Persoonia 42, 2019: 101–126
www.ingentaconnect.com/content/nhn/pimj

RESEARCH ARTICLE

ISSN (Online) 1878-9080
https://doi.org/10.3767/persoonia.2019.42.05

Taxonomy and phylogeny of *Postia*. Multi-gene phylogeny and taxonomy of the brown-rot fungi: *Postia* (*Polyporales*, *Basidiomycota*) and related genera

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Key words

Fomitopsidaceae
multi-marker analyses
Oligoporus
phylogeny
taxonomy
Tyromyces
wood-inhabiting fungi

Abstract Phylogenetic and taxonomic studies on the brown-rot fungi *Postia* and related genera, are carried out. Phylogenies of these fungi are reconstructed with multiple loci DNA sequences including the internal transcribed spacer regions (ITS), the large subunit (nLSU) and the small subunit (nSSU) of nuclear ribosomal RNA gene, the small subunit of mitochondrial rRNA gene (mtSSU), the translation elongation factor 1-α gene (TEF1), the largest subunit of RNA polymerase II (RPB1) and the second subunit of RNA polymerase II (RPB2). Ten distinct clades of *Postia* s.lat. are recognized. Four new genera, *Amaropostia*, *Calcipostia*, *Cystidiopostia* and *Fuscopostia*, are established, and nine new species, *Amaropostia hainanensis*, *Cyanosporus fusiformis*, *C. microporus*, *C. mongolicus*, *C. piceicola*, *C. subhirsutus*, *C. tricolor*, *C. ungulatus* and *Postia sublowei*, are identified. Illustrated descriptions of the new genera and species are presented. Identification keys to *Postia* and related genera, as well as keys to the species of each genus, are provided.

Article info Received: 20 April 2017; Accepted: 28 September 2018; Published: 29 November 2018.

INTRODUCTION

Postia was established by Fries (1874). *Postia* species are characterized by annual growth habit, mostly soft to corky fruiting bodies when fresh, a monomitic hyphal system with clamped generative hyphae, allantoid to cylindrical basidiospores which are usually thin-walled, negative in Melzer's reagent and acyanophilous in Cotton Blue, and producing a brown rot (Hattori et al. 2011, Cui & Li 2012). More than 60 species have been accepted in the genus worldwide so far (Jülich 1982, Larsen & Lombard 1986, Renvall 1992, Buchanan & Ryvarden 2000, Wei & Dai 2006, Hattori et al. 2011, Dai 2012, Shen et al. 2015), of which 34 species were recorded from China (Wei & Qin 2010, Dai 2012, Shen et al. 2014, 2015).

Postia is closely related to *Oligoporus* and *Spongiporus*. Historically, most taxa in the three genera were placed in *Tyromyces* (Murrill 1907, 1912, Bondartsev & Singer 1941, Lowe 1975, Ryvarden 1981). However, it became clear that the species in *Tyromyces* cause a white rot, while species in the other three genera cause a brown rot (Gilbertson & Ryvarden 1987, Ryvarden 1991, Ryvarden & Gilbertson 1994). Because no species was listed when *Postia* was first proposed in Fries (1874), some mycologists did not accept *Postia*, but supported *Spongiporus* or *Oligoporus* instead. *Oligoporus* was established in 1888 by Brefeld and included three species initially, with the characteristics of fleshy fruitbody when fresh, turning to fragile when dry and allantoid to cylindrical basidiospores. Later, Gilbertson & Ryvarden (1985) placed 22 taxa into *Oligoporus* containing two previous species in *Tyromyces* and gradually *Oligoporus* was widely used (Gilbertson & Ryvarden 1987, Ryvarden & Gilbertson 1994, Núñez & Ryvarden 2001, Bernicchia 2005, Ryvarden & Melo 2014). Murrill erected 29 genera, including *Spongiporus* for North American polypores in early 20th century, and he defined *Spongiporus* species as brown rot fungi with whitish and spongiose basidiocarps that bear cylindrical basidiospores. David (1980) transferred 13 *Tyromyces* species into *Spongiporus*, adopted by many other studies (Bondartsev & Singer 1941, Lowe 1975, Ryvarden 1981). In fact, *Postia* is the oldest name among the competing genera. Some mycologists combined the brown rot taxa of *Tyromyces* into *Postia* (Renvall 1992, Niemelä et al. 2005, Wei & Dai 2006, Hattori et al. 2011, Cui & Li 2012, Pildain & Rajchenberg 2013). With more species recognized in *Postia*, the definitions of the genus and related genera remain murky, and so are the genetic relationships among these fungi.

Pildain & Rajchenberg (2013) sequenced the ITS and nLSU regions from eleven species of *Postia* and related species; their phylogenetic analysis indicated that most species in *Postia* and *Oligoporus* were monophyletic, but supported the transfer of *P. placenta* into its own genus as *Rhodonia placenta*, in agreement with previous studies (Boidin et al. 1998, Kim et al. 2001, Binder et al. 2005, Niemelä et al. 2005). Ortiz-Santana et al. (2013) investigated the phylogenetic relationships among members of the antrodia clade with molecular data from ITS and nLSU regions; in their study, species of *Postia* s.lat. were divided into four clades: the *Spongiporus* clade, the *Oligoporus* clade, the *Postia* s.str. clade and the *Spongiporus undosus* clade. Cui et al. (2014) discussed the phylogenetic position of the monotypic genus *Osteina* in the *Fomitopsidaceae* of *Polyporales*, and accepted *Osteina obducta* rather than *Oligoporus obductus*.

Up to now, no comprehensive investigation has been carried out on *Postia* s.lat. with sufficient sampling, and taxonomic delimitation of *Postia* s.lat. has been controversial and remained insufficiently resolved (Donk 1960, Larsen & Lombard 1986, Ryvarden 1991, Walker 1996, Pildain & Rajchenberg 2013).

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Table 1 A list of species, specimens and GenBank accession numbers of sequences used in this study.

Species name	Sample no.	Location	GenBank No.							References
			ITS	nLSU	nSSU	mtSSU	TEF1	RPB1	RPB2	
Amaropostia hainanensis	Cui 5367	China	KX900910[a]	KX900980[a]	KX901124[a]	KX901052[a]	–	KX901172[a]	KX901224[a]	this study
	Cui 13739	China	KX900909[a]	KX900979[a]	KX901123[a]	KX901051[a]	–	KX901171[a]	KX901223[a]	this study
	Dai 15208	China	KX900911[a]	KX900981[a]	KX901125[a]	KX901053[a]	–	–	KX901225[a]	this study
A. stiptica	Cui 9268	China	KF727431	KX900978[a]	–	KX901048[a]	–	–	–	Shen et al. 2015
	Cui 10043	China	KX900906[a]	KX900976[a]	KX901119[a]	KX901046[a]	–	KX901167[a]	KX901219[a]	this study
	Cui 10981	China	KX900907[a]	KX900977[a]	KX901120[a]	KX901047[a]	–	KX901168[a]	KX901220[a]	this study
Amylocystis lapponica	HHB-13400-Sp	USA	KC585237	KC585059	–	–	–	–	–	Ortiz-Santana et al. 2013
	OKM-4418-Sp	USA	KC585238	KC585060	–	–	–	–	–	Ortiz-Santana et al. 2013
Amyloporia xantha	Cui 11544	China	KR605817	KR605756	KR605918	KR606018	KR610746	–	KR610836	Han et al. 2016
	Cui 11677	China	KR605818	KR605757	KR605919	–	KR610747	–	KR610837	Han et al. 2016
Antrodia juniperina	CBS 117.40	USA	DQ491416	AY515346				–	DQ491389	Kim et al. 2007
A. macra	Eriksson 1967	Unknown	KR605810	KR605749	KR605909	–	KR610739	–	–	Han et al. 2016
A. malicola	X1016	China	KC595896	KC595896	–	–	–	–	–	Ortiz-Santana et al. 2013
A. serialis	Cui 10519	China	KP715307	KP715323	KR605911	KR606011	KP715337	–	KR610830	Han et al. 2016
A. serpens	Dai 7465	China	KR605813	KR605752	KR605913	KR606013	KR610742	–	KR610832	Han et al. 2016
A. variiformis	CBS 309.82	USA	DQ491418	AY515344	–	DQ491445	–	–	DQ491391	Kim et al. 2007
Auriporia aurea	Cui 10665	China	KX966182[a]	KX966183[a]	–	–	KX966184[a]	–	–	this study
	FP-98524	USA	KC585316	KC585141	–	–	–	–	–	Ortiz-Santana et al. 2013
A. aurulenta	HHB-8864	USA	KC585317	KC585142	–	–	–	–	–	Ortiz-Santana et al. 2013
Buglossoporus eucalypticola	Dai 13660	China	KR605808	KR605747	KR605906	KR606007	KR610736	–	KR610825	Han et al. 2016
B. quercinus	JV 0906/15-J	USA	KR605800	KR605739	KR605898	KR606001	KR610729	–	KR610819	Han et al. 2016
Calcipostia guttulata	Cui 10018	China	KF727432	KJ684978	KX901138[a]	KX901065[a]	KX901276[a]	KX901181[a]	KX901236[a]	this study
	Cui 10028	China	KF727433	KJ684979	KX901139[a]	KX901066[a]	KX901277[a]	KX901182[a]	KX901237[a]	this study
	KHL 11739 (GB)	Finland	EU118650	EU118650	–	–	–	–	–	Larsson direct submission
Coriolopsis polyzona	Cui 11040	China	KR605824	KR605767	KR605932	KR606029	KR610760	–	KR610849	Han et al. 2016
Crustoderma flavescens	L-10857-Sp	USA	KC585326	KC585151	–	–	–	–	–	Ortiz-Santana et al. 2013
C. resinosum	L-10631-Sp	USA	KC585330	KC585155	–	–	–	–	–	Ortiz-Santana et al. 2013
Cyanosporus alni	Cui 7185	China	KX900879[a]	KX900949[a]	KX901092[a]	KX901017[a]	KX901254[a]	KX901155[a]	KX901202[a]	this study
	Dai 12709	Czech	KX900881[a]	KX900951[a]	KX901094[a]	KX901019[a]	KX901256[a]	KX901157[a]	KX901204[a]	this study
	Dai 14845	Poland	KX900880[a]	KX900950[a]	KX901093[a]	KX901018[a]	KX901255[a]	KX901156[a]	KX901203[a]	this study
	Dai 15060	China	KX900882[a]	KX900952[a]	KX901095[a]	KX901020[a]	KX901257[a]	KX901158[a]	KX901205[a]	this study
C. caesius	Cui 10788	China	KX900885[a]	KX900955[a]	KX901098[a]	KX901023[a]	–	KX901161[a]	KX901208[a]	this study
	Dai 12605	Finland	KX900883[a]	KX900953[a]	KX901096[a]	KX901021[a]	–	KX901159[a]	KX901206[a]	this study
	Dai 12974	China	KX900884[a]	KX900954[a]	KX901097[a]	KX901022[a]	KX901258[a]	KX901160[a]	KX901207[a]	this study
C. fusiformis	Cui 10775	China	KX900868[a]	KX900938[a]	KX901081[a]	KX901006[a]	KX901245[a]	–	KX901191[a]	this study
	Dai 15036	China	KX900867[a]	KX900937[a]	KX901080[a]	KX901005[a]	KX901244[a]	–	KX901190[a]	this study
C. mediterraneocaesius	LY BR 4274	France	KX900886[a]	–	KX901099[a]	KX901024[a]	–	–	–	this study
C. microporus	Cui 11014	China	KX900878[a]	KX900948[a]	KX901091[a]	KX901016[a]	–	–	KX901201[a]	this study
	Dai 11717	China	KX900877[a]	KX900947[a]	KX901090[a]	KX901015[a]	–	–	KX901200[a]	this study
C. mongolicus	Cui 13518	China	KX900887[a]	KX900957[a]	KX901100[a]	KX901025[a]	–	–	KX901209[a]	this study
	Cui 13519	China	KX900888[a]	KX900958[a]	KX901101[a]	KX901026[a]	–	–	–	this study
C. piciecola	Cui 10446	China	KX900863[a]	KX900933[a]	KX901076[a]	–	–	–	KX901186[a]	this study
	Cui 10617	China	KX900864[a]	KX900934[a]	KX901077[a]	KX901002[a]	–	KX901151[a]	KX901187[a]	this study
	Cui 10626	China	KX900862[a]	KX900932[a]	KX901075[a]	KX901001[a]	–	–	KX901185[a]	this study
	Cui 12088	China	KX900865[a]	KX900935[a]	KX901078[a]	KX901003[a]	–	KX901152[a]	KX901188[a]	this study
	Cui 12158	China	KX900866[a]	KX900936[a]	KX901079[a]	KX901004[a]	KX901243[a]	KX901153[a]	KX901189[a]	this study
C. subcaesius	KA12-1375	Republic of Korea	KR673585	–	–	–	–	–	–	Kim et al. 2015
	K(M)32713	UK	AY599576	–	–	–	–	–	–	Yao et al. 2005
C. subhirsutus	Cui 11019	China	KX900872[a]	KX900942[a]	KX901085[a]	KX901010[a]	KX901249[a]	–	KX901195[a]	this study
	Cui 11330	China	KX900873[a]	KX900943[a]	KX901086[a]	KX901011[a]	KX901250[a]	–	KX901196[a]	this study
	Dai 14892	China	KX900871[a]	KX900941[a]	KX901084[a]	KX901009[a]	KX901248[a]	–	KX901194[a]	this study
C. tricolor	Cui 10780	China	KX900874[a]	KX900944[a]	KX901087[a]	KX901012[a]	KX901251[a]	–	KX901197[a]	this study
	Cui 10790	China	KX900875[a]	KX900945[a]	KX901088[a]	KX901013[a]	KX901252[a]	–	KX901198[a]	this study

Table 1 (cont.)

Species name	Sample no.	Location	GenBank No.							References
			ITS	nLSU	nSSU	mtSSU	TEF1	RPB1	RPB2	
C. tricolor (cont.)	Cui 12233	China	KX900876[a]	KX900946[a]	KX901089[a]	KX901014[a]	KX901253[a]	–	KX901199[a]	this study
C. ungulatus	Cui 10778	China	KX900870[a]	KX900940[a]	KX901083[a]	KX901008[a]	KX901247[a]	–	KX901193[a]	this study
	Dai 12897	China	KX900869[a]	KX900939[a]	KX901082[a]	KX901007[a]	KX901246[a]	KX901154[a]	KX901192[a]	this study
Cystidiopostia hibernica	Cui 2658	China	KX900905[a]	KX900975[a]	KX901118[a]	KX901045[a]	–	–	KX901218[a]	this study
	Cui 8248	China	KF699126	KJ684980	KX901117[a]	–	–	–	KX901217[a]	this study
	K(M)17352	Austria	AJ006665	–	–	–	–	–	–	Yao et al. 2005
C. inocybe	Dai 3706	China	KX900904[a]	–	–	–	–	–	–	this study
	LY BR 3703	France	KX900903[a]	KX900973[a]	KX901116[a]	KX901044[a]	KX901267[a]	–	–	this study
C. pileata	Cui 5721	China	KF699127	KX900960[a]	KX901121[a]	KX901049[a]	KX901268[a]	KX901169[a]	KX901221[a]	this study
	Cui 10034	China	KX900908[a]	KX900956[a]	KX901122[a]	KX901050[a]	KX901269[a]	KX901170[a]	KX901222[a]	this study
Dacryobolus sudans	FP-100190-Sp	USA	KC585331	KC585156	–	–	–	–	–	Ortiz-Santana et al. 2013
	FP-101996-Sp	USA	KC585332	KC585157	–	–	–	–	–	Ortiz-Santana et al. 2013
	FP-150381	Jamaica	KC585333	KC585158	–	–	–	–	–	Ortiz-Santana et al. 2013
Daedalea dickinsii	Yuan 1090	China	KR605790	KR605729	KR605878	KR605981	KR610711	–	KR610802	Han et al. 2016
D. quercina	Dai 2260	Sweden	KR605792	KR605731	KR605885	KR605988	KR610718	–	KR610808	Han et al. 2016
Fomitopsis pinicola	Cui 10532	China	KP171214	KP171237	KR605858	KR605962	KR610691	–	KR610782	Han et al. 2016
Fibroporia albicans	Cui 9464	China	KC456250	KR605758	KR605920	KR606019	KR610748	–	KR610838	Han et al. 2016
F. radiculosa	Cui 11404	China	KP145011	KR605760	KR605922	KR606021	KR610750	–	KR610840	Han et al. 2016
Fragifomes niveomarginatus	Cui 10108	China	KR605778	KR605717	KR605851	KR605955	KR610684	–	KR610776	Han et al. 2016
	Wei 5583	China	HQ693994	KC507175	KR605852	KR605956	KR610685	–	–	Han et al. 2016
Fuscopostia duplicata	Cui 10366	China	KF699124	KJ684975	KR605927	KR606026	KR610755	KX901173[a]	KR610844	Han et al. 2016
	Dai 13411	China	KF699125	KJ684976	KR605928	KR606027	KR610756	KX901174[a]	KR610845	Han et al. 2016
F. fragilis	Cui 10020	China	KX900912[a]	KX900982[a]	KX901126[a]	KX901054[a]	KX901270[a]	–	KX901226[a]	this study
	Cui 10088	China	KF699120	KJ684977	KX901127[a]	KT893749	KT893745	–	KT893745	Han et al. 2016
	JV 0610-8	Czech	JF950573	–	–	–	–	–	–	Vampola et al. 2014
F. lateritia	Dai 2652	China	KX900913[a]	KX900983[a]	–	–	–	–	–	this study
	KUO 021153-1	Finland	JF950567	–	–	–	–	–	–	Vampola et al. 2014
F. leucomallella	Cui 9577	China	KF699122	KJ684982	KX901128[a]	KX901055[a]	KX901271[a]	KX901175[a]	KX901227[a]	this study
	Cui 9599	China	KF699123	KJ684983	KX901129[a]	KX901056	KX901272[a]	KX901176[a]	KX901228[a]	this study
Gilbertsonia angulopora	FP-133019	USA	KC585354	KC585182	–	–	–	–	–	Ortiz-Santana et al. 2013
Laetiporus sulphureus	Dai 12154	China	KF951295	KF951302	KR605924	KR606023	KR610752	–	KR610841	Song et al. 2014
	Dai 12826	China	KR605819	KR605762	KR605925	KR606024	KR610753	–	KR610842	Han et al. 2016
Laricifomes officinalis	JV 0309/49-J	USA	KR605821	KR605764	KR605929	–	KR610757	–	KR610846	Han et al. 2016
	JV 9010/14	Slovakia	KR605822	KR605765	KR605930	–	KR610758	–	KR610847	Han et al. 2016
Neolentiporus maculatissimus	Rajchenberg 158	Argentina	–	AF518632	AF334921	AF334884	–	–	AY218497	Hibbett & Donoghue 2001
Niveoporofomes spraguei	4638	France	KR605784	KR605723	KR605862	KR605966	KR610696	–	KR610786	Han et al. 2016
	JV 0509/62	USA	KR605786	KR605725	KR605864	KR605968	KR610697	–	KR610788	Han et al. 2016
Oligoporus rennyi	KEW 57	unknown	AY218416	AF287876	–	–	–	–	–	Ortiz-Santana et al. 2013
	MR 10497	Argentina	JX090117	–	–	–	–	–	–	Ortiz-Santana et al. 2013
O. sericeomollis	Cui 9560	China	KX900919[a]	KX900989[a]	KX901140[a]	KX901067[a]	–	KX901183[a]	–	this study
	Cui 9870	China	KX900920[a]	KX900990[a]	KX901141[a]	KX901068[a]	–	KX901184[a]	–	this study
Osteina obducta	Cui 9832	China	KX900925[a]	KX900995[a]	–	–	–	–	–	this study
	Cui 9959	China	KX900923[a]	KX900993[a]	KX901143[a]	KX901070[a]	–	–	KX901239[a]	this study
	Cui 10074	China	KX900924[a]	KX900994[a]	KX901144[a]	KX901071[a]	–	–	KX901240[a]	this study
O. undosa	Dai 6942	China	KX900922[a]	KX900992[a]	–	–	–	–	–	this study
	Dai 7105	China	KX900921[a]	KX900991[a]	KX901142[a]	KX901069[a]	–	–	KX901238[a]	this study
	L-6646	USA	KC585399	KC585232	–	–	–	–	–	Ortiz-Santana et al. 2013
	L-10830-Sp	USA	KC585396	KC585229	–	–	–	–	–	Ortiz-Santana et al. 2013
Phaeolus schweinitzii	AFTOL-ID 702	USA	–	AY629319	AY705961	JN710740	DQ028602	–	DQ408119	Matheny et al. 2007
	FP-133218-Sp	USA	KC585369	KC585198	–	–	–	–	–	Ortiz-Santana et al. 2013
Piptoporellus hainanensis	Dai 13714	China	KR605806	KR605745	KR605904	KR606005	KR610735	–	KR610824	Han et al. 2016
P. soloniensis	Cui 11390	China	KR605803	KR605742	KR605901	KR606003	KR610733	–	KR610822	Han et al. 2016

Table 1 (cont.)

