Mycosphere 14(1): 1665–1729 (2023) www.mycosphere.org ISSN 2077 7019
Article
Doi 10.5943/mycosphere/17/1/9

# A multi-gene phylogeny clarifies species diversity, taxonomy, and divergence times of *Ceriporia* and other related genera in Irpicaceae (Polyporales, Basidiomycota)

**Wang CG[1], Zhao H[1], Liu HG[2], Zeng GY[3], Yuan Y[1*], and Dai YC[1*]**

[1]*Institute of Microbiology, School of Ecology and Nature Conservation, Beijing Forestry University, Beijing 100083, China*
[2]*Yunnan Key Laboratory of Gastrodia and Fungi Symbiotic Biology, Zhaotong University, Zhaotong 657000, Yunnan China*
[3]*Guangxi Forestry Research Institute, Nanning 530002, China*

Wang CG, Zhao H, Liu HG, Zeng GY, Yuan Y, Dai YC 2023 – A multi-gene phylogeny clarifies species diversity, taxonomy, and divergence times of *Ceriporia* and other related genera in Irpicaceae (Polyporales, Basidiomycota). Mycosphere 14(1), 1665–1729, Doi 10.5943/mycosphere/14/1/19

**Abstract**

Phylogenetic and morphological analyses on *Ceriporia* and other related genera in Irpicaceae were carried out. *Ceriporia*, *Gloeoporus*, and *Meruliopsis* characterised as resupinate, effused-reflexed or pileate polypores with poroid and smooth hymenophore, a monomitic hyphal structure, crystals, and an oily substance are contained in the Irpicaceae. *Ceriporia* and *Meruliopsis* are phylogenetically related as sister genera. They share resupinate to rarely effused-reflexed basidiomata with a white, buff to brightly colored hymenophore, a monomitic hyphal structure with simple septa on the generative hyphae, and ellipsoid, cylindrical to allantoid basidiospores. However, hymenial cystidia are present in most *Meruliopsis* species, while they are absent in most *Ceriporia* species. *Gloeoporus* is distinguished from *Ceriporia* and *Meruliopsis* by having a gelatinous hymenophore and generative hyphae, sometimes with clamp connections. Phylogenies on *Ceriporia* and other related genera were reconstructed using multiple loci DNA sequences, including the internal transcribed spacer regions (ITS), the large subunit of nuclear ribosomal RNA gene (nLSU), the largest subunit of RNA polymerase II (RPB1), the translation elongation factor 1-α gene (TEF1) and the small subunit of nuclear ribosomal RNA gene (nSSU), as well as two combined datasets (ITS+nLSU) and (ITS+nLSU+RPB1+TEF1+nSSU). Eleven new species in *Ceriporia* are described and illustrated, four new combinations in the genus are proposed. Two new species in *Gloeoporus* and three in *Meruliopsis* are described and illustrated. Moreover, the evolutionary times of *Ceriporia* and other related genera in Irpicaceae were revealed based on conserved regions of five DNA fragments (ITS+nLSU+RPB1+TEF1+nSSU). Bayesian evolutionary analysis shows the divergence time of Irpicaceae emerged with a mean stem age of 169.1 Mya [95 % highest posterior density (HPD) of 124.66–231.04 Mya], which occurred during the middle Jurassic. *Ceriporia* and *Meruliopsis* grouped and the initial diversification occurred during the early of the Cretaceous with a mean stem age of 113.99 Mya [95% highest posterior density (HPD) of 81.53–153.07 Mya]. *Gloeoporus* emerged earlier with a mean stem age of 142.84 Mya [95% highest posterior density (HPD) of 102.39–196.41 Mya], which occurred during the early Cretaceous.

Submitted 3 July 2023, Accepted 25 September 2023, Published 24 October 2023
Corresponding Author: Yuan Yuan – e-mail – yuanyuan1018@bjfu.edu.cn,
Yu-Cheng Dai – e-mail – yuchengdai@bjfu.edu.cn

**Keywords** – Molecular clock – multi-marker analyses – polypore – taxonomy – wood-decaying fungi

## Introduction

Irpicaceae Spirin & Zmitr comprises corticioid species and resupinate to pileate polypores (Chen et al. 2021); *Ceriporia* Donk, *Gloeoporus* Mont. and *Meruliopsis* Bondartsev as resupinate, effused-reflexed to pileate polypores are contained in the Irpicaceae.

The genus *Ceriporia* (Polyporales, Basidiomycota), typified by *C. viridans* (Berk. & Br.) Donk, was established in 1933. Traditionally, it is characterized by resupinate to rarely effused-reflexed, soft basidiomata with a white or brightly colored (e.g., violet, yellow, pink etc.) pore surface when fresh, mostly a monomitic hyphal system, simple-septate generative hyphae, frequently covered with hyaline or yellowish crystals and an oily substance, cystidia and cystidioles rarely present, narrowly ellipsoid, cylindrical to allantoid basidiospores, and causing a white rot in dead angiosperm and gymnosperm wood (Spirin et al. 2016, Ryvarden & Melo 2017, Chen et al. 2020, Chen et al. 2022, Yuan et al. 2023). More than 80 species have been accepted in *Ceriporia* worldwide (Ryvarden & Johansen 1980, Rajchenberg 1983, Bernicchia & Niemelä 1998, Dai et al. 2002, Ryvarden & Iturriaga 2003, Jia & Cui 2012, Jia et al. 2014, Miettinen et al. 2016, Spirin et al. 2016, Yuan et al. 2017, Chen et al. 2020, Chen et al. 2022, Ryvarden et al. 2022, Wu et al. 2022), but some species have been combined into *Meruliopsis* and *Irpex* Fr. based on phylogenetic analyses, e.g., *M. albomellea* (Yuan Yuan et al.) C.C. Chen & Sheng H. Wu, *M. crassitunicata* (Y.C. Dai & Sheng H. Wu) C.C. Chen & Sheng H. Wu, *M. nanlingensis* (B.K. Cui & B.S. Jia) C.C. Chen & Sheng H. Wu, *M. pseudocystidiata* (B.S. Jia & Y.C. Dai) C.C. Chen & Sheng H. Wu, *M. tarda* (Berk.) Parmasto, *M. variegata* (B.S. Jia & Y.C. Dai) Zmitr. and *I. laceratus* (N. Maek. et al.) C.C. Chen & Sheng H. Wu, but these species still belong to Irpicaceae (Parmasto 1968, Zmitrovich 2018, Chen et al. 2020, Chen et al. 2021). However, some species previously addressed in *Ceriporia* nested in the Phanerochaetaceae Jülich, e.g., *Phanerochaete inflata* (B.S. Jia & B.K. Cui) Miettinen, *Phanerina mellea* (Berk. & Broome) Miettinen, *Riopa metamorphosa* (Fuckel) Miettinen & Spirin (Miettinen et al. 2016), and Meruliaceae Rea, e.g., *Hydnophlebia alachuana* (Murrill) Hallenb. (Chen et al. 2021).

*Emmia* Zmitr. et al. was established by Zmitrovich et al. including the type species *E. latemarginata* (Dur. & Mont.) Zmitr. et al. and *E. metamorphosa* (Fuckel) Spirin et al., and is characterized by resupinate to orbicular basidiomata, large and soft-waxy pores, a monomitic hyphal system, generative hyphae with simple septa, cylindrical cystidia sometimes with fine crystals, and ellipsoid to short-cylindrical basidiospores (Zmitrovich et al. 2006, Zmitrovich & Malysheva 2014). In accordance with phylogenetic analyses, *E. lacerata* (N. Maekawa et al.) F. Wu et al. was transferred to the genus (Wu et al. 2017). However, *Emmia* was proposed as the synonym of *Irpex* by Chen et al. (2021).

*Meruliopsis* and *Gloeoporus* are also placed in the Irpicaceae and are easily confused with *Ceriporia* by sharing some similar morphological characters. *Meruliopsis* was published by Bondartsev and typified with *M. taxicola* (Pers.) Bondartsev. It is characterized by resupinate to effused-reflexed basidiomata, a monomitic hyphal system, simple-septate generative hyphae, and the presence of cystidia or cystidioles in most species (Ginns 1976, Chen et al. 2020). *Gloeoporus* was published by Montagne and typified by *G. conchoides* Mon. (syn. *G. thelephoroides* (Hook.) G. Cunn.). The diagnostic features of the genus encompass resupinate to pileate basidiomata with a gelatinous hymenophore, a monomitic hyphal system, and generative hyphae with simple septa or clamp connections (Ryvarden & Gilbertson 1993, Ryvarden & Melo 2017, Jung et al. 2018).

Phylogenetic analyses based on nLSU indicated that *Meruliopsis taxicola* differs from the type species of *Gloeoporus*, and that *Byssomerulius* and *Ceriporia* represent separate genera in the "*Byssomerulius*" family (Larsson 2007). Binder et al. (2013) and Justo et al. (2017) also proved the independence of these four genera in Irpicaceae through constructing polygenic phylogenetic analyses. Jung et al. (2018) provided a detailed study on *Gloeoporus* and through phylogenetic and morphological analyses proposed cystidium-forming species of *Gloeoporus* being renamed to

*Meruliopsis*. Chen et al. (2020, 2021) published comprehensive studies on the phlebioid clade using sequences of multiple genes and revealed a convincing inter-generic relationship.

Up to now, 49, 23 and 15 taxa have been accepted in *Ceriporia*, *Gloeoporus* and *Meruliopsis* respectively in Index Fungorum (http://www.indexfungorum.org/), and excluded the species that were combined into other genera based on Index Fungorum, MycoBank (https://www.mycobank.org) and related publications. In this study, in order to clarify the taxonomy and phylogeny of *Ceriporia* and other related taxa in Irpicaceae, specimens from around the world were studied using morphology and molecular phylogenetic analyses based on five genes (ITS, nLSU, RPB1, TEF1 and nSSU). In addition, molecular divergence times on several polypore groups were analyzed (Zhao et al. 2017, Zhu et al. 2019, Ji et al. 2022), but they are unknown for taxa in Irpicaceae. The molecular divergence times of *Ceriporia* and other related genera are analyzed based on the combined 5-gene dataset (ITS+nLSU+RPB1+TEF1+nSSU) in the present study.

## Materials & Methods

### Morphological studies

The studied specimens were deposited in the herbaria of the Institute of Microbiology, Beijing Forestry University (BJFC) and the Institute of Applied Ecology, Chinese Academy of Sciences (IFP). Morphological descriptions are based on field notes and voucher specimens. The microscopic analysis follows Miettinen et al. (2018) and Wu et al. (2022). Sections were studied at a magnification of up to 1 000× using a Nikon Eclipse 80i microscope and phase contrast illumination. Microscopic features and measurements were made from slide preparations stained with Cotton Blue and Melzer's reagent. Spores were measured from sections cut from the tubes. To represent the variation in the size of spores, 5% of measurements were excluded from each end of the range and are given in parentheses. In the description: KOH = 5% potassium hydroxide, IKI = Melzer's reagent, IKI– = neither amyloid nor dextrinoid, CB = Cotton Blue, CB+ = cyanophilous in Cotton Blue, CB– = acyanophilous in Cotton Blue, L = arithmetic average of spore length, W = arithmetic average of spore width, Q = L/W ratios, and n = number of basidiospores/measured from given number of specimens. Color terms follow Anonymous (1969) and Petersen (1996).

### DNA extraction, amplification and sequencing

A CTAB rapid plant genome extraction kit-DN14 (Aidlab Biotechnologies Co., Ltd, Beijing) was used to obtain DNA from dried specimens, and to perform the polymerase chain reaction (PCR) according to the manufacturer's instructions with some modifications (Shen et al. 2019, Sun et al. 2020). The internal transcribed spacer (ITS) and large subunit nuclear ribosomal RNA gene (nLSU) were amplified using the primer pairs ITS5/ITS4 and LR0R/LR7 (White et al. 1990, Hopple & Vilgalys 1999) (https://sites.duke.edu/vilgalyslab/rdna_primers_for_fungi/). The nSSU region was amplified with primer pairs NS1 and NS4 (White et al. 1990). Part of TEF1 was amplified with primer pairs EF1-983F and EF1-1567R (Rehner & Buckley 2005). The RPB1 was amplified with primer pairs RPB1-Af and RPB1-Cr (Matheny et al. 2002).

The PCR procedure for ITS and TEF1 was as follows: initial denaturation at 95 °C for 3 min, followed by 34 cycles at 94 °C for 40 s, 54 °C for ITS and 54 °C for TEF for 45 s and 72 °C for 1 min, and a final extension of 72 °C for 10 min. The PCR procedure for nLSU and nSSU was as follows: initial denaturation at 94 °C for 1 min, followed by 34 cycles of denaturation at 94 °C for 30 s, annealing at 50 °C for nLSU and 52 °C for nSSU for 1 min and extension at 72 °C for 1.5 min, and a final extension at 72 °C for 10 min. The PCR procedure for RPB1 was initial denaturation at 94 °C for 2 min, followed by 10 cycles at 94 °C for 45 s, 60 °C for 45 s and 72 °C for 1.5 min, then followed by 37 cycles at 94 °C for 45 s, 52 °C for 1 min and 72 °C for 1.5 min, and a final extension of 72 °C. The PCR products were purified and sequenced at the Beijing Genomics Institute (BGI), China, with the same primers. DNA sequencing was performed at the Beijing Genomics Institute and the newly generated sequences were deposited in GenBank. All

sequences analysed in this study are listed in Table 1. Sequences generated from this study were aligned with additional sequences downloaded from GenBank using BioEdit (Hall 1999) and ClustalX (Thompson et al. 1997). The final ITS, nLSU, RPB1, TEF1 and nSSU datasets were subsequently aligned using MAFFT v.7 under the E-INS-i strategy with no cost for opening gaps and equal cost for transformations (command line: mafft –genafpair –maxiterate 1000) (Katoh & Standley 2013) and visualized in BioEdit (Hall 1999).

**Phylogenetic analyses**

In this study, two combined matrixes were reconstructed for phylogenetic analyses; a 2-gene dataset (ITS+nLSU) and a 5-gene dataset (ITS+nLSU+RPB1+TEF1+nSSU) were used to determine the phylogenetic position of the new species. The sequence alignments and the retrieved topologies were deposited in TreeBase (http://www.treebase.org), under accession ID: 30533 (Reviewer access URL: http://purl.org/phylo/treebase/phylows/study/TB2:S30533?x-access-code=db8cd845bfadc68dfecde0c1e48c2819&format=html). Sequences of *Bjerkandera adusta* (Willd.) P. Karst. and *B. fumosa* (Pers.) P. Karst., obtained from GenBank, were used as the outgroups (Chen et al. 2020). The phylogenetic analyses followed the approach of Han et al. (2016) and Zhu et al. (2019). Maximum Likelihood (ML), and Bayesian Inference (BI) analyses were performed based on the two datasets. The best-fit evolutionary model was selected by Hierarchical Likelihood Ratio Tests (HLRT) and Akaike Information Criterion (AIC) in MrModeltest 2.2 (Nylander 2004) after scoring 24 models of evolution in PAUP* version 4.0b10 (Swofford 2002).

Sequences were analysed using Maximum Likelihood (ML) with RAxML-HPC2 through the CIPRES Science Gateway (www.phylo.org; Miller et al. 2009). Branch support (BT) for ML analysis was determined by 1000 bootstrap replicates. Bayesian phylogenetic inference and Bayesian Posterior Probabilities (BPP) were computed with MrBayes 3.1.2 (Ronquist & Huelsenbeck 2003). Four Markov chains were run for 5 M generations (2-gene dataset), and for 5 M generations (5-gene dataset) until the split deviation frequency value was less than 0.01, and trees were sampled every 100 generations. The first 25 % of the sampled trees were discarded as burn-in and the remaining ones were used to reconstruct a majority rule consensus and calculate Bayesian Posterior Probabilities (BPP) of the clades. All trees were viewed in FigTree v. 1.4.3 (http:// tree.bio.ed.ac.uk/software/figtree/). Branches that received bootstrap support for ML (≥75% (ML-BS)), and BPP (≥ 0.95 BPP) were considered as significantly supported. The ML bootstrap (ML) ≥ 50% and BBP (BPP) ≥ 0.90 are presented on topologies from ML analyses, respectively.

**Table 1** Taxa information and GenBank accession numbers of the sequences used in this study.

| Species name | Sample no. | Location | GenBank accession No. | | | | |
|---|---|---|---|---|---|---|---|
| | | | ITS | nLSU | nSSU | TEF1 | RPB1 |
| *Agaricus campestris* | LAPAG370 | – | KM657927 | KR006607 | – | KR006636 | – |
| *Amylocorticium cebennense* | CFMR: HHB-2808 | USA | GU187505 | GU187561 | GU187612 | GU187675 | GU187439 |
| *Aphanobasidium pseudotsugae* | CFMR: HHB-822 | USA | GU187509 | GU187567 | GU187620 | GU187695 | GU187455 |
| *Athelia epiphylla* | CFMR: FP-100564 | USA | GU187501 | GU187558 | GU187613 | GU187676 | GU187440 |
| *Bjerkandera adusta* | Dai 14516 | China | MW507097 | MW520204 | OQ509532[a] | OQ559572[a] | OQ542973[a] |
| *Bjerkandera fumosa* | Dai 21100 | China | MW507109 | MW520211 | OQ509533[a] | OQ559573[a] | OQ542974[a] |
| *Boletopsis leucomelaena* | AFTOL-ID 1527 | USA | DQ484064 | DQ154112 | DQ435797 | GU187763 | GU187494 |
| *Boletus edulis* | HMJAU4637 | – | JN563894 | KF112455 | – | KF112202 | KF112586 |
| *Bondarzewia tibetica* | Yu 56 | China | KT693203 | KT693205 | – | KX066148 | KX066158 |
| *Byssomerulius corium* | FP-102382 | USA | KP135007 | KP135230 | – | – | KP134802 |
| *Callistosporium graminicolor* | AFTOL-ID 978 | USA | DQ484065 | AY745702 | AY752974 | GU187761 | GU187493 |

**Table 1** Continued.

| Species name | Sample no. | Location | GenBank accession No. | | | | |
|---|---|---|---|---|---|---|---|
| | | | **ITS** | **nLSU** | **nSSU** | **TEF1** | **RPB1** |
| *Crystallicutis serpens* | HHB-15692-Sp | USA | KP135031 | KP135200 | – | – | KP134785 |
| *Crystallicutis* sp. | Miettinen-16854.3 | USA | KY948742 | KY948890 | – | – | KY948964 |
| *Crystallicutis* sp. | Dai 6090 | China | JX623934 | JX644066 | – | – | – |
| ***Ceriporia allantoidea*** | Cui 8097 | China | KC182780 | – | – | – | – |
| ***Ceriporia allantoidea*** | Dai 8110 (holotype) | China | KC182767 | KC182784 | – | – | – |
| ***Ceriporia allantospora* (*Phanerochaete allantospora*)** | RLG-10478 (holotype) | USA | KP135039 | – | – | – | – |
| *Ceriporia arbuscula* | GC 1708–338 (holotype) | China | LC427008 | LC427040 | – | – | LC427058 |
| *Ceriporia arbuscula* | GC 1708-340 | China | LC427009 | LC427041 | – | – | LC427068 |
| *Ceriporia aurantiocarnescens* | JV 0105/10 | Czechia | KX236482 | KX236482 | – | – | – |
| *Ceriporia aurantiocarnescens* | Dai 17951 | China | MW491774 | MW491764 | – | – | – |
| *Ceriporia bresadolae* | VS 8849 | Canada | KX236468 | KX236468 | – | – | – |
| *Ceriporia bresadolae* | Rivoire 3701 | France | KX236467 | KX236467 | – | – | – |
| *Ceriporia bresadolae* | KKN-223-Sp | USA | KP135044 | KP135203 | – | – | KP134788 |
| *Ceriporia bresadolae* | Cui 17335 | China | OQ476819[a] | – | OQ509534[a] | OQ559574[a] | – |
| *Ceriporia bresadolae* | Dai 24539 | China | OQ476820[a] | OQ476765[a] | OQ509535[a] | OQ559575[a] | OQ542975[a] |
| *Ceriporia bresadolae* | Dai 24541 | China | OQ476821[a] | OQ476766[a] | OQ509536[a] | OQ559576[a] | OR090875[a] |
| *Ceriporia bresadolae* | VS 4018 | Russia | KX236466 | – | – | – | – |
| *Ceriporia bresadolae* | Dai 23934 | China | OR086074[a] | OQ476767[a] | OQ509537[a] | OQ559577[a] | OQ542976[a] |
| *Ceriporia bubalinomarginata* | Dai 17937 | China | MW491775 | MW491765 | – | – | – |
| *Ceriporia bubalinomarginata* | Dai 12113 | China | OQ476822[a] | OQ476768[a] | OQ509538[a] | – | – |
| *Ceriporia* cf. *mellita* | GC 1508-71 | China | LC427022 | LC427044 | – | – | LC427067 |
| *Ceriporia* cf. *mellita* | WEI 17-024 | China | LC427024 | LC427046 | – | – | – |
| *Ceriporia* cf. *mellita* | GC 1608-7 | Japan | LC427023 | LC427045 | – | – | LC427060 |
| *Ceriporia* cf. *mellita* | Dai 8168 | China | KC182768 | KC182785 | – | OQ559578[a] | – |
| ***Ceriporia crassa*** | Dai 22034 (holotype) | China | OQ476823[a] | OQ476769[a] | OQ509539[a] | OQ559579[a] | OQ542977[a] |
| ***Ceriporia daedaleoides*** | Dai 16779 (holotype) | Thailand | KY825130 | OR088493[a] | OR095704[a] | – | – |
| *Ceriporia eucalypti* | Dai 18675 (holotype) | Australia | MW491779 | MW491769 | – | OQ559580[a] | – |
| *Ceriporia excelsa* | Yuan 2747 | China | KC182778 | – | – | – | – |
| *Ceriporia excelsa* | Yuan 2744 | China | KC182773 | – | – | – | – |
| ***Ceriporia gossypinum*** | GC 1708-211 | China | LC427027 | LC427049 | – | – | LC427062 |
| ***Ceriporia gossypinum*** | FP-134993 | USA | KP135048 | – | – | – | KP134792 |
| ***Ceriporia gossypinum*** | Dai 23392 (holotype) | China | OQ476824[a] | OQ476770[a] | OQ509540[a] | OQ559581[a] | OR090876[a] |
| *Ceriporia griseoviolascens* | JV0110/26 | Czechia | KX236487 | KX236487 | – | – | – |
| *Ceriporia griseoviolascens* | Dai 13202 | France | OQ476825[a] | OQ476771[a] | OQ509541[a] | OQ559582[a] | – |
| ***Ceriporia hinnulea*** | Cui 11291 (holotype) | China | OQ476826[a] | OQ476772[a] | OQ509542[a] | OQ559583[a] | OQ542978[a] |
| *Ceriporia humilis* | Dai 7642 | China | KC182775 | – | OR095706[a] | OR113375[a] | – |
| *Ceriporia humilis* | Spirin 4706 (holotype) | Russia | KX752608 | – | – | – | – |
| ***Ceriporia langloisii* (*Candelabrochaete langloisii*)** | FP-110343-sp | USA | KY948793 | KY948886 | – | – | KY948981 |

**Table 1** Continued.

| Species name | Sample no. | Location | GenBank accession No. | | | | |
|---|---|---|---|---|---|---|---|
| | | | **ITS** | **nLSU** | **nSSU** | **TEF1** | **RPB1** |
| **"*Ceriporia* aff. *macrospora*"** | MEL 2382688 | Australia | KP013052 | – | – | – | – |
| ***Ceriporia macrospora*** | Cui 6740 (holotype) | China | OQ476827[a] | – | – | – | – |
| ***Ceriporia macrospora*** | Dai 24695 | China | OR086075[a] | OR088494[a] | OR095707[a] | — | OR090877[a] |
| *Ceriporia manzanitae* | Ryvarden 21832 (holotype) | USA | KX236478 | KX236478 | – | – | – |
| *Ceriporia mellita* | Dai 13407 | China | OQ476828[a] | OQ476773[a] | – | – | – |
| *Ceriporia mellita* | BR 4865 | France | KX236485 | KX236485 | – | – | – |
| *Ceriporia mellita* | Dai 13378 | China | OQ476829[a] | OQ476774[a] | OQ509545[a] | – | – |
| *Ceriporia mellita* | Dai 13193 | France | OQ476830[a] | OQ476775[a] | OQ509546[a] | – | – |
| *Ceriporia mellita* | Dai 19118 | China | OQ476831[a] | OQ476776[a] | OQ509547[a] | – | – |
| *Ceriporia mellita* | Yuan 5862 | China | KC182771 | KC182782 | – | – | – |
| *Ceriporia mellita* | Dai 18486A | China | OQ476832[a] | OQ476777[a] | OR095708[a] | – | – |
| *Ceriporia mpurii* | Dai 24426 | China | OQ476833[a] | OQ476778[a] | OR095709[a] | – | OR090878[a] |
| *Ceriporia mpurii* | He 6687 | China | OQ476834[a] | OQ476779[a] | OR095710[a] | OR113376[a] | OR090879[a] |
| *Ceriporia mpurii* | Miettinen 14381 (holotype) | Indonesia | KX752603 | KX752603 | – | – | – |
| *Ceriporia occidentalis* | Spirin 8558 | USA | KX236475 | KX236475 | – | – | – |
| *Ceriporia occidentalis* | JV 1105/12-J | USA | KX236473 | KX236473 | – | – | – |
| ***Ceriporia orientalis*** | Li 1045 | China | JX623946 | – | OR095711[a] | – | – |
| ***Ceriporia orientalis*** | Dai 13400 (holotype) | China | OQ476835[a] | OQ476780[a] | OQ509548[a] | OQ559585[a] | OQ542979[a] |
| *Ceriporia pierii* | Dai 23500 | China | OQ476836[a] | OQ476781[a] | OQ509549[a] | OQ559586[a] | OR090880[a] |
| *Ceriporia pierii* | Dai 23499 | China | OQ476837[a] | OQ476782[a] | OQ509550[a] | OQ559587[a] | OQ542980[a] |
| *Ceriporia pierii* | Rivoire 1161 (holotype) | France | KX752604 | KX752604 | – | – | – |
| ***Ceriporia pseudospissa*** | Dai 24566 (holotype) | China | OQ476838[a] | OQ476783[a] | OR095712[a] | OR113377[a] | – |
| ***Ceriporia pseudospissa*** | Yuan 5965 | China | KC182772 | KC182783 | – | – | – |
| ***Ceriporia punctata*** | Dai 15899 (holotype) | China | OQ476839[a] | OQ476784[a] | OQ509551[a] | OQ559588[a] | OQ542981[a] |
| ***Ceriporia punctata*** | Dai 15904 | China | OQ476840[a] | OR088495[a] | OQ509552[a] | OQ559589[a] | OQ542982[a] |
| *Ceriporia punicans* | Dai 13376 | China | OQ476841[a] | OQ476785[a] | OQ509553[a] | OQ559590[a] | OQ542983[a] |
| *Ceriporia punicans* | JV 0808/30 (holotype) | USA | KX236479 | KX236479 | – | – | – |
| *Ceriporia purpurea* | Dai 22445 | China | OQ476842[a] | OQ476786[a] | OQ509554[a] | OQ559591[a] | – |
| *Ceriporia purpurea* | Dai 16368 | China | KX494577 | KX494581 | OQ509555[a] | OQ559592[a] | OQ542984[a] |
| *Ceriporia purpurea* | Rivoire 4413 (neotype) | France | KX236461 | KX236461 | – | – | – |
| *Ceriporia reticulata* | Li 1316 | China | JX623947 | – | OR095713[a] | – | – |
| *Ceriporia reticulata* | KHL11981 | Norway | JX109845 | JX109845 | – | – | – |
| "*Ceriporia reticulata*" | RLG-11354-Sp | USA | KP135041 | KP135204 | – | – | KP134794 |
| ***Ceriporia septocystidia* (*Candelabrochaete septocystidia*)** | RLG-9759-sp | USA | MZ636934 | GQ470631 | – | MZ913692 | MZ748442 |
| ***Ceriporia septocystidia* (*Candelabrochaete septocystidia*)** | RMJ-119-sp | USA | KY948783 | – | – | – | KY948959 |
| *Ceriporia sericea* | Spirin 4944 (holotype) | Russia | KX752609 | KX752609 | – | – | – |
| ***Ceriporia sinospissa*** | Cui 11282 (holotype) | China | OQ476843[a] | OQ476787[a] | OQ509556[a] | OQ559593[a] | – |
| ***Ceriporia sinospissa*** | Dai 10477 | China | KC182769 | KC182781 | – | – | – |
| ***Ceriporia sinospissa*** | Dai 16831 | China | OQ476844[a] | OQ476788[a] | OQ509557[a] | OQ559594[a] | – |

**Table 1** Continued.

| Species name | Sample no. | Location | GenBank accession No. | | | | |
|---|---|---|---|---|---|---|---|
| | | | **ITS** | **nLSU** | **nSSU** | **TEF1** | **RPB1** |
| *Ceriporia sinoviridans* | Dai 13621A (holotype) | China | MW491781 | MW491771 | OQ509558[a] | – | – |
| *Ceriporia sinoviridans* | Li 1046 | China | KC182776 | – | – | – | – |
| *Ceriporia sordescens* | Miettinen 15492.2 (holotype) | USA | KX752606 | KX752606 | – | – | – |
| *Ceriporia spissa* | PRM 915964 | USA | GU594154 | – | – | – | – |
| *Ceriporia spissa* | JV 0108/6 | USA | KX236483 | KX236483 | – | – | – |
| *Ceriporia spissa* | PRM 915965 | USA | GU594155 | – | – | – | – |
| *Ceriporia spissa* | Dai 19164 | Canada | OQ476845[a] | OQ476789[a] | OQ509559[a] | – | – |
| *Ceriporia spissa* | FD-352 | USA | – | KP135206 | – | – | KP134793 |
| ***Ceriporia subbadia* (*Poria subbadia*)** | L-8020-sp | USA | KP135050 | – | – | – | KP134789 |
| ***Ceriporia subbadia* (*Poria subbadia*)** | KUC20131022-11 | Korea | KJ668563 | – | – | – | – |
| ***Ceriporia subbadia* (*Poria subbadia*)** | Dai 15062 | China | OQ476846[a] | – | OQ509560[a] | – | – |
| ***Ceriporia subviridans*** | Cui 8012 (holotype) | China | KC182774 | – | – | OR113378[a] | – |
| ***Ceriporia subviridans*** | GC 1704-54 | China | LC427026 | LC427048 | – | – | – |
| *Ceriporia torpida* | Murdoch 90 (holotype) | Finland | KX236477 | KX236477 | – | – | – |
| *Ceriporia triumphalis* | Kout 18 (holotype) | Spain | KX236476 | KX236476 | – | – | – |
| *Ceriporia viridans* | Dai 17003 | China | OQ476847[a] | OQ476790[a] | OQ509561[a] | – | – |
| *Ceriporia viridans* | Miettinen 11701 | Netherlands | KX752600 | KX752600 | – | – | – |
| *Ceriporia viridans* | Yuan 5702 | Netherlands | KC182779 | – | – | – | – |
| *Ceriporia viridans* | VS 3843 | Russia | KX236480 | KX236480 | – | – | – |
| *Ceriporia viridans* | VS 5909 | Finland | KX236481 | KX236481 | – | – | – |
| *Cotylidia* sp. | MB5 | – | AY854079 | AY629317 | AY705958 | AY885148 | AY864868 |
| *Cytidiella albida* | GB-1833 | Spain | KY948748 | KY948889 | – | MZ913675 | KY948960 |
| *Cytidiella nitidula* | T-407 | Canada | KY948747 | – | – | MZ913676 | KY948961 |
| *Efibula americana* | FP-102165 | USA | KP135016 | KP135256 | – | MZ913669 | KP134808 |
| *Gloeophyllum sepiarium* | Wilcox-3BB | USA | HM536091 | HM536061 | HM536062 | HM536110 | – |
| *Gloeoporus africanus* | O 918063 | Uganda | MG572763 | MG572747 | – | – | – |
| *Gloeoporus africanus* | O 918572 (holotype) | Uganda | MG572764 | MG572748 | – | – | – |
| *Gloeoporus citrinoalbus* | Dai 16238 (holotype) | China | KU360396 | KU360404 | OR095715[a] | – | – |
| *Gloeoporus citrinoalbus* | Yuan 9654 | China | KU360396 | KU360404 | – | – | – |
| *Gloeoporus citrinoalbus* | Dai 21981 | China | OQ476848[a] | OQ476791[a] | OQ509562[a] | – | OR090881[a] |
| *Gloeoporus citrinoalbus* | Dai 19547 | Sri Lanka | OQ476849[a] | OQ476792[a] | OQ509563[a] | OQ559595[a] | OQ542985[a] |
| *Gloeoporus citrinoalbus* | Dai 15293 | China | OQ476850[a] | OQ476793[a] | OQ509564[a] | OQ559596[a] | – |
| *Gloeoporus dichrous* | Dai 23626 | China | OQ476851[a] | OQ476794[a] | OQ509565[a] | OQ559597[a] | OQ542986[a] |
| *Gloeoporus dichrous* | BRNU 631507 | Czechia | MG572751 | MG572735 | – | – | – |
| *Gloeoporus dichrous* | Dai 23260 | China | OQ476852[a] | OQ476795[a] | OQ509566[a] | OQ559598[a] | OQ542987[a] |
| *Gloeoporus dichrous* | Dai 22633 | China | OQ476853[a] | OQ476796[a] | OQ509567[a] | OQ559599[a] | OQ542988[a] |
| *Gloeoporus hainanensis* | Dai 15259 | China | KU360403 | KU360410 | OQ509568[a] | OQ559600[a] | – |
| *Gloeoporus hainanensis* | Yuan 4397 | China | KU360400 | KU360409 | – | – | – |
| *Gloeoporus hainanensis* | Dai 15268 (holotype) | China | KU360401 | KU360411 | OQ509569[a] | OQ559601[a] | OQ542989[a] |
| *Gloeoporus orientalis* | Cui 17922 | China | OQ476854[a] | OQ476797[a] | OQ509570[a] | OQ559602[a] | – |
| *Gloeoporus orientalis* | Cui 11339 | China | OQ476855[a] | OR088496[a] | OQ509571[a] | OQ559603[a] | – |
| *Gloeoporus orientalis* | Dai 18536A | China | OQ476856[a] | – | – | – | – |

