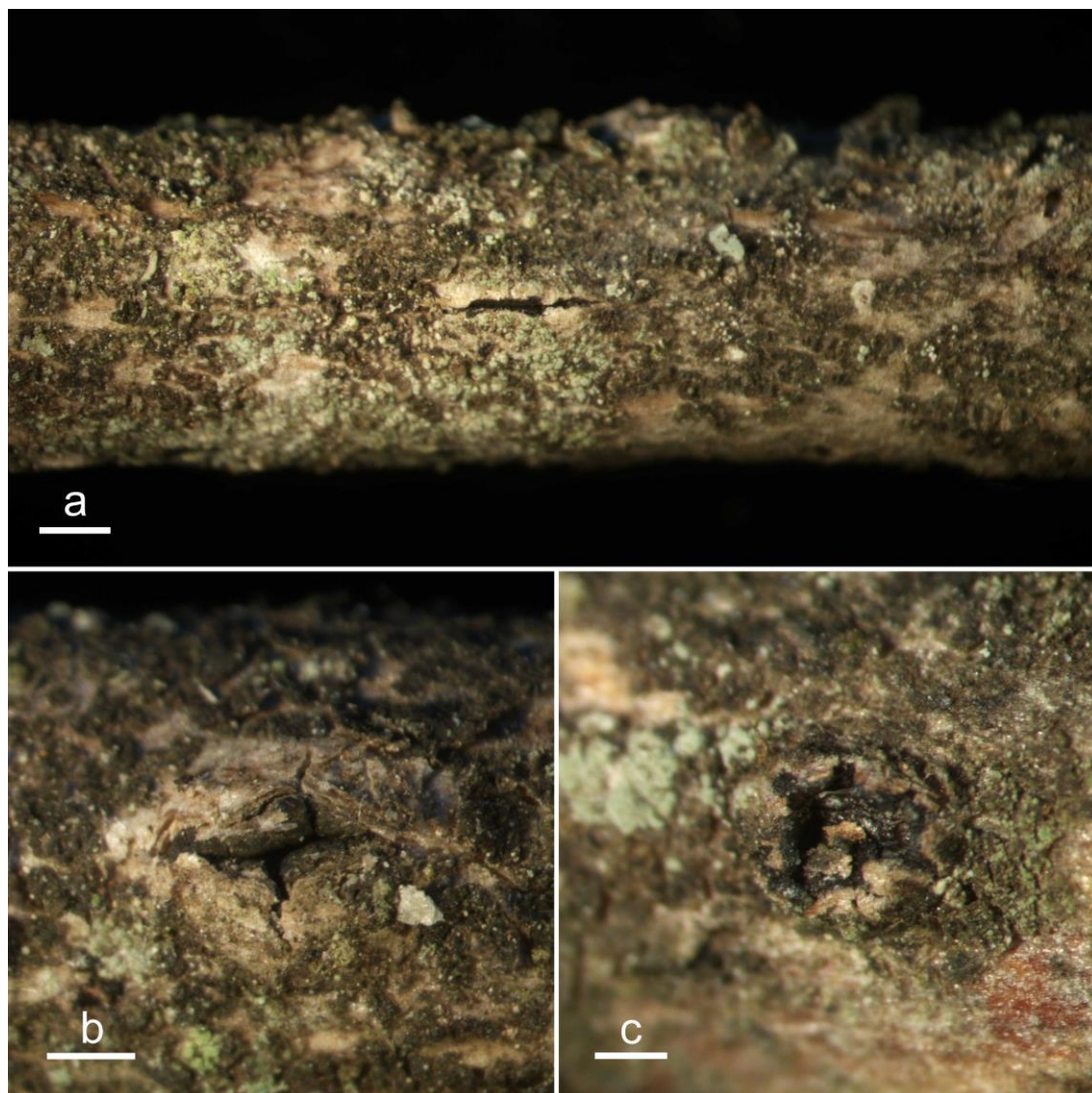


Figure 41 – *Shuqunia rhododendri* (HOU 1848D/BJTC 2022071, holotype). a Ascoma on a twig of *Rhododendron lutescens*. b–c Mature ascomata. Scale bars: a–b = 1 mm, c = 500 μm .

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimens examined – CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0504 N; 102.5053 E, alt. ca. 3823 m, on twigs of *Rhododendron lutescens* (*Ericaceae*), 23 Jun 2021, C.L. Hou, M.J. Guo and H. Zhou, HOU 1848C (BJTC 2022072, isotype) – living culture CNUCC 1848C (ex-type).

Known distribution – Known only from Yunnan Province, China.

Notes – *Shuqunia rhododendri* is similar to *S. longa*, but the latter has intracortical ascomata, a thicker (130–200 μm) covering stroma, and a layer formed by paraphysoid-like elements with dark reddish-brown tips embedded in gelatinous matrix on the inner surface of the covering layer, on the exposed surface close to the opening, a thicker (170–290 μm) basal stroma, an internal matrix in the stroma, and paraphyses that are swollen up to 3–4 μm diam. at their tips.

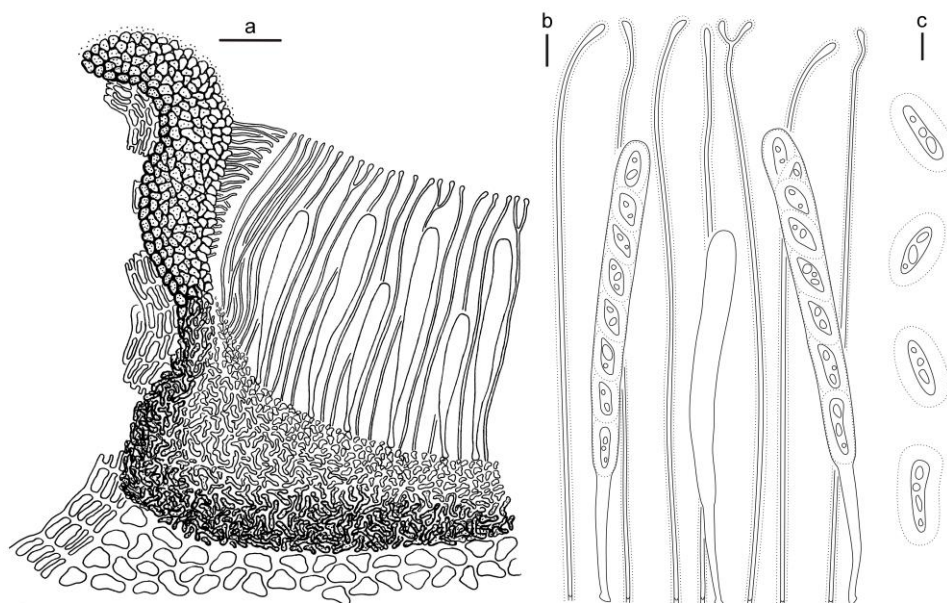


Figure 42 – *Shuqunia rhododendri* on *Rhododendron lutescens* (HOU 1848D/BJTC 2022071, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 100 μ m, b = 20 μ m, c = 10 μ m.

Shuqunia yunnanensis M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 43–44

MycoBank number: MB852677; Facesoffungi number: FoF15641

Diagnosis – The new species resembles *Shuqunia nitens*, but differs in poorly developed periphysoids, as well as paraphyses that are not branched and slightly swollen at their tips.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3924 N; 99.4836 E, alt. ca. 2862 m, on dead twigs of *Rhododendron decorum* (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1567 (BJTC 2022075, holotype).

Etymology – Referring to the name of the province (Yunnan) where the specimen was collected.

Sexual morph: *Ascomata* on bark, not associated with pale areas or zone lines, scattered. In surface view ascomata subround to broadly elliptical, 1000–1450 $\times$ 1150–1950 μ m, concolorous with the surface of the twig at immaturity, erumpent from the surface of the bark at maturity, opening by irregular splits to expose the black hymenium. *Lips* absent. In median vertical section, ascomata intracortical. *Covering stroma* 75–190 μ m thick near the centre of the ascomata, slightly thinner towards the edges, extending to the basal stroma, consisting of an outer layer of host cortex, an inner layer of carbonized hyphae, and an innermost layer of hyaline cells which are embedded in a gelatinous matrix. *Periphysoids* present. *Basal stroma* 75–100 μ m thick, consisting of carbonized hyphae. *Internal matrix of stroma* 75–220 μ m thick, consisting of hyaline textura intricata. *Subhymenium* 25–50 μ m thick, consisting of angular cells. *Excipulum* absent. *Paraphyses* aseptate, filiform, 350–450 $\times$ ca. 1 μ m, not branched, aggregated, slightly curved and swollen at their tips, forming a 25–35 μ m thick epithecium. *Asci* ripening sequentially, cylindrical, slightly round to truncate at the apex, 250–310 $\times$ 20–22 μ m, thin-walled, J–, 8-spored. *Ascospores* aseptate at maturity, elliptic to elongated elliptic, 17–35 $\times$ 6–11 μ m, L/W ratio of 2.1–5.5 (average ratio of 2.9), hyaline, covered by a 5–6 μ m thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimens examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3924 N; 99.4836 E, alt. ca. 2862 m, on twigs of *Rhododendron decorum* (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1566 (BJTC 2022074, paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3924 N; 99.4836 E, alt. ca. 2862 m, on twigs of *Rhododendron decorum* (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1572A (BJTC 2022076,

paratype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3924 N; 99.4836 E, alt. ca. 2862 m, on twigs of *Rhododendron decorum* (Ericaceae), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1573 (BJTC 2022077, paratype).

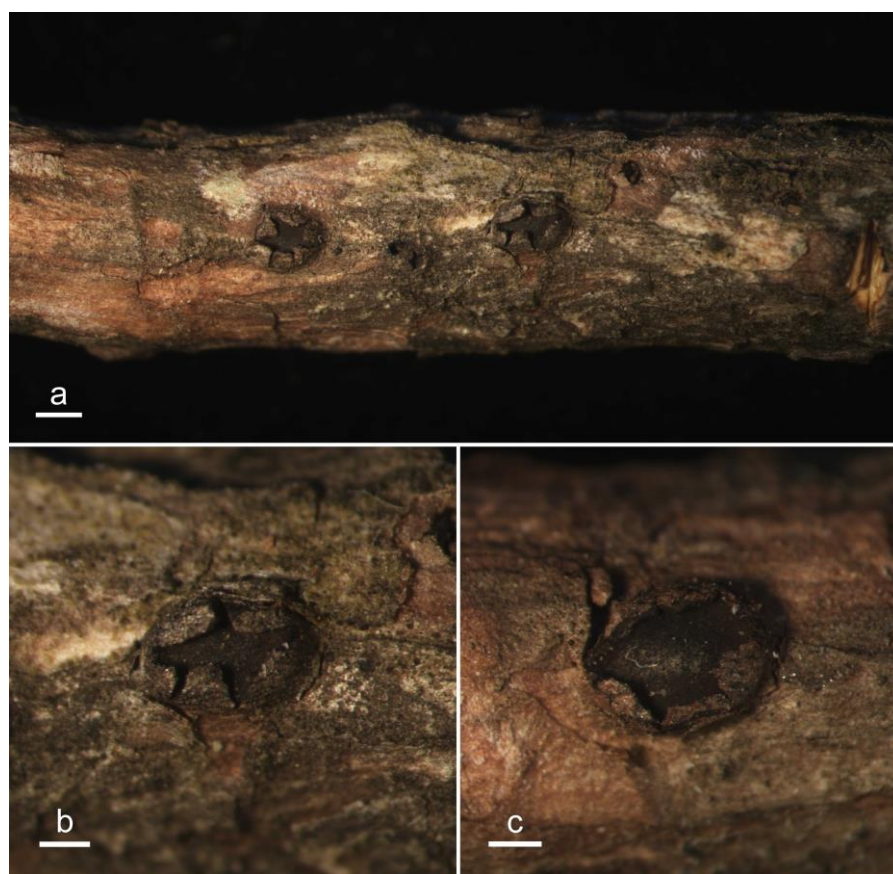


Figure 43 – *Shuqunia yunnanensis* (HOU 1567/BJTC 2022075, holotype). a Ascomata on a twig of *Rhododendron decorum*. b–c Mature ascomata. Scale bars: a = 1 mm, b–c = 500 μ m.

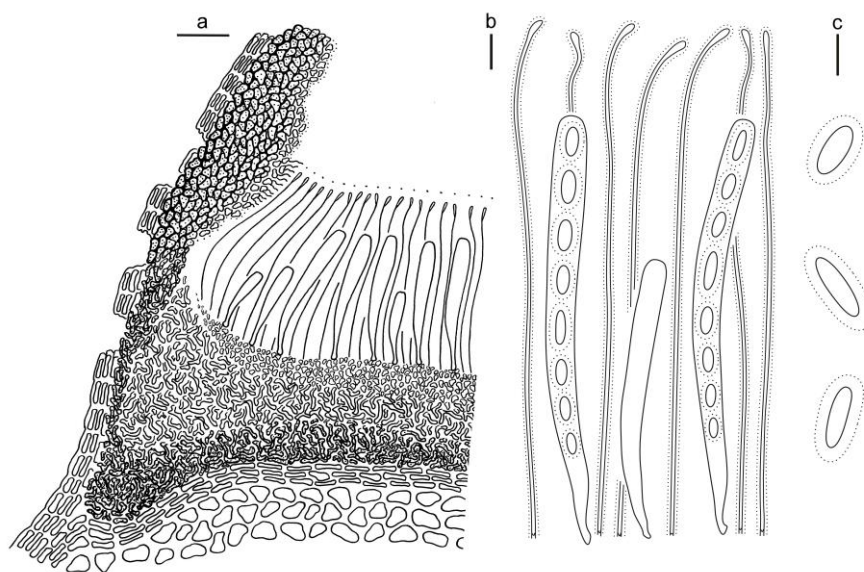


Figure 44 – *Shuqunia yunnanensis* (HOU 1567/BJTC 2022075, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 100 μ m, b–c = 20 μ m.

Known distribution – Known only from Yunnan Province, China.

Notes – This new species is similar to *Shuqunia nitens* and *S. clavata*, and closely related to them in the ITS-nrLSU-mtSSU rDNA phylogenetic tree. *Shuqunia nitens*, however, has the shiny black hymenium, a layer formed by paraphysoid-like elements with dark reddish-brown tips embedded in gelatinous matrix on the inner surface of the covering layer, on the exposed surface close to the opening, not swollen and occasionally branched paraphyses, and a reddish-brown, thicker (80–120 µm) epithecium. *Shuqunia clavata* has subcortical ascomata, occasionally branched paraphyses, wider (25–35 µm) and clavate asci, ascospores with a thicker gelatinous sheath (7–10 µm), and a higher ascospore L/W average ratio (4.8). The sequence similarity of ITS rDNA between *S. yunnanensis* and *S. nitens* is 95%, between *S. yunnanensis* and *S. clavata* 95%. Therefore, based on morphological characteristics and phylogenetic analyses, *Shuqunia yunnanensis* is considered as a new species.

Sporomega Corda, Icon. fung. (Prague) 5: 34 (1842)

Sexual morph: *Ascomata* elliptical to elongate, opening with an irregular, often jagged longitudinal slit, without lip cells or a preformed opening line. *Covering stroma* and basal stroma well developed. *Subhymenium* consisting of hyaline angular cells and/or textura porrecta. *Paraphyses* simple, filiform, straight to hooked to convolutedly coiled at the apex, covered by a thin gelatinous sheath. *Asci* ripening sequentially, clavate, thin-walled, J–, 8-spored. *Ascospores* aseptate, filiform-clavate, hyaline, covered by a thick gelatinous sheath. (Description based on Eriksson 1970, Minter & Cannon 2017)

Type species – *Sporomega degenerans* (Kunze) Corda, Icon. fung. (Prague) 5: 34 (1842).

Notes – In the phylogenetic analyses, the molecular sequences of several recently collected specimens form a strongly supported clade with the molecular sequence of the type species of *Sporomega*, *Sporomega degenerans*; the type species (Corda 1842, Lantz et al. 2011), with 100% MLB, and 0.99 PP bootstrap support (Clade 14, Fig. 1). Based on morphological characteristics and molecular data, a further new species of *Sporomega* is described and an immature specimen is studied but not assigned to existing species, herein referred to as *Sporomega* sp.

Sporomega nodulifera M.J. Guo & C.L. Hou, sp. nov.

Figs 45–46

Mycobank number: MB852678; Facesoffungi number: FoF15642

Diagnosis – The new species is characterized by a covering stroma with an innermost layer formed by hyaline hyphae with dark brown nodules.

Holotype – CHINA, Hunan Province, Chenzhou, Mangshan National Forest Park, 24.5639 N; 112.5605 E, alt. ca. 1279 m, on dead twigs of *Rhododendron stamineum* Franch. (*Ericaceae*), 19 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1629A (BJTC 2022078, holotype).

Etymology – *nodus* (lat.) = node, referring to the dark brown nodules among hyphae forming the inner layer of the covering stroma.

Sexual morph: *Ascomata* on bark of *Rhododendron* sp., not associated with pale areas, scattered. In surface view, ascomata elliptical to elongated elliptical, often acute at both ends, 1200–1950 × 475–700 µm, concolorous with the surface of the bark, raised from the surface of the bark at maturity, opening by a longitudinal split to expose the black hymenium. *Periphysoids* and *lips* absent. In median vertical section, ascomata intracortical. *Covering stroma* 100–145 µm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of host cortex, a middle layer of carbonized, thick-walled angular cells, and an inner layer formed by hyaline hyphae with dark brown nodules. *Basal stroma* well developed, 100–210 µm thick, consisting of carbonized, thick-walled angular cells. *Subhymenium* 25–45 µm thick, consisting of hyaline angular cells and textura porrecta. *Paraphyses* filiform, 200–310 × ca. 1 µm, not branched, curved at their tips, covered by a thin gelatinous sheath, forming an epithecium at the tip. *Asci* ripening sequentially, clavate, with a slightly truncate apex, 140–175 × 12–20 µm, short-stalked, thin-walled, J–, 8-spored. *Ascospores* aseptate, filiform-clavate, slightly acute at the base, often curved, 40–55 × 1.5–2 µm, covered by a 2–4 µm thick, gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Known distribution – Known only from Hunan Province, China.

Notes – The shape of the ascospores of *Sporomega nodulifera* is similar to the shape of the ascospores of *Sporomega degenerans* (type species of *Sporomega*). *Sporomega degenerans*, however, has a covering stroma consisting of thick-walled angular cells, no hyphae with nodules, a basal stroma consisting of entangled hyaline hyphae, smaller asci ($95\text{--}130 \times 8\text{--}12\text{ }\mu\text{m}$), and larger ascospores ($65\text{--}75 \times 2\text{--}2.5\text{ }\mu\text{m}$) (Minter & Cannon 2017).

***Sporomega* sp. 1**

Fig. 47

Specimen examined – CHINA, Hunan Province, Yongzhou, Yangmingshan National Forest Park, 26.0030 N; 111.5222 E, alt. ca. 734 m, on living twigs of *Rhododendron stamineum* (*Ericaceae*), 20 Apr 2021, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1709A (BJTC 2022079) – living culture CNUCC 1709A.

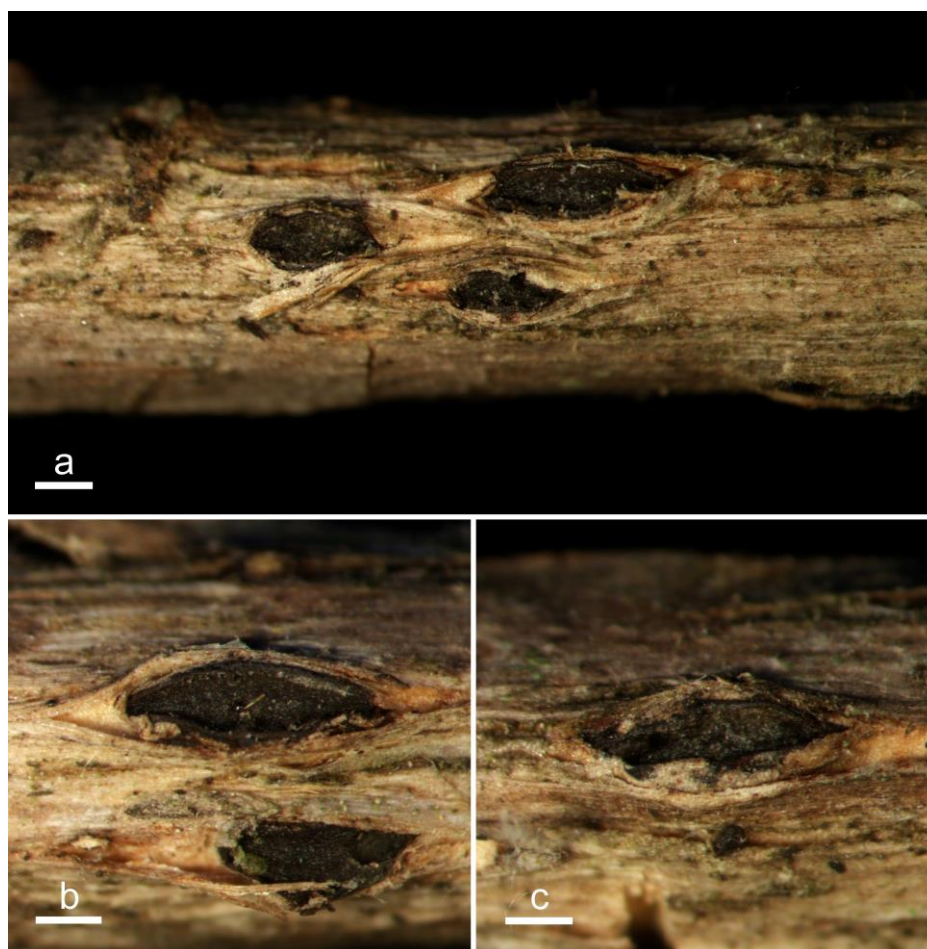


Figure 45 – *Sporomega nodulifera* (HOU 1629A/BJTC 2022078, holotype). a Ascomata on a twig of *Rhododendron stamineum*. b–c Mature ascomata. Scale bars: a–c = 500 μm .

Notes – In the multigene phylogenetic analysis, our sequences of *Sporomega* sp. 1 (HOU 1709A and CNUCC 1709A) shows sister relationship to *Sporomega nodulifera* with 100% MLB, 89% MPB, and 1.00 PP bootstrap support (Clade 14, Fig. 1). The ITS rDNA sequence similarity of these two species is 94%. As the specimen is immature, it is not described in detail and tentatively called *Sporomega* sp. 1.

Terriera B. Erikss., Symb. bot. ups. 19(no. 4): 58 (1970)

Sexual morph: *Ascomata* oblong to sublinear, with an obvious preformed dehiscence line, opening by a longitudinal split to expose the hymenium. *Lips* absent. *Covering stroma* with fungal

tissue extending from below the covering host cells towards the opening of the ascoma. *Basal stroma* well developed. *Excipulum* usually present and closely adhering to the covering stroma and the extension. A *space triangular* in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with vertically oriented rows of cylindrical cells (textura prismatica). *Subhymenium* flat or slightly depressed. *Paraphyses* branched or not, filiform, covered by a thin gelatinous sheath. *Asci* ripening sequentially, cylindrical, thin-walled, J–, 8-spored. *Ascospores* septate or aseptate, filiform, hyaline, covered by a gelatinous sheath.

Asexual morph: *Conidiomata* present or absent. (Description based on Eriksson 1970, Johnston 2001)

Type species – *Terriera cladophila* (Lév.) B. Erikss., *Symb. bot. upsal.* 19(no. 4): 59 (1970).

Notes – *Terriera* currently comprises forty-one known species (Zhang et al. 2020) and is one of the few monophyletic large genera in the *Rhytismataceae* (Clade 3, Fig. 1). Up to now, this genus included one species growing on twigs of *Rhododendron* sp., namely *Terriera elliptica* T.T. Zhang & C.L. Hou.

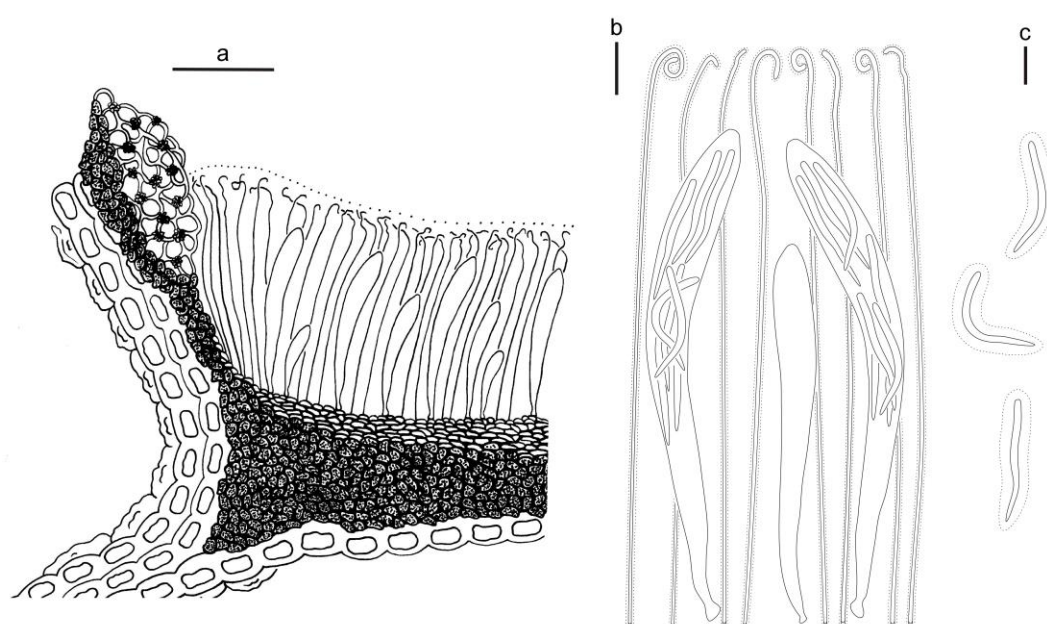


Figure 46 – *Sporomega nodulifera* on *Rhododendron stamineum* (HOU 1629A/BJTC 2022078, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 100 µm, b = 20 µm, c = 10 µm.

