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Research Article

An overview of Melanommataceae (Pleosporales, Dothideomycetes): Current insight into the host associations and geographical distribution with some interesting novel additions from plant litter

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Abstract

Melanommataceous species exhibit high diversity with a cosmopolitan distribution worldwide and show a prominent saprobic lifestyle. In this study, we explored five saprobic species collected from plant litter substrates from terrestrial habitats in China and Thailand. A combination of morphological characteristics and multi-locus phylogenetic analyses was used to determine their taxonomic classifications. Maximum Likelihood and Bayesian Inference analyses of combined LSU, SSU, ITS and *tef1-α* sequence data were used to clarify the phylogenetic affinities of the species. *Byssosphaeria poaceicola* and *Herpotrichia zingiberacearum* are introduced as new species, while three new host records, *Bertiella fici*, *By. siamensis* and *Melanomma populicola* are also reported from litter of *Cinnamomum verum*, *Citrus trifoliata* and *Fagus sylvatica*, respectively. Yet, despite the rising interest in the melanommataceous species, there is a considerable gap in knowledge on their host associations and geographical distributions. Consequently, we compiled the host-species associations and geographical distributions of all the so far known melanommataceous species.

Key words: Biodiversity, multi-gene phylogeny, new host records, Pleosporales, saprobes, systematics

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Introduction

Fungi occur in a wide range of ecosystems (Hawksworth 2001; De Silva et al. 2016; Hernández-Restrepo et al. 2017). With over 98,334 extant species, Ascomycota is the largest phylum of fungi and is widely distributed in terrestrial, freshwater and marine environments (Hill et al. 2021; Senanayake et

al. 2022; Bánki et al. 2023). The class Dothideomycetes is estimated to have 32,365 species and is one of the most ecologically diverse group of ascomycetes (Hongsanan et al. 2020; Bánki et al. 2023). Pleosporales is considered the largest and most diverse order in the class Dothideomycetes (Zhang et al. 2012; Hongsanan et al. 2020). They exhibit a wide range of lifestyles (e.g. biotrophs, endophytes, epiphytes, hemibiotrophs, pathogens, saprobes) and can be found worldwide, including terrestrial, marine and freshwater environments (Jones et al. 2019; Hongsanan et al. 2020; Calabon et al. 2022; Gao et al. 2023). In addition, they are extremely adaptable to various ecological niches and can exist in anaerobic, aquatic, mutualistic, terrestrial and even in severe habitats, such as deserts (Zhang et al. 2012; Hyde et al. 2013; Hongsanan et al. 2020). Pleosporales species play significant functional roles from an agricultural, ecological and economic perspectives (Zhang et al. 2012; Raja et al. 2017; Wen et al. 2020; Pimenta et al. 2021). According to the recent outline of Wijayawardene et al. (2022), Pleosporales consists of 91 families.

Melanommataceae is one of the species-rich families in Pleosporales, Dothideomycetes. It was introduced by Winter (1885) to include *Melanomma* as the type genus and species have globose or depressed ascomata, fissitunicate asci, pigmented and phragmosporous ascospores (Tian et al. 2015; Hongsanan et al. 2020). The ordinal level placement of Melanommataceae was controversial for a long time and Barr (1983) introduced Melanommatales to accommodate all taxa which have trabeculate pseudoparaphyses. The nature of trabeculate pseudoparaphyses was broadly discussed by Liew et al. (2000) and illustrated that they are generally 1 µm or thinner, clearly anastomose between the asci and are embedded in a gelatinous matrix. Subsequently, Barr (1990) introduced five genera in Melanommataceae (*Byssosphaeria*, *Keissleriella*, *Melanomma*, *Ostropella* and *Strickeria*) based on erumpent to superficial ascomata and thick-walled peridium. Over time, Melanommataceae has been transferred from Melanommatales to Pleosporales with the revolution of DNA-based molecular phylogenetic studies (Eriksson 2006; Wang et al. 2007; Zhang et al. 2012; Hyde et al. 2013; Tian et al. 2015; Hongsanan et al. 2020).

The species of Melanommataceae have cosmopolitan distribution worldwide in temperate, subtropical and tropical regions (Hyde et al. 2013; Tian et al. 2015; Jaklitsch and Voglmayr 2017; Kularathnage et al. 2022). They can play a vital role as saprobes, endophytes or hyperparasites and occur on twigs or bark of various woody plants in terrestrial, marine or freshwater habitats (Tian et al. 2015; Hashimoto et al. 2017; Tennakoon et al. 2018; Hongsanan et al. 2020; Gao et al. 2023). In addition, some species (e.g. *Seifertia alpina*) have been recorded as plant pathogens and cause bud blight or bud blast disease of *Rhododendron* species (Glawe and Hummel 2006; Li et al. 2016a). Interestingly, several species have also been reported from soil (e.g. *Herpotrichia gelasinosporoides*, *H. striatispora* and *Pleotrichocladium opacum*), on lichen species (e.g. *Aposphaeria ramalinae*) and on mushroom species (e.g. *Exosporiella fungorum* on *Thelephora* sp.) (Karsten 1892; Pitard and Harmand 1911).

