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ARTICLE

Multi–gene phylogeny and taxonomy of *Physisporinus* (Polyporales, Basidiomycota)

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Abstract

The polypores in *Physisporinus* are important wood decayers, in which they grow on both angiosperms and gymnosperms from living trees to rotten wood in almost all the forest ecosystems worldwide. The species diversity of the genus has been investigated, but it is still not well known. Phylogenetic and morphological analyses of this genus are carried out based on samples from Asia, Europe, Australia, and North and Central America. This genus is defined by a monomitic hyphal system with simple septa on generative hyphae, hyphoid cystidia present in most species, hyaline, thin-walled, ellipsoid to subglobose basidiospores, and having a white-rotting ecology. Phylogenies are reconstructed by using multiple loci DNA sequences containing ITS, nuc–LSU, nuc–SSU, mt–SSU, TEF1-α, and RPB2. The results demonstrate that *Physisporinus* and *Meripilus* belong to Meripilaceae of Polyporales. In addition, 12 new species in *Physisporinus* are illustrated and described, and three unnamed taxa are discussed with a full description. Our phylogeny demonstrates that all taxa of *Physisporinus* formed five clades nested in a major clade. A key to accepted 37 taxa of *Physisporinus* is provided.

Keywords – Meripilaceae – new taxa – polypore – phylogenetic analyses – white rot

INTRODUCTION

The genus *Physisporinus* P. Karst. (Polyporales, Basidiomycota) was introduced by Karsten (1889). It is conventionally defined by annual or stratified having a perennial habit, resupinate, effused–reflexed to rarely pileate or with a short stipe basidiomata having a white to brightly colored pore surface when fresh and often changing color when bruised or dried, a monomitic hyphal system with simple septa on generative hyphae, thin– to thick-walled and encrusted hyphoid cystidia and fusoid or mastoid cystidioles present in most species, ovoid, ellipsoid, subglobose to globose and thin-walled basidiospores with the negative reaction in Melzer's reagent and Cotton Blue. All species in the genus cause a white rot on both angiosperm and gymnosperm substrate

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from living tree to rotten wood and have a distribution from boreal to tropical forests. (Gilbertson & Ryvarden 1987, Núñez & Ryvarden 2001, Ryvarden & Melo 2017, Chen & Dai 2021, Wu et al. 2022a, Zhao et al. 2024).

Physisporinus is morphologically similar to *Rigidoporus* Murrill and *Oxyporus* (Bourdot & Galzin) Donk. Many taxa were described in these genera according to morphology (Dai 1998, Núñez & Ryvarden 1999, Buchanan & Ryvarden 2000, Núñez et al. 2001, Vampola & Vlasák 2012, Gomes–Silva et al. 2014, Wu et al. 2020, Dai et al. 2021). Several new species have been described in *Physisporinus*, and many combinations were proposed in *Physisporinus* and *Rigidoporus* by Wu et al. (2017) and Chen & Dai (2021).

Binder et al. (2013) first investigated the phylogeny of *Physisporinus*, their results showed the genus was nested in the residual polyporoid clade, and they treated it in Meripilaceae under Polyporales Gäum. Justo et al. (2017) carried out a comprehensive phylogeny on Polyporales using a three gene dataset (ITS+nuc–LSU+RPB1), and they indicated that *Physisporinus* and *Rigidoporus* belonged to Meripilaceae. Wu et al. (2017) demonstrated that the type species of *Rigidoporus* and *Oxyporus* were nested in a clade in Hymenochaetales Oberw., and the latter was treated as a synonym of the former; their study showed that *Physisporinus* is distantly related to *Rigidoporus*, and nested in Meripilaceae belonging to Polyporales. However, all recent phylogenies confirmed that *Physisporinus* belonged to Meripilaceae, Polyporales, and three genera, viz. *Meripilus*P. Karst., *Physisporinus* and *Spongipellis* Pat. addressed in Meripilaceae (Wang & Dai 2022).

In this study, we implement a further study on *Physisporinus* based on more samples from Asia, Australia, Europe, and North and Central America. Phylogenies based on a two loci DNA fragments dataset (ITS+nuc–LSU) and a six loci DNA fragments dataset (ITS+nuc−LSU+TEF1-α+RPB2+nuc–SSU+mt–SSU) are carried out; twelve new species in the genus are described and illustrated. In addition, three taxa are temporarily treated as *Physisporinu*s spp. with a full description.

MATERIALS AND METHODS

Morphological studies

The studied specimens are stored in the Fungarium of the Institute of Microbiology, Beijing Forestry University (BJFC), Museum Vysociny Jihlava, Czech Republic (MJ), Herbarium of V. N. Karazin National University, Kharkiv, Ukraine (CWU), the private herbarium of Josef Vlasák (JV), which will later be deposited at the National Museum Prague of Czech Republic (PRM), and the Herbarium of Institute of Applied Ecology, Chinese Academy of Sciences (IFP). Morphological studies fellow Wang et al. (2023b) and color terms are from Petersen (1996) and Anonymous (1969).

DNA extraction, amplification and sequencing

DNA extraction follows Sun et al. (2022) and Wang et al. (2023b). Then, the different DNA molecules obtained from studied specimens were mixed with primer pairs of ITS, nuc–LSU, TEF1, RPB2, nuc–SSU and mt–SSU for PCR, respectively. ITS (internal transcribed spacer, including the 5.8S gene) and nuc–LSU (nuclear large subunit rDNA) were amplified using the primer pairs ITS4 and ITS5 and LR7 and LR0R (White et al. 1990, Hopple & Vilgalys 1999). The primer pairs MS1/MS2 of mt–SSU (mitochondrial small subunit rDNA) were amplified to obtain DNA molecules under the suitable PCR procedure by PCR–Cycler (White et al. 1990). The primer pairs NS1/NS4 of nuc–SSU (nuclear small subunit rDNA) were amplified to obtain DNA molecules under the suitable procedure by PCR–Cycler (White et al. 1990). Part of TEF1-α (translation elongation factor 1α) was amplified with primer pairs EF1–983F/EF1–1567R (Rehner & Buckley 2005). The primer pairs fRPB2–5F/fRPB2–7CR of RPB2 (DNA−directed RNA polymerase II subunit 2) were amplified to obtain DNA molecules under the suitable procedure by PCR–Cycler (Matheny 2005).

The PCR procedures for ITS, nuc–LSU, TEF1, RPB2, nuc–SSU and mt–SSU, and performing of DNA sequences follow Sun et al. (2022) and Wang et al. (2023b). The sequences obtained from specimens involved in this study are uploaded to GenBank. All sequences analysed in this study are listed in Table 1. The final ITS, nuc−LSU, TEF1-α, RPB2, nuc–SSU, and mt–SSU datasets are 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), visualized and manually adjusted in BioEdit (Hall 1999). The different sequence alignments were spliced and transformed formats in Mesquite v.3.2. (Maddison & Maddison 2017). Multiple sequence alignments were trimmed by trimAI v.1.2 using the *–htmlout–gt 0.8 –st* option to deal with gaps, when necessary (Capella–Gutierrez et al. 2009).

Phylogenetic analyses

In this study, two datasets were analysed for phylogenies; a two loci DNA fragments dataset (ITS+nuc–LSU) and a six loci DNA fragments dataset (ITS+nuc–LSU+TEF1+RPB2+nuc–SSU+mt–SSU) were used to determine the taxonomic position of the new species in phylogenies, alignments of six loci DNA fragments (ITS+nuc–LSU+TEF1-α+RPB2+nuc–SSU+mt–SSU) are concatenated in sequence using Mesquite v.3.2., a total length of 5186 bp, among them 1−676 bp are involved in ITS fragment, 677–2018 bp in nuc–LSU fragment, 2019−2589 bp in TEF1 fragment, 2590−3668 bp in RPB2 fragment, 3669−4694 bp in nuc−SSU fragment and 4695−5186 bp in mt−SSU fragment. The sequence matrices and the obtained trees were uploaded in TreeBase (http://www.treebase.org), under accession ID: 31332 (Reviewer access URL: http://purl.org/phylo/treebase/phylows/study/TB2:S31332?x–access–code=3aa2558dd72e82bd4777eaadf08e5b9a&format=html). Following Wu et al. (2017) *Trametes ochracea* (Pers.) Gilb. & Ryvarden, used as the outgroup . In this study, phylogenetic analyses were conducted following previous studies (Han et al. 2016, Zhu et al. 2019, Wang et al. 2023b). Maximum Likelihood (ML), and Bayesian Inference (BI) analyses in phylogenies were implemented based on the two datasets respectively.

The sequence matrices were analysed using Maximum Likelihood (ML) with RAxML−HPC BlackBox v.8.2.12 tool to infer the phylogenetic tree in the CIPRES Science Gateway (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 5,000,000 generations (two loci DNA fragments dataset), and for 3,000,000 generations (six loci DNA fragments 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 ML ≥ 75%, and BPP ≥ 0.95 were considered as significantly supported. The ML bootstrap supports ≥ 50% and BBP ≥ 0.90 are shown on topologies from ML analysis, respectively.

RESULTS

Molecular phylogeny

The assembled two loci DNA fragments dataset (ITS+nuc−LSU) contained 197 sequences obtained from related specimens representing 93 taxa. Some of them were downloaded from NCBI directly according to relevant references. The dataset has an aligned length total of 2168 characters, of which 1210 (56%) characters are constant, 196 (9%) characters are variable and parsimony–uninformative and 762 (35%) characters are parsimony informative. 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). The phylogenetic reconstruction implemented with Maximum Likelihood (ML) and Bayesian Inference (BI) analyses for two assembled datasets showed similar topology

with only a few differences in statistical support. The result of Bayesian analysis showed a nearly congruent topology to ML analysis with an average standard deviation of split frequencies = 0.005088. Thus, only the topology of ML analysis is presented (Fig. 1). The phylogeny (Fig. 1) included nine families in Polyporales, and *Physisporinus* and *Meripilus* belonging to Meripilaceae Jülich (100% ML, 1.00 BPP). Samples of twelve new species and three other taxa in *Physisporinus* form 15 independent lineages and these 15 taxa are divided into five clades. *Physisporinus* and *Meripilus* belong to Meripilaceae of Polyporales.

The assembled six loci DNA fragments dataset (ITS+nuc−LSU+TEF1-α+RPB2+nuc−SSU+mt−SSU) contained 143 sequences obtained from related specimens representing 53 taxa. The dataset had an aligned length total of 5186 characters, of which 3664 (71%) characters are constant, 258 (5%) characters are variable and parsimony−uninformative and 1264 (24%) characters are parsimony informative. The phylogenetic reconstruction implemented with ML and BI analyses for two assembled datasets showed similar topologies with only a 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). The result of Bayesian analysis showed a nearly congruent topology to ML analysis with an average standard deviation of split frequencies=0.004847. Thus, the topology of ML analysis is just presented (Fig. 2). The phylogeny of *Physisporinus* using six loci DNA fragments dataset almost remains the same with phylogenetic analysis using two loci DNA fragments datasets.

Reliable taxa in BLAST results with the top 10 records from NCBI for new species are listed in Table 2.

Taxonomy

Polyporales contain 31 families, including Meripilaceae (Justo et al. 2017, Liu et al. 2023a, b). Three genera, viz. *Meripilus*, *Physisporinus* and *Spongipellis*, accepted in Meripilaceae (Wang & Dai 2022). So, *Physisporinus* belongs to Meripilaceae, Polyporales, Agaricomycetes, Basidiomycota.

Physisporinus P. Karst. Bidr. Känn. Finl. Nat. Folk 48: 324. 1889.

Basidiomata annual or stratified having a perennial habit, resupinate, effused–reflexed to rarely pileate or with a short stipe, ceraceous, soft, leathery to corky when fresh, turning fragile, corky, hard corky or bone hard in dried specimens. Pileal surface cream, buff to grayish brown, velutinous or glabrous, normally faintly zonate when dried. Pores white, buff, isabelline or ochraceous, pinkish to rose when fresh, some species changing color upon bruising or drying. Hyphal structure monomitic; hyphae with simple septa, usually thick-walled with different thickness of walls, occasionally thin-walled. Hyphoid cystidia or hymenial cystidia present in most species, thin to thick-walled, usually apically encrusted. Basidiospores broadly ellipsoid, ovoid, pyriform, subglobose to globose, colorless, with a thin wall, normally with oil drops, negative in Melzer's reagent, acyanophilous or weakly cyanophilous in Cotton Blue. Causing a white rot.

Notes – *Physisporinus* was established by *Physisporinus vitreus* (Pers.) P. Karst. (Karsten 1889). It now is a cosmopolitan genus recorded from almost all the forest ecosystems of the world. Species of the genus grow on both angiosperms and gymnosperms wood. Based on morphological characteristics and phylogenetic analyses 37 taxa are revealed, among them, twelve are newly described. In addition, three other taxa belonging to the genus are illustrated with a detailed description.

Physisporinus caesiomarginatus Y.C. Dai, Yuan Yuan & Chao G. Wang, sp. nov. Figs 3a, 5

Index Fungorum number: IF901992; Facesoffungi number: FoF15723

Etymology – "*caesiomarginatus*" (Lat.): refers to the species having a caesious sterile margin when fresh.

Basidiomata annual, effused–reflexed to resupinate, ceraceous to soft, with mushroom smell when fresh, turning hard corky in dried specimens, effused to 20 mm long and 15 mm wide when

resupinate; pileus flabelliform, extending up to 5 mm, 20 mm wide, 1.5 mm thick. Pileal surface cream to white when fresh, cream to buff yellow, glabrous and azonate when dried; margin sharp, thinning out, incurved when dried. Pores cream to white when fresh, buff yellow to salmon when dried, somewhat glancing; sterile margin distinct, caesious to bluish gray when fresh, turning clay buff in dried specimens, around 0.3 mm wide; pores irregular to angular, 6–8/mm; dissepiment thin, normally lacerated. Context cream, hard corky when dried, about 0.2 mm thick. Tubes with the same color as pores, hard corky to woody when dried, about 1.3 mm long.

Hyphal structure monomitic; hyphae with simple septa, colorless, not encrusted with crystals, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue; subiculum and tubes undissolved in potassium hydroxide. Hyphae in context usually distinctly thick-walled having a wide lumen, occasionally slightly thick-walled, without branches, mostly straight, loosely interlaced, agglutinated, 3–7.5 µm in diameter. Hyphae in tube trama usually obviously thick-walled having a wide to medium lumen, rarely with branches, slightly winding, almost parallel, agglutinated, 3.5–7 µm in diameter; hyphoid cystidia−like hyphae present at dissepiment edge, thin–walled, tips bearing crystals. Hymenial cystidia not present; cystidioles fusoid, with a thin wall, smooth, 9–16 × 3–5 µm; basidia barrel−shaped, bearing 4–spored and a simple septum at base, 9–12 × 6–7.5 µm; basidioles cephaloid, shorter than basidia. Fine crystalline particles present among hymenium and trama. Basidiospores broadly ovoid, colorless, with a thin wall, smooth, mostly with a big or two small oil drops, negative in Melzer's reagent, acyanophilous in Cotton Blue, 4–4.8(–5) × 3.3–4.1 µm, L = 4.23 µm, W = 3.75 µm, Q = 1.13 (n = 30/1).

Known distribution – Southwest China.

Material examined – CHINA, Yunnan Province, Honghe, Pingbian County, Daweishan National Forest Park, fallen angiosperm branch, 26 Jun 2019, Dai 19793 (BJFC031468, holotype).

Notes – *Physisporinus caesiomarginatus* is defined by effused−reflexed to resupinate basidiomata, cream pileal surface when fresh, cream to white pores when fresh, with caesious to bluish gray sterile margin, irregular to angular pores of 6–8/mm, hyphoid cystidia–like hyphae present at dissepiment edge, broadly ovoid basidiospores of 4–4.8 × 3.3–4.1 µm. It grows on hardwoods in southwest China.

Physisporinus caesiomarginatus, *P. neovitreus* and *P. crataegi* F. Wu, Jia J. Chen & Y.C. Dai are closely related in the phylogenies (Figs 1, 2), and the three species share resupinate to effused–reflexed basidiomata, buff to salmon dry pores, thin-walled, apically encrusted cystidia–like hyphae at dissepiment edge or hymenium. However, *P. neovitreus* has forked hymenial cystidia, and larger basidiospores (4.9–6 × 4–4.8 µm vs. 4–4.8 × 3.3–4.1 µm). Likewise, *Physisporinus crataegi* differs from *P. caesiomarginatus* by the pileal surface with a distinct pellicle and narrower tramal hyphae (2.5–4 µm vs. 3.5–7 µm, Wu et al. 2017). In addition, *Physisporinus caesiomarginatus* forms a different lineage grouped in *Physisporinus* (81% ML, 0.98 BPP, Fig. 1; 77% ML, 0.93 BPP, Fig. 2).

Physisporinus centroamericanus Y.C. Dai, Chao G. Wang & Vlasák, sp. nov. Figs 3b, 6

Index Fungorum number: IF901993; Facesoffungi number: FoF15724

Etymology – "*centroamericanus*" (Lat.): refers to the species having a distribution in Central America.

Basidiomata annual, resupinate, adnate, soft woody to corky, no taste or odor when fresh, turning hard corky to woody in dried specimens, effused to 30 mm long, 25 mm wide, and 3 mm thick. Pores red to violet when fresh, dark brown to gray when dried; sterile margin distinct, white when fresh, light vinaceous gray when dried, thinning out, around 2 mm wide; pores round when fresh, irregular to angular when dried, normally 8–10/mm; dissepiment thin, even. Subiculum cream, corky, about 0.5 mm thick, sometimes present between the two tube layers. Tubes stratified, buff yellow to salmon when dried, paler than pores, hard corky or woody when dried, about 2.5 mm long.

Table 1 Taxa information (including species, specimens, and locations) and GenBank accession numbers of the DNA sequences used in this study.

Species	Specimen nos.	Locations	GenBank accession nos.						References
			ITS	nuc–LSU	nuc–SSU	mt–SSU	TEF1	RPB2	
Abortiporus biennis	FD−319	USA	KP135300	KP135300	–	–	–	–	Floudas & Hibbett (2015)
A. biennis	Dai 22323	China	OL473602	–	–	–	–	–	Unpublished
Antella americana	HHB−4100−Sp	USA	EU232186	KP135196	–	–	–	–	Unpublished
Antrodiella trivialis	MCW 497/14	Brazil	MH475304	MH475304	–	–	–	–	Westphalen et al. (2019)
A. trivialis	MCW 369/12 (holotype)	Brazil	MH475302	MH475302	–	–	–	–	Westphalen et al. (2019)
Bjerkandera adusta	BRNM 771948	–	KT305935	KT305935	–	–	–	–	Westphalen et al. (2015)
B. atroalba	MW 425	Brazil	KT305930	KT305930	–	–	–	–	Westphalen et al. (2015)
Butyrea japonica	MN 1065 (holotype)	Japan	JN710556	JN710556	–	–	–	–	Miettinen et al. (2012)
B. luteoalba	FP−105786−Sp	USA	KP135320	KP135226	–	–	–	–	Floudas & Hibbett (2015)
Byssomerulius corium	FP−102382	USA	KP135007	KP135230	–	–	–	–	Floudas & Hibbett (2015)
Ceriporiopsis gilvescens	TN 5516	Czechia	HQ659222	HQ659222	–	–	–	–	Miettinen & Rajchenberg (2012)
Cerrena albocinnamomea	Dai 12892	China	KC485522	KC485539	–	–	–	–	Yuan (2014)
C. albocinnamomea	Dai 12955	China	KC485521	KC485538	–	–	–	–	Yuan (2014)
C. aurantiopora	NIBRFG0000102423 (holotype)	Rep. Korea	FJ821532	FJ821521	–	–	–	–	Lee & Lim (2010)
C. aurantiopora	SNU−m 03110102	Rep. Korea	FJ821531	FJ821520	–	–	–	–	Lee & Lim (2010)
C. consors	F20080702KCM29	Rep. Korea	FJ821527	FJ821516	–	–	–	–	Lee & Lim (2010)
C. consors	F20080208LYW10	Rep. Korea	FJ821528	FJ821517	–	–	–	FJ821543	Lee & Lim (2010)
C. unicolor	KHL−GB	Sweden	JQ031127	JQ031127	–	–	JX109891	JX109863	Sjoekvist et al. (2012)
C. unicolor	FD 299	USA	KP135304	KP135209	–	–	–	–	Floudas & Hibbett (2015)
C. zonata	Dai 7821	China	KC485529	KC485547	–	–	–	–	Yuan (2014)
C. zonata	Dai 7359	China	KC485528	KC485546	–	–	–	–	Yuan (2014)
Crustodontia chrysocreas	HHB−6333	USA	KP135358	KP135263	–	–	–	–	Floudas & Hibbett (2015)

Table 1 Continued.

Species	Specimen nos.	Locations	GenBank accession nos.						References
			ITS	nuc–LSU	nuc–SSU	mt–SSU	TEF1	RPB2	
Cymatoderma sp.	OMC 1427	USA	KY948826	KY948872	–	–	–	–	Justo et al. (2017)
Efibula americana	FP−102165 (holotype)	USA	KP135016	KP135256	–	–	–	–	Floudas & Hibbett (2015)
Flaviporus liebmannii	X 249	China	JN710539	JN710539	–	–	–	–	Miettinen et al. (2012)
F. minutus	Dai 16222	China	KY131881	KY131938	–	–	–	–	Wu et al. (2017)
F. minutus	Dai 16240	China	KY131883	KY131940	–	–	–	–	Wu et al. (2017)
Hyphoderma litschaueri	FP−101740−Sp	USA	KP135295	KP135219	–	–	–	–	Floudas & Hibbett (2015)
H. medioburiense	FD−335	USA	KP135298	KP135220	–	–	–	–	Floudas & Hibbett (2015)
H. mutatum	HHB−15479−Sp	USA	KP135296	KP135221	–	–	–	–	Floudas & Hibbett (2015)
H. setigerum	FD−312	USA	KP135297	KP135222	–	–	–	–	Floudas & Hibbett (2015)
Hyphodermella corrugata	KHL 3663	Norway	EU118630	EU118630	–	–	–	–	Larsson (2007a)
H. rosae	FP−150552	USA	KP134978	KP135223	–	–	–	–	Floudas & Hibbett (2015)
Hypochnicium cremicolor	NH 11149	Spain	DQ677506	DQ677506	–	–	–	–	Larsson (2007b)
H. karstenii	NH 10924	Sweden	DQ677510	DQ677510	–	–	–	–	Larsson (2007b)
H. polonense	NH 12117	Russia	EU118635	EU118635	–	–	–	–	Larsson (2007a)
H. punctulatum	FP−101698−sp	USA	KY948827	KY948860	–	–	–	–	Justo et al. (2017)
H. sphaerosporum	RLG−15138−sp	USA	KY948803	KY948861	–	–	–	–	Justo et al. (2017)
H. subrigescens	KHL 11968	Norway	JQ031128	JQ031128	–	–	–	–	Sjoekvist et al. (2012)
Irpex latemarginatus	FP−55521−T	USA	KP135024	KP135202	–	–	–	–	Floudas & Hibbett (2015)
Junghuhnia fimbriatella	Miettinen 2091	Russia	JN710555	JN710555	–	–	–	–	Miettinen et al. (2012)
Meripilus giganteus	CBS 421.48	Germany	MH856418	–	–	–	–	–	Vu et al. (2019)
M. giganteus	FP−100460−Sp	Netherland	KP135306	–	–	–	–	–	Floudas & Hibbett (2015)
M. giganteus	Cui 9202	UK	OM669888[a]	OM669973[a]	OM670021[a]	OM810032[a]	–	–	Present study
M. giganteus	Cui 9203	UK	OM669889[a]	–	OM670022[a]	OM810033[a]	–	–	Present study

Table 1 Continued.

Species	Specimen nos.	Locations	GenBank accession nos.						References
			ITS	nuc–LSU	nuc–SSU	mt–SSU	TEF1	RPB2	
M. giganteus	FP−135344−Sp	UK	KP135307	KP135228	–	–	–	–	Floudas & Hibbett (2015)
M. sumstinei	Russell 5913	USA	MN906088	–	–	–	–	–	Unpublished
Mycoacia fuscoatra	KHL 13275	Estonia	JN649352	JN649352	–	–	–	–	Sjoekvist et al. (2012)
M. nothofagi	KHL 13750	France	GU480000	GU480000	–	–	–	–	Moreno et al. (2011)
Panus fragilis	HHB−11042−Sp	USA	KP135328	KP135233	–	–	–	–	Floudas & Hibbett (2015)
P. fulvus	SP 446159	Brazil	MT669123	MT669144	–	–	–	–	Sousa–Guimarães et al. (2024)
Phanerochaete chrysosporium	BKM−F−1767	–	HQ188436	GQ470643	–	–	–	–	James et al. (2011)
P. chrysosporium	HHB−6251 (holotype)	USA	KP135094	KP135246	–	–	–	–	Floudas & Hibbett (2015)
P. rhodella	FD 18	USA	KP135187	KP135258	–	–	–	–	Floudas & Hibbett (2015)
Phlebia radiata	AFTOL 484	–	AY854087	AF287885	–	–	–	–	Lutzoni et al. (2004)
Phlebiporia bubalina	Dai 13168 (holotype)	China	KC782526	KC782528	–	–	–	–	Chen & Cui (2014)
Physisporinus caesiomarginatus	Dai 19793	China	OM669891[a]	OM669975[a]	OM670024[a]	–	OM810094[a]	OM810067[a]	Present study
P. castanopsidis	Dai 20396 (holotype)	China	MT309485	MT309470	OM670025[a]	OM810034[a]	OM810095[a]	OM810068[a]	Chen & Dai (2021), present study
P. castanopsidis	Dai 20397	China	MT309486	MT309472	OM670026[a]	OM810035[a]	OM810096[a]	OM810069[a]	Chen & Dai (2021), present study
P. castanopsidis	Dai 11693	China	KY131865	KY131922	–	–	–	–	Chen & Dai (2021)
P. centroamericanus	Kout 1807/15.1 (holotype)	Puerto Rico	OM669892[a]	OM669976[a]	OM670027[a]	–	–	OM810070[a]	Present study
P. centroamericanus	Kout 1508/18.1	Puerto Rico	OM669893[a]	–	–	–	–	–	Present study
P. centroamericanus	RP 185	Brazil	KP859303	–	–	–	–	–	Unpublished
P. cinereus	Cui 3266	China	KY131844	KY131903	–	–	–	–	Wu et al. (2017)
P. crataegi	Dai 15499	China	KY131846	KY131905	OM670028[a]	OM810036[a]	OM810097[a]	OM810071[a]	Wu et al. (2017), present study
P. crataegi	Dai 15497 (holotype)	China	KY131845	KY131904	OM670029[a]	OM810037[a]	OM810098[a]	OM810072[a]	Wu et al. (2017), present study
P. crocatus	JV 0509/40	USA	OM669894[a]	OM669977[a]	OM670030[a]	OM810038[a]	OM810099[a]	–	Present study

Table 1 Continued.