Key to twig-inhabiting species of *Terriera* on *Rhododendron* species

1. Ascospores aseptate 2
1. Ascospores 1-septate *Te. rhododendri*
2. Paraphyses aseptate, branching 1–3 times at the apex; ascospores covered by a 1–1.5 µm thick gelatinous sheath..... *Te. elliptica*
2. Paraphyses septate, branching once at the apex; ascospores lacking gelatinous sheath *Te. karsti*

Terriera elliptica T.T. Zhang & C.L. Hou, in Zhang, Tong, Lin & Hou, *Mycol. Progr.* 14(8/54): 2 (2015)

Type – CHINA, Yunnan Province, Chuxiong, Zixishan, alt. ca. 2400 m, on living twigs of *Rhododendron* sp. (*Ericaceae*), 5 Aug 2006, C.L. Hou, HOU 327 (BJTC 201419).

Notes – This species was described and illustrated in detail by Zhang et al. (2015). *Terriera elliptica* resembles *T. cladophila*, however, *T. elliptica* has mostly subhypodermal, longer ascomata

(1000–1800 μm), longer asci (135–175 μm), ascospores with a 1–1.5 μm thick gelatinous sheath. In the phylogenetic analyses, this species has a relatively independent position.

Terriera karsti J.F. Zhang & J.K. Liu, in Zhang, Liu, Hyde, Ekanayaka & Liu, MycoKeys 76: 90 (2020)

Holotype – CHINA, Guizhou Province, Guiyang, Yunyan District, on dead branch of unidentified ligneous plants, 6 May 2016, J.F. Zhang, SH-06 (MFLU 18-2288) (Zhang et al. 2020).

Specimen examined – CHINA, Hunan Province, Yongzhou, Yangmingshan National Forest Park, 26.0030 N; 111.5222 E, alt. ca. 734 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 20 Apr 2021, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1709B (BJTC 2022080).

Notes – This species was described and illustrated in detail by Zhang et al. (2020). The specimen examined in the present study morphologically fits into this species concept, and further molecular sequence data are presented here for this species.

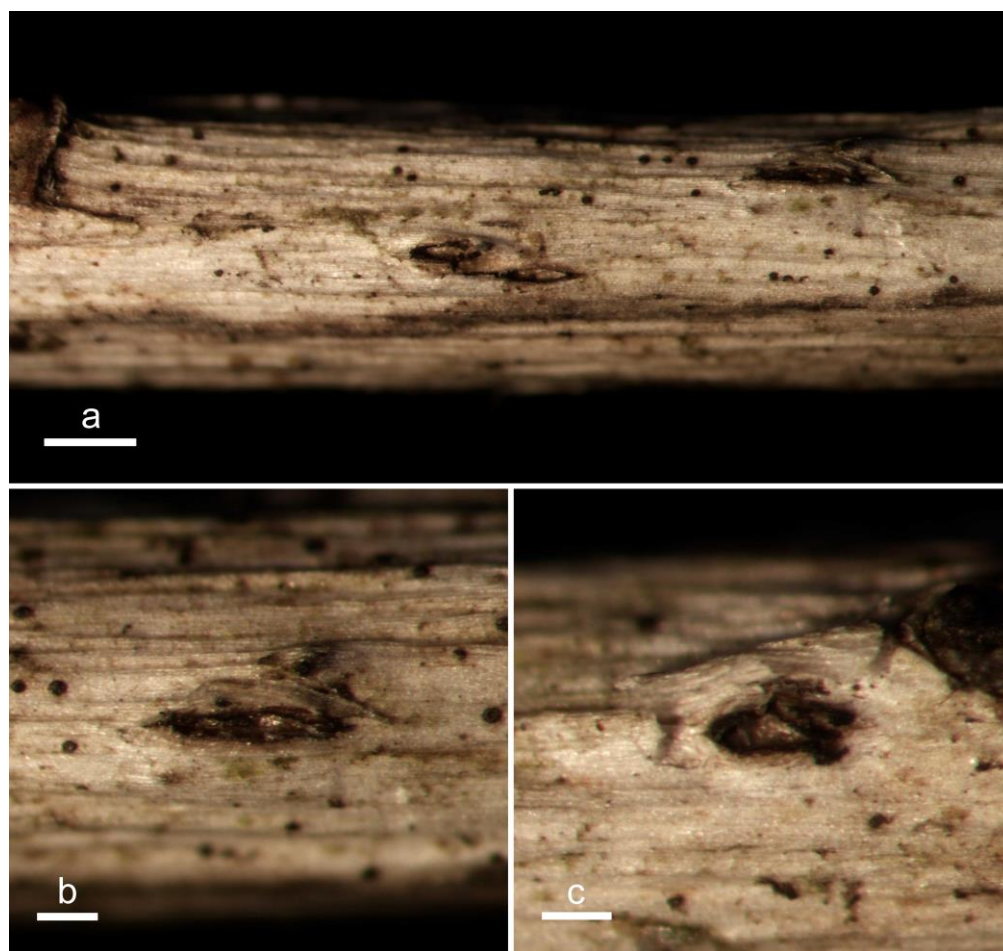


Figure 47 – *Sporomega* sp. 1 (HOU 1709A/BJTC 2022079, holotype). a Ascomata on a twig of *Rhododendron stamineum*. b–c Immature ascomata. Scale bars: a = 500 μm , b–c = 200 μm .

Terriera rhododendri L. Zhuo & C.L. Hou, sp. nov.

Figs 48–49

MycoBank number: MB852679; Facesoffungi number: FoF15643

Diagnosis – *Terriera rhododendri* is similar to *Terriera elliptica*, but *Terriera rhododendri* has ascomata without an epithecium, septate paraphyses, and smaller ascospores.

Holotype – CHINA, Yunnan Province, Lijiang, Yulong County, 26.4050 N; 99.5367 E, alt. ca. 2400 m, on living twigs of *Rhododendron* sp. (*Ericaceae*), 12 Jul 2013, C.L. Hou, HOU 1122 (BJTC 2022081).

Etymology – Referring to the host, a species of *Rhododendron*.

Sexual morph: *Ascomata* on twigs, scattered, associated with pale areas. In surface view, ascomata elliptical to elongated elliptical, $850\text{--}1400 \times 425\text{--}650\ \mu\text{m}$, dark brown to black, strongly raising above the surface of the host tissue at maturity, opening by a longitudinal split. *Periphysoids* and *lips* absent. In median vertical section, ascomata subhypodermal. *Covering stroma* ca. $58\ \mu\text{m}$ thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of host cuticle, epidermal and hypodermal cells filled with $3\text{--}5\ \mu\text{m}$ diam., dark brown, thick-walled, angular to globose cells, and an inner layer of $3\text{--}5\ \mu\text{m}$ diam., carbonized, thick-walled, angular to globose cells. Along the edge of the ascoma opening, there is a short extension of the covering stroma without host tissue, $20\text{--}30\ \mu\text{m}$ thick, formed by $3\text{--}5\ \mu\text{m}$ diam., carbonized, thick-walled, angular to globose cells. *Excipulum* attached to the covering stroma, formed by marginal paraphyses, thicker close to the opening. *Basal stroma* $23\text{--}25\ \mu\text{m}$ thick, consisting of $3\text{--}7\ \mu\text{m}$ diam., thick-walled, angular to globose cells. A *space triangular* in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with $45\text{--}60\ \mu\text{m}$ thick, vertically oriented rows of colorless, thin-walled cylindrical cells. *Subhymenium* $12\text{--}20\ \mu\text{m}$ thick, consisting of hyaline textura porrecta. *Paraphyses* septate, filiform, sometimes branched, $150\text{--}175 \times 1\text{--}2\ \mu\text{m}$, hyaline, thin-walled, covered by a thin gelatinous sheath, not forming an epithecium. *Asci* ripening sequentially, cylindrical, apex obtuse to truncate, $115\text{--}150 \times 5\text{--}6\ \mu\text{m}$, hyaline, thin-walled, J-, 8-spored. *Ascospores* 1-septate, filiform, tapering slightly towards both ends, $53\text{--}78 \times 1\text{--}2\ \mu\text{m}$, hyaline, covered by a $0.5\text{--}1\ \mu\text{m}$ thick, gelatinous sheath.

Asexual morph: *Conidiomata* not observed.

Zone lines frequent, dark brown.

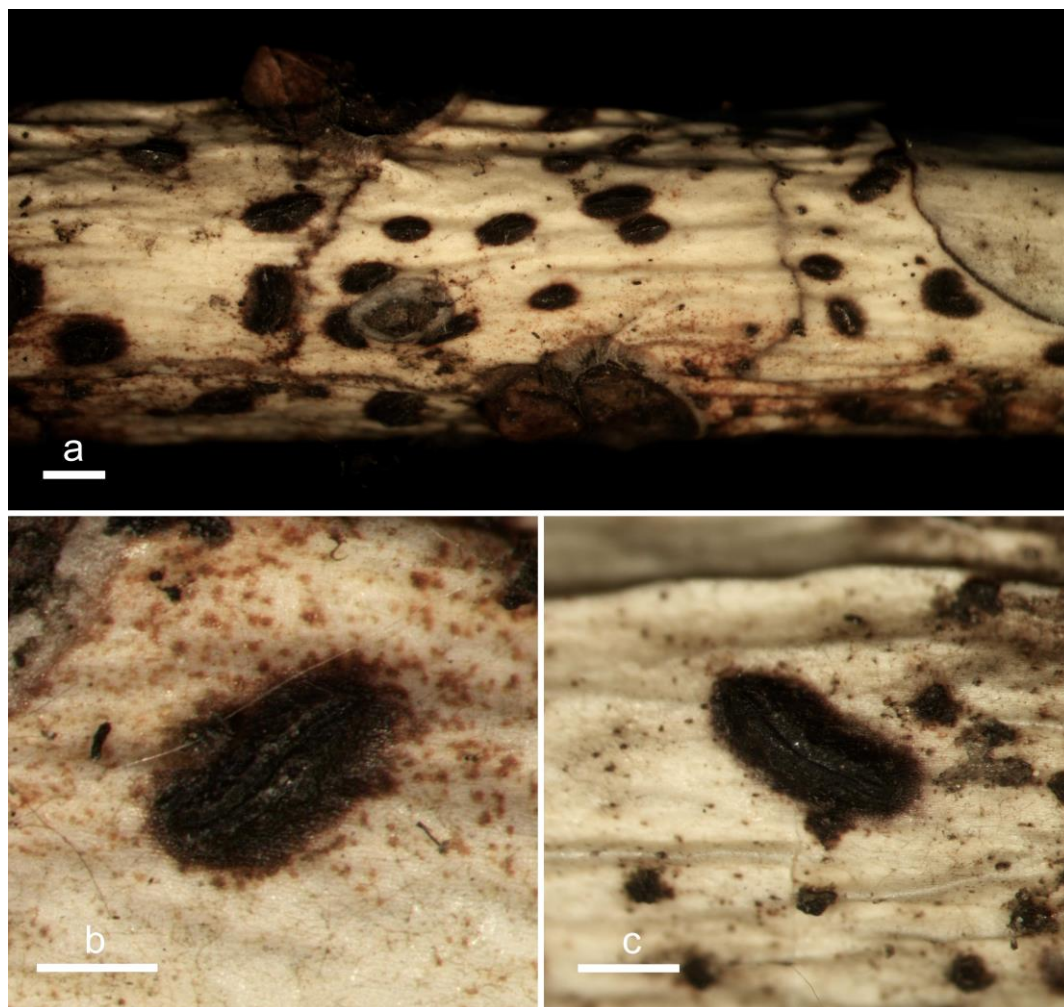


Figure 48 – *Terriera rhododendri* (HOU 1122/BJTC 2022081, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 1 mm, b–c = $500\ \mu\text{m}$.

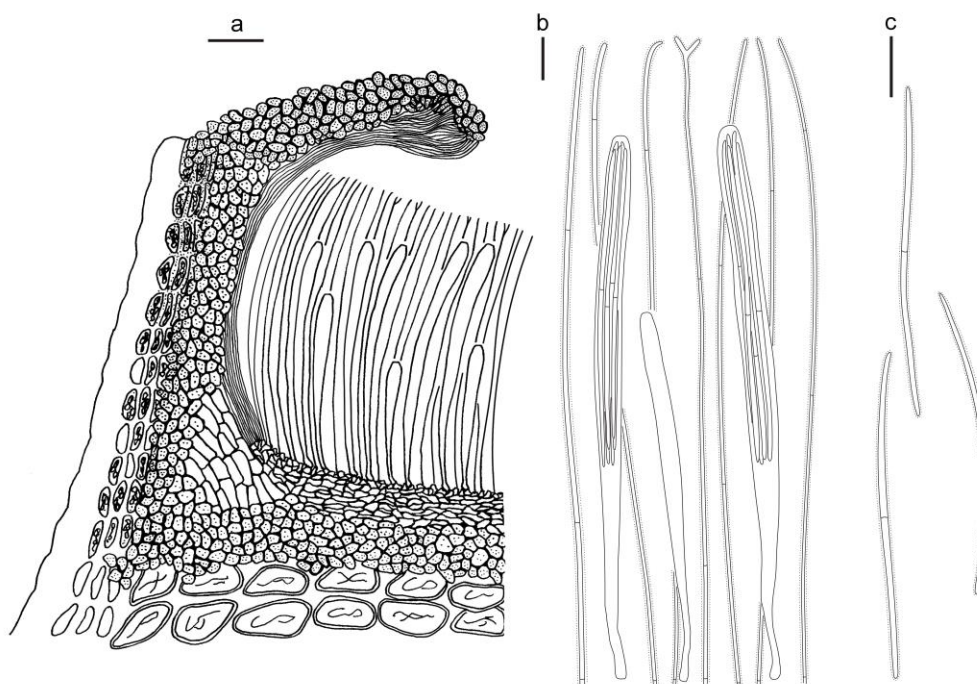


Figure 49 – *Terriera rhododendri* on *Rhododendron* sp. (HOU 1122/BJTC 2022081, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 25 µm, b–c = 10 µm.

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Yulong County, 26.4054 N; 99.5400 E, alt. ca. 2775 m, on twigs of *Rhododendron campylocarpum* (Ericaceae), 20 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1736 (BJTC 2022082, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – Phylogenetic analyses show that molecular sequences of *Terriera rhododendri* (HOU 1122 and CNUCC 1736) cluster with molecular sequences of other *Terriera* species (Clade 3, Fig. 1). *Terriera rhododendri* is morphologically similar to *Te. elliptica*, described on living twigs of *Rhododendron* sp. (Zhang et al. 2015). However, *Te. elliptica* has an epithecium, wider paraphyses (2–3 µm) that are branched 1–3 times at their tips and without septae, as well as larger, not septated ascospores (60–80 × 1.5–2 µm). Therefore, based on morphological characteristics and molecular data, these new specimens are presented as a new species in *Terriera*.

Triblidium Rebent., Index plantarum circum Berolinum sponte nascentium adiectis aliquot fungorum descriptionibus (Berolini): 40 (1805)

Sexual morph: *Ascomata* more or less erumpent, circular, elliptical or rectangular in outline, strongly melanized, with rough outer surface, opening by irregular splits. *Covering stroma* well developed, consisting of carbonized, thick-walled globose, angular cells or hyphae. *Basal stroma* well developed, consisting of textura intricata or angular cells. *Internal matrix of stroma* usually present, consisting of textura intricata or short, hyaline hyphae. *Subhymenium* flat or slightly depressed, consisting of textura intricata and/or small, hyaline angular cells. *Paraphyses* filiform, branched or not branched, not swollen at their tips, covered by a thin gelatinous sheath. *Asci* ripening sequentially, cylindrical, J–, 8-spored. *Ascospores* elliptical, muriform or phragmosporous, inamyloid, hyaline, without a gelatinous sheath. (Description based on Magnes 1997, Karakehian et al. 2019, and Lv et al. 2019a)

Type species – *Triblidium caliciiforme* Rebent., Index plantarum circum Berolinum sponte nascentium adiectis aliquot fungorum descriptionibus (Berolini): 40 (1805).

Notes – The genus *Triblidium* comprises 11 species and is the only genus in the family Tribliidiaceae (Lv et al. 2019a, Karakehian et al. 2019) (Clade 5, Fig. 1). There are four species of

Triblidium known to grow on twigs of *Rhododendron* spp., namely *Tr. carestiae* (De Not.) Rehm, *Tr. hubeiense* T. Lv & C.L. Hou, *Tr. rostriforme* T. Lv & C.L. Hou, and *Tr. yunnanense* T. Lv & C.L. Hou. In this study, three further species of *Triblidium* growing on twigs of *Rhododendron* spp. are described based on morphological characteristics and phylogenetic analyses.

Key to species of *Triblidium* on twigs of *Rhododendron* species

1. Ascospores ellipsoid, without rostriform beaks at the tips 2
1. Periphysoids absent; epithecium occasionally present 3
2. Asci $\leq 10\ \mu\text{m}$ wide; paraphyses not branched at their tips *Tr. laojunshanense*
2. Asci $> 10\ \mu\text{m}$ wide; paraphyses sometimes branched at their tips 4
3. Paraphyses multi-guttulate, mostly branched at the apex; thick-walled asci with 3–8 ascospores; ascospores with 7–14 transverse septa *Tr. carestiae*
3. Paraphyses sparsely guttulate, occasionally branched at the apex; asci thin-walled with 8 ascospores; ascospores with 6 transverse septa *Tr. rostriforme*
4. Epithecium present; asci clavate *Tr. rhododendri*
4. Epithecium absent; asci cylindrical 5
5. Asci 6–8-spored; ascospores more or less round at both ends; internal matrix of the stroma present *Tr. sichuanense*
5. Asci 8-spored; ascospores slightly acute at both ends; internal matrix of the stroma absent 6
6. Ascomata $\geq 1\text{mm}$ diam., circular or rectangular; excipulum absent *Tr. hubeiense*
6. Ascomata $< 1\text{mm}$ diam., circular or slightly irregular; excipulum present *Tr. yunnanense*

Triblidium carestiae (DE NOT.) REHM, 1888; 197.

Holotype – Caledonia; Crarae Gardens, prope Minard, Loch Fyne, Argyll, on bark of *Rhododendron* sp. (*Ericaceae*), 2 Apr 1991, Holotypus Kew (M) 17813.

Notes – This species was described and illustrated in detail by Magnés (1997). *Triblidium carestiae* lacks molecular sequence data, but it is morphologically distinct from other known species of *Triblidium* as well as the species described herein by a variable number of ripening ascospores in the asci.

Triblidium hubeiense T. Lv & C.L. Hou, in Lv, Hou & Johnston, MycoKeys 60: 5 (2019)

Holotype – CHINA, Hubei Province, Shennongjia National Nature Reserve, 31.4360 N; 110.3014 E, alt. ca. 2900 m, on dead twigs of *Rhododendron* sp., 23 Jul 2018, C.L. Hou, HOU 1350A (BJTC 201908).

Notes – This species was described and illustrated in detail by Lv et al. (2019a). Morphologically, *Triblidium hubeiense* is similar to *Tr. sherwoodiae* Magnés, but *Tr. sherwoodiae* has paraphyses with swollen terminal cells, straight ascospores and is only found on *Pinus ponderosa* Douglas ex C. Lawson. Phylogenetically, *Triblidium hubeiense* is closely related to *Tr. sichuanense* and *Tr. laojunshanense*, but differs by circular or rectangular, solitary or occasionally confluent ascomata, a well-developed covering stroma (270–300 μm), no internal matrix of the stroma, and 6–8-spored asci in morphology (Lv et al. 2019a).

Triblidium laojunshanense M.J. Guo & C.L. Hou, sp. nov.

Figs 50–51

MycoBank number: MB852680; Facesoffungi number: FoF15644

Diagnosis – The new species resembles *Triblidium rostriforme*, but differs by not branched paraphyses, smaller asci and shorter ascospores without rostriform structures at their tips.

Etymology – Referring to the name of the location (Laojunshan) where the specimen was collected.

Sexual morph: *Ascomata* erumpent from bark, scattered. In surface view, ascomata solitary, round to subround, 600–1000 μm diam., with a black outer surface sculptured with polygonal areolae, strongly raised from the surface of the substratum, opening by irregular splits to expose the

yellow hymenium. *Lips* absent. In median vertical section, ascomata 350–450 μm deep. *Covering stroma* 50–66 μm thick in the middle, thinning towards the base to 25–35 μm , consisting of an outer layer of strongly carbonized hyphae and an inner layer of hyaline hyphae. *Periphysoids* absent. *Basal stroma* 35–50 μm thick, consisting of an outer layer of strongly carbonized hyphae and an inner layer of hyaline hyphae. *Internal matrix of stroma* 70–115 μm thick, consisting of *textura intricata*. *Subhymenium* 25–75 μm thick, consisting of hyaline angular cells. *Excipulum* weakly developed, formed by marginal paraphyses. *Paraphyses* filiform, slightly curved at the tips, not swollen and not branched at their tips, 100–130 $\times$ ca. 1 μm , thin-walled, pluriguttulate, covered by a thin gelatinous sheath, forming a poorly developed epithecium at the tip. *Asci* ripening sequentially, cylindrical, apex obtuse to round, 80–110 $\times$ 8–10 μm , thin-walled, J–, 8-spored. *Ascospores* muriform at maturity, with usually 8 transverse septa and a few longitudinal and oblique septa, elliptical, 9–24 $\times$ 5–13 μm , hyaline, without a gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimen examined – CHINA, Yunnan Province, Dali Bai Autonomous Prefecture, Mount Cangshan, 25.6609 N; 100.1323 E, alt. ca. 2626 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 18 Aug 2023, C.L. Hou, L. Zhuo, and S.Y. Zhao, HOU 2123 (BJTC 2022127, paratype).

Known distribution – Known only from Yunnan Province, China.



Figure 50 – *Triblidium laojunshanense* (HOU 1620/BJTC 2022083, holotype). a Ascomata on a twig of *Rhododendron* sp. b Mature ascoma. c Immature ascoma. Scale bars: a–c = 500 μm .

Notes – Morphologically, *Triblidium laojunshanense* is similar to *Tr. hubeiense* and *Tr. rostriforme*. However, *Tr. hubeiense* has larger ascomata (1.3–2.0 mm) without excipulum,

larger asci ($160\text{--}200 \times 15\text{--}24 \mu\text{m}$) and ascospores ($20\text{--}30 \times 12\text{--}18 \mu\text{m}$) (Lv et al. 2019a). *Triblidium rostriforme* has paraphyses that are occasionally branched, larger asci ($160\text{--}220 \times 15\text{--}25 \mu\text{m}$), and longer ascospores ($35\text{--}50 \mu\text{m}$) with rostriform structures at their tips (Lv et al. 2019a). The ITS rDNA sequence similarity between this novel species and *Tr. hubeiense* and *Tr. rostriforme* is 93% and 94%, respectively.

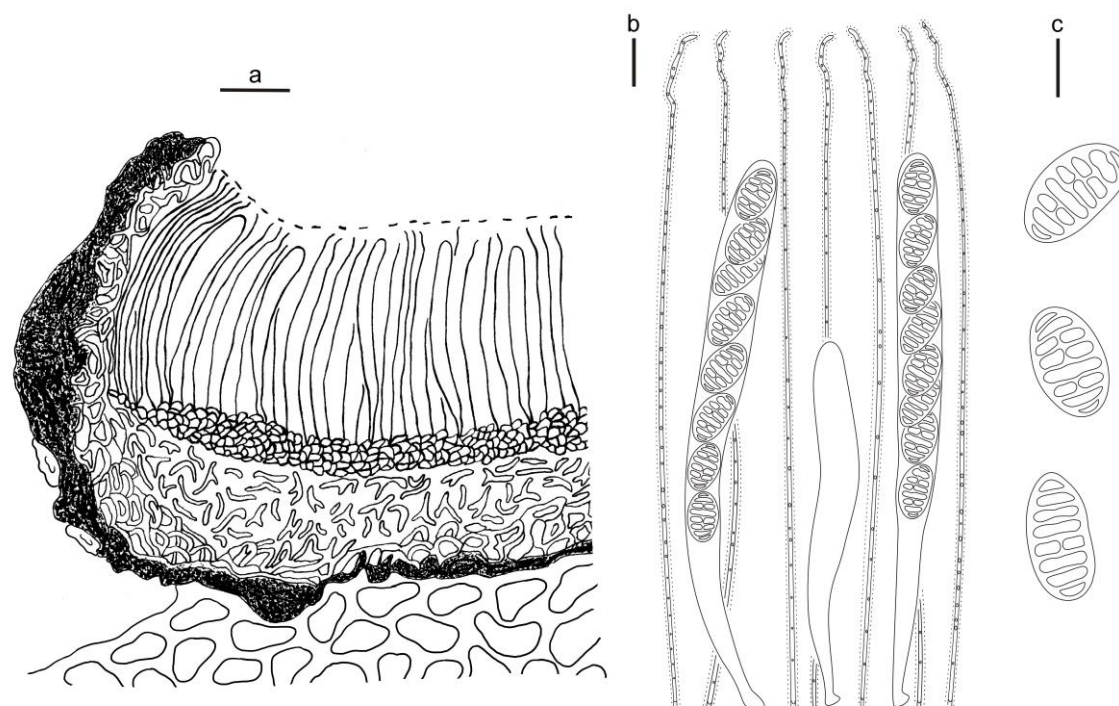


Figure 51 – *Triblidium laojunshanense* on *Rhododendron* sp. (HOU 1620/BJTC 2022083, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = $50 \mu\text{m}$, b–c = $10 \mu\text{m}$.

Triblidium rhododendri M.J. Guo & C.L. Hou, sp. nov.

Figs 52–53

Mycobank number: MB852681; Facesoffungi number: FoF15645

Diagnosis – The new species differs from the species of *Triblidium* on twigs of *Rhododendron* sp. by clavate asci and ascospores that are pointed at both tips.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, alt. ca. 3400 m, on dead twigs of *Rhododendron decorum* (Ericaceae), 5 Aug 2006, C.L. Hou, HOU 326A (BJTC 2022084, holotype).

Etymology – Referring to the host genus *Rhododendron*.