**Table 1** Continued.

| Species name | Sample no. | Location | GenBank accession No. | | | | |
|---|---|---|---|---|---|---|---|
| | | | **ITS** | **nLSU** | **nSSU** | **TEF1** | **RPB1** |
| *Gloeoporus pannocinctus* | FP 135015 | USA | MG572755 | MG572739 | – | – | – |
| *Gloeoporus pannocinctus* | L-15726-Sp | USA | KP135060 | KP135214 | – | – | KP134867 |
| ***Gloeoporus septatus*** | Dai 22221 (holotype) | China | OQ476857[a] | OQ476798[a] | OQ509572[a] | OQ559604[a] | OQ542990[a] |
| *Gloeoporus thelephoroides* | BZ-2896 | Belize | MG572757 | MG572741 | – | – | – |
| *Gloeoporus thelephoroides* | JV 1808/26 | French Guiana | OQ476858[a] | OQ476799[a] | OQ509573[a] | OQ559605[a] | – |
| ***Gloeoporus variiformis*** | Dai 18568 | Malaysia | – | OQ476800[a] | – | – | – |
| ***Gloeoporus variiformis*** | Dai 20655 | China | OQ476859[a] | OQ476801[a] | OQ509574[a] | OQ559606[a] | OQ542991[a] |
| ***Gloeoporus variiformis*** | Dai 22225 (holotype) | China | OQ476860[a] | OQ476802[a] | OQ509575[a] | OQ559607[a] | OQ542992[a] |
| *Hapalopilus ochraceolateritius* | Miettinen-16992.1 | USA | KY948741 | KY948891 | – | – | KY948965 |
| *Hydnochaete duportii* | AFTOL-ID 666 | – | DQ404386 | AY635770 | AY662669 | DQ435793 | – |
| *Hyphoderma praetermissum* | AFTOL-ID 518 | – | AY854081 | AY700185 | AY707094 | AY885150 | AY864871 |
| *Irpex flavus* | WHC 1381 | China | LC427029 | LC427052 | – | – | LC427064 |
| *Irpex laceratus* | Dai 16433 | China | OQ476861[a] | OQ476803[a] | OQ509576[a] | OQ559608[a] | OQ542993[a] |
| *Irpex laceratus* | PBU 0048 | Thailand | KC570339 | KU760725 | – | – | – |
| *Irpex laceratus* | Dai 21940 | China | OQ476862[a] | OQ476804[a] | OQ509577[a] | OQ559609[a] | OQ542994[a] |
| *Irpex laceratus* | SFFPS MZ-340 (holotype) | – | AB091675 | – | – | – | – |
| *Irpex lacteus* | Dai 11230 | China | OQ476863[a] | OQ476805[a] | OQ509578[a] | OQ559610[a] | OQ542995[a] |
| *Irpex lacteus* | FD-9 | – | KP135026 | KP135224 | – | – | KP134806 |
| *Irpex latemarginatus* | FP-55521-T | USA | KP135024 | KP135202 | – | – | KP134805 |
| *Irpex latemarginatus* | Marcin Piatek 4.IX.1997 | Poland | KX752592 | KX752592 | – | – | – |
| *Irpex rosettiformis* | Meijer 3729 | Brazil | JN649346 | JN649346 | – | – | – |
| *Jaapia argillacea* | CBS: 252.74 | Netherlands | GU187524 | GU187581 | – | GU187711 | – |
| *Lactarius deceptivus* | AFTOL-ID 682 | USA | AY854089 | AY631899 | AY707093 | AY885158 | AY864883 |
| *Leptoporus mollis* | RLG-7163 | USA | KY948794 | MZ637155 | – | MZ913693 | KY948956 |
| *Leptoporus mollis* | Dai 21062 | Belarus | MW377302 | MW377381 | – | MW337129 | – |
| *Leptoporus submollis* | Dai 20182 (paratype) | China | ON468434 | ON468246 | – | ON468452 | ON468448 |
| *Leptoporus submollis* | Cui 18379 (paratype) | China | ON468433 | ON468245 | – | ON468451 | ON468447 |
| *Leptoporus submollis* | TJV-93-174-T | USA | KY948795 | EU402510 | – | – | KY948957 |
| *Leptosporomyces raunkiaeri* | CFMR: HHB-7628 | USA | GU187528 | GU187588 | GU187640 | GU187719 | GU187471 |
| *Macrohyporia dictyopora* | PBU 0051 | Thailand | KC570331 | KU760726 | – | – | – |
| *Meruliopsis albomellea* | Dai 15205 (holotype) | China | KX494574 | KX494578 | | – | – |
| *Meruliopsis albomellea* | Dai 15223 | China | KX494575 | KX494579 | – | – | – |
| *Meruliopsis albostramineus* | HHB-10729 | USA | KP135051 | KP135229 | – | – | KP134787 |
| ***Meruliopsis bambusicola*** | Dai 21944 (holotype) | China | OQ476864[a] | OQ476806[a] | OQ509579[a] | OQ559611[a] | OQ542996[a] |
| *Meruliopsis crassitunicata* | Dai 10833 | China | JX623935 | JX644064 | OQ509580[a] | – | – |

**Table 1** Continued.

| Species name | Sample no. | Location | GenBank accession No. | | | | |
|---|---|---|---|---|---|---|---|
| | | | ITS | nLSU | nSSU | TEF1 | RPB1 |
| *Meruliopsis crassitunicata* | CHWC 1506-46 | China | LC427010 | LC427034 | – | – | LC427055 |
| *Meruliopsis crassitunicata* | Dai 9995 | China | JX623905 | – | – | – | – |
| *Meruliopsis cystidiata* | ICN 139059 | Brazil | MG572754 | MG572738 | – | – | – |
| *Meruliopsis cystidiata* | 776308 | Brazil | MG572749 | MG572733 | – | – | – |
| *Meruliopsis faginea* | LEF-334408 (holotype) | Russia | MW673659 | MW673660 | – | – | – |
| *Meruliopsis leptocystidiata* | Li 1011 | China | JX623898 | JX644049 | – | – | – |
| *Meruliopsis leptocystidiata* | Wu 1708-43 (holotype) | China | LC427013 | LC427033 | – | – | LC427070 |
| ***Meruliopsis marginata*** | Cui 6878 (holotype) | China | JX623943 | JX644057 | – | – | – |
| ***Meruliopsis marginata*** | Dai 14737 | China | OQ476865[a] | OQ476807[a] | OQ509581[a] | OR113379[a] | – |
| ***Meruliopsis marginata*** | Cui 11626 | China | OQ476866[a] | OQ476808[a] | OQ509582[a] | – | – |
| ***Meruliopsis marginata*** | Wei 3388 | China | OQ476867[a] | – | – | – | – |
| *Meruliopsis nanlingensis* | Dai 13414 | China | OQ476868[a] | OQ476809[a] | OQ509583[a] | OQ559612[a] | OQ542997[a] |
| *Meruliopsis nanlingensis* | Dai 17172 | China | OQ476869[a] | OQ476810[a] | OQ509584[a] | OQ559613[a] | – |
| *Meruliopsis nanlingensis* | Dai 8173 (holotype) | China | JX623942 | JX644053 | OQ509585[a] | – | – |
| *Meruliopsis parvispora* | CHWC 1505-129 | China | LC427015 | LC427051 | – | – | LC427066 |
| *Meruliopsis parvispora* | Wu 1209-58 (holotype) | China | LC427017 | LC427039 | – | – | LC427065 |
| *Meruliopsis pseudocystidiata* | Dai 3204 | China | – | JX644056 | – | – | – |
| *Meruliopsis pseudocystidiata* | Dai 18405 | Vietnam | OQ476870[a] | OQ476811[a] | OQ509586[a] | OQ559614[a] | OQ542998[a] |
| *Meruliopsis pseudocystidiata* | Li 1704 (holotype) | China | JX623944 | – | – | – | – |
| ***Meruliopsis rosea*** | Dai 18640A (holotype) | Australia | OQ476871[a] | OQ476812[a] | OQ509587[a] | OQ559615[a] | OQ542999[a] |
| *Meruliopsis* sp. | FD-278 | USA | KP135057 | KP135205 | – | – | KP134796 |
| *Meruliopsis tarda* | Dai 10226 | China | JX623945 | – | – | – | – |
| *Meruliopsis tarda* | LE 247365 | Russia | KF856503 | KF856506 | – | – | – |
| *Meruliopsis taxicola* | GC 1704-60 | China | LC427028 | LC427050 | – | – | LC427063 |
| *Meruliopsis taxicola* | Dai 21878 | China | OQ476872[a] | OQ476813[a] | OQ509588[a] | OQ559616[a] | OQ543000[a] |
| *Meruliopsis taxicola* | Dai 22625 | China | OL457966 | OL457436 | OQ509589[a] | OQ559617[a] | OQ543001[a] |
| *Meruliopsis taxicola* | Dai 22636 | China | OQ476873[a] | OQ476814[a] | OQ509590[a] | OQ559618[a] | OR090882[a] |
| *Meruliopsis taxicola* | Dai 17248 | China | OQ476874[a] | OQ476815[a] | OQ509591[a] | OQ559619[a] | – |
| *Meruliopsis variegata* | Li 1780 (holotype) | China | JX623936 | JX644065 | | – | – |
| *Meruliopsis variegata* | Dai 19791 | China | OQ476875[a] | OQ476816[a] | OQ509592[a] | – | – |
| *Meruliopsis variegata* | Dai 19886 | China | OQ476876[a] | OQ476817[a] | OQ509593[a] | OQ559620[a] | – |
| *Neolentinus adhaerens* | DAOM 214911 | – | HM536096 | HM536071 | HM536072 | HM536117 | – |
| *Phanerochaete* s.l. sp. | RLG-13408-Sp | USA | KP135020 | KP135257 | – | – | KP134801 |
| *Phanerochaetella exilis* | HHB-6988 | USA | KP135001 | KP135236 | – | – | KP134799 |
| *Phanerochaetella* sp. | HHB-11463 | USA | KP134994 | KP135235 | – | – | KP134797 |
| *Phanerochaetella xerophila* | HHB-8509-Sp | USA | KP134996 | KP135259 | – | – | KP134800 |
| *Podoserpula ailaoshanensis* | ZJL2015015 | China | KU324484 | KU324487 | KU324491 | KU324494 | – |

**Table 1** Continued.

| Species name | Sample no. | Location | GenBank accession No. | | | | |
|---|---|---|---|---|---|---|---|
| | | | **ITS** | **nLSU** | **nSSU** | **TEF1** | **RPB1** |
| *Raduliporus aneirinus* | HHB-15629-Sp | USA | KP135023 | KP135207 | – | – | KP134795 |
| *Resiniporus pseudogilvescens* | Wu 1209-46 | China | KY688203 | MZ637268 | – | MZ913713 | MZ748436 |
| *Resiniporus resinascens* | BRNM 710169 | Czechia | FJ496675 | FJ496698 | – | – | – |
| *Russula emeticicolor* | FH12253 | Germany | KT934011 | KT933872 | – | – | KT957382 |
| *Schizophyllum radiatum* | AFTOL-ID-516 | Panama | AY571060 | AY571023 | AY705952 | – | DQ447939 |
| *Serpula himantioides* | MUCL: 30528 | Belgium | GU187545 | GU187600 | GU187651 | GU187748 | GU187480 |
| *Tomentella* sp. | AFTOL-ID 1016 | USA | DQ835998 | DQ835997 | DQ092920 | – | – |
| *Trametopsis cervina* | AJ-185 | USA | JN165020 | JN164796 | – | – | JN164839 |
| *Trametopsis cervina* | Cui 9985 | China | – | OQ476818[a] | – | – | – |

Note: [a] Newly generated sequences in this study. **Bold** = new taxa.

## Divergence Time Estimation

We used two fossil calibrations *Archaeomarasmius leggetti* Hibbett et al. and *Quatsinoporites cranhamii* Smith et al. in the divergence times of *Ceriporia* and other related genera in Irpicaceae. *A. leggetti* was recorded to 94–90 Mya (Hibbett et al. 1997) as the representative of the minimum age of the Tricholomataceae R. Heim ex Pouzar belonging to the Agaricales. *Q. cranhamii,* found in Marine calcareous concretions on Vancouver Island, was considered to be the representative of the minimum divergence time of the Hymenochaetales at 113 Mya (Smith et al. 2004). Divergence times were estimated using BEAST v2.6.5 (Bouckaert et al. 2014) based on a dataset of ITS+nLSU+RPB1+TEF1+nSSU. The GTR+G+I substitution Model was selected as the best-fit model using MrModelTest2-v.2.4 (Nylander 2004). An XML file was executed using BEAUti v2. The clock model was set to uncorrelated lognormal relaxed clock (Drummond et al. 2006, Lepage et al. 2007). The Yule process speciation was used as the tree prior (Gernhard 2008). For calibration, we specified a gamma distribution prior (scale = 20, shape = 1) on the Agaricales (offset = 90 Ma), and Hymenochaetales (offset = 125 Ma) clades (Sánchez-Ramírez et al. 2014, Zhao et al. 2016, 2017). All the ucld. mean parameters for different genes were set to uniform. We ran Monte Carlo Markov Chains of 100 million generations, and logging states every 1,000 generations. The resulting log file was confirmed with convergence of the chains using Tracer v1.6 (Rambaut et al. 2013; http://tree.bio.ed.ac.uk/software/tracer/). An ultrametric Maximum Clade Credibility (MCC) tree was summarized using TreeAnnotator v2.6.5, discarding 20% of states as burn-in annotating clades with ≥ 0.8 posterior probability. FigTree v1.4.3 (http://tree.bio.ed.ac.uk/software/figtree/) was used to visualize the resulting tree and to obtain the means and 95% HPD (Drummond & Rambaut 2007). A 95% HPD marks the shortest interval that contains 95% of the values sampled.

## Results

### Phylogenetic analyses

The combined 2-gene dataset (ITS+nLSU) included sequences from 191 samples representing 88 taxa. The dataset had an aligned length of 2 275 characters, of which 1 337 (59%) characters were constant, 172 (7%) were variable and parsimony-uninformative and 766 (34%) were parsimony informative. The phylogenetic reconstruction performed with Maximum Likelihood (ML) and Bayesian Inference (BI) analyses for two combined datasets showed similar topology and few differences in statistical support. The best model-fit applied in the Bayesian analysis was GTR+I+G, lset nst = 6, rates = invgamma, and prset statefreqpr = dirichlet (1, 1, 1, 1).

Bayesian analysis resulted in a nearly congruent topology with an average standard deviation of split frequencies = 0.008386 to ML analysis, and thus only the ML tree is provided (Fig. 1).

The combined 5-gene dataset (ITS+nLSU+RPrdB1+TEF1+nSSU) included sequences from 191 samples representing 88 taxa. The dataset had an aligned length of 5 059 characters, of which 2 880 (57%) characters were constant, 421 (8%) were variable and parsimony-uninformative and 1 758 (35%) were parsimony informative. The phylogenetic reconstruction performed with ML and BI analyses for two combined datasets showed similar topology and few differences in statistical support. The best model-fit applied in the Bayesian analysis was GTR+I+G, lset nst = 6, rates = invgamma, and prset statefreqpr = dirichlet (1, 1, 1, 1). Bayesian analysis resulted in a nearly congruent topology with an average standard deviation of split frequencies = 0.005828 to ML analysis, and thus only the ML tree is provided (Fig. 2).

**Divergence Time Estimation**

The MCMC tree (Fig. 3) shows that the ancestor of the Irpicaceae evolved during the Middle Jurassic at 169.1 Mya [95% highest posterior density (HPD) of 124.66–231.04 Mya], which is largely consistent with the divergence time of the Polyporales by Ji et al. (2022). Among the three clades, the *Ceriporia* clade, the *Gloeoporus* clade and the *Meruliopsis* clade had strong support (1.0 PP, Fig. 3). The divergence time of the *Ceriporia* clade emerged with a mean stem age of 113.99 Mya [95% highest posterior density (HPD) of 81.53–153.07 Mya] and a mean crown age of 103.33 Mya [95% highest posterior density (HPD) of 74.71–140.56 Mya], which belongs to the early Cretaceous period. *Candelabrochaete langloisii* (Pat.) Boidin, *C. septocystidia* (Burt) Burds., *Leptoporus* Quél. and *Phanerochaete allantospora* Burds. & Gilb., are absorbed in the *Ceriporia* clade with the mean estimated stem ages of 24.18 Mya, 61.93Mya, 88.4 Mya and 57.15Mya, respectively. Except for the ancestor of *Leptoporus*, which diverged in the late Cretaceous, the other three species diverged in the Paleogene. The initial diversification of the *Gloeoporus* clade occurred during the early Cretaceous with a mean stem age of 142.84 Mya [95% highest posterior density (HPD) of 102.39–196.41 Mya], and a mean crown age of 72.01 Mya (95% HPD of 39.91–111.78 Mya). The *Meruliopsis* clade is closely related to the *Ceriporia* clade as a sister clade. The divergence times of the main nodes are shown in Fig. 3 and summarized in Table 2. The international chronostratigraphic chart follows Cohen et al. (2013; updated) (URL: http://www.stratigraphy.org/ICSchart/ChronostratChart2022-10.pdf).

**Taxonomy**

***Ceriporia*** Donk, Rev. Niederl. Homob. Aphyll. 2: 170 (1933).

Type species – *Ceriporia viridans* (Berk. & Broome) Donk [as 'Ceraporia'], Meded. Bot. Mus. Herb. Rijks Univ. Utrecht 9: 171 (1933).

Basidiomata annual, resupinate to rarely effused-reflexed, soft to slightly waxy when fresh, becoming fragile, soft corky to slightly leathery upon drying. Pore surface white, cream, buff, cinnamon, pale ochraceous, orange to purple when fresh, becoming cream, clay buff, honey yellow, fawn to pale reddish brown upon drying. Hyphal system monomitic; generative hyphae with simple septa, thin- to thick-walled, frequently covered with crystals and an oily substance. Cystidia absent in most species. Basidiospores cylindrical, ellipsoid, oblong ellipsoid to allantoid, hyaline, thin-walled, smooth, IKI−, CB− or weakly CB+. Causing a white rot.

Notes – *Ceriporia* was originally described by Donk (1933). It has a variably colored pore surface when fresh, and most species in the genus lack cystidia. 49 taxa under the genus are recorded in Index Fungorum (http://www.indexfungorum.org/). We excluded some species were combined into other genera based on Index Fungorum, MycoBank (https://www.mycobank.org) and related publications. Among them, 23 species have available DNA sequences, and they are currently recognized as good species. *Ceriporia globospora* Ryvarden and *C. merulioidea* Ryvarden have globose basidiospores in original descriptions (Læssøe & Ryvarden 2010, Ryvarden 2020), that do not fit the definition of *Ceriporia*, and are excluded from Supplementary Table 1.

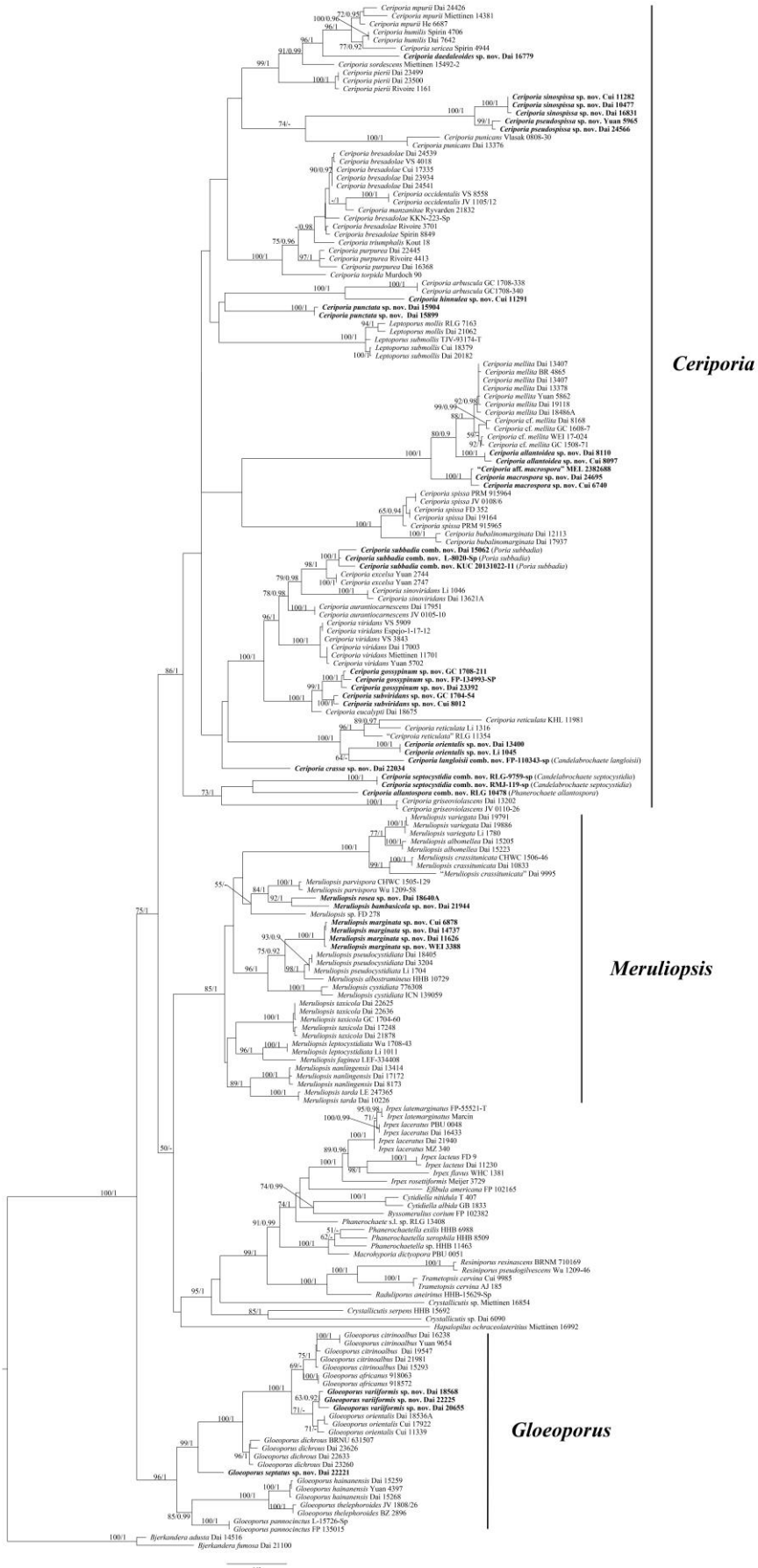


**Figure 1** – ML analysis of *Ceriporia* and other related genera in Irpicaceae based on the dataset of ITS+nLSU. ML bootstrap values higher than 50% and Bayesian Posterior Probabilities values more than 0.90 are shown. New taxa are in bold.

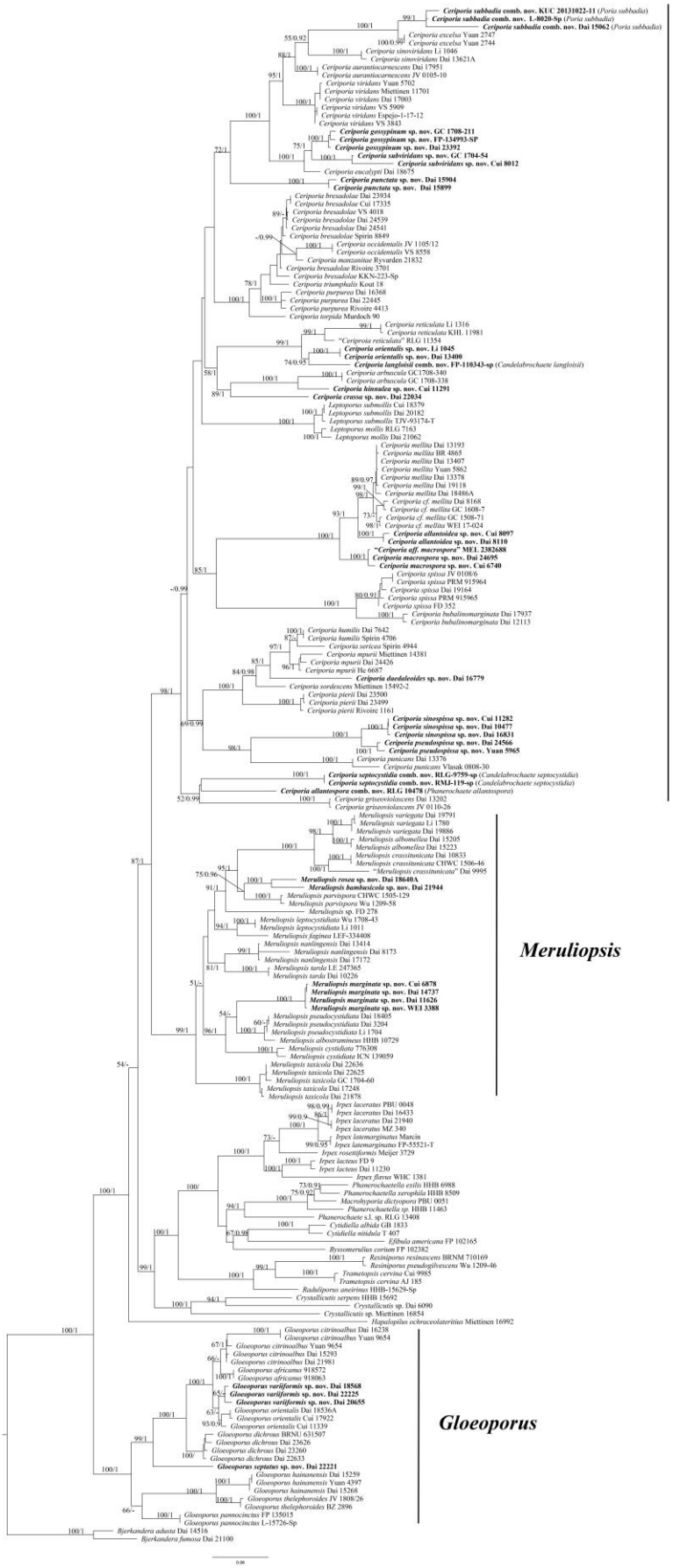


**Figure 2** – ML analysis of *Ceriporia* and other related genera in Irpicaceae based on the dataset of ITS+nLSU+RPB1+TEF1+nSSU. ML bootstrap values higher than 50% and Bayesian Posterior Probabilities values more than 0.90 are shown. New taxa are in bold.

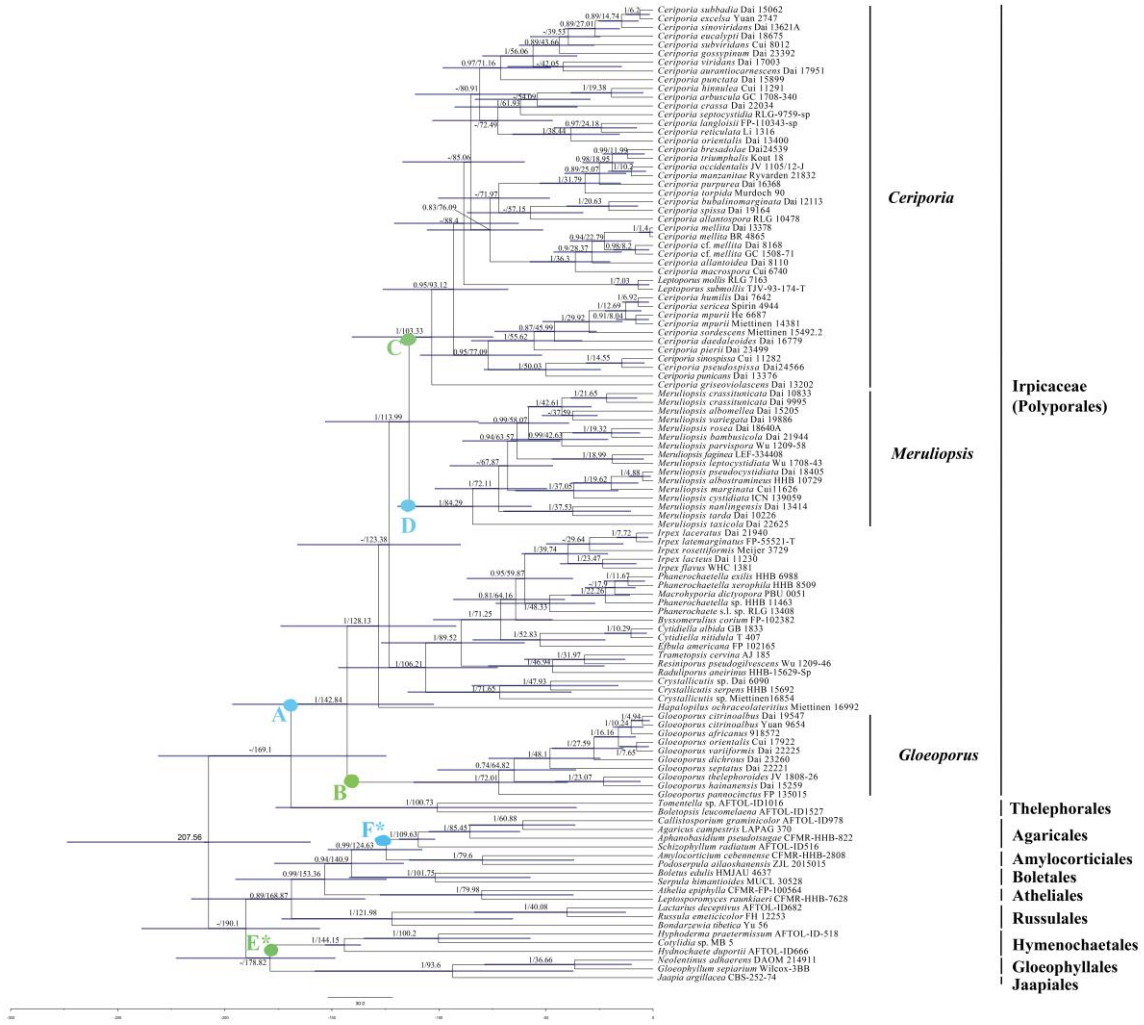


**Figure 3** – Divergence time estimation of *Ceriporia* and other related genera in Irpicaceae from Bayesian evolutionary analysis sampling tree based on the conserved regions of five DNA fragments (ITS+nLSU+RPB1+TEF1+nSSU). Posterior probabilities not less than 0.80 and the mean ages (Mya) of each node are annotated. The 95% highest posterior densities of divergence time estimation are marked by horizontal bars.