Species name	Sample no.	Location	GenBank No.							References
			ITS	nLSU	nSSU	mtSSU	TEF1	RPB1	RPB2	
Postia amurensis	Cui 1044	China	KX900902[a]	KX900972[a]	–	KX901043[a]	–	–	–	this study
	Dai 903	China	KX900901[a]	KX900971[a]	–	KX901042[a]	–	–	–	this study
P. carbophila	MR 10758	Argentina	JX090114	JX090132	–	–	–	–	–	Pildain & Rajchenberg 2013
	MR 12281	Argentina	JX090115	–	–	–	–	–	–	Pildain & Rajchenberg 2013
P. dissecta	CIEFAP 328	Argentina	JX090106	JX090134	–	–	–	–	–	Pildain & Rajchenberg 2013
	MR 12423	Argentina	JX090107	JX090135	–	–	–	–	–	Pildain & Rajchenberg 2013
P. hirsuta	Cui 11180	China	KJ684971	KJ684985	–	KX901039[a]	–	–	–	Shen & Cui 2014
	Cui 11237	China	KJ684970	KJ684984	KX901113[a]	KX901038[a]	KX901266[a]	–	–	Shen & Cui 2014
P. lactea	Cui 7156	China	KX900889[a]	KX900959[a]	–	KX901027[a]	KX901259[a]	–	–	this study
	Cui 7167	China	KX900890[a]	–	KX901102[a]	–	–	–	–	this study
	Cui 9319	China	KX900894[a]	KX900964[a]	KX901106[a]	KX901031[a]	KX901262[a]	KX901165[a]	KX901213[a]	this study
	Cui 11511	China	KX900893[a]	KX900963[a]	KX901105[a]	KX901030[a]	KX901261[a]	KX901164[a]	KX901212[a]	this study
	Cui 12141	China	KX900892[a]	KX900962[a]	KX901104[a]	KX901029[a]	KX901260[a]	KX901163[a]	KX901211[a]	this study
	Dai 15946	China	KX900891[a]	KX900961[a]	KX901103[a]	KX901028[a]	–	KX901162[a]	KX901210[a]	this study
P. lowei	Cui 9585	China	KX900898[a]	KX900968[a]	KX901110[a]	KX901035[a]	–	–	–	this study
	X1373	Finland	KC595941	–	–	–	–	–	–	Ortiz-Santana et al. 2013
	X1417	Finland	KC595942	–	–	–	–	–	–	Ortiz-Santana et al. 2013
P. ochraceoalba	Cui 10802	China	KM107903	KM107908	KX901115[a]	KX901041[a]	–	–	KX901216[a]	Shen et al. 2015
	Cui 10825	China	KM107902	KM107907	KX901114[a]	KX901040[a]	–	–	KX901215[a]	Shen et al. 2015
P. pelliculosa	MR 10592	Argentina	JX090102	JX090124	–	–	–	–	–	Pildain & Rajchenberg 2013
	MR 10671	Argentina	JX090101	JX090123	–	–	–	–	–	Pildain & Rajchenberg 2013
P. punctata	MR 11100	Argentina	JX090112	JX090128	–	–	–	–	–	Pildain & Rajchenberg 2013
	MR 12398	Chile	JX090111	JX090127	–	–	–	–	–	Pildain & Rajchenberg 2013
P. sublowei	Cui 9352	China	KX900899[a]	KX900969[a]	KX901111[a]	KX901036[a]	KX901264[a]	–	–	this study
	Cui 9597	China	KX900900[a]	KX900970[a]	KX901112[a]	KX901037[a]	KX901265[a]	–	–	this study
P. tephroleuca	Cui 10047	China	KX900895[a]	KX900965[a]	KX901107[a]	KX901032[a]	–	–	–	this study
	Cui 6020	China	KX900896[a]	KX900966[a]	KX901108[a]	KX901033[a]	–	–	–	this study
	Dai 12610	Finland	KX900897[a]	KX900967[a]	KX901109[a]	KX901034[a]	KX901263[a]	KX901166[a]	KX901214[a]	this study
	KUC20130725-34	Republic of Korea	KJ668465	KC585213	–	–	–	–	–	Binder et al. 2013
	TN 6900 (H)	Finland	JX109850	JX109850	–	–	–	–	–	Binder et al. 2013
Pycnoporellus alboluteus	HHB12816	USA	EU402588	EU402538				–		Lindner & Banik 2008
P. fulgens	Thorn-325	USA	AY218418	AF518643	AF518587	AF518690		–	AY218527	Han et al. 2016
Rhodofomes rosea	Cui 10633	China	KR605782	KR605721	KR605860	KR605964	KR610693	–	KR610784	Han et al. 2016
R. subfeei	Dai 11887	China	KC507160	KC507170	KR605870	KR605973	KR610703	–	KR610794	Han & Cui 2015
Rhodofomitopsis cupreorosea	CBS 236.87	Costa Rica	DQ491400	AY515325	–	DQ491427	–	–	DQ491373	Kim et al. 2007
R. lilacinogilva	Schigel 5193	Australia	KR605773	KR605712	KR605846	KR605951	KR610680	–	KR610774	Han et al. 2016
Rhodonia obliqua	Cui 10470	China	KX900926[a]	KX900996[a]	KX901146[a]	–	–	–	–	this study
	Dai 5728	China	KX900927[a]	KX900997[a]	KX901145[a]	–	–	–	–	this study
R. placenta	TN 7609 (GB)	Finland	JX109846	JX109846	–	–	JX109900	–	JX109872	Binder et al. 2013
	Wei 1406	China	KF699129	KT893750	–	–	KT893748	–	KT893746	Shen et al. 2015
R. rancida	Cui 12317	China	KX900928[a]	KX900998[a]	KX901147[a]	–	KX901278[a]	–	KX901241[a]	this study
	Cui 12339	China	KX900929[a]	KX900999[a]	KX901148[a]	KX901072[a]	KX901279[a]	–	KX901242[a]	this study
R. subplacenta	Cui 9818	China	KX900930[a]	KX901000[a]	KX901149[a]	KX901073[a]	–	–	–	this study
	Dai 13456	China	KX900931[a]	KX900974[a]	KX901150[a]	KX901074[a]	–	–	–	this study
Rubellofomes cystidiatus	Cui 5481	China	KF937288	KF937291	KR605832	KR605938	KR610667	–	KR610765	Han et al. 2016
	Yuan 6304	China	KR605769	KR605708	KR605833	KR605939	KR610668	–	–	Han et al. 2016
Ryvardenia campyla	NZFS 2826	New Zealand	JQ390051	–	–	–	–	–	–	Ortiz-Santana et al. 2013
	NZFS 2828	New Zealand	JQ390052	–	–	–	–	–	–	Ortiz-Santana et al. 2013
Sarcoporia polyspora	234-36	USA	KC585392	KC585225	–	–	–	–	–	Ortiz-Santana et al. 2013
	L-14910-Sp	USA	KC585393	KC585226	–	–	–	–	–	Ortiz-Santana et al. 2013
	TN 7672 (H)	Finland	JX109848	JX109848	–	–	–	–	–	Binder et al. 2013
	L-16072-Sp	USA	KC585394	KC585227	–	–	–	–	–	Ortiz-Santana et al. 2013

Table 1 (cont.)

Species name	Sample no.	Location	GenBank No. ITS	nLSU	nSSU	mtSSU	TEF1	RPB1	RPB2	References
Sparassis latifolia	CKM1	Republic of Korea	KF309263	–	KF309255	KF309259	–	–	KF309267	Lee et al. direct submission
S. radicata	TENN52558/ss33	USA	AY218450	AY218411	–	–	–	–	AY218547	Han et al. 2016
Spongiporus balsameus	Cui 9835	China	KX900916[a]	KX900986[a]	KX901134[a]	KX901061[a]	–	–	KX901233[a]	this study
	JV 8609-9	Slovakia	JF950570	–	–	–	–	–	–	Vampola et al. direct submission
S. floriformis	Cui 10292	China	KM107899	KM107904	KX901131[a]	KX901058[a]	KX901274[a]	KX901178[a]	KX901230[a]	Shen et al. 2015
	Dai 13887	China	KX900914[a]	KX900984[a]	KX901130[a]	KX901057[a]	KX901273[a]	KX901177[a]	KX901229[a]	this study
	X1295	Finland	KC595936	KC595936	–	–	–	–	–	Ortiz-Santana et al. 2013
S. gloeoporus	Cui 9507	China	KM107901	KM107906	KX901132[a]	KX901059[a]	–	–	KX901231[a]	Shen et al. 2015
	Cui 10401	China	KX900915[a]	KX900985[a]	KX901133[a]	KX901060[a]	–	–	KX901232[a]	Shen et al. 2015
S. leucospongia	JV 0709/123-J	USA	KX900918[a]	KX900988[a]	KX901137[a]	KX901064[a]	KX901275[a]	–	–	this study
	OKM-4335	USA	KC585395	KC585228	–	–	–	–	–	Ortiz-Santana et al. 2013
S. zebra	Cui 9973	China	KX900917[a]	KX900987[a]	KX901135[a]	KX901062[a]	–	KX901179[a]	KX901234[a]	this study
	Dai 7131	China	KF727430	KM190902	KX901136[a]	KX901063[a]	–	KX901180[a]	KX901235[a]	this study
Taiwanofungus camphoratus	ACT1	China	EU232205	EU232281	–	–	–	–	–	Ortiz-Santana et al. 2013
	ACT2	China	EU232204	EU232280	–	–	–	–	–	Ortiz-Santana et al. 2013
T. salmoneus	B147	China	EU232202	EU232278	–	–	–	–	–	Ortiz-Santana et al. 2013
	B492	China	EU232203	EU232279	–	–	–	–	–	Ortiz-Santana et al. 2013
Trametes suaveolens	Cui 11586	China	KR605823	KR605766	KR605931	KR606028	KR610759	–	KR610848	Han et al. 2016
Unguliaedalea fragilis	Cui 10919	China	KF937286	KF937290	KR605840	KR605946	KR610674	–	KR610770	Han et al. 2016
Wolfiporia dilatohypha	CS-63-59-13-A-R	USA	KC585400	KC585234	–	–	–	–	–	Ortiz-Santana et al. 2013
	FP-72162-R	USA	EU402556	KC585235	–	–	–	–	–	Ortiz-Santana et al. 2013

[a] Newly generated sequences for this study

In this study, we carried out further taxonomic studies and phylogenetic analyses by sampling more species to clarify the relationships of *Postia* and related genera including *Oligoporus*, *Osteina*, *Rhodonia* and *Spongiporus*.

MATERIALS AND METHODS

Morphological studies

Most of the studied specimens were deposited at the herbaria of the Institute of Microbiology, Beijing Forestry University (BJFC), the Institute of Applied Ecology, Chinese Academy of Sciences (IFP), the private herbarium of Dr. J. Vlasák in Czech Republic (JV), the Botanical Museum of the University of Oslo, Norway (O), Université Claude Bernard, France (LY), Botanical Museum of University of Helsinki, Finland (H), Royal Botanic Gardens, Kew, UK (K) and the Pennsylvania State University, USA (PAC). Macro-morphological descriptions were based on the field notes and the herbarium specimens. Colour terms followed Petersen (1996). Micro-morphological data were obtained from the dried specimens, and observed under a light microscope following Li et al. (2014) and Zhou et al. (2016). Sections were studied at a magnification of up to ×1000 using a Nikon Eclipse 80i microscope and phase contrast illumination. Drawings were made with the aid of a drawing tube. Microscopic features, measurements and drawings were made from slide preparations stained with Cotton Blue and Melzer's reagent. Spores were measured from sections cut from the tubes. In presenting the variation of spore size, 5 % of the measurements were excluded from each end of the range, and were given in parentheses. The following abbreviations were used: KOH = 5 % potassium hydroxide, CB = Cotton Blue, CB+ = cyanophilous, CB– = acyanophilous, IKI = Melzer's reagent, IKI– = neither amyloid nor dextrinoid, L = mean spore length (arithmetic average of all spores), W = mean spore width (arithmetic average of all spores), Q = variation in the L/W ratios between the specimens studied, n (a/b) = number of spores (a) measured from given number (b) of specimens.

Phylogenetic analyses

A CTAB rapid plant genome extraction kit-DN14 (Aidlab Biotechnologies Co., Ltd, Beijing) was used to extract total genomic DNA from dried specimens, and performed the polymerase chain reaction (PCR) according to the manufacturer's instructions (Chen et al. 2016). The ITS region was amplified with primer pairs ITS5 and ITS4 (White et al. 1990). The nLSU region was amplified with primer pairs LR0R and LR7 (https://sites.duke.edu/vilgalyslab/rdna_primers_for_fungi/). The mtSSU region was amplified with primer pairs MS1 and MS2 (White et al. 1990). The nSSU regions were amplified with primer pairs NS1 and NS4 (White et al. 1990). Part of TEF1 was amplified with primer pairs EF1-983F and EF1-1567R (Rehner & Buckley 2005). The RPB1 was amplified with primer pairs RPB1-Af and RPB1-Cf (Matheny et al. 2002). RPB2 was amplified with primer pairs f*RPB2*-f5F and bRPB2-7.1R (Matheny 2005). The PCR procedure for ITS and mtSSU was as follows: initial denaturation at 95 °C for 3 min, followed by 34 cycles at 94 °C for 40 s, 54 °C for ITS and 55 °C for mtSSU for 45 s and 72 °C for 1 min, and a final extension of 72 °C for 10 min. The PCR procedure for nLSU, nSSU and TEF1 was as follows: initial denaturation at 94 °C for 1 min, followed by 34 cycles at 94 °C for 30 s, 50 °C for nLSU and 59 °C for TEF1 for 1 min and 72 °C for 1.5 min, and a final extension of 72 °C for 10 min. The PCR procedure for RPB1 and RPB2 follow Justo & Hibbett (2011) with slight modifications: initial denaturation at 94 °C for 2 min, followed by 10 cycles at 94 °C for 40 s, 60 °C for 40 s and 72 °C for 2 min, then followed by 37 cycles at 94 °C for 45 s, 55 °C for

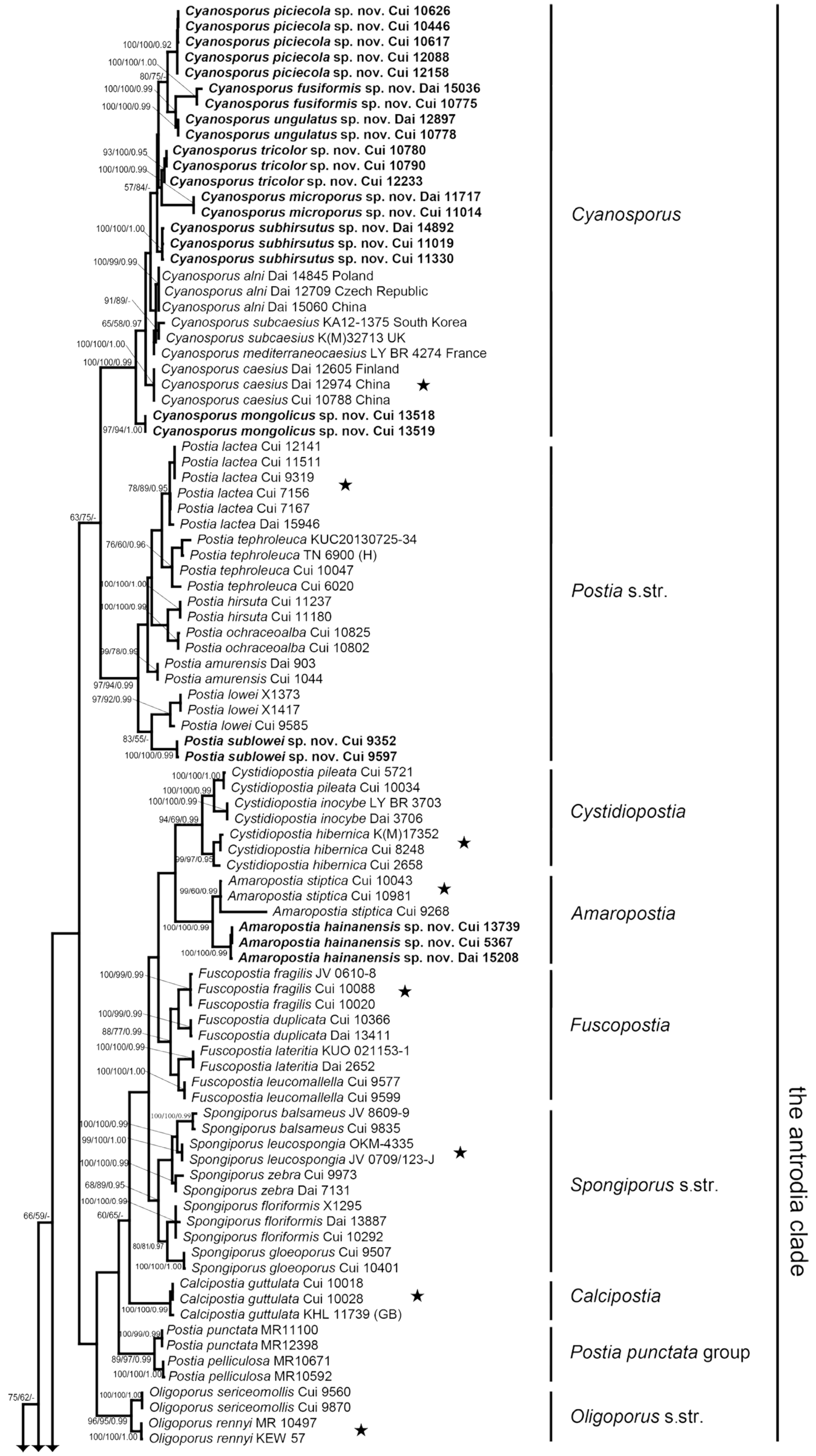
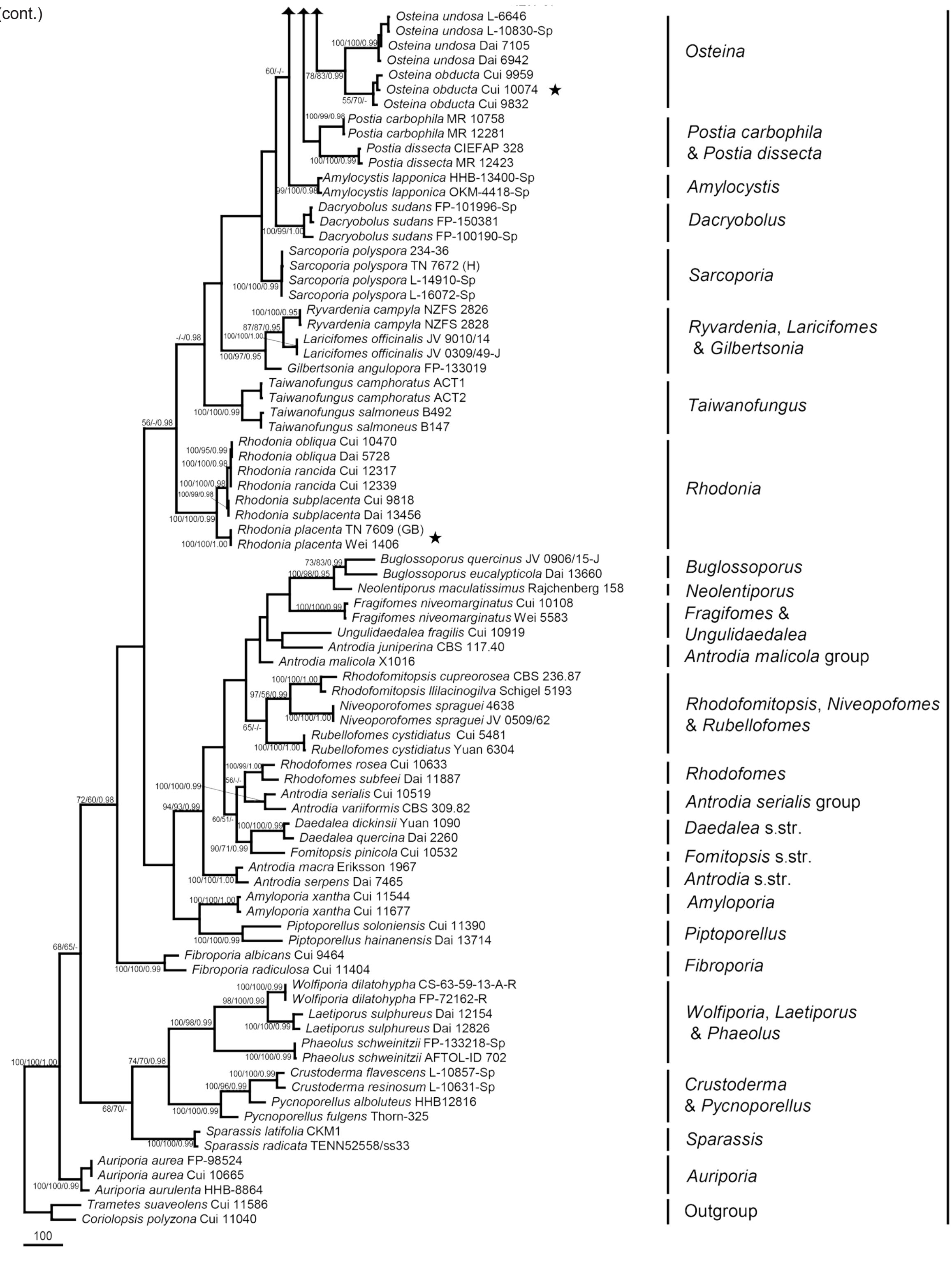


Fig. 1 Maximum parsimony tree illustrating the phylogeny of *Postia* and its related genera in the antrodia clade based on the combined sequences dataset of ITS+nLSU+RPB2. Branches are labelled with parsimony bootstrap proportions > 50 %, maximum likelihood bootstrap > 50 %, and Bayesian posterior probabilities > 0.95. ✶ = generic type.

Fig. 1 (cont.)



1.5 min and 72 °C for 2 min, and a final extension of 72 °C for 10 min. The PCR products were purified and sequenced at Beijing Genomics Institute. All newly generated sequences were deposited at GenBank (Table 1).

The sequenced dataset included 112 *Postia* s.lat. samples, of which 83 were types, paratypes or specimens from type localities. We used sequences mainly based on specimens from China, because those specimens were identified with careful morphological examinations and had more complete multi-gene sequence fragments. Additional sequences were downloaded from GenBank (Table 1) and were mainly referred to Ortiz-Santana et al. (2013) and Han et al. (2016). All sequences were aligned using ClustalX (Thompson et al. 1997) and manually adjusted in BioEdit (Hall 1999). The final concatenated sequence alignment was deposited in TreeBase (https://www.treebase.org/treebase-web/search/studySearch.html; submission ID 21389).