Species	Specimen nos.	Locations	GenBank accession nos.						References
			ITS	nuc–LSU	nuc–SSU	mt–SSU	TEF1	RPB2	
P. crocatus	DLL 2009−061	USA	JQ673152	–	–	–	–	–	Brazee et al. (2012)
P. crocatus	MJ 19/09	Slovakia	JQ409466	OM669978[a]	–	OM810039[a]	–	–	Vampola & Vlasá (2012), present study
P. crocatus	JV 0808/33	USA	OM669895[a]	OM669979[a]	OM670031[a]	OM810040[a]	OM810100[a]	–	Present study
P. crocatus	Dai 12800	USA	KY131869	KY131925	–	–	–	–	Wu et al. (2017)
P. crocatus	Dai 15917	China	KY131870	KY131926	OM670063[a]	–	OM810124[a]	–	Wu et al. (2017), present study
P. dollingerii	JV 1704/114	Costa Rica	OM669896[a]	–	–	–	–	–	Present study
P. dollingerii	Dollinger 880	USA	OM669897[a]	–	OM670032[a]	OM810041[a]	OM810101[a]	OM810073[a]	Present study
P. dollingerii	Dollinger 886 (holotype)	USA	OM669898[a]	OM669981[a]	OM670033[a]	–	OM810102[a]	OM810074[a]	Present study
P. dollingerii	Dollinger 1000	USA	OM669899[a]	OM669982[a]	OM670034[a]	OM810042[a]	–	OM810075[a]	Present study
P. eminens	Dai 11400	China	KY131852	KY131909	OM670035[a]	–	OM810103[a]	–	Wu et al. (2017), present study
P. eminens	Dai 20832	China	MT279689	MT279689	OM670036[a]	–	OM810104[a]	–	Unpublished, present study
P. eminens	Dai 22472	China	OM669900[a]	OM669983[a]	OM670037[a]	OM810043[a]	OM810105[a]	–	Present study
P. eminens	Dai 20868	China	MT840117	MT840135	–	–	–	–	Unpublished
P. expallescens	KHL 11959	Norway	JQ031129	JQ031129	–	–	–	–	Sjoekvist et al. (2012)
P. expallescens	Dai 21060	Belarus	MT840130	MT840148	OM670077[a]	–	–	OM810090[a]	Chen & Dai (2021), present study
P. expallescens	MJ 332/94	Czechia	OM669935[a]	–	–	–	–	–	Present study
P. expallescens	MJ 642/93	Czechia	OM669936[a]	–	–	–	–	–	Present study
P. expallescens	BRNM 699576	Czechia	FJ496671	FJ496725	–	FJ496750	–	–	Tomšovský et al. (2010)
P. furcatus	TAA 150972 (holotype)	Russia	KY131853	KY131910	–	–	–	–	Wu et al. (2017)
P. lavendulus	Dai 9925	China	KY131858	KY131915	–	–	–	–	Wu et al. (2017)
P. lavendulus	Dai 13587A (holotype)	China	KY131859	KY131916	OM670038[a]	–	OM810106[a]	–	Wu et al. (2017), present study
P. lineatus	Cui 9139	China	KY131860	KY131917	–	–	–	–	Wu et al. (2017)
P. lineatus	Dai 17986	China	MT840121	MT840139	OM670039[a]	OM810044[a]	OM810107[a]	OM810076[a]	Chen & Dai (2021), present study

Table 1 Continued.

Species	Specimen nos.	Locations	GenBank accession nos.						References
			ITS	nuc–LSU	nuc–SSU	mt–SSU	TEF1	RPB2	
P. lineatus	Dai 18281	Vietnam	MT840123	MT840141	OM670040[a]	OM810045[a]	OM810108[a]	OM810077[a]	Chen & Dai (2021), present study
P. lineatus	Cui 14038	China	MT840120	MT840138	OM670041[a]	–	–	–	Chen & Dai (2021), present study
P. lineatus	Dai 22268	China	OM669901[a]	OM669984[a]	–	–	–	–	Present study
P. lineatus	JV 1008/18	USA	OM669902[a]	OM669985[a]	OM670042[a]	–	–	–	Present study
P. lineatus	JV 1407/37	Costa Rica	OM669903[a]	OM669986[a]	OM670043[a]	–	OM810109[a]	OM810078[a]	Present study
P. lineatus	JV 1407/56	Costa Rica	OM669904[a]	–	OM670044[a]	–	–	OM810079[a]	Present study
P. longicystidius	PDD 70600 (holotype)	New Zealand	KY131863	–	–	–	–	–	Wu et al. (2017)
P. longicystidius	Cui 16630	Australia	MT279747	MT279912	–	–	–	–	Unpublished
P. minutissimus	JV 1704/83 (holotype)	Costa Rica	OM669905[a]	OM669987[a]	–	–	–	–	Present study
P. neovitreus	JV 0509/47	USA	OM669906[a]	OM669988[a]	OM670045[a]	–	OM810110[a]	OM810080[a]	Present study
P. neovitreus	JV 0509/127	USA	OM669907[a]	OM669989[a]	OM670046[a]	–	OM810111[a]	OM810081[a]	Present study
P. neovitreus	JV 1009/59 (holotype)	USA	OM669908[a]	OM669990[a]	OM670047[a]	–	OM810112[a]	OM810082[a]	Present study
P. neovitreus	JV 0709/188	USA	OM971904[a]	OM971890[a]	–	–	–	–	Present study
P. pouzarii	Dai 15005	China	KP420014	KP420017	–	–	–	–	Unpublished
P. pouzarii	Dai 21043	Belarus	MT840124	MT840142	OM670048[a]	–	OM810113[a]	OM810083[a]	Unpublished, present study
P. pouzarii	JV 0511/23	Czechia	JQ409465	KY131921	OM670049[a]	–	OM810114[a]	–	Vampola & Vlasá (2012), present study
P. pouzarii	MJ 27/04 (isotype)	Slovakia	JQ409462	–	–	–	–	–	Vampola & Vlasá (2012)
P. rhododendri	Dai 22272	China	OM669916[a]	OM669995[a]	OM670054[a]	OM810047[a]	OM810118[a]	–	Present study
P. rhododendri	Dai 22279 (holotype)	China	OM669917[a]	OM669996[a]	OM670055[a]	OM810048[a]	–	–	Present study
P. rigidus	JV 1704/79 (holotype)	Costa Rica	OM669918[a]	OM669997[a]	OM670056[a]	OM810049[a]	OM810119[a]	OM810084[a]	Present study
P. rigidus	F 2061	Mexico	KU747872	–	–	–	–	–	Del Olmo–Ruiz & Arnold (2017)
P. roseus	Dai 19877 (holotype)	China	MT840126	MT840144	OM670057[a]	OM810050[a]	–	OM810085[a]	Chen & Dai (2021), present study
P. sanguinolentus	Dai 20976	Belarus	MT840118	MT840136	OM670058[a]	–	–	–	Chen & Dai (2021), present study
P. sanguinolentus	DM 1068	Denmark	MT644902	MT644902	–	–	–	–	Unpublished
P. sanguinolentus	Dai 20995	Belarus	MT309483	–	–	–	–	–	Unpublished

Table 1 Continued.

Species	Specimen nos.	Locations	GenBank accession nos.						References
			ITS	nuc–LSU	nuc–SSU	mt–SSU	TEF1	RPB2	
P. sanguinolentus	Dai 21030	Belarus	MT309482	–	–	–	–	–	Unpublished
P. sanguinolentus	JV 1310/11	Czechia	OM669920[a]	OM669998[a]	OM670059[a]	OM810052[a]	OM810120[a]	OM810086[a]	Present study
P. sanguinolentus	JV 1610/2−Tejklova	Czechia	OM669921[a]	OM669999[a]	OM670060[a]	OM810053[a]	OM810121[a]	–	Present study
P. sanguinolentus	MJ 39/00	Slovakia	OM669922[a]	OM670000[a]	–	–	–	–	Present study
P. sanguinolentus	MJ 111/04	Czechia	OM669923[a]	–	OM670061[a]	–	OM810122[a]	–	Present study
P. srilankensis	Dai 19535 (holotype)	Sri Lanka	OM669924[a]	OM670001[a]	OM670062[a]	–	OM810123[a]	–	Present study
P. subfurcatus	Dai 2105 (holotype)	China	KY131854	KY131911	–	–	–	–	Wu et al. (2017)
P. subfurcatus	Dai 2544	China	KY131855	KY131912	–	–	–	–	Wu et al. (2017)
P. subfurcatus	Dai 11313	China	KY131856	KY131913	–	–	–	–	Wu et al. (2017)
P. sublineatus	Dai 20523 (holotype)	China	MT309462	MT309468	–	OM810054[a]	OM810125[a]	–	Unpublished, Present study
P. sublineatus	Dai 17885	Singapore	MT309460	MT309466	–	OM810055[a]	OM810126[a]	–	Unpublished, present study
P. sublineatus	Dai 19639	Sri Lanka	MT309461	MT309467	OM670064[a]	OM810056[a]	OM810127[a]	OM810087[a]	Unpublished, present study
P. sublineatus	Dai 22598	China	OM669925[a]	OM670002[a]	OM670065[a]	OM810057[a]	OM810128[a]	–	Present study
P. sublineatus	Dai 17553	China	OM669926[a]	OM670003[a]	OM670066[a]	OM810058[a]	–	–	Present study
P. sulphureus	Dai 17839 (holotype)	China	MG132179	MG132181	OM670067[a]	–	OM810129[a]	–	Dai & Dai (2018), present study
P. sulphureus	Dai 17841	China	MG132180	MG132182	OM670068[a]	OM810059[a]	OM810130[a]	–	Dai & Dai (2018), present study
P. tamilnaduensis	MKDM01a	India	OQ553780	OQ553784	–	–	–	–	Crous et al. (2023)
P. tamilnaduensis	MKDM01 (holotype)	India	OQ553779	OQ553783	–	–	–	–	Crous et al. (2023)
P. tasmanicus	Cui 16620 (holotype)	Australia	OM669927[a]	OM670004[a]	–	–	–	–	Present study
P. tibeticus	Cui 9588	China	KY131873	KY131929	OM670069[a]	–	OM810131[a]	–	Wu et al. (2017), present study
P. tibeticus	Cui 9381 (holotype)	China	KY131871	KY131927	OM670070[a]	–	–	–	Wu et al. (2017), present study
P. vinctus	Cui 16903	Puerto Rico	MT840129	MT840147	OM670074[a]	–	OM810135[a]	OM810088[a]	Chen & Dai (2021), present study
P. vinctus	JV 0610/A31B	Mexico	JQ409460	–	–	–	–	–	Vampola & Vlasá (2012)
P. vinctus	JV 0610/B5	Belize	JQ409459	OM670007[a]	–	–	–	–	Vampola & Vlasá (2012), present study

Table 1 Continued.

Species	Specimen nos.	Locations	GenBank accession nos.						References
			ITS	nuc–LSU	nuc–SSU	mt–SSU	TEF1	RPB2	
P. vinctus	JV 1407/36	Costa Rica	OM669933[a]	OM670008[a]	OM670075[a]	–	OM810136[a]	–	Present study
P. vinctus	Kout 1807/3	Puerto Rico	OM669934[a]	OM670009[a]	OM670076[a]	–	OM810137[a]	OM810089[a]	Present study
P. vitreosanguineus	MJ 144/95	Czechia	OM669937[a]	OM670010[a]	–	OM810062[a]	–	–	Present study
P. vitreosanguineus	Kout 0609/1	Czechia	OM669938[a]	–	–	–	–	–	Present study
P. vitreosanguineus	JV 0909/3 (holotype)	Czechia	OM669939[a]	OM670011[a]	OM670078[a]	OM810063[a]	–	–	Present study
P. vitreus	Miettinen–13591	Finland	KY948731	KY948870	–	–	–	–	Justo et al. (2017)
P. vitreus	Dai 12685	Czechia	MT840115	MT840133	OM670071[a]	–	OM810132[a]	–	Chen & Dai (2021), present study
P. vitreus	Cui 10340	China	KY131848	–	–	–	OM810133[a]	–	Wu et al. (2017), present study
P. vitreus	Cui 10341	China	KY131849	KY131907	OM670072[a]	–	–	–	Wu et al. (2017), present study
P. vitreus	JV 8611/3	Czechia	OM669928[a]	–	–	OM810060[a]	–	–	Present study
P. vitreus	JV 9010/3	Slovakia	OM669929[a]	–	–	–	–	–	Present study
P. vitreus	JV 9709/2	Czechia	OM669930[a]	–	–	–	–	–	Present study
P. vitreus	JV 0110/48	Czechia	OM669931[a]	OM670005[a]	OM670073[a]	OM810061[a]	OM810134[a]	–	Present study
P. vitreus	MJ 129/04	Czechia	OM669932[a]	OM670006[a]	–	–	–	–	Present study
P. yunnanensis	CLZhao 21583	China	OP852341	OP852343	–	–	–	–	Cai et al. (2023)
P. yunnanensis	CLZhao 21647 (holotype)	China	OP852340	OP852342	–	–	–	–	Cai et al. (2023)
***Physisporinus* sp. 1**	JV 0308/66	USA	OM669910[a]	–	OM670050[a]	–	OM810115[a]	–	Present study
***Physisporinus* sp. 1**	JV 0308/58	USA	OM669909[a]	OM669991[a]	–	–	–	–	Present study
***Physisporinus* sp. 1**	JV 0309/45	USA	OM669911[a]	–	OM670051[a]	–	OM810116[a]	–	Present study
***Physisporinus* sp. 1**	JV 0709/83	USA	OM669912[a]	OM669992[a]	OM670052[a]	–	OM810117[a]	–	Present study
***Physisporinus* sp. 2**	MJ 6003−Beneschova	Czechia	OM669919[a]	–	–	OM810051[a]	–	–	Present study
***Physisporinus* sp. 2**	CWU 3874	Ukraine	OM971903[a]	OM971889[a]	–	–	–	–	Present study
***Physisporinus* sp. 2**	KHL11913	Sweden	JX109843	JX109843	–	–	–	–	Binder et al. (2013)
***Physisporinus* sp. 3**	JV 8908/19	Czechia	OM669913[a]	–	–	–	–	–	Present study
***Physisporinus* sp. 3**	JV 1310/15−1	Czechia	OM669914[a]	OM669993[a]	–	OM810046[a]	–	–	Present study
***Physisporinus* sp. 3**	MJ 4738−53/02	Czechia	OM669915[a]	OM669994[a]	OM670053[a]	–	–	–	Present study
Podoscypha multizonata	Jahn 751012	Germany	EU118663	EU118663	–	–	–	–	Larsson (2007a)
P. venustula	LR 40821	Venezuela	JX109851	JX109851	–	–	–	–	Binder et al. (2013)
Pseudolagarobasidium acaciicola	CBS 115543	South Africa	DQ517883	–	–	–	–	–	Wood & Ginns (2006)

Table 1 Continued.

Species	Specimen nos.	Locations	GenBank accession nos.						References
			ITS	nuc–LSU	nuc–SSU	mt–SSU	TEF1	RPB2	
P. acaciicola	CBS 115544	South Africa	DQ517882	–	–	–	–	–	Wood & Ginns (2006)
P. baiyunshanense	Han 405 (holotype)	China	MT428549	MT428547	–	–	–	–	Han et al. (2021)
P. baiyunshanense	Han 406	China	MT428550	MT428548	–	–	–	–	Han et al. (2021)
P. belizense	VPB 197	Brazil	KJ832058	–	–	–	–	–	Martin et al. (2015)
P. belizense	CFMR: DCL04−31 (holotype)	Belize	JQ070173	–	–	–	–	–	Martin et al. (2015)
Pseudospongipellis delectans	MUcc 838	Czechia	HQ728294	HQ729004	–	–	–	–	Tomšovský (2012)
P. litschaueri	BRNM 67093	Czechia	HQ728303	HQ729013	–	–	–	–	Tomšovský (2012)
Rhizochaete brunnea	MR 11455	Argentina	AY219389	AY219389	–	–	–	–	Greslebin et al. (2004)
Rigidoporus hypobrunneus	JV 1712/13−J	Martinique	OM669886[a]	OM669970[a]	–	–	–	–	Present study
R. hypobrunneus	Dai 10569	China	KY131879	KY131936	–	–	–	–	Wu et al. (2017)
R. hypobrunneus	CM 108b	Cameroon	KJ831816	–	–	–	–	–	Martin et al. (2015)
R. hypobrunneus	Dai 10503	China	KY131878	KY131935	–	–	–	–	Wu et al. (2017)
Sarcodontia uda	FP−101544	USA	KP135361	KP135232	–	–	–	–	Floudas & Hibbett (2015)
Scopuloides rimosa	RLG 5104	USA	KP135351	KP135283	–	–	–	–	Floudas & Hibbett (2015)
S. rimosa	HHB 7042	USA	KP135350	KP135282	–	–	–	–	Floudas & Hibbett (2015)
Steccherinum ochraceum	KHL11902	Sweden	JN710590	JN710590	–	–	–	–	Miettinen et al. (2012)
S. tenue	KHL 12316	USA	JN710598	JN710598	–	–	–	–	Miettinen et al. (2012)
Trametes ochracea	HHB 13445	USA	JN164954	JN164812	–	–	–	–	Justo & Hibbett (2011)
Trametopsis brasiliensis	X 203	Brazil	JN710510	JN710510	–	–	–	–	Miettinen et al. (2012)
T. cervina	TJV−93216−T	USA	JN165020	JN164796	–	–	–	–	Justo & Hibbett (2011)

[a] Newly generated sequences in this study.

Bold = new taxa.

Table 2 BLAST results with the top 10 reliable taxa from NCBI for the new species in this study.

New species	Reliable taxa from NCBI	Similarity percentage
Physisporinus caesiomarginatus	*P. neovitreus, P. crataegi*	< 95%
P. centroamericanus	*P. pouzarii, P. crocatus*	< 90%
P. dollingerii	*P. sanguinolentus, P. pouzarii*	< 90%
P. minutissimus	*P. longicystidius, P. lavendulus, P. centroamericanus*	< 90%
P. neovitreus	*P. caesiomarginatus, P. crataegi*	< 95%
P. rhododendri	*P. sanguinolentus, P. yunnanensis*	< 96%
P. rigidus	*P. centroamericanus*	< 90%
P. srilankensis	*P. tibeticus, P. expallescens, P. castanopsidis*	< 90%
P. subfurcatus	*P. furcatus, P. sanguinolentus*	< 98%
P. sublineatus	*P. lineatus*	< 96%
P. tasmanicus	*P. vitreosanguineus, P. expallescens*	< 97%
P. vitreosanguineus	*P. castanopsidis*	< 97%

Hyphal structure monomitic; hyphae with simple septa, colorless to pale yellowish, not encrusted with crystals, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue; subiculum and tubes turning black in potassium hydroxide. Hyphae in subiculum distinctly thick-walled having a wide lumen, occasionally with branches, mostly straight, interlaced, 5.5–8 µm in diameter. Hyphae in tube trama usually slightly thick-walled, occasionally distinctly thick-walled but having a wide lumen, rarely with branches and with frequent simple septa, mostly straight, almost parallel, 4–6 µm in diameter. Hyphoid cystidia present, arising from tramal hyphae and totally embedded in tube trama, not protruding from the hymenium, thick-walled with swollen tips, apically encrusted, 8–11 µm in diameter at the apex; hymenial cystidia not present; but cystidioles a lot, fusoid or mamillated, with a thin wall, smooth, 12–16 × 5.5–7 µm; basidia long barrel–shaped, but frequently having basal curve, bearing 4−spored and a simple septum at base, 16–18 × 7–8 µm; basidioles mostly cephaloid, shorter than basidia. Basidiospores subglobose to broadly ellipsoid, colorless, with a thin wall, smooth, sometimes with a big to medium oil drop, negative in Melzer's reagent, weakly cyanophilous in Cotton Blue, (3.7–)4–4.7 × (3.1–)3.2–4 µm, L = 4.20 µm, W = 3.68 µm, Q = 1.13−1.15 (n = 60/2).

Known distribution – Central America.

Material examined – USA, Puerto Rico, Mayagüez, hardwood, 18 Aug 2015, Kout 1508/18.1 (JV); Jul 2018, Kout 1807/15.1 (JV, holotype), BJFC036141 (isotype).

Notes – *Physisporinus centroamericanus* is defined by annual basidiomata with stratified tubes, reddish pores changing very slowly to almost black on drying, contrast between buff yellow tubes and dark pores in several layers, thick-walled hyphoid cystidia embedded in trama, weakly cyanophilous basidiospores of 4–4.7 × 3.2–4 µm, and occurrence in Central America. In tropical areas some polypores have two tube layers because of the dry and rainy seasons, we treated this species as an annual species because our studied specimen had two layers only.

Physisporinus sulphureus Y.C. Dai resembles *P. centroamericanus* by small pores of 8–9/mm, thick-walled encrusted cystidia arising from hyphae in tube trama, and small basidiospores (4–5 × 3.5–4 µm, Dai & Dai 2018), but the former has sulphur yellow fresh pores, olivaceous buff or honey yellow pores when dried, and the hyphoid cystidia sometimes project from the hymenium (Dai & Dai 2018). *Physisporinus roseus* Jia J. Chen & Y.C. Dai and *P. vinctus* are confused with *P. centroamericanus*, because the similar basidiospore sizes (3.5–4.1 × 3.1–3.8 µm in *P. roseus*, 4–4.5 × 3–3.5 µm in *P. vinctus*; Ryvarden 1972, Ryvarden & Johansen 1980, Chen & Dai 2021). However, *Physisporinus roseus* differs from *P. centroamericanus* by a rose-pink pore surface when fresh which becomes vinaceous gray when dry, larger pores (5–6/mm vs. 8–10/mm), and thin-walled smooth hymenial cystidia (Chen & Dai 2021); *P. vinctus* differs from *P. centroamericanus* by a perennial habit, hyphoid cystidia sometimes projecting from the hymenium, and longer cystidioles (20–25 × 6–7.5 µm vs. 12–16 × 5.5–7 µm, Ryvarden 1972).

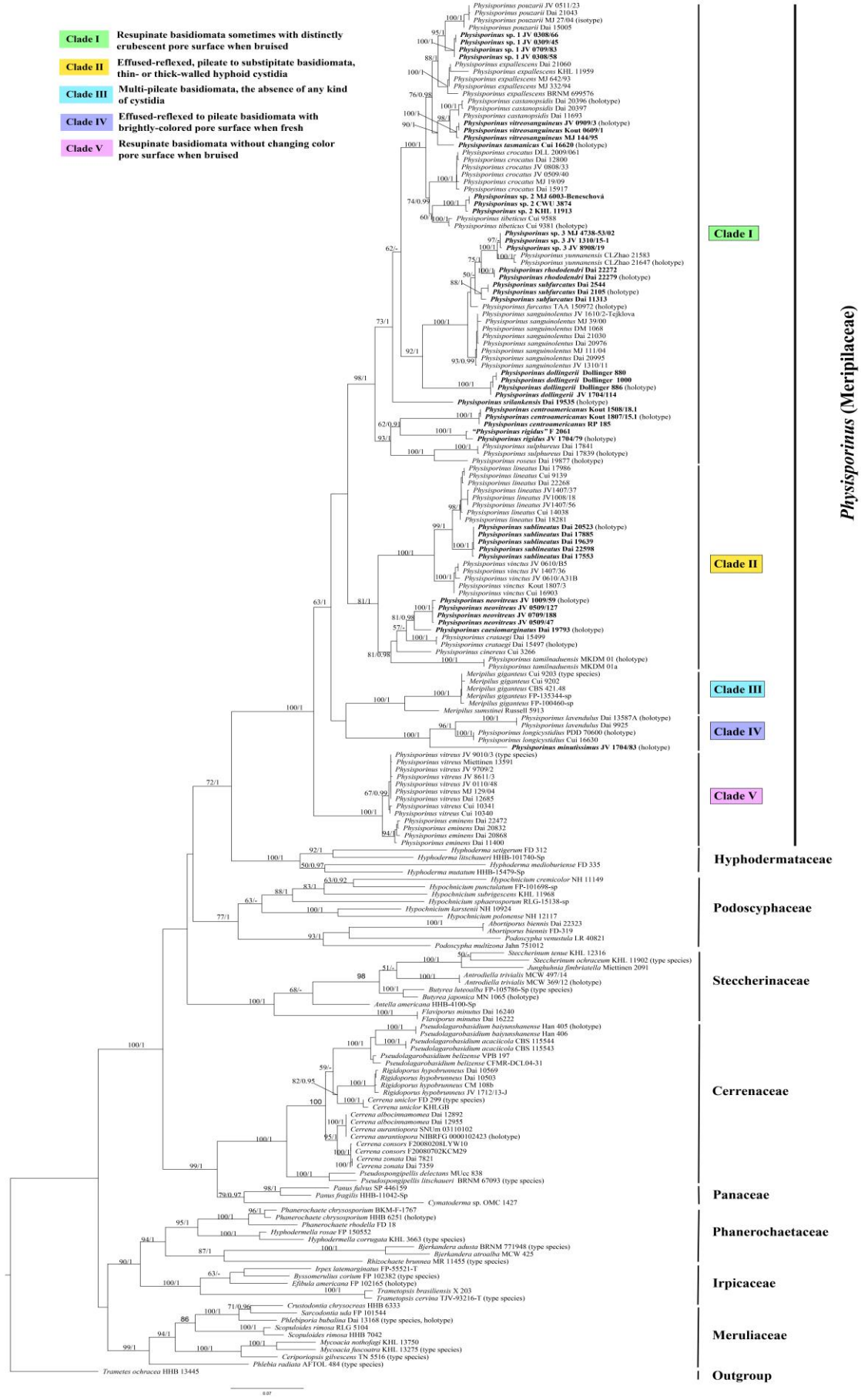

Figure 1 – ML analysis of *Physisporinus* based on a two loci DNA fragments dataset

(ITS+nuc–LSU). ML bootstrap values higher than 50% and Bayesian posterior probabilities values more than 0.90 are shown. New taxa are presented in bold.

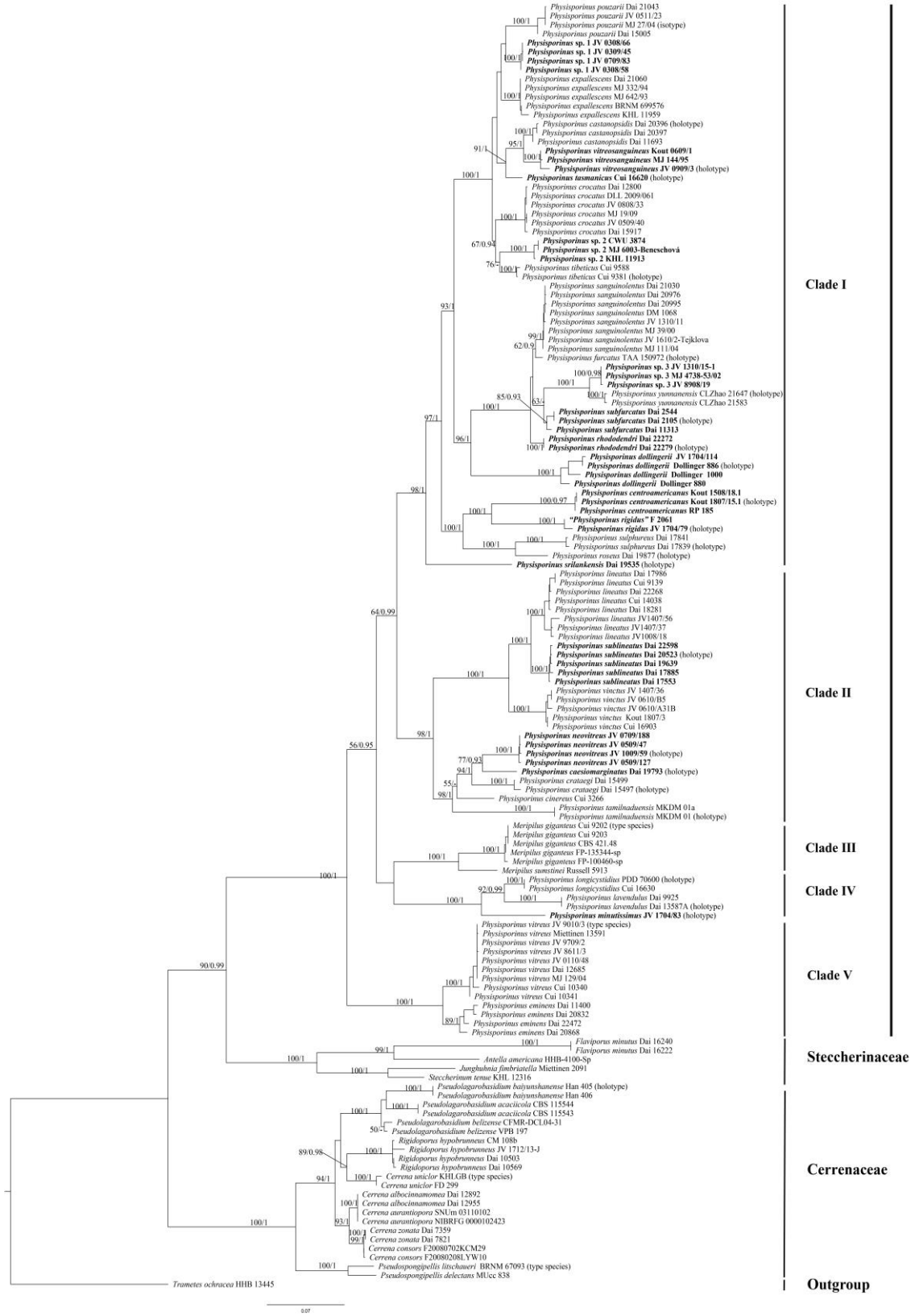

Figure 2 – ML analysis of *Physisporinus* based on a six loci DNA fragments dataset (ITS+nuc–LSU+TEF1+RPB2+nuc–SSU+mt–SSU). ML bootstrap values higher than 50% and Bayesian posterior probabilities values more than 0.90 are shown. New taxa are presented in bold.