**Table 2** Estimated divergence times of the main nodes.

| Node | Means of stem age (Mya)/ 95% HPD (Mya)/posterior probabilities | Means of crown age (Mya)/ 95% HPD (Mya)/ posterior probabilities | Period |
|---|---|---|---|
| A: Irpicaceae | 169.1/124.66–231.04/– | 142.84/102.39–196.41/1 | Middle Jurassic |
| B: The *Gloeoporus* clade | 142.84/102.39–196.41/1 | 72.01/39.91–111.78/1 | Early Cretaceous |
| C: The *Ceriporia* clade | 113.99/81.53–153.07/1 | 103.33/74.71–140.56/1 | Early Cretaceous |
| D: The *Meruliopsis* clade | 113.99/81.53–153.07/1 | 84.29/56.74–119.3/1 | Early Cretaceous |
| E*: Hymenochaetales (Calibration point) | 178.82/148.42–222.76/– | 144.15/136.5–153.13/1 | Early Jurassic |
| F*: Agaricales (Calibration point) | 124.63/107.79–151.78/0.99 | 109.63/101.8–118.6/1 | Early Cretaceous |

Hyphen "–" represents a posterior probability (PP) < 0.8.

The others all fit the definition of *Ceriporia*. So, we consider 49 taxa are good species in our study.

This study describes and illustrates eleven new species and proposes four new combinations, viz., *Ceriporia allantospora*, *C. langloisii*, *C. septocystidia*, and *C. subbadia*.

***Ceriporia allantoidea*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 4a, 6

Index Fungorum number: IF901066; Facesoffungi number: FoF14817

Etymology – "*allantoidea*" (Lat.): refers to the species having allantoid basidiospores.

Basidiomata annual, resupinate, soft corky, without odor or taste when fresh, becoming corky to slightly brittle upon drying, up to 7 cm long, 2 cm wide, and 1.1 mm thick at center. Pore surface cream to cinnamon buff when fresh, becoming clay buff to pale reddish brown upon drying; sterile margin cream when fresh, pinkish buff when dry, thinning out, up to 2 mm wide; pores round, sometimes slightly elongated, 4–6 per mm; dissepiments thin, entire to slightly lacerate. Subiculum cream, soft corky when dry, up to 0.3 mm thick. Tubes concolorous with pore surface, soft corky to slightly brittle when dry, up to 0.8 mm long.


**Figure 4** – Basidiomata of new species of *Ceriporia*. a *C. allantoidea* (Dai 8110). b *C. crassa* (Dai 22034). c *C. daedaleoides* (Dai 16779). d *C. gossypinum* (Dai 23392). e *C. hinnulea* (Cui 11291). f *C. macrospora* (Cui 6740). g *C. orientalis* (Dai 13400). h *C. pseudospissa* (Dai 24566). i *C. punctata* (Dai 15899). Scale bars: a–i = 1 cm.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, CB−; tissues unchanged in KOH. Subicular hyphae thin- to slightly thick-walled with a wide lumen, occasionally covered with large, irregular, hyaline crystals, encrusted with fine crystals, frequently branched at more or less an angle of 90 °, slightly flexuous, interwoven, 3–5 µm in diam. Tramal hyphae thin-walled with a wide lumen, abundantly covered with large, pale orange crystals and an oily substance, sometimes encrusted with fine crystals, frequently branched at more or less an angle of 90 °, straight, subparallel along the tubes, agglutinated, 2–3.5 µm in diam. Cystidia and cystidioles absent. Basidia clavate to barrel-shaped, with four sterigmata and a simple basal septum, 10–13 × 5–5.5 µm; basidioles mostly pyriform, smaller than basidia. Basidiospores allantoid,

hyaline, thin-walled, smooth, IKI−, CB−, 4.5–5(–5.1) × (1–)1.1–1.5 µm, L = 4.84 µm, W = 1.27 µm, Q = 3.67–3.97 (n = 60/2).

**Figure 5** – Basidiomata of new taxa and known species of *Ceriporia*, *Gloeoporua* and *Meruliopsis*. a *C. sinospissa* (Cui 11282). b *C. subbadia* (Dai 15062). c *G. septatus* (Dai 22221). d *G. variiformis* (Dai 22225). e *G. variiformis* (Dai 20655). f *M. bambusicola* (Dai 21944). g *M. marginata* (Dai 14737). h *M. rosea* (Dai18640A). i *C. excelsa* (Yuan 2744). Scale bars: a–i = 1 cm.

Known distribution – Southern China.

Material examined – China, Hunan Province, Yizhang County, Mangshan Nature Reserve, on fallen angiosperm trunk, 23 Jun. 2007, Dai 8110 (BJFC010190, holotype); Yunnan Province, Baoshan, Gaoligongshan Nature Reserve, on rotten angiosperm wood, 25 Oct. 2009, Cui 8097 (BJFC006586).

Notes – *Ceriporia allantoidea* is characterized by resupinate basidiomata with a cream to cinnamon buff pore surface when fresh, clay buff to pale reddish brown when dry, round to slightly elongated pores of 4–6 per mm, hyphae with both large and fine crystals, allantoid basidiospores measuring 4.5–5 × 1.1–1.5 µm, and growth on angiosperm wood in southern China.

*Ceriporia allantoidea*, *C. mellita* (Bourdot & Galzin) Bondartsev & Singer and *C. macrospora* are phylogenetically related (Figs 1, 2), belonging to the *Ceriporia mellita* group, which is characterized by a light-colored pore surface when fresh, fawn to reddish brown when dry, round to slightly elongated pores, uniform hyphae in both subiculum and trama, and allantoid basidiospores less than 2 µm in width. However, *C. mellita* and *C. macrospora* have larger basidiospores (5–6 × 1.5–2 µm in *C. mellita* and 5–7.2 × 1.6–2 µm in *C. macrospora* vs. 4.5–5 × 1.1–1.5 µm in *C. allantoidea*).

*Ceriporia retamoana* Rajchenb. originally described from Argentina, is characterized by resupinate basidiomata with a cream to straw-colored pore surface when fresh, and cylindric to slightly curved basidiospores (4.5–5 × 1.2–1.5 µm, Rajchenberg 2000). It resembles *C. allantoidea*, but the former has bigger angular pores (1–4 per mm vs. 4–6 per mm, Rajchenberg 2000).

***Ceriporia crassa*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 4b, 7

Index Fungorum number: IF 901067; Facesoffungi number: FoF14818

Etymology – "*crassa*" (Lat.): refers to species with thick basidiomata.

Basidiomata annual, resupinate, soft, without odor or taste when fresh, becoming soft corky upon drying, up to 13 cm long, 2 cm wide, and 1 mm thick at center. Pore surface white to cream when fresh, becoming buff to clay buff upon drying; sterile margin very narrow, white to cream when fresh, buff when dry, up to 0.3 mm wide; pores round to angular, 5–6 per mm; dissepiments thin, entire. Subiculum cream, soft corky when dry, up to 0.1 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.9 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, CB−; tissues becoming brownish in KOH. Subicular hyphae slightly thick- to distinctly thick-walled with a wide lumen, abundantly covered with large, irregular, hyaline crystals and an oily substance, frequently branched at an angle of 90 °, more or less flexuous, interwoven, 3–5 µm in diam. Tramal hyphae slightly thick-walled with a wide lumen, abundantly covered with large, irregular, hyaline crystals and an oily substance, frequently branched, more or less straight to slightly flexuous, subparallel along the tubes, agglutinated, 3–4 µm in diam. Cystidia and cystidioles absent. Basidia clavate to barrel-shaped, with four sterigmata and a simple basal septum, 11–13 × 4–4.5 µm; basidioles mostly pyriform, smaller than basidia. Basidiospores allantoid, hyaline, thin-walled, smooth, sometimes with one or two small guttules, IKI−, CB−, (3.5–)3.8–4.1 × 1.2–1.6 µm, L = 3.93 µm, W = 1.36 µm, Q = 2.89 (n = 30/1).

Known distribution – Southern China.

Material examined – China. Hainan Province, Chinese Academy of Forestry, Research Institute of Tropical Forestry, Ecological Station, on fallen branch of *Pinus* sp., 9 Nov. 2020, Dai 22034 (BJFC035930, holotype).

Notes – *Ceriporia crassa* is characterized by resupinate basidiomata with a white to cream pore surface when fresh, buff to clay buff when dry, round to angular pores, 5–6 per mm, regular and uniform hyphae in subiculum and trama, abundant crystals and an oily substance present among the hyphae in the subiculum and trama, allantoid basidiospores measuring 3.8–4.1 × 1.2–1.6 µm, and growth on *Pinus* sp. in southern China.

*Ceriporia crassa* is similar to *C. eucalypti* Y.C. Dai & Jia J. Chen and *C. allantoidea* by the white pore surface when fresh, almost the same pore size and allantoid basidiospores less than 1.6 µm in width. However, *Ceriporia eucalypti* has bigger pores (3–5 per mm vs. 5–6 per mm) and grows on rotten *Eucalyptus* sp. wood in Australia (Chen et al. 2022); *C. allantoidea* has longer basidiospores (4.5–5 × 1.1–1.5 µm vs. 3.8–4.1 × 1.2–1.6 µm). In addition, these three species form three independent lineages in *Ceriporia* (Figs 1, 2).

***Ceriporia daedaleoides*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 4c, 8

Index Fungorum number: IF901068; Facesoffungi number: FoF14819

Etymology – "*daedaleoides*" (Lat.): refers to the species having daedaleoid pores.

Basidiomata annual, resupinate, soft to more or less ceraceous, without odor or taste when fresh, becoming soft to more or less fragile upon drying, up to 10 cm long, 5 cm wide, and 0.5 mm thick at center. Pore surface cream to pale mouse gray when fresh, becoming salmon to pale orange-yellow upon drying; sterile margin indistinct, cream, up to 1.5 mm wide; pores angular, daedaleoid to slightly sinuous, 3–5 per mm; dissepiments thin, lacerate. Subiculum very thin to almost absent. Tubes concolorous with pore surface, soft corky when dry, up to 0.5 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, moderately CB+; tissues becoming pinkish in KOH. Subicular hyphae slightly thick- to thick-walled with a

wide lumen, abundantly covered with rhombic or irregular hyaline or yellowish crystals, sometimes encrusted with fine crystals, frequently branched at an angle of 90 °, slightly flexuous, interwoven, 6–10 µm in diam. Tramal hyphae thick-walled with a wide lumen, abundantly covered with rhombic or corolliform crystals, sometimes encrusted with small crystals, frequently branched, straight, subparallel along the tubes, agglutinated, 4–7 µm in diam. Cystidia and cystidioles absent. Basidia barrel-shaped, with four sterigmata and a simple basal septum, 10–12 × 4.5–5 µm; basidioles of similar shape to basidia, but smaller. Basidiospores ellipsoid to slightly curved, hyaline, thin-walled, smooth, IKI−, CB−, (3.5–)3.7–4.1 × 2–2.3(–2.4) µm, L = 3.92 µm, W = 2.15 µm, Q = 1.82 (n = 30/1).

Known distribution – Southeast Asia.

Material examined – Thailand, Chiangmai, Doi Suthep-Pui National Park, on rotten angiosperm wood, 26 Jul. 2016, Dai 16779 (BJFC022885, holotype).

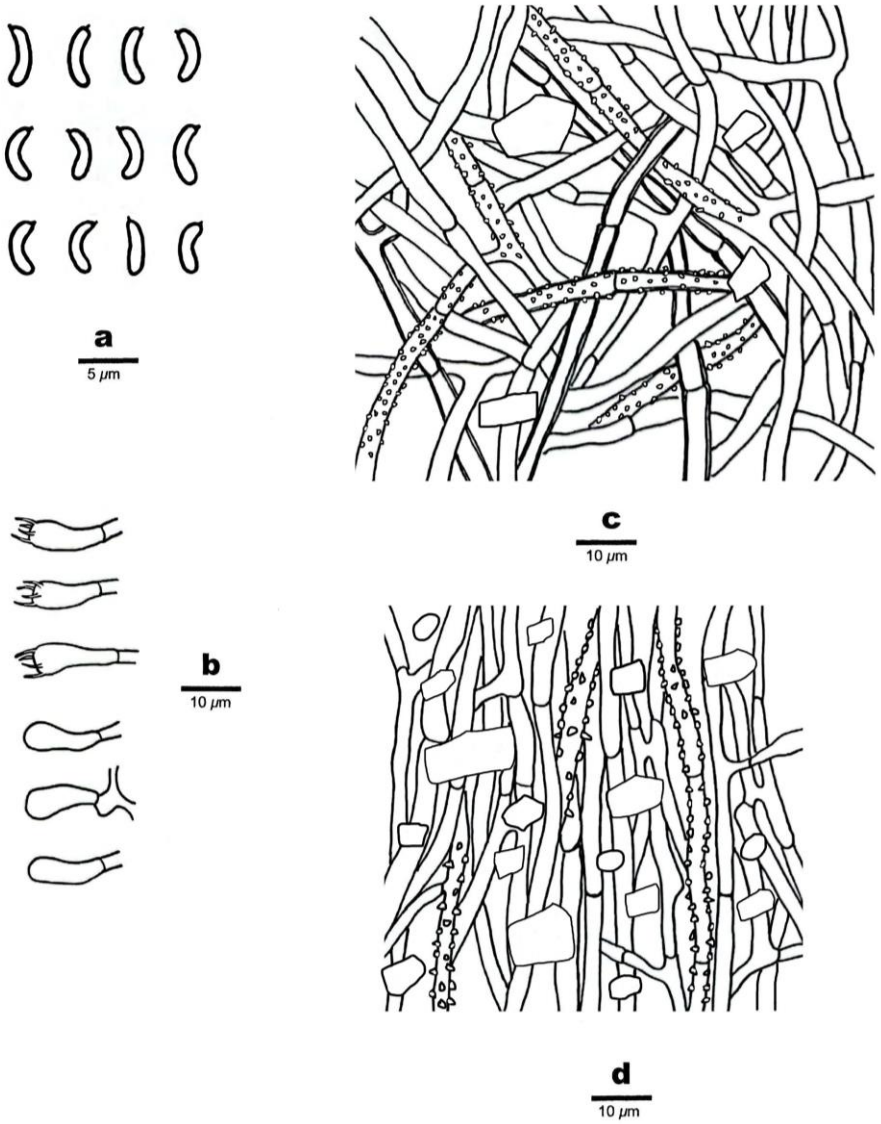


**Figure 6** – Microscopic structures of *Ceriporia allantoidea* (drawn from the holotype, Dai 8110). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

Notes – *Ceriporia daedaleoides* is characterized by resupinate basidiomata with a cream to pale mouse gray pore surface when fresh, salmon to pale orange-yellow when dry, lacerate

dissepiments, thick-walled subicular hyphae, 6–10 µm in diam., rhombic or corolliform crystals among the tube trama, ellipsoid to slightly curved basidiospores measuring 3.7–4.1 × 2–2.3 µm, and growth on angiosperm wood in southeast Asia.

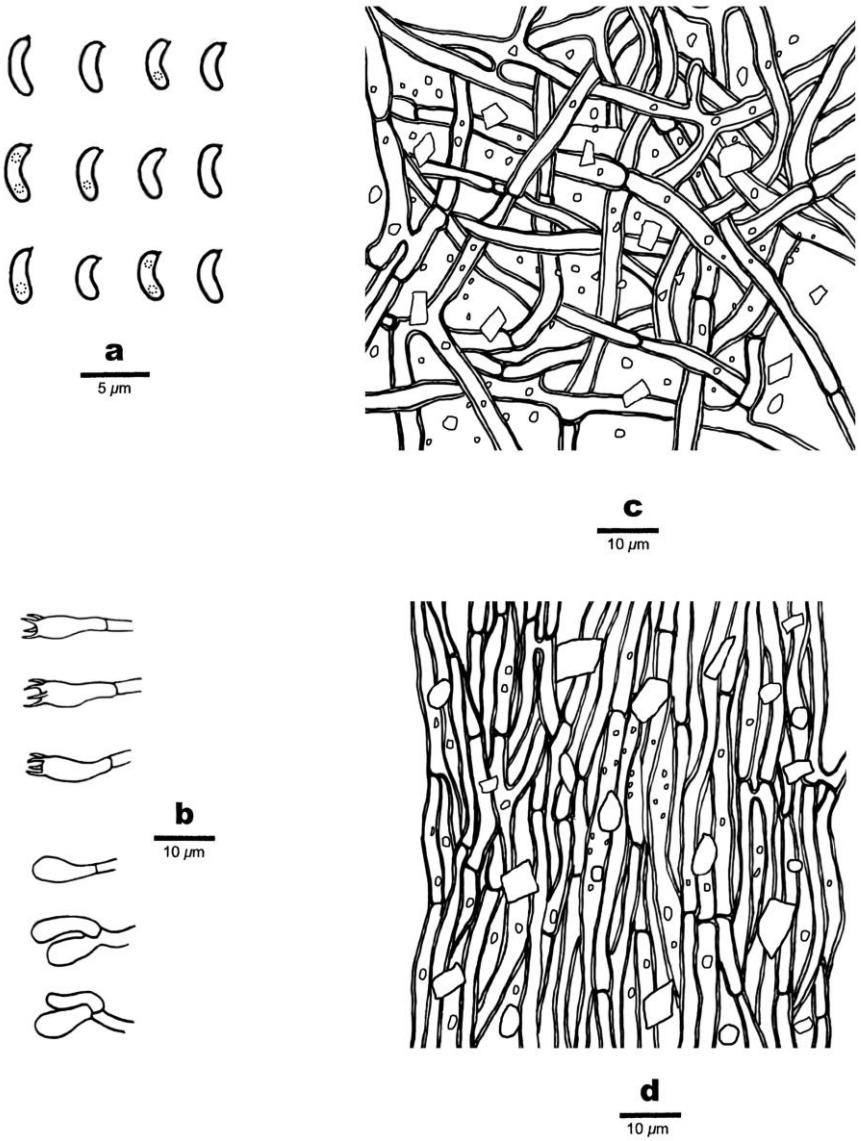


**Figure 7** – Microscopic structures of *Ceriporia crassa* (drawn from the holotype, Dai 22034). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

*Ceriporia daedaleoides*, *C. humilis* Spirin & Miettinen, *C. mpurii* Miettinen & Spirin, *C. sericea* Spirin & Vlasák, *C. sordescens* Miettinen & Spirin and *C. pierii* Rivoire *et al.* are phylogenetically related (Figs 1, 2), and belong to the *Ceriporia pierii* group which is characterized by a resupinate basidiomata with pale-colored (cream, yellowish to pinkish) pore surface when fresh, subicular hyphae wider than tramal hyphae and narrowly ellipsoid to cylindrical basidiospores exceeding 2 µm in width (Miettinen et al. 2016). *C. humilis* has round to angular pores of 5–6 per mm and entire dissepiments (Miettinen et al. 2016), which differs from *C. daedaleoides*; *C. mpurii* differs from *C. daedaleoides* by the presence of fan-shaped crystals among the tube trama (Miettinen et al. 2016); *C. sericea* has a pale ochraceous pore surface when dry and larger basidiospores (3.9–4.8 × 2.2–2.7 µm vs. 3.7–4.1 × 2–2.3 µm, Miettinen et al. 2016); *C. sordescens* has a yellowish pore surface when fresh and narrower tramal hyphae (2.6–4 µm in

diam. vs. 4–7 µm in diam.); *C. pierii* differs from *C. daedaleoides* by a cream to rosy pink pore surface when fresh, subicular hyphae with incomplete clamps and larger basidiospores (4.1–5.4 × 2.4–3.1 µm vs. 3.7–4.1 × 2–2.3 µm, Miettinen et al. 2016). In addition, these six species form six independent lineages in *Ceriporia* (Figs 1, 2).

*Ceriporia aurea* Ryvarden and *C. daedaleoides* share slightly sinuous pores, and thick-walled subicular hyphae up to 10 µm in diam., however, the former has a warm yellow pore surface and distinct white margin, longer basidiospores (4–5 × 2 µm vs. 3.7–4.1 × 2–2.3 µm, Ryvarden 2014), and is only found to date in South America (Venezuela).

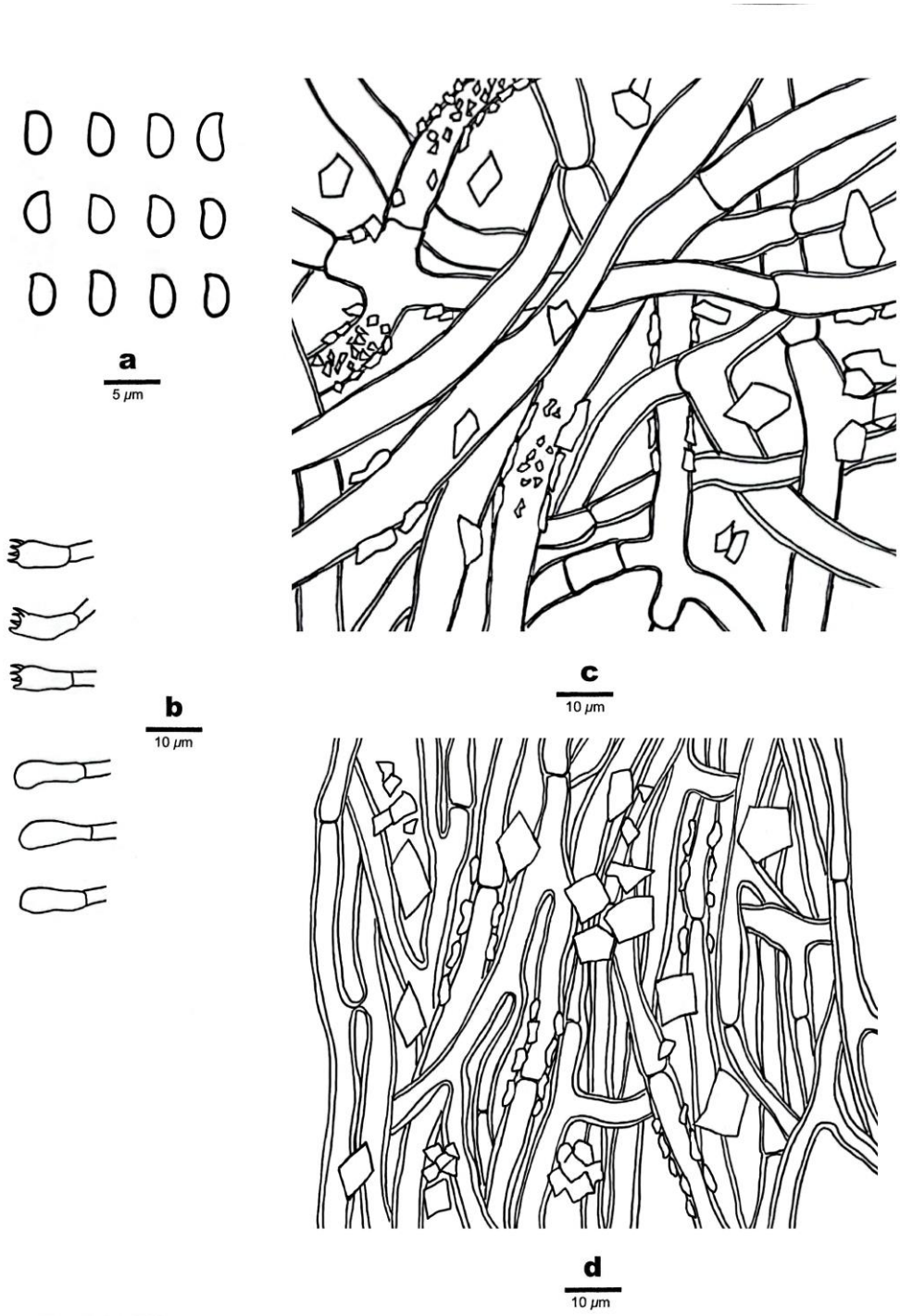


**Figure 8** – Microscopic structures of *Ceriporia daedaleoides* (drawn from the holotype, Dai 16779). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm; b–d = 10 µm.

***Ceriporia gossypinum*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 4d, 9

Index Fungorum number: IF 901069; Facesoffungi number: FoF14820

Etymology – "*gossypinum*" (Lat.): refers to the species having a cottony margin.

Basidiomata annual, resupinate, soft corky, without odor or taste when fresh, becoming corky upon drying, up to 5 cm long, 2.5 cm wide, and 0.3 mm thick at center. Pore surface white, buff to deep olive when fresh, becoming buff to honey yellow upon drying; sterile margin white when fresh, cream when dry, cottony, thinning out, up to 2 mm wide; pores round to angular, 4–5 per mm; dissepiments thin, entire. Subiculum cream, soft corky, up to 0.1 mm thick. Tubes concolorous with pore surface, soft corky, up to 0.2 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, CB−; tissues unchanged in KOH. Subicular hyphae slightly thick-walled with a very wide lumen, abundantly encrusted with fine crystals, sometimes with an oily substance, frequently branched at an angle of 90 °, straight to slightly flexuous, interwoven, 5–8 µm in diam. Tramal hyphae thin-walled with a wide lumen, abundantly encrusted with fine hyaline crystals and an oily substance, frequently branched, straight to slightly flexuous, subparallel along the tubes, agglutinated, 3–3.8 µm in diam. Cystidia and cystidioles absent. Basidia clavate, with four sterigmata and a simple basal septum, 13–16 × 3.5–4 µm; basidioles of similar shape to basidia, but smaller. Basidiospores allantoid, hyaline, thin-walled, smooth, sometimes with one or two small guttules, IKI−, CB−, 3.5–4(–4.1) × (1.7–)1.8–2(–2.1) µm, L = 3.82 µm, W = 1.95 µm, Q = 1.96 (n = 30/1).

Known distribution – Southwest China and New York, USA.

Material examined – China, Tibet Auto. Reg., Linzhi, Bomi County, Yigong Tea Plantation, on rotten angiosperm branch, 24 Oct. 2021, Dai 23392 (BJFC037963, holotype).

Notes – *Ceriporia gossypinum* is characterized by resupinate basidiomata with a white, buff to deep olive pore surface when fresh, buff to honey yellow when dry, round to angular pores, 4–5 per mm, subicular hyphae wider than tramal hyphae, allantoid basidiospores measuring 3.5–4 × 1.8–2 µm, and growth on angiosperm wood in southwest China and New York, USA. Two sequences of samples GC1708-211 and FP-134993-SP, were identified as *Ceriporia viridans* and *C.* sp. in previous studies (Justo et al. 2017, Chen et al. 2020), but these samples and a Chinese sample form an independent lineage differing from *C. viridans* s.s. (VS 5909 etc.) in phylogenetic analyses. Morphologically, *C. viridans* is very similar to *C. gossypinum*, but the former has slightly larger basidiospores (4–4.6 × 1.7–2.1 µm in *C. viridans* (Dai 17003) vs. 3.5–4 × 1.8–2 µm). *Ceriporia viridans* is widely distributed in Eurasia and Africa (Ryvarden et al. 2022), while *C. gossypinum* is distributed in Asia and America. In addition, *Ceriporia gossypinum*, *C. subviridans* and *C. eucalypti* are phylogenetically related; for morphological differences between them see the notes on *C. subviridans*.

*Ceriporia angulata* Gomes-Silva et al. and *C. gossypinum* share the white and cottony sterile margin, however, the former has an ochraceous pore surface, bigger pores (1–3 per mm vs. 4–5 per mm) and longer basidiospores (4–4.5 × 1.7–2.2 µm vs. 3.5–4 × 1.8–2 µm, Gomes-Silva et al. 2012), and is only found to date in South America (Brazil).

*Poria subbadia* Murrill was originally described by Murrill (1921) from Alabama, USA, and is listed as a synonym of *Ceriporia viridans* in MycoBank (http://www.mycobank.org/). *P. subbadia* differs from *C. gossypinum* by a white to rosy pink-isabelline pore surface when fresh and bigger basidiospores (4.5–5.8 × 2–2.6 µm (measured from Dai 15062) vs. 3.5–4 × 1.8–2 µm). *Poria vinaceorosea* Rodway & Cleland, *P. tenuisulphurea* Rick, *Polyporus nuoljae* Romell, *P. blepharistoma* Berk. & Broome and *Physisporus inconstans* P. Karst. were described from Australia, Brazil, Finland and UK, respectively, and they are listed as synonyms of *Ceriporia viridans* in MycoBank (http://www.mycobank.org/). *Poria vinaceorosea* differs from *C. gossypinum* by a vinaceous pink to orange-brown pore surface (Buchanan & Ryvarden 1993). *Poria tenuisulphurea*, *Polyporus nuoljae*, *P. blepharistoma*, *Physisporus inconstans* were described briefly (Berkeley & Broome 1875, Karsten 1887, Romell 1911, Rick 1960). The type localities of our new species do not overlap with the above mentioned taxa, therefore, we described our new species although we did not check the types of these other taxa.

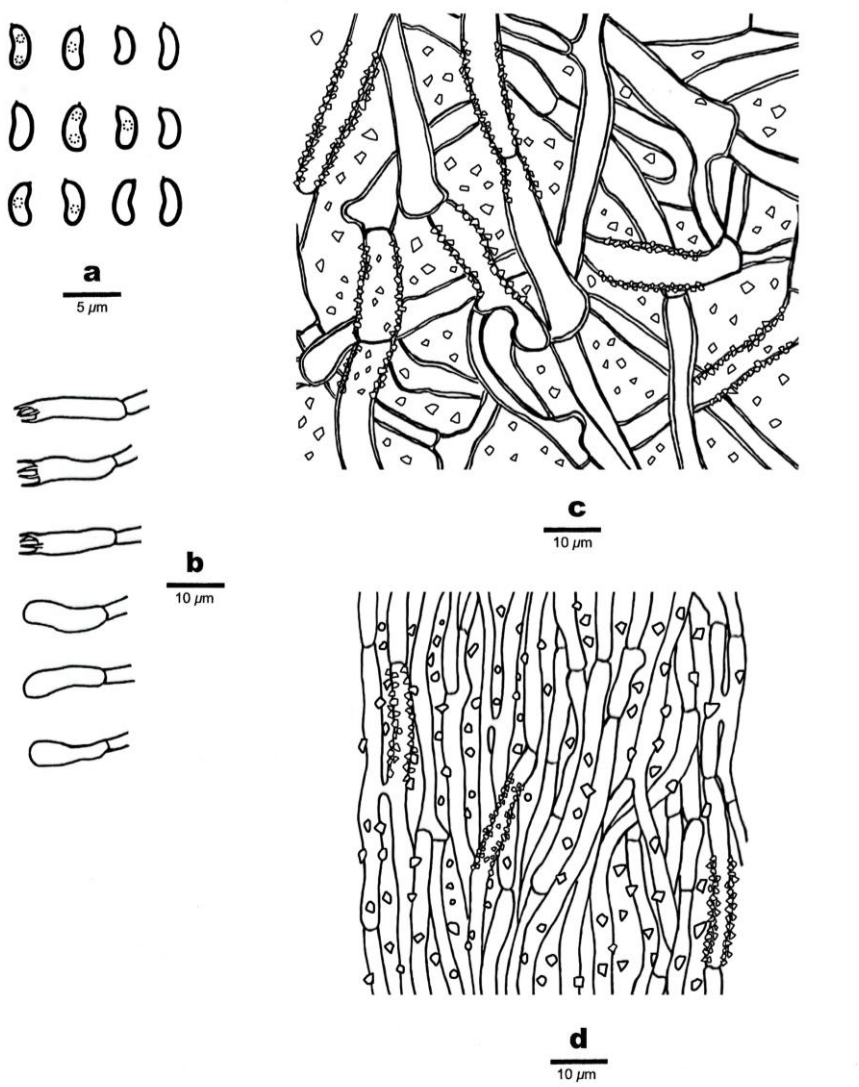


**Figure 9** – Microscopic structures of *Ceriporia gossypinum* (drawn from the holotype, Dai 23392). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 μm, b–d = 10 μm.

***Ceriporia hinnulea*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 4e, 10

Index Fungorum number: IF 901070; Facesoffungi number: FoF14821

Etymology – "*hinnulea*" (Lat.): refers to the pore surface being fawn when dry.

Basidiomata annual, resupinate, soft, without odor or taste when fresh, becoming soft corky to more or less fragile upon drying, up to 10 cm long, 3 cm wide, and 1 mm thick at center. Pore surface fawn to cinnamon when dry; sterile margin very narrow to almost absent; pores round to angular, 4–6 per mm; dissepiments thin, entire to slightly lacerate. Subiculum cream, soft corky when dry, up to 0.2 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.8 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, CB−; tissues becoming brownish black in KOH. Subicular hyphae slightly thick-walled with a wide lumen, smooth, frequently branched at an angle of 90 °, straight, interwoven, 3–5 μm in diam. Tramal hyphae thin- to slightly thick-walled with a wide lumen, abundantly covered with large, irregular, pale orange or yellowish crystals, sometimes encrusted with fine crystals, frequently branched, straight, subparallel along the tubes, agglutinated, 3–4 μm in diam. Cystidia and cystidioles absent. Basidia clavate to more or less pyriform, with four sterigmata and a simple basal septum, 13.5–16 ×

4–4.5 µm; basidioles mostly pyriform, smaller than basidia. Basidiospores lunate to allantoid, hyaline, thin-walled, smooth, IKI−, CB−, 3.5–4 × (1.9–)2–2.1 µm, L = 3.82 µm, W = 2.03 µm, Q = 1.88 (n = 30/1).