Sexual morph: *Ascomata* first embedded in bark, erumpent from the bark at maturity, solitary, circular or slightly irregular in outline, $625\text{--}1250 \mu\text{m}$ diam., with a black outer surface sculptured with polygonal areolae, opening by irregular splits to expose a light-yellow hymenium. In median vertical section, ascomata $425\text{--}670 \mu\text{m}$ deep. *Covering stroma* $40\text{--}100 \mu\text{m}$ thick near the center of the ascomata, and thinner towards the edges, consisting of an outer layer of carbonized, thick-walled, angular to globose cells, occasionally remains of host cortex adhering to the outermost layer fungal cells, and an inner layer of $3\text{--}5 \times 4\text{--}7 \mu\text{m}$, hyaline angular to globose cells. *Basal stroma* $40\text{--}60 \mu\text{m}$ thick, consisting of $3\text{--}5 \times 4\text{--}8 \mu\text{m}$, carbonized, thick-walled, angular to globose cells. *Internal matrix of stroma* well developed, $80\text{--}120 \mu\text{m}$ thick, consisting of hyaline hyphae. *Subhymenium* $25\text{--}30 \mu\text{m}$ thick, consisting of textura intricata, and small, hyaline, angular cells. *Paraphyses* filiform, sometimes branched or slightly circinate at their tips, $230\text{--}250 \times 1.5\text{--}2 \mu\text{m}$, covered by a thin gelatinous sheath, forming an excipulum by their tips. *Asci* ripening sequentially,

clavate, rounded at the apex, $120\text{--}225 \times 12.5\text{--}25\ \mu\text{m}$, thin-walled, J–, 8-spored. *Ascospores* muriform at maturity, elliptical, pointed at both ends, $25\text{--}37.5 \times 11\text{--}15\ \mu\text{m}$, hyaline, without a gelatinous sheath.

Asexual morph: Conidiomata and zone lines not seen.

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.0504 N; 102.5053 E, alt. ca. 3823 m, on twigs of *Rhododendron lutescens* (Ericaceae), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1848B (BJTC 2022085).

Known distribution – Known only from Yunnan Province, China.

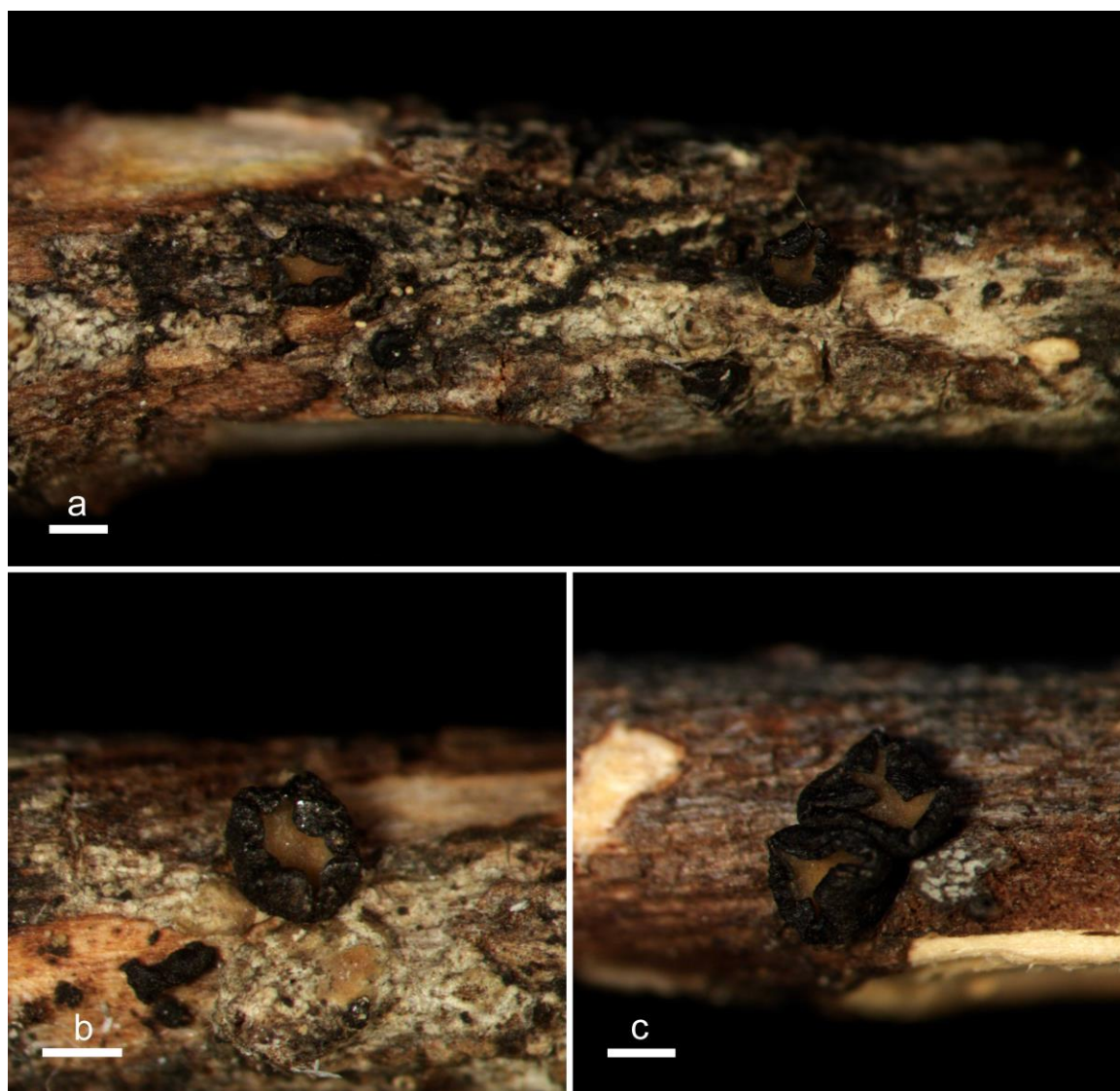


Figure 52 – *Triblidium rhododendri* (HOU 326A/BJTC 2022084, holotype). a Ascomata on a twig of *Rhododendron decorum*. b–c Mature ascomata. Scale bars: a–c = 500 μm .

Notes – *Triblidium rhododendri* is morphologically similar to *Tr. hubeiense*, but *Tr. hubeiense* has larger ascomata (1.3–2.0 mm) without an epithecium, not branched paraphyses, a basal stroma consisting of hyphae, and ellipsoidal ascospores with round ends. The ITS rDNA sequence similarity between these two species is 93%. Based on the combined analyses of ITS, nrLSU, and mtSSU rDNA sequences, this new species has a close relationship with *Tr. laojunshanense*, but *Tr. laojunshanense* significantly differs by a covering stroma consisting of hyphae, a moderately developed excipulum, thinner paraphyses (ca. 1 μm) and asci (8–10 μm), and shorter ascospores (9–24 μm) with round ends. The ITS sequences similarity between these two species is 96%.

Triblidium rostriforme T. Lv & C.L. Hou, in Lv, Hou & Johnston, MycoKeys 60: 8 (2019)

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.6831 N; 99.6997 E, alt. ca. 4056 m, on dead twigs of *Rhododendron* sp. (*Ericaceae*), 25 Jun 2011, C.L. Hou, HOU 889 (BJTC 201906).

Specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3754 N; 99.4330 E, alt. ca. 3837 m, on dead twigs of *Rhododendron* sp. (*Ericaceae*), 17 Jul 2020, C.L. Hou, M.J. Guo and Q.T. Wang, HOU 1603B (BJTC 2022086).

Notes – This species was described and illustrated in detail by Lv et al. (2019a). Morphologically, *Triblidium rostriforme* differs from most *Triblidium* species by producing ellipsoid ascospores that have rostriform structures at their tips. In the phylogenetic analyses, this species has a relatively independent position.

Triblidium sichuanense M.J. Guo & C.L. Hou, sp. nov.

Figs 54–55

Mycobank number: MB852682; Facesoffungi number: FoF15646

Diagnosis – This new species is similar to *Triblidium yunnanense*, but *Triblidium sichuanense* has larger ascomata and a basal stroma consisting of angular cells.

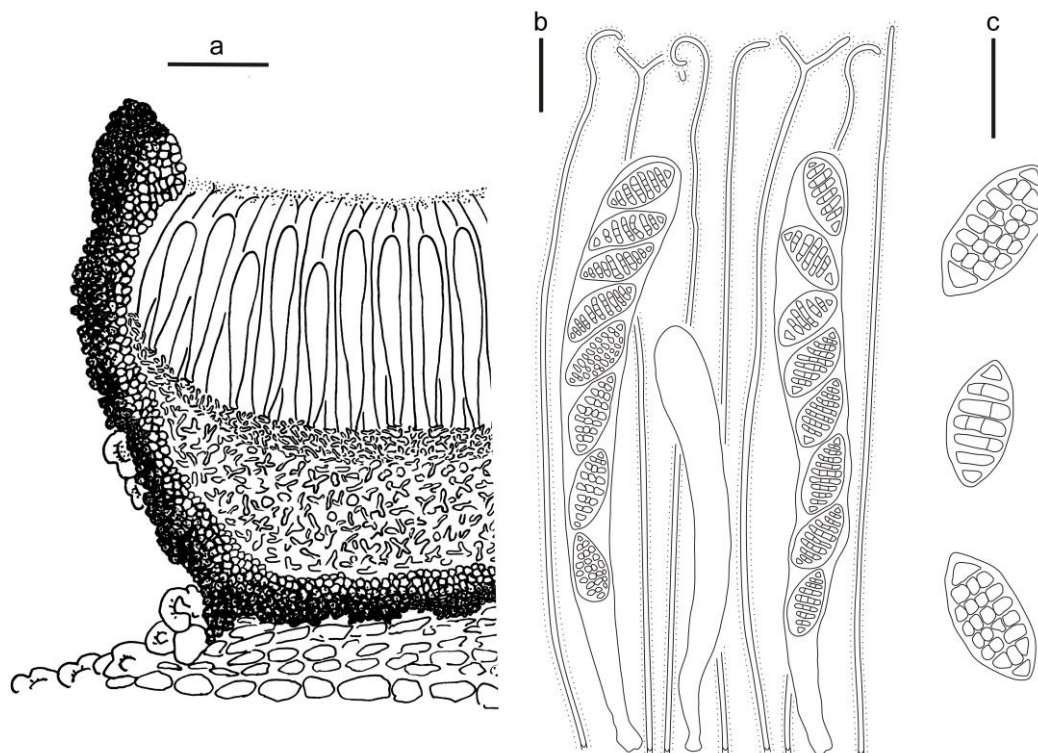


Figure 53 – *Triblidium rhododendri* on *Rhododendron decorum* (HOU 326A/BJTC 2022084, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 100 µm, b = 25 µm, c = 20 µm.

Holotype – CHINA, Sichuan Province, Xiaojin County, Jiajinshan, alt. ca. 4000 m, on dead twigs of *Rhododendron* sp. (*Ericaceae*), 25 Jul 2006, C.L. Hou, HOU 295 (BJTC 2022087, holotype).

Etymology – Referring to the name of the province (Sichuan) where the specimen was collected.

Sexual morph: *Ascomata* erumpent from bark, solitary, elliptical in outline, 850–1700 µm diam., with a black outer surface sculptured with polygonal areolae, opening by irregular splits to expose light yellow hymenium. In median vertical section, ascomata 450–550 µm deep. *Covering*

stroma 55–85 μm thick near the center of ascomata, consisting of an outer layer of strongly carbonized, thick-walled angular cells, some remains of host cortex adhering to the outermost layer fungal cells, and an inner layer of 3.5–5 μm diam., hyaline angular cells. *Basal stroma* 65–85 μm thick, consisting of an outer layer of strongly carbonized, thick-walled angular cells, and an inner layer of hyaline, angular cells. *Internal matrix of stroma* 50–80 μm thick, consisting of short, hyaline hyphae. *Subhymenium* 45–60 μm thick, consisting of small, hyaline angular cells and *textura intricata*. *Excipulum* inconspicuous, formed by marginal paraphyses. *Paraphyses* filiform, often branched at their tips, $200\text{--}260 \times 1 \mu\text{m}$, pluriguttulate. *Asci* ripening sequentially, cylindrical, rounded at the apex, $120\text{--}220 \times 12\text{--}20 \mu\text{m}$, thin-walled, J-, 8-spored. *Ascospores* muriform at maturity, usually with 8 transverse septa and a few longitudinal and oblique septa, elliptical to elongated elliptical, some slightly acute at both ends, $20\text{--}30 \times 12\text{--}20 \mu\text{m}$, hyaline, without a gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not seen.



Figure 54 – *Triblidium sichuanense* (HOU 295/BJTC 2022087, holotype). a Ascomata on a twig of *Rhododendron ovatum*. b–c Mature ascomata. Scale bars: a = 1 mm, b–c = 500 μm .

Additional specimen examined – CHINA, Gansu Province, Gannan Tibetan Autonomous Prefecture, Diebu County, 34.1538 N; 103.3477 E, alt. ca. 3647 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 10 Aug 2023, C.L. Hou, M.J. Guo, and X.N. Sui, HOU 1964 (BJTC 2022119, paratype); CHINA, Gansu Province, Gannan Tibetan Autonomous Prefecture, Diebu County, 39.1539 N; 103.3478 E, alt. ca. 3646 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 10 Aug 2023, C.L. Hou, M.J. Guo, and X.N. Sui, HOU 1965 (BJTC 2022120, paratype); CHINA, Gansu Province, Gannan Tibetan Autonomous Prefecture, Diebu County, 34.1539 N; 103.3476 E, alt. ca.

3666 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 10 Aug 2023, C.L. Hou, M.J. Guo, and X.N. Sui, HOU 1971 (BJTC 2022121, paratype); CHINA, Gansu Province, Gannan Tibetan Autonomous Prefecture, Diebu County, 34.1537 N; 103.3475 E, alt. ca. 3651 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 10 Aug 2023, C.L. Hou, M.J. Guo, and X.N. Sui, HOU 1977 (BJTC 2022122, paratype).

Notes – *Triblidium sichuanense* is similar to *Triblidium yunnanense* and *Triblidium hubeiense* occurring on twigs of *Rhododendron* sp., but *Tr. yunnanense* has smaller ascomata (0.5–0.8 mm), a well-developed excipulum and a basal stroma consisting of hyphae. *Tr. hubeiense* has not branched paraphyses, a basal stroma consisting of hyphae. The ITS rDNA sequences similarity between *Triblidium sichuanense* and *Tr. yunnanense* is 96%, between *Tr. sichuanense* and *Tr. hubeiense* 93%, so based on morphological characteristics and molecular data, this novel fungus is identified as a new species in *Triblidium*.

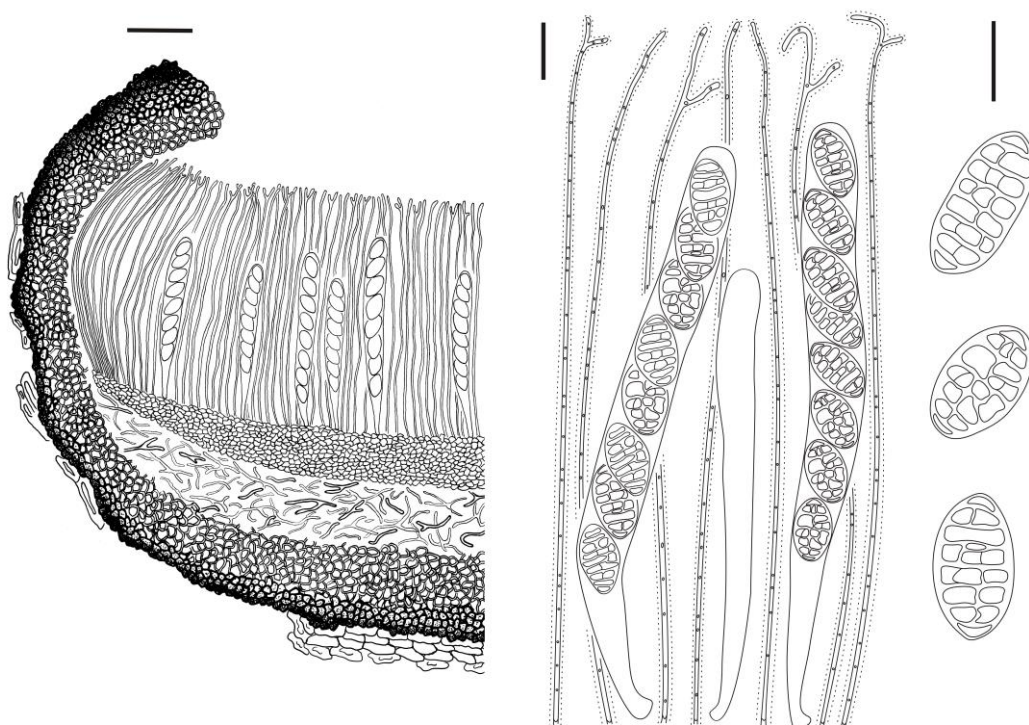


Figure 55 – *Triblidium sichuanense* on *Rhododendron ovatum* (HOU 295/BJTC 2022087, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 50 µm, b–c = 20 µm

Triblidium yunnanense T. Lv & C.L. Hou, in Lv, Hou & Johnston, MycoKeys 60: 9 (2019)

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.6571 N; 99.6944 E, alt. ca. 4070 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 25 Jun 2011, C.L. Hou 875A (BJTC 201903).

Specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3826 N; 99.4603 E, alt. ca. 3492 m, on living twigs of *Rhododendron clementinae* (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1611 (BJTC 2022089); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3751 N; 99.4259 E, alt. ca. 4004 m, on bark of *Rhododendron* sp. (*Ericaceae*), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1822B (BJTC 2022088).

Notes – This species was described and illustrated in detail by Lv et al. (2019a). Morphologically, *Triblidium yunnanense* is similar to *Tr. hafellneri* Magnes, but in contrast to *Tr. hafellneri*, *Tr. yunnanense* has narrower asci (13–18 µm), ascospores with 6–8 transverse septa and only occurs on twigs of *Rhododendron* sp. In the phylogenetic analyses, this species has a relatively independent position.

Yingrenia M.J. Guo, M. Piepenbr. & C.L. Hou, gen. nov.

Mycobank number: MB852683; Facesoffungi number: FoF 15606

Etymology – Honouring Prof. Ying-Ren Lin, a famous Chinese forest pathologist, for his great contribution to the research of *Rhytismatales* in China.

Sexual morph: *Ascomata* on twigs of *Rhododendron* spp., scattered, subround to elliptical, opening by a longitudinal split or irregular slit to expose the hymenium. *Lips* absent or poor developed. *Ascomata* intraepidermal, intracortical or subcortical. *Paraphysoids* absent. *Excipulum* mostly absent. *Covering stroma* well developed, consisting of carbonized, thick-walled globose to angular cells or hyphae. *Basal stroma* usually well developed, consisting of carbonized, thick-walled globose to angular cells or hyphae. *Internal matrix of stroma* sometimes present, consisting of thin-walled, hyaline, angular to globose cells or hyaline hyphae. *Subhymenium* flat or slightly depressed, consisting of hyaline textura porrecta, textura intricata, and thin-walled angular cells. *Paraphyses* filiform, usually swollen at their tips. *Asci* ripening sequentially, clavate, thin-walled, J–, 8-spored. *Ascospores*, aseptate, bifusiform, hyaline, covered by a gelatinous sheath.

Asexual morph: *Conidiomata* brown to dark brown, round or slightly irregular. *Conidiogenous cells* and *conidia* not seen.

Type species – *Yingrenia erumpens* (C.L. Hou & M. Piepenbr.) M.J. Guo, M. Piepenbr. & C.L. Hou, described below.

Notes – The phylogenetic analysis shows that sequence data obtained from specimens cited below for species of *Yingrenia* form a well-supported clade together with the sequence of *Neococcomyces erumpens* C.L. Hou & M. Piepenbr. with 100% MLB, 99% MPB, and 1.00 PP bootstrap support (Clade 10, Fig. 1). They are, however, only distantly related to *Neococcomyces rhododendri* Y.R. Lin, C.T. Xiang & Z.Z. Li, the type species of *Neococcomyces*. Like the new species of *Yingrenia*, *Neococcomyces erumpens* occurs on twigs of *Rhododendron* spp. In contrast, two other species of the genus *Neococcomyces*, the type species *Neococcomyces rhododendri* and *Neococcomyces yunnanensis* C.L. Hou & J. Gao, only occur on fallen leaves of *Rhododendron* sp. Morphologically, *Neococcomyces rhododendri* and *Neococcomyces yunnanensis* have triangular to polygonal ascomata and bifusiform ascospores, which are more elongated than the ascospores of species of *Yingrenia* that occur on twigs. Hou & Piepenbring (2009) already pointed out that the taxonomic position of *Neococcomyces erumpens* may be inaccurate, because leaf-inhabiting species and twig-inhabiting species might be distantly related. In the present study, with the addition of more specimens and data, *Neococcomyces erumpens* is proposed as type species of the new genus *Yingrenia*.

Key to twig-inhabiting species of *Yingrenia* on *Rhododendron* species

1. Ascomata elongated elliptical to sublinear, opening by a longitudinal split 2
1. Ascomata subround to elliptical, opening by irregular splits 4
2. Ascospores intracortical *Y. debililabioides*
2. Ascospores subcortical 3
3. Lip cell-like cells present; no internal matrix of stroma; ascospores covered by a 7–9 µm thick gelatinous sheath *Y. debililabiata*
3. Lip cell-like cells absent; internal matrix of stroma well developed; ascospores covered by a thin gelatinous sheath *Y. rhododendri*
4. Ascomata intraepidermal; conidiomata and zone lines present *Y. papillata*
4. Ascomata subcortical or intracortical; conidiomata and zone lines absent 5
5. Ascomata intracortical; basal stroma absent; internal matrix of stroma well-developed
..... *Y. laojunshanensis*
5. Ascomata subcortical; basal stroma present; internal matrix of stroma absent 6
6. Ascospores covered by a gelatinous sheath > 8 µm thick; Paraphyses pluriguttulate *Y. cannonii*
6. Ascospores covered by a gelatinous sheath < 4 µm thick; Paraphyses without guttulae 7
7. Ascomata circular; excipulum absent; asci < 20 µm wide; epithecium absent *Y. erumpens*

7. Ascomata subround or rounded triangular; excipulum moderately developed; asci $> 20\ \mu\text{m}$ wide; epithecium present *Y. yunnanensis*

Yingrenia cannonii M.J. Guo & C.L. Hou, sp. nov.

Figs 56–57

Mycobank number: MB852691; Facesoffungi number: FoF15647

Diagnosis – This new species is similar to *Neococcomyces erumpens*, but has a thinner covering stroma and basal stroma, a subhymenium consisting of textura porrecta, pluriguttulate paraphyses, and an epithecium with granular crystalloids.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3751 N; 99.4335 E, alt. ca. 3839 m, on twigs of *Rhododendron lutescens* (Ericaceae), 21 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1797 (BJTC 2022100, holotype).

Etymology – To honor the famous mycologists Paul F. Cannon, who made great contributions to the knowledge of *Rhytismatales*.

Sexual morph: *Ascomata* on bark, not associated with pale areas, scattered. As seen from above, ascomata subround to widely elliptical, 1000–1200 μm diam., concolorous with the surface of the bark, strongly raising above the surface of the host tissue at maturity, opening by irregular splits to expose a yellow to light orange hymenium. *Lips* absent. In median vertical section, ascomata subcortical. *Covering stroma* 50–60 μm thick near the centre of an ascoma, extending to the basal stroma, consisting of $3\text{--}8 \times 4\text{--}10\ \mu\text{m}$, thick-walled, angular to globose cells, gradually carbonized from the inner layer to the outer layer. *Periphysoids* absent. *Basal stroma* 18–30 μm thick, consisting of $5\text{--}10\ \mu\text{m}$ diam., thick-walled, angular to globose cells. *Subhymenium* 30–35 μm thick, consisting of textura porrecta. *Paraphyses* filiform, coiled and interweaved at their tips, forming an epithecium at the tip with granular crystalloids, $160\text{--}220 \times \text{ca. } 1\ \mu\text{m}$, pluriguttulate. *Asci* ripening sequentially, clavate, apex obtuse to round, with a stalk, $140\text{--}200 \times 15\text{--}20\ \mu\text{m}$, thin-walled, J–, 8-spored. *Ascospores* aseptate, bifusiform, $26\text{--}33 \times 3\text{--}6\ \mu\text{m}$, covered by an 8–15 μm thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Known distribution – Known only from Yunnan Province, China.

Notes – The shape of the ascomata and the asci of *Yingrenia cannonii* are similar to those of *Yingrenia erumpens*, but *Y. erumpens* has a thicker covering stroma (70–100 μm), a well-developed basal stroma (60–155 μm), a subhymenium consisting of textura intricata, paraphyses without guttulae, ascospores with a thinner gelatinous sheath (2–4 μm), and no epithecium. According to the phylogenetic analysis, *Y. cannonii* is closely related to *Yingrenia papillata*. *Yingrenia papillata*, however, has smaller (600–800 μm diam.), more or less circular to slightly irregular, shiny black, and intraepidermal ascomata that often present a small round papilla in the centre when they are immature, an internal matrix in the stroma, wider paraphyses (2–2.5 μm) that are often branched and swollen to 4–6 μm diam. at their tips, shorter asci (75–120 μm) and ascospores covered by a thinner gelatinous sheath (4–7 μm).

Yingrenia debililabiata M.J. Guo & C.L. Hou, sp. nov.

Figs 58–59

Mycobank number: MB852685; Facesoffungi number: FoF15648

Diagnosis – The new species is characterized by lip cell-like cells at the dehiscence line of the covering stroma.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3751 N; 99.4321 E, alt. ca. 3887 m, on dead twigs of *Rhododendron lutescens* (Ericaceae), 17 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1604B (BJTC 2022102, holotype).

Etymology – *debilis* (lat.) = poorly, *labium* (lat.) = lip, referring to the lip cell-like cells at the dehiscence line of the covering stroma.

Sexual morph: *Ascomata* on bark, scattered. As seen from above, ascomata elongated elliptical, often acute at both ends, $665\text{--}865 \times 265\text{--}300\ \mu\text{m}$, concolorous with the surface of the bark, slightly raising above the surface of the host tissue at maturity, opening by a longitudinal split to expose the yellow hymenium. In median vertical section, ascomata subcortical. *Covering stroma*

60–65 μm thick near the centre of the ascomata, thinner towards the basal stroma, consisting of 3–6 $\times$ 3–9 μm , carbonized, thick-walled, angular to globose cells, with host cortex adhering to the outermost layer of fungal cells. *Periphysoids* absent. *Lip* cell-like cells present at the dehiscence line of the covering stroma. *Basal stroma* 30–45 μm thick, consisting of carbonized, thick-walled angular cells. A *space triangular* in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with thin-walled, hyaline angular cells. *Subhymenium* 12–20 μm thick, consisting of hyaline angular cells and *textura porrecta*. *Paraphyses* filiform, slightly swollen and curved at the tips, not branched, 190–210 $\times$ ca. 2 μm . *Asci* ripening sequentially, clavate, apex obtuse to round, 165–170 $\times$ 15–20 μm , thin-walled, long-stalked, J–, 8-spored. *Ascospores* aseptate, bifusiform, with an obtuse to round apex and a somewhat pointed tip at the basis, 30–35 $\times$ 5–6 μm , covered by a 7–9 μm thick gelatinous sheath.