Figure 3 – Basidiomata of new species of *Physisporinus*. a *P. caesiomarginatus* (Dai 19793). b *P. centroamericanus* (Kout 1807/15.1). c *P. dollingerii* (Dollinger 886). d *P. minutissimus* (JV 1704/83). e *P. neovitreus* (JV 0709/188). f *P. rhododendri* (Dai 22279). g *P. rigidus* (JV 1704/79). h *P. srilankensis* (Dai 19535). i *P. subfurcatus* (Dai 2105). Scale bars: a–c = 1 cm, d = 2 cm, e–i = 1 cm.

Rigidoporus nevadensis Iturr. & Ryvarden was described from South America (Venezuela), and it is similar to *Physisporinus centroamericanus* by having red or pale orange pores, thick-walled encrusted hyphoid cystidia and occurrence in tropical America. However, the former has an effused–reflexed basidiomata, larger pores (5–8/mm vs. 8–10/mm) and smaller basidiospores (3–4 × 2.4–2.7 µm vs. 4–4.7 × 3.2–4 µm, Ryvarden & Iturriaga 2010). *Rigidoporus pendulus* Ryvarden was described from Indonesia, it has a violaceous pore surface when fresh, smaller pores of 8–10/mm, encrusted thick-walled hyphoid cystidia and globose basidiospores 4–4.5 µm in diam, which is similar to *P. centroamericanus* (Ryvarden 1990). However, *R. pendulus* has pileate basidiomata and a distinct cuticle below a warted surface (Ryvarden 1990).

In the phylogenetic analyses, *Physisporinus centroamericanus* is closely related to *P. rigidus* (Figs 1, 2), but the hyphoid cystidia of the latter species project from the hymenium and present at the dissepiment edge. *Physisporinus centroamericanus* is also related to *P. sulphureus* and *P. roseus*, (Figs 1, 2); differences between the former and the latter two species are detailed in the above paragraph.

Physisporinus dollingerii Y.C. Dai, Chao G. Wang & Vlasák, sp. nov. Figs 3c, 7

Index Fungorum number: IF901994; Facesoffungi number: FoF15725

Etymology – "*dollingerii*" (Lat.): in honor of Neil Dollinger who collected most of the specimens of this species.

Basidiomata annual, sometimes reviving and then with two loosely attached layers, resupinate, soft woody to corky, no taste or odor when fresh, turning hard corky to slightly hard bone in dried specimens, usually in small patches effused to 30 mm long, 20 mm wide, 1.7 mm thick, interconnected by strips of sterile tissue. Pores pinkish to red when fresh, unchanged after bruising but discoloring with age, clay buff, pale clay pink to pale orange–brown when dried; sterile margin broad to narrow, papery thin, sometimes extending to another basidiomata patch; pores angular, 5–7/mm; dissepiment thin, lacerated. Subiculum cream, soft woody to corky, about 0.2 mm thick. Tubes with the same color as pores or buff yellow, hard corky to slightly hard bone when dried, about 1.5 mm long.

Hyphal structure monomitic; hyphae with simple septa, colorless to pale yellowish, not encrusted with crystals, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue; subiculum and tubes turning dark brown in potassium hydroxide. Hyphae in subiculum normally thick-walled but having a wide lumen, rarely with branches, with frequent simple septa, mostly straight, slightly interlaced, agglutinated, 4–6 µm in diameter. Hyphae in tube trama usually slightly thick-walled having a wide lumen, occasionally with branches, with frequent simple septa, normally winding, almost parallel, agglutinated, 3–4.5 µm in diameter; some thin-walled hyphae at the dissepiment edge bearing crystals at tips and resembling hyphoid cystidia. Hymenial cystidia present, thin-walled, smooth, 21–24 × 3–4 µm; cystidioles fusoid, with a thin wall, smooth, 14–15 × 5 µm; basidia cephaloid to barrel−shaped, bearing 4–spores and a simple septum at base, 12–17 × 6–8 µm; basidioles of similar shape to basidia, but shorter. Crystals present in tube structure.

Figure 4 – Basidiomata of taxa of *Physisporinus* and *Rigidoporus*. a *P. sublineatus* (Dai 20493). b *P. tasmanicus* (Cui 16620). c *P. vitreosanguineus* (JV 0909/3). d *Physisporinus* sp. 1 (JV 0309/45). e *Physisporinus* sp. 2 (CWU 3875). f *Physisporinus* sp. 3 (JV 1310/15−1).

g *R. hypobrunneus* (Dai 10503). h *P. vinctus* (JV 0610/A31B). i *P. lineatus* (JV1008/18). Scale bars: a = 2 cm, b–i = 1 cm.

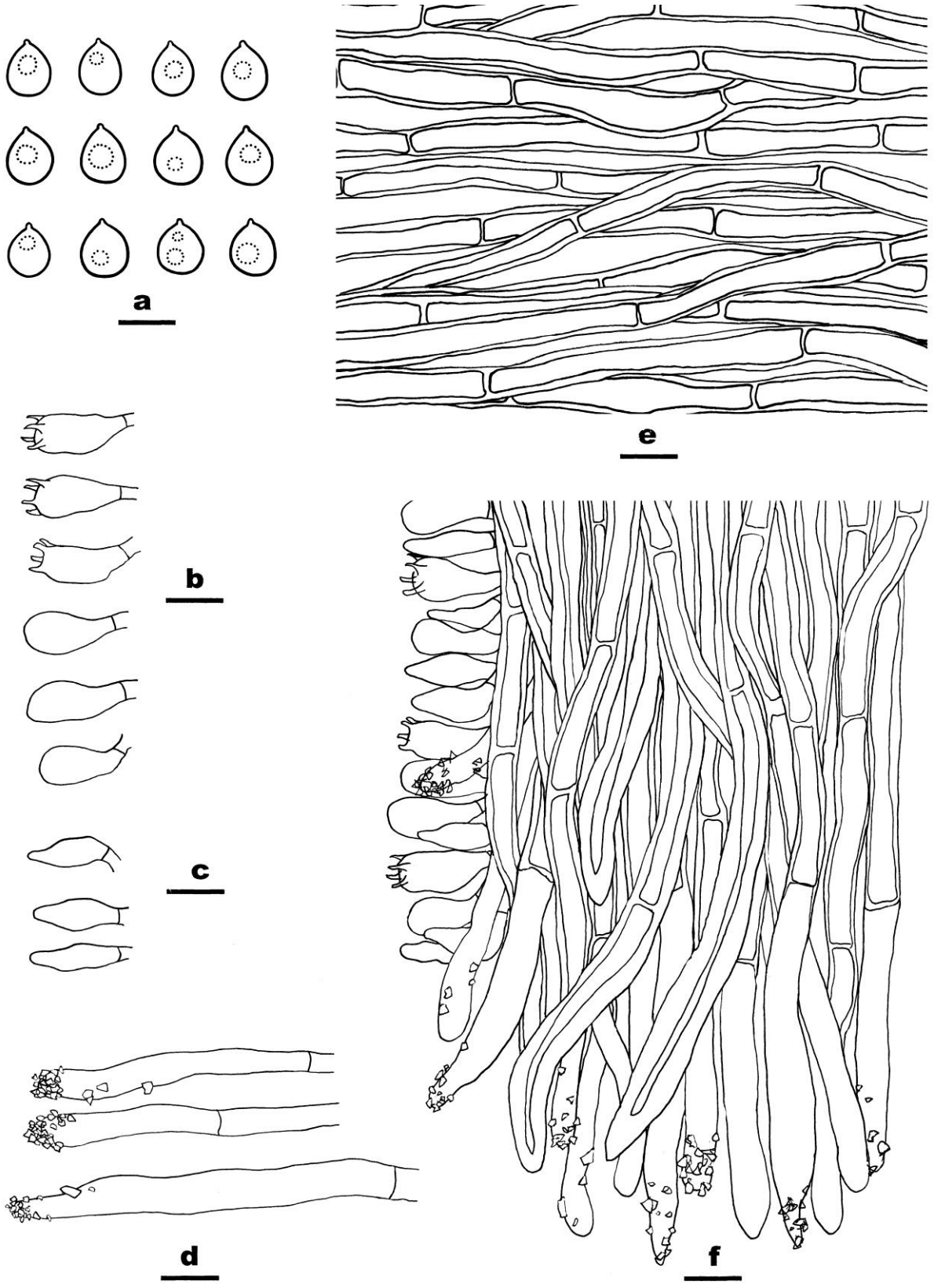

Figure 5 – Microscopic characteristics about *Physisporinus caesiomarginatus* (Dai

19793−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Hyphoid cystidia. e Contextual hyphae. f Tramal hyphae. Scale bars: a = 5 µm, b–f = 10 µm.

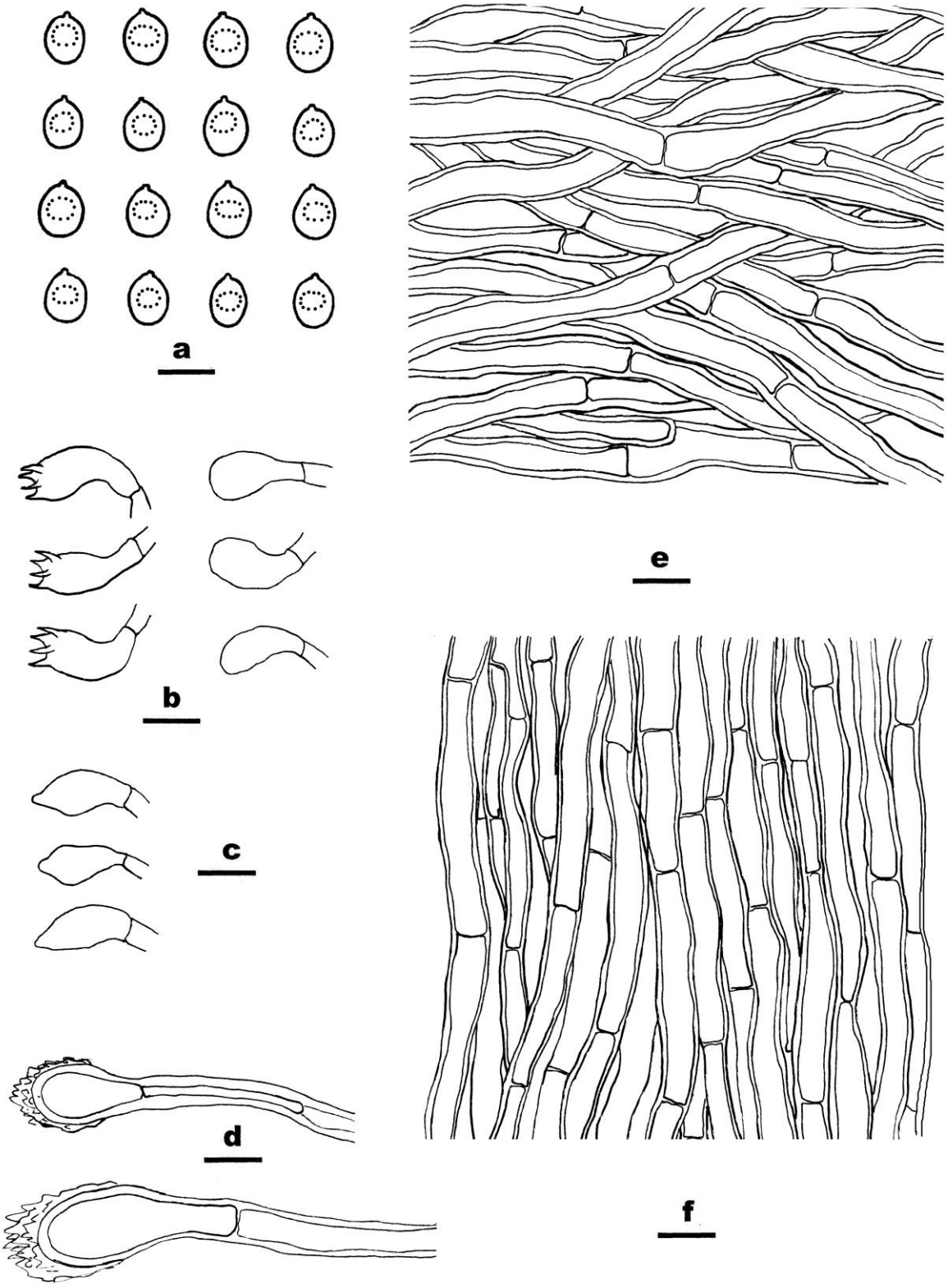

Figure 6 – Microscopic characteristics about *Physisporinus centroamericanus* (Kout

1807/15.1−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Hyphoid cystidia. e Subicular hyphae. f Tramal hyphae. Scale bars: a = 5 µm, b–f = 10 µm.

Basidiospores subglobose to broadly ellipsoid, colorless, with a thin wall, smooth, sometimes with a large or small oil drop, negative in Melzer's reagent, acyanophilous in Cotton Blue, 4.5–5.5(–6) × (3.5–)4–5 µm, L = 5.02 µm, W = 4.29 µm, Q = 1.15–1.20 (n = 120/4).

Known distribution – North and Central America.

Material examined – COSTA RICA, Braulio Carillo Nat. Park, 23 Apr 2017, JV 1704/114 (JV, duplicate, BJFC036127). – USA, Florida, hardwood, Dollinger 880 (JV, duplicate, BJFC036124); *Pinus*, Dollinger 1000 (JV, duplicate, BJFC036126); hardwood, Dollinger 886 (JV, holotype), BJFC036125 (isotype).

Notes – *Physisporinus dollingerii* is defined by annual to reviving, thin, resupinate basidiomata with reddish pores when fresh, clay pink to brown when dry, angular pores of 5–7/mm; thin-walled, apically encrusted hyphoid cystidia−like hyphae present at the dissepiment edge; subglobose to broadly ellipsoid basidiospores of 4.5–5.5 × 4–5 µm, and growth on both angiosperm and gymnosperm wood in North and Central America.

Physisporinus dollingerii is similar to *P. furcatus* (Núñez & Ryvarden) F. Wu, Jia J. Chen & Y.C. Dai and *P. yunnanensis* in morphology by having almost the same basidiospore size (4.5–5.5 µm in *P. furcatus*; 4–5.5 × 3.5–5 µm in *P. yunnanensis*; 4.5–5.5 × 4–5 µm in *P. dollingerii*, Núñez et al. 2001, Cai et al. 2023), but the latter two have bigger pores (2–3 per mm in *P. furcatus* and *P. yunnanensis* vs. 5–7 per mm), and *P. furcatus* has forked cystidia and a distribution in Eurasia (Núñez et al. 2001).

In the phylogenetic analyses, *Physisporinus* sp. 3, *P. rhododendri*, *P. subfurcatus*, *P. sanginolentus*, *P. furcatus* and *P. yunnanensis* are closely related to *P. dollingerii*, but the pores become red when bruised in the former four taxa species, and differences between *P. furcatus*, *P. yunnanensis* and *P. dollingerii* are detailed in the above paragraph. In addition, these seven taxa form seven different lineages grouped in *Physisporinus* (100% ML, 1.00 BPP; Figs 1, 2).

Physisporinus minutissimus Y.C. Dai, Chao G. Wang & Vlasák, sp. nov. Figs 3d, 8

Index Fungorum number: IF901995; Facesoffungi number: FoF15726

Etymology – "*minutissimus*" (Lat.): refers to the species having very small pores.

Basidiomata annual, effused–reflexed to resupinate, soft to ceraceous, with mushroom smell when fresh, turning hard corky to slightly hard bone in dried specimens, effused to 230 mm long and 80 mm wide when resupinate; pilei elongated, extending to 10 mm, 40 mm wide and 1.5 mm thick. Pileal surface light ochre to yellowish when fresh, cinnamon buff to buff yellow, rough, glabrous, and faintly zonate when dried; margin blunt, pale yellow. Pores sulphur yellow when fresh, brownish vinaceous when dried, somewhat glancing; sterile margin concolorous with fresh pores, orange−yellow to cream when dried, around 0.8 mm wide; pores elongated, angular to irregular, 12–15/mm; dissepiment thin, lacerated. Context buff yellow to cream, soft woody to corky when dried, about 0.2 mm thick. Tubes paler than pores and with the same color as pileal surface when dried, about 1.3 mm long.

Hyphal structure monomitic; hyphae with simple septa, colorless to pale yellowish, not encrusted with crystals, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue; subiculum and tubes turning slightly dark in potassium hydroxide. Hyphae in context normally distinctly thick-walled but having a wide lumen, without branches, with frequent simple septa, slightly winding, obviously interlaced, 4.5–6 µm in diameter. Hyphae in tube trama usually slightly thick-walled having a wide lumen, occasionally with branches, normally straight, completely parallel and strongly agglutinated, 3–4.8 µm in diameter. Hyphoid cystidia and hymenial cystidia not present; cystidioles fusoid or mastoid, with a thin wall, smooth, 11–13 × 4.5–6 µm; basidia cephaloid to barrel–shaped, bearing 4–spored and a simple septum at base, 13–14 × 7–8 µm; basidioles of similar shape to basidia, but shorter. Irregular or rhomboid crystals present in tube

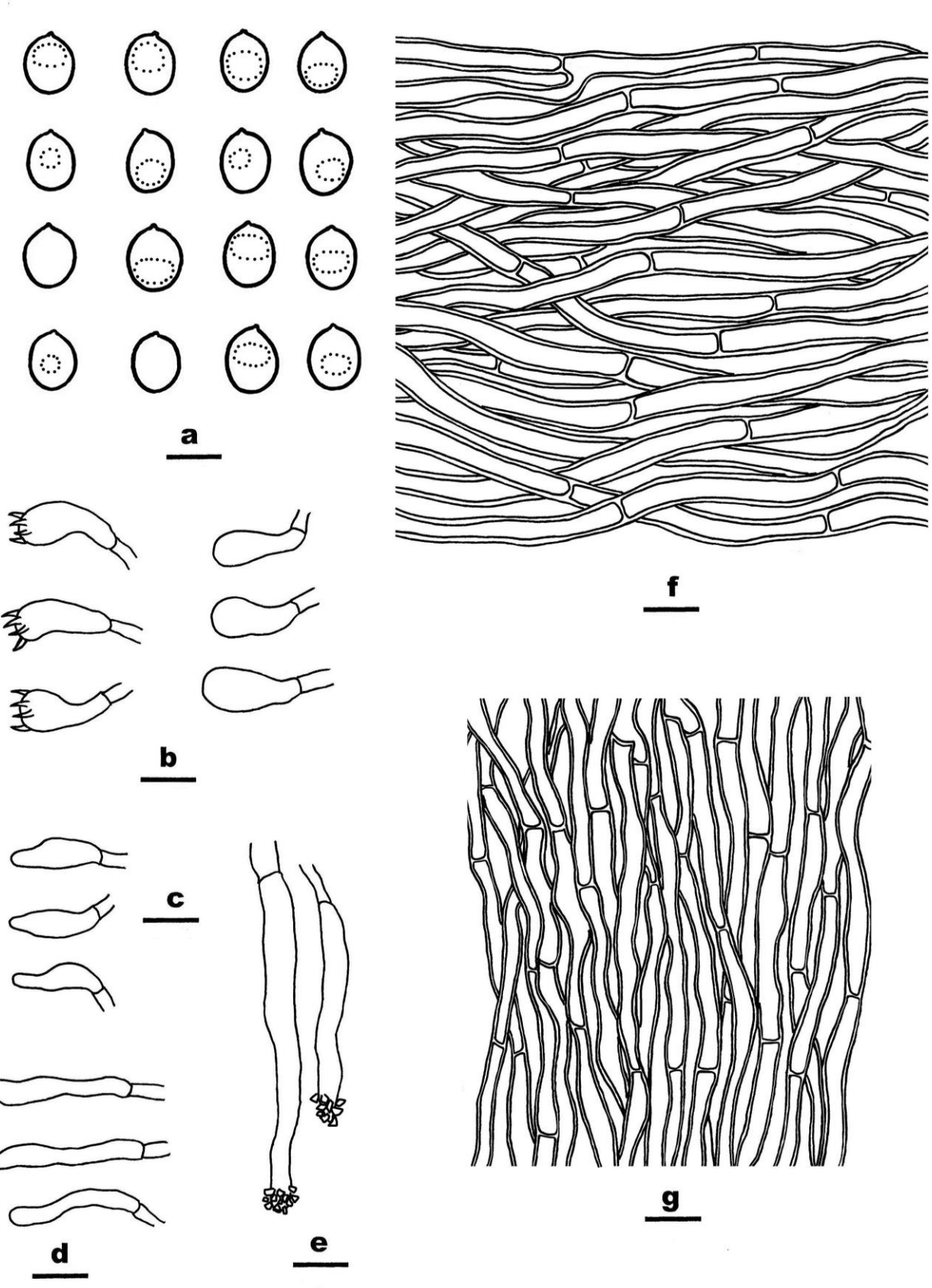

Figure 7 – Microscopic characteristics about *Physisporinus dollingerii* (Dollinger 886−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Hymenial cystidia. e Hyphoid cystidia. f Subicular hyphae. g Tramal hyphae. Scale bars: a = 5 µm, b–g = 10 µm.

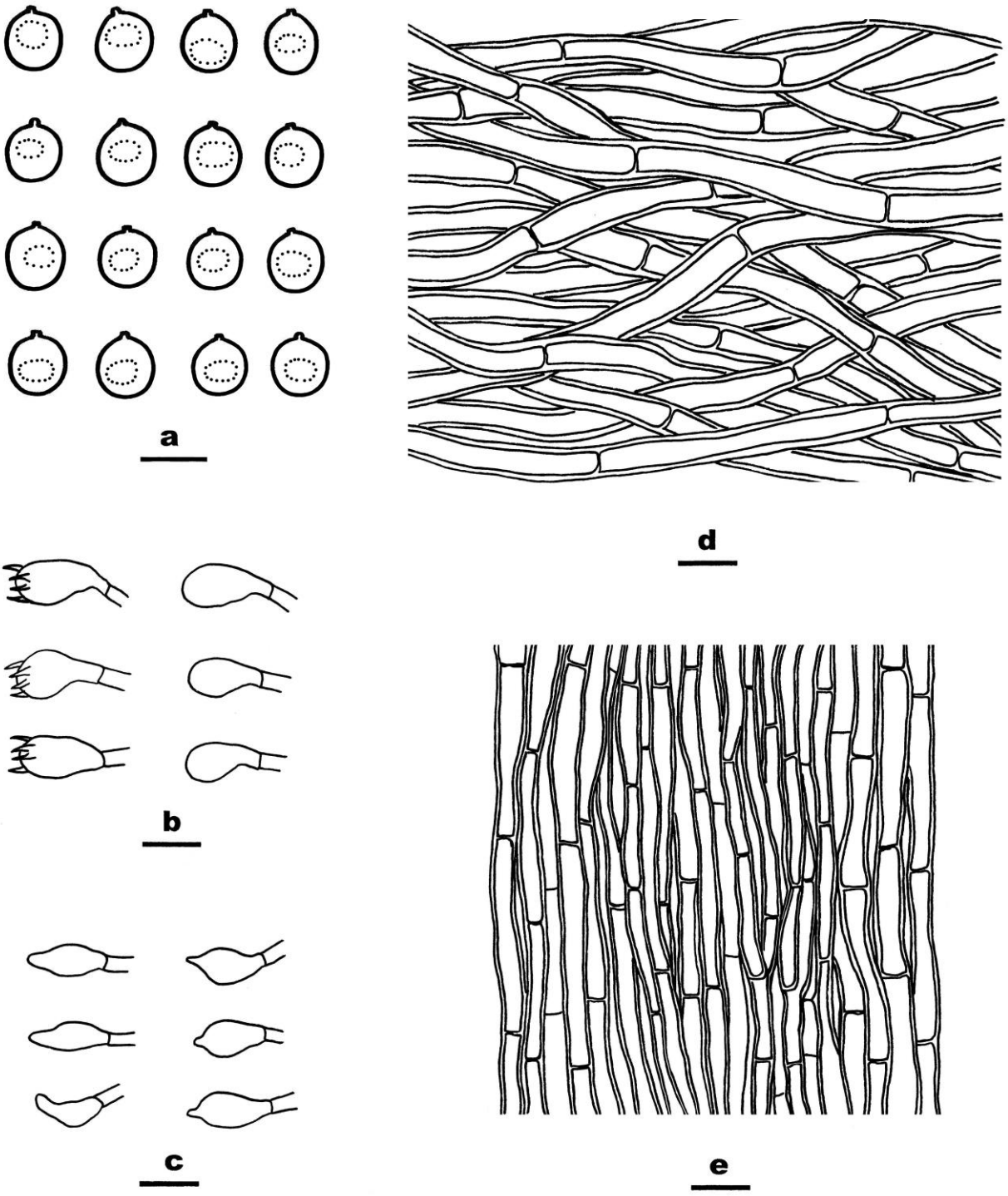

Figure 8 – Microscopic characteristics about *Physisporinus minutissimus* (JV 1704/83−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Contextual hyphae. e Tramal hyphae. Scale bars: a = 5 µm, b–e = 10 µm.

structure. Basidiospores globose to subglobose, colorless, with a thin wall, smooth, with a big to medium oil drop, negative in Melzer's reagent, weakly cyanophilous in Cotton Blue, 4.1–4.6(–4.8) × 4–4.6(–4.8) µm, L = 4.34 µm, W = 4.29 µm, Q = 1.01 (n = 30/1).

Known distribution – Central America.

Material examined – COSTA RICA, Dominical, Hacienda Barú, 21 Apr 2017, JV 1704/83 (JV, holotype), BJFC036144 (isotype).

Notes – *Physisporinus minutissimus* is defined by resupinate to effused–reflexed basidiomata, sulphur yellow fresh pores, very small pores of 12–15/mm, the lack of any cystidia, subglobose to globose basidiospores of 4.1–4.6 × 4–4.6 µm. It is known only from the type locality in Central America.