Most parsimonious phylogenies were inferred from the combined 3-gene dataset (ITS+nLSU+RPB2) and 7-gene dataset (ITS+nLSU+nSSU+mtSSU+TEF1+RPB1+RPB2), and their congruences were evaluated with the incongruence length difference (ILD) test (Farris et al. 1994) implemented in PAUP* v. 4.0b10 (Swofford 2002), under heuristic search and 1000 homogeneity replicates. Settings for phylogenetic analyses followed Song et al. (2016) and Zhao et al. (2015). Sequences of *Trametes suaveolens* and *Coriolopsis polyzona* obtained from GenBank were used as outgroups to root trees following Binder et al. (2013) and Han et al. (2016). Maximum parsimony

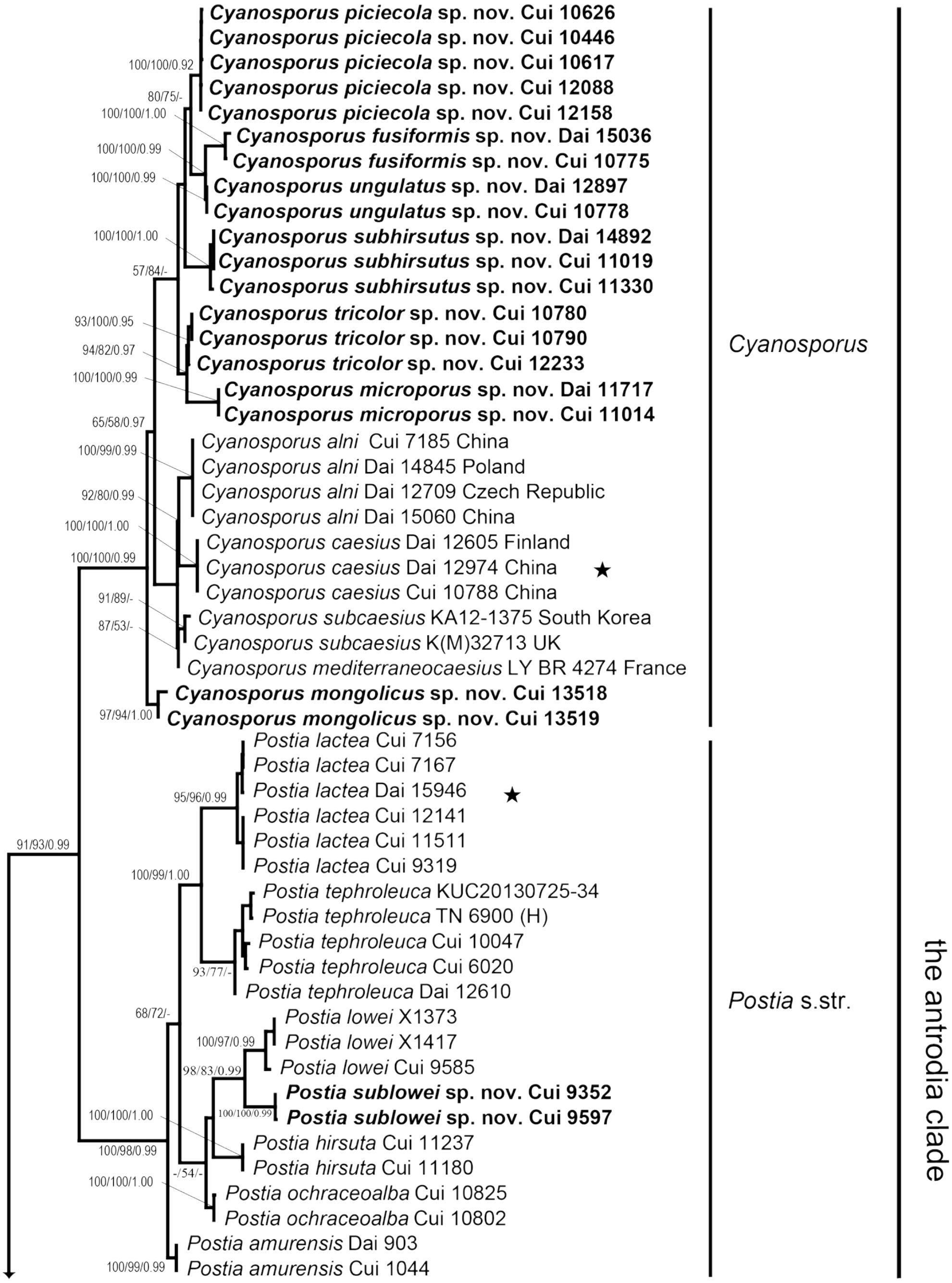
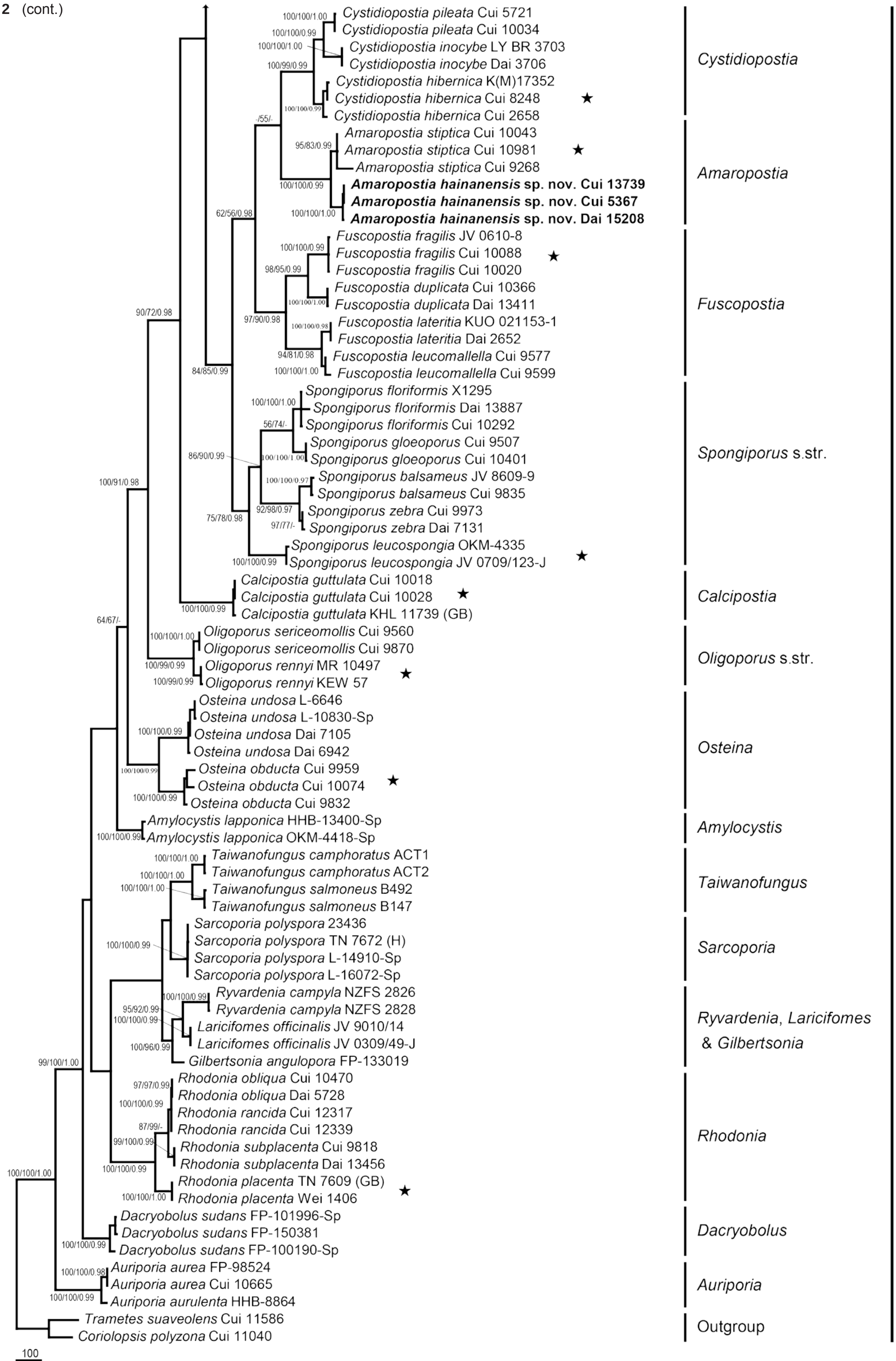


Fig. 2 Maximum parsimony tree illustrating the phylogeny of *Postia* and its related genera in the antrodia clade based on the combined sequences dataset of ITS+nLSU+nSSU+mtSSU+TEF1+RPB1+RPB2. Branches are labelled with parsimony bootstrap proportions > 50 %, maximum likelihood bootstrap > 50 %, and Bayesian posterior probabilities > 0.95. ✶ = generic type.

(MP) analysis was applied to the combined multiple genes dataset, this test under heuristic search and 1 000 homogeneity replicates gave a P value of 1.000, much greater than 0.01, which meant there was no discrepancy among the seven loci in reconstructing phylogenetic trees. The tree construction procedure was performed in PAUP* v. 4.0b10. All characters were equally weighted and gaps were treated as missing data. Trees were inferred using the heuristic search option with TBR branch swapping and 1 000 random sequence additions. Max-trees were set to 5 000, branches of zero length were collapsed and all parsimonious trees were saved. Clade robustness was assessed using a bootstrap (BT) analysis with 1 000 replicates (Felsenstein 1985). Descriptive tree statistics tree length (TL), consistency index (CI), retention index (RI), rescaled consistency index (RC) and homoplasy index (HI) were calculated for each most parsimonious tree (MPT) generated. RAxML v. 7.2.8 was used to construct a maximum likelihood (ML) tree with GTR+G+I model of site substitution (Stamatakis 2006). The branch support was evaluated with bootstrapping method of 1 000 replicates (Hillis & Bull 1993). Phylogenetic trees were visualized using Treeview (Page 1996).

MrModeltest v. 2.3 (Posada & Crandall 1998, Nylander 2004) was used to determine the best-fit evolution model for the combined multi-gene dataset for Bayesian inference (BI). Bayesian inference was calculated with MrBayes v. 3.1.2 with a general time reversible (GTR) model of DNA substitution and a gamma distribution rate variation across sites (Ronquist & Huelsenbeck 2003). Four Markov chains were run for 2 runs from random starting trees for 5 million generations (3-gene dataset), for 10 million generations (7-gene dataset) until the split deviation frequency value < 0.01, and sampled every 100th generation. A majority rule consensus tree of all remaining trees was calculated. Branches that received bootstrap ≥ 75 % (MP and BS) and Bayesian posterior probabilities (BPP) ≥ 0.95 were considered as significantly supported, respectively.

Fig. 2 (cont.)


Cystidiopostia pileata Cui 5721
Cystidiopostia pileata Cui 10034
Cystidiopostia inocybe LY BR 3703
Cystidiopostia inocybe Dai 3706
Cystidiopostia hibernica K(M)17352
Cystidiopostia hibernica Cui 8248 ★
Cystidiopostia hibernica Cui 2658
Amaropostia stiptica Cui 10043
Amaropostia stiptica Cui 10981 ★
Amaropostia stiptica Cui 9268
Amaropostia hainanensis sp. nov. Cui 13739
Amaropostia hainanensis sp. nov. Cui 5367
Amaropostia hainanensis sp. nov. Dai 15208
Fuscopostia fragilis JV 0610-8
Fuscopostia fragilis Cui 10088 ★
Fuscopostia fragilis Cui 10020
Fuscopostia duplicata Cui 10366
Fuscopostia duplicata Dai 13411
Fuscopostia lateritia KUO 021153-1
Fuscopostia lateritia Dai 2652
Fuscopostia leucomallella Cui 9577
Fuscopostia leucomallella Cui 9599
Spongiporus floriformis X1295
Spongiporus floriformis Dai 13887
Spongiporus floriformis Cui 10292
Spongiporus gloeoporus Cui 9507
Spongiporus gloeoporus Cui 10401
Spongiporus balsameus JV 8609-9
Spongiporus balsameus Cui 9835
Spongiporus zebra Cui 9973
Spongiporus zebra Dai 7131
Spongiporus leucospongia OKM-4335
Spongiporus leucospongia JV 0709/123-J ★
Calcipostia guttulata Cui 10018
Calcipostia guttulata Cui 10028 ★
Calcipostia guttulata KHL 11739 (GB)
Oligoporus sericeomollis Cui 9560
Oligoporus sericeomollis Cui 9870
Oligoporus rennyi MR 10497 ★
Oligoporus rennyi KEW 57
Osteina undosa L-6646
Osteina undosa L-10830-Sp
Osteina undosa Dai 7105
Osteina undosa Dai 6942
Osteina obducta Cui 9959
Osteina obducta Cui 10074 ★
Osteina obducta Cui 9832
Amylocystis lapponica HHB-13400-Sp
Amylocystis lapponica OKM-4418-Sp
Taiwanofungus camphoratus ACT1
Taiwanofungus camphoratus ACT2
Taiwanofungus salmoneus B492
Taiwanofungus salmoneus B147
Sarcoporia polyspora 23436
Sarcoporia polyspora TN 7672 (H)
Sarcoporia polyspora L-14910-Sp
Sarcoporia polyspora L-16072-Sp
Ryvardenia campyla NZFS 2826
Ryvardenia campyla NZFS 2828
Laricifomes officinalis JV 9010/14
Laricifomes officinalis JV 0309/49-J
Gilbertsonia angulopora FP-133019
Rhodonia obliqua Cui 10470
Rhodonia obliqua Dai 5728
Rhodonia rancida Cui 12317
Rhodonia rancida Cui 12339
Rhodonia subplacenta Cui 9818
Rhodonia subplacenta Dai 13456
Rhodonia placenta TN 7609 (GB) ★
Rhodonia placenta Wei 1406
Dacryobolus sudans FP-101996-Sp
Dacryobolus sudans FP-150381
Dacryobolus sudans FP-100190-Sp
Auriporia aurea FP-98524
Auriporia aurea Cui 10665
Auriporia aurulenta HHB-8864
Trametes suaveolens Cui 11586
Coriolopsis polyzona Cui 11040
100
Cystidiopostia
Amaropostia
Fuscopostia
Spongiporus s.str.
Calcipostia
Oligoporus s.str.
Osteina
Amylocystis
Taiwanofungus
Sarcoporia
Ryvardenia, Laricifomes & Gilbertsonia
Rhodonia
Dacryobolus
Auriporia
Outgroup

RESULTS

Phylogenetics analyses

The combined 3-gene dataset included sequences from 176 fungal samples representing 91 taxa. The dataset had an aligned length of 2 937 characters, of which 1 337 characters were constant, 268 were variable and parsimony-uninformative and 1 332 were parsimony-informative. Maximum parsimony analysis yielded 153 equally parsimonious trees (TL = 10077, CI = 0.286, RI = 0.751, RC = 0.214, HI = 0.714). Best model for the combined 3-gene dataset estimated and applied in the Bayesian analysis was GTR+I+G. The average standard deviation of split frequencies in the Bayesian analysis reached 0.008252. Bayesian analysis and ML analysis resulted in a similar topology as MP analysis, and the MP tree inferred from the combined 3-gene dataset was shown in Fig. 1. The phylogeny (Fig. 1) inferred from the combined 3-gene sequences demonstrated 42 major lineages (including four new genera) for the sampled 89 species of the antrodia clade, and confirmed *Postia* s.lat. is polyphyletic.

The combined 7-gene dataset included 129 fungal samples representing 53 taxa. The dataset had an aligned length of 6 428 characters, of which 4 145 characters were constant, 256 were variable and parsimony-uninformative and 2 027 were parsimony-informative. Maximum parsimony analysis yielded 12 equally parsimonious trees (TL = 7946, CI = 0.456, RI = 0.825, RC = 0.377, HI = 0.544). Best model for the combined 7-gene dataset estimated and applied in the Bayesian analysis was GTR+I+G with equal frequency of nucleotides. Bayesian analysis and ML analysis resulted in a similar topology as MP analysis, and the MP tree inferred from the combined 7-gene dataset was shown in Fig. 2. The 7-gene based phylogeny demonstrated that 41 species previously belonging to *Postia* s.lat. were embedded in ten lineages (Fig. 2).

Taxonomy

Amaropostia B.K. Cui, L.L. Shen & Y.C. Dai, *gen. nov.* — MycoBank MB819256

Type species. *Amaropostia stiptica* (Pers.) B.K. Cui, L.L. Shen & Y.C. Dai.

Etymology. *Amaropostia* (Lat.) refers to the new genus resembling *Postia* but with bitter taste.

Diagnosis. Morphologically, *Amaropostia* differs from *Postia* s.str. by woody hard basidiocarps when dry, relatively small pores, bitter taste, and cylindrical basidiospores.

Basidiocarps annual, sessile, soft corky when fresh, woody hard when dry, taste bitter. Pileal surface white when fresh, cream to buff when dry, glabrous, azonate. Pore surface white when fresh, cream or with yellowish tint upon drying; pores small, round to angular. Context white, woody hard. Tubes white to cream, brittle. Hyphal system monomitic; generative hyphae with clamp connections, IKI–, CB–. Cystidia absent, fusoid cystidioles occasionally present. Basidiospores cylindrical, hyaline, thin-walled, smooth, IKI–, CB–.

Fig. 3 Basidiocarps of the new species. a. *Amaropostia hainanensis* (Cui 13739); b. *Cyanosporus fusiformis* (Dai 15036); c. *Cyanosporus microporus* (Cui 11014); d. *Cyanosporus mongolicus* (Cui 13518); e. *Cyanosporus piceicola* (Cui 10626); f. *Cyanosporus subhirsutus* (Dai 14892); g. *Cyanosporus tricolor* (Cui 12233); h. *Cyanosporus ungulatus* (Dai 12897). i. *Postia sublowei* (Cui 9597). — Scale bars: a = 0.5 cm; b–i = 1 cm.

Amaropostia hainanensis B.K. Cui, L.L. Shen & Y.C. Dai, *sp. nov.* — MycoBank MB819258; Fig. 3a, 4

Holotype. China, Hainan Province, Ledong County, Jianfengling Forest Park, on fallen angiosperm branch, 21 Nov. 2015, *B.K. Cui*, *Cui 13739* (BJFC).

Etymology. Hainanensis (Lat.) refers to the type locality, Hainan Province of China.

Diagnosis. *Amaropostia hainanensis* differs from other species in the genus by shell-shaped pileus, small angular pores, and slightly curved cylindrical basidiospores.

Basidiome annual, sessile, solitary, soft and watery when fresh, becoming corky to woody hard upon drying, taste bitter; pileus shell-shaped, projecting up to 2 cm, 2.5 cm wide and 0.8 cm thick at base. Pileal surface white when fresh, glabrous, becoming cream to buff; margin acute, concolorous with pileal surface. Pore surface white when fresh, becoming buff when dry; sterile margin narrow to almost lacking, white when fresh, becoming clay-buff upon drying; pores angular, 7–9 per mm; dissepiments thin, entire. Context white, woody hard, up to 0.5 cm thick. Tubes white, more or less brittle, up to 0.3 cm long. *Hyphal system* monomitic; generative hyphae with clamp connections, IKI–, CB–; tissues unchanged in KOH. Generative hyphae in context hyaline, thick-walled with a wide lumen, occasionally branched, interwoven, 3–6 µm diam. Generative hyphae in trama hyaline, thin- to slightly thick-walled with a wide lumen, occasionally branched, interwoven, 2–3 µm diam. *Cystidia* or *cystidioles* absent. *Basidia* clavate, bearing four sterigmata and a basal clamp connection, 12.5–14 × 4–5 µm; basidioles in shape similar to basidia, but slightly smaller. *Basidiospores* cylindrical, slightly curved, hyaline, thin-walled, smooth, usually bearing a guttule and tapering at apiculus, IKI–, CB–, 4(–4.5)–5.5(–6) × 1.5–2 µm, L = 4.53 µm, W = 1.68 µm, Q = 2.59–2.73 (n = 90/3).

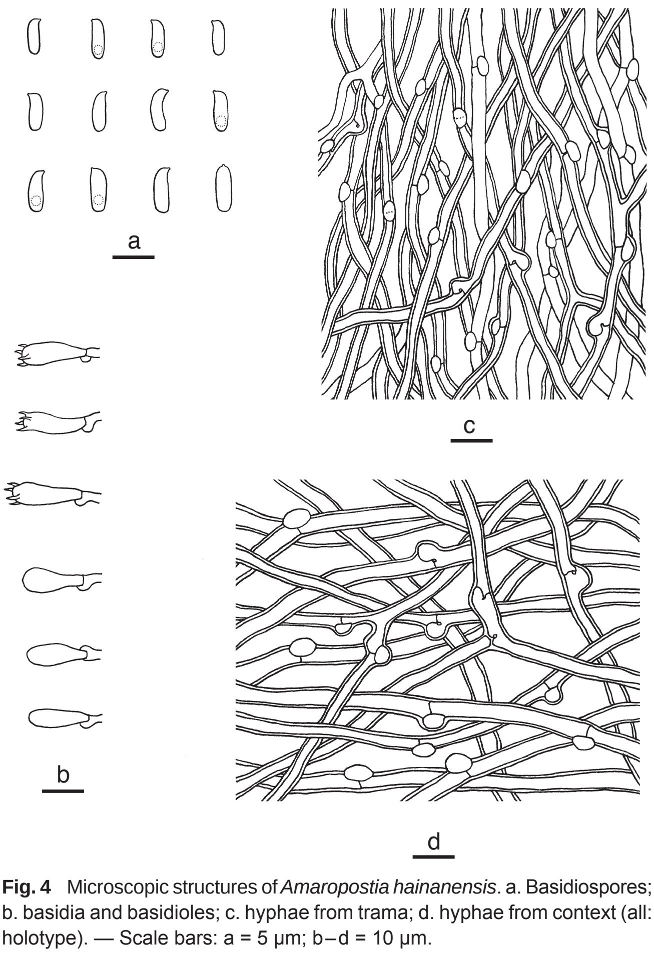


Fig. 4 Microscopic structures of *Amaropostia hainanensis*. a. Basidiospores; b. basidia and basidioles; c. hyphae from trama; d. hyphae from context (all: holotype). — Scale bars: a = 5 µm; b–d = 10 µm.

Additional specimens (paratypes) examined. China, Hainan Province, Lingshui County, Diaoluoshan Forest Park, on fallen angiosperm branch, 22 Nov. 2007, *B.K. Cui*, *Cui 5367* (BJFC 003408); Qiongzhong County, Limushan Forest Park, on fallen angiosperm branch, 30 May 2015, *Y.C. Dai*, *Dai 15208* (BJFC 019319).

Notes — *Amaropostia hainanensis* and *A. stiptica* have annual, pileate basidiocarps with glabrous pileal surface and white to buff pore surface, bitter taste, and similar cylindrical basidiospores, but *A. stiptica* has bigger pores (5–6 per mm) and fusoid cystidioles (Ryvarden & Melo 2014). In addition, *A. stiptica* is widespread in coniferous forests in boreal temperate areas, while *A. hainanensis* is only found in tropical areas of South China.

Amaropostia stiptica (Pers.) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819257

Basionym. *Boletus stipticus* Pers., Syn. Meth. Fung. 2: 525. 1801.