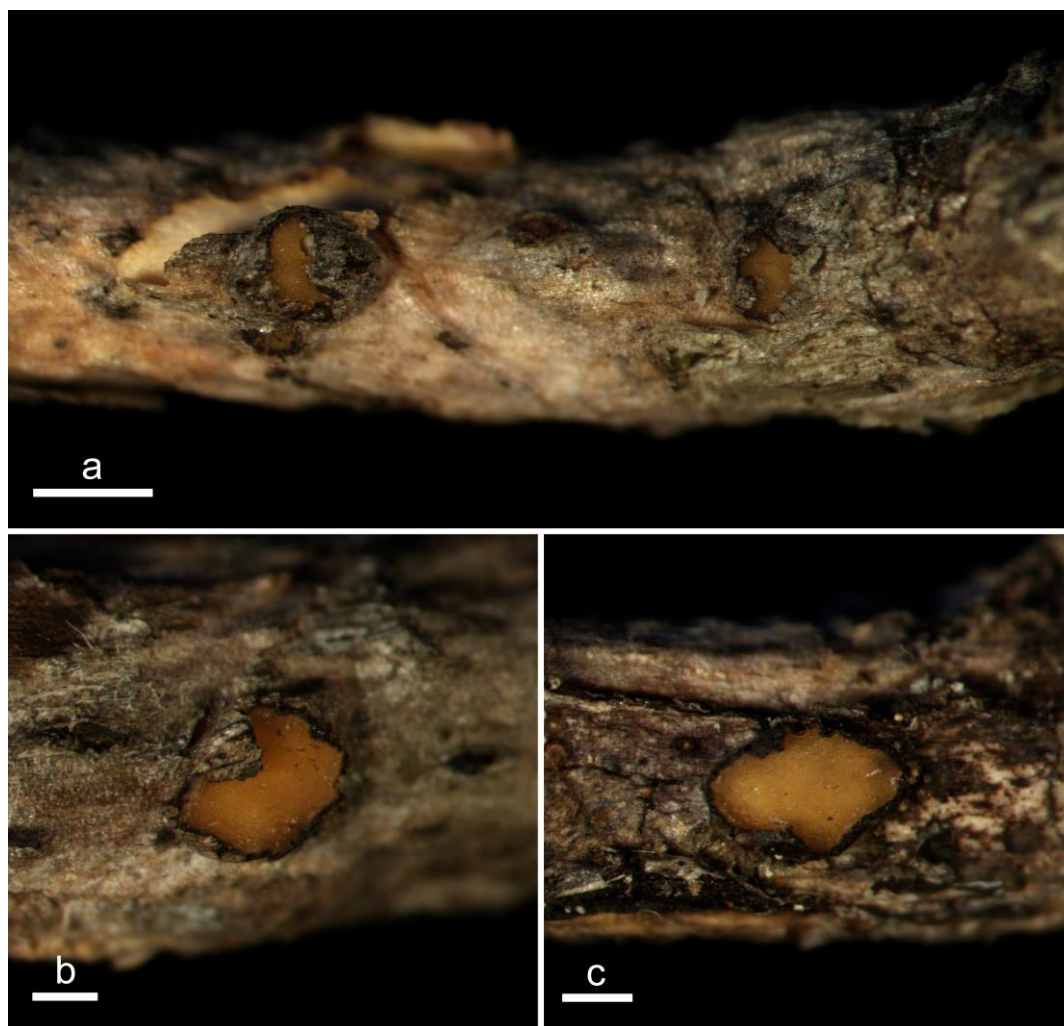


Figure 56 – *Yingrenia cannonii* (HOU 1797/BJTC 2022100, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 1 mm, b–c = 500 μm .

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.6310 N; 99.7226 E, alt. ca. 3895 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 17 Aug 2023, C.L. Hou, L. Zhuo, and S.Y. Zhao, HOU 2073B (BJTC 2022125, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – *Yingrenia debililabiata* is similar to *Yingrenia cannonii* and *Y. debililabioides*, but *Y. debililabiata* differs significantly from them by the presence of lip cell-like cells, a thicker basal stroma (30–45 μm), and wider paraphyses (ca. 2 μm).

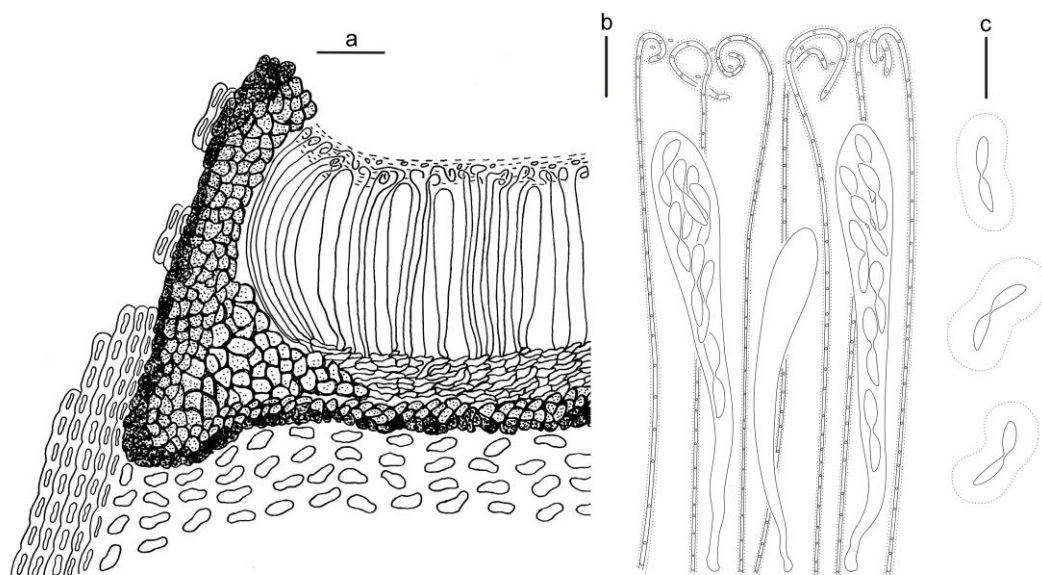


Figure 57 – *Yingrenia cannonii* on *Rhododendron* sp. (HOU 1797/BJTC 2022100, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and an immature ascus. c Liberated ascospores. Scale bars: a = 50 µm, b–c = 20 µm.

Yingrenia debililabioides M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 60–61

Mycobank number: MB852686; Facesoffungi number: FoF15649

Diagnosis – The new species is similar to *Yingrenia debililabiata*, but *Y. debililabioides* has intracortical ascomata, no lips, a thinner basal stroma, an internal matrix in the stroma, a thicker subhymenium, thinner paraphyses, shorter asci, and longer ascospores.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, alt. ca. 3500 m, on dead twigs of *Rhododendron* sp. (*Ericaceae*), 11 Jul 2007, C.L. Hou, HOU 444 (BJTC 2022103, holotype) – living culture CNUCC 444 (ex-type).

Etymology – Referring to the morphologically rather similar and phylogenetically close species *Yingrenia debililabiata*.

Sexual morph: *Ascomata* on dead or senescent twigs. As seen from above, ascomata elongated elliptical, 650–1500 × 350–450 µm, concolorous with the surface of the twigs, slightly raising above the surface of the host tissue at maturity, opening by a longitudinal split to expose a light-yellow hymenium. *Lip cells* absent. In median vertical section, ascomata intracortical. *Covering stroma* 50–110 µm thick near the center of the ascomata (without host tissue), of rather constant thickness towards the edges, consisting of an outer layer of host cortex and an inner layer of carbonized hyphae. *Periphysoids* absent. *Basal stroma* 15–25 µm thick, consisting of carbonized hyphae. Internal matrix of stroma 35–50 µm thick, consisting of hyaline hyphae. *Subhymenium* 30–40 µm thick, consisting of hyaline textura intricata. *Excipulum* absent. *Paraphyses* aseptate, filiform, not branched, swollen up to 4 µm diam. at their tips, 150–180 × 1–1.5 µm, usually with a thin gelatinous sheath. *Asci* ripening sequentially, clavate, apex obtuse to round, 90–150 × 12–19 µm, J–, 8-spored. *Ascospores* aseptate, bifusiform, 35–45 × 4–8 µm, hyaline, covered by a 3–7 µm thick gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Known distribution – Known only from Yunnan Province, China.

Notes – According to the phylogenetic analysis, *Yingrenia debililabiata* is closely related to this new species, but *Y. debililabiata* presents subcortical ascomata, a covering stroma of angular and globose cells, lip cell-like cells, a thicker basal stroma (30–45 µm) formed by angular cells, no internal matrix in the stroma, thicker paraphyses (ca. 2 µm), longer asci (165–170 µm), and shorter ascospores (30–35 µm) with a thicker gelatinous sheath (7–9 µm). The similarity of ITS rDNA sequences between these two species is 95%.

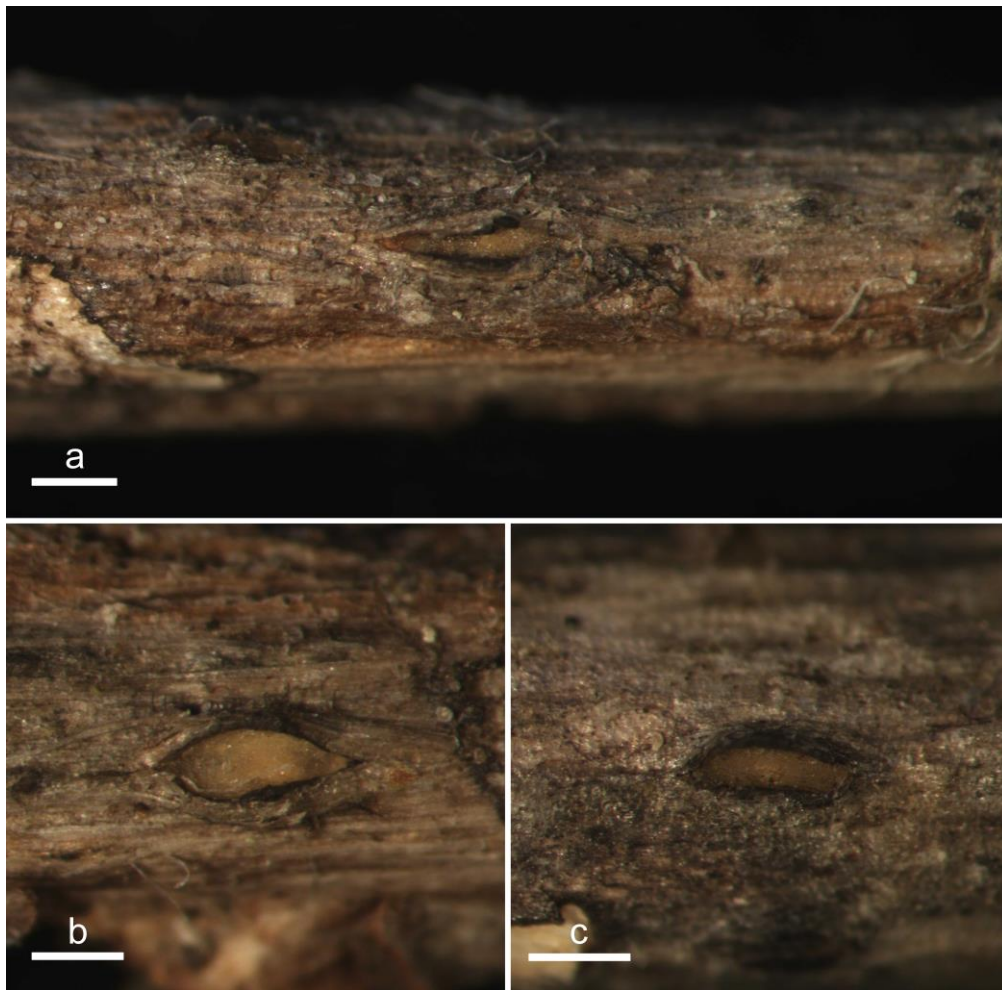


Figure 58 – *Yingrenia debililabiata* (HOU 1604B/BJTC 2022102, holotype). a Ascoma on a twig of *Rhododendron lutescens*. b–c Mature ascomata. Scale bars: a–c = 500 μ m.

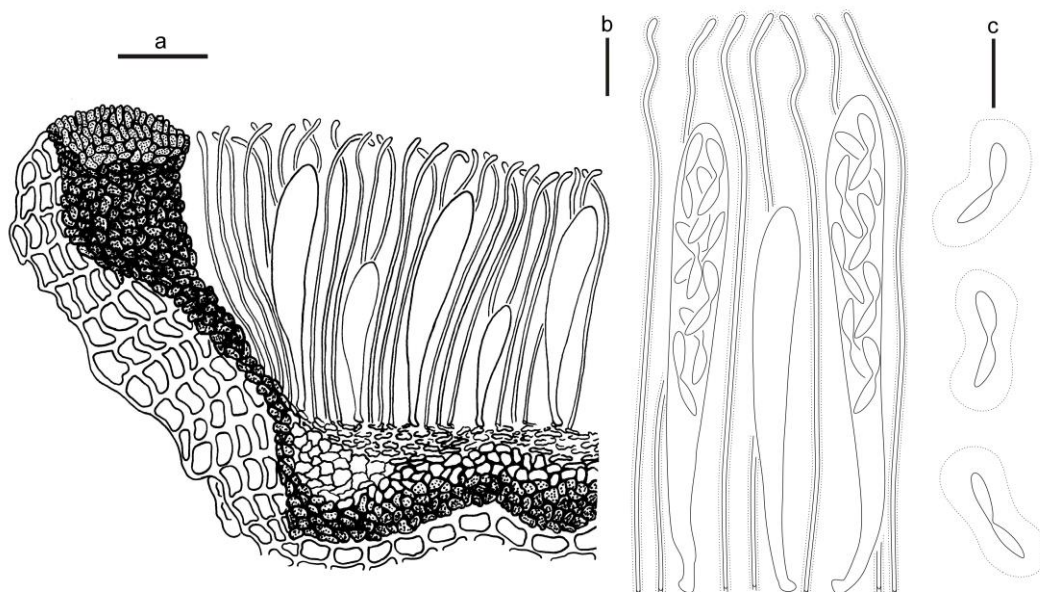


Figure 59 – *Yingrenia debililabiata* on *Rhododendron lutescens* (HOU 1604B/BJTC 2022102, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 50 μ m, b–c = 20 μ m.

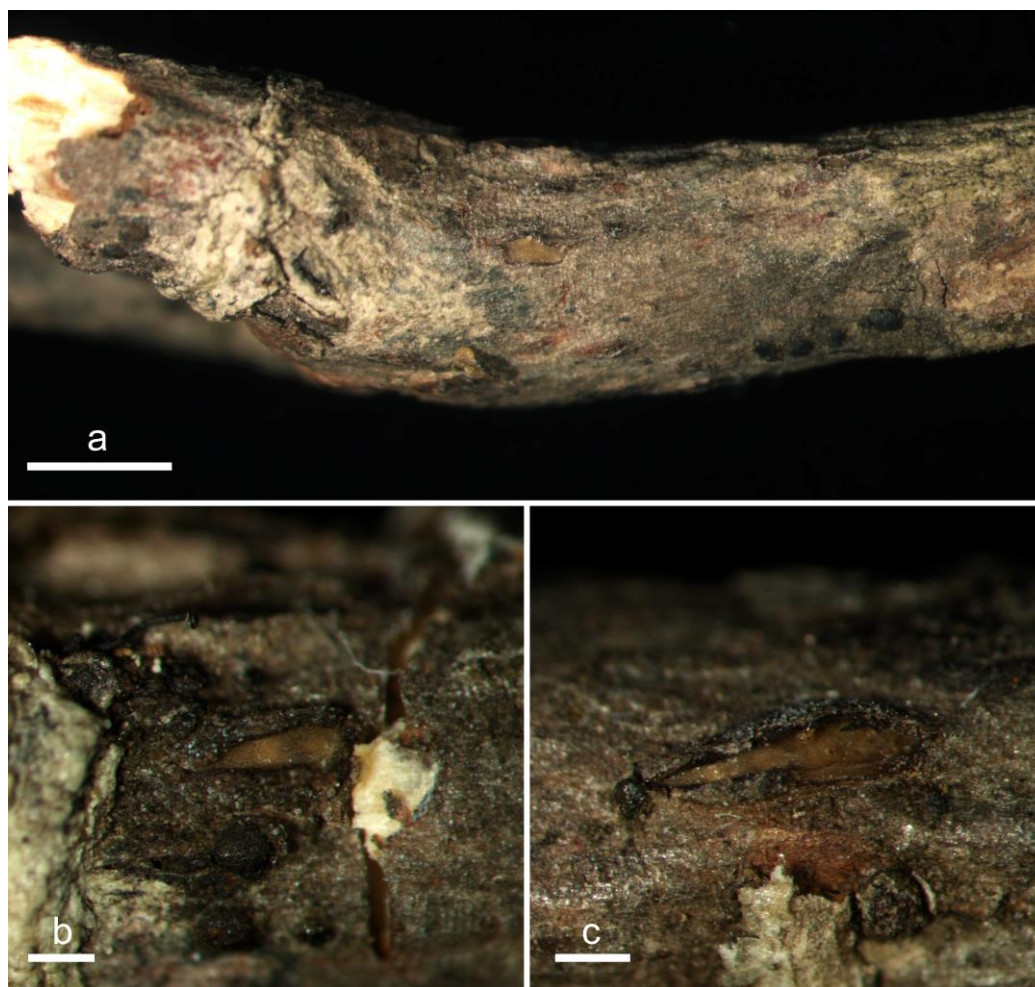


Figure 60 – *Yingrenia debililabioides* (HOU 444/BJTC 2022103, holotype). a Ascoma on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 2 mm, b–c = 500 μ m.

Yingrenia erumpens (C.L. Hou & M. Piepenbr.) M.J. Guo, M. Piepenbr. & C.L. Hou, comb. nov.

≡ *Neococcomyces erumpens* C.L. Hou & M. Piepenbr., Mycologia 101(3): 385 (2009).

Mycobank number: MB852694; Facesoffungi number: FoF15650

Holotype – CHINA, Sichuan province, Xiaojin, alt. ca. 4000 m, on living, senescent or dead twigs of *Rhododendron* sp. (*Ericaceae*), 25 Jul 2006, C.L. Hou, HOU 375 (AAUFP 900074).

Specimen examined – CHINA, Yunnan province, Lijiang, Laojunshan, alt. ca. 3500 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 25 Jul 2001, C.L. Hou, M. Piepenbring, R. Kirschner, and Z.L. Yang, 122 (AAUFP); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3656 N; 99.4303 E, alt. ca. 4100 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 4 Aug 2006, C.L. Hou, HOU 349 (BJTC 2022105); CHINA, Sichuan province, Xiaojin, alt. ca. 4000 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 25 Jul 2006, C.L. Hou, 438 (AAUFP); CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0503 N; 102.5051 E, alt. ca. 3800 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1844A (BJTC 2022104).

Notes – Hou & Piepenbring (2009) described *Neococcomyces erumpens* on *Rhododendron* sp. in the genus *Neococcomyces* Y.R. Lin, C.T. Xiang and Z.Z. Li based on the shape of asci and ascospores. However, Hou & Piepenbring (2009) mentioned that these characters of *Neococcomyces erumpens* might not be phylogenetically informative, because the typical species of *Neococcomyces* are characterized by multi-angular ascomata on leaves (Lin et al. 1999). In order to avoid the erection of a new monotypic genus, Hou & Piepenbring (2009) tentatively placed this fungus into the genus *Neococcomyces*.

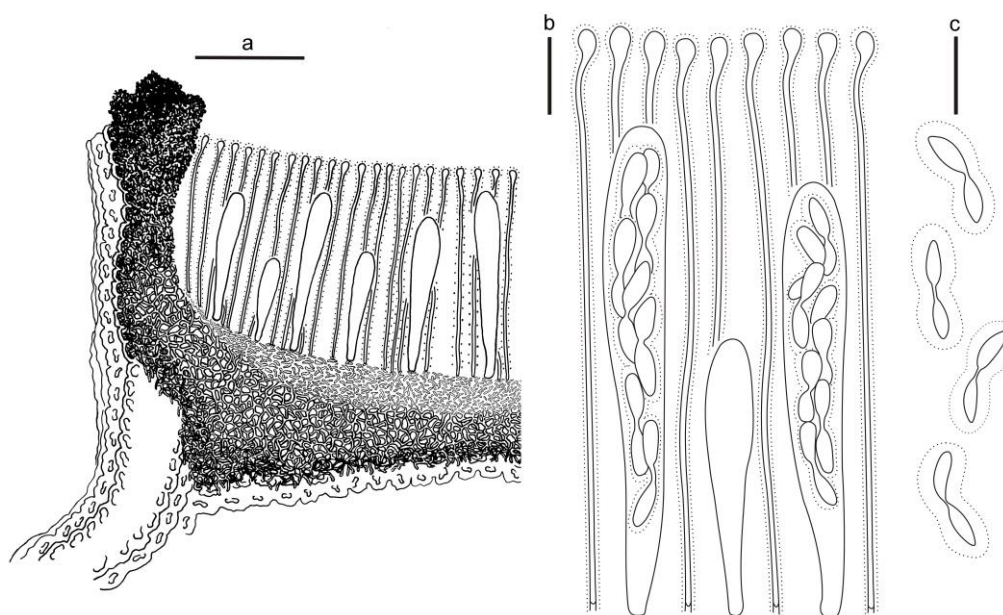


Figure 61 – *Yingrenia debililabioides* on *Rhododendron* sp. (HOU 444/BJTC 2022103, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 100 µm, b–c = 20 µm.

Our phylogenetic analyses show that some sequences of specimens of some further species with ascomata on twigs of *Rhododendron* sp. form a well-supported clade together with sequences of *Neococcomyces erumpens*. These species and *N. erumpens* are only distantly related to *Neococcomyces rhododendri*, the type species of *Neococcomyces*. Most species of this clade present similar characteristics of ascomata and ascospores, so based on morphological characteristics, the place of ascomata development and the results of phylogenetic analyses, *Neococcomyces erumpens* is transferred to the new genus *Yingrenia* here. For a detailed description of this species see Hou & Piepenbring (2009).

Yingrenia laojunshanensis M.J. Guo & C.L. Hou, sp. nov.

Figs 62–63

Mycobank number: MB852687; Facesoffungi number: FoF15651

Diagnosis – The new species is characterized by a thick internal matrix in the stroma consisting of hyaline hyphae.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3877 m, on living twigs of *Rhododendron decorum* (Ericaceae), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1593B (BJTC 2022111, holotype).

Etymology – Referring to the name of the mountains (Laojunshan) where the specimens of this species have been collected.

Sexual morph: *Ascomata* on bark, scattered, associated with pale areas. As seen from above, ascomata subround or slightly irregular, rugose, 520–765 × 650–920 µm, black, raised over the surface of the substrate, opening by irregular splits to expose the yellow hymenium. *Lips* absent. In median vertical section, ascomata intracortical, 850–950 µm deep. *Covering stroma* 80–120 µm thick near the centre of the ascomata, consisting of angular cells. *Periphysoids* absent. *Basal stroma* absent. *Internal matrix of stroma* well developed, 350–450 µm thick, consisting of hyaline hyphae. *Excipulum* absent. *Subhymenium* 30–40 µm thick, consisting of globose cells and textura intricata. *Paraphyses* filiform, slightly curved and not swollen at the tips, 120–140 × 2 µm, thin-walled, covered by a thin gelatinous sheath, forming an epithecium by their tips. *Asci* ripening sequentially, clavate, with slightly truncate apex, 105–120 × 11–16 µm, thin-walled, J–, 8-spored. *Ascospores* aseptate, bifusiform, 27–34 × 3.5–5 µm, covered by a 3–5 µm thick gelatinous sheath.

Asexual morph: *Conidiomata* round or slightly irregular, 150–250 μm diam., brown to dark brown. *Conidiogenous cells* and *Conidia* not seen.
Zone lines sometimes present, brown to dark brown.

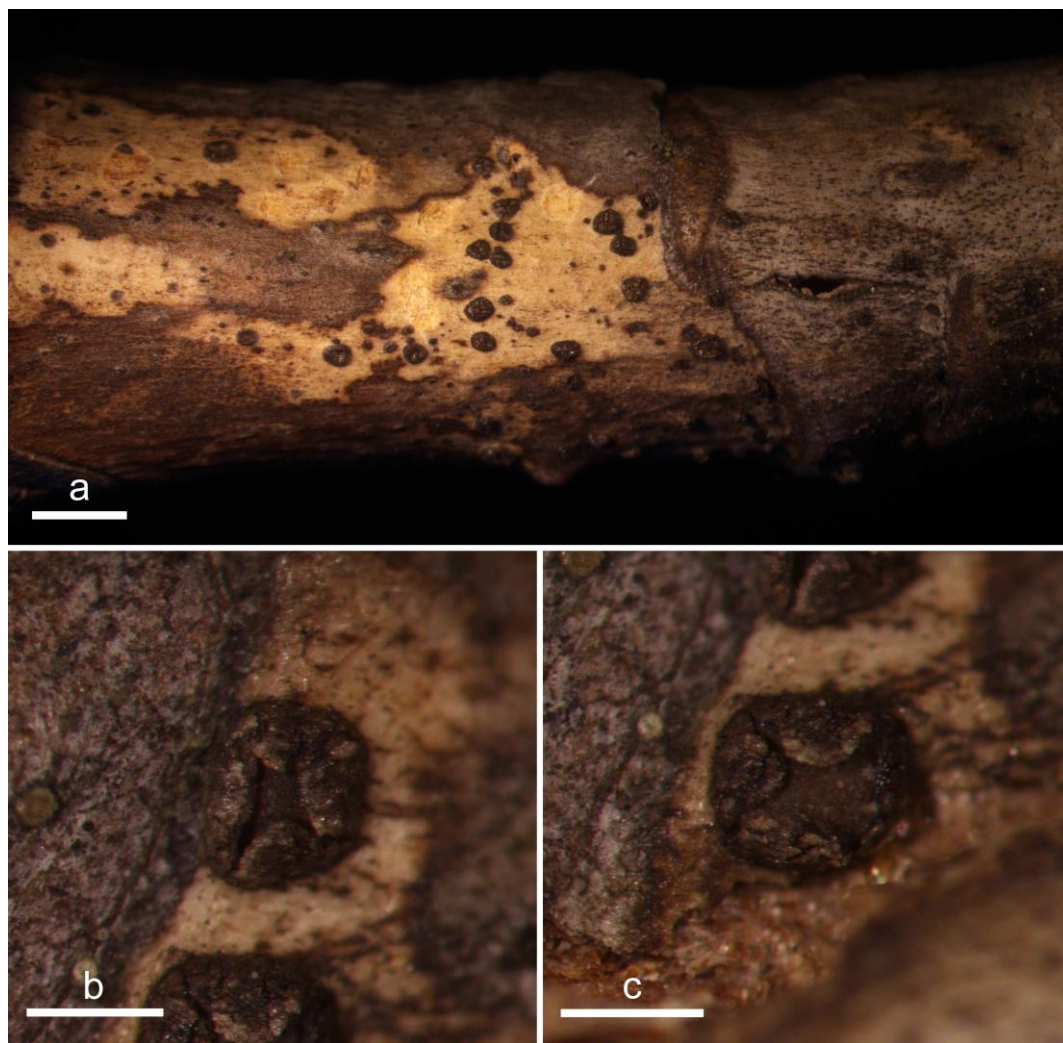


Figure 62 – *Yingrenia laojunshanensis* (HOU 1593B/BJTC 2022111, holotype). a Ascomata with pale areas and zone lines on a twig of *Rhododendron decorum*. b–c Mature ascomata. Scale bars: a = 2 mm, b–c = 500 μm .