Physisporinus minutissimus, *P. lavendulus* F. Wu, Jia J. Chen & Y.C. Dai and *P. longicystidius* (P.K. Buchanan & Ryvarden) F. Wu, Jia J. Chen & Y.C. Dai are closely related in the phylogenies (Figs 1, 2). However, *Physisporinus lavendulus* differs from *P. minutissimus* by distinctly pileate basidiomata, violet pore surface when fresh, and bigger pores (9–10/mm vs. 12–15/mm, Wu et al. 2017). *Physisporinus longicystidius* is distinguished from *P. minutissimus* by the presence of cystidia, and bigger pores (8–11/mm vs. 12–15/mm, Buchanan & Ryvarden 2000). In addition, these three species form three different lineages grouped in *Physisporinus* (100% ML, 1.00 BPP, Figs 1, 2).

Rigidoporus cystidioides is similar to *Physisporinus minutissimus* by having a more or less yellow pore surface when fresh, small pores and almost the same basidiospore size (3.5–4.5 × 3–4 µm vs. 4.1–4.6 × 4–4.6 µm, Corner 1987). However, the former has a resupinate basidiomata, the presence of the thick-walled encrusted hyphoid cystidia, and it is distributed in Southeast Asia (Corner 1987).

Physisporinus neovitreus Y.C. Dai, Chao G. Wang & Vlasák, sp. nov. Figs 3e, 9

Index Fungorum number: IF901996; Facesoffungi number: FoF15727

Etymology – "*neovitreus*" (Lat.): refers to the species similarity to *Physisporinus vitreus* but occurrence in North America.

Basidiomata annual, resupinate, nodulose, sometimes with step–like reflexed pilei, ceraceous, no taste or odor when fresh, turning bone hard to hard corky in dried specimens, effused to 140 mm long and 120 mm wide and 4 mm thick when resupinate; pilei elongated, extending up to 5 mm, 40 mm wide and 3 mm thick. Pileal surface curry-yellow when fresh, buff to clay buff, glabrous, and faintly zonate when dried; margin acute, white when fresh, apricot orange when dried. Pores straw yellow to white when fresh, pinkish-buff when dried, sterile margin concolorous with pores when fresh, buff to cream when dried, very narrow; pores usually angular, 8–10/mm; dissepiment thin, lacerated. Subiculum buff yellow, corky, about 0.4 mm thick. Tubes buff yellow to pinkish buff, hard corky to bone hard when dried, about 3.6 mm long.

Hyphal structure monomitic; hyphae with simple septa, colorless, not encrusted with crystals, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue; subiculum and tubes not dissolved in the potassium hydroxide. Hyphae in context normally slightly thick-walled, occasionally thick-walled having a wide or medium lumen, without branches, with frequent simple septa, usually winding, interlaced, 4–8 µm in diameter. Hyphae in tube trama normally thick-walled having a wide to medium lumen, sometimes subsolid, rarely with branches, mostly straight, almost parallel and strongly agglutinated, 4.5–7.5 µm in diameter; some thin-walled hyphae at dissepiment edge bearing crystals resembling hyphoid cystidia. Hymenial cystidia present, thin-walled, apically encrusted, sometimes apically forked, 21–26 × 6–8 µm; cystidioles abundant, fusoid, with a thin wall, smooth, 16–19 × 5–6.5 µm; basidia barrel−shaped, usually with an intermediate constriction, bearing 4−spored and a simple septum at base, 16–18 × 7–8 µm; basidioles cephaloid to pear–shaped, shorter than basidia. Irregular or rhomboid crystals present in tube structure. Basidiospores subglobose to broadly ellipsoid, colorless, with a thin wall, smooth, with a large or small oil drop, negative in Melzer's reagent, acyanophilous in Cotton Blue, (4.8–)4.9–6 × 4–4.8(–5.1) µm, L = 5.20 µm, W = 4.29 µm, Q = 1.17–1.23 (n = 90/3).

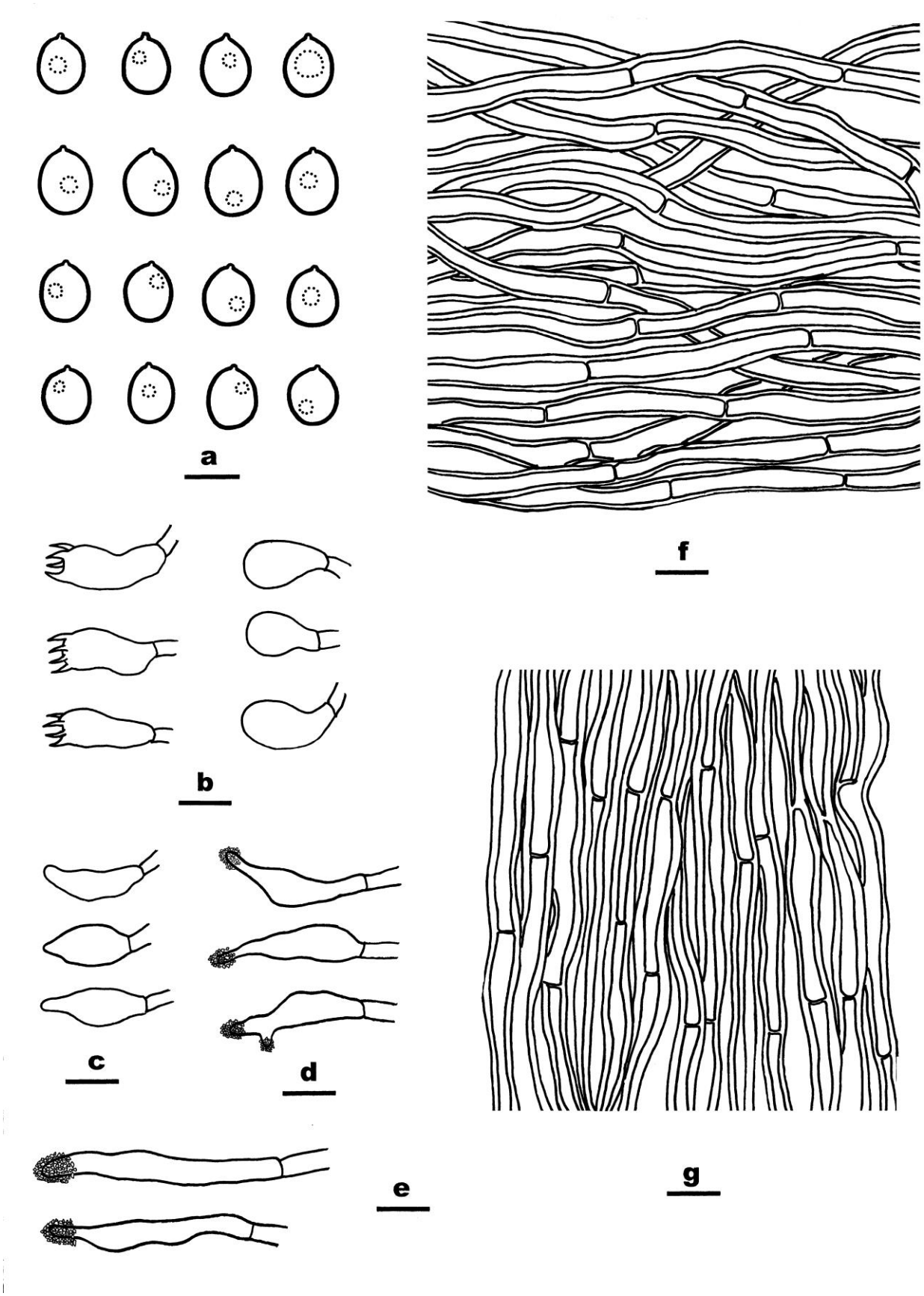

Figure 9 – Microscopic characteristics of *Physisporinus neovitreus* (JV 1009/59−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Hymenial cystidia. e Hyphoid cystidia. f Contextual hyphae. g Tramal hyphae. Scale bars: a = 5 µm, b–g = 10 µm.

Known distribution – North America.

Material examined – USA, New Jersey, Watchung Reservation, hardwood, 20 Sep 2010, JV 1009/59 (JV, holotype), BJFC036130 (isotype); Pennsylvania, Green Lane St. Park, hardwood, 22 Sep 2007, JV 0709/188 (JV); Philadelphia, Wissahickon Creek, Liriodendron, 14 Sep 2005, JV 0509/127 (JV, BJFC036129); Tennessee, Great Smoky Mt., Albright Grove, hardwood, 4 Sep 2005, JV 0509/47 (JV, duplicate, BJFC036128).

Notes – *Physisporinus neovitreus* is defined by resupinate to sometimes effused–reflexed basidiomata showing sometimes also step−like, elongated pilei with sharp margin, white to straw yellow fresh pores which become pinkish buff when dry, angular pores of 8–10/mm, apically forked and encrusted hymenial cystidia, and subglobose to broadly ellipsoid basidiospores of 4.9–6 × 4–4.8 µm. It is widely distributed in the eastern USA. *Physisporinus vitreus* was recorded in the USA (Gilbertson & Ryvarden 1987), however, the samples of so–called *P. vitreus* in the USA are most probably *P. neovitreus*.

Physisporinus neovitreus, *P. crataegi*, and *P. minutissimus* are similar in morphology. The three species share resupinate to effused−reflexed basidiomata with buff, straw yellow or sulphur yellow pores when fresh, and broadly ellipsoid to globose basidiospores. However, *Physisporinus crataegi* is known from *P. neovitreus* by larger pores (6–8/mm vs. 8–10/mm), narrower tramal hyphae (2.5–4 µm vs. 4.5–7.5 µm), and smaller subglobose to broadly ellipsoid basidiospores (4.2–5 × 3.2–4.2 µm vs. 4.9–6 × 4–4.8 µm, Wu et al. 2017). *Physisporinus minutissimus* is easily distinguished from *P. neovitreus* by smaller pores (12–15/mm vs. 8–10/mm) and smaller subglobose basidiospores (4.1–4.6 × 4–4.6 µm vs. 4.9–6 × 4–4.8 µm).

Physisporinus neovitreus and *P. caesiomarginatus*, *P. crataegi*, *P. cinereus* (Núñez & Ryvarden) F. Wu, Jia J. Chen & Y.C. Dai and *P. tamilnaduensis* Kaliyaperumal, Kezo & Bhat are closely related in the phylogenies (Figs 1, 2), but *P. caesiomarginatus* has white to cream pore surface when fresh, and small basidiospores (4–4.8 × 3.3–4.1 µm vs. 4.9–6 × 4–4.8 µm). *Physisporinus cinereus* has an obviously fibrillose pileus, and larger pores (5–6/mm vs. 8–10/mm; Núñez & Ryvarden 1999, Wu et al. 2017). *P. tamilnaduensis* has pileate basidiomata, brownish orange to light brown pileal surface when fresh, light brown pores when fresh and thick-walled encrusted hyphoid cystidia (Crous et al. 2023). In addition, *P. neovitreus* forms a different lineage grouped in *Physisporinus* (100% ML, 1.00 BPP; Figs 1, 2).

Rigidoporus incarnatus Corner is similar to *Physisporinus neovitreus* by the resupinate to effused–reflexed basidiomata and a pinkish buff pore surface when dry. However, the former has a dull bay brown pileal surface, a dimitic hyphal structure, smooth cystidia and smaller subglobose basidiospores (2.5–3.5 × 2–2.5 µm vs. 4.9–6 × 4–4.8µm, Corner 1987), and it is known from the type locality in Sumatra Island only (Corner 1987).

Physisporinus rhododendri Y.C. Dai, Yuan Yuan & Chao G. Wang, sp. nov. Figs 3f, 10

Index Fungorum number: IF901997; Facesoffungi number: FoF15728

Etymology – "*rhododendri*" (Lat.): refers to the species growth on *Rhododendron*.

Basidiomata annual, resupinate, soft to ceraceous, no taste or odor when fresh, turning fragile to brittle in dried specimens, 150 mm long, 30 mm wide and 0.5 mm thick. Pores snow white when fresh, quickly becoming blood red upon bruising, eventually becoming ivory to black–brown upon drying; sterile margin not distinct and nearly absent; pores angular to round, 5–6/mm; dissepiment fairly thick to thin, even to slightly lacerated. Subiculum ivory and fragile when dried, nearly absent, only about 0.1 mm thick. Tubes with the same color as pores, fragile when dried, about 0.4 mm long.

Hyphal structure monomitic; hyphae with simple septa, colorless, not encrusted with crystals, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue; subiculum and tubes undissolved in potassium hydroxide. Hyphae in subiculum usually thin-walled, occasionally slightly thick-walled, rarely with branches, with frequent simple septa, slightly winding, obviously interlaced, 6–9 µm in diameter. Hyphae in tube trama usually thin-walled, occasionally

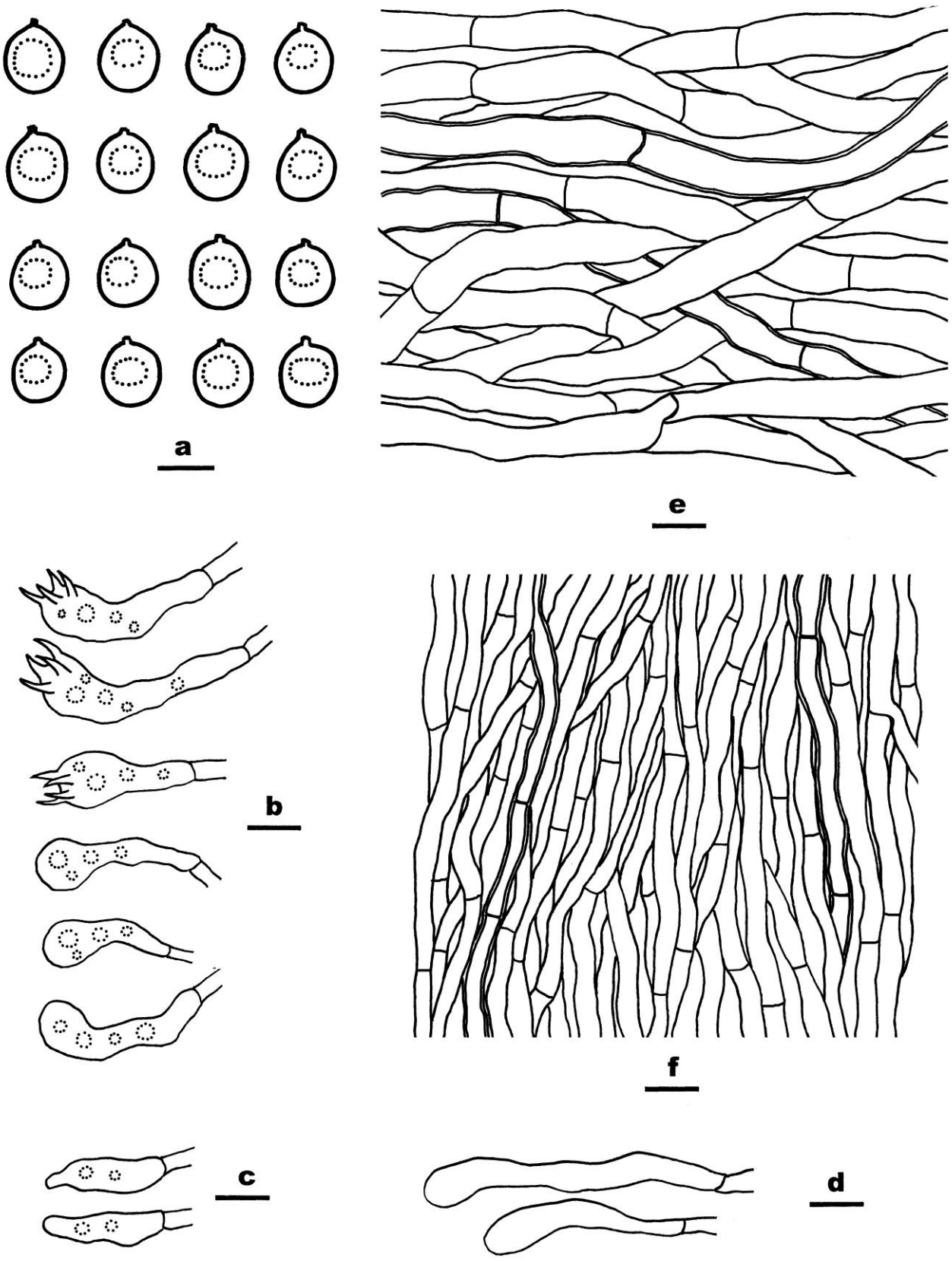

Figure 10 – Microscopic characteristics about *Physisporinus rhododendri* (Dai 22279−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Swollen hyphae at the dissepiment edge. e Subicular hyphae. f Tramal hyphae. Scale bars: a = 5 µm, b–f = 10 µm.

slightly thick-walled, rarely with branches, with frequent simple septa, mostly winding, almost parallel, strongly agglutinated, 3–4.5 µm in diameter; dissepimental hyphae thin-walled, not encrusted with crystals but swollen. Hyphoid cystidia and hymenial cystidia not seen; cystidioles fusoid, usually with a thin wall, smooth, frequently with two small oil drops, 19–21 × 5–6 µm; basidia clavate, bearing 4–spored and a simple septum at base, mostly with several drops, 20–35 × 8–10 µm; basidioles pear-shaped, shorter than basidia. Crystals absent in tube structure. Basidiospores subglobose, colorless, with a thin wall, smooth, mostly with a large to medium oil drops, negative in Melzer's reagent, acyanophilous in Cotton Blue, (5.2–)5.3–6.3(–6.5) × 5–5.5(–5.7) µm, L = 5.82 µm, W = 5.14 µm, Q = 1.13–1.14 (n = 60/2).

Known distribution – Southwest China.

Material examined – CHINA, Guizhou Province, Bijie, Bailidujuan Forest Park, fallen rotten branch of *Rhododendron*, 15 May 2021, Dai 22272 (BJFC036860); Dai 22279 (BJFC036867, holotype).

Notes – *Physisporinus rhododendri* is defined by white resupinate basidiomata, rapidly becoming blood red when bruised, round to angular pores of 5–6/mm, long basidia measuring 20–35 × 8–10 µm, the absence of any kind of cystidia, subglobose basidiospores of 5.3–6.3 × 5–5.5 µm, and growth on *Rhododendron* in Southwest China.

Physisporinus sanguinolentus is very similar to *P. rhododendri* by snow white pores when fresh which quickly become blood red when bruised, and then brown to black when dry (Donk 1966, Núñez & Ryvarden 2001). However, *P. sanguinolentus* differs from *P. rhododendri* by having narrower subicular hyphae (3.5–6.5 µm vs. 6–9 µm, this study), and shorter basidia (12–23 × 6.5–8 µm vs. 20–35 × 8–10 µm, Ryvarden & Melo 2017).

Phylogenetically *Physisporinus rhododendri* is closely related to *Physisporinus* sp. 3 and *P. yunnanensis* (Fig. 1), and the former two taxa share the fresh basidiomata reddening when bruised, and subglobose to broadly ellipsoid basidiospores (5.5–6.4 × 4.7–5.2 µm in *Physisporinus* sp. 3, 5.3–6.3 × 5–5.5 µm in *P. rhododendri*, this study). However, *Physisporinus* sp. 3 differs from *P. rhododendri* by thin-walled encrusted hyphoid cystidia, the presence of rhomboid or irregular crystals, and shorter basidia (16–20 × 8–9 µm vs. 20–35 × 8–10 µm, this study). *P. yunnanensis* is known from *P. rhododendri* by larger pores (2–3/mm vs. 5–6/mm, Cai et al. 2023) and smaller subglobose basidiospores (4–5.5 × 3.5–5 µm vs. 5.3–6.3 × 5–5.5 µm, Cai et al. 2023). In addition, *P. rhododendri* forms a different lineage grouped in *Physisporinus* (100% ML, 1.00 BPP; Figs 1, 2).

Physisporinus rigidus Y.C. Dai, Chao G. Wang & Vlasák, sp. nov. Figs 3g, 11

Index Fungorum number: IF901998; Facesoffungi number: FoF15729

Etymology – "*rigidus*" (Lat.): refers to the species having rigid basidiomata when dry.

Basidiomata annual, reviving and developing a second tube layer, resupinate, corky to soft woody, no taste or odor when fresh, turning rigid to hard corky in dried specimens, effused to 80 mm long, 50 mm wide and 1.2 mm thick. Pores brown–red when fresh, deep olive to honey yellow when dried; sterile margin not distinct; pores round, 10–12/mm; dissepiment thin, even. Subiculum cinnamon buff, corky to soft woody, about 0.5 mm thick. Tubes buff yellow to salmon, rigid, about 0.7 mm long, a dark line present between the two tube layers. Honey yellow mycelial plates present under the basidiomata in wood cavities.

Hyphal structure monomitic; hyphae with simple septa, colorless to pale yellowish, not encrusted with crystals, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue; subiculum and tubes undissolved in potassium hydroxide. Hyphae in subiculum normally distinctly thick-walled but having a wide to medium lumen, rarely with branches, mostly straight, strongly interlaced, 5.5–7.5 µm in diameter. Hyphae in tube trama normally thick-walled having a wide lumen, rarely with branches, with frequent simple septa, mostly straight, almost parallel, 4–5.5 µm in diameter. Hyphoid cystidia present, arising from hyphae in tube trama, embedded in trama,

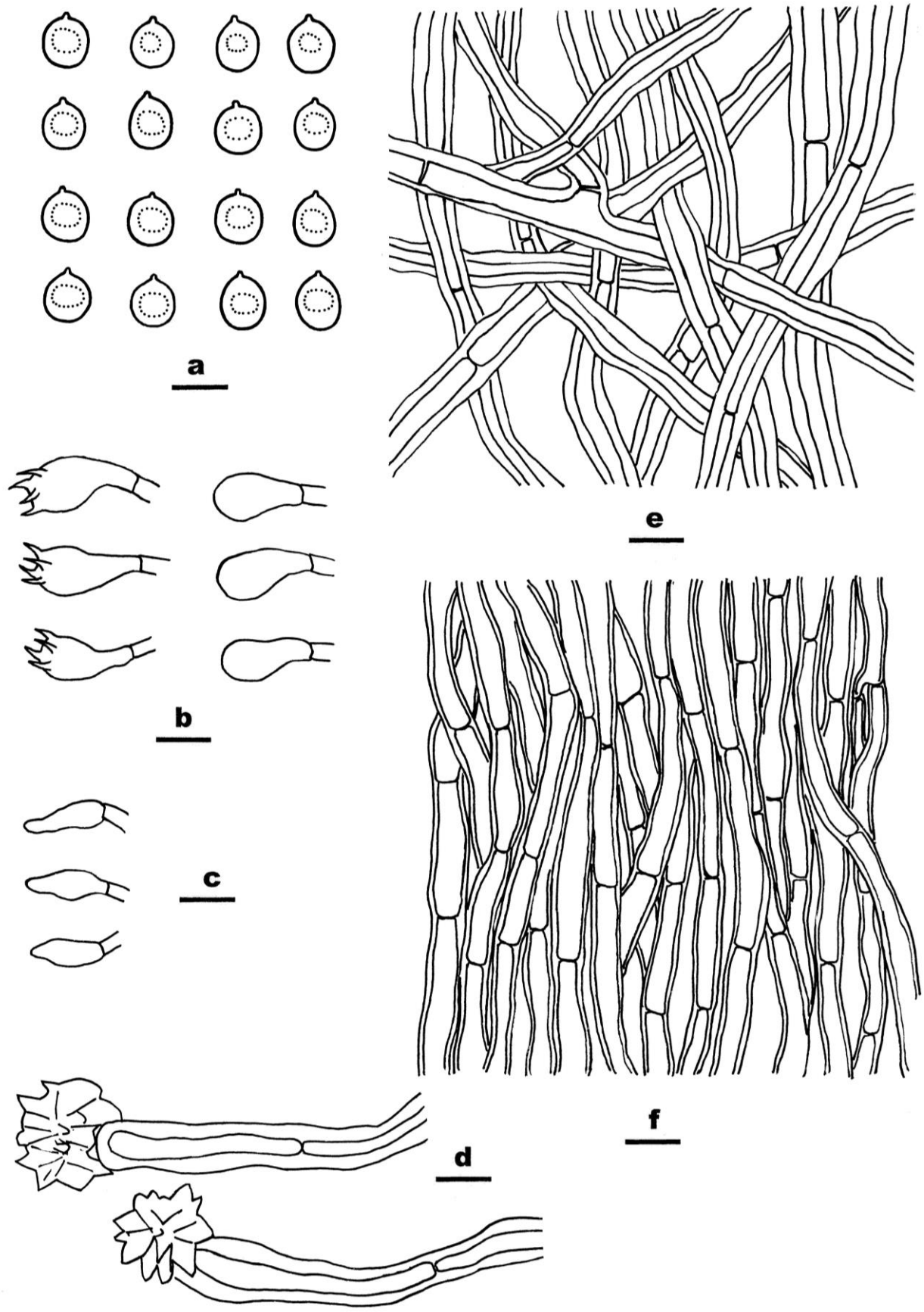

Figure 11 – Microscopic characteristics about *Physisporinus rigidus* (JV 1704/79−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Hyphoid cystidia. e Subicular hyphae. f Tramal hyphae. Scale bars: a = 5 µm, b–f = 10 µm.

sometimes protruding from the dissepiment edge, with a thick-wall, swollen at apex, apically encrusted, 10–15 µm in diam at the apex; hymenial cystidia not seen; cystidioles fusoid, with a thin wall, smooth, 12–14 × 5–5.5 µm; basidia long barrel–shaped to more or less pyriform, bearing 4−spored and a simple septum at base, 15–18 × 7–8 µm; basidioles mostly cephaloid, shorter than basidia. Basidiospores subglobose to broadly ellipsoid, colorless, with a thin wall, smooth, sometimes with a large or small oil drop, negative in Melzer's reagent, acyanophilous in Cotton Blue, 4–4.6(–5) × 3.2–4 µm, L = 4.26 µm, W = 3.72 µm, Q = 1.15 (n = 30/1).

Known distribution – Central and South America.

Material examined – COSTA RICA, Tarcoles, 22 Apr 2017, JV 1704/79 (JV, holotype), BJFC036143 (isotype).

Notes – *Physisporinus rigidus* is defined by annual, reviving, dark reddish basidiomata which become rigid when dry, small pores 10–12 per mm, thick-walled, apically encrusted hyphoid cystidia, subglobose to broadly ellipsoid basidiospores of 4–4.6 × 3.2–4 µm. To date, only known from type locality in Central America.

Interestingly a strain, F 2061, isolated from the fern *Tectaria heracleifolia* in Mexico grouped with *Physisporinus rigidus* forming an independent lineage in our study (Figs 1, 2). We treat this strain as "*Physisporinus rigidus*" because we did not study the material.

Physisporinus centroamericanus is similar and related to *P. rigidus* by the thick-walled, encrusted hyphoid cystidia, almost the same basidiospore size (4–4.7 × 3.2–4 µm vs. 4–4.6 × 3.2–4 µm), and overlapping distribution. However, the former has dark brown pores when dry, bigger pores (8–10/mm vs. 10–12/mm), the absence of true cystidia at the dissepiment edge, and mamillated cystidioles.

In the phylogenetic analyses, *Physisporinus sulphureus* and *P. roseus* are also closely related to *P. rigidus* (Figs 1, 2). However, *P. sulphureus* and *P. roseus* have sulphur yellow and pink pores when fresh, respectively, larger pores (8–9 per mm in *P. sulphureus*, 5–6 per mm in *P. roseus* vs. 10–12 per mm); furthermore, they are Asian species. (Dai & Dai 2018, Chen & Dai 2021).

Physisporinus srilankensis Y.C. Dai, Yuan Yuan & Chao G. Wang, sp. nov. Figs 3h, 12

Index Fungorum number: IF901999; Facesoffungi number: FoF15730

Etymology – "*srilankensis*" (Lat.): refers to the species having a distribution in Sri Lanka.