= *Oligoporus stipticus* (Pers.) Gilb. & Ryvarden, N. Amer. Polyp. 2: 485. 1987.

Specimens examined. China, Jilin Province, Antu County, Changbaishan Nature Reserve, on fallen trunk of *Picea*, 9 Aug. 2011, *B.K. Cui*, *Cui 10043* (BJFC 010936); Shandong Province, Taian, Taishan, on fallen trunk of *Pinus*, 4 Aug. 2012, *B.K. Cui*, *Cui 10981* (BJFC 013903); Xizang Autonomous Region (Tibet), Linzhi County, Lulang, on fallen trunk of *Pinus*, 16 Sept. 2010, *B.K. Cui*, *Cui 9268* (BJFC 008207). – Czech Republic, Libochovka, Hluboká, on *Picea*, *J. Vlasák 8911/27* (JV). – Finland, Uusimaa, Vantaa, Tamisto Nature Reserve, on fallen trunk of *Picea*, 22 Sept. 2010, *Y.C. Dai*, *Dai 11797* (BJFC 008904). – Norway, Oslo, Botanical Garden, on stump of *Populus*, 9 Nov. 2011, *Y.C. Dai*, *Dai 12677* (BJFC 012261). – USA, Pennsylvania, on *Picea*, *J. Vlasák 0407/32* (JV).

Notes — *Oligoporus stipticus* is characterized by woody hard basidiocarps when dry, glabrous pileal surface, bitter taste, fusoid cystidioles, and cylindrical basidiospores. It usually grows on coniferous woods and is widely distributed in temperate areas. Although we did not find the type specimen, we have examined the specimens from China, Europe and North America. The morphological characters of all the studied specimens fit well with *Oligoporus stipticus*. Based on morphological characters and phylogenetic analyses, we transferred *Oligoporus stipticus* to *Amaropostia* as a new combination. For a detailed description of the species, see *Oligoporus stipticus* by Ryvarden & Melo (2014).

Calcipostia B.K. Cui, L.L. Shen & Y.C. Dai, *gen. nov.* — MycoBank MB819259

Type species. Calcipostia guttulata (Sacc.) B.K. Cui, L.L. Shen & Y.C. Dai.

Etymology. Calcipostia (Lat.) refers to the new genus resembling *Postia* but with calcareous basidiocarps and circular guttulate depressions attached to the pileal surface.

Diagnosis. Morphologically, *Calcipostia* differs from *Postia* s.str. by big basidiocarps with calcareous texture, circular guttulate depressions on the pileal surface, bitter taste, and short-cylindrical to oblong basidiospores.

Basidiocarps annual, pileate or laterally substipitate. Pileus fleshy when fresh, fragile to hard fibrous when dry. Pileal surface white when fresh, buff or pale brown when dry, with circular guttulate depressions. Pore surface white to cream when fresh, pale buff when dry; pores round to angular. Context white to cream, hard fibrous. Tubes cream, fragile. Taste slightly bitter. Hyphal system monomitic, generative hyphae with clamp connections, IKI–, CB–. Cystidia absent; fusoid cystidioles present. Basidiospores short-cylindrical to oblong, hyaline, thin-walled, smooth, IKI–, CB–.

Calcipostia guttulata (Sacc.) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819261

Basionym. *Polyporus guttulata* Sacc., Syll. Fung. 6: 106. 1888.

= *Oligoporus guttulatus* (Peck) Gilb. & Ryvarden, Mycotaxon 22: 365. 1985.

Specimens examined. China, Jilin Province, Antu County, Changbaishan Nature Reserve, on fallen trunk of *Abies*, 9 Aug. 2011, *B.K. Cui*, *Cui 10018* (BJFC 010911), *Cui 10028* (BJFC 010921); Xizang Autonomous Region (Tibet), Linzhi County, on fallen trunk of *Abies*, 18 Sept. 2010, *B.K. Cui*, *Cui 9444* (BJFC 008382). – Finland, Etelä-Häme, Padasjoki Strict Nature Reserve, on fallen trunk of *Picea*, 10 Oct. 1992, *Y.C. Dai*, *Dai 238* (BJFC 002076). – Poland, Opole, Stawmatmloy, on fallen trunk of *Fagus*, 4 Oct. 2014, *Y.C. Dai*, *Dai 14864* (BJFC 017977). – USA, New York, on *Picea*, *J. Vlasák 0509/189* (JV).

Notes — This species is characterized by pileate basidiocarps with calcareous texture, circular guttulate depressions on the pileal surface, bitter taste, and short-cylindrical to oblong basidiospores. This species is widely distributed in temperate areas and usually grows on coniferous woods. It was originally described from the USA; although we did not find the type specimen, we have examined the specimens from China, Europe and USA. In addition, the older specimens deposited at the herbaria of BPI, NY, NYS and SYRF have been extensively studied by Lowe (1975). The morphological characters of our studied specimens fit well with the descriptions of Lowe (1975) and Ryvarden & Melo (2014). Based on morphological characters and phylogenetic analyses, we transferred *Oligoporus guttulatus* to *Calcipostia* as a new combination. For a detailed description of the species, see *Oligoporus guttulatus* by Ryvarden & Melo (2014).

Cyanosporus McGinty, Mycol. Notes 33: 436. 1909. — MycoBank MB819263

Type species. Cyanosporus caesius (Schrad.) McGinty.

Basidiocarps annual, resupinate to effused-reflexed or pileate, soft corky when fresh, corky to fragile when dry. Pileal surface white, cream, buff, yellow to greyish, usually with blue tint when fresh, cream, grey to greyish brown when dry, velutinate to hirsute or glabrous. Pore surface white to cream, frequently bluish when bruised, pores round to angular. Context white to cream, corky. Tubes cream, fragile. Hyphal system monomitic; generative hyphae with clamp connections, IKI–, CB–. Cystidia usually absent, gloeocystidia and thin-walled cystidioles occasionally present. Basidiospores narrow, allantoid to cylindrical, hyaline, usually slightly thick-walled, smooth, IKI–, weakly CB+.

Notes — The name *Cyanosporus* was proposed in 1909 as a monotypic genus for *Polyporus caesius* (McGinty 1909), but it was not accepted in subsequently studies (Donk 1960, Jahn 1963, Lowe 1975). Then the *Postia caesia* complex was mentioned based on recent molecular phylogenetic studies in which the *Postia caesia* complex formed a distinctive morphological group within the genus (Ţura et al. 2008). Papp (2014) proposed the combination *Postia* subg. *Cyanosporus* for the *Postia caesia* complex including five species (*P. alni*, *P. caesia*, *P. luteocaesia*, *P. mediterraneocaesia*, *P. subcaesia*). In our study, the genus *Cyanosporus* is supported as an independent genus which contains the *Postia caesia* complex and seven other clearly distinguished new species from China. Phylogenetically, the new species are closely related to the *Postia caesia* complex; all the species in the complex form a well-supported lineage (Fig. 1, 2), which is distant from *Postia* s.str. Morphologically, *Cyanosporus* differs from *Postia* s.str. by its more or less bluish basidiocarps, usually narrow allantoid, thin- to slightly thick-walled and weakly cyanophilous basidiospores.

Cyanosporus alni (Niemelä & Vampola) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819264

Basionym. *Postia alni* Niemelä & Vampola, Karstenia 41: 7. 2001.

= *Oligoporus alni* (Niemelä & Vampola) Piątek, Polish Bot. J. 48: 17. 2003.

Specimens examined. China, Guizhou Province, Suiyang County, Kuankuoshui Nature Reserve, on fallen angiosperm trunk, 26 June 2014, *Y.C. Dai*, *Dai 15060* (BJFC 018172); Hebei Province, Xinglong County, Wulingshan Nature Reserve, on fallen angiosperm trunk, 29 Aug. 2009, *B.K. Cui*, *Cui 7185* (BJFC 005672). – Czech Republic, Ceske Budejovice, on fallen trunk of *Fagus*, 22 Nov. 2011, *Y.C. Dai*, *Dai 12709* (BJFC 012293). – Finland, Uusimaa, Vantaa, Tamisto Nature Reserve, on fallen trunk of *Populus*, 15 Sept. 1997, *Y.C. Dai*, *Dai 2652* (IFP 005405); on fallen trunk of *Populus*, 4 Nov. 2011, *Y.C. Dai*, *Dai 12641* (BJFC 012223). – Poland, Brynica, Mcrow, on fallen trunk of *Fagus*, 3 Oct. 2014, *Y.C. Dai*, *Dai 14845* (BJFC 017959). – Slovakia, Bratislava, on *Alnus*, 12 Oct. 1995, *Vampola 32595* (holotype, H).

Notes — We have examined the type specimen and other specimens from China and Europe. Based on morphological characters and phylogenetic analyses, we transferred *Postia alni* to *Cyanosporus* as a new combination. For a detailed description of *Cyanosporus alni*, see *Postia alni* by Niemelä et al. (2001).

Cyanosporus caesius (Schrad.) McGinty, Mycol. Notes 33: 436. 1909

Basionym. *Boletus caesius* Schrad., Spic. Fl. Germ. 1: 167. 1794.

= *Oligoporus caesius* (Schrad.) Gilb. & Ryvarden, Mycotaxon 22: 365. 1985.

Specimens examined. China, Sichuan Province, Luding County, Hailuogou Forest Park, on fallen trunk of *Picea*, 20 Oct. 2012, *B.K. Cui*, *Cui 10788* (BJFC 013710); Puge County, Luoji Mountain, on fallen trunk of *Picea*, 19 Sept. 2012, *Y.C. Dai*, *Dai 12974* (BJFC 13220). – Finland, Uusimaa, Vantaa, Tamisto Nature Reserve, on fallen trunk of *Picea*, 3 Nov. 2011, *Y.C. Dai*, *Dai 12605* (BJFC 012192). – Germany, Göttingen, on *Picea*, 27 Sept. 2012, *LY BR 6776* (LY). – Spain, Cadiz Province, Sierra Grazalema Natural Park, on fallen trunk of *Abies*, 22 Nov. 2005, *Y.C. Dai*, *Dai 7438* (BJFC 002060).

Notes — Karsten (1881) transferred *Boletus caesius* into *Postia*; later McGinty (1909) established *Cyanosporus* with *C. caesius* as the type species but this was not widely accepted. Then *Spongiporus* and *Oligoporus* were sequentially erected, and *Cyanosporus caesius* was accordingly treated as *Spongiporus caesius* and *Oligoporus caesius*, respectively. In our study, *Cyanosporus* was treated as an independent genus and *C. caesius* is one species in the *Cyanosporus* lineage (Fig. 1, 2). This species is common in Europe, North America and East Asia. For a detailed description, see *Oligoporus caesius* by Ryvarden & Melo (2014).

Cyanosporus fusiformis B.K. Cui, L.L. Shen & Y.C. Dai, *sp. nov.* — MycoBank MB819269; Fig. 3b, 5

Holotype. China, Guizhou Province, Suiyang County, Kuankuoshui Nature Reserve, on dead angiosperm tree, 26 Nov. 2014, *Y.C. Dai*, *Dai 15036* (BJFC 018149).

Etymology. Fusiformis (Lat.) refers to the fusiform cystidioles.

Diagnosis. *Cyanosporus fusiformis* differs from other species in the genus by semicircular pileus, fusiform cystidioles presenting in hymenium and slim allantoid basidiospores.

Basidiome annual, pileate or effused reflexed, solitary or imbricate, soft corky and without odour or taste when fresh, becoming hard corky to brittle upon drying. Pileus semicircular, projecting up to 1 cm, 1.2 cm wide and 3 mm thick at base. Pileal surface white to cream, with blue tint at centre when fresh, finely tomentose, becoming vinaceous grey to dark grey upon drying; margin acute, concolorous with pileal surface. Pore surface white when fresh, becoming clay-buff when dry; sterile margin almost lacking; pores round, 4–5 per mm;

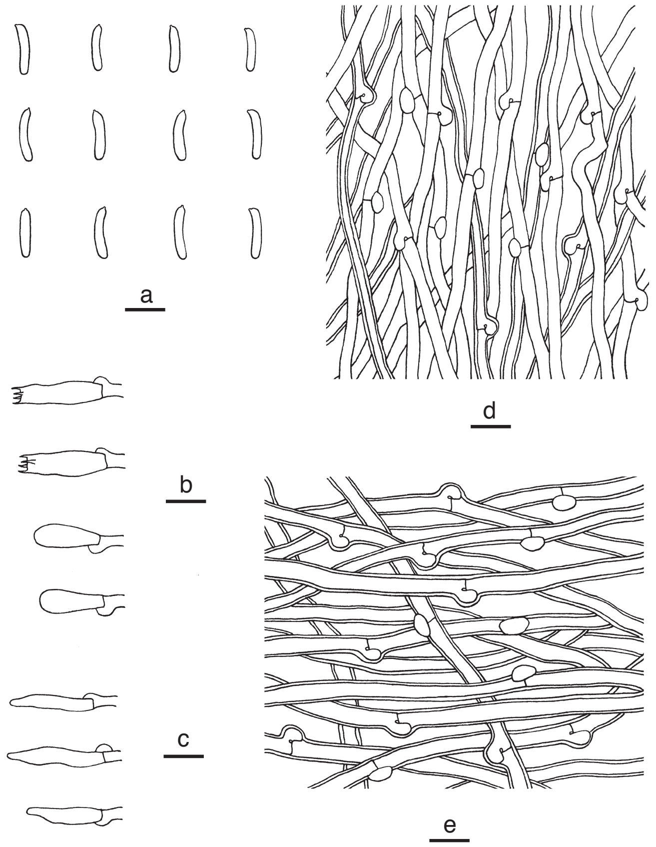


Fig. 5 Microscopic structures of *Cyanosporus fusiformis*. a. Basidiospores; b. basidia and basidioles; c. cystidioles; d. hyphae from trama; e. hyphae from context (all: holotype). — Scale bars: a = 5 µm; b–e = 10 µm.

dissepiments thin, entire to lacerate. Context white, hard corky, up to 2 mm thick. Tubes white, brittle, up to 1 mm long. *Hyphal system* monomitic; generative hyphae with clamp connections, IKI–, CB–; tissues unchanged in KOH. Generative hyphae in context hyaline, slightly thick-walled with a wide lumen, rarely branched, loosely interwoven, 3–5 µm diam. Generative hyphae in trama hyaline, thin- to slightly thick-walled with a wide lumen, occasionally branched, loosely interwoven, 2–4 µm diam. *Cystidia* absent; *cystidioles* present, fusiform, hyaline, thin-walled, 10–13 × 3–5 µm. *Basidia* clavate, constricted at middle, bearing four sterigmata and a basal clamp connection, 12–15 × 4.5–6 µm; basidioles clavate, and distinctly smaller than basidia. *Basidiospores* slim allantoid, hyaline, thin-walled, smooth, IKI–, CB–, 4.5–5.2(–5.5) × 0.8–1.1 µm, L = 5.01 µm, W = 0.92 µm, Q = 5.21–5.45 (n = 60/2).

Additional specimen (paratype) examined. China, Sichuan Province, Luding County, Hailuogou Forest Park, on dead tree of *Rhododendron*, 20 Oct. 2012, *B.K. Cui*, *Cui 10775* (BJFC 013697).

Notes — Two species of *Cyanosporus* produce cystidioles: *C. fusiformis* and *C. mongolicus*, but the latter one has resupinate basidiocarps and wider basidiospores (4.5–5 × 1.5–1.9 µm). In addition, its hyphae became swollen in KOH.

Cyanosporus luteocaesius (A. David) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819270

Basionym. *Spongiporus luteocaesius* A. David, Bull. Mens. Soc. Linn. Lyon 49: 119. 1980.

= *Oligoporus luteocaesius* (A. David) Ryvarden & Gilb., Syn. Fungorum 7: 421. 1993.

Specimens examined. France, Var, Massif des Maures, on *Pinus*, 26 Dec. 1970, *David 929* (holotype, LY); Porquerolles, on *Pinus*, 13 Nov. 2004, *LY BR 2605* (LY).

Notes — *Spongiporus luteocaesius* is a rare European species that exclusively grows on *Pinus*. We have examined the type specimen and another specimen from France. It has the typical morphological features of the *Cyanosporus caesius* group with blue greyish discoloration and similar allantoid basidiospores (Ryvarden & Gilbertson 1994, Niemelä et al. 2004). Therefore, we transferred *Spongiporus luteocaesius* into *Cyanosporus* as a new combination although without molecular data. For a detailed description, see *Oligoporus luteocaesius* by Ryvarden & Melo (2014).

Cyanosporus mediterraneocaesius (M. Pieri & B. Rivoire) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819271

Basionym. *Postia mediterraneocaesia* M. Pieri & B. Rivoire, Bull. Semestriel Féd. Assoc. Mycol. Méditerranéennes 28: 34. 2005.

Specimens examined. France, Bouches du Rhône, St. Rémy de Provence, on *Pinus*, 11 Nov. 2000, *LY BR* 1946 (holotype, LY); Bonnieux, 30 Nov. 2011, *LY BR 4274* (LY).

Notes — We have examined the type specimen and another specimen from France. Based on morphological characters and phylogenetic analyses, we transferred *Postia mediterraneocaesia* to *Cyanosporus* as a new combination. For a detailed description of the species, see *Postia mediterraneocaesia* by Pieri & Rivoire (2005).

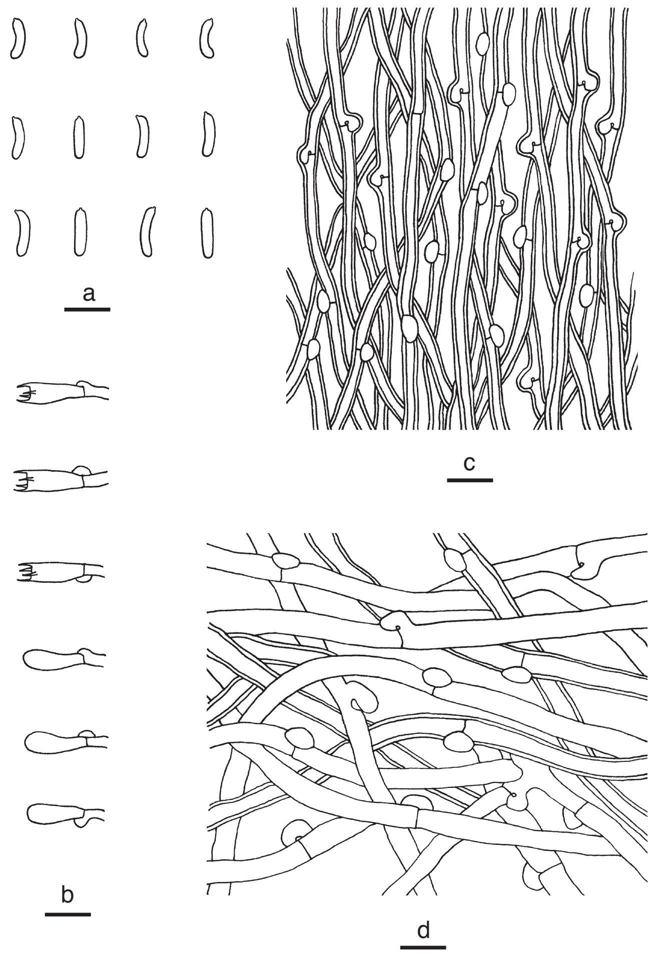


Fig. 6 Microscopic structures of *Cyanosporus microporus*. a. Basidiospores; b. basidia and basidioles; c. hyphae from trama; d. hyphae from context (all: holotype). — Scale bars: a = 5 µm; b–d = 10 µm.

Cyanosporus microporus B.K. Cui, L.L. Shen & Y.C. Dai, *sp. nov.* — MycoBank MB819272; Fig. 3c, 6

Holotype. China, Yunnan Province, Pu'er, Taiyanghe National Forest Park, on fallen angiosperm trunk, 8 July 2013, *B.K. Cui*, *Cui 11014* (BJFC 015131).

Etymology. Microporus (Lat.) refers to the small pores.

Diagnosis. *Cyanosporus microporus* differs from other species in the genus by subrotund pileus, small angular pores, and slightly thick-walled and allantoid basidiospores.

Basidiome annual, pileate, solitary, soft and watery, without odour or taste when fresh, becoming soft corky to fragile upon drying. Pileus subrotund, projecting up to 2.5 cm, 6 cm wide and 1.5 cm thick at base. Pileal surface velutinate, white to cream with blue tint when fresh, becoming smooth, rugose, cream to pinkish buff when dry; margin obtuse, white when fresh, greyish brown when dry. Pore surface white when fresh, bluish when bruised, becoming cream to buff when dry; sterile margin narrow to almost lacking; pores angular, 6–8 per mm; dissepiments thin, entire. Context white to cream, corky, up to 1.3 cm thick. Tubes cream, fragile, up to 2 mm long. *Hyphal system* monomitic; generative hyphae with clamp connections, IKI–, CB–; tissues unchanged in KOH. Generative hyphae in context hyaline, thin- to slightly thick-walled with a wide lumen, occasionally branched, interwoven, 3.5–6 µm diam. Generative hyphae in trama hyaline, thick-walled with a wide lumen, occasionally branched, interwoven, 2–4 µm diam. *Cystidia* or *cystidioles* absent. *Basidia* clavate, bearing four sterigmata and a basal clamp connection, 11–13.5 × 4–5 µm; basidioles in shape similar to basidia, but slightly smaller. *Basidiospores* allantoid, hyaline, slightly thick-walled, smooth, IKI–, weakly CB+, (4.2–)4.5–4.9(–5.2) × 1–1.2 µm, L = 4.69 µm, W = 1.08 µm, Q = 4.47–4.52 (n = 60/2).

Table 2 Comparisons of the main morphological characters of species in *Amaropostia*, *Calcipostia*, *Cyanosporus*, *Cystidiopostia*, *Fuscopostia*, *Oligoporus* s.str., *Osteina*, *Postia* s.str., *Rhodonia* and *Spongiporus* s.str.