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3877 m, on twigs of *Rhododendron decorum* (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1593Bzi (BJTC 2022109, isotype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3756 N; 99.4330 E, alt. ca. 3877 m, on twigs of *Rhododendron decorum* (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1593BY (BJTC 2022110, isotype); CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3754 N; 99.4329 E, alt. ca. 3860 m, on twigs of *Rhododendron* sp. (*Ericaceae*), 21 June 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1816A (BJTC 2022108, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – Based on the combined analyses of ITS, nrLSU and mtSSU rDNA sequences, this new species is closely related to *Yingrenia yunnanensis*, but *Y. yunnanensis* has subcortical ascomata, a thinner covering stroma (60–65 μm), a moderately developed excipulum, a basal stroma, no thick internal matrix in the stroma, swollen paraphyses, and wider asci (22–33 μm).

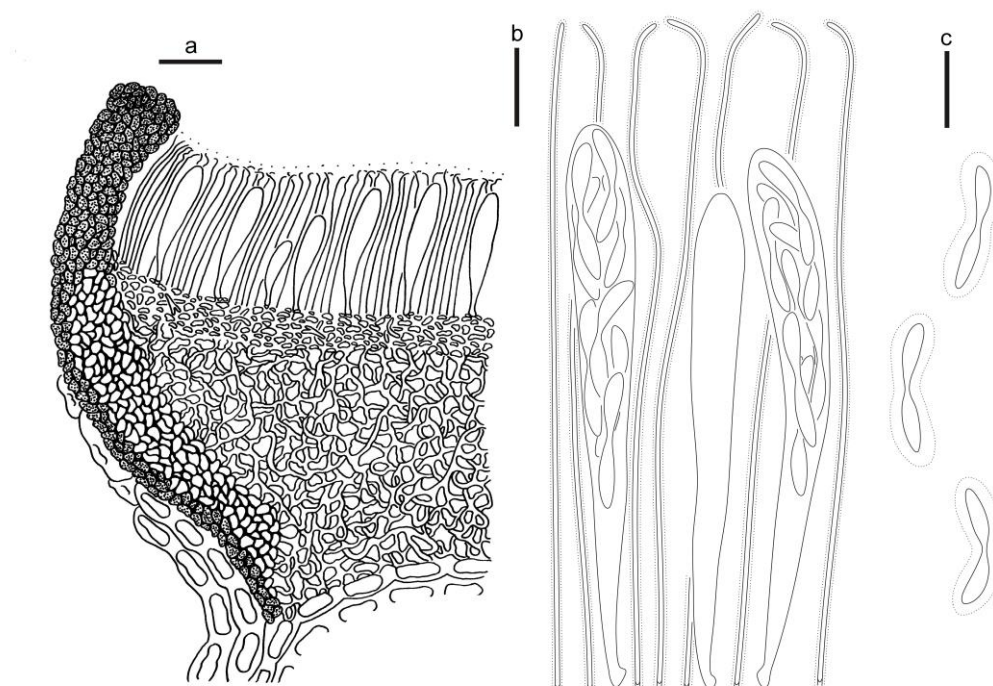


Figure 63 – *Yingrenia laojunshanensis* on *Rhododendron decorum* (HOU 1593B/BJTC 2022111, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and an immature ascus. c Liberated ascospores. Scale bars: a = 100 μ m, b–c = 20 μ m.

Yingrenia papillata M.J. Guo, M. Piepenbr. & C.L. Hou, sp. nov.

Figs 64–65

Mycobank number: MB852688; Facesoffungi number: FoF15652

Diagnosis – The new species is similar to *Neococcomyces erumpens*, but *Yingrenia papillata* has intraepidermal ascomata that are more or less circular to slightly irregular as seen from above, immature ascomata often have a small round papilla in the centre of the surface, mature ascomata have a thinner basal stroma, an internal matrix in the stroma, a thinner subhymenium, often branched paraphyses, and shorter asci.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, alt. ca. 3900 m, on living twigs of *Rhododendron yunnanense* (Ericaceae), 25 Jun 2011, C.L. Hou, HOU 845A (BJTC 2022112, holotype).

Etymology – *papillata* (lat.) = papilla, referring to the small round papilla often present in the centre of the surface of immature ascomata.

Sexual morph: *Ascomata* on twigs, scattered, associated with pale areas. As seen from above, ascomata more or less circular to slightly irregular, often with a small round papilla in the centre of the surface of immature ascomata, mature ascomata 600–800 μ m diam., shiny black, slightly raising above the surface of the host tissue at maturity, opening by irregular splits to expose the pale-yellow hymenium. *Lips* absent. In median vertical section, ascomata intraepidermal. *Covering stroma* 25–40 μ m thick near the centre of the ascomata, consisting of an outer layer of host cuticle and an inner layer of carbonized, thick-walled, angular to globose cells. *Periphysoids* absent. *Basal stroma* 15–25 μ m thick, consisting of carbonized, thick-walled, angular to globose cells. A *space triangular* in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with hyaline, thin-walled angular cells. *Internal matrix of the stroma* 15–25 μ m thick, consisting of thin-walled, hyaline angular cells. *Subhymenium* 10–15 μ m thick, consisting of hyaline textura intricata. *Excipulum* absent. *Paraphyses* aseptate, filiform, often branched, swollen to 4–6 μ m diam. at their tips, 100–150 $\times$ 2–2.5 μ m, covered by a thin gelatinous sheath. *Asci* ripening sequentially, clavate, apex obtuse to round, 75–120 $\times$ 10–18 μ m, thin-walled, J–, 8-spored. *Ascospores* aseptate, bifusiform, mostly with an obtuse to round apex and a somewhat pointed tip at the basis, 30–40 $\times$ 4–7 μ m, hyaline, covered by a 4–7 μ m thick gelatinous sheath.



Figure 64 – *Yingrenia papillata* (HOU 845A/BJTC 2022112, holotype). a Ascomata on a twig of *Rhododendron clementinae*. b–c Immature ascomata. d Mature ascoma. e Conidiomata. Scale bars: a–e = 500 μ m.

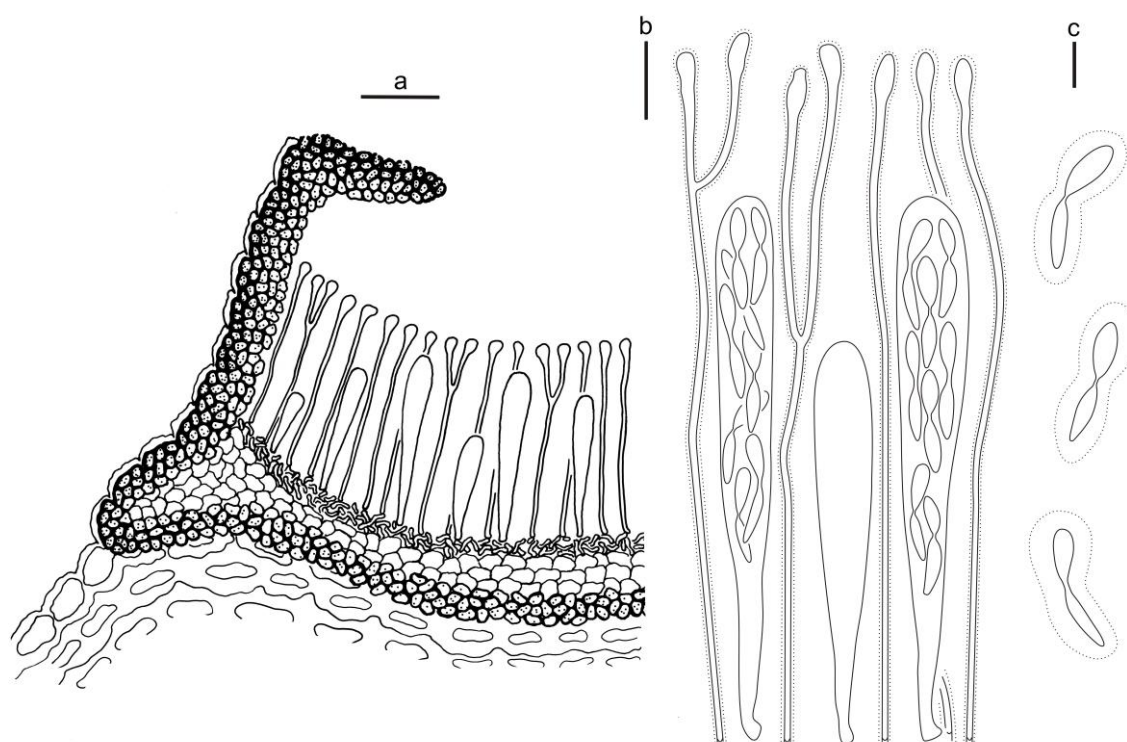


Figure 65 – *Yingrenia papillata* on *Rhododendron clementinae* (HOU 845A/BJTC 2022112, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and an immature ascus. c Liberated ascospores. Scale bars: a = 50 μ m, b = 20 μ m, c = 10 μ m.

Asexual morph: *Conidiomata* round or slightly irregular, 200–350 µm diam., brown to dark brown. *Conidiogenous cells* and *conidia* not seen.

Zone lines infrequent, dark brown.

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, alt. ca. 4100 m, on living twigs of *Rhododendron* sp. (*Ericaceae*), 4 Aug 2006, C.L. Hou, HOU 373 (BJTC 2022210, paratype).

Known distribution – Known only from Yunnan Province, China.

Notes – *Yingrenia papillata* is similar to *Yingrenia erumpens*, but *Y. erumpens* has subcortical ascomata, a thicker basal stroma (60–155 µm), no internal matrix of the stroma, a thicker subhymenium (25–40 µm), thinner (ca. 1.5 µm) and not branched paraphyses, longer asci (160–250 µm), and ascospores with a thinner gelatinous sheath (2–4 µm). Phylogenetically, *Y. papillata* and *Yingrenia cannonii* are closely related, but *Y. cannonii* has subcortical ascomata concolorous with the surface of the bark, no internal matrix in the stroma, a thicker subhymenium (30–35 µm) consisting of textura porrecta, pluriguttulate and narrower paraphyses (ca. 1 µm), longer asci (140–200 µm), and ascospores covered by a thicker gelatinous sheath (8–15 µm). The similarity of ITS rDNA sequences among these two species is 96%.

Yingrenia rhododendri M.J. Guo & C.L. Hou, sp. nov.

Figs 66–67

MycoBank number: MB852689; Facesoffungi number: FoF15653

Diagnosis – The new species is similar to *Yingrenia debililabioides*, but *Yingrenia rhododendri* presents subcortical ascomata, a thicker internal matrix in the stroma consisting of angular and globose cells, a subhymenium consisting of textura porrecta, and an epithecium.

Holotype – CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0504 N; 102.5053 E, alt. ca. 3823 m, on dead twigs of *Rhododendron lutescens* (*Ericaceae*), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1847A (BJTC 2022113, holotype).

Etymology – Referring to the host, a species of *Rhododendron*.

Sexual morph: *Ascomata* on bark, not associated with pale areas or zone lines, scattered, occasionally coalesced. As seen from above, ascomata almost elliptical, 600–1150 × 1160–1875 µm, concolorous with the surface of the bark, slightly erumpent from the surface of the bark at maturity, opening by an irregular longitudinal split to expose the pale-yellow hymenium. *Lips* absent. In median vertical section, ascomata subcortical. *Covering stroma* 60–135 µm thick near the centre of the ascomata, extending to the basal stroma, consisting of an outer layer of host cortex, an inner layer of 3–4 × 4–5 µm, carbonized, thick-walled, angular to globose cells, and an innermost layer of hyaline angular cells. *Periphysoids* absent. *Basal stroma* 30–45 µm thick, consisting of 3–5 × 4–10 µm, carbonized, thick-walled, angular to globose cells. *Internal matrix of stroma* 110–150 µm thick, consisting of 3–4 × 3–8 µm, hyaline, angular to globose cells. *Subhymenium* 20–30 µm thick, consisting of textura porrecta. *Paraphyses* filiform, not branched, slightly curved and swollen to 3–5 µm diam. at their tips, 150–180 × ca. 1 µm, covered by a thin gelatinous sheath, forming a thick epithecium by their tips. *Asci* ripening sequentially, clavate, with a slightly truncate apex, 100–125 × 12–20 µm, thin-walled, J–, 8-spored. *Ascospores* aseptate at maturity, bifusiform, 32–37 × 4–5 µm, hyaline, guttulate, with a thin gelatinous sheath.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimen examined – CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0504 N; 102.5053 E, alt. ca. 3823 m, on twigs of *Rhododendron lutescens* (*Ericaceae*), 23 Jun 2021, C.L. Hou, M.J. Guo, and H. Zhou, HOU 1848A (BJTC 2022114, paratype); CHINA, Yunnan Province, Kunming, Jiaozi Mountains, 26.0504 N; 102.5054 E, alt. ca. 3808 m, on twigs of *Rhododendron lutescens* (*Ericaceae*), 23 Jun 2021, C. L. Hou, M.J. Guo, and H. Zhou, HOU 1850A (BJTC 2022115, paratype) – living culture obtained from this specimen CNUCC 1850A (ex-type).

Known distribution – Known only from Yunnan Province, China.

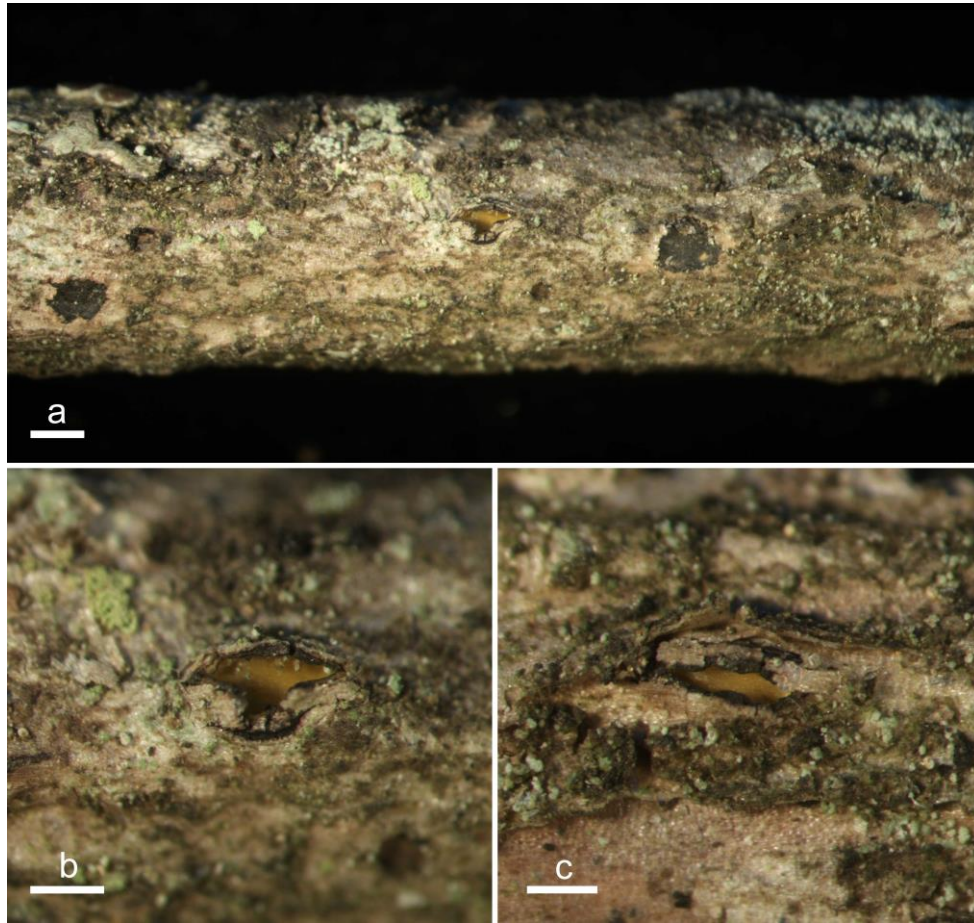


Figure 66 – *Yingrenia rhododendri* (HOU 1847A/BJTC 2022113, holotype). a Ascomata on a twig of *Rhododendron lutescens*. b–c Mature ascomata. Scale bars: a = 1 mm, b–c = 500 μm .

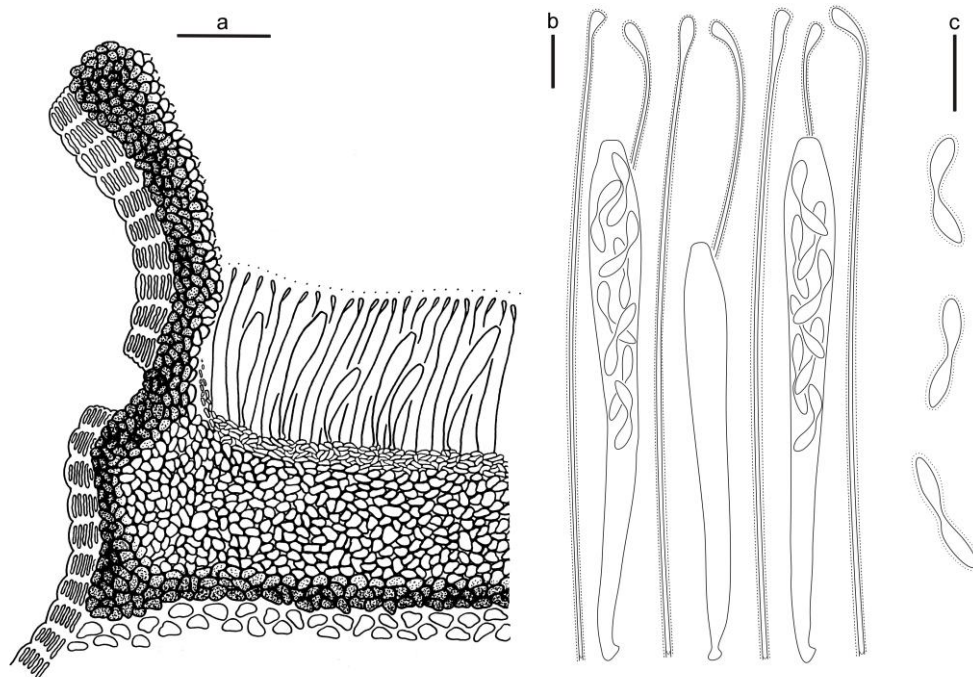


Figure 67 – *Yingrenia rhododendri* on *Rhododendron lutescens* (HOU 1847A/BJTC 2022113, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a = 100 μm , b–c = 20 μm .

Notes – The shape of the ascomata, asci and ascospores, as well as the opening mechanism of this new species are similar to the characteristics of *Yingrenia debililabioides* and *Yingrenia debililabiata*. *Yingrenia debililabioides*, however, presents intracortical ascomata, a covering stroma and basal stroma of carbonized hyphae and angular cells, a thinner internal matrix in the stroma (35–50 μm) of hyaline hyphae, a subhymenium of hyaline textura intricata, ascospores with a thicker gelatinous sheath (3–7 μm), and no epithecium. *Y. debililabiata* differs significantly from *Yingrenia rhododendri* by lip cell-like cells close to the opening, no internal matrix in the stroma, a thinner subhymenium (12–20 μm) of hyaline angular cells and textura porrecta, wider paraphyses (ca. 2 μm), wider ascospores (5–6 μm) with a thicker gelatinous sheath (7–9 μm), and the absence of an epithecium. In addition to these morphological characteristics, molecular sequence data of three specimens of this new species group in a distinct clade.

Yingrenia yunnanensis M.J. Guo & C.L. Hou, sp. nov.

Figs 68–69

Mycobank number: MB852690; Facesoffungi number: FoF15654

Diagnosis – The new species resembles *Yingrenia erumpens*, but differs by a well-developed epithecium and excipulum, shorter and wider asci, as well as narrower ascospores.

Holotype – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3944 N; 99.4722 E, alt. ca. 3047 m, on dead twigs of *Rhododendron* sp. (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1570 (BJTC 2022117, holotype).

Etymology – Referring to the name of the province (Yunnan) where the specimen was collected.



Figure 68 – *Yingrenia yunnanensis* (HOU 1570/BJTC 2022117, holotype). a Ascomata on a twig of *Rhododendron* sp. b–c Mature ascomata. Scale bars: a = 1 mm, b–c = 500 μm .

Sexual morph: *Ascomata* on bark, not associated with pale areas, scattered. As seen from above, ascomata subround or rounded triangular, $750\text{--}1435 \times 625\text{--}935 \mu\text{m}$, concolorous with the surface of the bark, strongly raised from the surface of the substratum at maturity, opening by irregular splits to expose a light-yellow hymenium. *Lips* absent. In median vertical section, ascomata subcortical. *Covering stroma* $60\text{--}65 \mu\text{m}$ thick near the centre of the ascomata, extending to the basal stroma, consisting of $3\text{--}4 \times 4\text{--}5 \mu\text{m}$, thick-walled, angular to globose cells, the inner and median layer moderately carbonized, the outer layer strongly carbonized, and host cortex closely adhering to the outermost layer of fungal cells. *Periphysoids* absent. *Excipulum* well-developed, formed by marginal paraphyses. *Basal stroma* $25\text{--}62 \mu\text{m}$ thick, consisting of carbonized, thick-walled, angular to globose cells. A *space triangular* in vertical section between the covering stroma and the basal stroma at the margin of the ascoma is filled with thin-walled globose cells. *Subhymenium* $20\text{--}35 \mu\text{m}$ thick, consisting of thin-walled, angular cells and a few *textura intricata*. *Paraphyses* filiform, not branched, curved and swollen to $3\text{--}4 \mu\text{m}$ diam. at their tips, $140\text{--}155 \times \text{ca. } 1 \mu\text{m}$, hyaline, thin-walled, covered by a thin gelatinous sheath, forming a well-developed epithecium at the tip. *Asci* ripening sequentially, clavate, with a slightly truncate apex, $112\text{--}125 \times 22\text{--}33 \mu\text{m}$, thin-walled, J-, 8-spored. *Ascospores* aseptate, bifusiform, mostly with an obtuse to round apex and a somewhat pointed tip at the basis, $30\text{--}32 \times 3\text{--}4 \mu\text{m}$, hyaline, pluriguttulate, covered by a $1\text{--}2 \mu\text{m}$ thick gelatinous sheath.

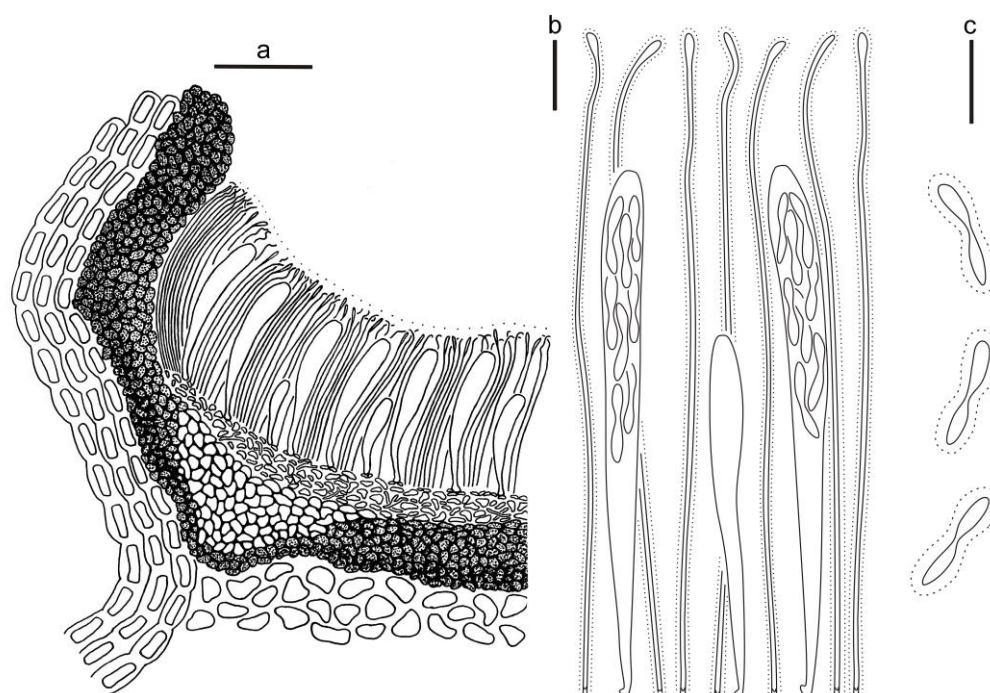


Figure 69 – *Yingrenia yunnanensis* on *Rhododendron* sp. (HOU 1570/BJTC 2022117, holotype). a Vertical section art of an ascoma (part). b Paraphyses, mature asci with ascospores, and immature ascus. c Liberated ascospores. Scale bars: a–b = $50 \mu\text{m}$, c = $20 \mu\text{m}$.

Asexual morph: *Conidiomata* and *zone lines* not observed.