Basidiomata annual, resupinate, corky to soft woody, no taste or odor when fresh, turning hard corky to slightly bone hard in dried specimens, effused to 50 mm long, 20 mm wide and 0.5 mm thick. Pores buff yellow to straw color when dried; sterile margin indistinct, cream when dried, around 0.5 mm wide; pores round, 5−7/mm; dissepiment thin, even. Subiculum not distinct to nearly absent. Tubes with the same color as pores, hard corky when dried, about 0.5 mm long.

Hyphal structure monomitic; hyphae with simple septa, colorless to pale yellowish, not encrusted with crystals, negative in Melzer's reagent, acyanophilous in Cotton Blue; subiculum and tubes turning dark in potassium hydroxide. Hyphae in tube trama normally distinctly thick-walled but having a wide lumen, rarely with branches, loosely interlaced to almost parallel, strongly agglutinated, 3.8–8 µm in diameter. Hyphoid cystidia present in trama and at the dissepiment edge, distinctly thick-walled, apically encrusted, sometimes projecting from the hymenium, 25–45 × 5–9 µm. Hymenial cystidia not present; cystidioles fusoid, with a thin wall, smooth, 8–14 × 2–4.5 µm. Basidia barrel−shaped, bearing 4–spored and a simple septum at base, and with one to a few oil drops, 11–19 × 7–9.5 µm; basidioles of similar shape to basidia, but shorter. Basidiospores subglobose to broadly ellipsoid, colorless, with a thin wall, smooth, with a small or large oil drop, negative in Melzer's reagent, acyanophilous in Cotton Blue, (4.8–)5–5.8(–6) × 4–4.8(–5) µm, L = 5.17 µm, W = 4.36 µm, Q = 1.19 (n = 30/1).

Known distribution – Southeast Asia.

Material examined – SRI LANKA, Wadduwa, South Bolgoda Lake, fallen angiosperm branch, 28 Feb 2019, Dai 19535 (BJFC031214, holotype).

Notes – *Physisporinus srilankensis* is defined by resupinate basidiomata, straw color to buff yellow pores when dried, round pores of 5−7/mm, thick-walled, encrusted hyphoid cystidia in

trama and at dissepiment edge, subglobose to broadly ellipsoid basidiospores of 5–5.8 × 4–4.8 µm, and growth on angiosperm wood in southeast Asia.

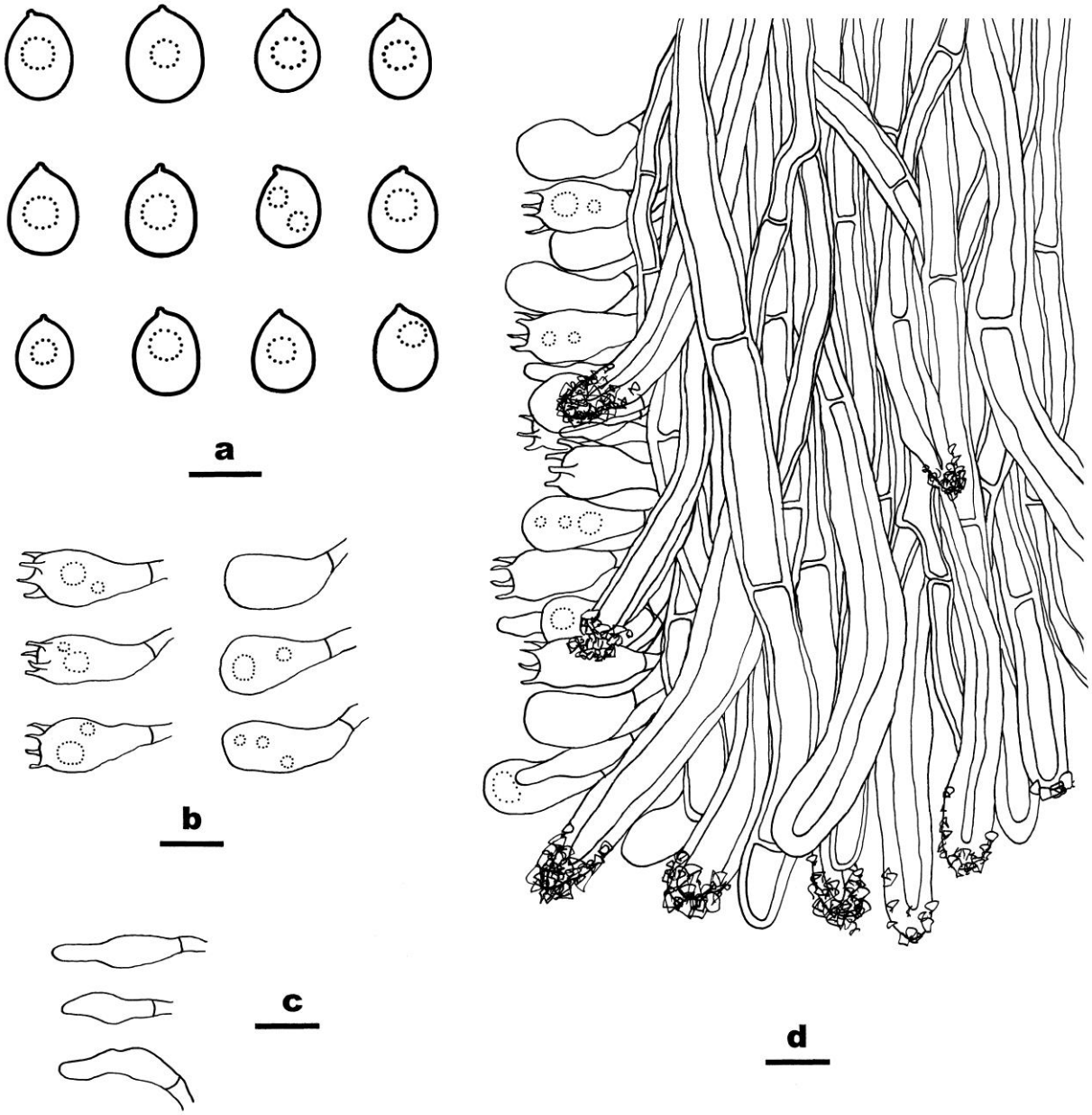

Figure 12 – Microscopic characteristics about *Physisporinus srilankensis* (Dai 19535−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Tramal hyphae. Scale bars: a = 5 µm, b–d = 10 µm.

Physisporinus srilankensis is similar to *P. centroamericanus* and *P. rigidus* by thick-walled, encrusted hyphoid cystidia, and broadly ellipsoid to subglobose basidiospores. However, the latter two have smaller pores (8−10/mm in *P. centroamericanus*, 10−12/mm in *P. rigidus* vs. 5−7/mm), and smaller basidiospores (4–4.6 × 3.2–4 µm in *P. centroamericanus*, 4–4.7 × 3.2–4 µm in

P. rigidus vs. 5–5.8 × 4–4.8 µm). Furthermore, *P. srilankensis* is an Asian species, and the latter two are American species.

Rigidoporus adnatus Corner, *R. albiporus* Corner, *R. cystidioides* (Lloyd) Corner, *R. hypobrunneides* Corner, *R. ochraceicinctus* Corner, *R. pellicula* (Jungh.) Teixeira occur in Southeast Asia, and have resupinate basidiomata. However, *R. adnatus* differs from *Physisporinus srilankensis* by a dimitic hyphal system and smaller basidiospores (2.5–3.2 × 1.7–2 µm vs. 5–5.8 × 4–4.8 µm, Corner 1987); *R. albiporus* differs from *P. srilankensis* by the absence of any kind of cystidia (Corner 1992); *R. cystidioides* is known from *P. srilankensis* by smaller pores (7−10/mm vs. 5−7/mm, Corner 1987) and smaller subglobose to broadly ellipsoid basidiospores (3.5–4.5 × 3–4 µm vs. 5–5.8 × 4–4.8 µm, Corner 1987); *R. hypobrunneides* has a drab brown pore surface when dry and a dimitic hyphal system, which are different from *P. srilankensis* (Corner 1987); *R. ochraceicinctus* differs from *P. srilankensis* by the absence of cystidia (Corner 1992); *R. pellicula* has almost the same basidiospore size (4.5–6.5 × 3–4.5 µm vs. 5–5.8 × 4–4.8 µm) with *P. srilankensis*, but *R. pellicula* has irregular and larger pores (1−3/mm vs. 5−7/mm, Teixeira 1992).

Phylogenetically *Physisporinus srilankensis* forms a different lineage grouped in *Physisporinus* (73% ML, 1.00 BPP, Fig. 1; 98% ML, 1.00 BPP, Fig. 2).

Physisporinus subfurcatus Y.C. Dai, Yuan Yuan & Chao G. Wang, sp. nov. Figs 3i, 13

Index Fungorum number: IF902000; Facesoffungi number: FoF15731

Etymology – "*subfurcatus*" (Lat.): refers to the species resembling *Physisporinus furcatus*.

Basidiomata annual, resupinate, ceraceous to soft, no taste or odor when fresh, turning fragile to brittle in dried specimens, effused to 100 mm long, 50 mm wide, 1.5 mm thick. Pores snow white when fresh, turning blood red upon bruising, eventually honey yellow when dried; sterile margin not distinct to nearly absent; pores angular to round, 3−4/mm, sometimes elongated; dissepiment thin, even. Subiculum soft woody to corky, very narrow, about 0.2 mm thick. Tubes with the same color as pores, fragile to brittle when dried, about 1.3 mm long.

Hyphal structure monomitic; hyphae with simple septa, colorless, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue; subiculum and tubes undissolved in potassium hydroxide. Hyphae in subiculum normally slight thick-walled having a wide lumen, occasionally with branches, mostly straight, loosely interlaced, 6–8 µm in diameter. Hyphae in tube trama usually thin-walled, occasionally slightly thick-walled having a wide lumen, sometimes encrusted with fine colorless crystals, frequently with branches and simple septa, normally winding, almost parallel, strongly agglutinated, 3.5–5.5 µm in diameter. Hyphoid cystidia and hymenial cystidia not present; cystidioles not seen. Basidia long barrel–shaped to pear–shaped, bearing 4–spored and a simple septum at base, 19–25 × 7.5–10 µm; basidioles cephaloid, shorter than basidia. Irregular or rhomboid crystals present in tube structure. Basidiospores subglobose to broadly ellipsoid, colorless, with a thin wall, smooth, with one oil drop, negative in Melzer's reagent, acyanophilous in Cotton Blue, (5.2–)5.3–6.4(–6.5) × (4.4–)4.5–5.6(–6) µm, L = 5.72 µm, W = 5 µm, Q = 1.14–1.15 (n = 60/2).

Known distribution – Central and Northeast China.

Material examined – CHINA, Henan Province, Neixiang County, Baotianman Nature Reserve, rotten angiosperm wood, 23 Sept 2009, Dai 11313 (BJFC007459); Jilin Province, Antu County, Changbaishan Nature Reserve, *Larix*, 16 Aug 1997, Dai 2544 (IFP 015205); 14 Sep 1995, Dai 2105 (BJFC001927, holotype).

Notes – *Physisporinus subfurcatus* is defined by resupinate basidiomata with snow-white pores when fresh, becoming blood red when bruised, encrusted tramal hyphae, the absence of any kind of cystidia, subglobose to broadly ellipsoid basidiospores of 5.3–6.4 × 4.5–5.6 µm, and growth on both angiosperm and gymnosperm wood in temperate China.

Physisporinus furcatus, *P. sanguinolentus*, *Physisporinus* sp. 3, *P. rhododendri*, *P. subfurcatus* and *P. yunnanensis* C.L. Zhao are phylogenetically related (Figs 1, 2) and share distinctly erubescent pores if bruised when fresh (except *P. furcatus* and *P. yunnanensis*).

Morphologically, *Physisporinus furcatus* has two types of cystidia (Núñez et al. 2001), which distinguishes it from the other four species. *Physisporinus* sp. 3 has distinctly pruinose pore edges and *P. rhododendri* has long basidia up to 35 µm, these features are unique characters to identify them. *Physisporinus sanguinolentus* differs from *P. subfurcatus* by smooth tramal hyphae. *Physisporinus yunnanensis* has thin-walled and encrusted hyphoid cystidia and smaller subglobose

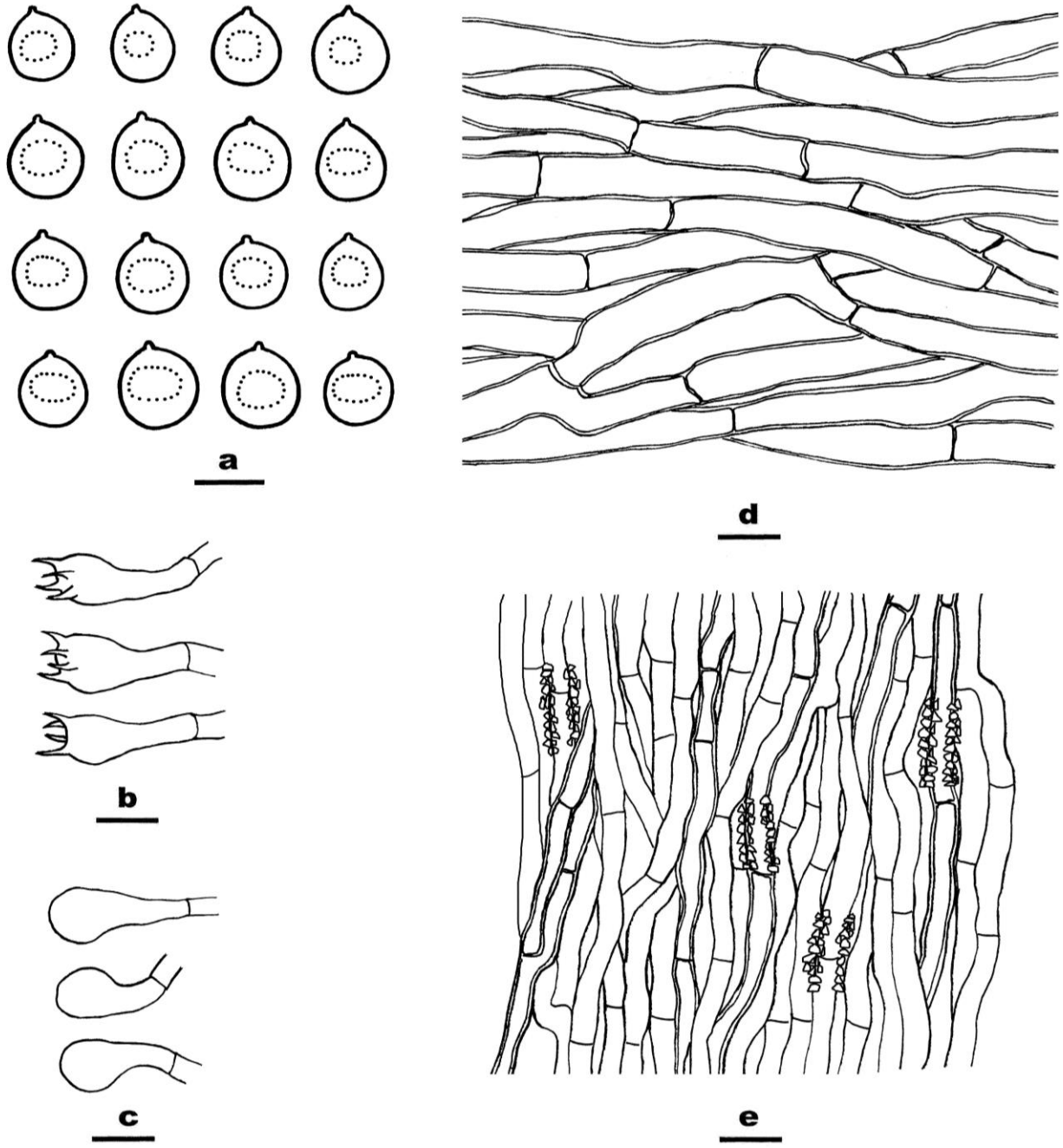

Figure 13 – Microscopic characteristics about *Physisporinus subfurcatus* (Dai 2105−holotype). a Basidiospores. b Basidia. c Basidioles. d Subicular hyphae. e Tramal hyphae. Scale bars: a = 5 µm, b–e = 10 µm.

to broadly ellipsoid basidiospores (4–5.5 × 3.5–5μm vs. 5.3–6.4 × 4.5–5.6 μm, Cai et al. 2023). In addition, the above taxa form six different lineages grouped in *Physisporinus* (Figs 1, 2).

Physisporinus sublineatus Y.C. Dai, Yuan Yuan & Chao G. Wang, sp. nov. Figs 4a, 14

Index Fungorum number: IF902001; Facesoffungi number: FoF15732

Etymology – "*sublineatus*" (Lat.): refers to the species resembling *Physisporinus lineatus*.

Basidiomata annual, effused–reflexed to resupinate, leathery, no taste or odor when fresh, turning hard corky to bony hard in dried specimens, effused to 80 mm long, 40 mm wide when resupinate; pileus flabelliform to elongated, extending up to 40 mm, 60 mm wide and 3.5 mm thick. Pileal surface buff yellow, ivory to cream, glabrous, normally azonate when fresh, olivaceous buff to bluish gray when dried, glabrous, no grooves and concentrically zonate when dried; margin not blunt, curved when dried. Pores ivory to cream when fresh, becoming yellowish upon bruising, clay buff to gray−brown when dried, bruised area becoming dark brown upon drying; sterile margin distinct, white when fresh, buff yellow to cream when dried, around 1 mm wide; pores angular to round, 8–10/mm; dissepiment thin, even. Context buff, hard corky to woody when dried, about 1.5 mm thick. Tubes with the same color as pores, bone hard to hard worky when dried, about 2 mm long.

Hyphal structure monomitic; hyphae with simple septa, colorless, not encrusted with crystals, negative in Melzer's reagent, cyanophilous in Cotton Blue; subiculum and tubes turning brownish in potassium hydroxide. Hyphae in context normally distinctly thick-walled but having a wide lumen, rarely with branches, mostly straight, orderly arranged, strongly agglutinated, 7–8 μm in diameter. Hyphae in tube trama normally distinctly thick-walled also having a wide to medium lumen, rarely with branches, normally straight, almost parallel, strongly agglutinated, 4.8–6.5 μm in diameter. Hyphoid cystidia abundant, clavate, arising from tramal hyphae, present in trama and at the dissepiment edge, sometimes protruding from the hymenium, thick-walled, apically encrusted with coarse crystals, strongly cyanophilous in Cotton Blue, 8.5–13 μm in diameter at the encrusted apex; hymenial cystidia normally ventricose with pointed tip, thin-walled, apically encrusted with fine crystals, 30–35 × 10–12 μm; cystidioles fusoid, with a thin wall, smooth, 15–17 × 5–6 μm. Basidia long barrel–shaped, bearing 4–spored and a simple septum at base, 16–19 × 6.5–7.5 μm; basidioles normally pear–shaped, shorter than basidia. Basidiospores globose to subglobose, colorless, with a thin wall, smooth, with a big or medium oil drop, negative in Melzer's reagent, acyanophilous in Cotton Blue, (4.6–)4.8–5.6(–6) × (4.3–)4.5–5.2(–5.5) μm, L = 5.18 μm, W = 4.85 μm, Q = 1.06–1.08 (n = 150/5).

Known distribution – Southwest China and Southeast Asia.

Additional specimens examined – CHINA, Yunnan Province, Jinghong, Virgin Forest Park, on dead bamboo, 17 Jun 2017, Dai 17553 (BJFC025085), rotten angiosperm wood, 7 Jul 2021, Dai 22598 (BJFC037172); Mengla County, Rainforest Valley, rotten angiosperm wood, 18 Aug 2019, Dai 20493 (BJFC032161); dead bamboo, 18 Aug 2019, Dai 20523 (BJFC032191, holotype). – SINGAPORE, Wuji Zhima Nature Reserve, rotten angiosperm wood, 20 Jul 2017, Dai 17885 (BJFC025417). – SRI LANKA, Svisavela, Salgala Forest, rotten angiosperm wood, 3 Mar 2019, Dai 19639 (BJFC031316).

Notes – *Physisporinus sublineatus* is defined by resupinate to effused–reflexed, leathery basidiomata with cream to ivory pores and white sterile margin when fresh, abundant hyphoid cystidia and hymenial cystidia, globose to subglobose basidiospores of 4.8–5.6 × 4.5–5.2 μm, and growth on angiosperm and bamboo in Southeast Asia.

Physisporinus sublineatus is similar and closely related to *P. lineatus* (Pers.) F. Wu, Jia J. Chen & Y.C. Dai and *P. vinctus* by sharing resupinate to effused–reflexed basidiomata which are leathery when fresh, the presence of thick-walled hyphoid cystidia, subglobose to globose basidiospores, and distribution in the tropics. However, *P. lineatus* differs from *P. sublineatus* by the distinctly concentrically zonate– sulcate pileal surface (Ryvarden 1972, Ryvarden & Johansen 1980); *P. vinctus* differs from *P. sublineatus* by the pseudodimitic hyphal system with the very thick-walled to almost solid hyphae (Ryvarden 1972).

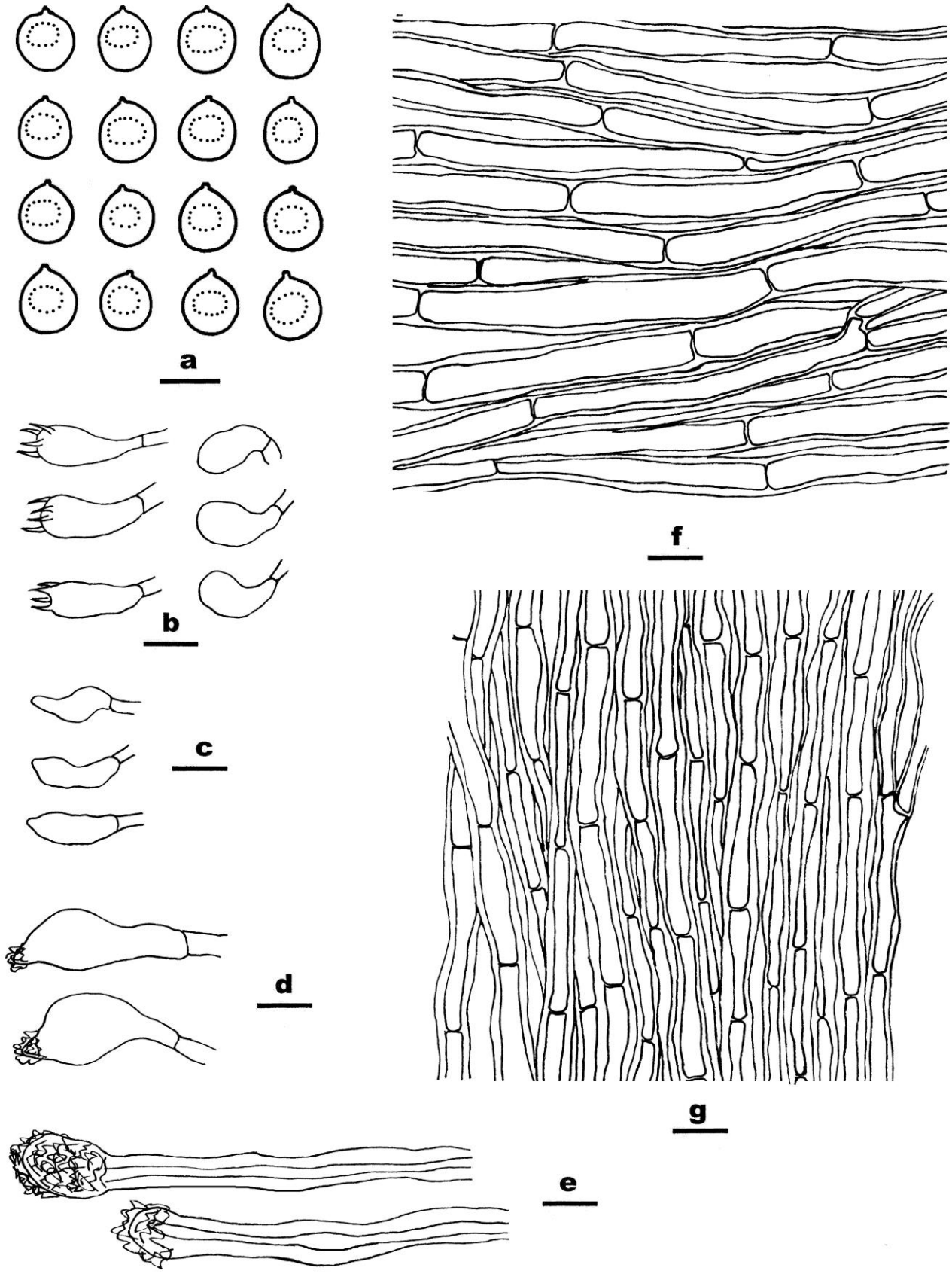

Figure 14 – Microscopic characteristics about *Physisporinus sublineatus* (Dai 20523−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Hymenial cystidia. e Hyphoid cystidia. f Contextual hyphae. g Tramal hyphae. Scale bars: a = 5 µm, b–g = 10 µm.

Rigidoporus subpileatus Corner and *Physisporinus sublineatus* are distributed in tropic Asia, and they share resupinate to effused–reflexed basidiomata, a cream pore surface when fresh and almost the same basidiospore size (4.5–5.7 µm vs. 4.8–5.6 × 4.5–5.2 µm, Corner 1987). But, the former has a dimitic hyphal system, an orange–cinnamon pileal surface and the absence of cystidia (Corner 1987). *Rigidoporus subvinctus* Ryvarden and *R. tomentosus* Ryvarden were described from Southern Africa, and they are similar to *P. sublineatus* in morphology by having a cream, whitish gray or wood colored pore surface when fresh and thin– or thick-walled encrusted hyphoid cystidia (Ryvarden 2018, Ryvarden 2020). However, *R. subvinctus* has a resupinate basidiomata and smaller basidiospores (3 × 2 µm vs. 4.8–5.6 × 4.5–5.2 µm, Ryvarden 2020); *R. tomentosus* has a pileate basidiomata with a tomentose pileal surface and smaller pores (10–12 per mm vs. 8–10 per mm, Ryvarden 2018).

In addition, *Physisporinus sublineatus* forms a different lineage grouped in *Physisporinus* (100% ML, 1.00 BPP, Figs 1, 2).

Physisporinus tasmanicus G.M. Gates, Y.C. Dai & Chao G. Wang, sp. nov. Figs 4b, 15

Index Fungorum number: IF902002; Facesoffungi number: FoF15733

Etymology – "*tasmanicus*" (Lat.): refers to the species being found in Tasmania, Australia.

Basidiomata annual, resupinate, ceraceous to soft, no taste or odor when fresh, turning woody hard, bone hard to more or less leathery in dried specimens, effused to 50 mm long, 40 mm wide, and 2 mm thick. Pores cream to white when fresh, yellowish brown when bruised, pinkish buff to pale violet when dried, bruised area becoming dark brown upon drying; sterile margin not distinct to nearly absent; pores angular to round, 5–7/mm; dissepiment thin, lacerated. Subiculum cream, corky when dried, very narrow, about 0.1 mm thick. Tubes with the same color as pores, corky to somewhat leathery when dried, about 1.9 mm long. A dark resinous zone presenting between subiculum and substrate.