Species	Basidio-carps	Pileal surface when dry	Pores (per mm)	Gloeo-plerous hyphae	hyphal pegs	Cystidia	Cystidioles	Basidiospores		References
								L × W (µm)	Q = L/W	
Amaropostia										
A. hainanensis	P	G	7–9	–	–	–	–	4–5.5 × 1.5–2	2.59–2.73	this study
A. stiptica	P	G	5–6	–	–	–	+	3.5–4.5 × 1.5–2	2.19–2.38	this study
Calcipostia										
C. guttulata	P	G	3–5	–	–	–	+	3–4 × 1.8–2.3	1.75–1.83	this study
Cyanosporus										
C. alni	P / ER	V	5–6	–	–	–	–	4.5–6 × 1–1.5	4.17–4.35	this study
C. caesius	P / ER	T	3–6	+	–	–	–	4.5–6 × 1.5–2	3.18–3.29	this study
C. fusiformis	P / ER	T	4–5	–	–	–	+	4.5–5.2 × 0.8–1.1	5.21–5.45	this study
C. luteocaesius	R / ER	T	3–4	–	–	–	–	4.7–6.3 × 1.6–1.9	3–3.2	Niemelä 2005
C. mediterraneocaesius	P / ER	V	4–5	–	–	–	–	5–6 × 1.5–2	3.74	this study
C. microporus	P	V	6–8	–	–	–	–	4.5–4.9 × 1–1.2	4.47–4.52	this study
C. mongolicus	R / ER	H	3–4	–	–	+	+	4.5–5 × 1.5–1.9	2.77–2.85	this study
C. piceicola	P	V	3–5	–	–	–	–	4–4.5 × 0.9–1.3	3.75–3.97	this study
C. subcaesius	P / ER	G	4–5	–	–	–	–	4–5 × 1–1.5	3.65–3.82	this study
C. subhirsutus	P	H	2–3	–	–	–	–	4–4.5 × 0.9–1.3	3.67–3.79	this study
C. tricolor	P	V	4–5	–	–	–	–	4–4.8 × 0.8–1.2	4.55–4.87	this study
C. ungulatus	P	G	4–6	–	–	–	–	4.5–5 × 0.9–1.2	4.79–4.83	this study
Cystidiopostia										
C. hibernica	R	–	2–4	–	–	+	–	5–6 × 1–1.5	4.58–4.73	this study
C. inocybe	R	–	3–5	–	–	+	–	5–6 × 1.5–1.7	3.32–3.59	this study
C. pileata	P / ER	G	3–4	–	–	+	–	3.8–4.8 × 0.9–1.1	4.04–4.52	Dai & Renvall 1994
Fuscopostia										
F. duplicata	P	G	3–4	–	–	+	–	3.8–5.8 × 1.8–2.5	2.28–2.41	Shen et al. 2014
F. fragilis	P / ER	T	4–6	–	–	–	–	4–6 × 1.7–2.1	2.49–2.69	this study
F. lateritia	R / ER	V	3–4	–	–	–	+	4.5–6 × 1.2–1.6	3.48–3.76	this study
F. leucomallella	P / ER	G	3–4	–	–	+	–	4.5–6 × 1–1.7	3.33–3.65	this study
Oligoporus s.str.										
O. rennyi	R	–	2–4	–	–	–	–	4.8–6 × 2.5–3.5	1.92–2.08	this study
O. sericeomollis	R	–	4–6	–	–	+	+	4–5 × 2–2.5	2.05–2.21	this study
Osteina										
O. obducta	P	G	3–5	–	–	–	–	4–5.2 × 2–2.4	2.06–2.2	Cui et al. 2014
O. undosa	R / ER	G	2–3	–	–	–	–	4.5–6 × 1–1.5	4.22–4.38	this study
Postia s.str.										
P. amurensis	P	G	3–4	–	–	+		4.1–5.2 × 1–1.2	3.93–4.18	Dai & Penttilä 2006
P. hirsuta	P	H	3–4	–	–	–	–	4–4.8 × 1–1.2	4.33–4.35	Shen & Cui 2014
P. lactea	P	G	4–5	+	–	–	–	4–5 × 1–1.5	3.86–4.11	this study
P. lowei	P / ER	V	3–4	–	–	–	–	4.8–5.2 × 1.8–2.2	2.52–2.73	this study
P. ochraceoalba	P	G	6–7	–	–	–	–	4–4.5 × 1–1.5	3.18–4.02	Shen et al. 2015
P. sublowei	P / ER	V	3–4	–	–	–	+	4–4.5 × 1–1.5	4.48–4.62	this study
P. tephroleuca	P / ER	T	3–4	–	–	–	–	4.5–6 × 1–1.5	3.75–3.92	this study
Rhodonia										
R. obliqua	R	–	2–3	+	–	–	–	4.8–6.3 × 2–2.5	2.41–2.53	Wei & Qin 2010
R. placenta	R	–	3–4	+	–	–	–	5–7 × 2.5–3	2.04–2.37	this study
R. rancida	R	–	2–4	–	–	–	–	6–8 × 2–3	2.55–2.69	this study
R. subplacenta	R	–	3–5	–	–	–	–	4.2–6 × 1.9–2.4	2.37–2.45	Cui & Li 2012
Spongiporus s.str.										
S. balsameus	P / ER	G	5–6	–	–	+	–	4–5 × 2.5–3	1.86–2.05	this study
S. florifomis	P / ER	G	6–8	–	+	–	–	3.5–4.5 × 2–2.5	1.76–1.89	this study
S. gloeoporus	P	V	3–4	–	–	–	+	4–4.5 × 2–2.5	1.86–2.16	Shen et al. 2015
S. leucospongia	P / ER	G	2–4	–	+	–	–	5–8 × 1.2–1.5	3.82–4.22	this study
S. zebra	P	G	7–8	–	–	–	–	3.6–4.2 × 2–2.5	1.82–1.91	this study

Abbreviations used: ER = Effused-reflexed; P = Pileate; R = Resupinate; G = Glabrous; H = Hirsute; T = Tomentose; V = Velutinate; + = Present; – = Absent.

Additional specimen (paratype) examined. China, Yunnan Province, Chuxiong, Zixishan Nature Reserve, on dead angiosperm tree, 28 Aug. 2010, *Y.C. Dai*, *Dai 11717* (BJFC 008830).

Notes — *Cyanosporus alni* may be confused with *C. microporus* by sharing velutinate, white with a blue-grey tint pileal surface and cream to buff pore surface when dry. However, *C. alni* differs in having bigger pores (5–6 per mm) and relatively longer basidiospores (4.5–6 × 1–1.5 µm; Table 2).

Cyanosporus mongolicus B.K. Cui, L.L. Shen & Y.C. Dai, *sp. nov.* — MycoBank MB819273; Fig. 3d, 7

Holotype. China, Inner Mongolia Autonomous Region, Ewenk, Honghuaerji Nature Reserve, on fallen trunk of *Pinus*, 19 Oct. 2015, *B.K. Cui*, *Cui 13518* (BJFC).

Etymology. Mongolicus (Lat.) refers to the type locality of Inner Mongolia Autonomous Region in China.

Diagnosis. *Cyanosporus mongolicus* differs from other species in the genus by resupinate to effused-reflexed basidiocarps, swollen hyphae in KOH, gloeocystidia and cystidioles presenting, and cylindrical to allantoid basidiospores.

Basidiome annual, resupinate to effused-reflexed, solitary, soft and watery, without odour or taste when fresh, becoming soft corky to fragile upon drying. Resupinate part up to 4 cm long, 3 cm wide and 4 mm thick at centre, easily separable from the substrate. Pileus flabelliform, projecting up to 2.5 cm, 4 cm wide and 8 mm thick at base. Pileal surface white to cream when fresh, hirsute, becoming greyish brown; margin acute, white when fresh, fuscous and incurved when dry. Pore surface white to cream when fresh, becoming greyish brown with bluish tint when dry; sterile margin up to 2 mm wide, white when fresh, becoming greyish brown upon drying; pores angular, 3 or 4 per mm; dissepiments thin, entire when juvenile, becoming lacerate with age. Context white, soft corky, up to 5 mm thick. Tubes pale mouse-grey with bluish tint, fragile, up to 3 mm long. *Hyphal system* monomitic; generative hyphae with clamp connections, IKI–, CB–; hyphae swollen in KOH. Generative hyphae in context hyaline, thick-walled with a wide lumen, occasionally branched, interwoven, 3.5–5 µm diam. Generative hyphae in trama hyaline, thick-walled with a wide lumen, moderately branched, interwoven, 2–5 µm diam. *Gloeocystidia* present, shape variable from pyriform to broadly clavate, dark blue in CB, bright yellow in IKI, 20–30 × 5–8 µm; *cystidioles* present, thin-walled, slim clavate with a narrow apex, 21–25 × 2–3 µm. *Basidia* clavate, bearing four sterigmata and a basal clamp connection, 12–14 × 5–7 µm; basidioles in shape similar to basidia, but slightly smaller. *Basidiospores* cylindrical to allantoid, hyaline, slightly thick-walled, smooth, IKI–, weakly CB+, (4–)4.5–5(–5.5) × 1.5–1.9(–2) µm, L = 4.94 µm, W = 1.74 µm, Q = 2.77–2.85 (n = 60/2).

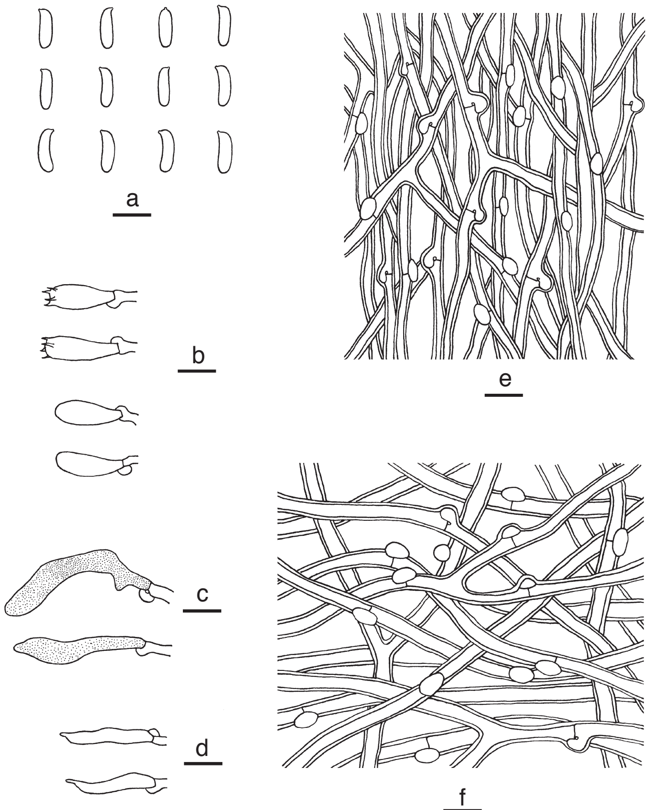


Fig. 7 Microscopic structures of *Cyanosporus mongolicus*. a. Basidiospores; b. basidia and basidioles; c. gloeocystidia; d. cystidioles; e. hyphae from trama; f. hyphae from context (all: holotype). — Scale bars: a = 5 µm; b–f = 10 µm.

Additional specimen (paratype) examined. China, Inner Mongolia Autonomous Region, Ewenk, Honghuaerji Nature Reserve, on fallen trunk of *Pinus*, 19 Oct. 2015, *B.K. Cui*, *Cui 13519* (BJFC).

Notes — *Cyanosporus luteocaesius* also produces resupinate basidiocarps and similar sized pores (3 or 4 per mm) as *C. mongolicus*, but it differs in bright yellow basidiocarps, unchanged hyphae in KOH, absence of cystidioles and longer basidiospores (4.7–6.3 × 1.6–1.9 µm; Niemelä 2005). *Cyanosporus caesius* resembles *C. mongolicus* in having white to bluish pore surface, similar sized pores, and similar basidiocarps, but it is distinguished by greyish to bluish pileal surface, presence of gloeoplerous hyphae, and absence of gloeocystidia and cystidioles (Ryvarden & Melo 2014).

Cyanosporus piceicola B.K. Cui, L.L. Shen & Y.C. Dai, *sp. nov.* — MycoBank MB819274; Fig. 3e, 8

Holotype. China, Sichuan Province, Jiuzhaigou County, Jiuzhaigou Nature Reserve, on stump of *Picea*, 11 Oct. 2012, *B.K. Cui*, *Cui 10626* (BJFC 013551).

Etymology. Piceicola (Lat.) refers to the species growing on *Picea*.

Diagnosis. *Cyanosporus piceicola* differs from other species in the genus by flabelliform pileus, slightly thick-walled and allantoid basidiospores, and specifically growing on *Picea*.

Basidiome annual, pileate, solitary, soft corky and without odour or taste when fresh, becoming hard corky and light in weight upon drying. Pileus flabelliform, projecting up to 3 cm, 5.5 cm wide and 1.8 cm thick at base. Pileal surface cream to clay-buff, with bluish grey zonation when fresh, velutinate, becoming light greyish brown upon drying; margin acute, concolorous with pileal surface. Pore surface white with bluish tint when fresh, becoming cream when dry; sterile margin up to 1 mm wide, clay-buff when fresh, becoming greyish brown upon drying; pores round, 3–5 per mm; dissepiments thin, entire. Context cream, hard corky, up to 1.5 cm thick. Tubes cream to buff-yellow, hard corky, up to 3 mm long. *Hyphal system* monomitic; generative hyphae with clamp connections, IKI–, CB–; tissues unchanged in KOH. Generative hyphae in context hyaline, thin- to slightly thick-walled with a wide lumen, seldom branched, loosely interwoven, 5–7 µm diam. Generative hyphae in trama hyaline, slightly thick-walled with a wide lumen, usually unbranched, parallel along the tubes, 2.5–4 µm diam. *Cystidia* or *cystidioles* absent. *Basidia* clavate, bearing four sterigmata and a basal clamp connection, 13–16 × 4–5 µm; basidioles in shape similar to basidia, but slightly smaller. *Basidiospores* allantoid, hyaline, slightly thick-walled, smooth, IKI–, weakly CB+, (3.9–)4–4.5(–4.8) × 0.9–1.3 µm, L = 4.65 µm, W = 1.21 µm, Q = 3.75–3.97 (n = 150/5).

Additional specimens (paratypes) examined. China, Sichuan Province, Jiuzhaigou County, Jiuzhaigou Nature Reserve, on fallen trunk of *Picea*,

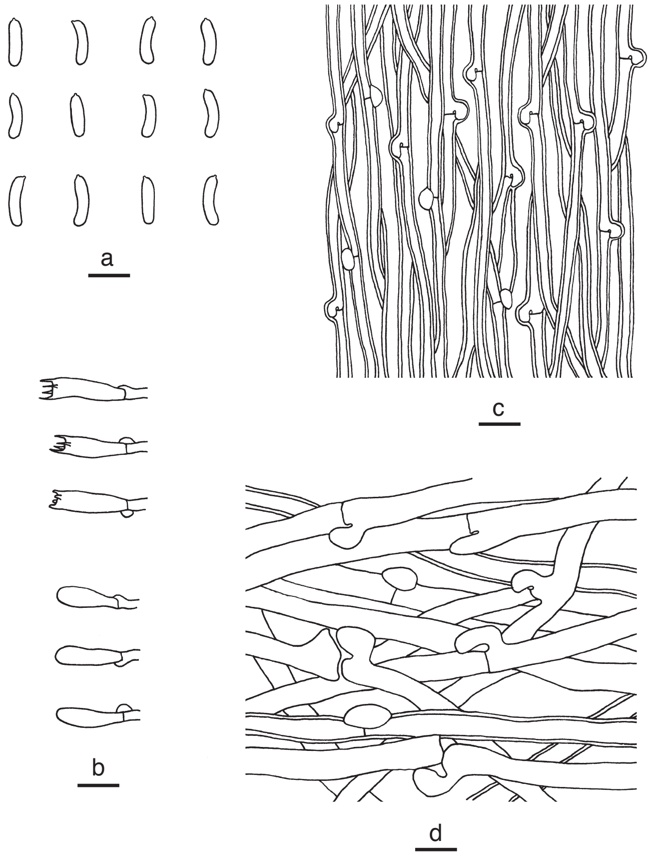


Fig. 8 Microscopic structures of *Cyanosporus piceicola*. a. Basidiospores; b. basidia and basidioles; c. hyphae from trama; d. hyphae from context (all: holotype). — Scale bars: a = 5 μm; b–d = 10 μm.

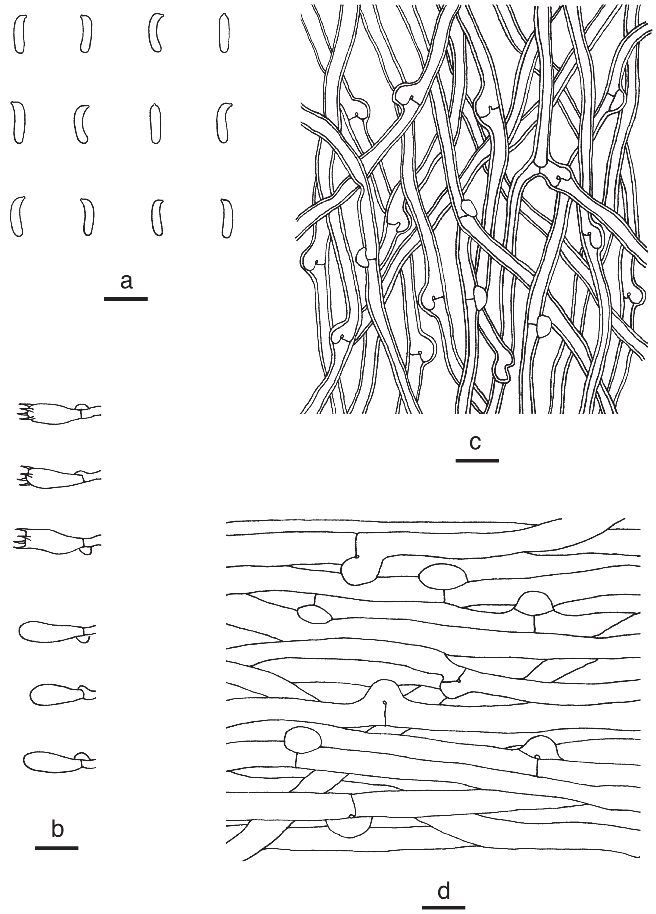


Fig. 9 Microscopic structures of *Cyanosporus subhirsutus*. a. Basidiospores; b. basidia and basidioles; c. hyphae from trama; d. hyphae from context (all: holotype). — Scale bars: a = 5 μm; b–d = 10 μm.

11 Oct. 2012, *B.K. Cui*, *Cui 10617* (BJFC 013542); Xizang Autonomous Region (Tibet), Linzhi County, Sejila Mountain, on fallen trunk of *Picea*, 18 Sept. 2014, *B.K. Cui*, *Cui 12158* (BJFC 017072); Milin County, Nanyigou Forest Park, on fallen trunk of *Picea*, 16 Sept. 2014, *B.K. Cui*, *Cui 12088* (BJFC 017002); Yunnan Province, Weixi County, Laojunshan Nature Reserve, on fallen trunk of *Picea*, 21 Sept. 2011, *B.K. Cui*, *Cui 10446* (BJFC 11341).

Notes — *Cyanosporus subcaesius* and *C. subhirsutus* resemble *C. piceicola* by producing similar basidiospores, but *C. subcaesius* differs from *C. piceicola* by glabrous pileal surface, white to pale grey pore surface, and interwoven, thin-walled tramal hyphae (Ryvarden & Melo 2014); while *C. subhirsutus* is separated by its dish-shaped pileus with hirsute pileal surface, bigger pores (2 or 3 per mm) and interwoven tramal hyphae.

Cyanosporus subcaesius (A. David) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819275

Basionym. *Tyromyces subcaesius* A. David, Bull. Mens. Soc. Linn. Lyon 43: 120. 1974.

= *Oligoporus subcaesius* (A. David) Ryvarden & Gilb., Syn. Fungorum 7: 435. 1993.

Specimens examined. Finland, Uusimaa, Helsinki, Arabia, on angiosperm stump, 23 Nov. 1996, *Y.C. Dai*, *Dai 2345* (IFP 015311); Vantaa, on fallen trunk of *Prunus*, 4 Oct. 1997, *Y.C. Dai*, *Dai 2725* (IFP 015280). – France, Isère, on *Malus*, Oct.1968, *David 652* (holotype, LY); Loire, on *Populus*, 31 Oct. 2000, *LY BR 1868* (LY).

Notes — *Cyanosporus subcaesius* can be recognized by whitish pileal surface with greyish tints in spots and streaks and pale grey pore surface. It is widespread in Europe. We have examined the type specimen and other specimens from Europe. This species has the typical morphological features of the *Cyanosporus caesius* group with blue greyish discoloration and similar allantoid basidiospores. Therefore, we proposed it as a new combination of *Cyanosporus*. For a detailed description of the species, see *Oligoporus subcaesius* by Ryvarden & Melo (2014).

Cyanosporus subhirsutus B.K. Cui, L.L. Shen & Y.C. Dai, *sp. nov.* — MycoBank MB819276; Fig. 3f, 9

Holotype. China, Guizhou Province, Jiangkou County, Fanjingshan Nature Reserve, on fallen trunk of *Pterocarya*, 21 Nov. 2014, *Y.C. Dai*, *Dai 14892* (BJFC 018005).

Etymology. Subhirsutus (Lat.) refers to the morphological similarity to *Postia hirsuta.*

Diagnosis. *Cyanosporus subhirsutus* differs from other species in the genus by dish-shaped pileus, hirsute and zonate pileal surface and big pores.

Basidiome annual, pileate, solitary, soft, watery, without odour or taste when fresh, becoming soft corky to fragile upon drying. Pileus dish-shaped, projecting up to 4 cm, 6 cm wide and 0.8 cm thick at base. Pileal surface with pale mouse-grey and cream zones when fresh, becoming cream to buff and hirsute when dry; margin acute, white with a little blue tint when fresh, cream when dry. Pore surface white when fresh, becoming pinkish buff to honey-yellow when dry; sterile margin narrow to almost lacking; pores angular, 2 or 3 per mm; dissepiments thin, entire. Context white, soft corky, up to 5 mm thick. Tubes cream, fragile, up to 3 mm long. *Hyphal system* monomitic; generative hyphae with clamp connections, IKI–, CB–; tissues unchanged in KOH. Generative hyphae in context hyaline, thin-walled, rarely branched, regularly arranged, 4–6 μm diam. Generative hyphae in trama hyaline, slightly thick-walled with a wide lumen, occasionally branched, interwoven, 3–4.5 µm diam. *Cystidia* and *cystidioles* absent. *Basidia* clavate, bearing four sterigmata and a basal clamp connection, 10–12 × 4–6 µm; basidioles in shape similar to basidia, but slightly smaller. *Basidiospores* allantoid, hyaline, slightly thick-walled, smooth, IKI–, weakly CB+, (3.9–)4–4.5 × 0.9–1.3 µm, L = 4.19 µm, W = 1.12 µm, Q = 3.67–3.79 (n = 90/3).