Known distribution – Southeast China.

Material examined – China. Fujian Province, Wuping County, Liangyeshan Nature Reserve, on fallen angiosperm branch, 25 Oct. 2013, Cui 11291 (BJFC015407, holotype).

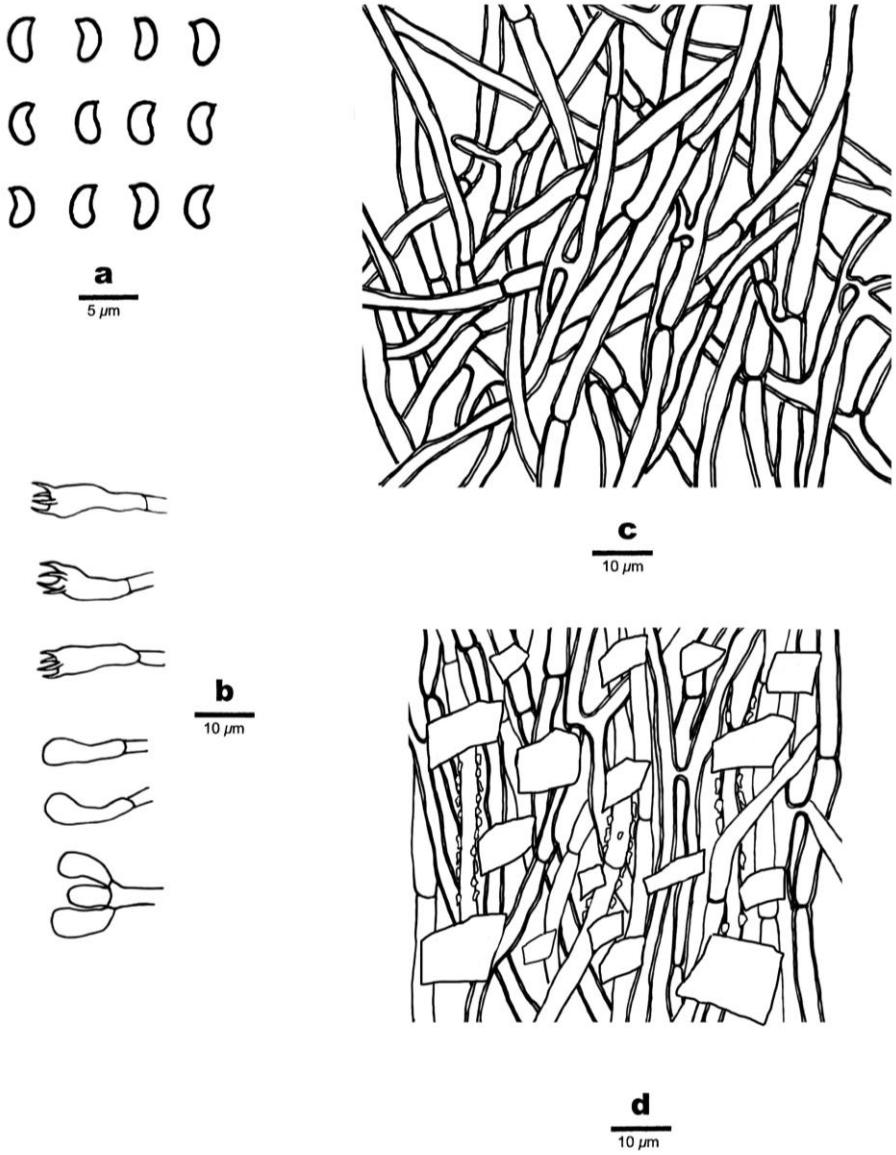


**Figure 10** – Microscopic structures of *Ceriporia hinnulea* (drawn from the holotype, Cui 11291). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

Notes – *Ceriporia hinnulea* is characterized by resupinate basidiomata with a fawn to cinnamon hymenophore when dry, round to angular pores of 4–6 per mm, abundantly large pale orange or yellowish crystals present among the trama, allantoid basidiospores measuring 3.5–4 × 2–2.1 µm, and growth on angiosperm wood in southeast China.

*Ceriporia hinnulea* is morphologically similar and phylogenetically related to *C. arbuscula* C.C. Chen & Sheng H. Wu (Figs 1, 2) by the yellowish brown, pale brown to brownish red pore

surface when dry, round to angular pores of 4–6 per mm. However, the latter has smaller basidiospores (3–3.5 × 1–1.5 µm vs. 3.5–4 × 2–2.1 µm, Chen et al. 2020).

***Ceriporia macrospora*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 4f, 11

Index Fungorum number: IF901071; Facesoffungi number: FoF14822

Etymology – "*macrospora*" (Lat.): refers to species with large basidiospores.

Basidiomata annual, resupinate, soft corky, without odor or taste when fresh, becoming corky upon drying, up to 12 cm long, 6 cm wide, and 1 mm thick at center. Pore surface salmon to brownish vinaceous when fresh, becoming pinkish buff, clay pink to fawn upon drying; sterile margin white to cream when fresh, cream to buff when dry, thinning out, up to 1.5 mm wide; pores round, sometimes slightly elongated, 5–7 per mm; dissepiments thin to slightly thick, entire to slightly lacerate. Subiculum cream to buff, corky when dry, up to 0.4 mm thick. Tubes concolorous with pore surface, corky when dry, up to 0.6 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, moderately CB+; tissues unchanged in KOH. Subicular hyphae thin- to thick-walled with a wide lumen, abundantly covered with irregular, yellowish crystals and an oily substance, sometimes encrusted with fine crystals, frequently branched at an angle of 90 °, flexuous, interwoven, 2–3.5 µm in diam. Tramal hyphae slightly thick-walled with a wide lumen, abundantly covered with large, irregular, yellowish crystals and an oily substance, sometimes encrusted with fine crystals, frequently branched, straight to slightly flexuous, subparallel along the tubes, agglutinated, 2.5–3.5 µm in diam. Cystidia and cystidioles absent. Basidia clavate to pyriform, with four sterigmata and a simple basal septum, 10–13 × 4.5–5 µm; basidioles pyriform, smaller than basidia. Basidiospores allantoid, hyaline, thin-walled, smooth, IKI−, CB−, 5–7.2(–7.6) × (1.4–)1.6–2 µm, L = 5.76 µm, W = 1.85 µm, Q = 2.97–3.27 (n = 60/2).

Known distribution – Southern China and Australia.

Material examined – China, Guangdong Province, Shenzhen, Yangtaishan Forest Park, on rotten angiosperm wood, 17 Apr. 2023, Dai 24695 (BJFC039974); Hainan Province, Wenchang, Maihao, on fallen angiosperm trunk, 15 May 2009, Cui 6740 (BJFC004593, holotype).

Notes – *Ceriporia macrospora* is characterized by resupinate basidiomata with a pinkish buff, clay pink to fawn pore surface when dry, round to slightly elongated pores, 5–7 per mm, allantoid basidiospores measuring 5–7.2 × 1.6–2 µm, and growth on angiosperm wood in southern China.

One sequence of sample MEL 2382688 from Australia was identified as *Ceriporia* sp. in GenBank (GenBank accession NO. KP013052); this sample and two Chinese samples nested together as an independent lineage in our phylogenies (Figs 1, 2) and we treat the Australian sample as "*Ceriporia aff. macrospora*" because we did not study the sample.

For the differences with morphologically similar species and phylogenetically related species see the notes on *Ceriporia allantoidea*.

***Ceriporia orientalis*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 4g, 12

Index Fungorum number: IF 901072; Facesoffungi number: FoF14823

Etymology – "*orientalis*" (Lat.): refers to the species being found in East Asia.

Basidiomata annual, resupinate, ceraceous, without odor or taste when fresh, becoming soft upon drying, up to 6 cm long, 2 cm wide, and 0.5 mm thick at center. Pore surface cream to buff when dry; sterile margin very narrow, cream when dry, up to 0.2 mm wide; pores round, 3–4 per mm; dissepiments slightly thick, entire. Subiculum very thin to almost absent. Tubes concolorous with pore surface, soft when dry, up to 0.5 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, moderately CB+; tissues becoming lilac in KOH. Subicular hyphae thin- to slightly thick-walled with a wide lumen, abundantly covered with irregular hyaline or yellowish brown crystals and an oily substance, sometimes encrusted with fine crystals, frequently branched at an angle of 90 °, slightly flexuous, interwoven, 5–6.5 µm in diam. Tramal hyphae thin- to slightly thick-walled with a wide lumen, abundantly covered with large, rhombic, or irregular hyaline crystals and an oily substance,

sometimes encrusted with fine crystals, frequently branched, straight to slightly flexuous, subparallel along the tubes, agglutinated, 3–4 µm in diam. Cystidia and cystidioles absent. Basidia barrel-shaped, with four sterigmata and a simple basal septum, 13–15 × 5.5–6 µm; basidioles of similar shape to basidia, but smaller. Basidiospores lunate to allantoid, hyaline, thin-walled, smooth, IKI−, CB−, (5.2–)5.4–6.5(–7) × (2.7–)2.8–3.1(–3.2) µm, L = 5.98 µm, W = 2.99 µm, Q = 1.99–2.01 (n = 60/2).

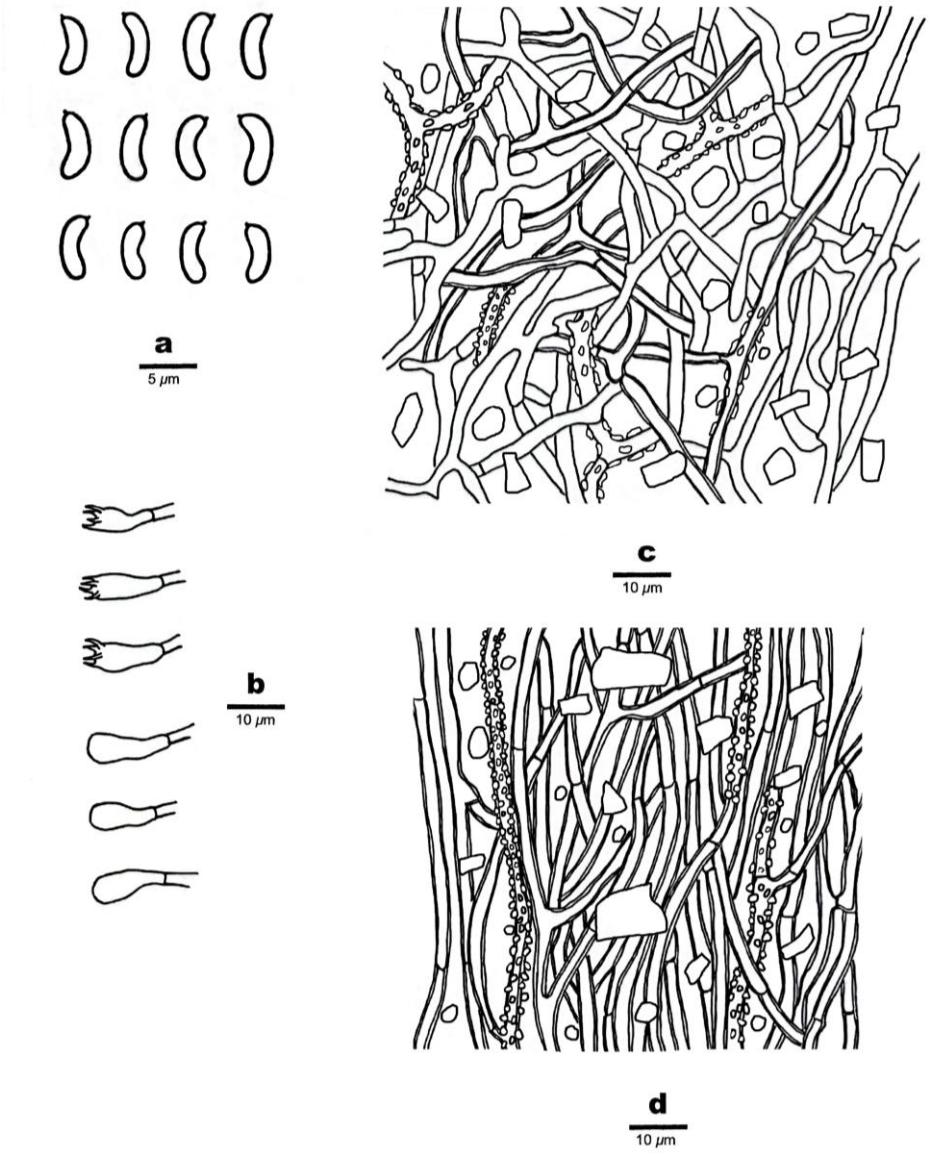


**Figure 11** – Microscopic structures of *Ceriporia macrospora* (drawn from the holotype, Cui 6740). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

Known distribution – Central and Eastern China.

Material examined – China. Henan Province, Nanyang, Baotianman Nature Reserve, on rotten angiosperm wood, 23 Aug. 2005, Li 1045 (BJFC010169); Zhejiang Province, Kaihua County, Gutianshan Nature Reserve, on rotten angiosperm wood, 12 Aug. 2013, Dai 13400 (BJFC014861, holotype).

Notes – *Ceriporia orientalis* is characterized by resupinate basidiomata with a cream to buff pore surface when dry, round pores, 3–4 per mm, subicular hyphae wider than tramal hyphae,

lunate to allantoid basidiospores, 5.4–6.5 × 2.8–3.1 µm, and growth on angiosperm wood in central and eastern China.

*Ceriporia orientalis* and *C. reticulata* are phylogenetically related and share the cream to buff or pinkish to pale orange pore surface and big pores (2–3 per mm in *C. reticulata*), however, the latter has bigger basidiospores (7–8.5 × 3–3.5 µm vs. 5.4–6.5 × 2.8–3.1 µm). In addition, these two species form two independent lineages in *Ceriporia* (Figs 1, 2).

*Ceriporia citrina* M. Mata & Ryvarden has big angular pores of 1–3 per mm and large basidiospores (7–8 × 3.2–3.5 µm, Mata & Ryvarden 2010), which is similar to *C. reticulata*, however, the former has a citric yellow pore surface when fresh and is found in Costa Rica, Central America.

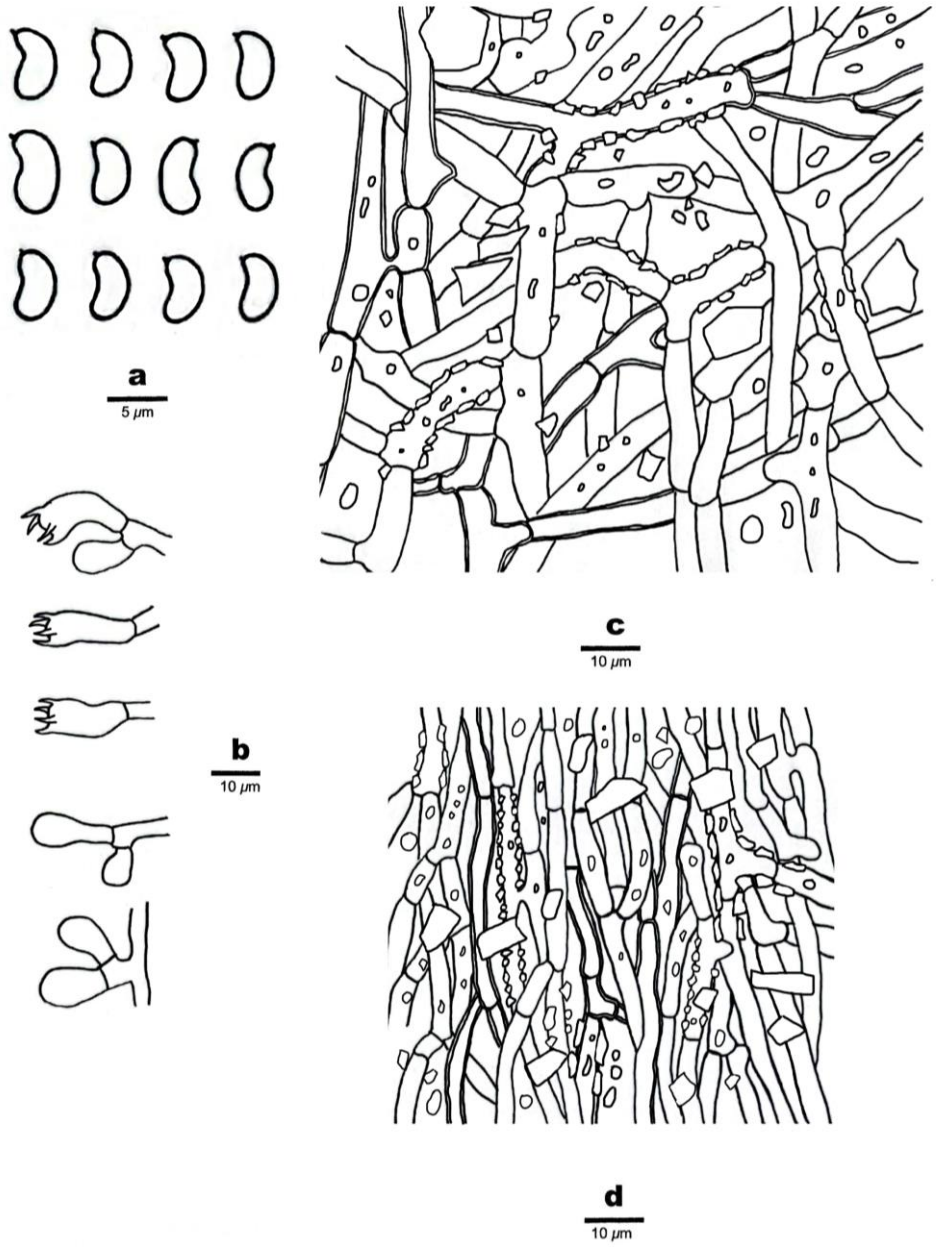


**Figure 12** – Microscopic structures of *Ceriproia orientalis* (drawn from the holotype, Dai 13400). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

***Ceriporia pseudospissa*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 4h, 13

Index Fungorum number: IF901073; Facesoffungi number: FoF14824

Etymology – "*pseudospissa*" (Lat.): refers to the species resembling *Ceriporia spissa* in the hymenophore becoming reddish brown when bruised.

Basidiomata annual, resupinate, soft corky, without odor or taste when fresh, becoming soft corky to corky upon drying, up to 10 cm long, 4 cm wide, and 0.8 mm thick at center. Pore surface pinkish buff to clay pink when fresh, becoming clay buff to fawn upon drying, reddish brown when bruised; sterile margin white when fresh, cream to pinkish buff when dry, somewhat incised, thinning out, up to 0.6 mm wide; pores angular, 4–5 per mm; dissepiments thin, entire to slightly lacerate. Subiculum cream, soft corky when dry, up to 0.1 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.7 mm long.

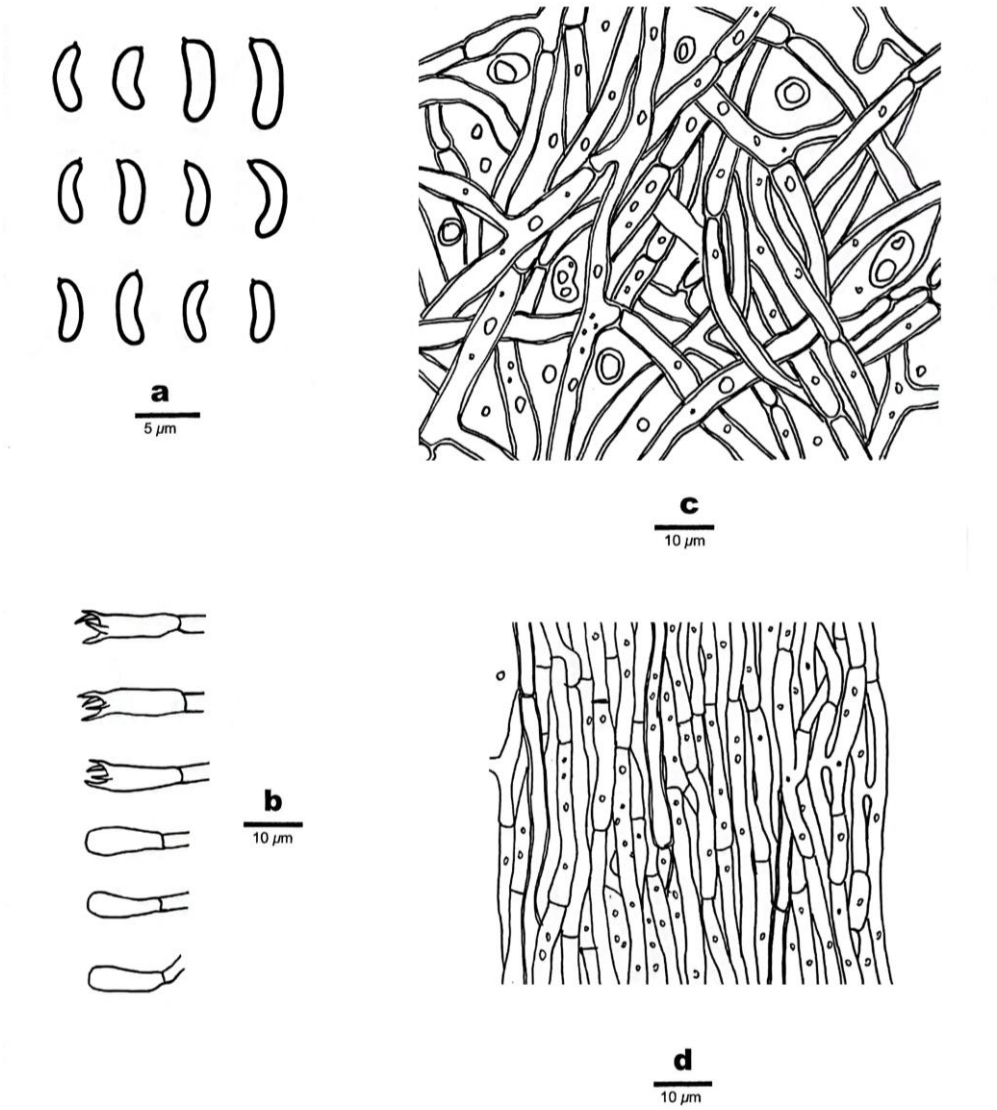


**Figure 13** – Microscopic structures of *Ceriporia pseudospissa* (drawn from the holotype, Dai 24566). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 μm, b–d = 10 μm.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, smooth, IKI−, CB−; tissues becoming brownish in KOH. Subicular hyphae thick-walled with a wide lumen, with abundant oily substance, frequently branched at an angle of 90 °, more or less straight, interwoven, 3–5.5 μm in diam. Tramal hyphae thin- to slightly thick-walled, with abundant oily substance,

frequently branched, straight, subparallel along the tubes, agglutinated, 2–3 µm in diam. Cystidia and cystidioles absent. Basidia clavate, with four sterigmata and a simple basal septum, 13–14 × 4–4.5 µm; basidioles mostly pyriform, smaller than basidia. Basidiospores allantoid, hyaline, thin-walled, smooth, IKI−, CB−, (4.7–)5–7.2(–7.5) × (1.5–)1.6–2.1(–2.2) µm, L = 5.7 µm, W = 1.9 µm, Q = 3.01 (n = 30/1).

Known distribution – Northern and southern China.

Material examined – China, Beijing, Yudushan Nature Reserve, on fallen angiosperm branch, 24 Oct. 2022, Dai 24566 (BJFC039808, holotype); Guangxi Auto. Reg., Nanning, Wuming County, Damingshan Nature Reserve, on rotten angiosperm wood, 29 Aug. 2011, Yuan 5965 (IFP017250).

Notes – *Ceriporia pseudospissa* is characterized by resupinate basidiomata with a clay buff to fawn pore surface when dry, angular pores of 4–5 per mm, subicular hyphae wider than tramal hyphae, the absence of rhombic or irregular crystals, smooth hyphae, allantoid basidiospores, 5–7.2 × 1.6–2.1 µm, and growth on angiosperm wood in China.

*Ceriporia pseudospissa* is similar to *C. macrospora* by the clay pink, clay buff to fawn pore surface when dry and almost the same size of basidiospores (5–7.2 × 1.6–2 µm in *C. macrospora*; 5–7.2 × 1.6–2.1 µm in *C. pseudospissa*). However, the latter has smaller pores (5–7 per mm vs. 4–5 per mm) and uniform hyphae in both subiculum and trama (2–3.5 µm in diam. in subiculum; 2.5–3.5 µm in diam. in trama). In addition, *Ceriporia pseudospissa* and *C. macrospora* nested in two independent lineages (Figs 1, 2). *Ceriporia spissa* and *C. pseudospissa* share a reddish brown hymenophore when bruised, but the former has smaller basidiospores (4.2–4.8 × 1.3–1.6 µm vs. 5–7.2 × 1.6–2.1 µm).

In our phylogenetic analyses, *Ceriporia pseudospissa* is closely related to *C. sinospissa*. However, the latter has clay pink, apricot orange to orange-brown pore surface when dry, thin- to slightly thick-walled subicular hyphae and slightly smaller basidiospores (5–5.8 × 1.5–2 µm vs. 5–7.2 × 1.6–2.1 µm).

***Ceriporia punctata*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 4i, 14

Index Fungorum number: IF901074; Facesoffungi number: FoF14825

Etymology – "*punctata*" (Lat.): refers to the species having cushion-shaped basidiomata.

Basidiomata annual, resupinate, cushion-shaped, soft, without odor or taste when fresh, becoming soft corky to more or less fragile upon drying, up to 16 cm long, 3 cm wide, and 0.8 mm thick at center. Pore surface cinnamon buff when dry; sterile margin cream when dry, thinning out, up to 0.3 mm wide; pores angular, 2–5 per mm; dissepiments thin, lacerate. Subiculum very thin to almost absent. Tubes concolorous with pore surface, soft corky when dry, up to 0.8 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, CB−; tissues unchanged in KOH. Subicular hyphae thin- to slightly thick-walled with a wide lumen, abundantly covered with rhombic or irregular yellowish-brown crystals, sometime encrusted with fine crystals, frequently branched at an angle of 90 °, straight, interwoven, 3–5.5 µm in diam. Tramal hyphae thin-walled, abundantly encrusted with fine yellowish crystals, frequently branched, straight to slightly flexuous, subparallel along the tubes, agglutinated, 2–3 µm in diam. Cystidia and cystidioles absent. Basidia clavate to barrel-shaped, with four sterigmata and a simple basal septum, 12–15 × 4–5 µm; basidioles mostly pyriform, smaller than basidia. Basidiospores allantoid, hyaline, thin-walled, smooth, IKI−, CB−, 4–5 × (1.6–)1.7–2.1 µm, L = 4.41 µm, W = 1.93 µm, Q = 2.20–2.36 (n = 60/2).

Known distribution – Northwest China.

Material examined – China. Xinjiang Auto. Reg., Yining, Yili Hotel Campus, on rotten wood of *Populus* sp., 13 Sep. 2015, Dai 15899 (BJFC020000, holotype); Dai 15904 (BJFC020005).

Notes – *Ceriporia punctata* is characterized by resupinate, cushion-shaped basidiomata with cinnamon buff hymenophore when dry, angular pores of 2–5 per mm, tramal hyphae abundantly encrusted with fine crystals, allantoid basidiospores, 4–5 × 1.7–2.1 µm, and growth on *Populus* sp. in northwest China.

*Ceriporia punctata* forms an independent lineage in *Ceriporia* (Figs 1, 2), and is similar to *Ceriporia mellita* by sharing the cinnamon buff or buff to reddish brown pore surface when dry, angular pores (4–5 per mm in *C. mellita*, 2–5 per mm in C. *punctata*). However, the latter has uniform hyphae in the subiculum and trama and longer basidiospores (5–6 × 1.5–2 µm in *C. mellita*, 4–5 × 1.7–2.1 µm in *C. punctata*). In addition, *Ceriporia punctata* and *C. mellita* are only phylogenetically distantly related (Figs 1, 2).

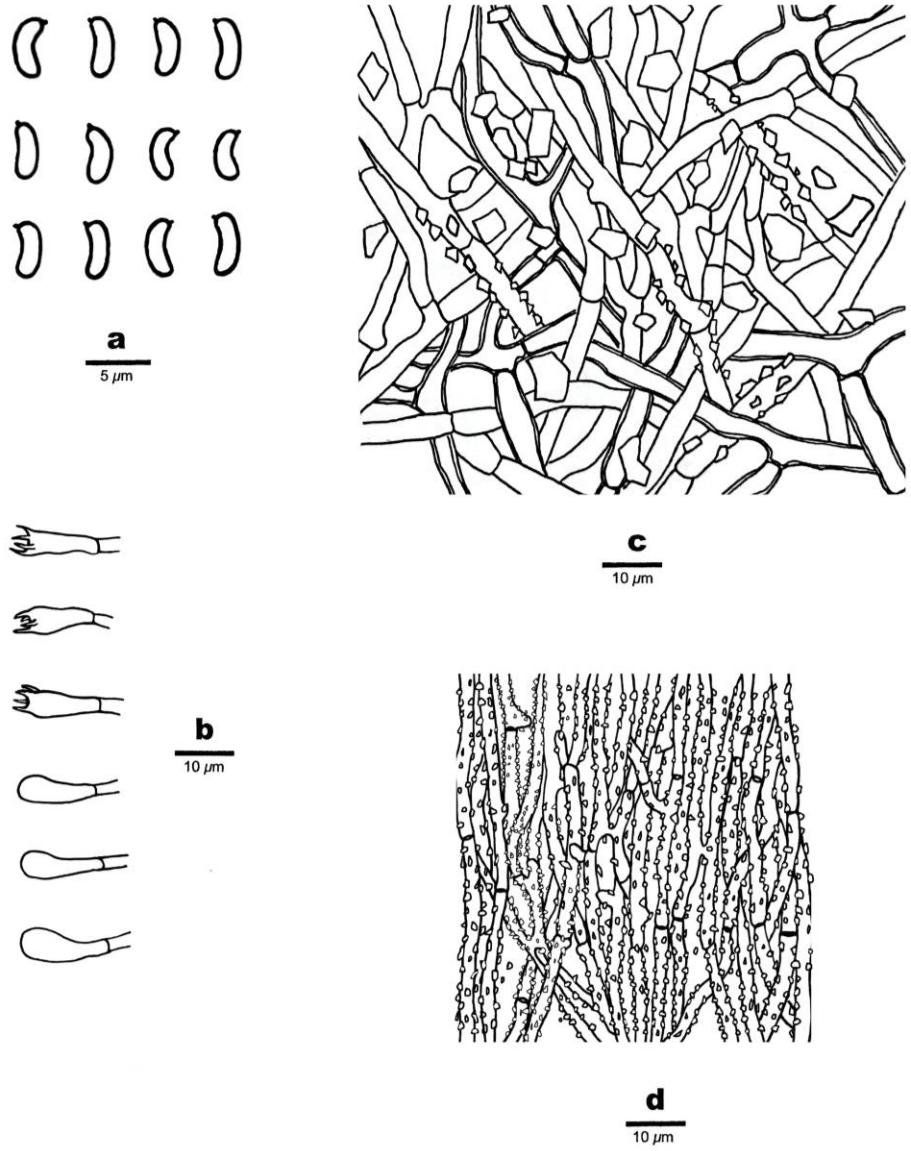


**Figure 14** – Microscopic structures of *Ceriporia punctata* (drawn from the holotype, Dai 15899). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

***Ceriporia sinospissa*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 5a, 15

Index Fungorum number: IF 901076; Facesoffungi number: FoF14826

Etymology – "*sinospissa*" (Lat.): refers to the species being similar to *Ceriporia spissa* and origin in China.

Basidiomata annual, resupinate, soft, without odor or taste when fresh, becoming soft corky upon drying, up to 10 cm long, 1.8 cm wide, and 0.2 mm thick at center. Pore surface clay pink, apricot orange to orange-brown when dry; sterile margin cream to clay pink when dry, thinning out,

up to 0.3 mm wide; pores round to angular, 3–5 per mm; dissepiments thin, entire. Subiculum cream, soft corky when dry, up to 0.05 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.15 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, moderately CB+; tissues unchanged in KOH. Subicular hyphae thin- to slightly thick-walled with a wide lumen, covered with large, rhombic or irregular crystals and an orange oily substance, abundantly encrusted with fine crystals, frequently branched most at an angle of 90 °, straight, interwoven, 3–5 µm in diam. Tramal hyphae thin- to slightly thick-walled with a wide lumen, abundantly covered with rhombic crystals and an orange oily substance, sometimes encrusted with fine crystals, frequently branched, straight, subparallel along the tubes, agglutinated, 3–3.5 µm in diam. Cystidia and cystidioles absent. Basidia clavate to barrel-shaped, with four sterigmata and a simple basal septum, 9–14 × 4–5 µm; basidioles mostly pyriform, smaller than basidia. Basidiospores allantoid, hyaline, thin-walled, smooth, IKI−, CB−, (4.8–)5–5.8(–6.2) × 1.5–2 µm, L = 5.27 µm, W = 1.74 µm, Q = 2.83–3.24 (n = 60/2).