Hyphal structure monomitic; hyphae with simple septa, colorless, not encrusted with crystals, negative in Melzer's reagent, cyanophilous in Cotton Blue; subiculum and tubes undissolved in potassium hydroxide. Hyphae in subiculum usually distinctly thick-walled having a medium to wide lumen, occasionally slightly thick-walled, without branches, mostly straight, loosely interlaced, 5.5–8 µm in diameter. Hyphae in tube trama normally thick-walled but having a wide lumen, occasionally with branches, slightly winding, almost parallel, 3.5–5 µm in diameter. Hyphoid cystidia and hymenial cystidia not seen; cystidioles fusoid, with a thin wall, smooth, 15–17 × 4.5–5.5 µm; basidia long barrel–shaped to more or less pyriform, bearing 4–spored and a simple septum at base, 15–18 × 7–8 µm; basidioles pear–shaped, shorter than basidia. Basidiospores subglobose to broadly ellipsoid, colorless, with a thin wall, smooth, sometimes with a large or small oil drop, negative in Melzer's reagent, acyanophilous in Cotton Blue, 5–5.7(–6) × (3.9–)4–4.8 µm, L = 5.18 µm, W = 4.35 µm, Q = 1.19 (n = 30/1).

Known distribution – Oceania.

Material examined – AUSTRALIA, Tasmania, Hobart, Mount Wellington, fallen trunk of *Eucalyptus*, 13 May 2018, Cui 16620 (BJFC029919, holotype).

Notes – *Physisporinus tasmanicus* is defined by annual, resupinate, ceraceous and white basidiomata when fresh that become woody hard to bone hard when dry with a dark resinous zone present between subiculum and substrate, the absence of any kind of cystidia, broadly ellipsoid to subglobose basidiospores of 5–5.7 × 4–4.8 µm, and growth on *Eucalyptus* in Australia.

Physisporinus tasmanicus and *P. vitreosanguineus* share more or less leathery basidiomata, bruised pores that become yellowish brown when dry, and subglobose to ellipsoid basidiospores of almost the same size (5–5.7 × 4–4.8 µm in *P. tasmanicus*, 5–6.1 × 4–5 µm in *P. vitreosanguineus*). However, the latter has a cinnamon buff dry pore surface, bigger pores (3–4/mm vs. 5–7/mm), and is known on gymnosperm woods so far only from Czechia in Europe.

Physisporinus castanopsidis Jia J. Chen & Y.C. Dai, *P. tibeticus* and *P. expallescens* (P. Karst.) Pilát resemble *P. tasmanicus* by resupinate, white and ceraceous basidiomata when fresh

without any erubescent reaction when bruised. However, the former three species can be easily

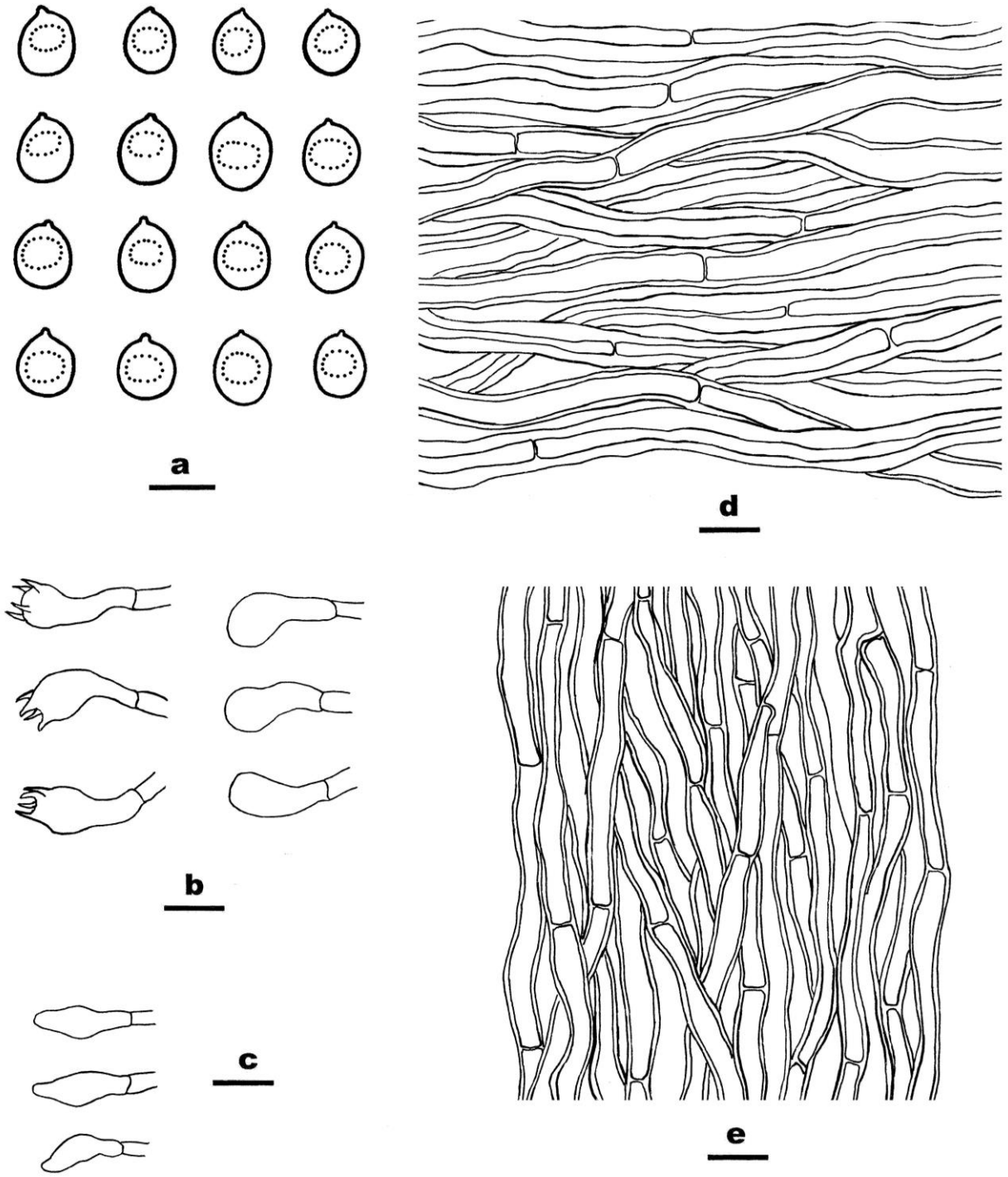

Figure 15 – Microscopic characteristics of *Physisporinus tasmanicus* (Cui 16620−holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Subicular hyphae. e Tramal hyphae. Scale bars: a = 5 µm, b–e = 10 µm.

distinguished from *P. tasmanicus* by the presence of thin-walled hyphoid cystidia (Ryvarden & Melo 2017, Wu et al. 2017, Chen & Dai 2021).

Rigidoporus aureofulvus (Lloyd) P.K. Buchanan & Ryvarden and *Rigidoporus laetus* (Cooke) P.K. Buchanan & Ryvarden were described from Wellington of New Zealand and Victoria of Australia, respectively, and they have almost the same basidiospores size (4.5–6 µm in *R. aureofulvus* and *R. laetus* vs. 5–5.7 × 4–4.8 µm, Buchanan & Ryvarden 1988, Cooke 1883) with *Physisporinus tasmanicus*. However, the former two have pileate basidiomata and orange or orange–rufous pores when fresh (Buchanan & Ryvarden 1988, Cooke 1883).

In our phylogenetic analyses, *Physisporinus tasmanicus* is closely related to *P. vitreosanguineus* and *P. castanopsidis*; for differences between them see the above paragraph. The three species form three different lineages grouped in *Physisporinus* (90% ML, 1.00 BPP in Fig. 1; 91% ML, 1.00 BPP in Fig. 2).

Physisporinus vitreosanguineus Y.C. Dai, Chao G. Wang & Vlasák, sp. nov. Figs 4c, 16

Index Fungorum number: IF902003; Facesoffungi number: FoF15734

Etymology – "*vitreosanguineus*" (Lat.): refers to the species having a combination of features of *P. vitreus* and *P. sanguinolentus*.

Basidiomata annual, resupinate to nodulose, mostly quite robust, ceraceous and somewhat transparent when fresh, no taste or odor, turning hard corky to more or less resinous in dried specimens, effused to 150 mm long, 50 mm wide and 3 mm thick. Pores cream to white when fresh, slowly turning orange–brown to black upon bruising, cinnamon buff to clay buff upon drying, eventually bruised area turning dark brown to ash gray in dried specimens; sterile margin distinct, around 2 mm wide when juvenile, turning narrow by age; pores angular, 3–4/mm; dissepiment thick, lacerated on sloping substrates. Subiculum cream, corky when dried, very narrow, about 0.1 mm thick. Tubes with the same color as pores, corky to somewhat resinous, about 2.9 mm long, tube wall often undulated when on sloping substrate.

Hyphal structure monomitic; hyphae with simple septa, colorless, not encrusted with crystals, negative in Melzer's reagent, acyanophilous in Cotton Blue; subiculum and tubes undissolved in potassium hydroxide. Hyphae in subiculum usually slightly thick-walled, occasionally thick-walled but having a wide lumen, without branches, normally winding, loosely interlaced, agglutinated, 4.5–7.5 µm in diameter. Hyphae in tube trama usually slightly thick-walled, occasionally thick-walled having a wide lumen, occasionally with branches, mostly winding, almost parallel, 3–5.5 µm in diameter. Hyphoid cystidia and hymenial cystidia not seen; cystidioles fusoid, with a thin wall, smooth, 14–20 × 4.5–5 µm; basidia barrel–shaped, bearing 4–spored and a simple septum at base, 15–20 × 7–8 µm; basidioles of similar size and shape to basidia. Irregular or rhomboid crystals present among hymenium and trama. Basidiospores subglobose to broadly ellipsoid, colorless, with a thin wall, smooth, sometimes with a small or big oil drop. negative in Melzer's reagent, acyanophilous in Cotton Blue, 5–6.1(–6.5) × (3.8–)4–5 µm, L = 5.57 µm, W = 4.41 µm, Q = 1.23–1.32 (n = 120/4).

Known distribution – Europe.

Material examined – CZECHIA, Boubín Mt., Boubín virgin forest, gymnosperm wood, 16 Sep 2009, JV 0909/3 (JV, holotype), BJFC036111 (isotype); Jihlava, Vysoká, Luzný pond, Stump of *Pinus sylvestris*, P. Vampola, MJ 144/95 (MJ, duplicate, BJFC036109); Novohradské hory, Dálava, *Picea abies*, Nov 2006, Kout 0609/1 (JV, duplicate, BJFC036110); Plzeň, PR Kamenný rybník, on the soil around *Pinus sylvestris* roots, 10 Oct 2010, Kout 1010/1 (JV); NPR Diana, *Abies alba*, 7 Aug 2012, Kout 1208/7 (JV); Plzeň, PR Hůrky, undetermined wood, 15 Aug 2012, Kout 1208/15 (JV).

Notes – *Physisporinus vitreosanguineus* is defined by robust, annual, resupinate to nodulose, transparent basidiomata, pores white when fresh, becoming very slowly (in several, minutes to hours) orange–brown and finally black when bruised, pores of 3–4/mm with thick dissepiments, the absence of any kind of cystidia, broadly ellipsoid to subglobose basidiospores of 5–6.1 × 4–5 µm, and growth on gymnosperm wood in Europe.

The similar and phylogenetically related species to *Physisporinus vitreosanguineus* are discussed in the notes to *P. tasmanicus*.

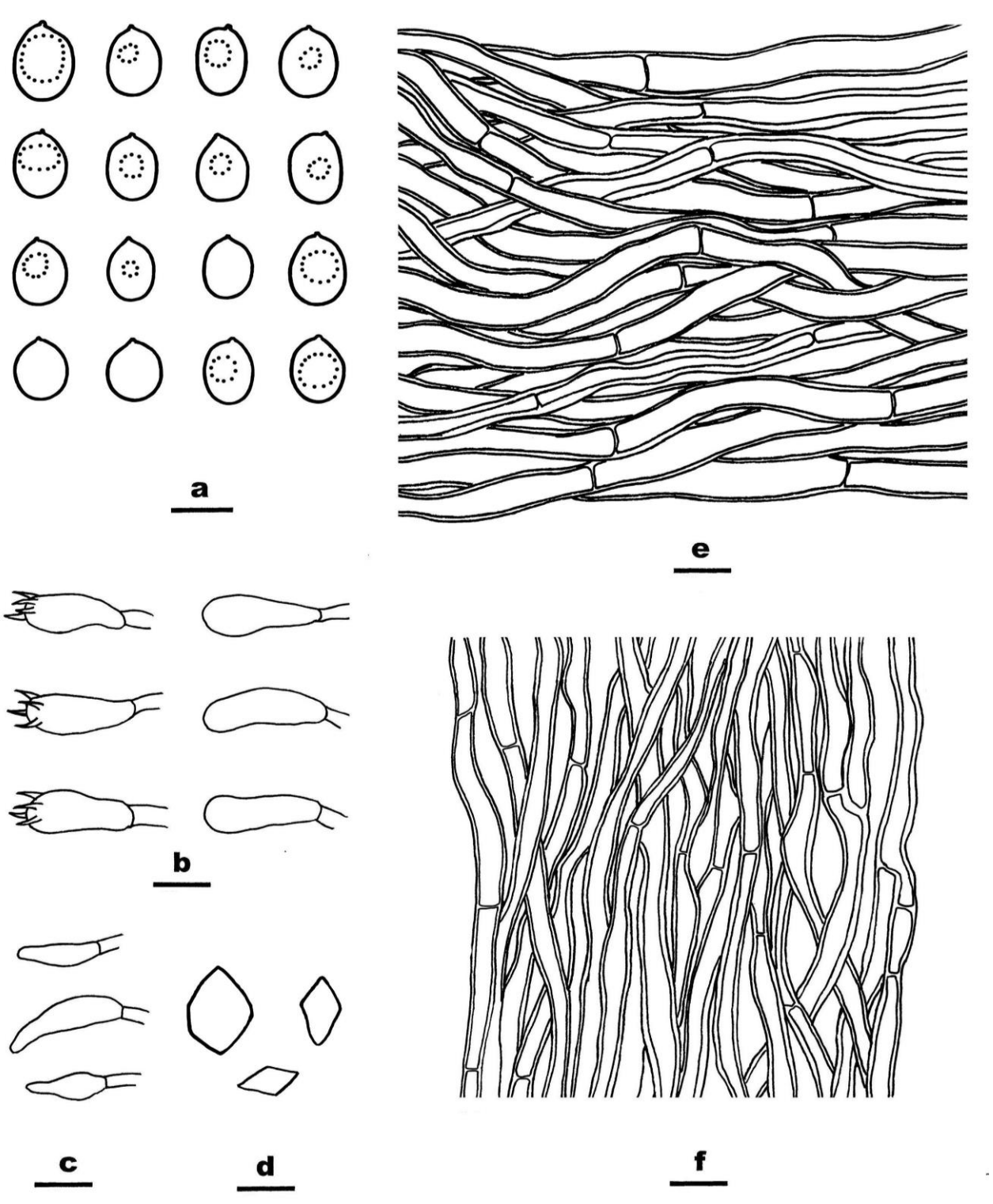

Figure 16 – Microscopic characteristics about *Physisporinus vitreosanguineus* (JV 0909/3–holotype). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Crystals. e Subicular hyphae. f. Tramal hyphae. Scale bars: a = 5 µm, b–f = 10 µm.

***Physisporinus* sp. 1** Figs 4d, 17

Basidiomata annual, resupinate, soft woody to corky and no taste or odor when fresh, turning hard corky in dried specimens, effused to 80 mm long, 50 mm wide and 2.8 mm thick, easily separated from substrate when dry. Pores white when fresh, changing to red in juvenile specimens after bruising, cinnamon buff to clay buff when dried, bruised area and untouched juvenile pores becoming black; sterile margin very narrow to almost absent; pores angular to round, 8–10/mm; dissepiment thin, even. Subiculum cream, hard corky when dried, very narrow, about 0.1 mm thick. Fresh tubes with the same color as pores, turning to ochre when dry but not blackening, paler than pore surface, hard corky when dried, about 2.7 mm long. A dark resinous layer present between subiculum and substrate.

Hyphal structure monomitic; hyphae with simple septa, colorless to pale yellowish, not encrusted with crystals, negative in Melzer's reagent, acyanophilous in Cotton Blue; subiculum and tubes turning dark brown in potassium hydroxide. Hyphae in subiculum normally distinctly thick-walled but having a wide lumen, without branches, mostly straight, more or less regularly arranged, strongly agglutinated, 4–7 µm in diameter. Hyphae in tube trama normally thick-walled having a wide lumen, rarely with branches, mostly straight, almost parallel and loosely interlaced, 4–6 µm in diameter. Hyphoid cystidia not seen; hymenial cystidia clavate, with a thin wall, smooth, sometimes with a medium oil drop, 20–25 × 3.5–5.5 µm; cystidioles fusoid, with a thin wall, smooth, usually with a small oil drop, 10–14.5 × 4.5–6 µm; basidia barrel–shaped, bearing 4–spored and a simple septum at base, with a small oil drop, 14–16 × 6–7 µm; basidioles of similar shape to basidia, but smaller. Basidiospores broadly ellipsoid to ellipsoid, colorless, with a thin wall, smooth, with a large or medium oil drop, negative in Melzer's reagent, acyanophilous in Cotton Blue, (4.9–)5–6(–6.2) × (3.6–)3.8–4.5(–4.8) µm, L = 5.41 µm, W = 4.12 µm, Q = 1.27–1.36 (n = 120/4).

Known distribution – North America.

Material examined – USA, California, Crescent City, Myrtle Creek Trail, gymnosperm wood, Sep 2007, JV 0709/83 (JV, duplicate, BJFC036123); Washington, Hoh River, Rain Forest, gymnosperm wood, 30 Aug 2003, JV 0308/66 (JV, duplicate, BJFC036121), *Picea sitchensis*, 30 Aug 2003, JV 0308/58 (JV, duplicate, BJFC036120), Rainier Mt., Grove of Patriarchs, *Thuja plicata*, 5 Sep 2003, JV 0309/45 (JV, duplicate, BJFC036122).

Notes – *Physisporinus* sp. 1 is defined by resupinate basidiomata often easily separated from the substrate, pores slowly reddening in juvenile basidiomata when bruised and unchanged in mature basidiomata, clay buff to blackish pore surface when dried, angular to round pores of 8–10/mm, smooth hymenial cystidia, ellipsoid to broadly ellipsoid basidiospores of 5–6 × 3.8–4.5 um, and growth on gymnosperm wood in northwestern USA. In our opinion, *Physisporinus* sp. 1 may be determined as *P. sanguinolentus* (Gilbertson & Ryvarden 1987), and the occurrence of *P. sanguinolentus* in North America is not confirmed in our study.

Physisporinus sp. 1 resembles *P. pouzarii* (Vampola & Vlasák) F. Wu, Jia J. Chen & Y.C. Dai by ellipsoid to broadly ellipsoid basidiospores, and two species are phylogenetically related (Fig. 1), yet the latter has larger pores (5–7/mm vs. 8–10/mm) and thin-walled hyphoid, encrusted cystidia. In addition, *P. pouzarii* grows on angiosperm wood in Europe (Vampola & Vlasák 2012).

Physisporinus sp. 1 is indeed different from existing species in *Physisporinus*, and forms an independent lineage in the genus (Figs 1, 2).

***Physisporinus* sp. 2** Figs 4e, 18

Basidiomata annual, resupinate, soft corky, no taste or odor when fresh, turning more or less fragile to brittle in dried specimens, effused to 150 mm long, 100 mm wide and 1 mm thick, but much smaller in most cases. Pores white when fresh, slowly changing to reddish brown upon bruising in some specimens, eventually buff yellow to salmon in dried specimens, clay buff in reddened parts; sterile margin not distinct and nearly absent; pores round when fresh, angular when dried, 7–9/mm; dissepiment thin, even to lacerated. Subiculum almost absent and not seen. Tubes with the same color as pores, more or less resinous, about 1 mm long. The presence of a dark brown resinous zone between subiculum and substrate.

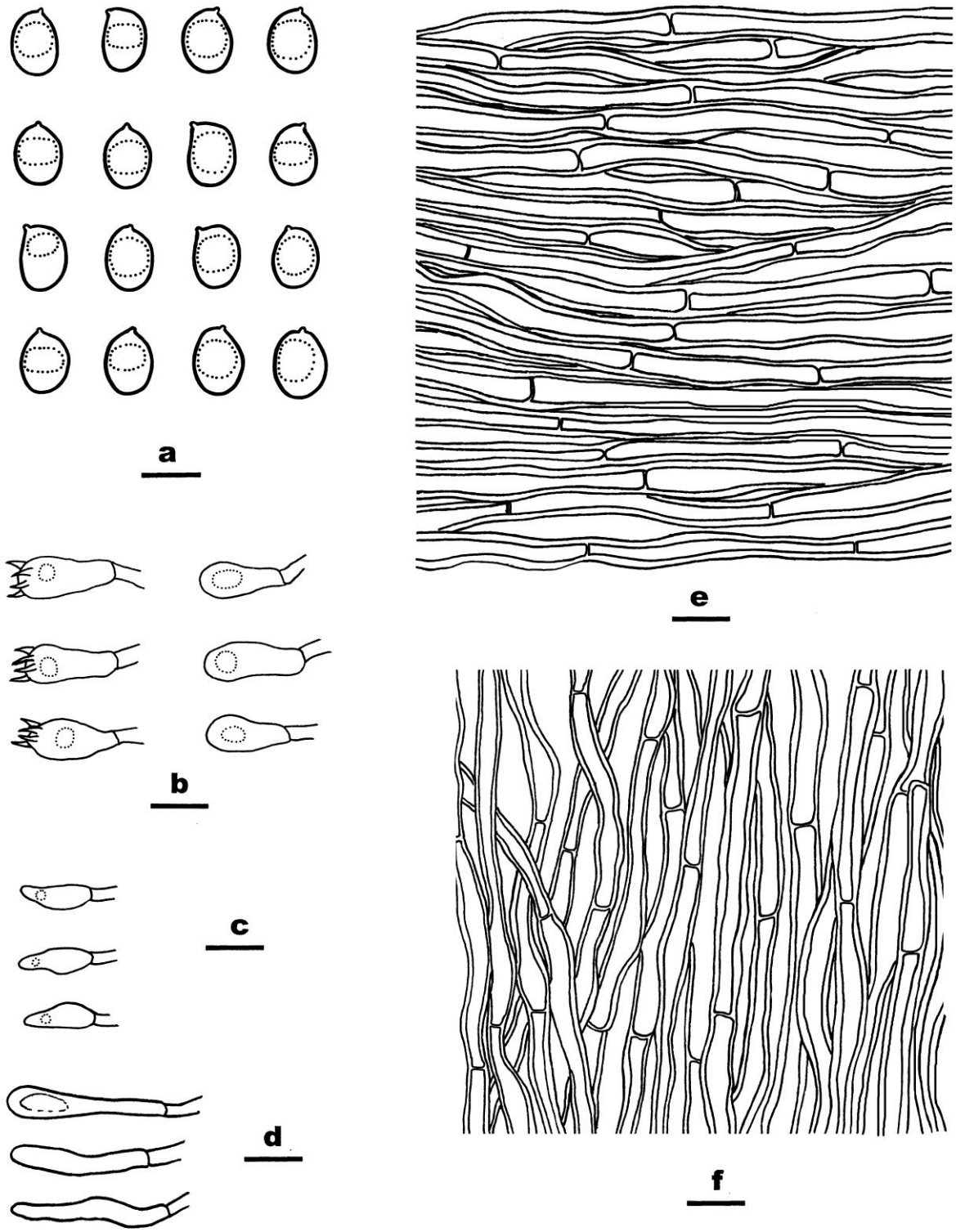

Figure 17 – Microscopic characteristics about *Physisporinus* sp. 1 (drawn from JV 0309/45). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Hymenial cystidia. e Subicular hyphae. f Tramal hyphae. Scale bars: a = 5 µm, b–f = 10 µm.

Hyphal structure monomitic; hyphae with simple septa, colorless to pale yellowish, not encrusted with crystals, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue;

subiculum and tubes undissolved in potassium hydroxide. Hyphae in tube trama normally slightly thick-walled having a wide lumen, occasionally with branches, mostly straight, almost parallel, agglutinated, 4–5.5 µm in diameter; hyphoid cystidia–like hyphae present at the dissepiment edge, thin–walled, apically encrusted. Hymenial cystidia not seen; cystidioles fusoid, with a thin wall, smooth, 12–15 × 5–6 µm; basidia barrel–shaped, bearing 4–spored and a simple septum at base, 12.5–14.5 × 6.5–7.5 µm, basidioles of similar shape to basidia, but shorter. Small rhombic crystals occasionally in tube structure. Basidiospores broadly ellipsoid, colorless, with a thin wall, smooth, sometimes with one large or small oil drop, negative in Melzer's reagent, acyanophilous in Cotton Blue, 4.6–5.2(–5.3) × (3.7–)3.8–4.2 µm, L = 4.95 µm, W = 4 µm, Q = 1.24 (n = 30/1).

Known distribution – Europe.

Material examined – CZECHIA, Znojmo, Božice Pond, *Alnus glutinosa*, 19 Sep 2013, J. Beneschová (MJ 6003, duplicates, JV and BJFC036107). – UKRAINE, Sviatohorsk, Krasnyi Liman district, *Alnus glutinosa*, 24 Aug 2007, Ordynets & Akulov (CWU 3874, CWU 3875); Yaremivskyi Wildlife sanctuary, Izum, *Alnus glutinosa*, 6 May 2010, Akulov & Ordynets (CWU 6095).

Notes – *Physisporinus* sp. 2 is defined by usually small, resupinate and thin basidiomata and small pores which become slowly or indistinctly reddish brown upon bruising, the presence of thin-walled hyphoid cystidia–like hyphae at dissepiment edges, broadly ellipsoid basidiospores of 4.6–5.2 × 3.8–4.2 µm, and growth on *Alnus* in Europe. It is a common species in Eastern Europe in wet and muddy *Alnus* stands (K. Runnel, personal comment).

Physisporinus sp. 2 resembles *Physisporinus* sp. 3, *P. rhododendri*, *P. sanguinolentus* (Alb. & Schwein.) Pilát and *P. subfurcatus* by white pores when fresh and erubescent when bruised. However, the latter four species have bigger basidiospores (5.5–6.4 × 4.7–5.2 µm in *Physisporinus* sp. 3, 5.3–6.3 × 5–5.5 µm in *P. rhododendri*, 6–7 × 5–6 µm in *P. sanguinolentus*, 5.3–6.4 × 4.5–5.6 µm in *P. subfurcatus* vs. 4.6–5.2 × 3.8–4.2 µm). In addition, *P. sanguinolentus* and *P. subfurcatus* differ from *Physisporinus* sp. 2 by their larger pores (3–5/mm in *P. sanguinolentus*, 3−4/mm in *P. subfurcatus* vs. 7–9/mm).

Our results demonstrate the proximity of *Physisporinus* sp. 2 and *P. tibeticus* F. Wu, Jia J. Chen & Y.C. Dai (Figs 1, 2). But *P. tibeticus* can be easily distinguished from it by its bigger and unchanged fresh pores when bruised (5–7/mm vs. 7–9/mm, Wu et al. 2017). In addition, *Physisporinus* sp. 2 differs from other existing species in *Physisporinus* and forms a different lineage grouped in the genus (100% ML, 1.00 BPP; Figs 1, 2).

***Physisporinus* sp. 3** Figs 4f, 19

Basidiomata annual, resupinate, ceraceous and soft, no taste or odor when fresh, turning fragile to corky in dried specimens, effused to 160 mm long, 150 mm wide and 2.2 mm thick. Pores white when fresh, turning red upon bruising, eventually buff yellow to clay buff in dried specimens; sterile margin not distinct and nearly absent; pores angular to round when fresh, very irregular when dry, 4–6/mm; dissepiment thin, lacerated, distinctly pruinose, swollen. Subiculum almost absent and not seen. Tubes with the same color as pores, somewhat brittle to corky when dried, about 2.2 mm long. A dark resinous layer present between subiculum and substrate.