Additional specimen examined – CHINA, Yunnan Province, Lijiang, Laojunshan, 26.3944 N ; 99.4722 E , alt. ca. 3047 m , on twigs of *Rhododendron* sp. (*Ericaceae*), 16 Jul 2020, C.L. Hou, M.J. Guo, and Q.T. Wang, HOU 1570Y (BJTC 2022118, isotype) – living culture obtained from this specimen CNUCC 1570 (ex-type).

Known distribution – Known only from Yunnan Province, China.

Notes – *Yingrenia yunnanensis* is similar to *Yingrenia erumpens*, but *Y. erumpens* differs from it by a thicker covering stroma ($70\text{--}100 \mu\text{m}$), the absence of an excipulum, longer and

narrower asci (160–250 × 15–20 µm), wider ascospores (4–6 µm) with a thinner gelatinous sheath (1–2 µm) and the absence of an epithecium.

DISCUSSION

Host-specificity is a relationship in which a fungus derives its nutrition from a live host plant during some phase of its life cycle, and is restricted to a particular host or group of related species, but does not occur on other unrelated plants in the same habitat (Zhou & Hyde 2001). Several recent studies have revealed that the species of *Rhytismatales* have host-specificity (Sherwood 1980, Lantz et al. 2011, Wang et al. 2014a, 2023). Thus far, a total of 54 species classified across 17 genera within *Rhytismatales*, all discovered on the twigs of *Rhododendron* spp. In the present study, eight new genera, 33 new species and three new combinations are proposed herein based on recently collected specimens, based on the analyses of morphology, phylogeny, host specificity, as well as host organ specificity. There is no doubt that additional sampling on *Rhododendron* spp. in various regions, including northeastern India, Myanmar, Malaysia, Indonesia, New Guinea, as well as exploring on this and other genera of *Ericaceae* globally, will reveal numerous new species. The sequences from two specimens with immature ascomata also indicate that there are additional species yet to be discovered.

Host organ specificity

Numerous studies have shown that many species of *Rhytismatales* are specific to certain host organs, and that even some genera like *Nematococcomyces* occurs on twigs of *Rhododendron* spp. and *Tryblidiopsis* occurs on twigs of *Picea* spp., present this host organ specificity (Cannon & Minter 1986, Sherwood 1980, Hou 2004, Lin 2012). The phylogenetic analysis in this study shows that the species on twigs of *Rhododendron* spp. usually clustered together to form several strongly supported clades, that are separated from leaf-inhabiting species on *Rhododendron* spp.

Lophodermium vagulum M. Wilson & N.F. Robertson described by Wilson & Robertson (1947) appears to be an exception, because in the type specimen of this species, ascomata are present on living twigs as well as on living leaves of *Rhododendron croceum* Balf.f. & W.W.Sm. (a synonym of *Rhododendron wardii* var. *wardii*). Wilson & Robertson (1947) did not compare morphological characteristics of the ascomata of *L. vagulum* on leaves with those on twigs. Cannon & Minter (1986) observed that the ascomata on young twigs are slightly longer than those on leaves, apiculate, and with a split extending the whole length of the fruit body. They suggest that this difference may be due to effects of the differing properties of the different organs. However, these characteristics of ascomata are important characteristics for the definition of species of *Rhytismatales*. Therefore, further morphological comparisons and molecular data are needed to verify the conspecificity of the infections of the two different organs.

Host organ specificity can also be observed in *Rhytismatales* on conifers, i.e., needle-inhabiting species are separated from twig-inhabiting species in the phylogenetic analysis (Fig. 1) (Hou 2004, Ortiz-Garcia et al. 2003, Wang et al. 2014a, Tanney & Seifert 2019). For example, four species of *Tryblidiopsis* are parasitic only on twigs of conifers and form a monophyletic group (Fig. 1). Eleven *Lophodermium* species and *Hypoderma junipericola* C.L. Hou, Y.R. Lin & M. Piepenbr., *Davisomycella medusa* (Dearn.) Darker, the type species of *Elytroderma* Darker, *Elytroderma deformans* (Weir) Darker, and *Meloderma desmazieri* (Duby) Darker, the type species of *Meloderma* Darker, cluster together to form a clade of needle-inhabiting species in our phylogenetic analysis (Fig. 1).

Life styles

Most specimens of the species of *Rhytismatales* on twigs of *Rhododendron* spp. were collected at high altitudes, mainly in Yunnan Province, mostly in June and July. This period is shortly after the period of the most abundant rainfalls of year, when the humidity apparently is ideal for the maturation of the ascomata of *Rhytismatales*.

The species of *Rhytismatales* found on twigs of *Rhododendron* spp. exhibit dual lifestyles as either pathogens infecting living twigs or saprotrophs on dead twigs. According to the phylogenetic analysis, certain genera reveal strict preferences for living or dead twigs. For example, the species of *Colpoma*, *Neotrybliopsis*, *Septomyces*, *Shuqunia*, and *Triblidium* develop their ascomata on dead twigs, while the species of *Occultomyces*, *Rhodohypoderma*, and *Septofusella* develop ascomata on living twigs. Perhaps due to the different physical properties of the substrates, ascomata on dead twigs are usually deeply embedded in host tissue and have a well-developed covering stroma, in contrast to species on living twigs with ascomata that develop more closely to the surface of the substrate and present a thinner covering stroma. Some species on old bark of living twigs often have disc-shaped ascomata, such as the species of *Neotrybliopsis* and *Septomyces*.

Morphological characteristics for the definition of genera

Most genera established before molecular data became available, are polyphyletic according to molecular sequence data (Fig. 1). They were originally defined based on few morphological characteristics like the shapes of ascomata and ascospores (Darker 1967), leading to an artificial and unnatural classification (Cannon & Minter 1986, Sherwood 1980, Powell 1974, Hou 2000, Lin 2012). Consequently, the previously established concepts for most genera in *Rhytismatales* need revisions.

Morphological characteristics, however, are useful for the definition of genera, if they are considered in detail. According to the present research, the distinctive shape of the ascomata appears to be a morphological character with taxonomic significance at the generic level. Wang et al. (2023) divided the *Rhytisma*-like species into nine separate clades according to the phylogenetic tree, and found morphologically distinct ascomata shapes typical for each individual clade. *Trybliopsis* and the new genus *Neotrybliopsis* indicate that stipes of ascomata are important for the genus level.

For the slits leading to the opening of ascomata, we conclude that this characteristic is not good for the characterization of genera. The two largest genera of *Rhytismataceae*, *Coccomyces* and *Lophodermium* were distinguished according to the opening of ascomata by several irregular teeth versus one longitudinal slit, but the phylogenetic analysis shows that the species of these two genera frequently cross-cluster together, showing a complex polyphyletic structure. The fact that shapes of ascomatal openings are often similar by convergency is confirmed by ascomata of *Coccomyces arbutifolius* Sherwood, *Coccomyces bipartitus* (Kauffman) Sherwood, and *Coccomyces castanopsidis* (Seaver) Sherwood which exhibit intraspecific variability concerning this aspect, i.e., open irregularly by teeth or by one longitudinal slit (Sherwood 1980). The species of *Yingrenia* also do not strictly present one type of opening of ascomata. The depth to which ascomata are embedded in host tissue is also not helpful for the classification of genera, because the majority of genera are not restricted to one level of depth.

The shape of ascospores is helpful for the definition of species, but usually only in combination with other characteristics for the circumscription of genera of *Rhytismatales*. As evident by phylogenetic analyses, ascospores of some monophyletic genera vary considerably in shape. The genus *Trybliopsis*, for example, contains species with clavate, fusiform, or ellipsoidal-fusiform to fusiform-clavate ascospores. In the case of *Cudonia*, *Spathularia*, and *Terriera*, as well as the new genera *Septomyces* and *Yingrenia*, however, the shape of ascospores is helpful for the circumscription of genera, when combined with other characteristics. In the case of the family Tribliaceae, muriform ascospores are typical even on family level.

In addition to the characteristics mentioned above, there are also many further morphological characteristics helpful to define taxa of *Rhytismatales*, such as the shape and size of asci, zone lines, cellular structures of lips, excipulum, epithecium, periphysoids, the composition of the covering stroma, basal stroma, internal matrix of stroma and subhymenium, as well as the characteristics of the anamorph. A natural classification of *Rhytismatales* on genus level cannot be defined based on few morphological characteristics, but it is necessary to combine many morphological

characteristics. They should be used together with information concerning the host relationship, the organ infected and molecular sequence data.

Molecular phylogeny and DNA markers used for *Rhytismatales*

The topology of the ITS-nrLSU-mtSSU rDNA phylogenetic tree obtained in this study (Fig. 1) is similar to that presented by Lantz et al. (2011) and Wang et al. (2023). Cudoniaceae, Tribliidiaceae, and *Rhytismataceae* s. str. are nested within the *Rhytismataceae* s. l. (*Rhytismatales*), similar to the result of Ge et al. (2014), Karakehian et al. (2019), and Wang et al. (2023). The *Rhytisma*-like species are found in two groups, one corresponds to *Rhytismataceae* s. str. and the other is *Neorhytisma*, which is segregated from *Rhytismataceae* s. str. This result is similar to that of Wang et al. (2023). The group of species of *Rhytismatales* on twigs of *Rhododendron* spp. is polyphyletic, because these species are located in many different relationships of the order according to the phylogenetic analyses.

Apparently, twigs of *Rhododendron* spp. were colonized repeatedly during evolution by members of *Rhytismatales*. Radiation on this substrate took place relatively recently leading to species diversity within genera. The relatively low number of samples for each species, however, do not allow conclusions concerning the specificity of species of *Rhytismatales* on species of *Rhododendron*. With a larger number of specimens with known host species from more regions all over the world the understanding of the interactions between species of *Rhytismatales* on twigs of *Rhododendron* and their hosts will be improved.

Up to now, in most molecular phylogenetic studies of *Rhytismatales* two gene loci, namely nrLSU and mtSSU rDNA (Lantz et al. 2011, Wang et al. 2023), or three gene loci, ITS, nrLSU, and mtSSU rDNA (Zhang et al. 2015, Karakehian et al. 2019, Lv & Hou 2019), have been used. For some studies, protein genes, namely *rpb2*, *tef1*, and *act*, have been added and proved to be helpful to resolve some deep nodes of small groups within *Rhytismatales* (Reignoux et al. 2014, Ekanayaka et al. 2019, Lv et al. 2019b). However, many species collected earlier lack sequence data of these protein-coding genes, so these genes cannot be used for an overall analysis of *Rhytismatales*.

For the three commonly used genes, numerous studies have shown that ITS rDNA provides good resolution at species level (Schoch et al. 2012, Zhang & Guo 2012, Vu et al. 2019, Wang et al. 2023). The results of the molecular analyses of the currently limited molecular data in this study revealed that the topology of phylogenetic trees generated with the ITS dataset is almost identical to the topology based on the three-gene dataset (ITS/nrLSU/mtSSU rDNA) at species level. Therefore, the ITS region is helpful at least for the delimitation of species of *Rhytismatales*.

Therefore, we attempted to analyse the ITS sequence similarity threshold for species delimitation of *Rhytismatales*. The BLASTn analyses for species of monophyletic genera revealed that the intrageneric similarity of ITS sequences ranged from 84% to 98%. Therefore, 98% ITS identity might be a good threshold to delimitate species of *Rhytismatales*.

According to the studies of Lantz et al. (2011) and Wang et al. (2023), the combination of the nrLSU and mtSSU rDNA is adequate to recognize genera of *Rhytismatales*. However, the results of the present ITS-nrLSU-mtSSU rDNA phylogenetic analysis still show many polyphyletic taxa, as well as many clades with low support values. In addition to the taxonomic confusion caused by few morphological characters, the genes currently used apparently do not provide the most effective resolution for genera of *Rhytismatales*. The phylogenetic results obtained so far for *Rhytismatales* are based on limited data and do not reflect their real evolutionary relationships. Therefore, in subsequent studies, new and more appropriate gene markers, or even phylogenomics, should be used. Phylogenomics has been widely used to resolve ambiguous and controversial evolutionary relationships among species and genera of plants as well as fungi (Lücking et al. 2020, Muggia et al. 2020, Li et al. 2021, Song et al. 2023). Whichever method is chosen, it means that extensive specimen collection activities are needed. In this process, not only new species will be discovered, but also, more importantly, molecular data of known species based only on morphological characteristics need to be provided, which is a major challenge in the study of *Rhytismatales*.

After the introduction of more effective molecular tools, the trend in fungal taxonomy has in many cases lead to smaller, natural genera (Buyck et al. 2008, Sánchez-García et al. 2014, Matheny et al. 2020, Liimatainen et al. 2022). This will cause many nomenclatural changes, but in the end, a natural and stable taxonomic system will provide a good framework for understanding and classifying fungal diversity of *Rhytismatales* in an evolutionary context.

ACKNOWLEDGEMENTS

This study was supported by National Natural Science Foundation of China (No. 32270012) and Science & Technology Fundamental Resources Investigation Program (Grant No. 2023FY101300).

REFERENCES

- Ata JP, Burns KS, Marchetti S, Munck IA et al. 2021 – Molecular characterization and phylogenetic analyses of *Lophodermella* needle pathogens (*Rhytismataceae*) on *Pinus* species in the USA and Europe. *PeerJ* 9, e11435.
- Baral HO. 2015 – Nomenclatural novelties. *Index Fungorum* 225, 1–3.
- Blumenstein K, Bußkamp J, Langer GJ, Schlößer R et al. 2021 – *Sphaeropsis sapinea* and associated endophytes in scots pine: interactions and effect on the host under variable water content. *Frontiers in Forests and Global Change* 4, 655769.
- Buyck B, Hofstetter V, Eberhardt U, Verbeken A et al. 2008 – Walking the thin line between *Lactarius* and *Russula*: the dilemma of *Russula* sect. *Ochricompactae*. *Fungal Diversity* 28, 15–40.
- Cai SR, Wang SJ, Lv T, Hou CL. 2020 – Three new species of *Terriera* (*Rhytismatales*, Ascomycota) from China. *Mycological Progress* 19, 825–835.
- Cannon PF, Minter DW. 1986 – The *Rhytismataceae* of the Indian subcontinent. *Mycological Papers* 155, 1–123.
- Chethana TKW, Manawasinghe IS, Hurdeal VG, Bhunjun CS et al. 2021 – What are fungal species and how to delineate them? *Fungal Divers* 109, 1–25.
- Cooke MC. 1889 – Memorabilia. *Grevillea* 17(83), 58–59.
- Corde ACJ. 1842 – Icones Fungorum hucusque Cognitorum 5, 34.
- Crous PW, Osieck ER, Jurjevi Ž, Boers J et al. 2021 – Fungal Planet description sheets: 1284–1382. *Persoonia* 47, 178–374.
- Darker GD. 1932 – The Hypodermataceae of conifers. *Contributions from the Arnold Arboretum of Harvard University* 1, 1–131.
- Darker GD. 1967 – A revision of the genera of the Hypodermataceae. *Canadian Journal of Botany* 45, 1399–1444.
- De Notaris G. 1847 – Prime linee di una nuova disposizione de’Pirenomiceti Isterini. *Giornale Botanico Italiano* 2, 1–52.
- Deckert RJ, Hsiang T, Peterson RL. 2002 – Genetic relationships of endophytic *Lophodermium nitens* isolates from needles of *Pinus strobus*. *Mycological Research* 106, 305–313.
- Ekanayaka AH, Hyde KD, Gentekaki E, McKenzie EHC et al. 2019 – Preliminary classification of *Leotiomycetes*. *Mycosphere* 10, 310–489.
- Ellis JB, Everhart BM. 1892 – The North American *Pyrenomyces*. Newfield, New Jersey, 793.
- Eriksson B. 1970 – On *Ascomycetes* on *Diapensiales* and *Ericales* in Fennoscandia. I. *Discomycetes*. *Symbolae Botanicae Upsalienses* 19(4), 1–71.
- Eriksson OE. 1992 – *Huangshania verrucosa* gen. et sp. nov. (Triblidiaceae, Triblidiales ordo nov.), a discomycete on *Pinus* from China. *Systema Ascomycetum* 11(1), 1–10.
- Fan L, Lin YR, Wang S, Hou CL. 2012 – Two species of *Lirula* on *Abies* from Yunnan, Southwest China. *Mycological Progress* 11, 279–286.
- Ganley RJ, Brunsfeld SJ, Newcombe G. 2004 – A community of unknown, endophytic fungi in western white pine. *Proceedings of the National Academy of Sciences* 101, 10107–10112.

- Gao XM, Lin YR, Huang HY, Hou CL. 2013 – A new species of *Lophodermium* associated with the needle cast of Cathay silver fir. *Mycological Progress* 12, 141–149.
- Gardes M, Bruns TD. 1993 – ITS primers with enhanced specificity for basidiomycetes application to the identification of mycorrhizae and rusts. *Molecular Ecology* 2, 113–118.
- Ge ZW, Yang ZL, Pfister DH, Carbone M et al. 2014 – Multigene Molecular Phylogeny and Biogeographic Diversification of the Earth Tongue Fungi in the Genera *Cudonia* and *Spathularia* (*Rhytismatales*, Ascomycota). *Plos One* 9, e103457.
- GenBank [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2013 – [cited 2024 March 11]. Available from: <https://www.ncbi.nlm.nih.gov/genbank/>
- Gernandt DS, Platt JL, Stone JK, Spatafora JW et al. 2001 – Phylogenetics of Helotiales and *Rhytismatales* based on partial small subunit nuclear ribosomal DNA sequences. *Mycologia* 93, 915–933.
- Gu HL, Xu YF, Lu DD, Wang SJ et al. 2015 – A new species of *Lophodermium* with variously branched paraphyses. *Mycotaxon* 130(1), 191–196.
- Haelewaters D, Dima B, Abdel-Hafiz AI, Abdel-Wahab MH et al. 2020 – Fungal Systematics and Evolution: FUSE 6. *Sydowia*, 72.
- Han JG, Hosoya T, Sung GH, Shin HD. 2014 – Phylogenetic reassessment of *Hyaloscyphaceae* sensu lato (*Helotiales*, *Leotiomyces*) based on multigene analyses. *Fungal Biology* 118, 150–167.
- Hawksworth DL, Sutton BC, Ainsworth GC. 1983 – Ainsworth & Bisby's Dictionary of the Fungi (7th edn.). Commonwealth Mycological Institute, Kew, 1–445.
- Hou CL. 2000 – A new species of *Bifusella* on *Camellia sinensis*. *Mycosystema* 19, 7–9.
- Hou CL. 2004 – *Rhytismatales* (Ascomycota) in China-morphology, ecology, and systematics. PhD Dissertation, J.W. Goethe-Universität Frankfurt, Frankfurt am Main. 1–272.
- Hou CL, Li L, Piepenbring M. 2009 – *Lophodermium pini-mugonis* sp. nov. on needles of *Pinus mugo* from the Alps based on morphological and molecular data. *Mycological Progress* 8, 29–33.
- Hou CL, Piepenbring M. 2005 – Two new species of *Colpoma* on trees from China. *Forest Pathology* 35(5), 359–364.
- Hou CL, Piepenbring M. 2006 – Five new species of *Hypoderma* (*Rhytismatales*, Ascomycota) with a key to *Hypoderma* species known from China. *Nova Hedwigia* 82, 91–104.
- Hou CL, Piepenbring M. 2007 – Two new species of *Rhytismataceae* on twigs of conifers from Yunnan Province, China. *Mycotaxon* 102, 165–170.
- Hou CL, Piepenbring M, Oberwinkler F. 2004 – *Nematococcomyces rhododendri*, a new species in a new genus of the *Rhytismatales* from China. *Mycologia* 96(6), 1380–5.
- Hou CL, Piepenbring M. 2009 – Two new *Rhytismatales* on *Rhododendron* from China. *Mycologia*. 101(3), 383–389.
- Hou CL, Trampe T, Piepenbring M. 2010 – A new species of *Rhytisma* causes Tar Spot on *Comarostaphylis arbutoides* (*Ericaceae*) in Panama. *Mycopathologia* 169, 225–229.
- Huelsenbeck JP, Ronquist F, Nielsen R, Bollback JP. 2001 – Bayesian inference of phylogeny and its impact on evolutionary biology. *Science* 294, 2310–2314.
- Hyde KD, Chaiwan N, Norphanphoun C, Boonmee S et al. 2018 – Mycosphere notes 169–224. *Mycosphere* 9, 271–430.
- Hyde KD, Hongsanan S, Jeewon R, Bhat DJ et al. 2016 – Fungal diversity notes 367–490: taxonomic and phylogenetic contributions to fungal taxa. *Fungal Diversity* 80, 1–270.
- Jia GJ. 2011 – Studies on Taxonomy of *Coccomyces* on Evergreen Broad-leaved Trees from Huangshan Scenic Spot and Analysis of Interspecific Genetic Diversity of the Genus. PhD thesis, Anhui Agricultural University, Hefei.
- Johnston PR. 1990 – *Rhytismataceae* in New Zealand 3. The genus *Hypoderma*. *New Zealand Journal Botany* 28, 159–183.

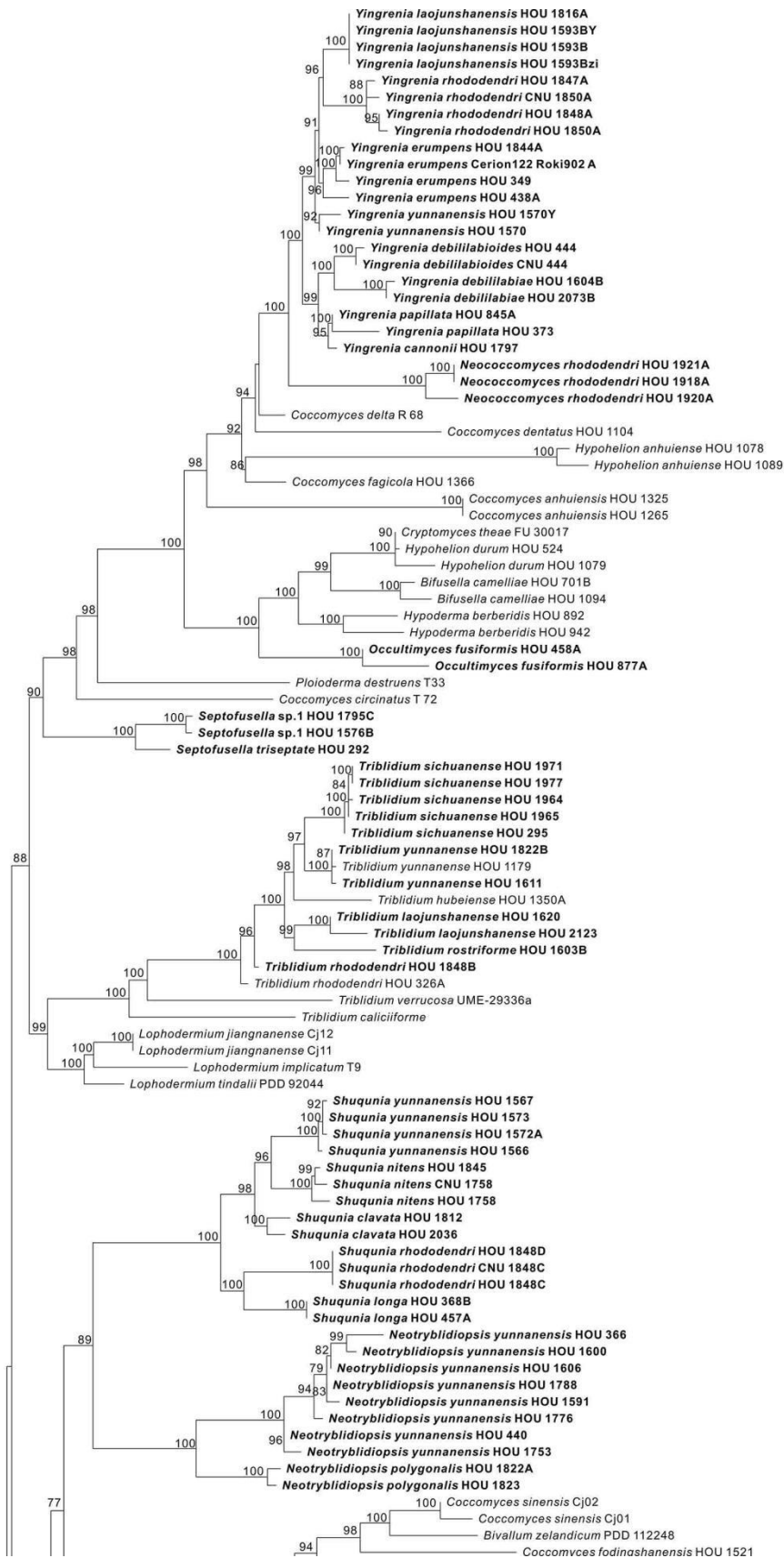
- Johnston PR. 1991 – *Bivallum* gen. nov. (*Rhytismataceae*) on Southern Hemisphere Cupressaceae and Podocarpaceae. Australian Systematic Botany 4, 355–374.
- Johnston PR. 2001 – Monograph of the monocotyledon-inhabiting species of *Lophodermium*. Mycol. Pap. 176: 1–239.
- Johnston PR, Quijada L, Smith CA, Baral HO et al. 2019 – A multigene phylogeny toward a new phylogenetic classification of *Leotiomyces*. IMA Fungus 1, 1–22.
- Johnston PR. 1988 – An undescribed pattern of ascocarp development in some non-coniferous *Lophodermium* species. Mycotaxon 31, 383–394.
- Johnston PR. 1989 – *Lophodermium* (*Rhytismataceae*) on *Clusia*. Sydowia 41, 170–179.
- Karakehian JM, Quijada L, Friebe G, Tanney JB et al. 2019 – Placement of *Triblidiaceae* in *Rhytismatales* and comments on unique ascospore morphologies in *Leotiomyces* (Fungi, Ascomycota). MycoKeys 54, 99–133.
- Kirk B, Isabel M, Stephen W, Gloria I et al. 2015 – Characterization of fungal pathogens associated with white pine needle damage (WPND) in northeastern North America. Forests 6: 4088–4104.
- Kirk PM, Cannon PF, David JC, Stalpers JA. 2001 – Anisworth & Bisby's Dictionary of the Fungi. 9th edn. Wallingford, 1–655.
- Lamarck JB, De Candolle AP. 1805 – Flore française, ou descriptions succinctes de toutes les plantes qui croissent naturellement en France, disposées selon une nouvelle méthode d'analyse, et précédées par un exposé des principes élémentaires de la botanique, 3rd edn. Paris.
- Lantieri A, Johnston PR, Park D, Lantz H et al. 2012 – *Hypoderma siculum* sp. nov. from Italy. Mycotaxon 118, 393–401.
- Lantz H, Johnston PR, Park D, Minter DW. 2011 – Molecular phylogeny reveals a core clade of *Rhytismatales*. Mycologia 103, 57–74.
- Lei RH, Sun KY, Zhang Q, Hou CL. 2013 – *Coccomyces pinicola* sp. nov. on *Pinus armandii* from China. Mycotaxon 123, 121–128.
- Li YN, Steenwyk JL, Chang Y, Wang Y et al. 2021 – A genome-scale phylogeny of the kingdom Fungi. Current Biology 31(8), 1653–1665.
- Li ZJ, Taylor JE, Hou, CL. 2016 – An unusual *Lophodermium* species on needles of *Pinus taiwanensis* from China. Mycological Progress 15, 1229–1237.
- Liimatainen K, Kim JT, Pokorny L, Kirk P et al. 2022 – Taming the beast: a revised classification of Cortinariaceae based on genomic data. Fungal Diversity 112, 89–170.
- Lin YR. 2012 – Flora Fungorum Sinicorum VOL.40 *Rhytismatales*. Science Press, Beijing. 1–261.
- Lin YR, Li ZZ, Xiang CT, Liang SW et al. 1999 – A new genus of *Discomycetes*, *Neococcomyces* gen. nov. Mycosystema 18(4), 357–360.
- Lin YR, Wang SJ, He YF, Ye GB. 2004 – Two new taxa of the genus *Hypoderma* (*Rhytismataceae*). Mycosystema 23(1), 11–13.
- Liu NYW, Zhang L, Zhou Y, Tu M et al. 2021 – The *Rhododendron* Plant Genome Database (RPGD): a comprehensive online omics database for *Rhododendron*. BMC genomics 22(1), 376.
- Livsey S, Minter DW. 2011 – The taxonomy and biology of *Tryblidiopsis pinastri*. Canadian Journal of Botany 72(5), 549–557.
- Lu DD, Tang YP, Wang LH, Wang SJ et al. 2014 – *Lophodermium quadrisporum* sp. nov. (*Rhytismataceae*) on *Rhododendron faberi* subsp. *prattii*. Mycotaxon 129(2), 459–463.
- Lücking R, Aime MC, Robbertse B, Miller AN et al. 2020 – Unambiguous identification of fungi: where do we stand and how accurate and precise is fungal DNA barcoding? IMA fungus 11: 14.
- Lumbsch HT, Schmitt I, Lindemuth R, Miller A et al. 2005 – Performance of four ribosomal DNA regions to infer higher-level phylogenetic relationships of inoperculate euascomycetes (*Leotiomyces*). Molecular Phylogenetics and Evolution 34: 512–524.