The cosmopolitan nature of Melanommataceae is further supported by the numerous novel genera and species that have been introduced in the past years. Based on the year of introduction, we compiled the data and revealed that nine genera were introduced between 1800 and 1899 and nine more genera between 1900 and 1999. In addition, 18 genera were introduced between 2000 and 2024

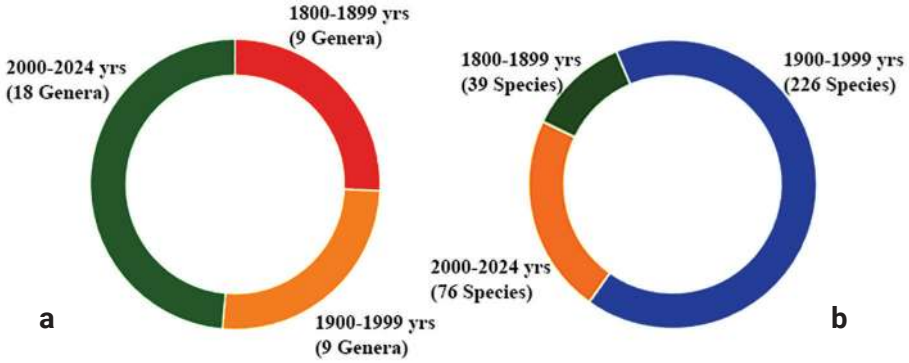

Figure 1. a The number of melanommataceous genera introduced in different time periods **b** the number of melanommataceous species introduced in different time periods (Source – MycoBank Database).

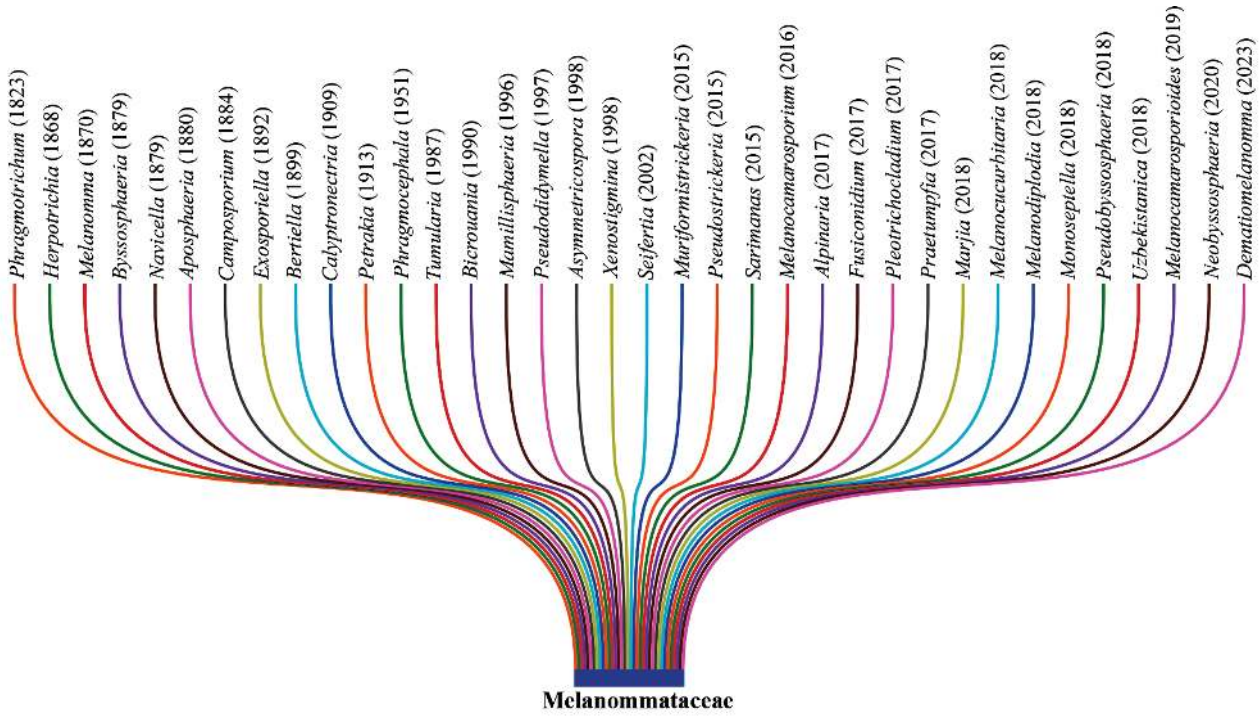

Figure 2. The melanommataceous genera introduced in different time periods (Source – MycoBank Database).