Hyphal structure monomitic; hyphae with simple septa, colorless, not encrusted with crystals, negative in Melzer's reagent, moderately cyanophilous in Cotton Blue; subiculum and tubes turning dark brown in potassium hydroxide. Hyphae in tube trama usually thin-walled, occasionally slightly thick-walled having a wide lumen, frequently with branches, normally straight, almost parallel, strongly agglutinated, 3–5 µm in diameter. Hyphoid cystidia–like hyphae present at dissepiment edge, thin-walled, apically encrusted with crystals, sometimes forked. Hymenial cystidia not seen, cystidioles fusoid, with a thin wall, smooth, usually with a or two small oil drops, 17–19 × 5.5–6.5 µm; basidia barrel–shaped, bearing 4–spored and a simple septum at base, normally with a few small guttules, 16–20 × 8–9 µm; basidioles mostly cephaloid, shorter than basidia. Irregular or rhomboid crystals present in tube structure. Basidiospores ovoid or broadly ellipsoid, colorless, with a thin wall, smooth, with a large oil drop, negative in Melzer's reagent,

acyanophilous in Cotton Blue, (5.3–)5.5–6.4(–6.5) × (4.5–)4.7–5.2(–5.5) µm, L = 5.89 µm, W = 4.97 µm, Q = 1.16–1.22 (n = 90/3).

Known distribution – Europe.

Material examined – CZECHIA, Lanžhot, *Quercus*, 31 Aug 1989, JV 8908/19 (JV, duplicate, BJFC036100); Ostrava, Svinov, *Alnus glutinosa*, P. Vampola, MJ 4738−53/02 (MJ, duplicate, BJFC036102); Záton, Boubín virgin forest, *Picea abies*, 20 Oct 2013, JV 1310/15−1 (JV, duplicate, BJFC036101).

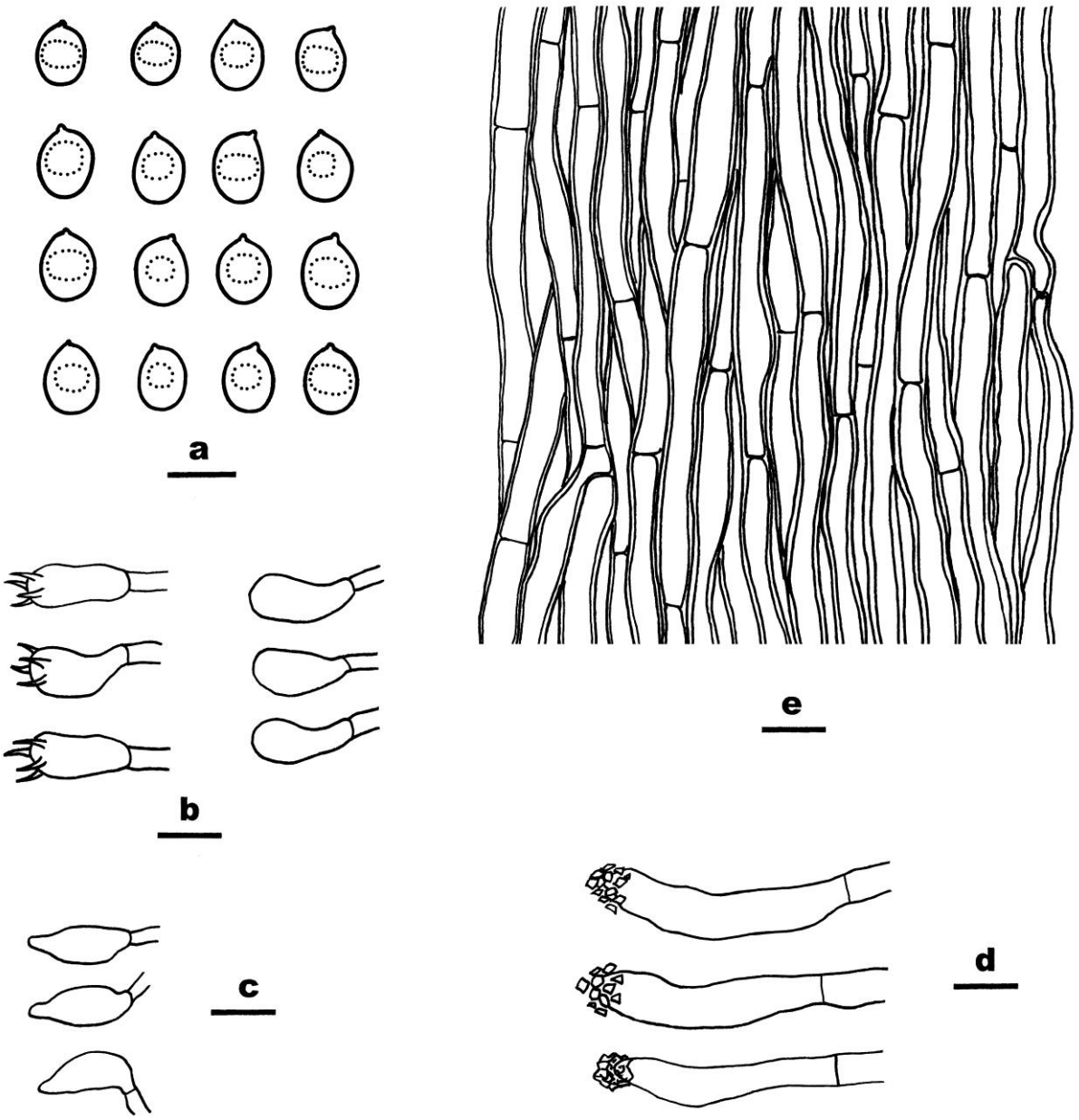

Figure 18 – Microscopic characteristics of *Physisporinus* sp. 2 (drawn from CWU 3874). a Basidiospores. b Basidia and basidioles. c Cystidioles. d Hyphoid cystidia. e Tramal hyphae. Scale bars: a = 5 µm, b–e = 10 µm.

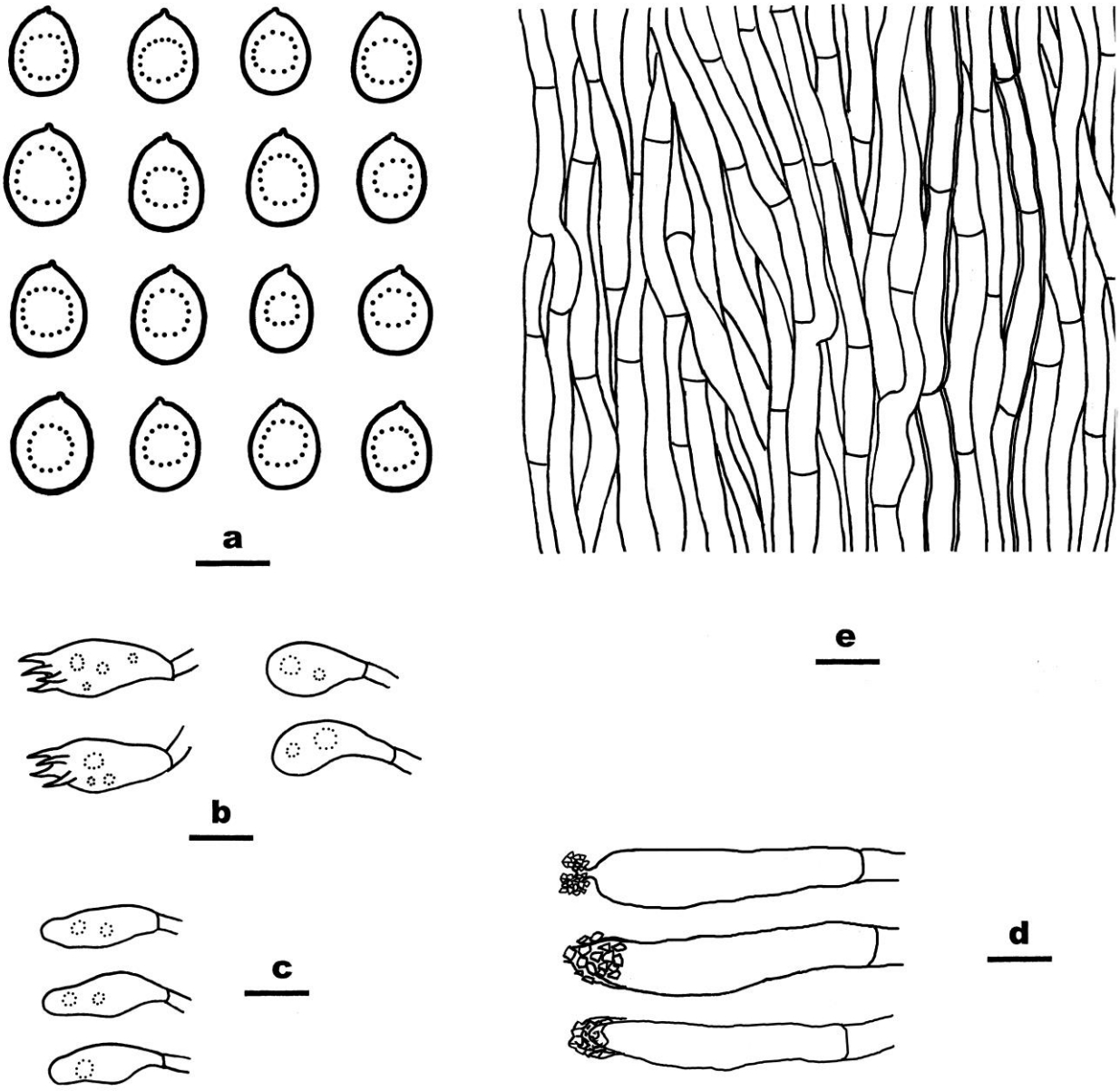

Figure 19 – Microscopic characteristics of *Physisporinus* sp. 3 (drawn from JV 1310/15−1). a Basidiospores. b Basidia and basidioles. c Cystidioles. d. Hyphoid cystidia. e Tramal hyphae. Scale bars: a = 5 µm, b–e = 10 µm.

Notes – *Physisporinus* sp. 3 is defined by resupinate and ceraceous basidiomata, erubescent pores if bruised when fresh, irregular pores when dry, 4–6/mm with distinctly pruinose dissepiments, thin-walled encrusted hyphoid cystidia, broadly ellipsoid or ovoid basidiospores of 5.5–6.4 × 4.7–5.2 µm, and growth on both gymnosperm and angiosperm woods in Europe.

Physisporinus sp. 3, *P. pouzarii*, and *P. sanguinolentus* share resupinate basidiomata, and erubescent pores with bruising when fresh. However, *P. pouzarii* differs from *Physisporinus* sp. 3 by its café–au–lait color fresh basidiomata, fusoid or lageniform cystidioles and narrower basidiospores (4.7–6.3 × 4–4.6 µm vs. 5.5–7.2 × 4.7–5.2 µm; Vampola & Vlasák 2012). *Physisporinus sanguinolentus* differs from *Physisporinus* sp. 3 by quicker reddening, tube edges

thin and fimbriate, and larger, globose basidiospores (6–7 × 5–6 μm vs. 5.5–6.4 × 4.7–5.2 μm; Donk 1967, Ryvarden & Melo 2017). *Physisporinus* sp. 3 is closely related to *P. yunnanensis* C.L. Zhao, but the latter has larger pores (2–3/mm vs. 4–6/mm) and smaller subglobose basidiospores (4–5.5 × 3.5–5 μm vs. 5.5–6.4 × 4.7–5.2 μm; Cai et al. 2023)

Phylogenetically *Physisporinus* sp. 3 differs from other existing taxa in *Physisporinus* and forms an independent and well–supported lineage in the genus (100% ML, 1.00 BPP in Fig. 1; 100% ML, 0.98 BPP in Fig. 2).

Key to accepted taxa of *Physisporinus*

1. Basidiomata effused–reflexed to pileate or stipitate 2
1. Basidiomata resupinate 13
2. Cystidia absent 3
2. Cystidia present 4
3. Pore surface white to ochraceous when fresh ..... *P. africanus*
3. Pore surface sulphur yellow when fresh ..... *P. minutissimus*
4. Thin-walled hyphoid cystidia present 5
4. Thin-walled hyphoid cystidia absent or thick-walled hyphoid cystidia present 8
5. Hymenial cystidia present; American species ..... *P. neovitreus*
5. Hymenial cystidia absent; Asian species 6
6. Pores of 5–6/mm ..... *P. cinereus*
6. Pores of 6–8/mm 7
7. Sterile margin almost lacking ..... *P. crataegi*
7. Sterile margin distinct caesious to bluish gray when fresh ..... *P. caesiomarginatus*
8. Basidiomata completely pileate 9
8. Basidiomata effused–reflexed to pileate 10
9. Pore surface lavender when fresh; pores of 9–10/mm ..... *P. lavendulus*
9. Pore surface light brownish when fresh; pores of 6–8/mm ..... *P. tamilnaduensis*
10. Pileal surface distinctly sulcate and zonate ..... *P. lineatus*
10. Pileal surface indistinctly sulcate and zonate 11
11. Thick-walled hyphoid cystidia present in both context and trama ..... *P. longicystidius*
11. Thick-walled hyphoid cystidia present in trama only 12
12. Pileal surface salmon to clay pink when dry ..... *P. vinctus*
12. Pileal surface olivaceous buff to bluish gray when dry ..... *P. sublineatus*
13. Pore surface becoming bright red upon bruising 14
13. Pore surface unchanged or becoming yellowish– to orange–brown rather than bright red upon bruising 20
14. Thin-walled hyphoid and apically encrusted cystidia present 15
14. Thin-walled hyphoid and apically encrusted cystidia absent 17
15. Pores > 7/mm ..... *P.* sp. 2
15. Pores ≤ 7/mm 16
16. Pore surface smoky gray to pinkish brown when dry ..... *P. pouzarii*
16. Pore surface buff yellow to clay yellow when dry ..... *P.* sp. 3
17. Tramal hyphae sometimes encrusted with crystals ..... *P. subfurcatus*
17. Tramal hyphae smooth 18
18. Pores of 8–10/mm ..... *P.* sp. 1
18. Pores of 5–7/mm 19
19. Basidia clavate, 20–35 × 8–10 μm ..... *P. rhododendri*
19. Basidia broadly clavate, 12–23 × 6.5–8 μm ..... *P. sanguinolentus*
20. Cystidia absent 21
20. Cystidia present 25
21. Pores of 3–4/mm ..... *P. vitreosanguineus*

21. Pores of 5–10/mm 22
22. Oceanian species ..... *P. tasmanicus*
22. Asian, European, American or African species 23
23. Pore surface flesh–colored to light pinkish when fresh; tube layer hard corky ..... *P. crocatus*
23. Pore surface dirty white or deep clay–colored when fresh; tube layer resinous 24
24. Basidiospores globose 2.5–3 µm in diam ..... *P. resinosus*
24. Basidiospores globose 4–5 µm in diam ..... *P. cataractus*
25. Basidiomata perennial ..... *P. roseus*
25. Basidiomata annual 26
26. Hyphoid cystidia thick-walled, completely embedded in trama ..... *P. centroamericanus*
26. Hyphoid cystidia absent or thin-walled or thick-walled and projecting from hymenium 27
27. Pores of 2–3/mm 28
27. Pores of 4–12/mm 29
28. Forked hymenial cystidia present ..... *P. furcatus*
28. Forked hymenial cystidia absent ..... *P. yunnanensis*
29. Hyphoid cystidia thick-walled 30
29. Hyphoid cystidia thin-walled 34
30. Pores of 10–12/mm ..... *P. rigidus*
30. Pores of 5–9/mm 31
31. Pore surface sulphur yellow when fresh ..... *P. sulphureus*
31. Pore surface isabelline to white or pale brown to buff yellow when fresh 32
32. Pore surface often nodulose ..... *P. vitreus*
32. Pores surface not nodulose 33
33. Pores round, 5–7/mm ..... *P. srilankensis*
33. Pores angular, 7–9/mm ..... *P. eminens*
34. Hymenial cystidia present 35
34. Hymenial cystidia absent 36
35. Basidiospores ovoid, Q = 1.22–1.28 ..... *P. castanopsidis*
35. Basidiospores broadly ellipsoid to subglobose, Q = 1.15–1.20 ..... *P. dollingerii*
36. Basidiomata juicy when fresh, easily separated from substrate ..... *P. tibeticus*
36. Basidiomata waxy when fresh, not easily separated from substrate ..... *P. expallescens*

DISCUSSION

Notes on the five clades in *Physisporinus*

In the present study, phylogenies utilizing the two gene sequences (Fig. 1) and the six gene sequences (Fig. 2) based on samples from Asia, Australia, Europe, and North and Central America demonstrate that *Physisporinus* and *Meripilus* belong to Meripilaceae in Polyporales. Our results are consistent with previous studies on the taxonomic status of *Physisporinus* (Binder et al. 2013, Justo et al. 2017, Wu et al. 2017, Chen & Dai 2021). *Rigidoporus* is confirmed as a genus in Hymenochaetales (Wu et al. 2017, 2022b, Zhou et al. 2023). The type locality and main morphological characteristics of accepted species in *Physisporinus* are summarized (Table 3).

Our phylogenies (Figs 1, 2) demonstrated five clades in *Physisporinus*. Clade I includes 21 taxa that share resupinate basidiomata. *Physisporinus* sp. 1 grouped with *P. pouzarii*, *P. expallescens*, *P. castanopsidis*, *P. vitreosanguineus*, *P. tasmanicus*, *P. crocatus* (Pat.) F. Wu, Jia J. Chen & Y.C. Dai, *P. tibeticus*, and *Physisporinus* sp. 2 in a joint subclade (Figs 1, 2), and share white, ivory to buff pore surfaces when fresh, mostly without reddening when bruised (except *Physisporinus* sp. 2) or slightly in the juvenile specimens, then fawn to black–brown when dry, and ovoid to subglobose basidiospores. *Physisporinus dollingerii*, *P. centroamericanus*, *P. rigidus*, *P. sulphureus*, *P. roseus*, and *P. srilankensis* have a bright–colored or fuscous pore surface, and thin– or thick-walled cystidia. *P. furcatus*, *P. rhododenri*, *P. sanguinolentus*, *P. subfurcatus*,

P. yunnanensis and *Physisporinus* sp. 3 nested in a joint subclade (Figs 1, 2), and they have distinct reddening of pore surface when bruised (except *P. furcatus* and *P. yunnanensis*).

Clade II includes eight species of *Physisporinus*, viz., *P. caesiomarginatus*, *P. cinereus*, *P. crataegi*, *P. lineatus*, *P. neovitreus*, *P. sublineatus*, *P. tamilnaduensis* and *P. vinctus*, all these species have effused–reflexed, pileate to substipitate basidiomata, fresh pore surface unchanged or indistinctly changed in color when bruised, and presence of thin– or thick-walled hyphoid cystidia.

Clade III contains two taxa of *Meripilus* P. Karst., *M. giganteus* (Pers.) P. Karst. and *M. sumstinei* (Murrill) M.J. Larsen & Lombard. They are characterized by annual, multi–pileate basidiomata from a common base or stem, fleshy when fresh and brittle when dry, fresh pores unchanged in color when bruised, the absence of any cystidia, and globose basidiospores (Ryvarden & Melo 2017). *Meripilus sumstinei* was originally described from North America and treated as a synonym of *Meripilus giganteus*. The type locality of *M. giganteus* is in Europe (Donk 1974, Ryvarden 1985), but Larsen & Lombard (1988) had the opinion that they were two independent species. Our phylogeny shows the sample of Russell 5913 represents another taxon close to *M. giganteus*. Because we did not study the material of this taxon, for now we are keeping it as *Meripilus sumstinei.* Six other taxa, viz., *Meripilus applanatus* Corner, *M. lentifrondosus* (Murrill) M.J. Larsen & Lombard, *M. lobatus* P. Karst., *M. maculatus* Corner, *M. tropicalis* Guzmán & Pérez–Silva and *M. villosulus* Corner, were addressed in *Meripilus* (Karsten 1882, Guzmán & Pérez–Silva 1975, Corner 1984, Larsen & Lombard 1988). We did not study any specimens or DNA data, and cannot comment on them.

Although *Meripilus* and *Physisporinus* are nested in a major clade (Figs 1, 2), it has large multi–pileate basidiomata from a common stem and lacks any cystidia, and these characteristics readily distinguished from *Physisporinus.* So, we keep it as an independent genus as treated in most previously taxonomy (Gilbertson & Ryvarden 1987, Ryvarden & Melo 2017). In addition, *Meripilus* (1882) is an earlier name than *Physisporinus* (1889), and it has priority in nomenclature if both genera are merged.

Clade IV contains three species, viz., *Physisporinus lavendulus*, *P. longicystidius*, and *P. minutissimus*, and all share effused–reflexed to pileate basidiomata with brightly–colored pores when fresh. Clade V includes *Physisporinus vitreus* (the type species of *Physisporinus*) and *P. eminens* (Y.C. Dai) F. Wu, Jia J. Chen & Y.C. Dai, are characterized by resupinate basidiomata, fresh pore surface unchanged in color when bruised, and apically encrusted, thin– or thick-walled hyphoid cystidia.

Notes on *Rigidoporus*

Rigidoporus was established by Murrill in 1905 with type species *Polyporus micromegas* Mont. (Synonym: *Rigidoporus microporus* (Fr.) Overeem) and it is usually defined in Polyporales (Gilbertson & Ryvarden 1987). *Physisporinus* and *Rigidoporus* share some important characteristics, especially in the monomitic hyphal system and ovoid to globose basidiospores, both genera are sometimes confused about definition (Pouzar 1966a). However, morphologically, *Rigidoporus* is different from *Physisporinus* by mostly pileate or with a stipe basidiomata, bony hard basidiomata when dry and a monomitic or pseudodimitic hyphal structure that the hyphae are very thick-walled alike skeletal hyphae but frequently simple septate (Ryvarden & Melo 2017); phylogenetically, Wu et al. (2017) sequenced the ITS and nLSU regions from *Physisporinus* and related genera in morphology, their phylogenetic analyses indicated that *Physisporinus* and *Rigidoporus* pertained to Polyporales and Hymenochaetales respectively, as well proved seven species of *Rigidoporus* should be placed into *Physisporinus*. To date, there are 98 taxa of *Rigidoporus* recorded in Index Fungorum (http://www.indexfungorum.org/), and we accept 54 species in *Rigidoporus* after excluding some taxa that do not fit the definition of the genus. Among the accepted species 18 have molecular data (Wu et al. 2017, Yuan et al. 2020, Wang et al. 2023a) and 36 are temporarily treated in the genus because their morphology fit *Rigidoporus* although without molecular data so far. Further studird are needed to confirm the phylogenetic relationships after their molecular data are available.

Notes on *Physisporinus expallescens*, *P. sanguinolentus* and *P. vitreus*

Physisporinus was traditionally defined as a genus of Polyporales with resupinate basidiomata, pore color often changing when bruised, and ellipsoid to globose basidiospores. Karsten (1889) established this genus and segregated it from *Poria* based on the "fruit–layer (most probably fruiting body) separated from basal layer" (Donk 1966). The type species that Karsten determined as *Poria vitrea* Pers. seems to be an unknown species, as the described spores are quite different from *Polyporus vitreus* (Pers.) Fr. sensu Fries and the fungus could not be identified in any herbaria or among Karsten's specimens sent to contemporary mycologists marked as *Physisporinus vitreus* (Donk 1960, 1966). Accordingly, Donk (1967) transferred *Poria vitrea* and other typical *Physisporinus* species to *Rigidoporus*, although, it is not yet acceptable. The type species of *Rigidoporus* is phylogenetically very distant from *Poria vitrea* and similar species, for which, we believe, the traditional definition of *Physisporinus* is still the best solution.

Donk (1966) also indicated that the type specimen of *Physisporinus vitreus*, *Poria vitrea* Pers. 1795 sensu Persoon may not exist, and mycologists have often confused the species with *Polyporus undatus* Pers. 1825 which is also unchanging in color. The type of *P. undatus* is in Leiden herbarium and is distinguished by thick-walled cystidia. Even if this feature had not been mentioned in the diagnosis of *Poria vitrea* Pers., Donk (1966) concluded that Persoon's protologue of *Poria vitrea* "could very well have been based on the same fungus". Moreover, Karsten (1883) described *Caloporus expallescens* P. Karst., which Lowe (1956) determined as aberrant (not changing color) *Physisporinus sanguinolentus*, but Pilát (1938) regarded as a good species similar to *P. vitreus*.

Physisporinus sanguinolentus and *P. vitreus* were also reported as common species in North America, but identifying them with European species was sometimes difficult (Lowe 1966). The rather uniform morphology of *Physisporinus* species and lack of data on old herbarium specimens about color of pore surface when fresh and any changes make morphological determination problematic.

Based on the above considerations, we performed extensive sampling of European and North American *Physisporinus*, followed by DNA isolation, sequencing, and phylogenetic analysis, which was the starting point of the present work. It was fortunate that quality DNA could be isolated from most *Physisporinus* samples, including old herbarium specimens, and intra–species sequence variability was minimal. We have obtained two clades of European species with unchanging color. Eight samples from Europe (Czechia, Slovakia, and Belarus) but also from Asia (China) form a distinct lineage with high support in our phylogenies, and they are closely related to *Physisporinus eminens*. Morphologically, these eight samples have corky to more or less cartilaginous basidiomata when dried, pore surface often nodulose, watery, white, without color change on bruising when fresh, pale brown to pinkish buff when dried, and small, subglobose spores rarely exceeding 5.5 μm in diam., thick-walled cystidia apically encrusted with coarse crystals embedded in trama or sometimes projecting from hymenium, but not in all specimens and always as a minority among thin-walled cystidia. Morphology corresponding to Persoon's protologue of *Poria vitrea* – "effusa, interrupta, hinc inde etiam subtuberculosa" and Donk comments above on this species justify the decision to regard this species as *Physisporinus vitreus* (Pers.) P. Karst. (Syn.: *P. undatus* (Pers.) Pilát). It belongs to Clade V in our study, relatively unrelated to color–changing *Physisporinus* species.

The second clade of specimens that do not change color, MJ 642/93 (Czechia), MJ 332/94 (Czechia), Dai 21060 (Belarus), KHL11959 (Norway) and BRNM 699576 (Czechia) show smooth, waxy and translucent fresh basidiomata relatively well adhered to the substrate, soft corky to fragile basidiomata when dry, white to light ochre pore surface without color change or indistinctly

Table 3 The type locality and main morphological characteristics of accepted species in *Physisporinus*.

Species	Type locality	Basidiomata	Color of pilei	Pores in per mm	Color of poroid surface	Cystidia		Cystidioles	Shape of Basidiospores	Size of Basidiospores (µm)	References
						Hyphoid cystidia	Hymenial cystidia				
P. africanus	São Tomé	Annual, effused–reflexed to pileate	Black	5–9	White to ochraceous when fresh	–	–	–	Subglobose	3–3.5 × 2.5–3	Decock & Ryvarden (2021)
P. caesiomarginatus	China	Annual, effused–reflexed to resupinate	White to cream when fresh, cream to buff yellow when dried	6–8	White to cream when fresh, buff yellow to salmon when dried	Thin-walled, with apical crystals	–	+	Broadly ovoid	4–4.8 × 3.3–4.1	Present study
P. castanopsidis	China	Annual, resupinate	–	6–8	Snow white and bruised area brown when fresh, salmon when dried	Thin-walled, with crystals	Thin-walled, with crystals	+	Ovoid	4.8–5.6 × 3.8–4.3	Chen & Dai (2021)
P. cataractus	Zimbabwe	Annual, resupinate	–	7–10	Dirty whitish when fresh, dark olivaceous to black when dry	–	–	–	Globose	4–5	Ryvarden (2019)
P. centroamericanus	USA	Annual, resupinate	–	8–10	Red to violet when fresh, dark brown to gray when dried	Thick-walled, with crystals	–	+	Subglobose to broadly ellipsoid	4–4.7 × 3.2–4	Present study
P. cinereus	Japan	Annual, effused–reflexed to pileate	Gray	5–6	Cream to pale ochraceous	Thin-walled, without crystals	–	+	Globose	5–6	Núñez & Ryvarden (1999)
P. crataegi	China	Annual, effused–	Cream when	6–8	White when fresh, buff in	Thin-walled, with crystals	–	+	Subglobose to broadly	4.2–5 × 3.2–4.2	Wu et al. (2017)

Table 3 Continued.