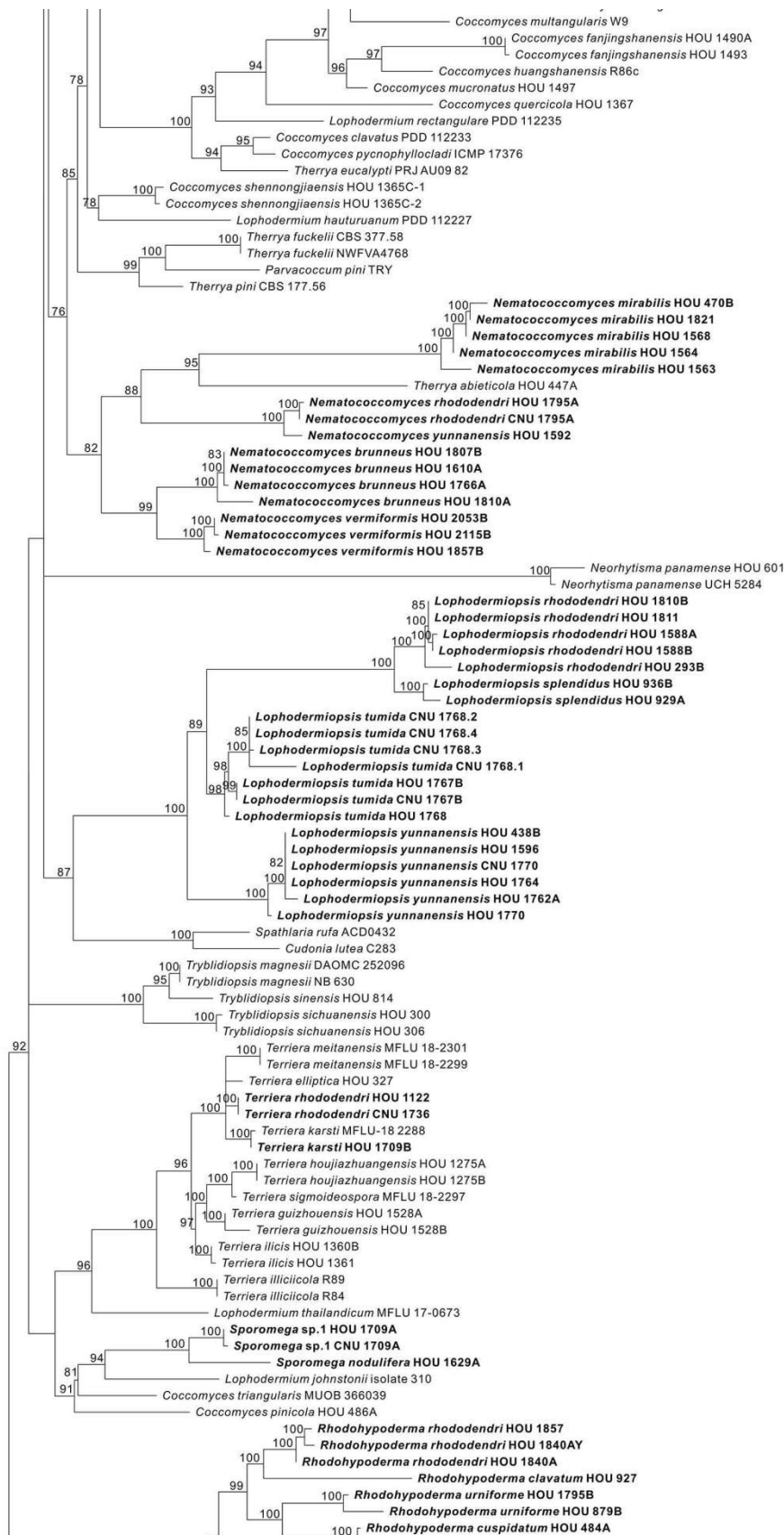
- Lv T. 2020 – Taxonomy and phylogeny of *Rhytismatales* in parts of southern China. PhD thesis, Capital Normal University, Beijing.
- Lv T, Hou CL. 2019 – A new species of *Coccomyces* on *Cunninghamia lanceolata* and its phylogenetic placement based on multi-gene analysis. *Phytotaxa* 391, 108–114.
- Lv T, Hou CL, Johnston PR. 2019a – Three new species and a new combination of *Triblidium*. *MycKeys* 60, 1–15.
- Lv T, Tang WP, Cai SR, Hou CL. 2019b – Three new *Coccomyces* species from Shennongjia National Nature Reserve in China. *Mycological Progress* 18, 1263–1273.
- Magnes M. 1997 – Weltmonographie der Tribliidiaceae. *Bibliotheca Mycologica* 165, 1–177.
- Masumoto S, Tojo M, Uchida M, Satoshi I. 2015 – Morphological and molecular characterization of *Rhytisma filamentosum* sp. nov. from Nagano Prefecture, Japan. *Mycological Progress* 14, 44.
- Matheny PB, Hobbs AM, Esteve-Raventós F. 2020 – Genera of *Inocybaceae*: new skin for the old ceremony. *Mycologia* 112(1), 83–120.
- Matsukura K, Hirose D, Kagami M, Osono T et al. 2017 – Geographical distributions of rhytismataceous fungi on *Camellia japonica* leaf litter in Japan. *Fungal Ecology* 26, 37–44.
- Minh BQ, Schmidt HA, Chernomor O, Schrempf D et al. 2020 – IQ-TREE 2: New models and efficient methods for phylogenetic inference in the genomic era. *Molecular Biology and Evolution* 37: 1530–1534.
- Minter D. 2005 – *Lophodermium maculare*. [Descriptions of Fungi and Bacteria]. IMI Descriptions of Fungi and Bacteria 166
- Minter D, Cannon P. 2017 – *Sporomea degenerans*. Descriptions of Fungi and Bacteria 213
- Minter DW. 1996a – *Coccomyces leptideus*. IMI descriptions of fungi and bacteria No. 1291. *Mycopathologia* 136, 147–149.
- Minter DW. 1996b – *Colpoma ledi*. IMI descriptions of fungi and bacteria No. 1294. *Mycopathologia* 136, 159–161.
- Minter DW, Millar CS. 1978 – *Lophodermium pinastri*, *L. seditiosum*. CMI descriptions of pathogenic fungi and bacteria. nos. 567.568
- Minter DW and Millar CS. 1984 – *Lirula nervisequia*. CMI Descr. Path. Fungi & Bact. no. 783
- Mo ZQ, Fu CN, Zhu MS, Milne RI et al. 2022 – Resolution, conflict and rate shifts: insights from a densely sampled plastome phylogeny for *Rhododendron* (*Ericaceae*). *Annals of botany* 130(5), 687–701.
- Muggia L, Ametrano CG, Sterflinger K, Tesei D. 2020 – An overview of genomics, phylogenomics and proteomics approaches in Ascomycota. *Life* 10(12), 356.
- Oono R, Lutzoni F, Arnold AE, Kaye L et al. 2014 – Genetic variation in horizontally transmitted fungal endophytes of pine needles reveals population structure in cryptic species. *American Journal of Botany* 101(8), 1362–1374.
- Ortiz-García S, Gernandt DS, Stone JK, Johnston PR et al. 2003 – Phylogenetics of *Lophodermium* from pine. *Mycologia* 95, 846–859.
- Pastirčák M, Pastirčáková K. 2017 – *Hypoderma rubi* on two new hosts in Slovakia. *Mycotaxon* 132(4), 849–855.
- Peck CH. 1876 – Report of the Botanist. Annual Report on the New York State Museum of Natural History 28, 31–88.
- Powell PE. 1974 – Taxonomic studies in the genus *Hypoderma* (*Rhytismataceae*). PhD Dissertation, Cornell University, Ithaca, New York.
- Pu SC, Guo MJ, Hou CL. 2022 – A new species of *Coccomyces* from oak leaves in Fodingshan National Nature Reserve in China. *Phytotaxa* 558(1), 116–124.
- Rambaut A. 2000 – Estimating the rate of molecular evolution: incorporating non-contemporaneous sequences into maximum likelihood phylogenies. *Bioinformatics* 16, 395–399.
- Raymundo T, Soto-Agudelo R, Valenzuela R. 2017 – *Colpoma guadueticola* sp. nov. in a gradual forest from Quindío Department, Colombia. *Mycotaxon* 132, 819–829.

- Rehm H. 1888 – Ascomyceten: Hysteriaceen und Discomyceten. Rabenhorst's Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz. 1, 65–208.
- Rehm H 1913 – Ascomycetes novi VI. Annales Mycologici 11, 150–155.
- Reignoux SNA, Green S, Ennos RA. 2014 – Molecular identification and relative abundance of cryptic *Lophodermium* species in natural populations of Scots pine, *Pinus sylvestris* L. Fungal Biology 118: 835–845.
- Ronquist F, Huelsenbeck JP. 2003 – MrBayes 3: Bayesian phylogenetic inference under mixed models. Bioinformatics 19, 1572–1574.
- Saccardo PA. 1891 – Sylloge fungorum omnium hucusque cognitorum. 9, 1141.
- Salas-Lizana R, Oono R. 2018 – Double-digest RADseq loci using standard Illumina indexes improve deep and shallow phylogenetic resolution of *Lophodermium*, a widespread fungal endophyte of pine needles. Ecol Evol. 8(13): 6638–6651.
- Sánchez-García M, Matheny PB, Palfner G, Lodge DJ. 2014 – Deconstructing the *Tricholomataceae* (Agaricales) and introduction of the new genera *Albomagister*, *Corneriella*, *Pogonoloma* and *Pseudotracheloma*. Taxon 63(5): 993–1007.
- Schoch CL, Seifert KA, Huhndorf S, Robert V. 2012 – Nuclear ribosomal internal transcribed spacer (ITS) region as a universal DNA barcode marker for fungi. Proceedings of the National Academy of Sciences of the United States of America. 109(16), 6241–6246.
- Sherwood MA. 1974 – *Myriophacidium*, A New Genus of *Rhytismataceae* from Western Oregon. Mycologia, 66, 690–692.
- Sherwood MA. 1980 – Taxonomic studies in *Phacidiales*: the genus *Coccomyces* (*Rhytismataceae*). Occasional papers of the Farlow Herbarium of cryptogamic botany 15, 1–120.
- Shrestha N, Wang ZH, Su XY, Xu XT et al. 2018 – Global patterns of *Rhododendron* diversity: The role of evolutionary time and diversification rates. Global Ecology and Biogeography 27, 913–924.
- Solheim H, Torp TB, Hietala AM. 2013 – Characterization of the ascomycetes *Therrya fuckelii* and *T. pini* fruiting on Scots pine branches in Nordic countries. Mycological Progress 12, 37–44.
- Song SQ, Cameron K, Wang Y, Wang SY et al. 2023 – Phylogenomics and phylogeography of *Menispermum* (Menispermaceae). Frontiers in Plant Science 14, 1116300.
- Spatafora JW, Sung GH, Johnson D, Hesse C et al. 2006 – A five-gene phylogeny of Pezizomycotina. Mycologia 98(6), 1018–1028.
- Spooner BM. 1991 – *Lophodermium* and *Hypoderma* (*Rhytismatales*) from Mt Kinabalu, Sabah. Kew Bulletin 46(1), 73–100.
- Swofford DL. 1998 – PAUP*: phylogenetic analysis using parsimony (and other methods). Sinauer Associates, Massachusetts, 1–144.
- Tanney JB, Seifert KA. 2017 – *Lophodermium resinosum* sp. nov. from red pine (*Pinus resinosa*) in Eastern Canada. Botany 95, 773–784.
- Tanney JB, Seifert KA. 2019 – *Tryblidiopsis magnesii* sp. nov. from *Picea glauca* in Eastern Canada. Journal of Systematics and Evolution 4, 13–20.
- Tian HZ, Yang Z, Wang S, Hou CL et al. 2013 – A new species and phylogenetic data for *Nematococcomyces*. Botany 91(9), 592–596.
- Toju H, Yamamoto S, Sato H, Tanabe AS et al. 2013 – Community composition of root-associated fungi in a Quercus-dominated temperate forest: “codominance” of mycorrhizal and root-endophytic fungi. Ecology and Evolution 3(5), 1281–1293.
- Vassiljeva LN. 1979 – Mikologiya i Fitopatologiya 13(4): 280.
- Vu D, Groenewald M, de Vries M, Gehrmann T et al. 2019 – Large-scale generation and analysis of filamentous fungal DNA barcodes boosts coverage for kingdom fungi and reveals thresholds for fungal species and higher taxon delimitation. Studies in Mycology 92: 135–154.
- Wang QT, Guo MJ, Lv T, Zhou H et al. 2023 – Phylogeny and taxonomy of *Rhytisma*-like species worldwide. Fungal Diversity 120, 77–119.

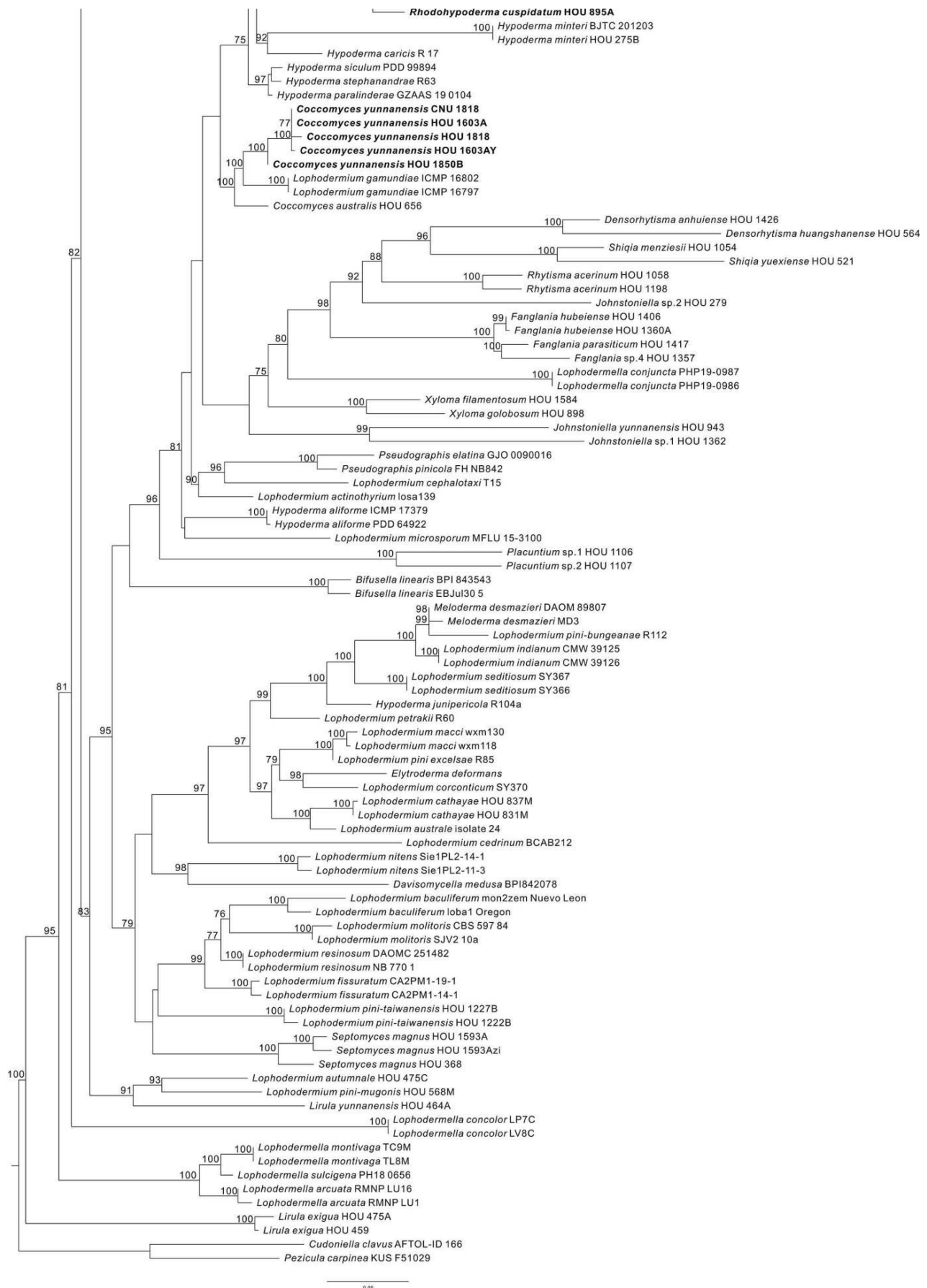
- Wang S, Cannon P, Li ZJ, Hou CL. 2014a – Multigene phylogenetic analysis detects cryptic species of *Tryblidiopsis* in China. *Mycologia* 106(1), 95–104.
- Wang S, Kirschner R, Wang YW, Hou CL. 2014b – *Hypohelion* from China. *Mycological Progress* 13, 781–789.
- Wang S, Taylor JE, Hou CL. 2013 – Species of *Rhytismatales* on *Berberis* from China. *Mycological Progress* 12, 629–635.
- Wang SJ, Xu Y, Tang YP, Li Q et al. 2014c – *Lophodermium urniforme*, a new species of *Rhytismataceae* from China. *Mycosystema* 33(4), 768–772.
- White TJ, Bruns T, Lee S, Taylor J. 1990 – Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. PCR protocols: A guide to methods and applications. Academic Press, Inc., New York.
- Wijayawardene NN, Hyde KD, Dai DQ, Sánchez-García et al. 2022 – Outline of Fungi and fungus-like taxa – 2021. *Mycosphere* 13: 53–453.
- Wilson M, Robertson NF. 1947 – The biology, culture, morphology, and relationships of *Lophodermium vagulum* sp. nov.; the cause of a disease of Chinese *Rhododendrons*. *Earth and Environmental Science Transactions of The Royal Society of Edinburgh* 61(2), 517–531.
- Zang W, Lv T, Sun JQ, Hou, CL. 2020 – A new species of *Coccomyces* from Guizhou Province of China. *Phytotaxa* 446, 23–32.
- Zhang JF, Liu JK, Hyde KD, Ekanayaka AH et al. 2020 – Morpho-phylogenetic evidence reveals new species in *Rhytismataceae* (*Rhytismatales*, *Leotiomyces*, *Ascomycota*) from Guizhou Province, China. *Mycosystema* 76, 81–106.
- Zhang TT, Tong X, Lin YR, Hou CL. 2015 – A new species and a new combination of *Terriera* based on morphological and molecular data. *Mycological Progress* 14: 54.
- Zhang Y, Guo LD. 2012 – Progress of fungal DNA barcode. *Mycosystema* 31, 809–820.
- Zhou D, Hyde KD. 2001 – Host-specificity, host-exclusivity, and host-recurrence in saprobic fungi. *Mycological Research* 105(12), 1449–1457.
- Zoller S, Scheidegger C, Sperisen C. 1999 – PCR primers for the amplification of mitochondrial small subunit ribosomal DNA of lichen-forming ascomycetes. *Lichenologist* 31, 511–516.

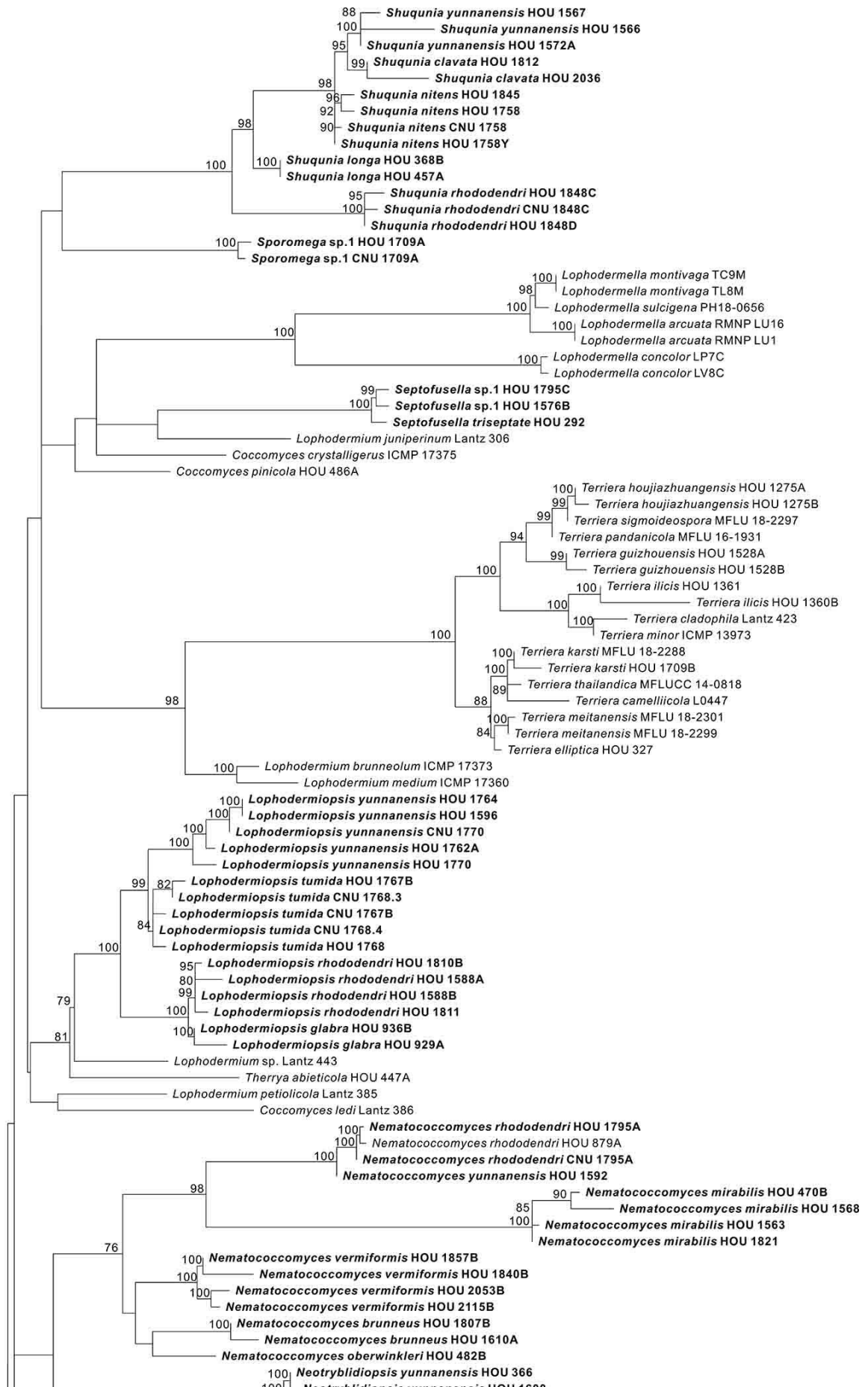
Supplementary Figure 1 – Phylogenetic tree generated by ML analysis based on sequences of the ITS. *Cudoniella clavus* (AFTOL-ID 166) and *Pezicula carpineae* (KUS-F51029) were selected as outgroups. Maximum likelihood bootstrap values (MLB $\geq 75\%$) were shown at the nodes.