Additional specimens (paratypes) examined. CHINA, Fujian Province, Yongjing County, Huboliao Nature Reserve, on fallen angiosperm branch, 26 Oct. 2013, *B.K. Cui*, *Cui 11330* (BJFC 015446); Yunnan Province, Pu'er, Taiyanghe National Forest Park, on fallen angiosperm trunk, 8 July 2013, *B.K. Cui*, *Cui 11019* (BJFC 015136).

Notes — *Postia hirsuta* may be confused with *Cyanosporus subhirsutus* by pale mouse-grey and hirsute pileal surface, yellowish pore surface when dry, and allantoid to cylindrical basidiospores, but *P. hirsuta* differs in its thick pileus, without bluish margin, and thick-walled contextual hyphae (Shen & Cui 2014).

Cyanosporus tricolor B.K. Cui, L.L. Shen & Y.C. Dai, *sp. nov.* — MycoBank MB819277; Fig. 3g, 10

Holotype. CHINA, Xizang Autonomous Region (Tibet), Motuo County, on fallen branch of *Abies*, 20 Sept. 2014, *B.K. Cui*, *Cui 12233* (BJFC 07147).

Etymology. Tricolor (Lat.) refers to white, blue and pale mouse-grey upper surface when fresh.

Diagnosis. *Cyanosporus tricolor* differs from other species in the genus by semicircular pileus with white, blue and pale mouse-grey upper surface, and vertical projections nearby clamp connections frequently presenting in hyphae.

Basidiome annual, pileate, soft, watery, without odour or taste when fresh, becoming hard corky upon drying. Pileus semicircular, projecting up to 2 cm, 4 cm wide and 1 cm thick at base. Pileal surface light greyish brown with bluish grey zone, velutinate when fresh, becoming greyish brown, glabrous when dry; margin acute, white when fresh, greyish brown when dry. Pore surface white when fresh, becoming cream to buff when dry; sterile margin up to 1 mm wide, white when fresh, clay-buff when dry; pores angular, 4 or 5 per mm; dissepiments thin, entire. Context white, hard corky, up to 9 mm thick. Tubes cream, fragile, up to 1 mm long. *Hyphal system* monomitic; generative hyphae with clamp connections, IKI–, CB–; tissues unchanged in KOH. Generative hyphae in context hyaline, thin-walled, occasionally branched, interwoven, 3–5 µm diam, vertical projections nearby clamp connections frequently present. Generative hyphae in trama hyaline, thin-walled, seldom branched, interwoven, 2–3 µm diam, vertical projections occasionally present near to clamp connections. *Cystidia* and *cystidioles* absent. *Basidia* clavate, bearing four sterigmata and a basal clamp connection, 12–15 × 4–5 µm; basidioles in shape similar to basidia, but slightly smaller. *Basidiospores* allantoid, hyaline, slightly thick-walled, smooth, IKI–, weakly CB+, (3.9–)4–4.8(–4.9) × 0.8–1.2 µm, L = 4.51 µm, W = 0.97 µm, Q = 4.55–4.87 (n = 90/3).

Additional specimens (paratypes) examined. CHINA, Sichuan Province, Luding County, Hailuogou Forest Park, on fallen trunk of *Abies*, 20 Oct. 2012, *B.K. Cui*, *Cui 10790* (BJFC 013712); on fallen trunk of *Picea*, 20 Oct. 2012, *B.K. Cui*, *Cui 10780* (BJFC 013702).

Notes — *Cyanosporus microporus* has similar basidiospores with *C. tricolor*, but it is easily distinguished from *C. tricolor* by subrotund pileus, bluish pore surface when bruised and smaller pores (6–8 per mm).

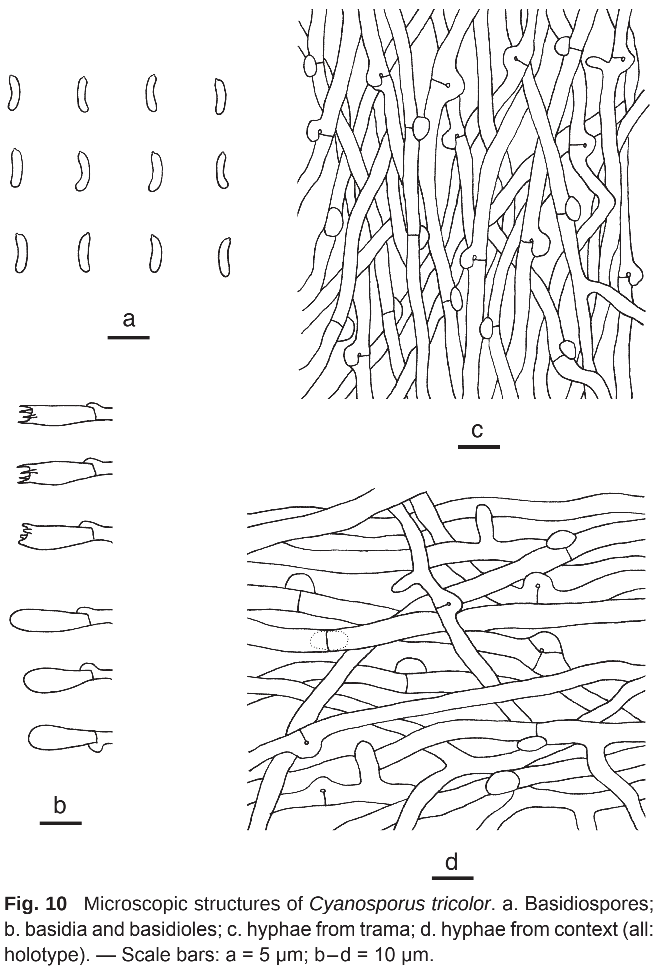


Fig. 10 Microscopic structures of *Cyanosporus tricolor*. a. Basidiospores; b. basidia and basidioles; c. hyphae from trama; d. hyphae from context (all: holotype). — Scale bars: a = 5 µm; b–d = 10 µm.

Cyanosporus ungulatus B.K. Cui, L.L. Shen & Y.C. Dai, *sp. nov.* — MycoBank MB819278; Fig. 3h, 11

Holotype. CHINA, Sichuan Province, Mianning County, Lingshan Temple, on fallen branch of *Castanopsis*, 17 Sept. 2012, *Y.C. Dai*, *Dai 12897* (BJFC 013166).

Etymology. Ungulatus (Lat.) refers to ungulate basidiocarps.

Diagnosis. *Cyanosporus ungulatus* differs from other species in the genus by ungulate basidiocarps, sulcate pileal surface with olivaceous buff, pinkish buff, cream to ash-grey and white zones when fresh.

Basidiome annual, pileate, ungulate, solitary, soft corky, without odour or taste when fresh, becoming hard and chalky upon drying. Pileus semicircular, projecting up to 1.8 cm, 2 cm wide and 1.5 cm thick at base. Pileal surface sulcate with olivaceous buff, pinkish buff, cream to ash-grey and white zones when fresh, glabrous, slightly darkening when dry; margin acute and white when fresh, cream upon drying. Pore surface white when fresh, becoming cream when dry; sterile margin up to 1 mm wide, concolorous with pore surface; pores round, 4–6 per mm; dissepiments thin, entire. Context cream, hard corky, up to 1.2 cm thick. Tubes cream to buff, hard and chalky, up to 3 mm long. *Hyphal system* monomitic; generative hyphae with clamp connections, IKI–, CB–; tissues unchanged in KOH. Generative hyphae in context hyaline, thin- to slightly thick-walled with a wide lumen, frequently branched, interwoven, 2.5–4.5 µm diam. Generative hyphae in trama hyaline, slightly thick-walled with a wide lumen, occasionally branched, interwoven, 2–3 µm diam. *Cystidia* and *cystidioles* absent. *Basidia* clavate, bearing four sterigmata and a basal clamp connection, 12–15 × 4–5 µm; basidioles in shape similar to basidia, but slightly smaller. *Basidiospores* allantoid, hyaline, thin-walled, smooth, IKI–, CB–, 4.5–5(–5.5) × 0.9–1.2 µm, L = 4.86 µm, W = 1.01 µm, Q = 4.79–4.83 (n = 60/2).

Additional specimen (paratype) examined. CHINA, Sichuan Province, Luding County, Hailuogou Forest Park, on fallen trunk of *Abies*, 20 Oct. 2012, *B.K. Cui*, *Cui 10778* (BJFC 013700).

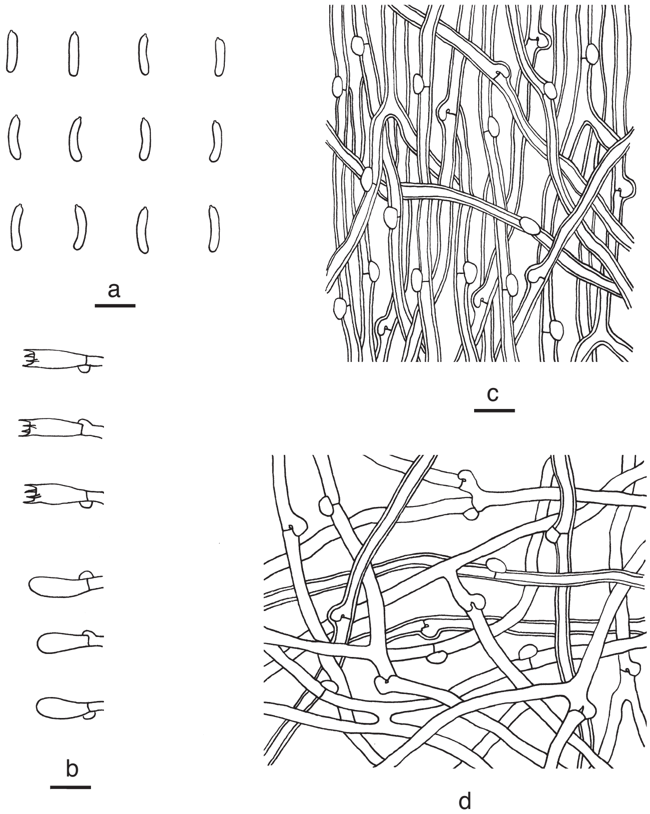


Fig. 11 Microscopic structures of *Cyanosporus ungulatus*. a. Basidiospores; b. basidia and basidioles; c. hyphae from trama; d. hyphae from context (all: holotype). — Scale bars: a = 5 µm; b–d = 10 µm.

Notes — Phylogenetically, *Cyanosporus ungulatus* grouped together with *C. fusiformis*. Both species produce slim thin-walled basidiospores, but *C. fusiformis* differs from *C. ungulatus* by its small basidiocarps, darkish pileal surface when dry and the presence of cystidioles.

Cystidiopostia B.K. Cui, L.L. Shen & Y.C. Dai, *gen. nov.* — MycoBank MB819279

Type species. Cystidiopostia hibernica (Berk. & Broome) B.K. Cui, L.L. Shen & Y.C. Dai.

Etymology. Cystidiopostia (Lat.) refers to the new genus resembling *Postia* but with apically encrusted cystidia.

Diagnosis. Morphologically, *Cystidiopostia* differs from *Postia* s.str. by resupinate basidiocarps and presence of apically encrusted cystidia.

Basidiocarps annual, resupinate to effused-reflexed, or pileate, soft when fresh, fragile when dry. Pileal surface white when fresh, cream to buff when dry, smooth to slightly radially rugose, azonate. Pore surface white when fresh, cream or with yellowish tint upon drying. Context white, soft corky. Tubes white to cream, fragile. Pores round to angular. Hyphal system monomitic; generative hyphae with clamp connections, IKI–, CB–. Cystidia present, thin- to thick-walled, mostly subulate, usually with a narrow apex. Basidiospores allantoid, hyaline, thin-walled, smooth, IKI–, CB–.

Cystidiopostia hibernica (Berk. & Broome) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819280

Basionym. *Polyporus hibernicus* Berk. & Broome, Ann. Mag. Nat. Hist., ser. IV, 7: 428. 1871.

= *Oligoporus hibernicus* (Berk. & Broome) Gilb. & Ryvarden, Mycotaxon 22: 365. 1985.

Specimens examined. China, Jilin Province, Antu County, Changbaishan Nature Reserve, on fallen branch of *Abies*, 13 July 2007, *Y.C. Dai*, *Dai 8248* (IFP 005454); Zhejiang Province, Lin'an County, Tianmushan Nature Reserve, on fallen angiosperm trunk, 10 Oct. 2005, *B.K. Cui*, *Cui 2658* (BJFC 002080). – Finland, Kittilän Lappi, Kittila, Jerisjavi, on fallen trunk of *Pinus*, 30 Aug. 1999, *Y.C. Dai*, *Dai 3189* (IFP 015561); Perä-Pohjanmaa, South Pisavaara National Park, on fallen trunk of *Pinus*, 15 Sept. 1997, *Y.C. Dai*, *Dai 2653* (IFP 015286). – Ireland, Luggela, on *Abies*, Sept. 1867, *181070* (holotype, K).

Notes — This species was described from Ireland. We have examined the type specimen and other specimens from China and Europe. Based on morphological characters and phylogenetic analyses, we transferred *Oligoporus hibernicus* to *Cystidiopostia* as a new combination. For a detailed description of the species, see *Oligoporus hibernicus* by Ryvarden & Melo (2014).

Cystidiopostia inocybe (A. David & Malençon) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819281

Basionym. *Tyromyces inocybe* A. David & Malençon, Bull. Trimestriel Soc. Mycol. France 94: 395. 1978.

= *Oligoporus inocybe* (A. David & Malençon) Ryvarden & Gilb., Syn. Fungorum 7: 415. 1993.

Specimens examined. China, Heilongjiang Province, Yichun, Fenglin Nature Reserve, on stump of *Populus*, 8 Sept. 2002, *Y.C. Dai*, *Dai 3706* (IFP 005406). – France, Fleury d'Aude, 28 Nov. 2009, *LY BR 3703* (LY).

Notes — This species was originally described from France. Although we did not find the type specimen, we have examined one specimen from France (type locality), and its morphological characters fit well with this species. Based on morphological characters and phylogenetic analyses, we transferred *Oligoporus inocybe* to *Cystidiopostia* as a new combination. For a detailed description of the species, see *Oligoporus inocybe* by Ryvarden & Melo (2014).

Cystidiopostia pileata (Parmasto) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819282

Basionym. *Auriporia pileata* Parmasto, Mycotaxon 11: 173. 1980.

= *Postia pileata* (Parmasto) Y.C. Dai & Renvall, Fungal Science 11: 98. 1996.
= *Postia amylocystis* Y.C. Dai & Renvall, Ann. Bot. Fenn. 31: 72. 1994.

Specimens examined. China, Anhui Province, Huangshan County, Huangshan, on fallen branch of *Pinus*, 13 Oct. 2004, *Y.C. Dai*, *Dai 6137* (BJFC 002088); Jilin Province, Antu County, Changbaishan Nature Reserve, on fallen trunk of *Abies*, 9 Aug. 2011, *B.K. Cui*, *Cui 10034* (BJFC 010927); Liaoning Province, Huanren County, Laotudingzi Nature Reserve, on fallen trunk of *Abies*, 31 July 2008, *B.K. Cui*, *Cui 5721* (BJFC 003664). – Russia, Far East, Sikhote Alinskij Nature Reserve, 19 Sept. 1967, *E. Parmasto* (holotype, TAA 52807, isotype in O).

Notes — This species was originally described from the Russia Far East. We have examined the type specimen and other specimens from Northeast China. Based on morphological characters and phylogenetic analyses, we transferred *Auriporia pileata* to *Cystidiopostia* as a new combination. For a detailed description of the species, see *Auriporia pileata* by Núñez & Ryvarden (2001).

Fuscopostia B.K. Cui, L.L. Shen & Y.C. Dai, *gen. nov.* — MycoBank MB819283

Type species. Fuscopostia fragilis (Fr.) B.K. Cui, L.L. Shen & Y.C. Dai.

Etymology. Fuscopostia (Lat.) refers to the new genus resembling *Postia* but with brownish basidiocarps when bruised or dried.

Diagnosis. Morphologically, *Fuscopostia* differs from *Postia* s.str. by pileal surface and pore surface turning to brownish when bruised.

Basidiocarps annual, resupinate, effused-reflexed or pileate, soft when fresh, fragile when dry. Pileal surface white to cream when fresh, mostly turned to brownish when bruised or dried, tomentose to glabrous, azonate. Pore surface whitish to buff when fresh, soon became reddish to rusty brown when bruised or dried. Context white, corky. Tubes brownish, fragile. Pores round to angular. Hyphal system monomitic; generative hyphae with clamp connections, IKI–, CB–. Gloeocystidia present or not, cystidioles frequently present. Basidiospores cylindrical to allantoid, hyaline, thin-walled, smooth, IKI–, CB–.

Fuscopostia duplicata (L.L. Shen, B.K. Cui & Y.C. Dai) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819284

Basionym. *Postia duplicata* L.L. Shen, B.K. Cui & Y.C. Dai, Phytotaxa 162: 149. 2014.

Specimens examined. China, Zhejiang Province, Qingyuan County, Baishanzu Nature Reserve, on rotten angiosperm wood, 14 Aug. 2013, *Y.C. Dai*, *Dai 13411* (holotype, BJFC 014872); Yunnan Province, Lanping County, Tongdian, Luoguqing, on stump of *Pinus*, 19 Sept. 2011, *B.K. Cui*, *Cui 10366* (paratype, BJFC 011261).

Notes — This species was only found in China. We have examined the type specimen. Based on morphological characters and phylogenetic analyses, we transferred *Postia duplicata* to *Fuscopostia* as a new combination. For a detailed description of the species, see *Postia duplicata* by Shen et al. (2014).

Fuscopostia fragilis (Fr.) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819285

Basionym. *Polyporus fragilis* Fr., Elench. Fung. 1: 86. 1828.

= *Postia fragilis* (Fr.) Jülich, Persoonia 11: 423. 1982.
= *Oligoporus fragilis* (Fr.) Gilb. & Ryvarden, Mycotaxon 22: 365. 1985.

Specimens examined. China, Jilin Province, Antu County, Changbaishan Nature Reserve, on fallen trunk of *Abies*, 9 Aug. 2011, *B.K. Cui*, *Cui 10020* (BJFC 010913); Fusong County, Lushuihe Forest Farm, on fallen trunk of *Pinus*, 11 Aug. 2011, *B.K. Cui*, *Cui 10088* (BJFC 010981); Yunnan Province, Lanping County, Changyanshan Nature Reserve, on fallen trunk of *Picea*, 18 Sept. 2011, *B.K. Cui*, *Cui 10306* (BJFC 011201).

Notes — This is a widespread species in temperate areas. The older specimens deposited in the herbaria of BPI, NY and K together with the isotype of its synonym *Spongipellis sensibilis* have been studied by Lowe (1975). The morphological characters of our studied specimens from China fit well with the description of Lowe (1975). Based on morphological characters and phylogenetic analyses, we transferred *Oligoporus fragilis* to *Fuscopostia* as a new combination. For a detailed description of the species, see *Oligoporus fragilis* by Ryvarden & Melo (2014).

Fuscopostia lateritia (Renvall) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819286

Basionym. *Postia lateritia* Renvall, Karstenia 32: 44. 1992.

= *Oligoporus lateritius* (Renvall) Ryvarden & Gilb., Syn. Fungorum 7: 417. 1993.

Specimens examined. China, Jilin Province, Antu County, Changbaishan Nature Reserve, on rotten wood of *Picea*, 25 Aug. 2005, *Y.C. Dai*, *Dai 6946* (IFP 011823), 29 Aug. 2005, *Y.C. Dai*, *Dai 7139* (IFP 011844). – Finland, Pohjois-Karjala, Lieksa, Patvinsuo National Park, Autiovaara, on fallen decorticated trunk of *Pinus*, 3 Oct. 1991, *Tuomo Niemelä 5547* (holotype, H); Perä-Pohjanmaa, South Pisavaara National Park, on fallen trunk of *Pinus*, 15 Sept. 1997, *Y.C. Dai*, *Dai 2662* (BJFC 002083).

Notes — This species was originally described from Finland. We have examined the type specimen and other specimens from Finland and China. Based on morphological characters and phylogenetic analyses, we transferred *Postia lateritia* to *Fuscopostia* as a new combination. For a detailed description of the species, see *Postia lateritia* by Renvall (1992).

Fuscopostia leucomallella (Murrill) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819287

Basionym. *Tyromyces leucomallellus* Murrill, Bull. Torrey Bot. Club 67: 63. 1940.

= *Oligoporus leucomallellus* (Murrill) Gilb. & Ryvarden, Mycotaxon 22: 365. 1985.

Specimens examined. China, Sichuan Province, Jiuzhaigou County, Jiuzhaigou Nature Reserve, on fallen trunk of *Abies*, 11 Oct. 2012, *B.K. Cui*, *Cui 10593* (BJFC 013518); Xizang Autonomous Region (Tibet), Bomi County, on fallen trunk of *Pinus*, 20 Sept. 2010, *B.K. Cui*, *Cui 9577* (BJFC 008515), *Cui 9599* (BJFC 008537); Linzhi County, Kadinggou Forest Park, on fallen trunk of *Abies*, 24 Sept. 2014, *B.K. Cui*, *Cui 12320* (BJFC 017234). – Finland, Etelä-Häme, Sudenpesänkangas old Forest, on rotten wood of *Pinus*, 19 Sept. 1996, *Y.C. Dai*, *Dai 2291* (BJFC 002085).

Notes — This is a widespread species in temperate areas of Europe, North America and East Asia. The older specimens, including the paratypes deposited in the herbaria of BPI, FLAS, PC, PR and S, have been studied by Lowe (1975). The morphological characters of our studied specimens from China and Finland fit well with the descriptions of Lowe (1975) and Ryvarden & Melo (2014). Based on morphological characters and phylogenetic analyses, we transferred *Oligoporus leucomallellus* to *Fuscopostia* as a new combination. For a detailed description of the species, see *Oligoporus leucomallellus* by Ryvarden & Melo (2014).