Species	Type locality	Basidiomata	Color of pilei	Pores in per mm	Color of poroid surface	Cystidia		Cystidioles	Shape of Basidiospores	Size of Basidiospores (µm)	References
						Hyphoid cystidia	Hymenial cystidia				
		reflexed	fresh, buff yellow when dried		bruised area, buff to pinkish buff when dried				ellipsoid		
P. crocatus	Tunisia	Annual to perennial, resupinate	–	5–7	Light pinkish when fresh, pinkish brown or smoky gray when dried	–	–	–	Subglobose to ovoid	3.5–5.5 × 3.5–5	Ryvarden & Melo (2017)
P. dollingerii	USA	Annual, resupinate	–	5–7	Pinkish to red when fresh, pale orange−brown, pale clay pink to clay buff when dried	Thin-walled, with crystals	Thin-walled, without crystals	+	Subglobose to broadly ellipsoid	4.5–5.5 × 4–5	Present study
P. eminens	China	Annual, resupinate	–	7–9	Cream to white when fresh, buff to cream when dried	Thick-walled, with crystals	–	+	Globose	4.2–6 × 3.9–5.2	Present study
P. expallescens	Finland	Annual, resupinate	–	5–6	White when fresh, buff to dark gray when dried	Thin-walled, smooth	–	+	Globose to ovoid	5.5–6.5 × 4.5–5.2	Present study
P. furcatus	Russia	Annual, resupinate	–	2–3	Ochraceous	–	Thin– to slightly thick-walled, with crystals or smooth	–	Globose	4.5–5.5	Núñez et al. (2001)
P. lavendulus	China	Annual, pileate	Cream, pinkish buff or grayish	9–10	Lavender when fresh, dark gray in bruised area,	Thick-walled, with crystals	–	+	Globose	4.2–5 × 4–5	Wu et al. (2017)

Table 3 Continued.

Species	Type locality	Basidiomata	Color of pilei	Pores in per mm	Color of poroid surface	Cystidia		Cystidioles	Shape of Basidiospores	Size of Basidiospores (µm)	References
						Hyphoid cystidia	Hymenial cystidia				
			blue when fresh, pinkish buff to dark grayish blue when dried		blackish blue to black when dried						
P. lineatus	Hungary	Annual, resupinate, effused−reflexed to pileate or with a stipe	Pinkish buff, cream to white when fresh, pale red brown or wood−colored when dried	7–9	White to pale gray when dried	Thick-walled, with crystals	Thin-walled, with crystals, sometimes absent	+	Globose	5–6	Ryvarden (1972), Ryvarden & Johansen (1980), Gilbertson & Ryvarden (1987)
P. longicystidius	New Zealand	Annual, effused–reflexed to resupinate	Pale ochraceous	8–11	Beige to ochraceous to pale pink when dried	Thick-walled, with crystals	–	+	Globose	4.2–5.7	Buchanan & Ryvarden (2000)
P. minutissimus	Costa Rica	Annual, effused−reflexed to resupinate	Light ochre to yellowish when fresh, cinnamon buff to buff yellow when dried	12–15	Sulphur yellow when fresh, brownish vinaceous when dried	–	–	+	Globose to subglobose	4.1–4.6 × 4–4.6	Present study
P. neovitreus	USA	Annual, effused–reflexed to	Curry yellow when	8–10	Watery white to straw yellow when	Thin-walled, with crystals	Thin-walled, with crystals, sometimes	+	Subglobose to broadly ellipsoid	4.9–6 × 4–4.8	Present study

Table 3 Continued.

Species	Type locality	Basidiomata	Color of pilei	Pores in per mm	Color of poroid surface	Cystidia		Cystidioles	Shape of Basidiospores	Size of Basidiospores (µm)	References
						Hyphoid cystidia	Hymenial cystidia				
		resupinate	fresh, clay buff to buff when dried		fresh, pinkish buff when dried		apically forked				
P. pouzarii	Slovakia	Annual, resupinate	–	5–7	White, cream to pale pinkish when fresh, bruised area bright red in juvenile basidiomata, pinkish brown when dried	Thin-walled, with crystals	–	+	Broadly ellipsoid to ovoid	4.7–6.3 × 4–4.6	Vampola & Vlasák (2012)
P. resinosus	Uganda	Annual, resupinate	–	6–8	Deep clay colored with a slightly tint of brown when fresh, darker in bruised parts when fresh	–	–	–	Globose	2.5–3	Ipulet & Ryvarden (2005)
P. rhododendri	China	Annual, resupinate	–	5–6	White when fresh, blood red when bruised, black–brown to ivory when dried	–	–	+	Subglobose	5.3–6.3 × 5–5.5	Present study
P. rigidus	Costa Rica	Annual, resupinate	–	10–12	Brown–red when fresh, honey yellow to deep olive when dried	Thick-walled, with crystals	–	+	Subglobose to broadly ellipsoid	4–4.6 × 3.2–4	Present study

Table 3 Continued.

Species	Type locality	Basidiomata	Color of pilei	Pores in per mm	Color of poroid surface	Cystidia		Cystidioles	Shape of Basidiospores	Size of Basidiospores (µm)	References
						Hyphoid cystidia	Hymenial cystidia				
P. roseus	China	Perennial, resupinate	–	5–6	Rose when fresh, vinaceous gray when dried	–	Thin-walled, without crystals	–	Subglobose	3.5–4.1 × 3.1–3.8	Chen & Dai (2021)
P. sanguinolentus	Germany	Annual or biennial, resupinate	–	3–5	White or ivory when fresh, bright red when bruised, buff yellow to clay buff when dry, bruised area dark brown when dried	–	–	+	Subglobose to ovoid	6–7 × 5–6	Present study
P. srilankensis	Sri Lanka	Annual, resupinate	–	5–7	Buff yellow to straw color when dried	Thick-walled, with crystals	–	+	Subglobose to broadly ellipsoid	5–5.8 × 4–4.8	Present study
P. subfurcatus	China	Annual, resupinate	–	3–4	White when fresh, blood red when bruised, honey yellow when dry, bruised area dark brown when dried	–	–	–	Subglobose to broadly ellipsoid	5.3–6.4 × 4.5–5.6	Present study
P. sublineatus	China	Annual, effused−reflexed to resupinate	Buff yellow to ivory when fresh, olivaceous buff to bluish gray when dried	8–10	Cream to ivory when fresh, yellowish, when bruised, clay buff to gray brown when dry,	Thick-walled, with crystals	Thin-walled, with fine crystals	+	Globose to subglobose	4.8–5.6 × 4.5–5.2	Present study

Table 3 Continued.

Species	Type locality	Basidiomata	Color of pilei	Pores in per mm	Color of poroid surface	Cystidia		Cystidioles	Shape of Basidiospores	Size of Basidiospores (µm)	References
						Hyphoid cystidia	Hymenial cystidia				
					bruised area dark brown when dried						
P. sulphureus	Singapore	Annual, resupinate	–	8–9	Sulphur yellow when fresh, olivaceous buff to honey yellow when dried	Thick-walled, with crystals	–	+	Globose to subglobose	4–5 × 3.5–4	Dai & Dai (2018)
P. tamilnaduensis	India	Annual, Pileate	brownish orange to light brown when fresh, brownish orange to brown when dried	6–8	light brown when fresh, brown when dried	Thick-walled, with crystals	–	+	Subglobose broadly to ellipsoid	4.5–5.8 × 4–5	Crous et al. (2023)
P. tasmanicus	Australia	Annual, resupinate	–	5–7	Cream to white when fresh, yellowish brown when bruised, pinkish buff and bruised area dark brown when dried	–	–	+	Subglobose to broadly ellipsoid	5–5.7 × 4–4.8	Present study
P. tibeticus	China	Annual, resupinate	–	5–7	Snow white when fresh, yellowish brown when bruised,	Thin-walled, with crystals	–	+	Broadly ellipsoid	4.8–5.5 × 3.7–4.3	Wu et al. (2017)

Table 3 Continued.

Species	Type locality	Basidiomata	Color of pilei	Pores in per mm	Color of poroid surface	Cystidia		Cystidioles	Shape of Basidiospores	Size of Basidiospores (µm)	References
						Hyphoid cystidia	Hymenial cystidia				
					pinkish buff to buff yellow and bruised area dark brown when dried						
P. vinctus	Dominican Republic	Perennial, effused–reflexed to resupinate	Salmon to clay pink when dried	8–12	More or less pink, pinkish buff to pale ochraceous buff when dried	Thick-walled, with crystals	Thin-walled, without crystals, sometimes absent	+	Subglobose to ovoid	4–5.5 × 3–4	Ryvarden (1972), Setliff (1972), Ryvarden & Johansen (1980)
P. vitreosanguineus	Czechia	Annual, resupinate	–	3–4	Cream to white to when fresh, orange–brown to black when bruised, cinnamon buff to clay buff when dry, bruised area brown to ash gray when dried	–	–	+	Subglobose to broadly ellipsoid	5–6.1 × 4–5	Present study
P. vitreus	Finland	Annual, resupinate	–	5–6	White to bluish white when fresh, ochraceous to pale pinkish brown when dried	Thick-walled or thin-walled, with crystals	–	+	Subglobose to ovoid	5–5.5 × 4–4.5	Present study
P. yunnanensis	China	Annual, resupinate	–	2–3	Olivaceous when fresh, olivaceous to	Thin-walled, with crystals	–	–	Subglobose	4–5.5 × 3.5–5	Cai et al. (2023)

Table 3 Continued.

Species	Type locality	Basidiomata	Color of pilei	Pores in per mm	Color of poroid surface	Cystidia		Cystidioles	Shape of Basidiospores	Size of Basidiospores (µm)	References
						Hyphoid cystidia	Hymenial cystidia				
					black when dried						
***Physisporinus* sp. 1**	USA	Annual, resupinate	–	8–10	White when fresh, red when bruised, cinnamon buff to clay buff when dry, bruised area black when dried	–	Thin-walled, without crystals	+	Broadly ellipsoid to ellipsoid	5–6 × 3.8–4.5	Present study
***Physisporinus* sp. 2**	Czechia	Annual, resupinate	–	7–9	Watery white when fresh, reddish brown when bruised, buff yellow to salmon when dried, clay buff in reddened parts	Thin-walled, with crystals	–	+	Broadly ellipsoid	4.6–5.2 × 3.8–4.2	Present study
***Physisporinus* sp. 3**	Czechia	Annual, resupinate	–	4–6	White when fresh, red when bruised, buff yellow to clay buff when dry, bruised area dark brown when dried	Thin-walled, with crystals	–	+	Broadly ellipsoid or ovoid	5.5–6.4 × 4.7–5.2	Present study

Abbreviations used: + = Present; – = Absent. **Bold** = new taxa.

brownish a long time after being bruised, cinnamon buff when dry, the absence of thick-walled cystidia and ovoid basidiospores 5.5–6.5 m long. These specimens correspond to *Physisporinus expallescens* (P. Karst.) Pilát (Karsten's type studied) and are phylogenetically close to *P. sanguinolentus* in Clade I in our study.

Physisporinus sanguinolentus assumed to be a species complex in previous studies (Binder et al. 2013, Wu et al. 2017, Westphalen et al. 2019, Chen & Dai 2021). Morphologically, it is traditionally characterized by quick reddening of fresh pore surface when bruised, thin-walled and ovoid to subglobose, large basidiospores of 6–7 × 5–6 μm (Donk 1967, Ryvarden & Melo 2017). In the current study, three distinct clades of European reddening / becoming orange-brown to black *Physisporinus* could be detected and two others from Asia (China). Seven samples (from Czechia, Slovakia, and Belarus) form a distinct lineage and show reddening pore surface when bruised, and broadly ellipsoid to subglobose, thin-walled basidiospores measuring 6–7 × 5–6 μm, which agrees with the description of *Physisporinus sanguinolentus.* So, we treat these seven samples and DM 1068 as *Physisporinus sanguinolentus* in the present study. *Physisporinus* sp. 3, *P. rhododendri* and *P. subfurcatus* from Czechia and China are phylogenetically related (Figs 1, 2), and they share with *P. sanguinolentus* the distinct reddening of pore surface when bruised but have smaller basidiospores. The third European reddening species, *Physisporinus* sp. 2 is relatively unrelated, appearing close to *P. crocatus* and *P. tibeticus* in our phylogenies (Figs 1, 2).

Notes on synonyms of some species of *Physisporinus*

The synonyms of *Physisporinus crocatus*, *P. expallescens*, *P. lineatus*, *P. sanguinolentus*, *P. vinctus* and *P. vitreus* (MycoBank, http://www.mycobank.org/) are summarized in Table 4.

Physisporinus crocatus (Basionym: *Poria crocata* Pat.) was originally described from Tunisia by Patouillard (1894), and it is characterized by perennial resupinate basidiomata with flesh–colored to pinkish brown pores, the absence of any cystidia or other sterile elements, and it is widespread in Europe (Ryvarden & Melo 2017). *Physisporus microsporus* P. Karst. from Finland as a synonym of *Physisporinus crocatus* has simple macro–morphology – "thick and pale basidiomata, round and small pores" (Karsten 1904). *Poria nigrescens* Bres. as a synonym of *Physisporinus crocatus* was described from Hungary and it has a perennial basidiomata, erubescent pores (white when fresh, then "carneo–violaceis", finally black), but no basidiospores data (Bresadola 1897). Lowe (1966) redescribed it based on American specimens; he indicated it has rigid tubes when dry, round to angular pores of 5–7/mm, subglobose basidiospores measuring 4–5.5 × 3–4 μm and a wide distribution in America. Specimens JV 0309/45, JV 0709/83, JV 0308/66 and JV 0308/58 from USA are characterized by resupinate basidiomata often easily separated from substrate, pores slowly reddening in juvenile basidiomata when bruised and unchanged in mature basidiomata, clay buff to blackish pore surface when dry, round to angular pores 8–10 per mm, smooth hymenial cystidia, ellipsoid to broadly ellipsoid basidiospores measuring 5–6 × 3.8–4.5 um, and growth on gymnosperm wood in northwestern USA. These characteristics are very consistent with *Poria nigrescen* except for the perennial basidiomata. In addition, this taxon is also very similar with *P. sanguinolentus***,** but the occurrence of *P. sanguinolentus* in North America is not confirmed in our study. Because of the complexity of *Physisporinus crocatus* and its synonyms, we temporarily treated samples JV 0309/45, JV 0709/83, JV 0308/66 and JV 0308/58 as *Physisporinus* sp. 1 with a detailed description. *Physisporinus subcrocatus* was originally described by Wu et al. (2017) from China, and it differs from *P. crocatus* by bigger basidiospores (5.1–5.8 × 4.2–5 μm vs. 4.4–5.2 × 4–4.5 μm). However, *Physisporinus crocatus* and *P. subcrocatus* were nested in the same lineage in our phylogenies, and they are very similar in morphology. Thus, we consider *P. subcrocatus* is a synonym of *P. crocatus*.

Physisporinus lineatus (Basionym: *Polyporus lineatus* Pers.) was originally described by Persoon in 1827 from Hungary, and it is characterized by seldom resupinate to pileate or with a stipe basidiomata, often imbricate, a rich color render and distinct concentrically zonate–sulcate pileal surface, a cream, orange-yellow to bright orange-red pore surface when fresh, thick-walled encrusted hyphoid cystidia, globose to subglobose basidiospores of 4.5–6 × 4–5 μm / 5–6 μm in

diam, and it is very common species and has a wide distribution from temperate to tropical areas (Ryvarden 1972, Ryvarden 2015, Ryvarden & Melo 2017, this study). *Polyporus zonalis* Berk. was originally described from Sri Lanka by Berkeley in 1843, then it was combined as *Rigidoporus zonalis* (Berk.) Imazeki based on its pileate and imbricate basidiomata, thick-walled encrusted hyphoid cystidia and subglobose to globose basidiospores (Imazeki 1952). Ryvarden (1972) considered that *R. zonalis* as a synonymy of *R. lineatus* according to these morphological characteristics, and indicated that *R. lineatus* is different from *R. microporus* by the presence of encrusted cystidia and slightly larger basidiospores. *Polyporus micromegas* Mont. was described by Montagne (1842) from Cuba, then it was combined as *Rigidoporus micromegas* (Mont.) Murrill. It is defined by effused–reflexed to pileate basidiomata with a rudimentary stipe (3.5 cm × 2–4 mm) and narrowly zonate–sulcate pileal surface, smooth and thin-walled cystidia globose to subglobose basidiospores of 3.5–4.5 × 3.2–4 µm / 4.5–5.5 µm in diam, and it is very common in tropical America (Murrill 1905, Corner 1987). These characters do not fit *Physisporinus lineatus*. However, we did not study the types of these taxa, and their DNA data are not available, and we can't comment on them. *Polyporus pusiolus* Ces. was described by Cesati (1879) from Malaysia with simple macro–morphology. Fortunately, a critical morphological feature is delivered "omnino resupinatus" meaning completely resupinate basidiomata, which can be distinguished from *Physisporinus lineatus* and *P. sublineatus*. *Polyporus epilinteus* Berk. & Broome was described by Berkeley & Broome (1873) from Sri Lanka, as having a "totus resupinatus" basidiomata, which is different from *Physisporinus lineatus* and *P. sublineatus*. *Leptoporus moeszii* Pilát ex Pilát was described by Pilát (1953) from Hungary, then it was combined as *Rigidoporus moeszii* (Pilát) Pouzar (Pouzar 1966b). It is characterized by resupinate to pileate basidiomata with narrowly concentrically zonate–sulcate pileal surface, encrusted cystidia and subglobose to globose basidiospores measuring 5–8 µm diam (Pilát 1953), which are consistent with *Polyporus zonalis* Berk.

Polyporus guhae Bose, *P. surinamensis* Miq., *P. inconspicuus* Miq., *P. plumbeus* Lév., *P. microstomus* Berk. & M.A. Curtis, *P. subliberatus* Berk. & M.A. Curtis, *P. cotyledoneus* Speg., *P. memorandus* Speg., *Polystictus cordobensis* Speg., *P. rufopictus* Berk. & M.A. Curtis ex Cooke and *P. cordubensis* Speg., listed as synonyms of *Physisporinus lineatus*, were described from India, Suriname, Guadeloupe, Cuba, and Argentina, respectively (MycoBank, http://www.mycobank.org/), unfortunately, descriptions on these taxa are very simple, and no comments without checking their types. However, all the above taxa have distinct pileate basidiomata, while all our above-described new species have resupinate basidiom ata. So, our new species are different from these taxa although the DNA data of the above taxa are not available.

Physisporinus sanguinolentus (Basionym: *Boletus sanguinolentus* Alb. & Schwein.) was originally described from Germany by Albertin and Schweinitz in 1805, *Daedalea aquosa* Velen. and *Polyporus reichertii* Velen. from Czechia and *Polyporus nebulosus* Berk. & M.A. Curtis, *Polyporus oxydatus* Berk. & M.A. Curtis from Cuba and *Boletus carmichaelii* Spreng. from the UK as synonyms of *Physisporinus sanguinolentus* listed in MycoBank (http://www.mycobank.org/). Because we did not study the types of these synonyms, we temporarily treated our European samples as *Physisporinus* sp. 2 and *Physisporinus* sp. 3 which are surely two different species in morphology and DNA data (Figs 1, 2). Both taxa and *P. sanguinolentus* share the erubescent pores if bruised when fresh. However, *Physisporinus* sp. 2 and *Physisporinus* sp. 3 have hyphoid cystidia, which differs from *P. sanguinolentus*.

Physisporinus vinctus (Basionym: *Polyporus vinctus* Berk.) was originally described by Berkeley in 1852 from the Dominican Republic, and it is defined by effused–reflexed to resupinate basidiomata with cinnamon–orange to buff pores, thick-walled encrusted hyphoid cystidia, mammillate cystidia, subglobose to globose basidiospores, and it is a common species in the tropics (Ryvarden 1972, Setliff 1972, Ryvarden & Johansen 1980, Ryvarden 2015). Setliff (1972) discussed the species *Poria vincta* (Berk.) Cooke including two varieties *Poria vincta* var. *vincta* (Berk.) Cooke and *Poria vincta* var. *cinerea* (Bres.) Setliff., and these two varieties are different in

Table 4 The list of synonyms in *Physisporinus*.

Accepted species	Type locality	Basionym	Synonyms	Type locality	References
P. crocatus (3)	Tunisia	*Poria crocata* Pat.	*Poria nigrescens* Bres	Hungary	Bresadola (1897)
			Physisporus microsporus P. Karst	Finland	Karsten (1904)
			Physisporinus subcrocatus F. Wu, Jia J. Chen & Y.C. Dai	China	Wu et al. (2017)
P. expallescens (7)	Finland	*Boletus sanguinolentus* Alb. & Schwein.	*Daedalea aquosa* Velen.	Czechia	Velenovský (1922)
			Polyporus reichertii Velen.	Czechia	Velenovský (1922)
			Caloporus expallescens P. Karst.	Finland	Karsten (1883)
			Polyporus nebulosus Berk. & M.A. Curtis	Cuba	Berkeley & Curtis (1869)
			Polyporus oxydatus Berk. & M.A. Curtis	USA: South Carolina	Berkeley & Curtis (1869)
			Physisporus alboater P. Karst.	Finland	Karsten (1892)
			Boletus carmichaelii Spreng.	UK	Sprengel (1827)
P. lineatus (16)	Hungary	*Polyporus lineatus* Pers.	*Polyporus zonalis* Berk.	Sri Lanka	Berkeley (1843)
			Polyporus guhae Bose	India	Lloyd (1922)
			Polyporus surinamensis Miq.	Suriname	Miquel (1839)
			Polyporus inconspicuus Miq.	Suriname	Miquel (1839)
			Polyporus plumbeus Lév.	Guadeloupe	Léveillé (1846)
			Polyporus micromegas Mont.	Cuba	Montagne (1842)
			Polyporus pusiolus Ces.	Malaysia	Cesati (1879)
			Polyporus microstomus Berk. & M.A. Curtis	Cuba	Berkeley & Curtis (1869)
			Polyporus punctatus Jungh.	Indonesia	Junghuhn (1838)
			Polyporus epilinteus Berk. & Broome	Sri Lanka	Berkeley & Broome (1873)
			Polyporus subliberatus Berk. & M.A. Curtis	Cuba	Berkeley & Curtis (1869)
			Polyporus cotyledoneus Speg.	Argentina	Spegazzini (1880a)

Table 4 Continued.

Accepted species	Type locality	Basionym	*Synonyms*	Type locality	References
			Polyporus memorandus Speg.	Argentina	Spegazzini (1880b)
			Polystictus cordobensis Speg.	Argentina	Spegazzini (1898)
			Polystictus rufopictus Berk. & M.A. Curtis ex Cooke	Cuba	Cooke (1886)
			Leptoporus moeszii Pilát ex Pilát	Hungary	Pilát (1953)
P. sanguinolentus (7)	Germany	*Boletus sanguinolentus* Alb. & Schwein.	*Daedalea aquosa* Velen.	Czechia	Velenovský (1922)
			Polyporus reichertii Velen.	Czechia	Velenovský (1922)
			Caloporus expallescens P. Karst.	Finland	Karsten (1883)
			Polyporus nebulosus Berk. & M.A. Curtis	Cuba	Berkeley & Curtis (1869)
			Polyporus oxydatus Berk. & M.A. Curtis	Cuba	Berkeley & Curtis (1869)
			Physisporus alboater P. Karst.	Finland	Karsten (1892)
			Boletus carmichaelii Spreng.	UK	Sprengel (1827)
P. vinctus (10)	Dominican	*Polyporus vinctus* Berk.	*Polyporus benetostus* Berk.	French Polynesia: Tahiti	Berkeley (1877)
			Polyporus carneopallens Berk.	Brazil	Berkeley (1856)
			Polyporus hyposclerus Berk. ex Cooke	Australia	Cooke (1882)
			Polyporus porphyrophaea Bres.	Philippines	Bresadola (1915)
			Polyporus albostygius Berk. & M.A. Curtis	Cuba	Berkeley & Curtis (1869), Lowe (1966)
			Polyporus acupunctatus Berk. & Broome	Sri Lanka	Berkeley & Broome (1873)
			Polyporus bistratosus Berk. & Cooke	Brazil	Berkeley & Cooke (1876)
			Poria fulvobadia Pat.	Vietnam	Patouillard (1897)
			Poria fumosa Bres. & Pat.	Samoa	Lloyd (1901)
			Poria porphyrophaea Bres.	Philippines	Bresadola (1915)
P. vitreus (1)	Finland	*Poria vitrea* Pers.	*Polyporus adiposus* Berk. & Broome	UK: Twycross	Berkeley & Broome (1854)

pore colors, the former is buff to cinnamon–orange, and the latter is reddish brown to gray. *Poria vincta* var. *vincta* (Berk.) Cooke includes *Polyporus vinctus* Berk., *Polyporus carneopallens* Berk. and *Polyporus hyposclera* Berk. *Poria vincta* var. *cinerea* (Bres.) Setliff. includes *Poria carneopallens* f. *cinerea* Bres., *P. porphyrophaea* Bres. and *P. hypobrunnea* Petch (Setliff 1972). The presence of mammillate cystidia appears to be controversial, we find this structure only in Kout 1807/3 among our studied four samples with resupinate to effused–reflexed basidiomata. Although the type specimen of *Polyporus vinctus* is resupinate, the species was described with resupinate to effused–reflexed basidiomata by most mycologists (Gilbertson & Ryvarden 1987, Ryvarden 1972, Ryvarden 2015). The samples JV 1712/13−J, Dai 10503 and Dai 10569 have resupinate basidiomata with fuscous pores and the absence of mammillate cystidia. Thus, we consider the samples JV 0610/B5, JV 1407/36, JV 0610/A31B, Kout 1807/3 and Cui 16903 as *Physisporinus vinctus*, the samples JV 1712/13−J, Dai 10503, Dai 10569 as *Rigidoporus hypobrunneus*. In addition, in terms of distribution, the samples JV 0610/B5, JV 1407/36, JV 0610/A31B, Kout 1807/3 and Cui 16903 from Central America only, while the samples Dai 10503 and Dai 10569 from Asia and JV 1712/13−J from Central America. The type localities of *Physisporinus vinctus* and *Rigidoporus hypobrunneus* are from the Dominican Republic and Sri Lanka, respectively, which supports our conclusion.

Polyporus adiposus Berk. & Broome as a synonym of *Physisporinus vitreus* was described from England with a resupinate to effused–reflexed, white and waxy basidiomata, darkly tomentose pileal surface, but without basidiospore data (Berkeley & Broome 1854). Our new species *P. neovitreus* also has a resupinate to effused–reflexed basidiomata, but it differs from *Polyporus adiposus* by glabrous and faintly zonate pileal surface and occurrence in North America. Though *P. vitreus* is reported widely distributed in North American forest regions (Gilbertson & Ryvarden 1987), we describe *P. neovitreus* from North America because it differs from the European *P. vitreus* and other taxa are listed as synonyms of *P. vitreus.*

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