Known distribution – Southeast China.

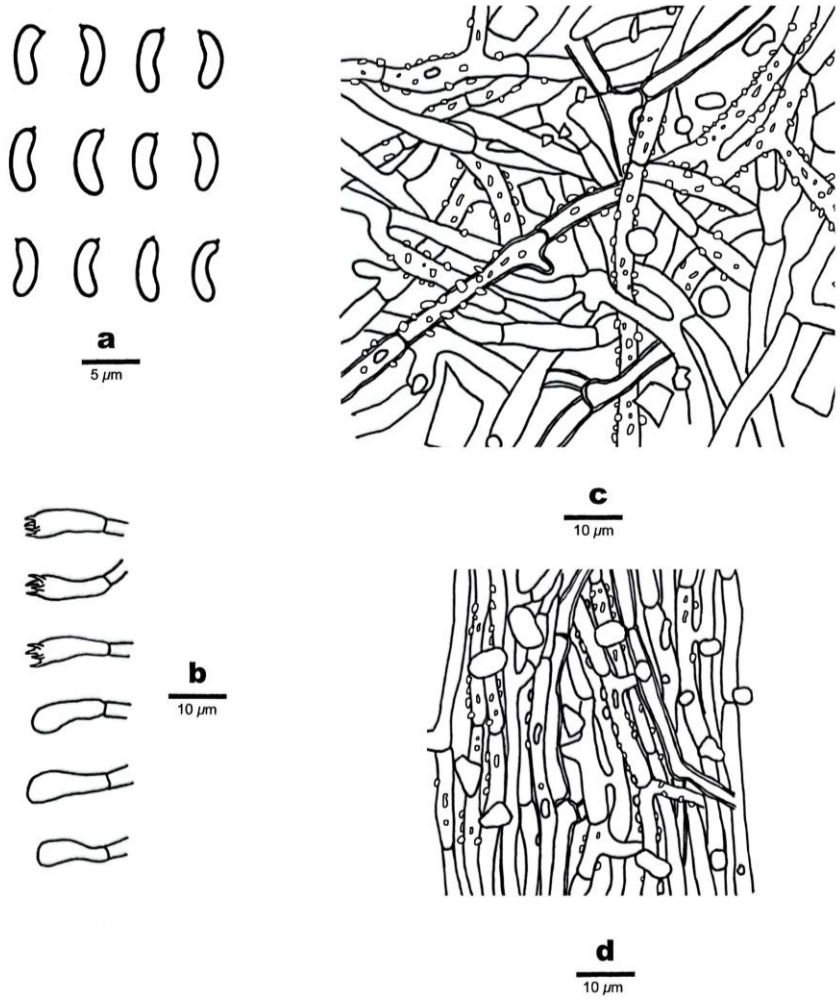


**Figure 15** – Microscopic structures of *Ceriporia sinospissa* (drawn from the holotype, Cui 11282). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

Material examined – China, Fujian Province, Shanghang County, Meihuashan Nature Reserve, on fallen angiosperm branch, 24 Oct. 2013, Cui 11282 (BJFC015398, holotype); Hunan Province, Yizhang County, Mangshan Nature Reserve, on rotten angiosperm wood, 27 Jul. 2008,

Dai 16831 (BJFC022937); Jiangxi Province, Fenyi County, Dagang Mountain, on rotten angiosperm wood, 18 Sep. 2008, Dai 10477 (BJFC004726).

Notes – *Ceriporia sinospissa* is characterized by resupinate basidiomata with a clay pink, apricot orange to orange-brown pore surface when dry, round to angular pores of 3–5 per mm, the presence of rhombic crystals, fine crystals and an orange oily substance, allantoid basidiospores measuring 5–5.8 × 1.5–2 µm, and growth on angiosperm wood in southeast China.

*Ceriporia sinospissa* is similar to *C. mellita*, *C. spissa* and *C. subspissa* by the red-colored pore surface and similar hyphae. However, the latter three have a darker (reddish brown to dark violet) pore surface when dry, and *C. mellita* lacks crystals or an oily substance (Chen et al. 2020); *C. spissa* has smaller pores (7–9 per mm vs. 3–5 per mm, Ryvarden & Gilbertson 1993); *C. subspissa* has smaller basidiospores (4–4.5 × 2 µm vs. 5–5.8 × 1.5–2 µm, Aime et al. 2007), which differ from *C. sinospissa*.

*Boletus juglandinus* Schwein., *Polyporus crociporus* Berk. & M.A. Curtis and *P. cruentatus* Mont. were described from America and listed as synonyms of *Ceriporia spissa* in MycoBank (http://www.mycobank.org/). However, *C. sinospissa* and *C. spissa* nested in two independent lineages in *Ceriporia*, and we expect that *Boletus juglandinus*, *Polyporus crociporus* and *P. cruentatus* are different from *C. sinospissa*. In addition, the distribution of the former three taxa and *C. sinospissa* do not overlap.

*Ceriporia rhodella* (Fr.) Donk and *C. sinospissa* share the pinkish or orange-tan pore surface. However, the former has smaller pores (5–7 per mm vs. 3–5 per mm) and basidiospores (3.5–4 × 1.5–2 µm vs. 5–5.8 × 1.5–2 µm, Lombard & Gilbertson 1965).

*Ceriporia sinospissa* is closely related to *C. pseudospissa* and *C. punicans* in our phylogenetic analyses. However, *C. pseudospissa* is distinguished from *C. sinospissa* by shorter basidiospores (4–5 × 1.7–2.1 µm vs. 5–5.8× 1.5–2 µm); *C. punicans* differs from *C. sinospissa* by smaller pores (5–7 per mm vs. 3–5 per mm) and wider subicular hyphae (4.8–7.4 µm in diam. vs. 3–5 µm in diam., Spirin et al. 2016).

***Ceriporia subbadia*** Y.C. Dai, Chao G. Wang & Yuan Yuan, comb. nov. Figs 5b, 16

Index Fungorum number: IF901086; Facesoffungi number: FoF14827

Basionym – *Poria subbadia* Murrill, Mycologia 13(2): 93 (1921).

Basidiomata annual, resupinate, ceraceous, without odor or taste when fresh, becoming soft corky upon drying, up to 20 cm long, 8 cm wide, and 1 mm thick at center. Pore surface ash gray when fresh, becoming flesh pink upon bruising, eventually becoming cream, buff to clay buff upon drying; sterile margin indistinct; pores angular, 3–4 per mm; dissepiments thin, lacerate. Subiculum cream, soft corky when dry, up to 0.1 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.9 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, CB−; tissues unchanged in KOH. Subicular hyphae thick-walled with a wide lumen, occasionally covered with irregular crystals, sometimes encrusted with irregular corolliform crystals, frequently branched mostly at an angle of 90 °, straight, interwoven, 6–11 µm in diam. Tramal hyphae thin- to slightly thick-walled with a wide lumen, occasionally covered with large, with rhombic hyaline crystals and a yellowish oily substance, sometimes encrusted with fine crystals, frequently branched, straight, subparallel along the tubes, agglutinated, 3–5 µm in diam. Cystidia and cystidioles absent. Basidia clavate, with four sterigmata and a simple basal septum, 14–17 × 4.5–5 µm; basidioles of similar shape to basidia, but smaller. Basidiospores cylindric to allantoid, hyaline, thin-walled, smooth, IKI−, CB−, (4.2–)4.5–5.8(–6.8) × 2–2.6(–2.8) µm, L = 5.19 µm, W = 2.32 µm, Q = 2.24 (n = 30/1).

Known distribution – Southwest China, Korea and USA.

Material examined – China, Guizhou Province, Suiyang County, Kuankuoshui Nature Reserve, on rotten wood of *Fagus* sp., 26 Nov. 2014, Dai 15062 (BJFC018174).

Notes – *Poria subbadia* Murrill was described from Alabama, USA, and is characterized by resupinate basidiomata with a white to rosy pink-isabelline pore surface when fresh, testaceous to pale bay brown when dry, angular pores of 2–3 per mm and ellipsoid basidiospores measuring 5 ×

3 µm (Murrill 1921). The Chinese specimen Dai 15062 is characterized by ash gray to flesh pink pore surface when fresh, angular pores of 3–4 per mm, and cylindric to allantoid basidiospores (4.5–5.8 × 2–2.6 µm). These characteristics are somewhat similar to *Poria subbadia*. In addition, two sequences of samples -L-8020-Sp, and KUC20131022-11- from Washington, USA and Rep. Korea respectively were identified as *Ceriporia* sp. and *Ceriporia viridans* in GenBank (GenBank accession Nos. KP135050 and KJ668563). These two samples labelled Dai 15062 form an independent lineage nested in *Ceriporia* (Figs 1, 2). Thus, we propose the above combination, and give an illustrated description of the species.

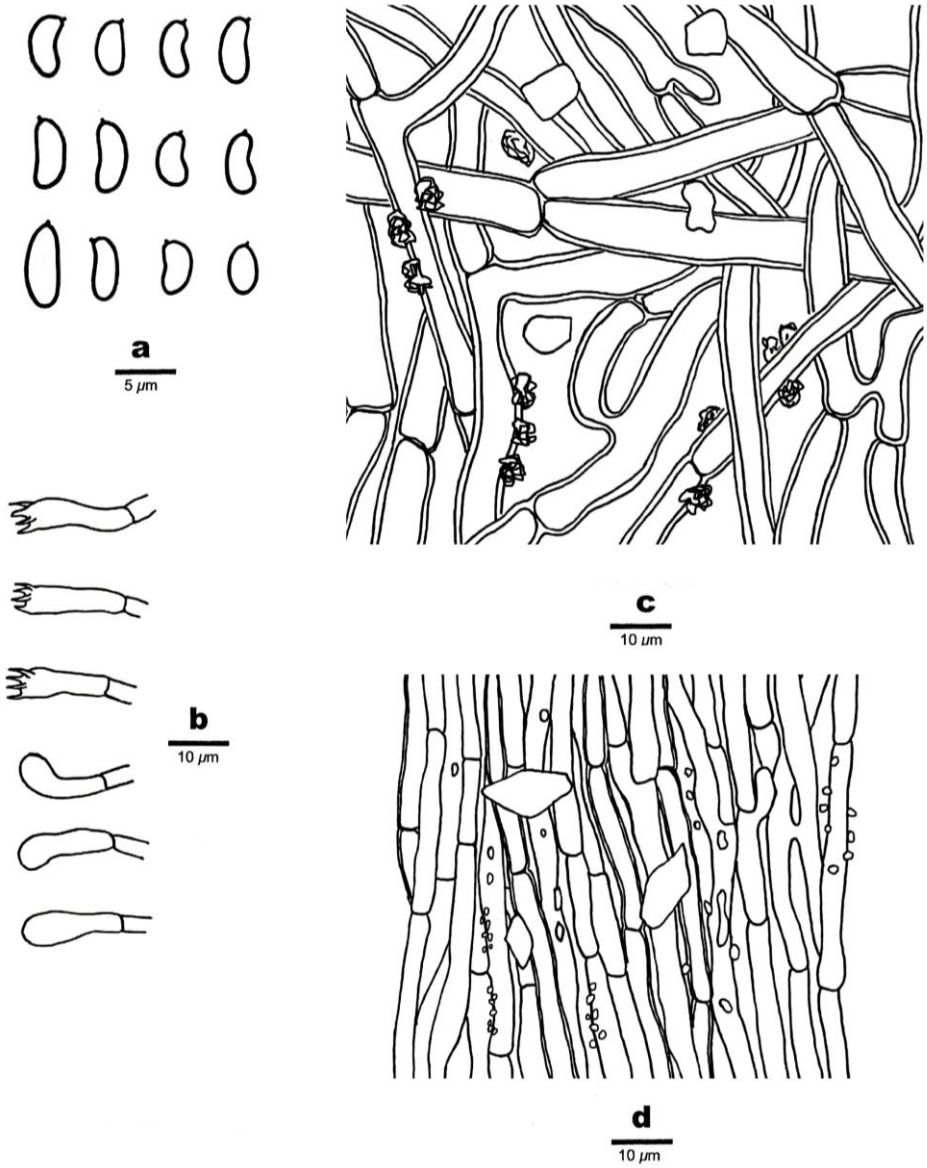


**Figure 16** – Microscopic structures of *Ceriproia subbadia* (drawn from Dai 15062). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

***Ceriporia subviridans*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Fig. 17

Index Fungorum number: IF 901077; Facesoffungi number: FoF14828

Etymology – "*subviridans*" (Lat.): refers to the species being similar to *Ceriporia viridans.*

Basidiomata annual, resupinate, soft to ceraceous, without odor or taste when fresh, becoming soft corky upon drying, up to 8 cm long, 4 cm wide, and 0.3 mm thick at center. Pore surface peach to apricot orange when dry; sterile margin indistinct; pores round to angular, 4–5 per mm;

dissepiments thin, entire to lacerate. Subiculum cream, soft corky when dry, up to 0.1 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.2 mm long.

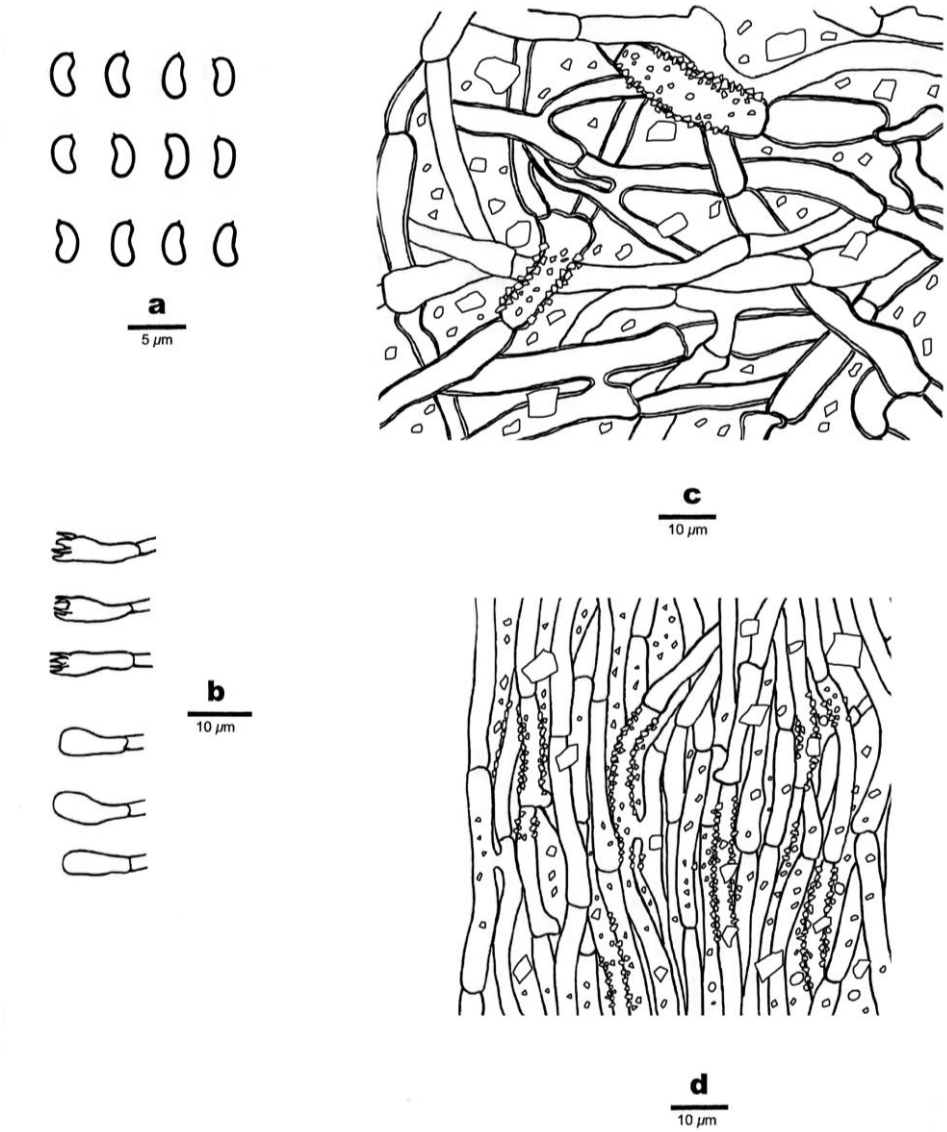


**Figure 17** – Microscopic structures of *Ceriporia subviridans* (drawn from the holotype, Cui 8012). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. e hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, CB−; tissues unchanged in KOH. Subicular hyphae thin- to slightly thick-walled with a very wide lumen, abundantly covered with rhombic or irregular crystals, sometimes encrusted with fine crystals, occasionally branched at an angle of 90 °, straight to slightly flexuous, interwoven, 4.5–9 µm in diam. Tramal hyphae thin-walled with a wide lumen, abundantly covered with rhombic crystals and an oily substance, encrusted with fine hyaline crystals, frequently branched, straight to slightly flexuous, subparallel along the tubes, agglutinated, 3–5 µm in diam. Cystidia and cystidioles absent. Basidia clavate to barrel-shaped, with four sterigmata and a simple basal septum, 10–13 × 4–5 µm; basidioles mostly pyriform, smaller than basidia. Basidiospores lunate to allantoid, hyaline, thin-walled, smooth, IKI−, CB−, 3.3–3.7(–4) × 1.8–2 µm, L = 3.48 µm, W = 1.92 µm, Q = 1.82 (n = 30/1).

Known distribution – Southwest and southeast China.

Material examined – China, Yunnan Province, Baoshan, Tengchong County, Gaoligongshan Nature Reserve, on fallen angiosperm trunk, 24 Oct. 2009, Cui 8012 (BJFC006501, holotype).

Notes – *Ceriporia subviridans* is characterized by resupinate basidiomata with a peach to apricot orange pore surface when dry, round to angular pores of 4–5 per mm, subicular hyphae distinctly wider than tramal hyphae, lunate to allantoid basidiospores, 3.3–3.7 × 1.8–2 µm, and growth on angiosperm wood in southwest and southeast China.

*Ceriporia subviridans*, *C. gossypinum* and *C. eucalypti* are phylogenetically related (Fig. 1), and they share almost the same size of pores (3–5 per mm in *C. eucalypti*, 4–5 per mm in *C. subviridans* and *C. gossypinum*). *Ceriporia eucalypti* differs from *C. subviridans* by a buff to orange-yellow pore surface when dry and narrower basidiospores (4–4.4 × 1.1–1.4 µm vs. 3.3–3.7 × 1.8–2 µm, Chen et al. 2022); *C. gossypinum* is different from *C. subviridans* by a buff to honey yellow pore surface when dry, and longer basidia (13–16 × 3.5–4 µm vs. 10–13 × 4–5 µm). In addition, these three species form three independent lineages in *Ceriporia* (Figs 1, 2).

*Ceriporia rubescens* (Petch) Ryvarden was described from Sri Lanka and is characterized by resupinate basidiomata with a cream to chrome yellow to pale reddish purplish brown pore surface, angular pores of 3–5 per mm, but it differs from *C. subviridans* by cylindrical basidiospores measuring 4–5 × 1.5–2 µm (Ryvarden 2015).

***Gloeoporus*** Mont., Annals Sci. Nat., Bot., sér. 2 17: 126 (1842).

Type species – *Gloeoporus thelephoroides* (Hook.) G. Cunn., Bull. N.Z. Dept. Sci. Industr. Res. 164: 111 (1965).

Basidiomata annual, resupinate to pileate, easily separated from the substrate, gelatinous, soft, corky to leathery when fresh, becoming fragile, corky to resinous hard upon drying. Pileal surface cream, grayish white to pale yellow when fresh, becoming cream, ochraceous to pale yellowish brown upon drying. Pore surface white, pale ochraceous, pinkish to black when fresh, becoming cream, gray, orange, brown to black upon drying. Hyphal system monomitic; generative hyphae with clamp connections or simple septa, thin- to thick-walled, sometimes covered with crystals and an oily substance. Hymenial cystidia present in some species, clavate, fusiform to capitate, thin-walled, smooth. Basidiospores cylindrical, ellipsoid to allantoid, hyaline, thin-walled, smooth, IKI−, CB−. Causing a white rot.

Notes – *Gloeoporus* was originally described by Montagne (1842) and is a cosmopolitan genus. We excluded the species combined into other genera, so far 23 species are listed in *Gloeoporus* in Index Fungorum (http://www.indexfungorum.org/), but only seven species have DNA sequences available (Supplementary Table 1). According to Hattori (2001), *Gloeoporus carrii* Corner, *G. dolosus* Corner, *G. pendens* Corner, *G. friabilis* Corner, *G. hispidus* Corner and *G. subochraceus* Corner were combined into *Tyromyces* based on generative hyphae with clamp connections and ellipsoid to subglobose basidiospores. *Gloeoporus dimiticus* Corner and *G. cremeoalbus* Corner were combined into *Rigidoporus* and *Skeletocutis*, respectively. *Gloeoporus vitellinus* Corner is a synonym of *G. chlorinus* (Pat.) Ginns, and *G. papuanus* Corner is a synonym of *G. dichrous* (Fr.) Bres. So, these species are excluded from Supplementary Table 1 in our study. *Gloeoporus similis* Corner has broadly ellipsoid to subglobose basidiospore in original description (Corner 1989), that do not fit the definition of *Gloeoporus*, it is also excluded from Supplementary Table 1. So, all 23 species of *Gloeoporus* are good species in Supplementary Table 1. In this study, two new species are described and illustrated.

***Gloeoporus septatus*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 5c, 18

Index Fungorum number: IF 901078; Facesoffungi number: FoF14829

Etymology – "*septatus*" (Lat.): refers to the species having septate cystidia.

Basidiomata annual, resupinate, soft, without odor or taste when fresh, becoming soft corky to more or less fragile upon drying, up to 15 cm long, 4 cm wide, and 0.2 mm thick at center. Pore surface pale pinkish when fresh, becoming cream to pinkish buff upon drying; sterile margin white

when fresh and dry, thinning out, up to 5 mm wide; pores round, 5–6 per mm; dissepiments thin, entire. Subiculum cream, soft corky when dry, up to 0.05 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.15 mm long.

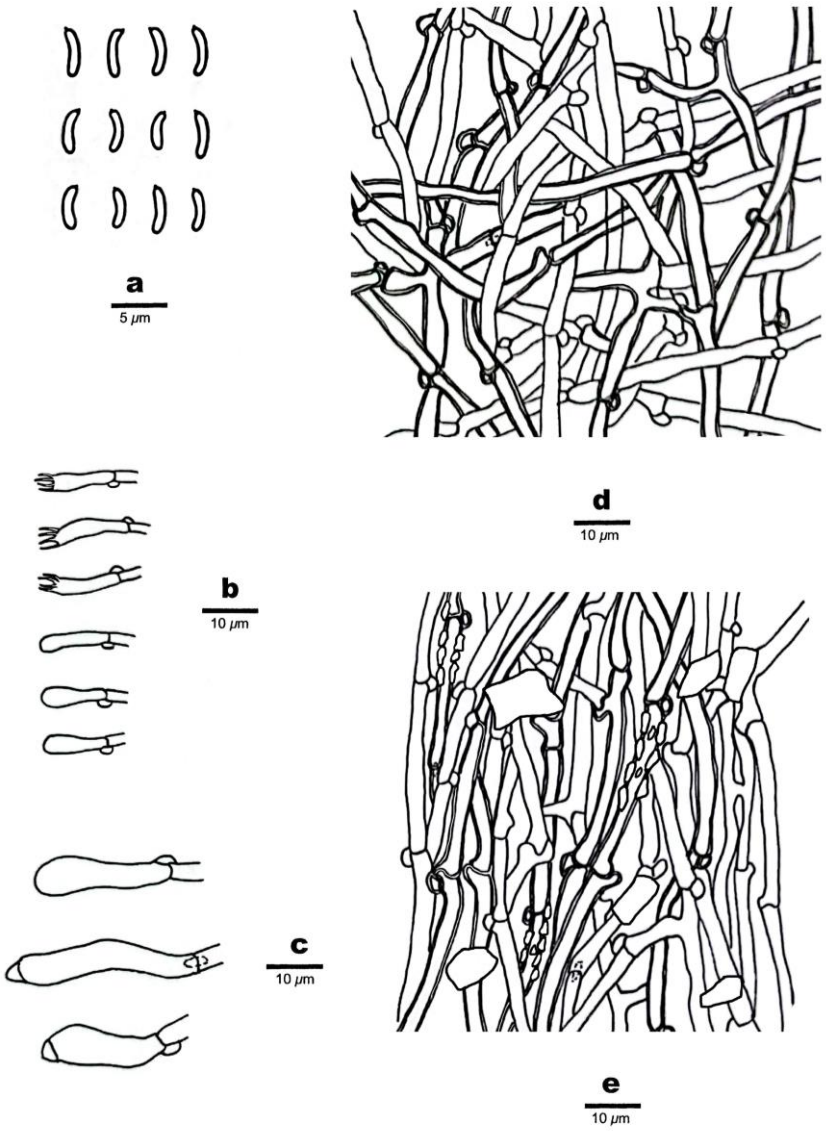


**Figure 18** – Microscopic structures of *Gloeoporus septatus* (drawn from the holotype, Dai 22221). a Basidiospores. b basidia and basidioles. c hymenial cystidia. d hyphae from subiculum. e hyphae from trama. Scale bars: a = 5 µm, b–e = 10 µm.

Hyphal system monomitic; generative hyphae with clamp connections, hyaline, smooth, IKI−, CB+; tissues unchanged in KOH. Subicular hyphae thin- to slightly thick-walled with a wide lumen, occasionally branched at an angle of 90 °, straight, interwoven, 2–4 µm in diam. Tramal hyphae thin- to slightly thick-walled with a wide lumen, covered with large, rhombic or irregular crystals and encrusted with small crystals, frequently branched, straight, subparallel along the tubes, agglutinated, 2.5–4 µm in diam. Hymenial cystidia present, clavate, thin-walled, smooth, sometimes with a septum at apex, 22–32 × 6–7 µm; cystidioles absent. Basidia clavate, with four sterigmata and a basal clamp connection, 12–13.5 × 3–3.5 µm; basidioles of similar shape to basidia, but smaller. Basidiospores narrowly allantoid, hyaline, thin-walled, smooth, IKI−, CB−, (3.7–)3.8–4.2 × (0.7–)0.8–1(–1.1) µm, L = 3.98 µm, W = 0.94 µm, Q = 4.22 (n = 30/1).

Known distribution – Southern China.

Material examined – China. Hainan Province, Lingshui County, Hainan Tropical Rainforest National Park, Diaoluoshan, on rotten angiosperm wood, 1 Apr. 2021, Dai 22221 (BJFC036812, holotype).

Notes – *Gloeoporus septatus* is characterized by resupinate basidiomata with a pale pinkish pore surface when fresh, generative hyphae with clamp connections, encrusted tramal hyphae, thin-walled, smooth hymenial cystidia sometimes with a septum at apex, narrowly allantoid basidiospores measuring 3.8–4.2 × 0.8–1 µm, and growth on angiosperm wood in southern China.

*Gloeoporus septatus*, *G. hainanensis* Yuan Yuan & Jia J. Chen, *G. pannocinctus* (Romell) J. Erikss. and *G. thelephoroides* share a light-colored pore surface and allantoid basidiospores. However, *G. hainanensis* and *G. thelephoroides* have resupinate to effused-reflexed or pileate basidiomata, generative hyphae with simple septa, and hymenial cystidia are absent (Yuan et al. 2016, Cunningham 1965); *G. pannocinctus* has smaller pores (6–8 per mm vs. 5–6 per mm) and a distinct dark resinous line between the tubes and the subiculum (Eriksson 1958, Ryvarden & Gilbertson 1993).

*Gloeoporus cremeoalbus* Corner and *G. septatus* share almost the same size of basidiospores (3–4.2 × 0.8–1 µm in *G. cremeoalbus*; 3.8–4.2 × 0.8–1 µm in *G. septatus*, Hattori 2001), however, the former has effused-reflexed basidiomata and a dimitic hyphal system.

In our phylogenetic analyses, *Gloeoporus septatus* forms an independent lineage nested in *Gloeoporus* (Figs 1, 2).

***Gloeoporus variiformis*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 5d-e, 19

Index Fungorum number: IF 901079; Facesoffungi number: FoF14830

Etymology – "*variiformis*" (Lat.): refers to the species having variable cystidia.

Basidiomata annual, resupinate to effused-reflexed, soft, without odor or taste when fresh, becoming soft corky to fragile upon drying, up to 15 cm long, 4 cm wide when resupinate; pilei flabelliform, projecting up to 0.5 cm, 1 cm wide and 2 mm thick at base. Pileal surface buff to yellowish, velutinous, azonate when dry; margin obtuse. Pore surface brownish vinaceous, orange-brown to black when dry; sterile margin distinct, cream to buff when dry, up to 1.5 mm wide; pores round to angular, 9–10 per mm; dissepiments thick, entire. Context buff, soft corky when dry, up to 1 mm thick. Tubes concolorous with pore surface, soft corky to fragile when dry, up to 1 mm long.

Hyphal system monomitic; generative hyphae with clamp connections, hyaline, smooth, IKI−, CB+; tissues becoming dark in KOH. Contextual hyphae thick-walled, moderately branched at an angle of 90 °, straight, interwoven, 3–4 µm in diam. Tramal hyphae thin-walled, covered with large, rhombic or irregular crystals, occasionally branched, straight, subparallel along the tubes, agglutinated, 2–3 µm in diam. Hymenial cystidia present, clavate, fusiform to pyriform, thin-walled, smooth, 20–25 × 4.5–7 µm; cystidioles absent. Basidia clavate, with four sterigmata and a basal clamp connection, 12–13 × 3–4 µm; basidioles of similar shape to basidia, but smaller. Basidiospores narrowly allantoid, hyaline, thin-walled, smooth, IKI−, CB−, (3.6–)3.8–4.2 × 0.8–1 µm, L = 3.96 µm, W = 0.95 µm, Q = 4.06–4.34 (n=90/3).

Known distribution – Tropical regions of Asia.

Material examined – China. Hainan Province, Lingshui County, Hainan Tropical Rainforest National Park, Diaoluoshan, on rotten angiosperm wood, 1 Apr. 2021, Dai 22225 (BJFC036816, holotype); Yunnan Province, Mengla County, Shangyong Nature Reserve, on rotten angiosperm wood, 20 Aug. 2019, Dai 20655 (BJFC032322). Malaysia, Selangor, Forest Research Institute of Malaysia, on rotten angiosperm wood, 15 Apr. 2018, Dai 18568 (BJFC026857).

Notes – *Gloeoporus variiformis* is characterized by resupinate to effused-reflexed basidiomata, a brownish vinaceous, orange-brown to black pore surface when dry, variable hymenial cystidia, narrowly allantoid basidiospores, 3.8–4.2 × 0.8–1 µm, and growth on angiosperm wood in tropical regions of Asia.

*Gloeoporus variiformis* and *G. orientalis* are phylogenetically related (Figs 1, 2), and share resupinate to effused-reflexed basidiomata with the brownish vinaceous, orange-brown to black

pore surface when dry. However, the latter has wider contextual hyphae (4–6.3 µm vs. 3–4 µm), an absence of hymenial cystidia and shorter basidiospores (3–3.6 × 0.6–0.8 µm vs. 3.8–4.2 × 0.8–1 µm, Jung et al. 2018). In addition, *Gloeoporus variiformis* forms an independent lineage nested in *Gloeoporus* (Figs 1, 2).