Oligoporus Bref., Unters. Gesammtgeb. Mykol. 8: 114. 1888 — MycoBank MB18144

Type species. Oligoporus rennyi (Berk. & Broome) Donk.

Basidiocarps annual, resupinate, easily separable, soft, gossypine when fresh, soft corky when dry. Pore surface white to cream when fresh, becoming yellowish to pale brown upon drying; margin narrow, whitish, tomentose. Context white, very thin, soft corky. Tubes white, corky when dry. Pores angular. Hyphal system monomitic; generative hyphae with clamp connections, IKI–, CB–. Cystidia present or not. Basidiospores oblong ellipsoid to ellipsoid, hyaline, slightly thick-walled, smooth, IKI–, CB+; chlamydospores occasionally present, subglobose to ellipsoid, thick-walled, strongly CB+.

Specimens examined. ***Oligoporus rennyi***. China, Heilongjiang Province, Hegang, Lianying Forest Farm, on fallen trunk of *Pinus*, 30 Aug. 2008, *H.S. Yuan*, *Yuan 5194* (IFP 014196). ***Oligoporus sericeomollis***. Belgium, Louvain, Louvain-la-Neuve, on fallen trunk of *Larix*, 3 July 2005, *Y.C. Dai*, *Dai 7458* (BJFC 001308). – China, Xizang Autonomous Region (Tibet), Bomi County, on fallen trunk of *Pinus*, 20 Sept. 2010, *B.K. Cui*, *Cui 9560* (BJFC 008498); Heilongjiang Province, Yichun, Fenglin Nature Reserve, on rotten wood of *Picea*, 2 Aug. 2011, *B.K. Cui*, *Cui 9870* (BJFC 010763). – Finland, Sompion Lappi, Sodankylä, on charred wood of *Pinus*, 5 Aug. 1998, *Y.C. Dai*, *Dai 2776* (BJFC 001309). – Norway, Oslo, Botanical Garden, on rotten wood of *Picea*, 9 Nov. 2011, *Y.C. Dai*, *Dai 12675* (BJFC 012258).

Notes — The name *Oligoporus* was usually treated as a synonym of *Postia*. Some mycologists supported the use of *Oligoporus* (Gilbertson & Ryvarden 1987, Ryvarden & Gilbertson 1994, Núñez & Ryvarden 2001, Bernicchia 2005), while other mycologists preferred to use *Postia* instead (Renvall 1992, Niemelä et al. 2005, Wei & Dai 2006, Hattori et al. 2011, Cui & Li 2012, Pildain & Rajchenberg 2013). In our study, we propose the use of *Postia* s.str. for taxa with thin-walled basidiospores, *Oligoporus* s.str. for taxa having thick-walled and cyanophilous basidiospores (see also Erkkilä & Niemelä (1986) and Renvall (1992)). Phylogenetically, *O. rennyi* and *O. sericeomollis* form a well-supported monophyletic lineage (Fig. 1, 2), which is distant from *Postia* s.str.

Osteina Donk, Schweiz. Z. Pilzk. 44: 86. 1966 — MycoBank MB18164

Type species. Osteina obducta (Berk.) Donk.

Basidiocarps annual, effused-reflexed to pileate or stipitate, watery to fleshy, without odour or taste when fresh, become bone hard when dry; pileal margin characteristically undulate. Pileal surface white when fresh, cream to greyish brown after drying. Pore surface white to cream when fresh, becoming yellowish to yellowish brown when dry; pores angular to irregular. Context white, fleshy when fresh, becoming hard corky when dry. Tubes pale white to yellow, fleshy when fresh, cream to yellowish brown, brittle when dry. Hyphal system monomitic; generative hyphae with clamp connections, thick-walled, IKI–, CB–. Cystidia or cystidioles absent. Basidiospores cylindrical, hyaline, thin-walled, smooth, IKI–, CB–.

Specimens examined. ***Osteina obducta***. China, Heilongjiang Province, Yichun, Fenglin Nature Reserve, on fallen trunk of *Betula*, 1 Aug. 2011, *B.K. Cui*, *Cui 9832* (BJFC 010725); on fallen trunk of *Pinus*, 1 Aug. 2011, *B.K. Cui*, *Cui 9825* (BJFC 010718); on fallen trunk of *Picea*, 2 Aug. 2011, *B.K. Cui*, *Cui 9865* (BJFC 010758); Tahe County, Huzhong Nature Reserve, on root of *Larix*, 18 Aug. 2003, *Y.C. Dai*, *Dai 4756* (IFP 003369), *Dai 4796* (IFP 003370); Inner Mongolia Autonomous Region, Arshan County, Arshan Nature Reserve, on rotten wood of *Larix*, 31 July 2005, *B.K. Cui*, *Cui 2017* (IFP 003341); Genhe County, Great Hinggan Nature Reserve, on rotten wood of *Larix*, 27 Aug. 2009, *Y.C. Dai*, *Dai 11024* (IFP 008504); Jilin Province, Antu County, Changbaishan Nature Reserve, on root of *Larix*, 10 Aug. 1997, *Y.C. Dai*, *Dai 2360* (IFP 003340); 13 Sept. 2007, *Y.C. Dai*, *Dai 9519* (IFP 003348); 1 Aug. 2008, *Y.C. Dai*, *Dai 10076* (IFP 008243); on fallen trunk of *Abies*, 10 Aug. 2011, *B.K. Cui*, *Cui 10074* (BJFC 010967); on living tree of *Pinus*, 8 Aug. 2011, *B.K. Cui*, *Cui 9959* (BJFC 010852), *B.K. Cui*, *Cui 9957* (BJFC 010850); Xinjiang Autonomous Region, Buerjin County, Kanasi Nature Reserve, on rotten *Larix*, 12 Aug. 2004, *Y.L. Wei*, *Wei 1444* (IFP 003382). – Czech Republic, Moravia, Chroustov, on *Pinus*, 22 July 1996, Laznicka (H); Obora, Hluboká, Velký Kameník, on *Larix*, Aug. 2002, *J. Vlasák 0208/8* (JV). – Russia, Khabarovsk Reg., Solnechny Dist., Suluk-Makit, on *Larix*, 20 Aug. 2011, *Spirin 4238* (H). – USA, Pennsylvania, Ricketts Glen Sate Park, Wilkes-Barre, on *Tsuga*, July 2003, *J. Vlasák 0307/6-J* (JV); Washington, Olympic Peninsula, Soleduck River, gymnosperm wood, 3 July 1957, *Lowe 7954* (H).

Notes — *Osteina* was introduced by Donk (1966), but the genus has not been widely accepted and was treated as a synonym of *Oligoporus*. Cui et al. (2014) used ITS rDNA sequences to infer the phylogenetic position of *Osteina* in *Fomitopsidaceae* and defined *Osteina obducta* as the valid name of the species rather than *Oligoporus obductus*. In our phylogenetic analyses, the species of *Osteina* form a single lineage with high support (Fig. 1, 2), and is distinct from *Postia* s.str. Morphologically, *Osteina* differs from *Postia* s.str. by its bone hard basidiocarps when dried, characteristically undulate margin and lacerate pores in older fruitbodies.

Osteina undosa (Peck) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819288

Basionym. *Polyporus undosus* Peck, Ann. Rep. N.Y. State Mus. Nat. Hist. 34: 42. 1881.

= *Postia undosa* (Peck) Jülich, Persoonia 11: 424. 1982.
= *Oligoporus undosus* (Peck) Gilb. & Ryvarden, Mycotaxon 22: 365. 1985.

Specimens examined. China, Jilin Province, Antu County, Changbaishan Nature Reserve, on rotten wood of *Picea*, 25 Aug. 2005, *Y.C. Dai*, *Dai 6942* (IFP 011822); 28 Aug. 2005, *Y.C. Dai*, *Dai 7105* (IFP 011838); Sichuan Province, Jiuzhaigou County, Jiuzhaigou Nature Reserve, on fallen trunk of *Picea*, 12 Oct. 2002, *Y.C. Dai*, *Dai 4062* (IFP 005517). – Finland, Etelä-Häme, Lammi Biological Station, on fallen trunk of *Picea*, 9 Oct. 1992, *Y.C. Dai*, *Dai 209* (IFP 015316); Sudenpesänkangas Old Forest, on fallen trunk of *Picea*, 19 Sept. 1996, *Y.C. Dai*, *Dai 2292* (IFP 015317).

Notes — This species is widely distributed in North America, Europe and East Asia. The older specimens deposited at the herbaria of BPI, FH, NY, NYS and SYRF have been extensively studied by Lowe (1975). Although we did not find the type specimen, we have examined the specimens from China and Finland. The morphological characters of our studied specimens fit well with the description of Lowe (1975) and Ryvarden & Melo (2014). Based on morphological characters and phylogenetic analyses, we transferred *Oligoporus undosus* to *Osteina* as a new combination. For a detailed description of the species, see *Oligoporus undosus* by Ryvarden & Melo (2014).

Postia Fr., Hymenomyc. Eur.: 586. 1874 — MycoBank MB18356

Type species. Postia lactea (Fr.) P. Karst.

Basidiocarps annual, effuse-reflexed to pileate, corky when dry. Pileal surface white or greyish to pale greyish brown, smooth or velutinate to hirsute when fresh, cream to greyish brown with some streaks or lines when dry. Pore surface white when fresh, cream to buff or pale reddish brown when dry. Context cream, corky. Tubes white to cream, corky to fragile. Hyphal system monomitic, generative hyphae with clamp connections, IKI–, CB–. Basidiospores allantoid to cylindrical, hyaline, thin-walled, smooth, IKI–, CB–.

Specimens examined. ***Postia amurensis***. China, Jilin Province, Antu County, Changbaishan Nature Reserve, on fallen trunk of *Alnus*, 1 Sept. 1993, *Y.C. Dai*, *Dai 903* (holotype, IFP 015745); Liaoning Province, Kuandian County, Baishilazi Nature Reserve, on fallen trunk of *Acer*, 31 Aug. 2004, *B.K. Cui*, *Cui 1044* (BJFC 013486). ***Postia calcarea***. China, Anhui Province, Huangshan County, Yellow Mts National Park, on fallen angiosperm trunk, 13 Oct. 2004, *Y.C. Dai*, *Dai 6167* (holotype, IFP), *Y.C. Dai*, *Dai 6185* (paratype, IFP); Zhejiang Province, Lin'an County, Tianmushan Nature Reserve, 14 Oct. 2004, *Y.C. Dai*, *Dai 6301* (paratype, IFP). ***Postia cana***. China, Shanxi Province, Qinshui County, Lishan Nature Reserve, on dead fallen trunk of *Picea*, 15 Sept. 2006, *H.S. Yuan*, *Yuan 2443* (holotype, IFP); on fallen trunk of *Picea*, 15 Sept. 2006, *H.S. Yuan*, *Yuan 2417* (paratype, IFP); on stump of *Picea*, 15 Sept. 2006, *H.S. Yuan*, *Yuan 2429* (paratype, IFP), *H.S. Yuan*, *Yuan 2452* (paratype, IFP). ***Postia gloeocystidia***. China, Zhejiang Province, Lin'an County, Tianmushan Nature Reserve, on *Pinus*, 14 Oct. 2004, *Y.C. Dai*, *Dai 6338* (holotype, IFP), *Y.C. Dai*, *Dai 6327* (paratype, IFP). ***Postia hirsuta***. China, Shaanxi Province, Zhashui County, Niubeiliang Forest Park, on fallen angiosperm trunk, 16 Sept. 2013, *B.K. Cui*, *Cui 11237* (holotype, BJFC 015352); Taibai Mountains, Honghegu Forest Park, on fallen angiosperm trunk, 10 Sept. 2013, *B.K. Cui*, *Cui 11180* (paratype, BJFC 015295). ***Postia lactea***. China, Heilongjiang Province, Tangyuan County, Daliangzihe National Forest Park, on fallen trunk of *Pinus*, 25 Aug. 2014, *B.K. Cui*, *Cui 11511* (BJFC 016753); Shandong Province, Mengyin County, Mengshan Forest Park, on fallen trunk of *Pinus*, 17 Aug. 2009, *B.K. Cui*, *Cui 7156* (BJFC 005643), *Cui 7167* (BJFC 005654); Xinjiang Autonomous Region, Gongliu County, Xitianshan Nature Reserve, on fallen trunk of *Populus*, 14 Sept. 2015, *Y.C. Dai*, *Dai 15946* (BJFC 020047); Xizang Autonomous Region (Tibet), Linzhi County, Sejila Mountain, on fallen trunk of *Abies*, 17 Sept. 2010, *B.K. Cui*, *Cui 9319* (BJFC 008258); on fallen trunk of *Picea*, 17 Sept. 2014, *B.K. Cui*, *Cui 12141* (BJFC 017055). – Finland, Etelä-Häme, North Kotinen Forest, on fallen trunk of *Pinus*, 12 Sept. 1997, *Y.C. Dai*, *Dai 2627* (BJFC 002081); Uusimaa, Vantaa, Tamisto Nature Reserve, on fallen trunk of *Betula*, 4 Nov. 2011, *Y.C. Dai*, *Dai 12643* (BJFC 012225). ***Postia lowei***. China, Jilin Province, Changbaishan Nature Reserve, on fallen trunk of *Pinus*, 30 July 1993, *Y.C. Dai*, *Dai 865* (BJFC 013412); Xizang Autonomous Region (Tibet), Bomi County, on fallen trunk of *Pinus*, 20 Sept. 2010, *B.K. Cui*, *Cui 9585* (BJFC 008523). ***Postia ochraceoalba***. China, Sichuan Province, Luding County, Hailuogou Forest Park, on fallen trunk of *Picea*, 20 Oct. 2012, *B.K. Cui*, *Cui 10802* (holotype, BJFC 013724), *B.K. Cui*, *Cui 10825* (paratype, BJFC 13747); Xizang Autonomous Region (Tibet), Linzhi County, Kadinggou Forest Park, on stump of *Abies*, 24 Sept. 2014, *B.K. Cui*, *Cui 12333* (BJFC 017247). ***Postia qinensis***. China, Shaanxi Province, Huayin County, Huashan Park, on rotten wood of *Pinus tabuliformis*, 6 Aug. 2006, *Y.C. Dai*, *Dai 7723* (holotype, IFP). ***Postia subundosa***. China, Heilongjiang Province, Yichun, Fenglin Nature Reserve, on *Picea*, 7 Sept. 2002, *Y.C. Dai*, *Dai 3608* (holotype, IFP), *Y.C. Dai*, *Dai 3633* (paratype, IFP), *Y.C. Dai*, *Dai 3628* (paratype, IFP). ***Postia tephroleuca***. China, Jiangxi Province, Jiujiang, Lushan Mountain, on fallen trunk of *Abies*, 9 Oct. 2008, *B.K. Cui*, *Cui 6020* (BJFC 003876); Jilin Province, Antu County, Changbaishan Nature Reserve, on fallen trunk of *Picea*, 9 Aug. 2011, *B.K. Cui*, *Cui 10047* (BJFC

010940). – Finland, Uusimaa, Vantaa, Tamisto Nature Reserve, on fallen trunk of *Betula*, 3 Nov. 2011, *Y.C. Dai*, *Dai 12603* (BJFC 012225), *Y.C. Dai*, *Dai 12610* (BJFC 012196).

Notes — In our 7-gene based phylogenetic study (Fig. 2), *Postia amurensis*, *P. hirsuta*, *P. lactea*, *P. lowei*, *P. ochraceo-alba*, *P. tephroleuca*, and a new species from China form a monophyletic lineage with high support (100% MP, 98% BS, 0.99 BPP). These seven species share similar morphological characters and form the core group of *Postia*.

Postia sublowei B.K. Cui, L.L. Shen & Y.C. Dai, *sp. nov.* — MycoBank MB819289; Fig. 3i, 12

Holotype. China, Xizang Autonomous Region (Tibet), Bomi County, on fallen trunk of *Picea*, 20 Sept. 2010, *B.K. Cui*, *Cui 9597* (BJFC 008535).

Etymology. Sublowei (Lat.) refers to the morphological similarity to *Postia lowei.*

Diagnosis. *Postia sublowei* differs from other species in the genus by white pileal surface with pale orange tint when fresh, and fusoid cystidioles presenting in hymenium.

Basidiome annual, pileate or effused-reflected, solitary or in small clusters, soft corky, without odour or taste when fresh, brittle and light in weight when dry. Pileus semicircular, projecting up to 1 cm, 2 cm wide and 0.5 cm thick at base. Pileal surface basically white, with a pale orange tint when fresh, velutinate, becoming cream to greyish brown, glabrous; margin obtuse, white when fresh, fuscous and incurved when dry. Pore surface white when fresh, becoming cream to buff when dry; sterile margin narrow to almost lacking, white when fresh, becoming greyish brown upon drying; pores angular, 3 or 4 per mm; dissepiments thin, entire. Context white, corky, up to 1 mm thick. Tubes cream, fragile to brittle, up to 4 mm long. *Hyphal system* monomitic; generative hyphae with clamp connections, IKI–, CB–; tissues unchanged in KOH. Generative hyphae in context hyaline, slightly thick-walled with a wide lumen, moderately branched, loosely interwoven, 4–6.5 µm diam. Generative hyphae in trama hyaline, thin- to slightly thick-walled with a wide lumen, occasionally branched, more or less parallel along the tubes, 3–4.5 µm diam. *Cystidia* absent; *cystidioles* present, fusoid, hyaline, thin-walled, 17–20 × 2–4 µm. *Basidia* clavate, bearing four sterigmata and a basal clamp connection, 16–20 × 4–4.5 µm; basidioles in shape similar to basidia, but slightly smaller. *Basidiospores* allantoid to cylindrical, hyaline, thin-walled, smooth, occasionally bearing one or two guttules, IKI–, CB–, 4–4.5(–5) × 1–1.5 µm, L = 4.78 µm, W = 1.06 µm, Q = 4.48–4.62 (n = 60/2).

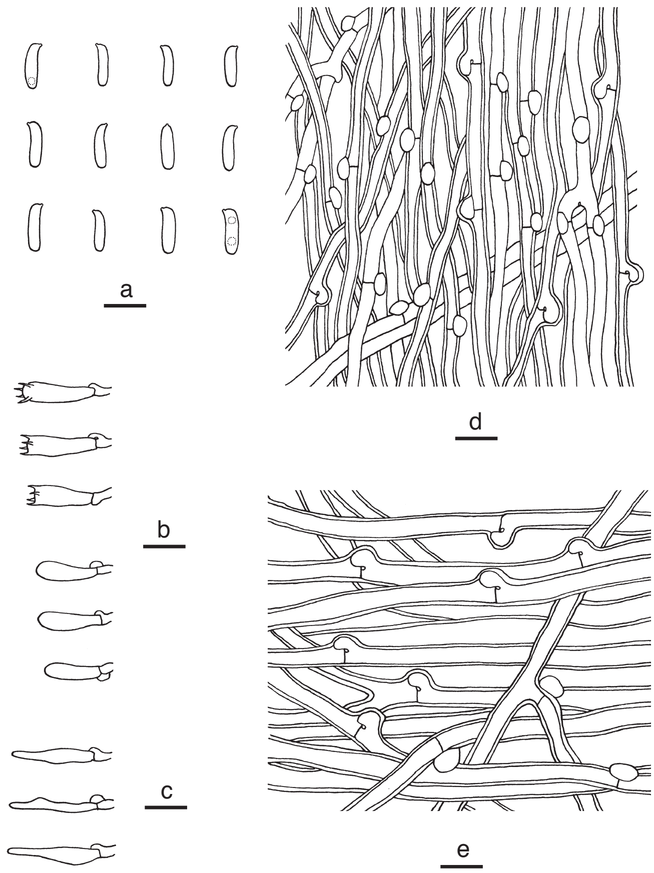


Fig. 12 Microscopic structures of *Postia sublowei*. a. Basidiospores; b. basidia and basidioles; c. cystidioles; d. hyphae from trama; e. hyphae from context (all: holotype). — Scale bars: a = 5 µm; b–e = 10 µm.

Additional specimen (paratype) examined. China, Xizang Autonomous Region (Tibet), Bomi County, on fallen trunk of *Picea*, 20 Sept. 2010, *B.K. Cui*, *Cui 9601* (BJFC 008539).

Notes — *Postia lowei* resembles *P. sublowei* by having brittle basidiocarps with greyish brown pileal surface when dry, similar sized pores, but *P. lowei* differs in whitish pileal surface without pale orange tint when fresh, the absence of cystidioles and wider basidiospores (4.8–5.2 × 1.8–2.2 µm; Table 2).

Rhodonia Niemelä, Karstenia 45: 79. 2005 — MycoBank MB500978

Type species. Rhodonia placenta (Fr.) Niemelä, K.H. Larss. & Schigel.

Basidiocarps annual, resupinate, fairly thick, soft and watery when fresh, corky to brittle when dry. Pore surface white to cream or pale rose-coloured when fresh, becoming cream to buff or brownish when dry; pores round to angular. Context white to red-brown, very thin, corky. Tubes cream to reddish brown, brittle when dry. Hyphal system monomitic; generative hyphae with clamp connections, IKI–, CB–. Gloeoplerous hyphae occasionally present. Cystidia or cystidioles absent. Basidiospores cylindrical, hyaline, thin-walled, smooth, IKI–, CB–.

Specimens examined. ***Rhodonia placenta***. China, Xinjiang Autonomous Region, Buerjin County, Kanasi Nature Reserve, on stump of *Larix*, 12 Aug. 2004, *Y.L. Wei*, *Wei 1406* (BJFC 002092). – Finland, Uusimaa, Helsinki, Botanical Garden, 28 Aug. 2007, on dead tree of *Salix*, *Y.C. Dai*, *Dai 8288* (IFP 015301); Pohjois Karjala, Patvinsuo National Park, on fallen trunk of *Pinus*, 2 Aug. 1995, *Y.C. Dai*, *Dai 1949* (BJFC 002093). – Russia, Bashkortostan, Uchaly Dist., on fallen trunk of *Pinus*, 25 Aug. 2001, *Y.C. Dai*, *Dai 11143* (IFP 015300).

Notes — In our study, *Rhodonia placenta* is clustered with three other species and form a well-supported lineage (Fig. 1, 2) in the antrodia clade. Morphologically, *Rhodonia* differs from *Postia* s.str. by its fairly large, thick resupinate basidiocarps and big cylindrical basidiospores.