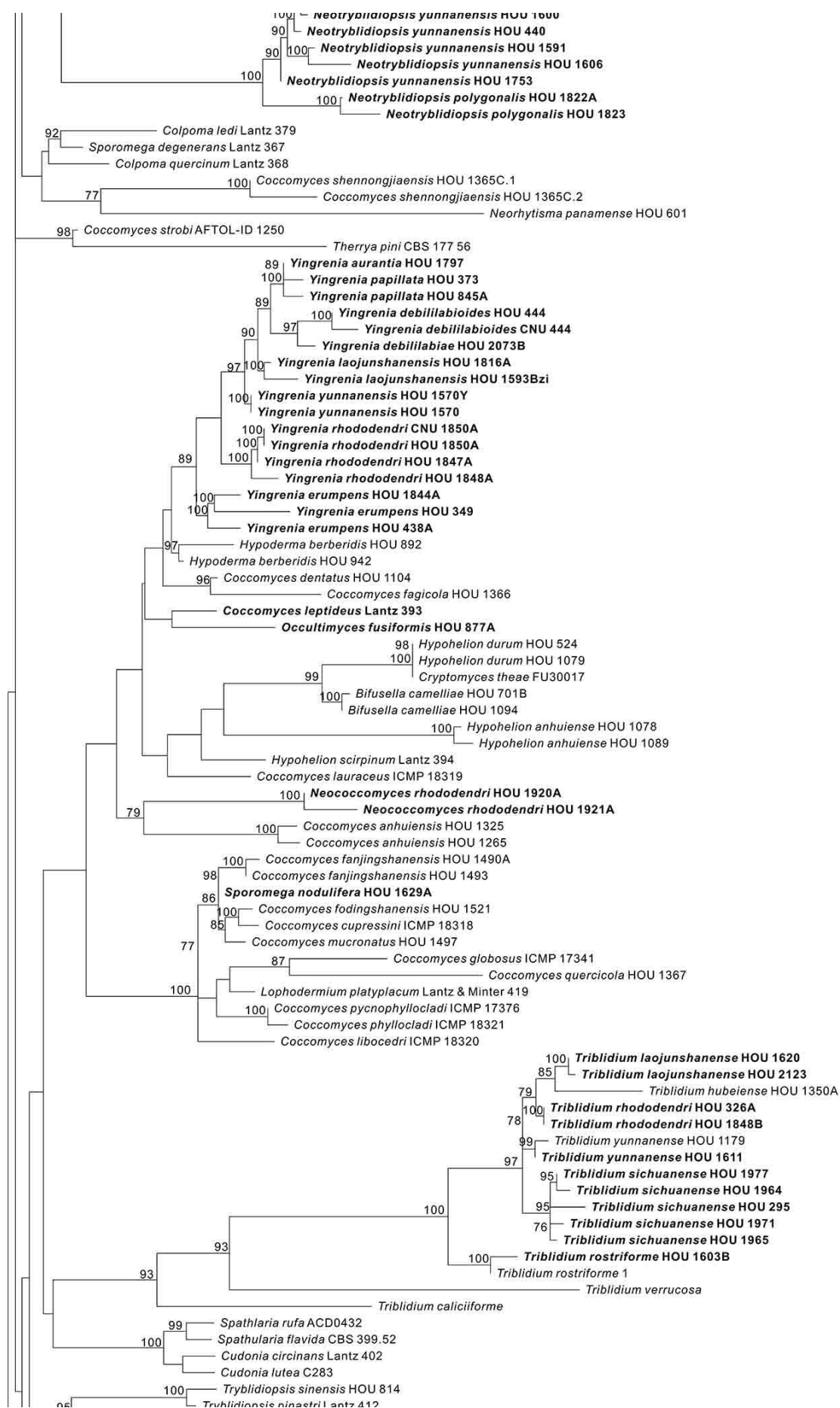


Supplementary Figure 1 – Continued.

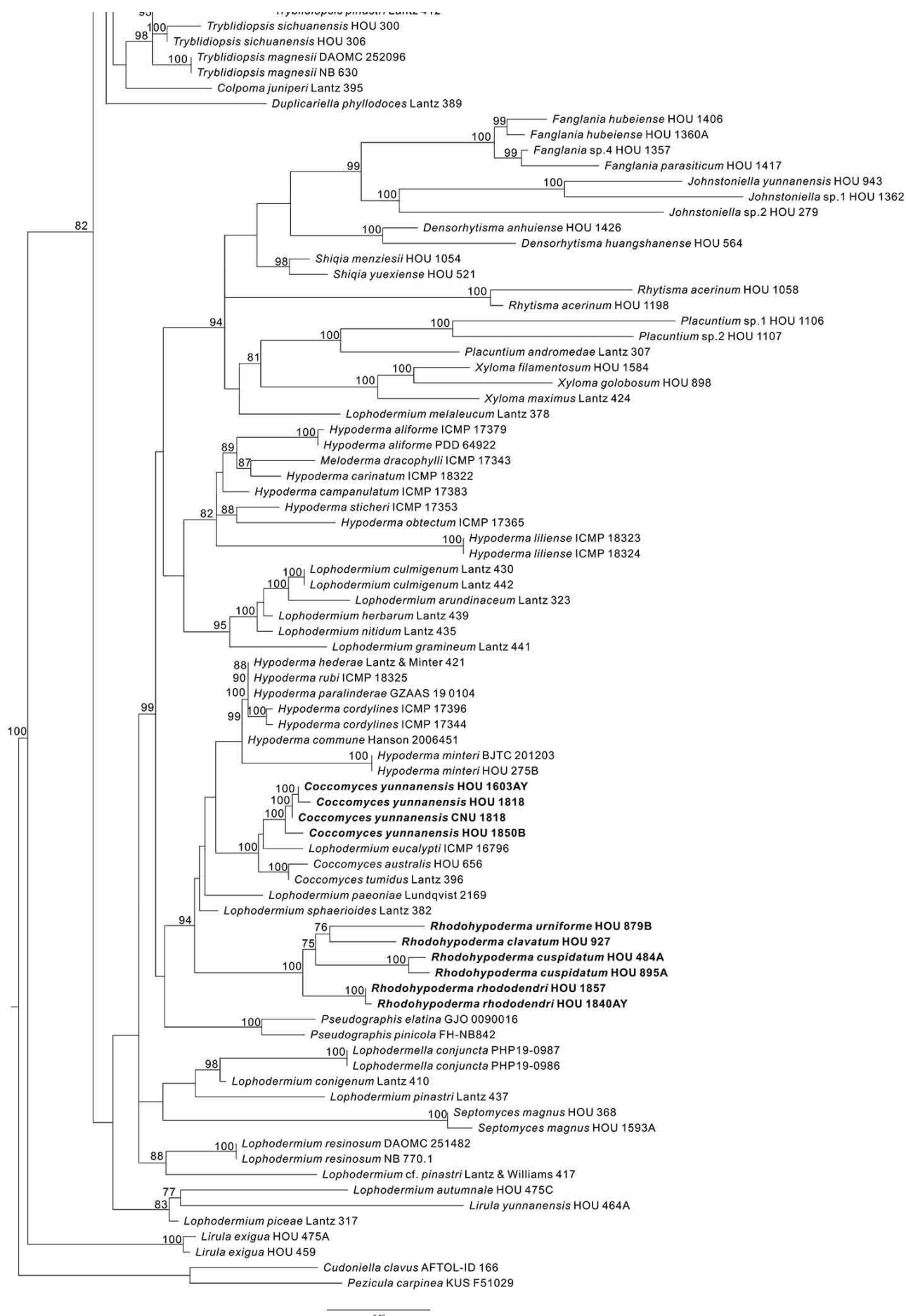




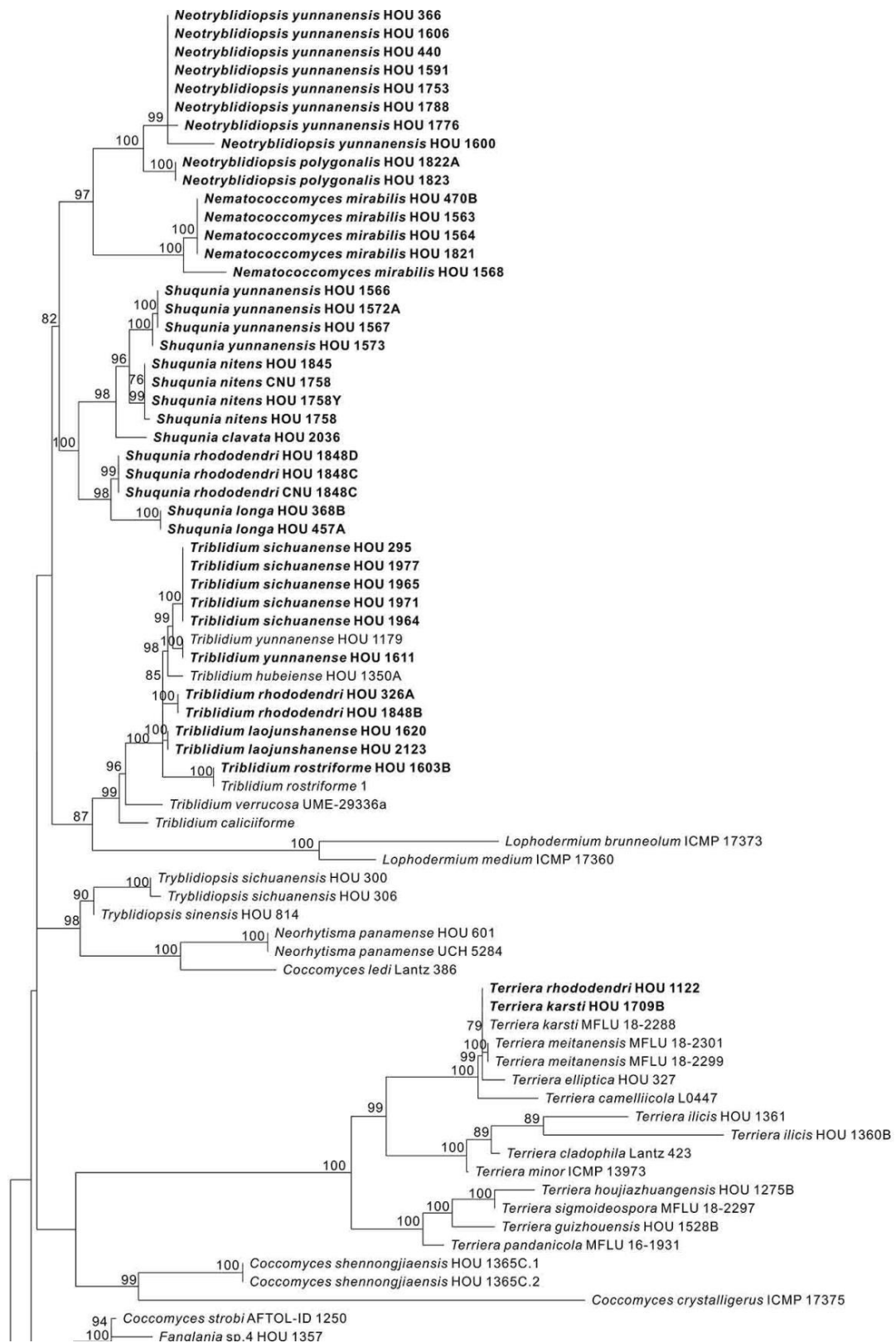
Supplementary Figure 2 – Continued.



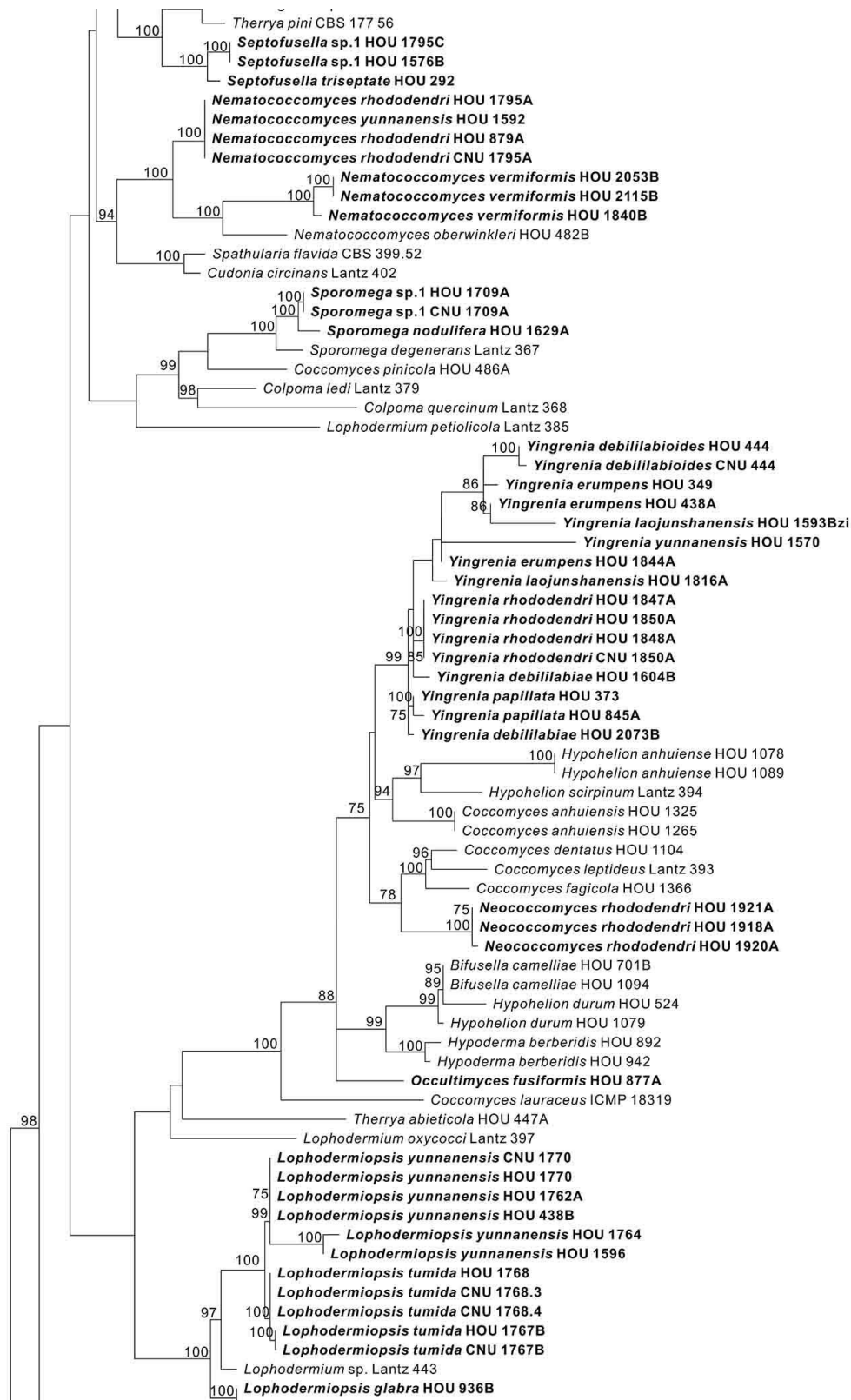
Supplementary Figure 2 – Continued.



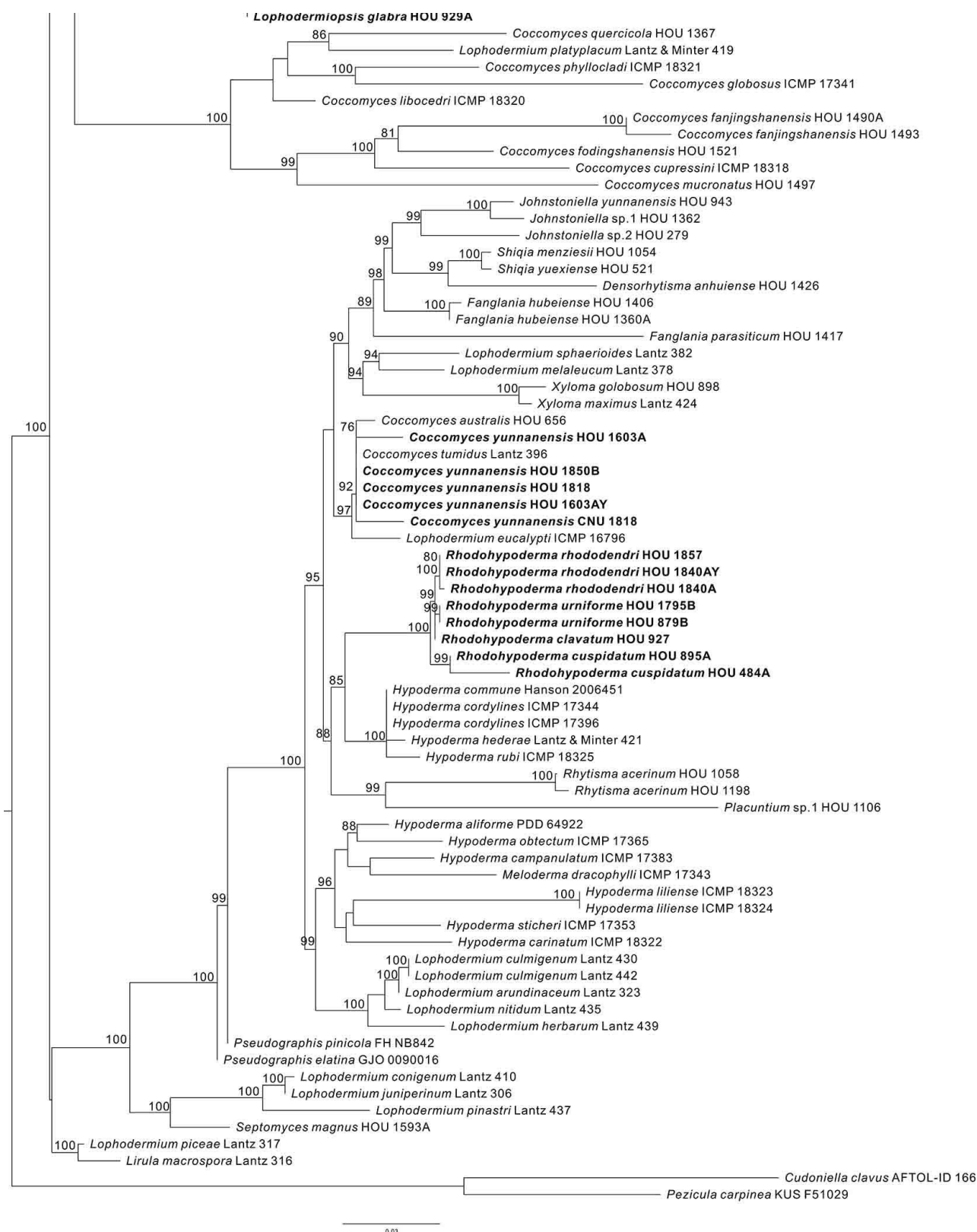
Supplementary Figure 2 – Continued.



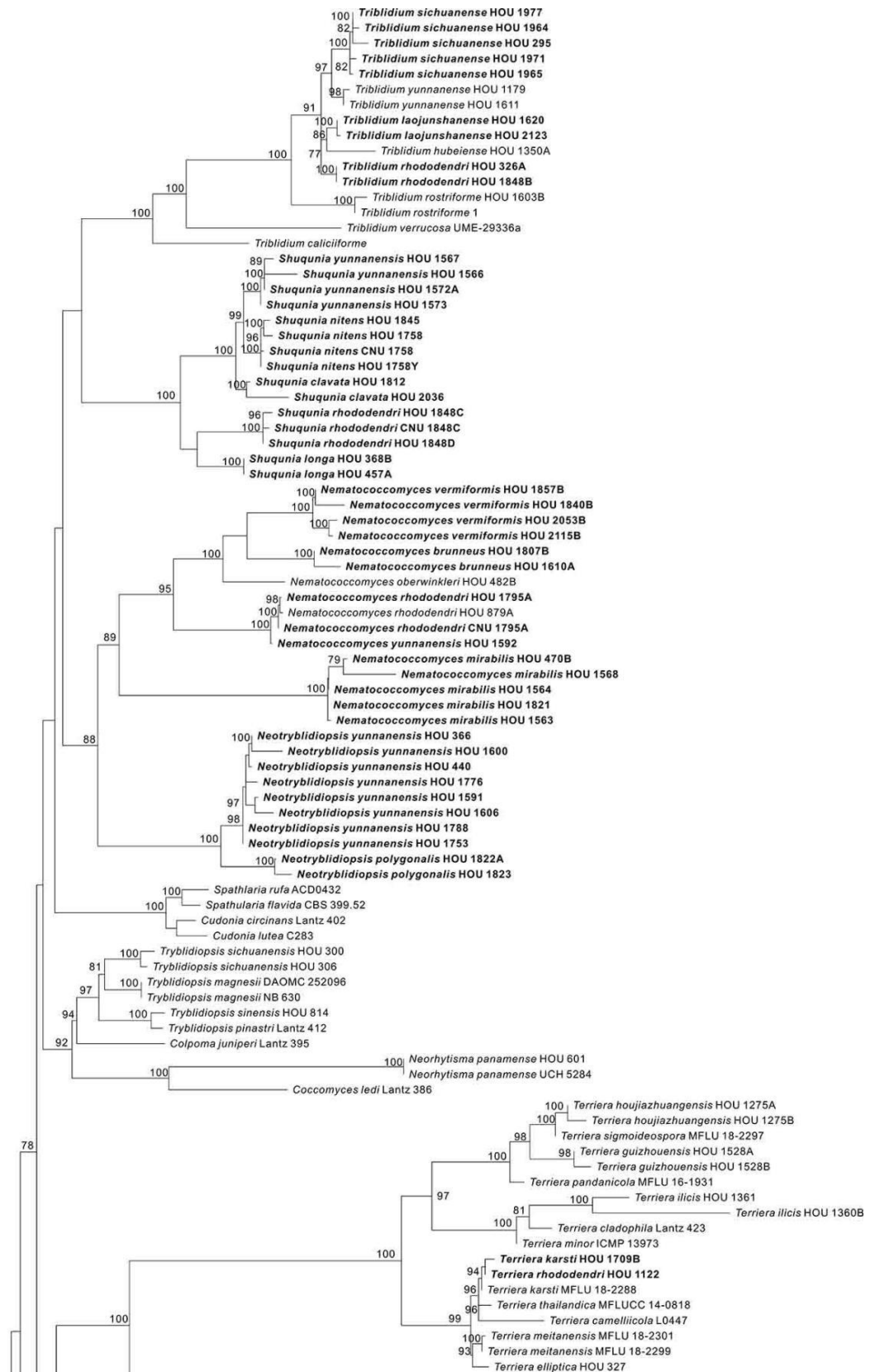
Supplementary Figure 3 – Phylogenetic tree generated by ML analysis based on sequences of the mtSSU. *Cudoniella clavus* (AFTOL-ID 166) and *Pezicula carpinea* (KUS-F51029) were selected as outgroups. Maximum likelihood bootstrap values (MLB $\geq$ 75%) were shown at the nodes.



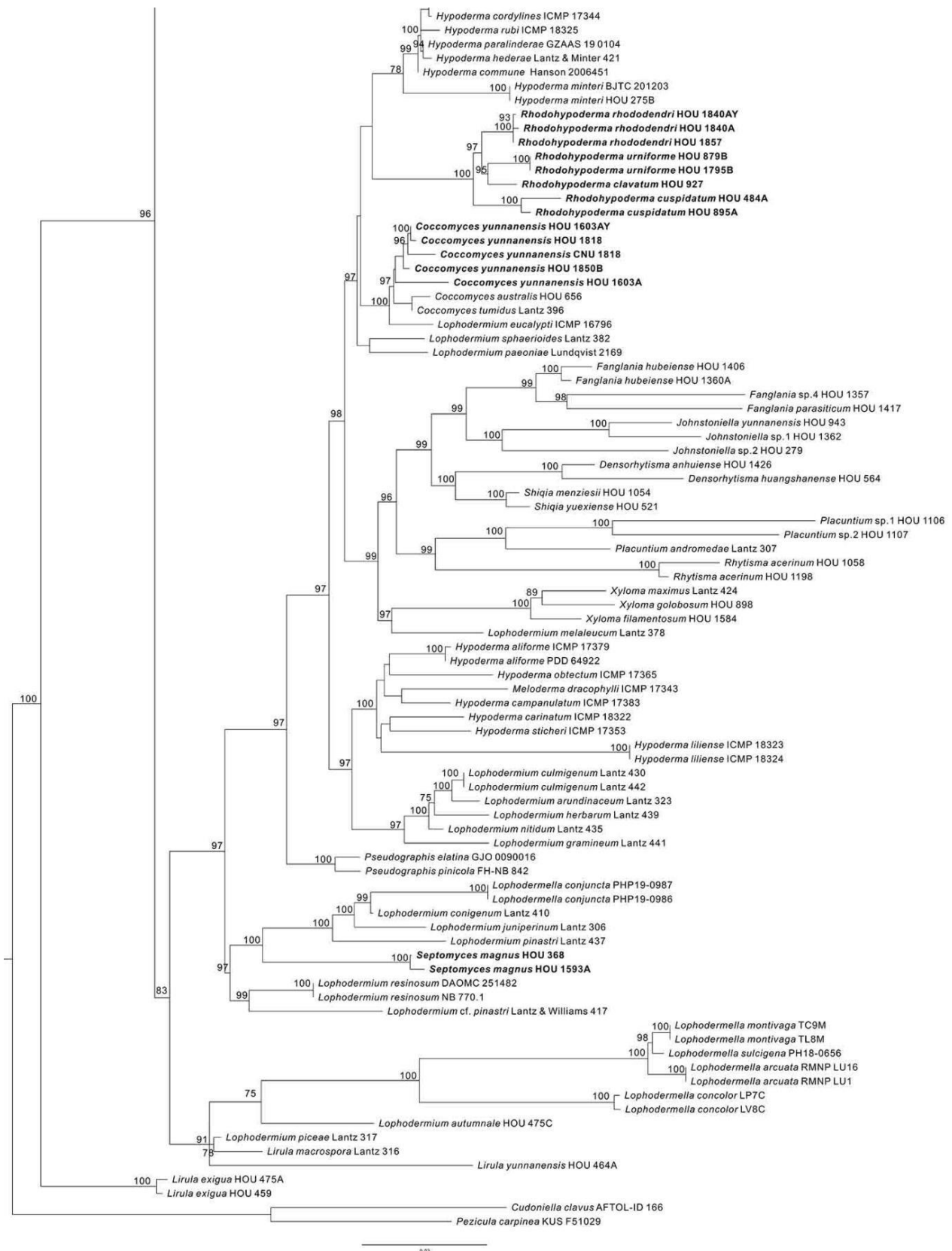
Supplementary Figure 3 – Continued.



Supplementary Figure 4 – Phylogenetic tree generated by ML analysis based on sequences of the LSU and mtSSU. *Cudoniella clavus* (AFTOL-ID 166) and *Pezicula carpineae* (KUS-F51029) were selected as outgroups. Maximum likelihood bootstrap values (MLB $\geq 75\%$) were shown at the nodes.



Supplementary Figure 4 – Continued.



Supplementary Figure 4 – Continued.