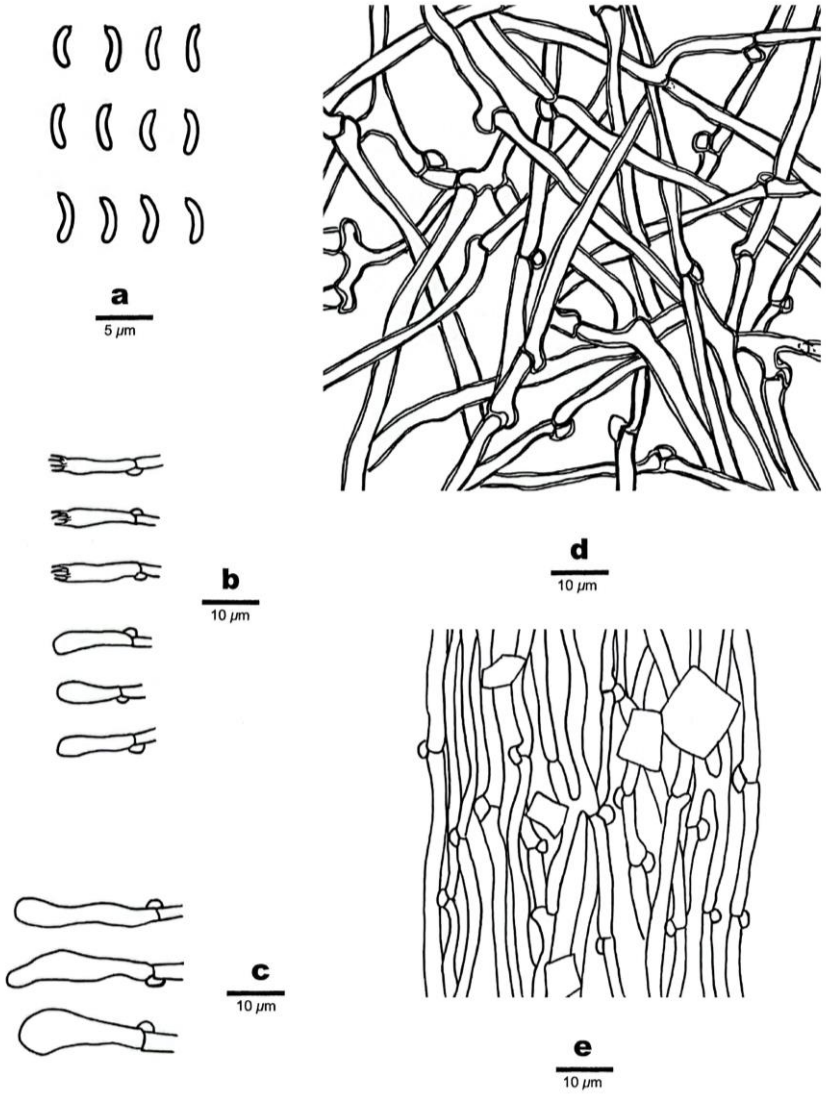


**Figure 19** – Microscopic structures of *Gloeoporus variiformis* (drawn from the holotype, Dai 22225). a Basidiospores. b basidia and basidioles. c hymenial cystidia. d hyphae from context. e hyphae from trama. Scale bars: a = 5 µm, b–e = 10 µm.

*Gloeoporus croceopallens* Bres. was described from Indonesia (Ryvarden & Johansen 1980) and differs from *G. variiformis* by a white to cream pileal surface, the absence of any cystidia and smaller basidiospores (2.4–3.2 × 0.4–0.8 µm vs. 3.8–4.2 × 0.8–1 µm, Ryvarden & Johansen 1980).

*Gloeoporus nigrescens* Corner and *G. umbrinus* Corner were described from Malaysia and share a dark pore surface and small pores (7–12 per mm in *G. nigrescens*; 8–11 per mm in *G. umbrinus*, Corner 1989). However, they have ellipsoid basidiospores (3.7–4.5 × 2.3–3 µm in *G. nigrescens*; 3–3.7 × 2.3–2.7 µm in *G. umbrinus*) and lack cystidia (Corner 1989).

*Gloeoporus friabilis* Corner, *G. hispidus* Corner, *G. similis* Corner, *G. subochraceus* Corner and *G. sulphureus* Corner were also described from Malaysia, and have effused-reflexed to pileate

basidiomata. However, the former four species have ellipsoid or subglobose basidiospores (3.5–4 × 2.7–3 µm in *G. friabilis*; 4–5 × 2.5–3 µm in *G. hispidus*; 4–4.5 × 3–3.5 µm in *G. similis*; 4–5 × 2.7–3.3 µm in *G. subochraceus* vs. 3.8–4.2 × 0.8–1 µm, Corner 1989, Hattori 2001), which are different from that of *G. variiformis*. In addition, *G. friabilis*, *G. hispidus*, *G. subochraceus* were combined into *Tyromyces*, and the type specimen of *G. similis* was probably lost (Hattori 2001). *Gloeoporus sulphureus* and *G. variiformis* share small pores (7–9 per mm in *G. sulphureus*; 9–10 per mm in *G. variiformis*, Hattori 2001), almost the same size of basidiospores (3.5–4.5 × 0.8–1.2 µm in *G. sulphureus*; 3.8–4.2 × 0.8–1 µm, Hattori 2001). However, the former has a grayish orange pileal surface when dry, a light orange pore surface when dry, the absence of cystidia and 2-sterigmate basidia (Hattori 2001). Hattori (2001) considered that *Gloeoporus papuanus* Corner as a synonymy of *G. dichrous*, but the size of basidiospores was recorded as 3–3.5 µm in original description resembling *Bjerkandera* (Corner 1989).

***Meruliopsis*** Bondartsev, in Parmasto, Izv. Akad. Nauk Estonsk. SSR, Ser. Bio l. 8: 274 (1959).

Type species – *Meruliopsis taxicola* (Pers.) Bondartsev, in Parmasto, Eesti NSV Tead. Akad. Toim., Biol. seer 8(4): 274 (1959).

Basidiomata annual, resupinate to effused-reflexed, soft to slightly ceraceous when fresh, becoming fragile, soft corky to slightly leathery upon drying. Hymenophore poroid to irpicoid. Pileal surface white to gray when fresh, floccose. Pore surface white, cream, pinkish to purple when fresh, becoming clay buff, fawn to brownish vinaceous upon drying. Hyphal system monomitic; generative hyphae simple-septate, thin- to thick-walled, frequently covered with crystals and an oily substance. Hymenial cystidia present in some species. Basidiospores cylindrical, oblong-ellipsoid to allantoid, hyaline, thin-walled, smooth, IKI−, CB−. Causing a white rot.

Notes – *Meruliopsis* is very similar to *Ceriporia* except that the latter lacks cystidia in most species. We excluded the species that were combined into other genera, so far 15 species of *Meruliopsis* are recorded in Index Fungorum (http://www.indexfungorum.org/), and twelve species have DNA sequences available (Supplementary Table 1). *Meruliopsis ambigua* (Berk.) Ginns has oblong to ovoid basidiospores (5.6–7.2 × 2.2–2.8 µm). It was combined into *Meruliopsis* by Ginns (1976), then transferred to *Gloeoporus* by Zmitrovich & Spirin (Zmitrovich et al. 2006). However, the latter just a treatment without related discussion. Thus, we consider it is a species of *Meruliopsis* based on the description by Ginns (1976). So, all 15 species of *Meruliopsis* are good species in Supplementary Table 1. In this study, three new species are described and illustrated.

***Meruliopsis bambusicola*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 5f, 20

Index Fungorum number: IF 901080; Facesoffungi number: FoF14831

Etymology – "*bambusicola*" (Lat.): refers to the species growing on bamboo.

Basidiomata annual, resupinate, soft, without odor or taste when fresh, becoming corky upon drying, up to 15 cm long, 3 cm wide, and 0.2 mm thick at center. Pore surface cream to pinkish buff when fresh and dry; sterile margin cream when fresh and dry, up to 5 mm wide; pores angular, 4–5 per mm; dissepiments slightly thick, entire. Subiculum cream, soft corky when dry, up to 0.1 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.1 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, smooth, IKI−, CB−; tissues unchanged in KOH. Subicular hyphae hyaline, thin- to slightly thick-walled with a wide lumen, sometimes covered with rhombic or irregular hyaline crystals, frequently branched at an angle of 90 °, more or less straight, interwoven, 4–6 µm in diam. Tramal hyphae thin- to slightly thick-walled with a wide lumen, sometimes covered with rhombic or irregular hyaline crystals, frequently branched, straight to slightly flexuous, interwoven, agglutinated, 2.5–4 µm in diam. Cystidia and cystidioles absent. Basidia clavate to more or less pyriform, with four sterigmata and a simple basal septum, 14–16 × 4–4.5 µm; basidioles of similar shape to basidia, but smaller. Basidiospores oblong-ellipsoid to slightly curved, hyaline, thin-walled, smooth, IKI−, CB−, 3.8–4.2(–4.3) × 1.8–2(–2.1) µm, L = 4.02 µm, W = 1.95 µm, Q = 2.06 (n = 30/1).

Known distribution – Southern China.

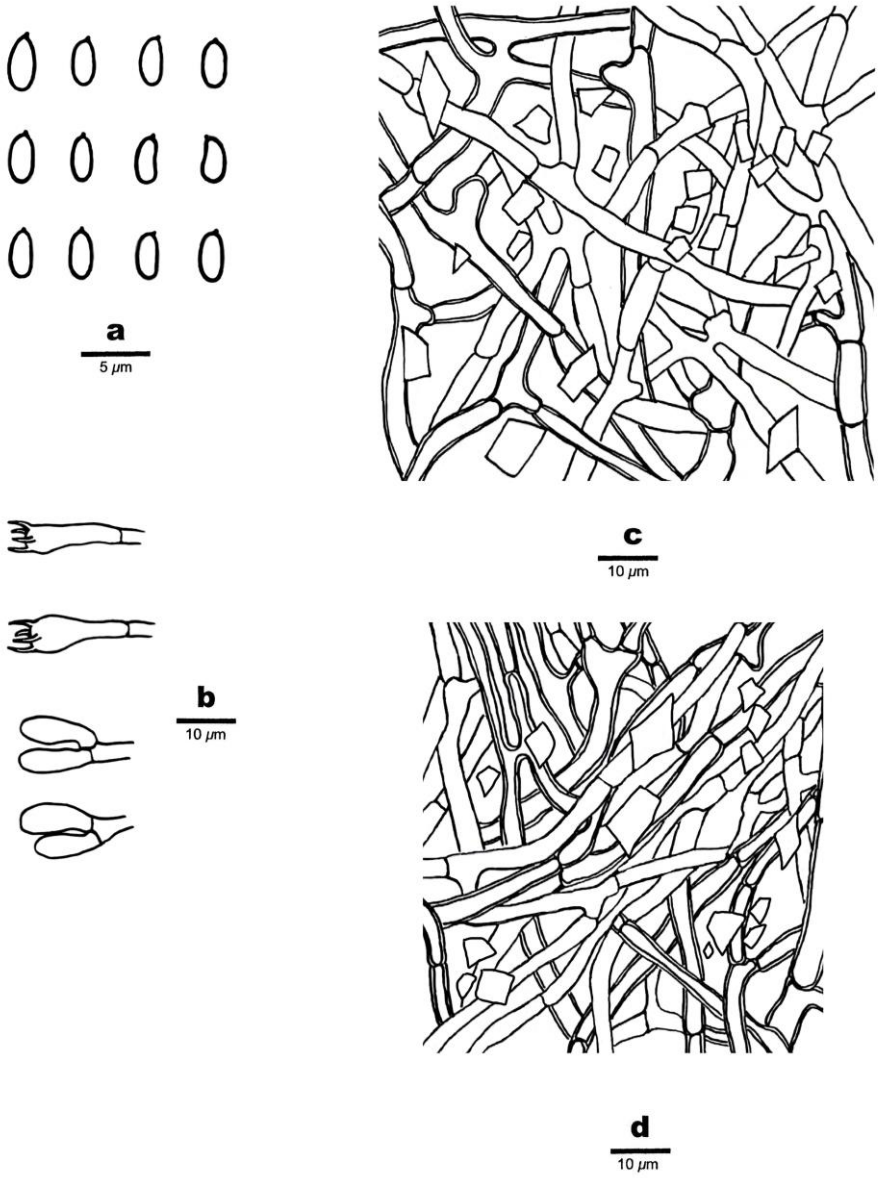


**Figure 20** – Microscopic structures of *Meruliopsis bambusicola* (drawn from the holotype, Dai 21944). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 μm, b–d = 10 μm.

Material examined – China. Hainan Province, Haikou, Jinniuling Park, on dead *Phyllostachys*, 7 Nov. 2020, Dai 21944 (BJFC035843, holotype).

Notes – *Meruliopsis bambusicola* is characterized by resupinate basidiomata with a cream to pinkish buff pore surface when fresh, very shallow pores of 4–5 per mm, interwoven tramal hyphae, oblong-ellipsoid to slightly curved basidiospores, 3.8–4.2 × 1.8–2 μm, and growth on bamboo in southern China.

*Meruliopsis bambusicola* and *M. crassitunicata*, *M. parvispora* C.C. Chen & Sheng H. Wu share a white to cream pore surface when fresh and the absence of cystidia. However, *M. crassitunicata* has lacerate to dentate dissepiments and distinct thick-walled subicular hyphae (Dai et al. 2002); *M. parvispora* has smaller pores (5–7 per mm vs. 4–5 per mm), narrower subicular hyphae (2–4 μm in diam. vs. 4–6 μm in diam.) and smaller basidiospores (2.5–3×1–1.5 μm vs. 3.8–4.2 × 1.8–2 μm, Chen et al. 2020). In addition, these three species form three independent lineages in *Meruliopsis* (Figs 1, 2).

***Meruliopsis marginata*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 5g, 21

Index Fungorum number: IF 901081; Facesoffungi number: FoF14832

Etymology – "*marginata*" (Lat.): refers to the species having a distinct sterile margin.

Basidiomata annual, resupinate, soft, without odor or taste when fresh, becoming soft corky upon drying, up to 12 cm long, 4 cm wide, and 0.4 mm thick at center. Pore surface pinkish buff to straw-colored when fresh, becoming clay buff, cinnamon to fawn upon drying; sterile margin white when fresh, cream to fawn when dry, up to 0.5 mm wide; pores round to slightly sinuous, 4–6 per mm; dissepiments thick, entire. Subiculum cream, soft corky when dry, up to 0.2 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.2 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, CB−; tissues becoming blackish in KOH. Subicular hyphae thin- to thick-walled with a wide lumen, abundantly covered with irregular hyaline crystals, occasionally branched at an angle of 90 °, straight to slightly flexuous, interwoven, 4–6 µm in diam. Tramal hyphae thin- to slightly thick-walled with a wide lumen, abundantly covered with large, irregular, pale orange or yellowish crystals and an oily substance, sometimes encrusted with fine crystals, frequently branched, straight to slightly flexuous, subparallel along the tubes, agglutinated, 3.5–5 µm in diam. Cystidia and cystidioles absent. Basidia clavate to more or less pyriform, with four sterigmata and a simple basal septum, 14–18 × 4–5 µm; basidioles of similar shape to basidia, but smaller. Basidiospores allantoid, hyaline, thin-walled, smooth, IKI−, CB−, (3.7–)3.8–4.5(–5) × (1.2–)1.3–1.7(–1.8) µm, L = 4.10 µm, W = 1.49 µm, Q = 2.68–2.82 (n = 90/3).

Known distribution – Northern China.

Material examined – China. Hebei Province, Xinglong County, Wulingshan Nature Reserve, on fallen trunk of *Populus* sp., 29 Jul. 2009, Cui 6878 (BJFC005365, holotype); Heilongjiang Province, Huma County, Nanwonghe Nature Reserve, on fallen trunk of *Populus* sp., 27 Aug. 2014, Dai 14737 (BJFC017854); Yichun, Liangshui Nature Reserve, on fallen gymnosperm trunk, 26 Aug. 2014, Cui 11626 (BJFC016821).

Notes – *Meruliopsis marginata* is characterized by resupinate basidiomata with a cinnamon to fawn pore surface when dry, distinct white sterile margin when fresh, round to slightly sinuous pores, 4–6 per mm, the absence of cystidia, allantoid basidiospores, 3.8–4.5 × 1.3–1.7 µm, and growth on both angiosperm and gymnosperm wood in northern China.

*Meruliopsis marginata* is morphologically similar and phylogenetically related to *M. cystidiata* (Ryvarden) P.E. Jung & Y.W. Lim, *M. pseudocystidiata* and *M. albostramineus* (Torrend) Jülich & Stalpers (Figs 1, 2). However, the latter three have hymenial cystidia (Ginns 1976, Hjortstam & Ryvarden 2004, Jia et al. 2014). In addition, these four species form four independent lineages in *Meruliopsis* (Figs 1, 2).

***Meruliopsis rosea*** Y.C. Dai, Chao G. Wang & Yuan Yuan, sp. nov. Figs 5h, 22

Index Fungorum number: IF 901082; Facesoffungi number: FoF14833

Etymology – "*rosea*" (Lat.): refers to the species having a rose pink hymenophore when fresh.

Basidiomata annual, resupinate, ceraceous, without odor or taste when fresh, becoming soft corky upon drying, up to 8 cm long, 3.5 cm wide, and 0.4 mm thick at center. Hymenophore poroid to irpicoid, rose pink to lilac when fresh, buff to clay buff with age, becoming buff to clay buff upon drying; sterile margin lilac to cream when fresh, buff when dry, thinning out, up to 0.2 mm wide; pores round, sometimes slightly elongated, 5–7 per mm; dissepiments thick, lacerate. Subiculum cream, soft corky when dry, up to 0.2 mm thick. Tubes concolorous with pore surface, soft corky when dry, up to 0.2 mm long.

Hyphal system monomitic; generative hyphae simple-septate, hyaline, IKI−, CB−; tissues unchanged in KOH. Subicular hyphae hyaline, thin- to slightly thick-walled with a wide lumen, covered with large, irregular hyaline crystals, sometimes encrusted with fine crystals and an oily substance, occasionally branched at an angle of 90 °, straight, interwoven, 4–6 µm in diam. Tramal hyphae thin-walled with a wide lumen, abundantly covered with large, irregular, pale orange

crystals and an oily substance, encrusted with fine crystals, frequently branched, straight, subparallel along the tubes, agglutinated, 3–4 µm in diam; hyphae at dissepiment edge usually encrusted with fine crystals and an oily substance. Cystidia and cystidioles absent. Basidia clavate to more or less pyriform, with four sterigmata and a simple basal septum, 15–26 × 5 µm; basidioles of similar shape to basidia, but smaller. Basidiospores oblong-ellipsoid, some slightly curved, hyaline, thin-walled, smooth, IKI−, CB−, (4.5–)4.8–5.1 × (2–)2.1–2.6 µm, L = 4.90 µm, W = 2.35 µm, Q = 2.10 (n = 30/1).

Known distribution – Australia.

Material examined – Australia, Victoria, Yarra Ranges National Park, on charred wood of *Eucalyptus* sp., 10 May 2018, Dai 18640A (BJFC027109, holotype).

Notes – *Meruliopsis rosea* is characterized by resupinate basidiomata with a rose pink to lilac hymenophore when fresh, round to slightly elongated pores of 5–7 per mm, the absence of cystidia, long basidia measuring 15–26 × 4.5–5 µm, oblong ellipsoid basidiospores measuring 4.8–5.1 × 2.1–2.6 µm, and growth on charred wood of *Eucalyptus* sp. in Australia.

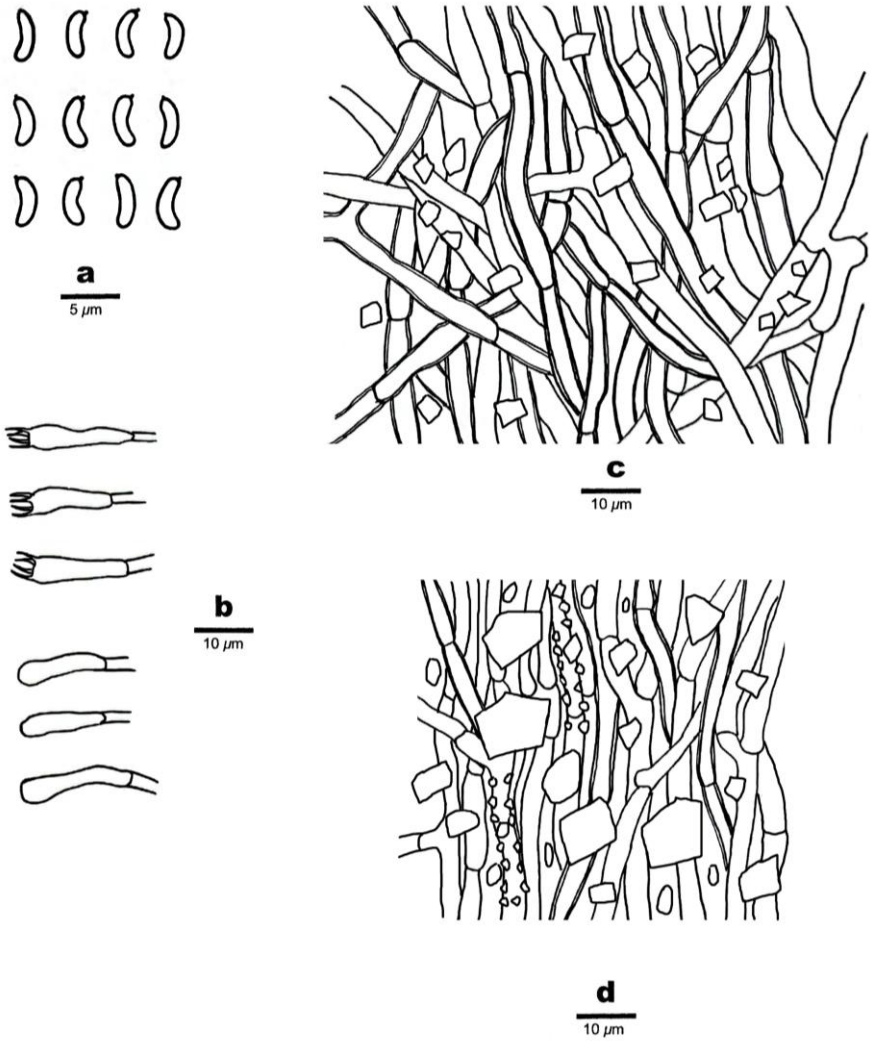


**Figure 21** – Microscopic structures of *Meruliopsis marginata* (drawn from the holotype, Cui 6878). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. Scale bars: a = 5 µm, b–d = 10 µm.

*Meruliopsis rosea*, *M. cystidiata* (Ryvarden) P.E. Jung & Y.W. Lim, *M. miniata* (Wakef.) Ginns and *M. nanlingensis* share lilac to violet pore surface when fresh. However, the latter three

have hymenial cystidia. *Meruliopsis taxicola* is similar to *M. rosea* by purplish or reddish pore surface and the absence of cystidia, but the former has narrower basidiospores (4.5–6 × 1–1.5 µm vs. 4.8–5.1 × 2.1–2.6 µm, Ryvarden & Gilbertson 1993). In addition, *Meruliopsis rosea* forms an independent lineage in *Meruliopsis* (92% ML, 1.00 BPP, Fig. 1; 100% ML, 1.00 BPP, Fig. 2).

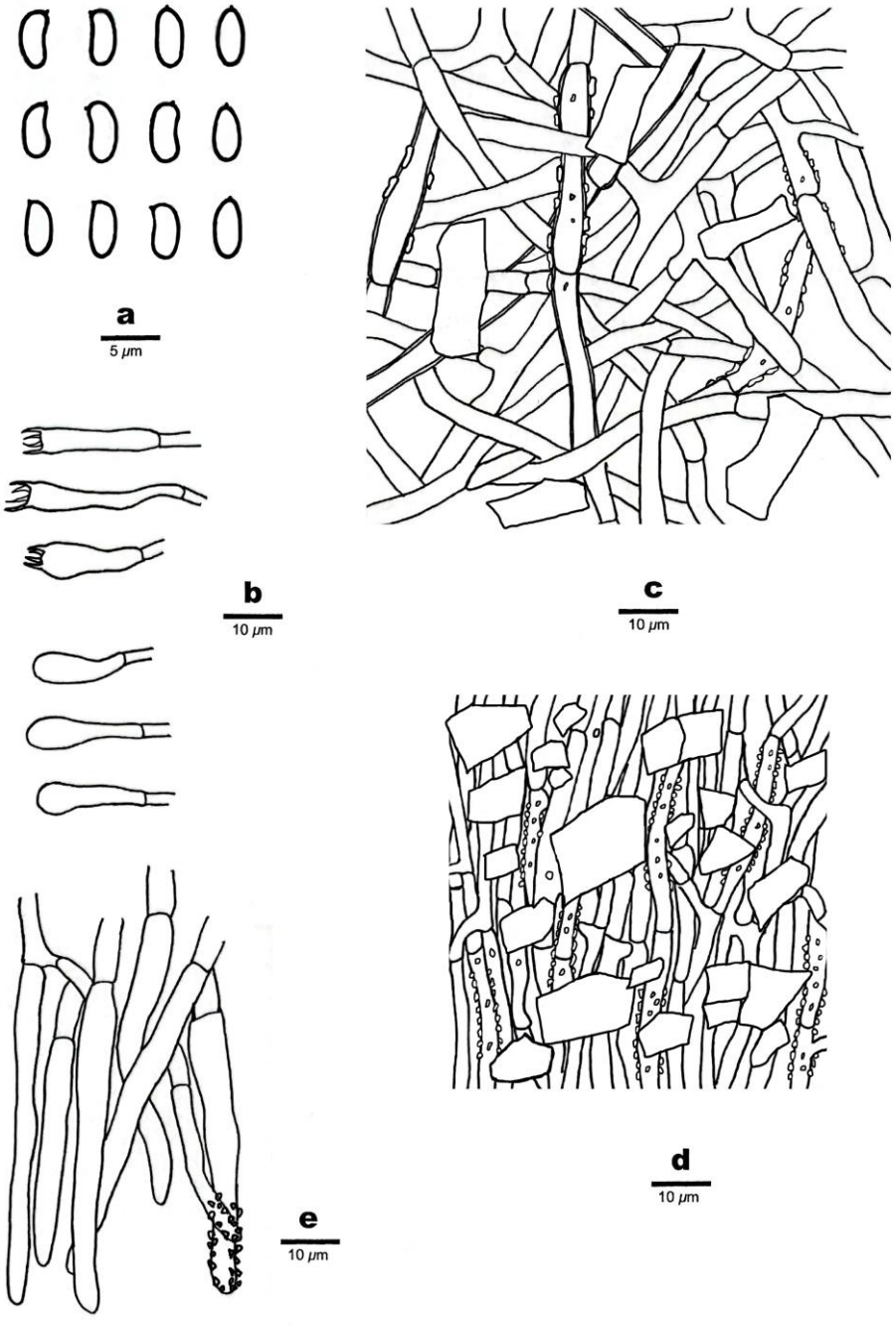


**Figure 22** – Microscopic structures of *Meruliopsis rosea* (drawn from the holotype, Dai 18640A). a Basidiospores. b basidia and basidioles. c hyphae from subiculum. d hyphae from trama. e swollen hyphae at the dissepiment edge. Scale bars: a = 5 µm, b–e = 10 µm.

**Combinations**

The three species, *Candelabrochaete septocystidia* (Burt) Burds., *C. langloisii* (Pat.) Boidin, *Phanerochaete allantospora* Burds. & Gilb., nested in *Ceriporia* in our phylogenies although they all have smooth hymenophores (Figs 1, 2). So, we propose the following new combinations:

***Ceriporia allantospora*** (Burds. & Gilb.) Y.C. Dai, Chao G. Wang & Yuan Yuan, comb. nov.
Index Fungorum number: IF 901083; Facesoffungi number: FoF14834
Basionym – *Phanerochaete allantospora* Burds. & Gilb., Mycologia 66(5): 780 (1974).

***Ceriporia langloisii*** (Pat.) Y.C. Dai, Chao G. Wang & Yuan Yuan, comb. nov.
Index Fungorum number: IF 901084; Facesoffungi number: FoF14835
Basionym – *Hypochnus langloisii* Pat., Bull. Soc. mycol. Fr. 24(1): 3 (1908).
≡ *Candelabrochaete langloisii* (Pat.) Boidin, Cahiers de La Maboké 8: 24 (1970).

***Ceriporia septocystidia*** (Burt) Y.C. Dai, Chao G. Wang & Yuan Yuan, comb. nov.
Index Fungorum number: IF 901085; Facesoffungi number: FoF14836
Basionym – *Peniophora septocystidia* Burt, Ann. Mo. bot. Gdn 12: 260 (1926).
≡ *Candelabrochaete septocystidia* (Burt) Burds., Mycotaxon 19: 392 (1984).

Notes – *Candelabrochaete langloisii*, *C. septocystidia* and *Phanerochaete allantospora* nested in the *Ceriporia* clade in our phylogenetic analyses, which is consistent with previous studies (Justo et al. 2017, Chen et al. 2020, 2021). *Candelabrochaete* Boidin was originally described by Boidin (1970), and the type species, *C. africana* Boidin, formed an independent lineage in the phlebioid clade (Irpicaceae, Meruliaceae, Phanerochaetaceae) of the Polyporales. Traditionally, the genus is characterized by resupinate basidiomata with a smooth to odontoid hymenophore, a monomitic hyphal system, thin- to thick-walled generative hyphae with simple septa, cylindrical cystidia, and ellipsoid to allantoid basidiospores (Eriksson et al. 1981, Maekawa 2021). *Candelabrochaete langloisii* has a smooth hymenophore, narrowly clavate to cylindrical cystidia, and broadly sub-allantoid basidiospores measuring 7–9.5 × 3–4 µm (Burdsall 1984, Maekawa 1999, Hjortstam & Ryvarden 2007). *Candelabrochaete septocystidia* has a corticoid hymenophore, cylindrical pseudocystidia, allantoid basidiospores measuring 4.5–6.5 × 1.5–2 µm, and is usually distributed in northern temperate regions, which distinguishes it from other species in this genus (Burdsall 1984). *Phanerochaete allantospora* was described from Arizona, USA, and has a smooth to slightly tuberculate hymenophore, cylindric cystidia, and allantoid basidiospores measuring 10–11.5 × 2.5–3 µm/9–14 × 2.5–3.5 µm (Burdsall & Gilbertson 1974, Gilbertson et al. 1976). In addition, the sequence of *P. allantospora* is from the holotype, so its identity is clear. In the phylogenetic analyses, *Candelabrochaete septocystidia* is closely related to *Ceriporia griseoviolascens* and *Phanerochaete allantospora* (Figs 1, 2); *Candelabrochaete langloisii* is closely related to *Ceriporia reticula* and *C. orientalis* (Figs 1, 2). Thus, three new combinations, *Ceriporia allantospora*, *C. langloisii*, *C. septocystidia*, are proposed in this study.

We amend the definition of *Ceriporia* as follows:

Basidiomata annual, resupinate to rarely effused-reflexed, soft to waxy when fresh, becoming fragile, soft corky to slightly leathery upon drying. Hymenophore poroid to smooth, variable in color. Hyphal system monomitic; generative hyphae with simple septa, thin- to thick-walled, CB− or weakly CB+, in most species covered with crystals and an oily substance. Cystidia absent in most species. Basidiospores cylindrical, ellipsoid, oblong ellipsoid to allantoid, hyaline, thin-walled, smooth, IKI−, CB− or weakly CB+. Causing a white rot.

## Discussion

Irpicaceae is one of three families in the phlebioid clade (Binder et al. 2013, Justo et al. 2017, Chen et al. 2020) including species with a poroid, irpicoid or corticioid hymenophore. In the present study, phylogenetic analyses using the 2-gene sequences (Fig. 1) and the 5-gene sequences (Fig. 2) based on specimens of *Ceriporia*, *Gloeoporus* and *Meruliopsis* from Asia and Oceania demonstrated that resupinate, effused-reflexed to pileate polypores with a monomitic hyphal structure, crystals and an oily substance belong to the Irpicaceae. In addition, based on phylogenetic analyses, we have studied some morphologically confusing species belonging to these three genera.

In our phylogenetic analyses, four distinct groups are nested: the *Ceriporia mellita* group, the *Ceriporia pierii* group, the *Ceriporia purpurea* group and the *Ceriporia viridans* group. The *Ceriporia mellita* group with *C. allantoidea*, *C. macrospora* and *C. mellita*, and these species share resupinate basidiomata with a cream, buff, fawn to reddish brown pore surface, almost uniform hyphae in subiculum and trama, and allantoid basidiospores less than 2 µm in width. The *Ceriporia pierii* group contains six species, viz., *C. daedaleoides*, *C. humilis*, *C. mpurii*, *C. pierii*, *C. sericea*, *C. sordescens*, and these species have resupinate basidiomata with a white, cream, gray, yellowish, pale ochraceous pore surface, a rhizomorphic margin (except *C. daedaleoides*), subicular hyphae wider than tramal hyphae, the presence of fan-shaped, rhombic or corolliform crystals, and ellipsoid, narrowly ellipsoid to cylindrical basidiospores wider than 2 µm. The *Ceriporia purpurea* group encompasses six species, viz., *C. bresadolae* (Bourdot & Galzin) Donk, *C. manzanitae* Spirin & Vlasák, *C. occidentalis* Spirin & Vlasák, *C. purpurea*, *C. torpida* Spirin & Miettinen, and *C. triumphalis* Spirin & Kout; species in this group have resupinate to rarely effused-reflexed basidiomata with a pinkish, purple to bright brick-red pore surface, a floccose sterile margin, almost uniform hyphae in subiculum and trama, the presence of cystidioles in some species, and short cylindrical to allantoid basidiospores mostly longer than 5 µm. The *Ceriporia viridans* group includes eight species, viz., *C. aurantiocarnescens*, *C. eucalypti*, *C. excelsa* Parmasto, *C. gossypinum*, *C. sino-viridans*, *C. subbadia*, *C. subviridans*, and *C. viridans*; these species share resupinate basidiomata with a cream, cinnamon buff, pinkish, lilac to apricot orange pore surface, subicular hyphae wider than tramal hyphae, hyphae frequently branched at an angle of 90 °, and oblong-ellipsoid, short cylindrical to allantoid basidiospores mostly wider than 1.5 µm.