Rhodonia obliqua (Y.L. Wei & W.M. Qin) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819290

Basionym. *Postia obliqua* Y.L. Wei & W.M. Qin, Sydowia 62: 166. 2010.

Specimens examined. China, Xizang Autonomous Region (Tibet), Linzhi County, Sejila Mountain, on stump of *Larix*, 4 Aug. 2004, *Y.C. Dai*, *Dai 5724* (holotype, IFP 015757), *Y.C. Dai*, *Dai 5728* (paratype, IFP 015758), *Y.C. Dai*, *Dai 5730* (paratype, IFP 015759); Yunnan Province, Weixi County, Laojunshan Nature Reserve, on fallen trunk of *Picea*, 21 Sept. 2011, *B.K. Cui*, *Cui 10470* (BJFC 011365).

Notes — This species was only found in China. We have examined the type specimen. Based on morphological characters and phylogenetic analyses, we transferred *Postia obliqua* to *Rhodonia* as a new combination. For a detailed description of the species, see *Postia obliqua* by Wei & Qin (2010).

Rhodonia rancida (Bres.) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819291

Basionym. *Poria rancida* Bres., Fungi Trident. 2: 96. 1900.

= *Oligoporus rancidus* (Bres.) Gilb. & Ryvarden, Mycotaxon 22: 365. 1985.

Specimens examined. Austria, Trient, Tirol, on *Larix*, 1896, *Bresadola*, *Overholts 25368* (holotype, PACMA 000994). – China, Xizang Autonomous Region (Tibet), Linzhi County, Kadinggou Forest Park, on stump of *Pinus*, 24 Sept. 2014, *B.K. Cui*, *Cui 12317* (BJFC 017231), *Cui 12339* (BJFC 017253).

Notes — We have examined the type specimen and other specimens of this species. Based on morphological characters and phylogenetic analyses, we transferred *Oligoporus rancidus* to *Rhodonia* as a new combination. For a detailed description of the species, see *Oligoporus rancidus* by Ryvarden & Melo (2014).

Rhodonia subplacenta (B.K. Cui) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819292

Basionym. *Postia subplacenta* B.K. Cui, Mycotaxon 120: 232. 2012.

Specimens examined. China, Heilongjiang Province, Ning'an County, Jingbohu Forest Park, 5 Sept. 2013, on stump of *Picea*, *Y.C. Dai*, *Dai 13456* (BJFC 014917); Yichun, Fenglin Nature Reserve, on stump of *Pinus*, 1 Aug. 2011, *B.K. Cui*, *Cui 9818* (paratype, BJFC 010711); Jilin Province, Antu County, Changbaishan Nature Reserve, on fallen trunk of *Pinus*, 8 Aug. 2011, *B.K. Cui*, *Cui 10001* (holotype, BJFC 010894).

Notes — This species was only found in China. We have examined the type specimen. Based on morphological characters and phylogenetic analyses, we transferred *Postia subplacenta* to *Rhodonia* as a new combination. For a detailed description of the species, see *Postia subplacenta* by Cui & Li (2012).

Spongiporus Murrill, Bull. Torrey Bot. Club 32: 474. 1905 — MycoBank MB18577

Type species. Spongiporus leucospongia (Cooke & Harkn.) Murrill.

Basidiocarps annual, pileate or effused-reflexed, pilei usually imbricate, soft to fibrous when fresh, without odour or taste, corky and slightly fragile upon drying. Pileal surface white when fresh, turning to buff to brownish when dry, velutinate or glabrous, azonate or zonate. Pore surface whitish to buff when fresh, colour unchanged when dry. Context white, corky. Tubes brownish, fragile. Pores round to angular. Hyphal system monomitic; generative hyphae with clamp connections, IKI–, CB–. Hyphal pegs occasionally present. Cystidia present or not. Basidiospores cylindrical to allantoid, hyaline, thin-walled, smooth, IKI–, CB–.

Specimens examined. ***Spongiporus balsameus***. China, Heilongjiang Province, Yichun, Fenglin Nature Reserve, on angiosperm stump, 1 Aug. 2011, *B.K. Cui*, *Cui 9835* (BJFC 010728); Yunnan Province, Baoshan, Gaoligong Nature Reserve, on fallen angiosperm trunk, 26 Oct. 2009, *B.K. Cui*, *Cui 8207* (BJFC 006696). – Czech Republic, Hluboka, on stump of *Picea*, 20 Nov. 2011, *Y.C. Dai*, *Dai 12691* (BJFC 012275). ***Spongiporus leucospongia***. USA, California, *J.B.Ellis 3731* (K); Pinnacles, Crater Lake National Park, *J. Vlasák 0709/123-J* (JV).

Notes — *Spongiporus*, typified by *S. leucospongia*, was originally established by Murrill (1905), and then it was treated as a genus for all brown-rot species with a monomitic hyphal system (David 1980). However, it had been always regarded as a synonym of *Oligoporus* or *Postia* (Pildain & Rajchenberg 2013, Ryvarden & Melo 2014). Since molecular techniques are widely used in taxonomy, the genus is restricted to species with the above definition. In our phylogenetic study (Fig. 1, 2), five species of *Spongiporus* form a separated lineage in the antrodia clade, they share similar morphological characters and form the core group of *Spongiporus* s.str.

Spongiporus florifomis (Quél.) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819293

Basionym. *Polyporus floriformis* Quél., Fungi Trident. 1: 61. 1884.

= *Postia floriformis* (Quél.) Jülich, Persoonia 11: 423. 1982.
= *Oligoporus floriformis* (Quél.) Gilb. & Ryvarden, Mycotaxon 22: 365. 1985.

Specimens examined. China, Yunnan Province, Kunming, Heilongtan Park, on gymnosperm stump, 25 July 2014, *Y.C. Dai*, *Dai 13887* (BJFC 017617); Laping County, Changyanshan Nature Reserve, on fallen angiosperm trunk, 18 Sept. 2011, *B.K. Cui*, *Cui 10292* (BJFC 011187); on fallen trunk of *Pinus*, 19 Sept. 2011, *B.K. Cui*, *Cui 10401* (BJFC 011296). – Spain, Cadiz Province, Sierra Grazalema Natural Park, on fallen trunk of *Abies*, 22 Nov. 2005, *Y.C. Dai*, *Dai 7441* (BJFC 001300).

Notes — This species is widely distributed in North America, Europe and East Asia. The isotype deposited at BPI has been studied by Lowe (1975). We have examined the specimens from China and Europe. The morphological characters of our studied specimens fit well with the descriptions of Lowe (1975) and Ryvarden & Melo (2014). Based on morphological characters and phylogenetic analyses, we transferred *Oligoporus floriformis* to *Spongiporus* as a new combination. For a detailed description of the species, see *Oligoporus floriformis* by Ryvarden & Melo (2014).

Spongiporus gloeoporus (L.L. Shen, B.K. Cui & Y.C. Dai) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819294

Basionym. *Postia gloeopora* L.L. Shen, B.K. Cui & Y.C. Dai, Mycol. Progr. 14: 7. 2015.

Specimens examined. China, Xizang Autonomous Region (Tibet), Bomi County, on stump of *Pinus*, 19 Sept. 2010, *B.K. Cui*, *Cui 9507* (holotype, BJFC 008445), 20 Sept. 2010, *B.K. Cui*, *Cui 9517* (paratype, BJFC 008455).

Notes — This species was only found in China. We have examined the type specimen. Based on morphological characters and phylogenetic analyses, we transferred *Postia gloeopora* to *Spongiporus* as a new combination. For a detailed description of the species, see *Postia gloeopora* by Shen et al. (2015).

Spongiporus zebra (Y.L. Wei & W.M. Qin) B.K. Cui, L.L. Shen & Y.C. Dai, *comb. nov.* — MycoBank MB819295

Basionym. *Postia zebra* Y.L. Wei & W.M. Qin, Sydowia 62: 167. 2010.

Specimens examined. China, Jilin Province, Antu County, Changbaishan Nature Reserve, on rotten stump of *Abies*, 29 Aug. 2005, *Y.C. Dai*, *Dai 7131* (holotype, IFP 015764); 8 Aug. 2011, *B.K. Cui*, *Cui 9973* (BJFC 010866).

Notes — This species was only found in China. We have examined the type specimen. Based on morphological characters and phylogenetic analyses, we transferred *Postia zebra* to *Spongiporus* as a new combination. For a detailed description of the species, see *Postia zebra* by Wei & Qin (2010).

DISCUSSION

Recently, many studies focused on the taxonomy and phylogeny of different brown-rot fungal groups in the antrodia clade (Binder et al. 2005, 2013, Lindner & Banik 2008, Rajchenberg et al. 2011, Cui & Dai 2013, Ortiz-Santana et al. 2013, Pildain & Rajchenberg 2013, Spirin et al. 2013a, b, 2015, 2016a, b, Cui et al. 2014, Song et al. 2014, Shen et al. 2014, 2015, Chen & Cui 2016, Han et al. 2016, Spirin 2016, Chen et al. 2017, Justo et al. 2017, Song & Cui 2017), and species of *Postia* s.lat. were included in different subclades in the antrodia clade (Binder et al. 2005, Ortiz-Santana et al. 2013, Pildain & Rajchenberg 2013, Cui et al. 2014, Justo et al. 2017). Our phylogenetic results were consistent with previous studies on polyphyly nature of *Postia* s.lat.

The phylogenies inferred from the combined datasets of 3-gene sequences (Fig. 1) and 7-gene sequences (Fig. 2) strongly support the segregation of *Amaropostia*, *Calcipostia*, *Cyanosporus*, *Cystidiopostia*, *Fuscopostia*, *Spongiporus* from *Postia* s.str. Morphologically, *Cyanosporus*, *Fuscopostia*, *Spongiporus*, all have pileate or effused-reflexed basidiocarps with corky to slightly fragile pileus when dry and mild taste, but *Cyanosporus* differs from *Fuscopostia* and *Spongiporus* by its more or less bluish basidiocarps and weakly cyanophilous basidiospores; *Fuscopostia* differs from *Spongiporus* by pileal surface and pore surface turning brownish when bruised. *Amaropostia* and *Calcipostia* share pileate basidiocarps with bitter taste, but *Calcipostia* differs from *Amaropostia* by its large and calcareous basidiocarps with circular guttulate depressions on pileal surface.

Morphologically, *Oligoporus* s.str. is different from *Postia* s.str. by resupinate, gossypine basidiocarps and thick-walled, cyanophilous basidiospores; moreover, species in *Oligoporus* s.str. mostly grow on gymnosperm wood, while species in *Postia* s.str. were reported on both angiosperm and gymnosperm wood (Donk 1971, Ryvarden & Melo 2014). In the current study, species of *Oligoporus* s.str. form a monophyletic lineage, distant from *Postia* s.str. (Fig. 1, 2).

Rhodonia was established by Niemelä et al. (2005) based on previous phylogenetic studies (Boidin et al. 1998, Kim et al. 2001, Binder et al. 2005), in which *R. placenta* was distinct from the bulk of species in *Postia*. The genus is characterized by annual, resupinate, fairly thick, soft and watery basidiocarps, white or pale rose-coloured pore surface, a monomitic hyphal system with clamped generative hyphae, and thin-walled, smooth, cylindrical basidiospores (Cui et al. 2014). These morphological characters are applicable for *P. obliqua*, *P. rancida* and *P. subplacenta*, and the transfer of these three species to *Rhodonia* is strongly supported by the phylogenetic analyses (Fig. 1, 2).

Compared with previous studies (Binder et al. 2005, Ortiz-Santana et al. 2013, Pildain & Rajchenberg 2013), we used more samples and more gene markers to make an extensive understanding of the phylogenetic relationships within species in *Postia* and related genera. Our current phylogeny (Fig. 1) inferred from the combined 3-gene sequences demonstrated 12 major lineages for the 45 sampled species of *Postia* s.lat. However, four *Postia* species from Argentina, namely *P. pelliculosa*, *P. punctata*, *P. dissecta* and *P. carbophila*, weakly grouped with species in *Postia* s.str., of which *P. pelliculosa* and *P. punctata* consistently formed a separated lineage with high support (100 % MP, 100 % BS, 1.00 BPP) in accordance with Pildain & Rajchenberg (2013), while *P. dissecta* and *P. carbophila* were grouped together in a separated lineage with no significant support (Fig. 1). In the phylogeny inferred from the combined 7-gene dataset (Fig. 2), 41 species of *Postia* s.lat. were divided into ten monophyletic clades, and four new genera were established for monophyletic groups here. However, phylogenetic positions of four species of *Postia* from Argentina are not resolved because only limited gene sequences are available for them. Morphologically, *P. pelliculosa* and *P. punctata* have thick-walled, ellipsoid basidiospores that are consistent with species of *Oligoporus* s.str. (Rajchenberg 1987, Rajchenberg & Buchanan 1996); *P. carbophila* is similar to *Rhodonia placenta* (Rajchenberg 1995); *P. dissecta* is characterized by dimidiate basidiocarps with applanate pileus and cylindrical basidiospores (Rajchenberg 1987), which are similar to species of *Spongiporus* s.str. But their positions in the respective genera are not supported in the phylogenetic analysis (Fig. 1). For the time being, we still retain these four species in *Postia* s.lat.

In the current study, about 300 specimens of 41 species of *Postia* s.lat. had been morphologically examined, including 57 type materials (holotypes and paratypes) and many specimens from type localities, and 469 sequences had been newly obtained in this work. However, some species of *Postia* s.lat. were still not included in our phylogenetic analyses due to the lack of DNA sequences. For example, *P. calcarea* and *Spongiporus cerifluus* should be placed in *Spongiporus* s.str. because they have thin, fibrous pileus and cylindrical basidiospores; chalky basidiocarps when dry, and have hyphal pegs (Wei & Dai 2006), which are similar to species of *Spongiporus* s.str.; *P. simanii* has resupinate basidiocarps and apically encrusted cystidia, which are in line with *Cystidiopostia*; *P. subundosa* described from China resembles *Osteina undosa* by having hard basidiocarps with undulate pileal margin and similar sized pores (Wei & Dai 2006); *P. cana*, *P. gloeocystidiata* and *P. qinensis* have soft corky basidiocarps with white pore surface and allantoid basidiospores (Wei & Dai 2006, Dai et al. 2009, Yuan et al. 2010), their morphological characters are consistent with species of *Postia* s.str. Since no molecular data is available to support their phylogenetic positions, these species are remained in *Postia* s.lat.

KEY TO GENERA OF POSTIA S.LAT. IN THE ANTRODIA CLADE

1. Cystidia encrusted . . . . *Cystidiopostia*
1. Cystidia absent, or not encrusted if present 2
2. Basidiocarps bond hard when dry, margin distinctly undulate . . . . *Osteina*
2. Basidiocarps corky to hard corky when dry, margin not undulate 3
3. Basidiocarps resupinate 4
3. Basidiocarps mostly pileate, effused-reflexed 5
4. Basidiocarps thin and gossypine when fresh; basidiospores strongly CB+ . . . . *Oligoporus* s.str.
4. Basidiocarps fairly thick and fleshy when fresh; basidiospores CB– . . . . *Rhodonia*
5. Basidiocarps taste bitter. 6
5. Basidiocarps taste mild 7
6. Pileal surface with circular guttulate depressions; basidiospores 2–2.5 µm wide . . . . *Calcipostia*
6. Pileal surface glabrous; basidiospores 1.5–2 µm wide . . . . *Amaropostia*
7. Pileal surface and pore surface turning brownish when bruised . . . . *Fuscopostia*
7. Pileal surface and pore surface non-discolouring when bruised 8
8. Basidiocarps usually imbricate; basidiospores mostly 2–3 µm wide . . . . *Spongiporus* s.str.
8. Basidiocarps usually solitary; basidiospores mostly < 2 µm wide 9
9. Basidiocarps more or less bluish; basidiospores weakly CB+ . . . . *Cyanosporus*
9. Basidiocarps without blue tint; basidiospores CB– . . . . *Postia* s.str.

KEY TO SPECIES OF AMAROPOSTIA

1. Pores 5–6 per mm; cystidioles present . . . . *A. stiptica*
1. Pores 7–9 per mm; cystidioles absent . . . *A. hainanensis*

KEY TO SPECIES OF CYANOSPORUS

1. Basidiospores 1.4–2 µm wide 2
1. Basidiospores 0.8–1.3 µm wide 5
2. Cystidia present . . . . *C. mongolicus*
2. Cystidia absent 3
3. Basidiocarps white with bright yellow margin . . . . *C. luteocaesius*
3. Basidiocarps white or greyish without yellow margin . . 4
4. Pore surface becoming bluish when bruised . . *C. caesius*
4. Pore surface unchanged when bruised . . . . *C. mediterraneocaesius*
5. Basidiospores thin-walled, CB–. 6
5. Basidiospores slightly thick-walled, CB+ 7
6. Basidiocarps semicircular with azonate pileal surface; cystidioles present . . . . *C. fusiformis*
6. Basidiocarps ungulate with zonated pileal surface; cystidioles absent . . . . *C. ungulatus*
7. Pores 6–8 per mm . . . . *C. microporus*
7. Pores < 6 per mm 8
8. Pileal surface glabrous . . . . *C. subcaesius*
8. Pileal surface velutinate to hirsute 9
9. Pores 2–3 per mm . . . . *C. subhirsutus*
9. Pores > 3 per mm 10
10. Pileal surface concentrically zoned by white, bluish grey and greyish brown . . . . *C. tricolor*
10. Pileal surface white to cream with blue tint 11
11. Growing on angiosperm wood; tramal hyphae interwoven . . . . *C. alni*
11. Growing on *Picea* exclusively; tramal hyphae parallel . . . . *C. piceicola*

KEY TO SPECIES OF CYSTIDIOPOSTIA

1. Basidiospores 1.5–1.7 µm wide . . . . *C. inocybe*
1. Basidiospores < 1.5 µm wide 2
2. Basidiocarps usually pileate; cystidia thick-walled, apically encrusted . . . . *C. pileata*
2. Basidiocarps resupinate; cystidia thin-walled, smooth or apically encrusted . . . . *C. hibernica*

KEY TO SPECIES OF FUSCOPOSTIA

1. Gloeocystidia present 2
1. Gloeocystidia absent 3
2. Context duplex; basidiospores 1.8–2.5 µm wide . . . . *F. duplicata*
2. Context homogeneous; basidiospores 1–1.7 µm wide . . . . *F. leucomallella*
3. Pores 3–4 per mm; basidiospores 1.2–1.6 um wide . . . . *F. lateritia*
3. Pores 4–6 per mm; basidiospores 1.7–2.1 um wide . . . . *F. fragilis*

KEY TO SPECIES OF OLIGOPORUS S.STR.

1. Pores 2–4 per mm; cystidia absent, chlamydospores present . . . . *O. rennyi*
1. Pores 4–6 per mm; cystidia present, chlamydospores absent . . . . *O. sericeomollis*

KEY TO SPECIES OF OSTEINA

1. Pores 3–5 per mm; basidiospores 2–2.5 µm wide . . . . *O. obducta*
1. Pores 2–3 per mm; basidiospores 1–1.5 µm wide . . . . *O. undosa*

KEY TO SPECIES OF POSTIA S.STR.

1. Pore surface grey, cream or reddish brown when dry . . . 2
1. Pore surface yellowish when dry 4
2. Basidiospores broadly allantoid, 1.8–2.2 µm wide *P. lowei*
2. Basidiospores narrowly allantoid, 0.8–1.5 µm wide 3
3. Basidiocarps zonate, pores 6–7 per mm; gloeoplerous hyphae absent . . . . *P. ochraceoalba*
3. Basidiocarps azonate, pores 4–5 per mm; gloeoplerous hyphae present . . . . *P. lactea*
4. Cystidia or cystidioles present 5
4. Cystidia and cystidioles absent 6
5. Basidiocarps small (1 × 2 × 0.5 cm), pileal surface with orange tint; grows on angiosperm wood . . . . . *P. sublowei*
5. Basidiocarps big (3 × 5.5 × 1 cm), pileal surface without orange tint; grows on gymnosperm wood . . . *P. amurensis*
6. Pileal surface mouse-grey and hirsute; tramal hyphae thick-walled . . . . *P. hirsuta*
6. Pileal surface cream with brown tint and tomentose; tramal hyphae thin-walled . . . . *P. tephroleuca*

KEY TO SPECIES OF RHODONIA

1. Gloeoplerous hyphae present 2
1. Gloeoplerous hyphae absent 3
2. Basidiocarps with oblique tubes and brownish pore surface when dry; basidiospores 2–2.5 µm wide . . . . . *R. obliqua*
2. Basidiocarps with straight tubes and buff pore surface when dry; basidiospores 2.5–3 µm wide . . . . *R. placenta*
3. Basidiocarps taste rancid; basidiospores larger (6–8 × 2–3 µm). . . . . *R. rancida*
3. Basidiocarps taste mild; basidiospores smaller (4.2–6 × 1.9–2.4 µm) . . . . *R. subplacenta*

KEY TO SPECIES OF SPONGIPORUS S.STR.

1. Pores 5–8 per mm 2
1. Pores 2–4 per mm 4
2. Cystidia present, basidiospores 2.5–3 µm wide . . . . *S. balsameus*
2. Cystidia absent, basidiospores 2–2.5 µm wide 3
3. Pileal surface with grey-brown zonations; hyphal pegs absent . . . . *S. zebra*
3. Pileal surface azonate; hyphal pegs present . . *S. florifomis*
4. Hyphal pegs present, basidiospores allantoid (1–1.5 µm wide) . . . . *S. leucospongia*
4. Hyphal pegs absent, basidiospores ellipsoid (2–2.5 µm wide) . . . . *S. gloeoporus*

Acknowledgements We are grateful to Dr. Zheng Wang (Yale University, USA) for improving the manuscript. We express our gratitude to the curators of H, IFP, JV, K, LY, O, PAC and TAA herbaria for the loan of specimens, to Drs. Mario Rajchenberg (CIEFAP) and Pertii Renvall (KUO) for providing specimen data. Special thanks are due to Drs. Shuang-Hui He (Beijing Forestry University, China), Hai-Sheng Yuan, Yu-Lian Wei and Li-Wei Zhou (Institute of Applied Ecology, Chinese Academy of Sciences, China) for assistance during field collections. The research was financed by the National Natural Science Foundation of China (Project Nos. 31750001 and 31670016), the

Fundamental Research Funds for the Central Universities (No. 2016ZCQ04) and the National Science and Technology Foundation Project of China (No. 2014FY210400).

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