The following four species were addressed in *Ceriporia*: *C. alachuana* (Murrill) Hallenb. *C. cystidiata* Ryvarden & Iturr., *C. mellea* (Berk. & Broome) Ryvarden, and *C. sulphuricolor* Bernicchia & Niemelä, but they did not nest in the *Ceriporia* clade of previous studies (Miettinen et al. 2016, Justo et al. 2017, Chen et al. 2020, 2021). *Ceriporia alachuana*, nested in *Hydnophlebia* Parmasto, belongs to the Meruliaceae, and was combined into *Hydnophlebia alachuana* (Chen et al. 2021). *Ceriporia cystidiata* was originally described from Venezuela and is characterized by a white to pale cream pore surface, hymenial cystidia with apical crystals and allantoid basidiospores measuring 4–4.5 × 1 µm (Ryvarden & Iturriaga 2003). Permpornsakula et al. (2016) recorded *C. cystidiata* from Thailand, but the representative sample (PBU 0048) nested in *Irpex laceratus* in phylogeny (Chen et al. 2021, this study). We studied the type specimen of *C. cystidiata* (Ryvarden 35169) and it differs from *I. laceratus* because the latter has bigger pores of 2–6 per mm, and oblong-ellipsoid to ellipsoid basidiospores measuring 4.2–5 × 2.5–3 µm (Suhara et al. 2003). Thus, the Thai sample (PBU 0048) may represent *Irpex laceratus* rather than *C. cystidiata*. Unfortunately, we did not obtain sequences from the type specimen of *Ceriporia cystidiata*, and its phylogenetic position is uncertain. *Ceriporia mellea* was combined as *Phanerina mellea* (Berk. & Broome) Miettinen (Miettinen et al. 2016), and the species is characterized by a yellowish cream to brownish yellow pore surface, shallow pores, 2–4 per mm, subulate hymenial cystidia and cylindrical to narrowly ellipsoid basidiospores measuring 5.8–7.5 × 2.9–3.8 µm. *Ceriporia sulphuricolor* was described from Italy (Bernicchia & Niemelä 1998). In the previous study, the sample Dai 6090 was regarded as *C. sulphuricolor* (Jia et al. 2014), but El-Gharabawy et al. (2021) obtained the sequence (GenBank: MW508516) from the type material (HUBO 6591) and confirmed it nested together with two specimens of *C. alachuana* (now *Hydnophlebia alachuana*) in phylogeny. Morphologically, these two taxa have no distinct differences, so, we consider *C. sulphuricolor* to be a synonym of *H. alachuana*.

We study two Chinese specimens of *Ceriporia excelsa*, and is characterized by resupinate basidiomata with buff, honey yellow to reddish orange pore surface, round to angular, big pores, 3–4 per mm, subicular hyphae wider than tramal hyphae (5–8 µm in diam. vs. 3–4.5 µm in diam.), sometimes covered with large, rhombic or irregular crystals among the subiculum and tube trama, long basidia (17–18 × 4.5–5.5 µm) and lunate to short cylindric and moderately curved basidiospores, 3.6–4.2 × 2–2.2 µm, and mostly growth on angiosperm wood in Asia, Europe and America (Ryvarden & Melo 2017).

*Leptoporus mollis* (Pers.) Quél. as the type species of *Leptoporus* Quél. has effused-reflexed to pileate basidiomata, a poroid hymenophore, an ochraceous, whitish pink to purplish brown pileal surface, white, a pale reddish purple to dark purplish brown pore surface, round to angular pores of 3–4 per mm, and cylindric to allantoid basidiospores measuring 4.9–6 × 2–2.3 µm (Ryvarden & Melo 2017). Although *Leptoporus mollis* and *L. submollis* B.K. Cui & Shun Liu nested in the *Ceriporia* clade, they are only distantly related to any other taxa of *Ceriporia* (Figs 1, 2). In addition, *Leptoporus* and *Ceriporia* are similar in morphology, and share a monomitic hyphal system, simple-septate generative hyphae, the absence of cystidia and cylindric to allantoid basidiospores. However, most species of *Ceriporia* have resupinate basidiomata, the hyphae branched at a right angle, subicular hyphae are wider than tramal hyphae, and they are associated with a white rot. Now, two species are in *Leptoporus*, *L. mollis* and *L. submollis*, which have available DNA sequences. They have effused-reflexed to pileate, but rarely resupinate basidiomata, almost uniform hyphae in context and trama, the presence of gloeoplerous hyphae, and cause a brown rot (Ryvarden & Melo 2017, Liu et al. 2023). So, we keep this name rather than proposing to combine them in *Ceriporia*.

*Meruliopsis* is very confused with *Ceriporia* morphologically except the former sometimes has effused-reflexed basidiomata and hymenial cystidia. However, they form two independent clades in the Irpicaceae (Figs 1, 2). *Meruliopsis ambigua* (Berk.) Ginns, *M. bella* (Berk. & M.A. Curtis) Ginns and *M. miniata* are addressed in *Meruliopsis* in Index Fungorum but without available DNA sequences. *Meruliopsis ambigua* was combined by Ginns in 1976, and has effused-reflexed basidiomata, dark purple to violet-brown pore surface, big pores of 1–3 per mm, the absence of cystidia and oblong to ovoid basidiospores measuring 5.6–7.2 × 2.2–2.8 µm (Ginns 1976). *Meruliopsis bella* was redescribed from the USA (Ginns 1971), and has resupinate basidiomata with white rhizomorphs, a pallid to pale ochraceous pore surface, oval to round pores of 2–4 per mm, cylindrical cystidia, oval to ellipsoid basidiospores measuring 4–5 × 2–2.5 µm and is associated with a white rot (Ginns 1971). *Meruliopsis miniata* is known from New Zealand and Australia, and has a reddish to somewhat vinaceous pore surface, oval to round pores of 2–3 per mm, cylindrical to slenderly clavate gloeocystidia, and cylindrical to allantoid basidiospores measuring 4.5–6.5 × 1.5–2 µm (Ginns 1976). So, they are morphologically different from our three new species of *Meruliopsis.*

*Meruliopsis* was previously considered a synonym of *Gloeoporus* because the type species, *M. taxicola*, was placed in *Gloeoporus* (Ryvarden & Gilbertson 1980, Coelho *et al.* 2006, Ryvarden & Melo 2017), but phylogenetically, *M. taxicola* is only distantly related to *Gloeoporus* (Figs 1, 2).

*Byssomerulius* Parmasto was treated as a synonym of *Meruliopsis* because the type species of *Byssomerulius* (*B. corium*) and *Meruliopsis* (*M. taxicola*) were regarded as congeneric by culture study (Ginns 1976). However, *Byssomerulius* is now accepted as an independent genus (Spirin & Zmitrovich 2004, Zmitrovich et al. 2006, Zmitrovich 2018), and it is phylogenetically distantly related to *Meruliopsis*.

In the dating analyses, we estimated the divergence times of studied taxa by using stem ages, as stated in Zhao et al. (2017). The divergence times of the Polyporales (Irpicaceae) with a mean stem age of 169.1 Mya occurred during the Middle Jurassic. Our result is consistent with the divergence time ranges of orders proposed by Zhao et al. (2017) and Ji et al. (2022). *Ceriporia*, *Gloeoporus* and *Meruliopsis* are estimated to have emerged in the early Cretaceous, which coincides with the time of rapid differentiation and dominance of the angiosperms (Grimaldi 1999, Ji et al. 2022). Similarly, species of these three genera mostly have angiosperm hosts. *Candelabrochaete septocystidia*, *C. langloisii*, *Leptoporus* and *Phanerochaete allantospora* occurred between 24.18 and 88.4 Mya in our study. In contrast, species in *Ceriporia* occurred between 6.2 and 103.33 Mya, and they all evolved from the early Cretaceous, became more prevalent in Neogene. *Leptoporus* emerged earlier than other species of *Ceriporia* (except *C. griseoviolascens*). The sample Miettinen 14381 as the type specimen of *Ceriporia mpurii* from Indonesia, and another sample, He 6687 from China, (both specimens are very similar in morphology). So, we also treat Chinese sample as *C. mpurii*, and this species diverged at 12.69

Mya. The samples BR 4865, Dai 8168 and GC 1508-71 are all treated as *Ceriporia mellita* in previous studies (Spirin et al. 2016, Chen et al. 2020). However, the sample BR 4865 collected in Europe diverged at 22.79 Mya, and those labelled Dai 8168 and GC 1508-71 from Asia diverged at 8.2 Mya. It seems that the three samples represent different species. Because they are very similar in morphology, we treat the two Asian samples as *Ceriporia cf. mellita* in our study.

**Acknowledgements**

The research was supported by the Second Tibetan Plateau Scientific Expedition and Research Program (STEP, Grant No. 2019QZKK0503), the National Natural Science Foundation of China (Project Nos. 31870007, 32161143013) and the Yunnan Province expert workstation program (No. 202205AF150014).

**References**

Aime L, Ryvarden L, Henkel TW. 2007 – Studies in neotropical polypores 22. Additional new and rare species from Guyana. Synopsis Fungorum 23, 15–31.

Anonymous. 1969 – Flora of British fungi. *Colour identification chart*. Her Majesty's Stationery Office, London.

Berkeley MJ, Broome CE. 1875 – Notices of British fungi (1402-1500). Annals and Magazine of Natural History 15, 28–41.

Bernicchia A, Niemelä T. 1998 – *Ceriporia suiphuricolor*, a new polypore species from Italy. Folia Cryptogamica Estonica 33, 15–17.

Binder M, Justo A, Riley R, Salamov A et al. 2013 – Phylogenetic and phylogenomic overview of the Polyporales. Mycologia 105, 1350–1373. Doi 10.3852/13-003

Boidin J. 1970 – Basidiomycètes de la République Centralafricaine. 2. – Les genres *Botryobasidium* Donk et *Candelabrochaete* nov. gen. Cahiers de la Maboké 8, 17–25.

Bondartsev AS. 1953 – The Polyporaceae of the European USSR and Caucasia, 1–896.

Bondartseva MA. 1969 – Species novae Polyporacearum. Novosti Sistematiki Nizshikh Rastenii 6, 142–146.

Bouckaert R, Heled J, Kühnert D, Vaughan T et al. 2014 – BEAST 2: a software platform for Bayesian evolutionary analysis. PLoS Computational Biology 10, e1003537. Doi 10.1371/journal.pcbi.1003537

Buchanan PK, Ryvarden L. 1988 – Type studies in the Polyporaceae - 18. Species described by G.H. Cunningham. Mycotaxon 31, 1–38.

Buchanan PK, Ryvarden L. 1993 – Type studies in the Polyporaceae 24. Species described by Cleland, Rodway and Cheel. Australian Systematic Botany 6, 215–235.

Burdsall HH Jr. 1984 – The genus *Candelabrochaete* (Corticiaceae) in North America and a note on *Peniophora mexicana*. Mycotaxon 19, 389–395.

Burdsall HH Jr, Gilbertson RL. 1974 – Three new species of *Phanerochaete* (Aphyllophorales, Corticiaceae). Mycologia 66, 780–790.

Chen CC, Chen CY, Lim YW, Wu SH. 2020 – Phylogeny and taxonomy of *Ceriporia* and other related taxa and description of three new species. Mycologia 112, 64–82.

Chen CC, Chen CY, Wu SH. 2021 – Species diversity, taxonomy, and multi-gene phylogeny of phlebioid clade (Phanerochaetaceae, Irpicaceae, Meruliaceae) of Polyporales. Fungal Diversity 111, 337–442.

Chen JJ, Wang YR, Wang CG, Dai YC. 2022 – Two new species of *Ceriporia* (Irpicaceae, Basidiomycota) from the Asia Pacific area. Mycological Progress 21, 39–48.

Coelho G, da Silveira RMB, Rajchenberg M. 2006 – A new *Gloeoporus* species growing on bamboo from southern Brazil. Mycologia 98, 821–827.

Cohen KM, Finney SC, Gibbard PL, Fan JX. 2013; updated – The ICS International Chronostratigraphic Chart. Episodes 36, 199–204.

Cooke MC. 1891 – New sub-genus of *Agaricus*. Grevillea 19, 104–105.

Corner EJH. 1989 – Ad Polyporaceas 5. Beihefte zur Nova Hedwigia 96, 1–218.
Corner EJH. 1992 – Additional resupinate non-xanthochroic polypores from Brazil and Malesia. Nova Hedwigia 55, 119–152.
Crous PW, Cowan DA, Maggs-Kölling G, Yilmaz N et al. 2021 – Fungal planet description sheets: 1182–1283. Persoonia 46, 313–528.
Cunningham GH. 1947 – New Zealand Polyporaceae 1. The genus *Poria*. Bulletin of the New Zealand Department of Scientific and Industrial Research, Plant Diseases Division 72, 1–43.
Cunningham GH. 1965 – Polyporaceae of New Zealand. Bulletin of the New Zealand Department of Scientific and Industrial Research 164, 1–304.
Dai YC, Wu SH, Chou WN. 2002 – Two new polypores (Basidiomycota) from Taiwan. Mycotaxon 83, 209–216.
Decock C, Ryvarden L, Wagara I. 2021 – Aphyllophorales of Africa 52 Some poroid species from Kakamega Forest National Reserve in Kenya. Synopsis Fungorum 44, 32–35.
Domanski S. 1963 – Dwa nowe rodzaje grzybów z grupy "*Poria* Pers. ex S.F. Gray". Acta Societatis Botanicorum Poloniae 32, 731–739.
Donk MA. 1933 – Revisie van de Nederlandse Heterobasidiomyceteae (uitgez. Uredinales en Ustilaginales) en Homobasidiomyceteae-Aphyllophraceae 2. Mededelingen van het botanisch Museum en Herbarium van de Rijksuniversiteit Utrecht 9, 1–278.
Drummond AJ, Ho SYW, Phillips MJ, Rambaut A. 2006 – Relaxed phylogenetics and dating with confidence. PLoS Biology 4, e88. Doi 10.1371/journal.pbio.0040088.
Drummond AJ, Rambaut A. 2007 – BEAST: bayesian evolutionary analysis by sampling trees. BMC Evolutionary Biology 7, 214. Doi 10.1186/1471-2148-7-214.
El-Gharabawy HM, Leal-Dutra CA, Griffith GW. 2021 – *Crystallicutis* gen. nov. (Irpicaceae, Basidiomycota), including *C. damiettensis* sp. nov., found on *Phoenix dactylifera* (date palm) trunks in the Nile Delta of Egypt. Fungal Biology 125, 447–458. Doi 10.1016/j.funbio.2021.01.004
Eriksson J. 1958 – Studies in the Heterobasidiomycetes and Homobasidiomycetes – Aphyllophorales of Muddus National Park in North Sweden. Symbolae Botanicae Upsalienses 16, 1–172.
Eriksson J, Hjortstam K, Ryvarden L. 1981 – The Corticiaceae of North. Europe 6, 1048–1276.
Gernhard T. 2008 – The conditioned reconstrued process. Journal of Theoretical Biology 253, 769–778.
Gilbertson RL, Burdsall HH, Canfield ER. 1976 – Fungi that decay Mesquite in Southern Arizona. Mycotaxon 3, 487–551.
Gilbertson RL, Hemmes DE. 2004 – New species of lignicolous basidiomycetes from Hawaii. Memoirs of the New York Botanical Garden 89, 81–92.
Ginns JH. 1971 – The genus *Merulius* 4. Species proposed by Berkeley and Curtis, and By Berkeley and Broome. Mycologia 63, 219–236. Doi 10.1080/00275514.1971.12019105
Ginns JH. 1976 – *Merulius*: s. s. and s. l., taxonomic disposition and identification of species. Canadian Journal of Botany 54, 100–167.
Gomes-Silva AC, Ryvarden L, Gibertoni TB. 2012 – Resupinate poroid fungi from Brazil: two new species and new records. Mycological Progress 11, 879–885.
Grimaldi D. 1999 – The co-radiations of pollinating insects and angiosperms in the Cretaceous. Annals of the Missouri Botanical Garden 86, 373–406. Doi 10.2307/2666181.
Hall TA. 1999 – BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. Nucleic Acids Symposium Series 41, 95−98.
Han ML, Chen YY, Shen LL, Song J et al. 2016 – Taxonomy and phylogeny of the brown-rot fungi: *Fomitopsis* and its related genera. Fungal Diversity 80, 343–373. Doi 10.1007/s13225-016-0364-y
Hattori T. 2001 – Type studies of the polypores described by E.J.H. Corner from Asia and West Pacific Areas 3. Species described in *Trichaptum*, *Albatrellus*, *Boletopsis*, *Diacanthodes*, *Elmerina*, *Fomitopsis* and *Gloeoporus*. Mycoscience 42, 423–431.

Hibbett DS, Grimaldi D, Donoghue MJ. 1997 – Fossil mushrooms from Miocene and Cretaceous ambers and the evolution of Homobasidiomycetes. American Journal of Botany 84, 981–991. Doi 10.2307/2446289
Hjortstam K. 1995 – Two new genera and some new combinations of corticioid fungi (Basidiomycotina, Aphyllophorales) from tropical and subtropical areas. Mycotaxon 54, 183–193.
Hjortstam K, Ryvarden L. 2004 – Some new and noteworthy corticioid fungi (Basidiomycotina, Aphyllophorales) from Japan. Synopsis Fungorum 18, 8–13.
Hjortstam K, Ryvarden L. 2007 – Studies in corticioid fungi from Venezuela 3 (Basidiomycotina, Aphyllophorales). Synopsis Fungorum 23, 56–107.
Hopple JS, Vilgalys R. 1999 – Phylogenetic relationships in the mushroom genus *Coprinus* and dark-spored allies based on sequence data from the nuclear gene coding for the large ribosomal subunit RNA: divergent domains, outgroups, and monophyly. Molecular Phylogenetics and Evolution 13, 1–19. Doi 10.1006/mpev.1999.0634
Ji X, Zhou JL, Song CG, Xu TM et al. 2022 – Taxonomy, phylogeny and divergence times of *Polyporus* (Basidiomycota) and related genera. Mycosphere 13, 1–52. Doi 10.5943/mycosphere/13/1/1
Jia BS, Cui BK. 2011 – Notes on *Ceriporia* (Basidiomycota, Polyporales) in China. Mycotaxon 116, 457–468.
Jia BS, Cui BK. 2012 – *Ceriporia* (Basidiomycota, Polyporales) from China with a description of two new species. Mycotaxon 121, 305–312.
Jia BS, Zhou LW, Cui BK, Rivoire B et al. 2014 – Taxonomy and phylogeny of *Ceriporia* (Polyporales, Basidiomycota) with an emphasis of Chinese collections. Mycological Progress 13, 81–93.
Jung PE, Lee H, Wu SH, Hattori T et al. 2018 – Revision of the taxonomic status of the genus *Gloeoporus* (Polyporales, Basidiomycota) reveals two new species. Mycological Progress 17, 855–863.
Justo A, Miettinen O, Floudas D, Ortiz-Santana B et al. 2017 – A revised family-level classification of the Polyporales (Basidiomycota). Fungal Biology 121, 798–824. Doi 10.1016/j.funbio.2017.05.010
Karsten PA. 1887 – Fungi novi vel minus bene cogniti Fenniae et Galliae. Revue Mycologique Toulouse 9, 9–11.
Katoh K, Standley DM. 2013 – MAFFT multiple sequence alignment software version 7: improvements in performance and usability. Molecular Phylogenetics and Evolution 30, 772–780. Doi 10.1093/molbev/mst010
Larsson KH. 2007 – Re-thinking the classification of corticioid fungi. Mycological Research 111, 1040–1063.
Læssøe T, Ryvarden L. 2010 – Studies in Neotropical polypores 26. Some new and rarely recorded polypores from Ecuador. Synopsis Fungorum 27, 34–58.
Lepage T, Bryant D, Philippe H, Lartillot N. 2007 – A general comparison of relaxed molecular clock models. Molecular Biology and Evolution 24, 2669–2680. Doi 10.1093/molbev/msm193
Léveillé JH. 1844 – Champignons exotiques. Annales des Sciences Naturelles Botanique 2, 167–221.
Lindblad I, Ryvarden L. 1999 – Studies in neotropical polypores. 3. New and interesting Basidiomycetes (Poriales) from Costa Rica. Mycotaxon 71, 335–359.
Liu S, Sun YF, Ji X, Song CG et al. 2023 – Molecular phylogeny and taxonomy of the remarkable genus *Leptoporus* (Polyporales, Basidiomycota) with description of a new species from Southwest China. Frontiers in Cellular and Infection Microbiology 12, 1–10.
Lombard FF, Gilbertson RL. 1965 – Studies on some western *Poria* with negative or weak oxidase reactions. Mycologia 57, 43–76.

Maekawa N. 1999 – Taxonomic study of Japanese Corticiaceae (Aphyllophorales) 5. Reports of the Tottori Mycological Institute 37, 7–20.
Maekawa N. 2021 – Taxonomy of corticioid fungi in Japan: Present status and future prospects. Mycoscience 62, 345–355.
Mata M, Ryvarden L. 2010 – Studies in neotropical polypores 27. More new and interesting species from Costa Rica. Synopsis Fungorum 27, 59–72.
Matheny PB, Liu YJ, Ammirati JF, Hall BD. 2002 – Using RPB1 sequences to improve phylogenetic inference among mushrooms (*Inocybe*, Agaricales). American Journal of Botany 89, 688–698. Doi 10.3732/ajb.89.4.688
Miettinen O, Spirin V, Vlasak J, Rivoire B et al. 2016 – Corrigenda: Miettinen O, Spirin V, Vlasak J, Rivoire B, Stenroos S, Hibbett D (2016) Polypores and genus concepts in *Phanerochaetaceae* (Polyporales, Basidiomycota). MycoKeys 17, 1–46. Doi 10.3897/mycokeys.17.10153
Miettinen O, Vlasák J, Rivoire B, Spirin V. 2018 – *Postia caesia* complex (Polyporales, Basidiomycota) in temperate Northern Hemisphere. Fungal Systematics and Evolution 1, 101–129. Doi 10.3114/fuse.2018.01.05
Miller MA, Holder MT, Vos R, Midford PE et al. 2009 – The CIPRES Portals. CIPRES URL: http://www.phylo.org/sub_sections/portal. (Archived by WebCite(r) at http://www.webcitation.org/5imQlJeQa).
Montagne JPFC. 1842 – Troisième Centurie de plantes cellulaires exotiques nouvelles, Décades 1, 2, 3 et 4. Fungi cubenses. Annales des Sciences Naturelles Botanique 17, 119–128.
Murrill WA. 1921 – Light-colored resupinate polypores 3. Mycologia 13, 83–100. Doi 10.1080/00275514.1921.12016864
Niemelä T. 1981 – Polypores rare in or new to Finland. Karstenia 21, 15–20.
Núñez M, Ryvarden L. 2001 – East Asian polypores. Synopsis Fungorum 14, 170–522.
Nylander JAA. 2004 – MrModeltest v2. Program distributed by the author. Evolutionary Biology Centre, Uppsala University.
Parmasto E. 1968 – Conspectus Systematis Corticiacearum, 1–261.
Permpornsakula P, Prasongsuk S, Lotrakul P, Eveleigh DE et al. 2016 – Two new records of the resupinate polypore fungi, *Ceriporia cystidiata* and *Macrohyporia dictyopora*, in Thailand. Science Asia 42, 171–177. Doi 10.2306/scienceasia1513-1874.2016.42.171
Petersen JH. 1996 – The Danish Mycological Society's colour-chart. Foreningen til Svampekundskabens Fremme, Greve.
Pieri M, Rivoire B. 1997 – A propos du genre *Ceriporia* Donk (Aphyllophoromycetidae). Bulletin de la Société Mycologique de France 113, 193–250.
Pilát A, Lindtner V, Litschauer V. 1938 – Ein Beitrag zur Kenntnis der Basidiomyceten von Südserbien. Glasnik Skopskog Naucnog Drustva 18, 173–192.
Rajchenberg M. 1983 – Cultural studies of resupinate polypores. Mycotaxon 17, 275–293.
Rajchenberg M. 2000 – The genus *Ceriporia* Donk (Polyporaceae) in Patagonian Andes Forests of Argentina. Karstenia 40, 143–146.
Rambaut A, Suchard M, Drummond A. 2013 – Tracer. http://tree.bio.ed.ac.uk/software/tracer/. Accessed 15 Sept. 2016
Rehner SA, Buckley E. 2005 – A Beauveria phylogeny inferred from nuclear ITS and EF1-alpha sequences: evidence for cryptic diversification and links to *Cordyceps* teleomorphs. Mycologia 97, 84–98.
Rick J. 1960 – Basidiomycetes Eubasidii in Rio Grande do Sul Brasilia. 4. Meruliaceae, Polyporaceae, Boletaceae. Iheringia 7, 193–295.
Romell L. 1911 – Hymenomycetes of Lappland. Arkiv før Botanik 11, 1–35.
Ronquist F, Huelsenbeck JP. 2003 – MRBAYES 3: Bayesian phylogenetic inference under mixed models. Bioinformatics 19, 1572–1574. Doi 10.1093/bioinformatics/btg180
Ryvarden L. 1975 – Studies in the Aphyllophorales of Africa 2. Some new species from East Africa. Norwegian Journal of Botany 22, 25–34.

Ryvarden L. 1987 – New and noteworthy polypores from tropical America. Mycotaxon 28, 525–541.
Ryvarden L. 2014 – Studies in neotropical polypores 37. Some new and interesting species from tropical America. Synopsis Fungorum 32, 58–67.
Ryvarden L. 2015 – Type studies in Polyporaceae 32 Species described by T. Petch. Synopsis Fungorum 33, 9–12.
Ryvarden L. 2018 – Studies in African Aphyllophorales 25. New poroid species from East and Central Africa. Synopsis Fungorum 38, 25–32.
Ryvarden L. 2020 – Aphyllophorales of Africa 45 Some polypores from Akok lowland rain forest reserve in Cameroon. Synopsis Fungorum 42, 28–29.
Ryvarden L, Decock C, Mossebo D, Masuka A. 2022 – Poroid fungi of Africa. Synopsis Fungorum 45, 1–271.
Ryvarden L, Gilbertson RL. 1993 – European polypores 1 *Abortiporus* – *Lindtneria*. Synopsis Fungorum 6, 1–387.
Ryvarden L, Iturriaga T. 2003 – Studies in neotropical polypores 10. New polypores from Venezuela. Mycologia 95, 1066–1077.
Ryvarden L, Johansen I. 1980 – A preliminary polypore flora of East Africa, Oslo, Fungiflora, 1–636.
Ryvarden L, Melo I. 2017 – Poroid fungi of Europe, 2nd edition. Synopsis Fungorum 37, 1–431.
Sánchez-Ramírez S, Tulloss RE, Amalfi M, Moncalvo JM. 2014 – Palaeotropical origins, boreotropical distribution and increased rates of diversification in a clade of edible ectomycorrhizal mushrooms (*Amanita* section Caesareae). Journal of Biogeography 42, 351–363. Doi 10.1111/jbi.12402
Shen LL, Wang M, Zhou JL, Xing JH et al. 2019 – Multi-gene phylogeny and taxonomy of the brown-rot fungi: *Postia* (Polyporales, Basidiomycota) and related genera. Persoonia 42, 101–126. Doi 10.3767/persoonia.2019.42.05
Smith SY, Currah RS, Stockey RA. 2004 – Cretaceous and Eocene poroid hymenophores from Vancouver Island, British Columbia. Mycologia 96, 180–186. Doi 10.2307/3762001
Soares AMS, Sotão HMP, Ryvarde L, Gibertoni TB. 2014 – *Ceriporia amazonica* (Phanerochaetaceae, Basidiomycota), a new species from the Brazilian Amazonia and *C. albobrunea* Ryvarden & Iturriaga new to Brazil. Phytotaxa 175, 176–180.
Spirin V, Vlasák J, Rivoire B, Kout J et al. 2016 – Studies in the *Ceriporia purpurea* group (Polyporales, Basidiomycota), with notes on similar *Ceriporia* species. Mycologie 37, 421–435.
Spirin V, Zmitrovich IV. 2004 – A contribution to the taxonomy of corticioid fungi: *Merulius* Fr., *Phlebia* Fr., and related genera. Novitates systematicae plantarum non vascularium 37, 166–188.
Suhara H, Maekawa N, Kaneko S, Hattori T et al. 2003 – A new species, *Ceriporia lacerata*, isolated from white-rotted wood. Mycotaxon 86, 335–347.
Sun YF, Costa-Rezende DH, Xing JH, Zhou JL et al. 2020 – Multi-gene phylogeny and taxonomy of *Amauroderma* s. lat. (Ganodermataceae). Persoonia 44, 206–239. Doi 10.3767/persoonia.2020.44.08
Swofford DL. 2002 – PAUP*: phylogenetic analysis using parsimony (*and other methods), version 4.0b10. Sinauer Associates, Sunderland, Massachusetts. Doi 10.1002/0471650129.dob0522
Thompson JD, Gibson TJ, Plewniak F, Jeanmougin F et al. 1997 – The Clustal_X windows interface: flexible strategies for multiple sequence alignment aided by quality analysis tools. Nucleic Acids Research 25, 4876−4882. Doi 10.1093/nar/25.24.4876
White TJ, Bruns T, Lee S, Taylor J. 1990 – Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. In: Innis MA, Gelfand DH, Sninsky JJ, 1245 White, JT (Eds.) PCR Protocols: A guide to methods and applications. Academic Press, San Diego, pp. 315–322.

Wu F, Chen JJ, Ji XH, Vlasák J et al. 2017 – Phylogeny and diversity of the morphologically similar polypore genera *Rigidoporus*, *Physisporinus*, *Oxyporus*, and *Leucophellinus*. Mycologia 109, 749–765. Doi 10.1080/00275514.2017.1405215

Wu, F, Man XW, Tohtirjap A, Dai YC. 2022 – A comparison of polypore funga and species composition in forest ecosystems of China, North America, and Europe. Forest Ecosystems 9, 100051.

Wu F, Zhou LW, Vlasák J, Dai YC. 2022 – Global diversity and systematics of Hymenochaetaceae with poroid hymenophore. Fungal Diversity 113, 1–192. Doi 10.1007/s13225-021-00496-4

Yuan Y, Bian LS, Wu YD, Chen JJ et al. 2023 – Species diversity of pathogenic wood-rotting fungi (Agaricomycetes, Basidiomycota) in China. Mycology. Doi 10.1080/21501203.2023.2238779

Yuan Y, Ji XH, Wu F, He SH et al. 2016 – Two new *Gloeoporus* (Polyporales, Basidiomycota) from tropical China. Nova Hedwigia 103, 169–183.

Yuan Y, Ji XH, Wu F, Chen JJ. 2017 – *Ceriporia albomellea* (Phanerochaetaceae, Basidiomycota), a new species from tropical China based on morphological and molecular evidence. Phytotaxa 298, 20–28

Zhao RL, Li GJ, Sánchez-Ramírez S, Stata M et al. 2017 – A six-gene phylogenetic overview of Basidiomycota and allied phyla with estimated divergence times of higher taxa and a phyloproteomics perspective. Fungal Diversity 84, 43–74. Doi 10.1007/s13225-017-0381-5

Zhao RL, Zhou JL, Chen J, Margaritescu S et al. 2016 – Towards standardizing taxonomic ranks using divergence times – a case study for reconstruction of the *Agaricus* taxonomic system. Fungal Diversity 78, 239–292. Doi 10.1007/s13225-016-0357-x

Zhu L, Song J, Zhou JL, Si J et al. 2019 – Species diversity, phylogeny, divergence time and biogeography of the genus *Sanghuangporus* (Basidiomycota). Frontiers in Microbiology 10, 812. Doi 10.3389/fmicb.2019.00812

Zmitrovich IV. 2018 – Conspectus systematis Polyporacearum v. 1.0. Folia Cryptogamica Petropolitana 6, 3–145.

Zmitrovich IV, Malysheva VF. 2014 – Studies on *Oxyporus* l. Segregation of *Emmia* and general topology of phylogenetic tree. Микология и фитопатология 3, 161–171.

Zmitrovich IV, Malysheva VF, Spirin WA. 2006 – A new morphological arrangement of the Polyporales 1. *Phanerochaetineae*. Mycena 6, 4–56.

**Supplementary Table 1** The type locality and main morphological characteristics of *Ceriporia*, *Gloeoporus* and *Meruliopsis*.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (μm) | Shape of basidiospores | Size of basidiospore (μm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| ***Ceriporia*** | | | | | | | | | | | | |
| ***C. allantoidea*** | + | China: Hunan | Resupinate | – | Round, sometimes slightly elongated, 4–6 | Cream to cinnamon buff when fresh, clay buff to pale reddish brown when dry | Large, irregular, hyaline crystals; fine crystals | Large, pale orange crystals; oily substance; fine crystals | – | Allantoid | 4.5–5 × 1.1–1.5 | This study |
| ***C. allantospora*** | + | USA | Resupinate | – | – | Pale yellow-orange to pale buff | Oily substance | – | Cylindric, smooth, 50–125 × 5.5–8 | Allantoid | 10–11.5 × 2.5–3 | Gilbertson et al. (1976) |
| *C. arbuscula* | + | China: Taiwan | Resupinate | – | Round to angular, 4–6 | Yellowish-brown to pale brown when dry | – | Yellowish oily substance | – | Cylindrical to slightly curved | 3–3.5 × 1–1.5 | Chen et al. (2020) |
| *C. aurantiocarnescens* | + | Germany | Resupinate | – | Round to angular, 3–5 | Cream to buff pore surface when fresh, clay buff to rose when dry | Large, irregular crystals; oily substance | Large, irregular crystals; oily substance | – | Short cylindrical and moderately curved | 3.2–4 × 1.8–2.2 | This study |
| *C. bresadolae* | + | France | Resupinate to effused-reflexed | Grayish white | Round to angular, 3–5 | First pinkish, later pinkish red, dark reddish to almost black with age | – | Oily substance | – | Allantoid | 5.9–8.2 × 1.8–2.3 | This study |
| *C. bubalinomarginata* | + | China: Henan | Resupinate | – | Angular, 6–7 | Clay buff, orange-brown, fawn to reddish brown when dry | Fine, pale yellow crystals | Large, irregular, orange-brown crystals | Clavate, smooth, 21.8–26.6 × 2.8–4.1 | Allantoid | 3.5–4.3 × 1–1.2 | Jia et al. (2014) |
| ***C. crassa*** | + | China: Hainan | Resupinate | – | Round to angular, 5–6 | White to cream when fresh, buff to clay buff when dry | Large, irregular, hyaline crystals; tiny oily substance | Large, irregular, hyaline crystals; oily substance | – | Allantoid | 3.8–4.1 × 1.2–1.6 | This study |
| ***C. daedaleoides*** | + | Thailand | Resupinate | – | Angular, daedaleoid to slightly sinuous, 3–5 | Cream to pale mouse gray when fresh, salmon to pale | Large, rhombic or irregular hyaline or yellowish | Large, rhombic or corolliform crystals; | – | Ellipsoid to slightly curved | 3.7–4.1 × 2–2.3 | This study |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| | | | | | | orange-yellow when dry | crystals; fine crystals | fine crystals | | | | |
| *C. eucalypti* | + | Australia: Victoria | Resupinate | – | Angular, 3–5 | Snow white when fresh, curry yellow when dry | Fine, irregular crystals; oily substance | Fine irregular crystals | – | Allantoid | 4–4.4 × 1.1–1.4 | Chen et al. (2022) |
| *C. excelsa* | + | Sweden | Resupinate | – | Round to angular, 2–4 | Buff, honey yellow to reddish orange | Large, rhombic or irregular crystals | Large, rhombic, yellowish crystals; oily substance | – | Lunate to short cylindrical, moderately curved | 3.6–4.2 × 2–2.2 | This study |
| ***C. gossypinum*** | + | China: Tibet | Resupinate | – | Round to angular, 4–5 | White, buff to deep olive when fresh, buff to honey yellow when dry | Fine crystals; oily substance | Fine, hyaline crystals; oily substance | – | Allantoid | 3.5–4 × 1.8–2 | This study |
| *C. griseoviolascens* | + | France | Resupinate | – | Round to angular, 4–6 | Pinkish violet tints, and then changing to grayish violet | – | Oily substance | Rather long | Bean-shaped | 5–6.1 × 2.5–3.1 | Spirin et al. (2016) |
| ***C. hinnulea*** | + | China: Fujian | Resupinate | – | Round to angular, 4–6 | Fawn to cinnamon when dry | – | Large, irregular, pale orange or yellowish crystals; fine crystals | – | Lunate to allantoid | 3.5–4 × 2–2.1 | This study |
| *C. humilis* | + | Russia | Resupinate | – | Round to angular, 5–6 | White to cream | – | – | – | Narrowly ellipsoid to cylindrical | 3.2–4.2 × 1.9–2.2 | Miettinen et al. (2016) |
| ***C. langloisii*** | + | USA | Resupinate | – | – | Grayish orange | Large, hyaline crystals; yellow to orange oily substance | – | Cylindrical, encrusted, 75–200 × 9–15 | Ellipsoid to broadly allantoid | 7–9.5 × 3–4 | Burdsall (1984) |
| ***C. macrospora*** | + | China: Hainan | Resupinate | – | Round, sometimes slightly elongated, | Salmon to brownish vinaceous when fresh, pinkish | Large, irregular, yellowish crystals; oily substance; fine crystals | Large, irregular, yellowish crystals; | – | Allantoid | 5–7.2 × 1.6–2 | This study |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| | | | | | 5–7 | buff, clay pink to fawn when dry | | oily substance; fine crystals | | | | |
| *C. manzanitae* | + | USA: California | Resupinate | – | Angular, 4–5 | Bright brick-red | – | Oily substance | – | Cylindrical to allantoid | 5.1–6.2 × 2.2–2.7 | Spirin et al. (2016) |
| *C. mellita* | + | France (Lectotype) | Resupinate | – | Angular, 4–5 | Cinnamon buff to reddish brown when dry | – | – | – | Allantoid | 5–6 × 1.5–2 | This study |
| *C. mpurii* | + | Indonesia | Resupinate | – | Angular, 5–6 | Cream, in older parts with pale gray hues | Large, fan-shaped and rhomboidal crystals | Large, fan-shaped and rhomboidal crystals | – | Ellipsoid to narrowly ellipsoid | 2.8–3.9 × 2–2.3 | Spirin et al. (2016) |
| *C. occidentalis* | + | USA: Washington | Resupinate | – | Angular, 4–6 | White or pinkish to pinkish red, vinaceous brown to almost black with age | – | Oily substance | – | Allantoid | 5.1–7.1 × 1.8–2.2 | Spirin et al. (2016) |
| ***C. orientalis*** | + | China: Zhejiang | Resupinate | – | Round, 3–4 | Cream to buff when dry | Large irregular hyaline or yellowish-brown crystals; oily substance; fine crystals | Large, rhombic or irregular hyaline crystals; oily substance; fine crystals | – | Lunate to allantoid | 5.4–6.5 × 2.8–3.1 | This study |
| *C. pierii* | + | France | Resupinate | – | Angular, 2–3 | Cream to rosy, sometimes apricot tints | Large, irregular crystals | Large, irregular crystals | – | Ellipsoid to rarely cylindrical | 4.1–5.4 × 2.4–3.1 | Miettinen et al. (2016) |
| ***C. pseudospissa*** | + | China: Beijing | Resupinate | – | Angular, 4–5 | Pinkish buff to clay pink when fresh, clay buff to fawn when dry, reddish brown when bruised | Oily substance | Oily substance | – | Allantoid | 5–7.2 × 1.6–2.1 | This study |
| ***C. punctata*** | + | China: Xinjiang | Resupinate | – | Angular, 2–5 | Cinnamon buff when dry | Large, rhombic or irregular yellowish- | Fine yellowish crystals | – | Allantoid | 4–5 × 1.7–2.1 | This study |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (μm) | Shape of basidiospores | Size of basidiospore (μm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| | | | | | | | brown crystals; fine crystals | | | | | |
| *C. punicans* | + | USA: Pennsylvania | Resupinate | – | Angular, 5–7 | White to pale pink when fresh, orange to pinkish orange when dry, vinaceous red when bruised | – | Oily substance | – | Short cylindrical, slightly curved | 4.1–5.3 × 1.7–2.1 | Spirin et al. (2016) |
| *C. purpurea* | + | France | Resupinate | – | Round to angular, 4–6 | White to pale pink when fresh, orange to pinkish orange when dry | – | Oily substance | – | Allantoid | 5–8.4 × 1.7–2.3 | Spirin et al. (2016) |
| *C. reticulata* | + | Germany | Resupinate | – | Angular, 2–3 | Cream, pinkish to pale orange | – | Large, quadrate crystals | – | Allantoid | 7.5–9 × 3–3.5 | Domanski (1963) |
| ***C. septocystidia*** | + | Jamaica | Resupinate | – | – | Pale yellowish tan | Yellowish-brown oily substance | – | Cylindrical, encrusted, 760–150 × 5–9 | Allantoid | 4.5–6.5 × 1.5–2 | Burdsall (1984) |
| *C. sericea* | + | Russia: Khabarovsk | Resupinate | – | Angular, 3–5 | Cream to pale ochraceous | – | – | – | Cylindrical to slightly curved | 3.9–4.8 × 2.2–2.7 | Miettinen et al. (2016) |
| ***C. sinospissa*** | + | China: Fujian | Resupinate | – | Round to angular, 3–5 | Clay pink, apricot orange to orange-brown when dry | Large, rhombic or irregular crystals; orange oily substance; fine crystals | Large, rhombic crystals; oily substance; fine crystals | – | Allantoid | 5–5.8 × 1.5–2 | This study |
| *C. sino-viridans* | + | China: Hainan | Resupinate | – | More or less round, 4–6 | White to flesh pink when fresh, pinkish buff when dry | Large, irregular crystals | – | – | Lunate to allantoid | 3–3.5 × 1.7–2.2 | Chen et al. (2022) |
| *C. sordescens* | + | USA: New York | Resupinate | – | Angular, 3–4 | Yellowish when fresh, pale to dirty ochraceous to pinkish when dry | – | – | – | Ellipsoid to narrowly ellipsoid | 3.3–4.2 × 2.1–2.5 | Miettinen et al. (2016) |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (μm) | Shape of basidiospores | Size of basidiospore (μm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| *C. spissa* | + | USA: Carolina | Resupinate | – | Angular, 7–9 | Orange when fresh, darkening to reddish brown when dry | Irregular yellowish oily substance | – | – | Allantoid | 4.2–4.8 × 1.3–1.6 (Dai 19164) | Rajchenberg (1983), this study |
| ***C. subbadia*** | + | USA: Alabama | Resupinate | – | Angular, 3–4 | Ash gray when fresh, flesh pink when bruised, eventually cream, buff to clay buff when dry | Large, irregular or corolliform crystals | Large, rhombic hyaline crystals; oily substance; fine crystals | – | Cylindrical to allantoid | 4.5–5.8 × 2–2.6 | This study |
| ***C. subviridans*** | + | China: Yunnan | Resupinate | – | Round to angular, 4–5 | Peach to apricot orange when dry | Large, rhombic or irregular crystals; fine crystals | Large, rhombic crystals; oily substance; fine hyaline crystals | – | Lunate to allantoid | 3.3–3.7 × 1.8–2 | This study |
| *C. torpida* | + | Finland | Resupinate | – | Round to angular, 6–8 | First pink, dark vinaceous red with age | Oily substance | Oily substance | – | Short cylindrical, slightly to moderately curved | 4.3–5.7 × 1.9–2.3 | Spirin et al. (2016) |
| *C. triumphalis* | + | Spain: Canary Island | Resupinate | – | Round to angular, 5–7 | Bright yellow-orange when fresh, red to dark brick-red when dry | Oily substance | Oily substance | – | Short cylindrical to allantoid | 4.1–5 × 1.8–2.1 | Spirin et al. (2016) |
| *C. viridans* (type species) | + | UK | Resupinate | – | Round to sinuous, 3–5 | Variable, mostly cream to cinnamon or sordid brown with a greenish tint, more rarely pinkish sordid white | Fine crystals; oily substance | Fine crystals; oily substance | – | Cylindrical to allantoid | 4–4.6 × 1.7–2.1 (Dai 17003) | Ryvarden & Gilbertson (1993), this study |
| *C. alania* | * | USA: Hawaiian Island | Resupinate | – | Round to angular, 4–6 | Bright orange when fresh, brown when dry | Fine crystals | – | – | Narrowly allantoid | 7.5–10 × 2–2.5 | Gilbertson & Hemmes (2004) |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| *C. alba* | * | France | Resupinate | – | Angular to irregular, 3–4 | White when fresh, white to yellowish when dry | Large, hyaline crystals; oily substance | Large, hyaline crystals; oily substance | – | Cylindrical to allantoid | 5.5–7 × 2–2.5 | Pieri & Rivoire (1997) |
| *C. albobrunnea* | * | Venezuela | Resupinate | – | Round to angular, slightly irregular, 2–3 | Unevenly whitish brown, with patches where bruised when fresh | – | – | – | Cylindrical | 4–4.5 × 1.5 | Ryvarden & Iturriaga (2003) |
| *C. amazonica* | * | Brazil: Amapá | Resupinate | – | Angular, 1–3 | Salmon to peach colored when fresh, snuff brown to yellowish-brown when dry | – | – | – | Ellipsoid | 3 × 2 | Soares et al. (2014) |
| *C. angulata* | * | Brazil: Amazonas | Resupinate | – | Angular, 2–3 | Ochraceous | – | – | – | Oblong-ellipsoid | 4–4.5 × 1.7–2.2 | Gomes-Silva et al. (2012) |
| *C. aurea* | * | Venezuela | Resupinate | – | Round to sinuous, 2–3 | Warm yellow | – | – | – | Cylindrical to allantoid | 4–5 × 2 | Ryvarden (2014) |
| *C. camaresiana* | * | France | Resupinate | – | Angular, 1–3 | White when fresh, ochraceous to pale cinnamon, sometimes with a slight reddish tint when dry | – | – | – | Cylindrical to sub-allantoid | 5–6 × 2–3 | Ryvarden & Gilbertson (1993) |
| *C. citrina* | * | Costa Rica | Resupinate | – | Slightly angular, 1–3 | Citric yellow when fresh | – | – | – | Oblong-ellipsoid to subcylindrical | 7–8 × 3.2–3.5 | Mata & Ryvarden (2010) |
| *C. cystidiata* | * | Venezuela | Resupinate | – | Round to angular, slightly irregular, 6–8 | White to pale cream | – | – | Tubular, encrusted | Allantoid | 4–4.5 × 1 | Ryvarden & Iturriaga (2003) |
| *C. dentipora* | * | Ecuador | Resupinate | – | Angular to irregular, 2–3 | Ochraceous | – | – | – | Oblong-ellipsoid to cylindrical | 5–6 × 2.5–3 | Læssøe & Ryvarden (2010) |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| *C. ellipsospora* | * | Seychelles | Resupinate | – | Angular, 2–3 | Pale cream | – | – | – | Ellipsoid | 3–4 × 2.5–2.8 | Ryvarden (2018) |
| *C. ferrugineocincta* | * | USA: Florida | Resupinate | – | Angular, 6–8 | Cream to pale brown when fresh, cinnamon to unevenly pale umber when dry | – | – | – | Subcylindrical | 3.5–5 × 2–3 | Ryvarden & Johansen (1980) |
| *C. incrustata* | * | Costa Rica | Resupinate | – | Round, 6–8 | Ochraceous | – | – | – | Ellipsoid | 3–3.5 × 1.8–2 | Mata & Ryvarden (2010) |
| *C. kenyensis* | * | Kenya | Resupinate | – | Angular to irregular, 3–5 | White | – | – | – | Cylindrical | 3–4 × 1–1.2 | Decock et al. (2021) |
| *C. leptoderma* | * | Sri Lanka | Resupinate | – | Angular to slightly elongated, 6–7 | Pale ochraceous | – | – | – | Broadly ellipsoid | 5–6 × 3–4 | Ryvarden & Johansen (1980) |
| *C. microspora* | * | Costa Rica | Resupinate | – | Round to angular, slightly irregular, 6–8 | White to buff | – | – | – | Ellipsoid | 3–3.5 × 1.5–2 | Lindblad & Ryvarden (1999) |
| *C. otakou* | * | New Zealand | Resupinate | – | Round or angular, irregular, 1–3 | Dingy cream or isabelline when fresh, dingy yellow when dry | – | – | – | Ovoid to ellipsoid or pip-shaped | 4.5–6 × 2–2.5 | Cunningham (1947) |
| *C. retamoana* | * | Argentina: Chubut | Resupinate | – | Round to angular, 1–4 | Cream or straw/white or dark duckling yellow when fresh, darkening upon drying | – | – | – | Cylindrical, slightly curved | 4.5–5 × 1.2–1.5 | Rajchenberg (2000) |
| *C. rhodella* | * | – | Resupinate | – | Round to angular, 5–7 | Cream-colored, pinkish to orange-tan | Large, rhombic crystals | – | – | Short cylindrical, slightly curved | 3.5–4 × 1.5–2 | Lombard & Gilbertson (1965) |
| *C. rubescens* | * | Sri Lanka | Resupinate | – | Angular, 3–5 | Cream chrome yellow to pale reddish purplish brown, more | – | – | – | Cylindrical | 4–5 × 1.5–2 | Ryvarden (2015) |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| | | | | | | pure sulphur yellow when fresh | | | | | | |
| *C. straminea* | * | Bolivia | Resupinate | – | Angular to partly irregular, 1–3 | Straw-colored | – | – | – | Ellipsoid | 4.5–5.5 × 2.5–2.8 | Ryvarden (2014) |
| *C. subpudorina* | * | – | Resupinate | – | Angular, 200–400 µm wide | Creamy-woody with a blush or pinkish orange tint | – | – | – | Ovoid to ellipsoid, slightly narrowed | 5–6 × 3–3.5 | Bondartsev (1953) |
| *C. subspissa* | * | Guyana | Resupinate | – | Angular, 4–5 | Purple | – | – | Smooth | Ellipsoid | 5.5–6.5 × 3–3.5 | Aime et al. (2007) |
| *C. totara* | * | New Zealand | Resupinate | – | Irregular, 3–5 | Cream, buff to cinnamon buff, vinaceous when fresh, cinnamon to clay buff when dry | Fine, hyaline to pale yellowish crystals | Fine, hyaline to pale yellowish crystals | Clavate, smooth, 18–47 × 3.8–5 | Ovoid to subglobose | 2.5–3 × 1.7–2.5 | Buchanan & Ryvarden (1988) |
| *C. vermicularis* | * | France: Réunion | Resupinate | – | Angular to irregular, 1–2 | Reddish purple | – | – | – | Cylindrical to allantoid | 6–7 × 0.8–1 | Pieri & Rivoire (1997) |
| *C. violacea* | * | – | Resupinate | – | Round to angular, 3–4 | Violet | – | – | – | Oblong-ellipsoid | 3.5–4.5 × 2–2.4 | Ryvarden & Melo (2017) |
| ***Gloeoporus*** | | | | | | | | | | | | |
| *G. africanus* | + | Uganda | Pileate | First white to cream, become beige when old | Round and shallow, 6–8 | Gray to black when dry | – | – | – | Allantoid | 3.8–4.2 × 0.6–0.7 | Jung et al. (2018) |
| *G. citrinoalbus* | + | China: Hainan | Resupinate to effused-reflexed | White when fresh and dry | Round, 8–10 | Lemon-yellow when actively growing, clay pink with age, brownish orange to dark violet when dry | – | – | Clavate, smooth, 13–17 × 3.5–5.5 | Allantoid | 3.8–4.1 × 0.8–1 | Yuan et al. (2016) |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| *G. dichrous* | + | Europe | Resupinate, effused-reflexed to pileate | White to cream | Round and angular, 4-6 | First pale reddish, soon dark purplish, brown with age | – | – | – | Cylindrical to allantoid | 3.5–5.5 × 0.7–1.5 | Ryvarden & Johansen (1980) |
| *G. hainanensis* | + | China: Hainan | Resupinate, effused-reflexed to pileate | White to grayish white when fresh, almost unchanged when dry | Round, 9–11 | White to cream when fresh, more or less cream to olivaceous buff when dry | – | – | – | Allantoid | 3.5–4.5 × 1 | Yuan et al. (2016) |
| *G. orientalis* | + | Korea | Resupinate to effused-reflexed | Reddish brown | Round and shallow, 7–9 | First chestnut to pale redwood color changing to reddish brown and brownish black with age | – | – | – | Allantoid | 3–3.6 × 0.6–0.8 | Jung et al. (2018) |
| *G. pannocinctus* | + | – | Resupinate | – | Round to angular, 6–8 | Ivory to lemon yellow or olivaceous | – | – | Fusiform, smooth, 17–42 × 3–5.5 | Allantoid | 3.5–4.5 × 0.7–1 | Eriksson (1958) |
| ***G. septatus*** | + | China: Hainan | Resupinate | – | Round, 5–6 | Pale pinkish when fresh, cream to pinkish buff when dry | – | Large, rhombic or irregular crystals; fine crystals | Clavate, smooth, 22–32 × 6–7 | Narrowly allantoid | 3.8–4.2 × 0.8–1 | This study |
| *G. thelephoroides* (type species) | + | Ecuador | Pileate | White, wood-colored to pale yellow, later pale yellowish-brown | Round to angular, 5–7 | Pale ochraceous to pinkish in young specimens, resinous pinkish brown in very old ones | – | – | – | Cylindrical to allantoid | 3.5–5 × 0.7–1 | Cunningham (1965) |
| ***G. variiformis*** | + | China: Hainan | Resupinate to effused-reflexed | Buff to yellowish when dry | Round to angular, 9–10 | Brownish vinaceous, orange-brown to | – | Large, rhombic or irregular | Clavate, fusiform to pyriform, | Narrowly allantoid | 3.8–4.2 × 0.8–1 | This study |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| | | | | | | black when dry | | crystals | smooth, 20–25 × 4.5–7 | | | |
| *G. acidulus* | * | Russia | * | * | * | * | * | * | * | * | * | Bondartseva (1969) |
| *G. bourdotii* | * | Turkey | Resupinate | – | Round, 3–6 | Sulphurous-yellow to brown | – | – | – | Cylindrical to allantoid | 3–4 × 0. 4–0.6 | Pilát et al. (1938) |
| *G. chlorinus* | * | New Caledonia | Resupinate | – | Round to angular, 3 | Tan to dark brown | – | – | – | Cylindrical, oblong-ellipsoid to slightly curved | 4.5–5.5 × 1.5–2 | Ginns (1976) |
| *G. citrinus* | * | Tanzania | Resupinate to effused-reflexed to pileate with numerous small imbricate pilei | White | Round, grayish orange | Bright citric yellow when fresh, deep straw-colored to orange when dry | – | – | – | Allantoid | 2.4–3.2 × 0.4–0.8 | Ryvarden (1975) |
| *G. corrugatus* | * | India: Tamil Nadu | Pileate | Fleshy-white to red brown | Round | Paler | * | * | * | * | * | Cooke (1891) |
| *G. croceopallens* | * | Indonesia | Resupinate to effused-reflexed or pileate with numerous small imbricate pilei | White to cream | Round, 7–10 | Bright citric yellow when fresh, straw-colored to orange when dry | – | – | – | Allantoid | 2.4–3.2 × 0.4–0.8 | Ryvarden (1975) |
| *G. gelatinosotubulosus* | * | Russia | Resupinate | | Angular, 2–3 | Translucent whitish or cream-colored | – | – | – | Ellipsoid to cylindrical | 4.2–5 × 1.9–2.1 | Niemelä (1981) |
| *G. leptopilus* | * | Suriname | Pileate | White to yellowish | Angular to irregular | Brownish | * | * | * | * | * | Léveillé (1844) |
| *G. longisporus* | * | Costa Rica | Pileate | Deep blackish | Round to slightly | Pale cream | – | – | – | Allantoid | 7–9 × 2–2.5 | Mata & Ryvarden |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| | | | | brown | angular, 5–6 | | | | | | | (2010) |
| *G. nigrescens* | * | Malaysia | Resupinate to effused-reflexed | White, then pallid bistre to dirty ochraceo us and pale fawn tan | Angular, 7–12 | Whitish then pale dingy ochraceous buff, slowly fuliginous with age, fuliginous black when bruised | – | – | – | Ellipsoid | 3.7–4.5 × 2.3–3 | Corner (1989) |
| *G. phlebophorus* | * | New Zealand | Pileate | White when fresh, cream when dry | Round or angular, 6–7 | White when fresh, cream when dry | – | – | – | Allantoid | 3–3.5 × 1–1.25 | Cunningham (1965) |
| *G. purpurascens* | * | Malaysia | Resupinate to rarely effused-reflexed | * | Angular, 2–4 | Tan to purplish-black | – | – | – | Ellipsoid | 4–5 × 1.5–2 | Hjortstam (1995) |
| *G. subambiguus* | * | Brazil | Resupinate | – | Oval to round, 2–3 | Pale vinaceous to pale brown | – | – | – | Cylindrical to allantoid | 4–5 × 1–2 | Ginns (1976) |
| *G. subvinaceus* | * | Brazil: Amazonas | * | * | * | * | * | * | * | * | * | Corner (1992) |
| *G. sulphureus* | * | Malaysia | Resupinate to effused-reflexed | White to pale yellowish, then gray with age | Round, 6–10 | Pale sulphur yellow when fresh, fuscous ochraceous or unaltered when dry | – | – | – | Allantoid | 3.5–4.5 × 0.8–1.2 | Hattori (2001) |
| *G. umbrinus* | * | Malaysia | Effused-reflexed to pileate | Umber brown | Angular, 8–11 | Grayish brown | – | – | – | Ovoid | 3–3.7 × 2.3–2.7 | Corner (1989) |
| ***Meruliopsis*** | | | | | | | | | | | | |
| *M. albomellea* | + | China: Hainan | Resupinate | – | Round to angular, 5–7 | White when fresh, cinnamon buff when dry | – | – | Clavate, 20–40 × 6–9 | Oblong-ellipsoid | 3.1–3.8 × 1.7–2 | Yuan et al. (2017) |
| *M. albostramineus* | + | Portugal | Resupinate | – | * | Bright orange to reddish when | – | – | Tubular, smooth, 30– | Allantoid | 4.5–6 × 1.5–2 | Hjortstam & Ryvarden |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| | | | | | | fresh, usually paler when dry | | | 50 × 5–7 | | | (2004) |
| ***M. bambusicola*** | + | China: Hainan | Resupinate | – | Angular, 4–5 | Cream to pinkish buff when fresh and dry | Large, rhombic or irregular hyaline crystals | Large, rhombic or irregular hyaline crystals | – | Oblong-ellipsoid, slightly curved | 3.8–4.2 × 1.8–2 | This study |
| *M. crassitunicata* | + | China: Taiwan | Resupinate | – | Round to angular, 3–4 | Cream to very pale yellowish cream | – | – | – | Oblong-ellipsoid | 3.4–4.1 × 1.6–2 | Dai et al. (2002) |
| *M. cystidiata* | + | Brazil: Amazonas | Resupinate to effused-reflexed | White | Angular, 4–6 | Purplish | – | – | Clavate, smooth, 25–30 × 5–7 | Cylindrical to sub-allantoid | 4 × 1 | Ryvarden (1987) |
| *M. faginea* | + | Russia | Resupinate | – | Round to angular and slightly elongate, 3–4 | Pale grayish brown with pale pinkish brown tints | Fine crystals | Fine crystals | Almost cylindrical to fusoid, smooth, 25–35 × 3.5–4.5 | Ellipsoid to sub-allantoid | 4–4.9 × 2–2.3 | Crous et al. (2021) |
| *M. leptocystidiata* | + | China: Liaoning | Resupinate | – | Round, 4–5 | White to cream when dry | Fine crystals | – | Cylindrical, occasionally clavate, smooth, 24–40 × 3.5–4.5 | Ellipsoid | 3–4 × 1.5–2 | Chen et al. 2020 |
| ***M. marginata*** | + | China: Hebei | Resupinate | – | Round to slightly sinuous, 4–6 | Pinkish buff to straw-colored when fresh, clay buff, cinnamon to fawn when dry | Large, irregular hyaline crystals | Large, irregular, pale orange or yellowish crystals; oily substance; fine crystals | – | Allantoid | 3.8–4.5 × 1.3–1.7 | This study |
| *M. nanlingensis* | + | China: Hunan | Resupinate | – | Round to irregular, 3–5 | White, lilac to lavender when fresh, flesh-pink, clay pink, pinkish buff, clay buff, vinaceous to brownish | Large, hyaline to pale yellowish crystals | Large, hyaline to pale yellowish crystals | Clavate, 25–36 × 3–6 | Oblong-ellipsoid | 3.7–4.6 × 1.7–2 | Jia & Cui (2011) |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| | | | | | | vinaceous when dry | | | | | | |
| *M. parvispora* | + | China: Taiwan | Resupinate | – | Round to angular, 5–7 | White when fresh, white to cream when dry | – | – | – | Narrowly ellipsoid to cylindrical, slightly curved | 2.5–3 × 1.7–2 | Chen et al. (2020) |
| *M. pseudocystidiata* | + | China: Hunan | Resupinate | – | Round to irregular, very shallow, 4–5 | Buff yellow to cinnamon buff when dry | – | Large, pale yellowish crystals; oily substance | Clavate, mostly 25–54 × 3–6, sometimes up to 90 | Allantoid | 3.7–4.3 × 1.6–1.8 | Jia et al. (2014) |
| ***M. rosea*** | + | Australia: Victoria | Resupinate | – | Round, sometimes slightly elongated, 5–7 | Rose to lilac when fresh, buff when dry | Large, irregular, hyaline crystals; fine crystals; oily substance | Large, irregular, pale orange crystals; fine crystals; oily substance | – | Oblong-ellipsoid, sometimes slightly curved | 4.8–5.1 × 2.1–2.6 | This study |
| *M. tarda* | + | Australia | Resupinate | – | Angular, 3–5 | Cream to pinkish when fresh, cream to pinkish buff when dry | Fine crystals | Fine crystals | – | Oblong to subellipsoid | 4–5 × 2–2.5 | Núñez & Ryvarden (2001) |
| *M. taxicola* (type species) | + | France | Resupinate to rarely effused-reflexed | Gray | Angular, 2–4 | Tan to purplish black | Golden oily substance | Golden oily substance | – | Cylindrical to allantoid | 4.5–6 × 1–1.5 | Ginns (1976), Ryvarden & Gilbertson (1993) |
| *M. variegata* | + | China: Hunan | Resupinate | – | Round to radially elongated, shallow, 4–6 | White when fresh, cream when dry | Fine crystals | Fine crystals | Clavate, fusoid or lanceolate, 25–60 × 4.8–8 | Cylindrical to oblong-ellipsoid | 3–4 × 1.6–2 | Jia et al. (2014) |
| *M. ambigua* | * | USA: South Carolina | Effused-reflexed | Cream to gray | Round, 1–3 | Dark purple (nearly black), also violet-brown | Yellow oily substance | – | – | Oblong to ovoid, sometimes basally curved | 5.6–7.2 × 2.2–2.8 | Ginns (1976) |

**Supplementary Table 1** Continued.

| Species | DNA sequences | Type locality | Shape of basidiomata | Upper surface color | Shape and size of pore (per mm) | Hymenophore color | Crystals or oily substance among the hyphae | | Shape and size of Cystidia (µm) | Shape of basidiospores | Size of basidiospore (µm) | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | In subiculum/ context | In tube trama | | | | |
| *M. bella* | * | USA: Alabama | Resupinate | – | Oval to round, 2–4 | Pallid to pale ochraceous | Fine crystals | Fine crystals | Cylindrical, granule-encrusted, 15 × 5–6 | Oval to ellipsoid | 4–5 × 2–2.5 | Ginns (1971) |
| *M. miniata* | * | New Zealand | Resupinate | – | Oval to round, 2–3 | Reddish or somewhat vinaceous | – | – | Gloeocystidia cylindrical to slenderly clavate, granule-encrusted, 25–33 × 4–7 | Cylindrical to allantoid | 4.5–6.5 × 1.5–2 | Ginns (1976) |

**Bold** = new taxa. Abbreviations used: + = data available, – = Absent, * = data unavailable.