(Fig. 1). This rapid increase may be primarily due to the revolution in fungal taxonomical studies with DNA sequence-based molecular phylogenies in the last two decades. Interestingly, six genera were introduced in the year 2018, such as *Marjia*, *Melanocucurbitaria*, *Melanodiplodia*, *Monoseptella*, *Pseudobyssosphaeria* and *Uzbekistanica* (Fig. 2). Consequently, 36 genera are currently accepted in Melanommataceae, viz. *Alpinaria*, *Aposphaeria*, *Asymmetricospora*, *Bertiella*, *Bicrouania*, *Byssosphaeria*, *Calyptronectria*, *Camposporium*, *Dematiomelanomma*, *Exosporiella*, *Fusiconidium*, *Herpotrichia*, *Mamillisphaeria*, *Marjia*, *Melanocamarosporioides*, *Melanocamarosporium*, *Melanocucurbitaria*, *Melanodiplodia*, *Melanomma*, *Monoseptella*, *Muriformistrickeria*, *Navicella*, *Neobyssosphaeria*, *Petrakia*, *Phragmocephala*, *Phragmotrichum*, *Pleotrichocladium*, *Praetumpfia*, *Pseudobyssosphaeria*, *Pseudodidymella*, *Pseudostrickeria*, *Sarimanas*, *Seifertia*,

Tumularia, *Uzbekistanica* and *Xenostigmina* (Hongsanan et al. 2020; Gao et al. 2023). Conversely, the species discoveries are much higher during the 1900 and 1999 period (226 species) and thirty-nine species have been introduced between 1800 and 1899. However, despite having introduced 18 genera during the 2000–2024 period, only 76 species have been introduced (Fig. 1). Nevertheless, it could be much more in future with the extensive taxon samplings, particularly in poorly studied countries/regions, substrates and hosts.

We are exploring the fungal diversity of plant litter substrates with the aim of clarifying their taxonomy, based on morphology coupled with multi-gene phylogeny (Thambugala et al. 2017; Tennakoon et al. 2018, 2021, 2023; Wanasinghe et al. 2018). Thus, we have collected five taxa from China and Thailand which belong to the family Melanommataceae. The objectives of this study are to identify the melanommataceous taxa associated with plant litter using both morphological and phylogenetic approaches and to provide an updated checklist of species in Melanommataceae. This study provides a database on melanommataceous species for future studies, increases knowledge of fungal diversity and helps to understand their global distribution and host associations.

Materials and methods

Sample collection and examination

Fresh fungal specimens were collected from plant litter (dead wood and leaves) from Chiang Mai, Thailand and Kunming, China. The collected specimens were taken back to the laboratory in zip lock bags and paper envelopes. All the samples were subjected for an incubation period (one day) in plastic boxes lined with wet tissue paper. The micro- and macro-morphological characteristics were observed as described by Tennakoon et al. (2023). Sections of ascomata were taken manually and were mounted in distilled water. A stereomicroscope (AXIOSKOP 2 PLUS Series, Göttingen, Germany) was used to examine the surface morphological characteristics of fungal fruiting bodies. Micro-morphological characteristics, such as asci, ascospores and pseudoparaphyses were examined using Axioskop 2 Plus (Göttingen, Germany) compound microscope. Images were taken using Canon Axiocam 506 color digital camera (Hanover, Germany) fitted to a Axioskop 2 Plus (Göttingen, Germany) compound microscope. The micro morphological characteristics, such as colour, shape, height and diameter of ascomata, asci, ascospores, peridium and pseudoparaphyses were recorded. Indian ink was used to inspect the existence of the mucilaginous sheath in ascospores. The prepared slides were permanently preserved using lactoglycerol and sealed by applying nail-polish around the margins of cover slips. All measurements were obtained using Tarosoft (R) Image Framework application. Adobe Photoshop CS3 Extended version 10.0 software (Adobe Systems, USA) was used to construct the photo plates. Specimens were deposited in the Herbarium of Department of Biology (CMUB) and Sustainable Development of Biological Resources Laboratory (SDBR), Faculty of Science, Chiang Mai University and Herbarium of Fungi, Jiangxi Agricultural University (HFJAU), Nanchang, China. The Faces of Fungi (FOF) and Index Fungorum (IF) numbers were obtained for new species (*Byssosphaeria poaceicola* and *Herpotrichia zingiberacearum*) as mentioned in Jayasiri et al. (2015) and Index Fungorum (2024).

DNA extraction, PCR amplification and sequencing

Genomic DNA was extracted from fungal fruiting bodies on the natural substrate by using a DNA extraction kit (E.Z.N.A. ® Forensic DNA Kit, D3591-01, Omega BIO-TEK) following the manufacturer's protocol. DNA products were intended for use as a template for PCR and stored at 4 °C and the duplicates were kept at -20 °C for long-term storage. Four genomic regions were amplified, the internal transcribed spacer (ITS) region (ITS1-5.8S-ITS2), the 28S large subunit rDNA (LSU), 18S small subunit rDNA (SSU) and the translation elongation factor 1-alpha gene (*tef1-α*). The primers ITS4 and ITS5 were used to amplify the ITS (White et al. 1990), LR0R and LR5 primers for LSU (Vilgalys and Hester 1990), NS1 and NS4 for SSU (White et al. 1990) and EF1-983F and EF1-2218R primers for *tef1-α* (Rehner 2001). The amplification reactions were performed in a total reaction volume of 25 µl, which contained 9.5 µl of sterilised distilled water, 12.5 µl of 2 × Power Taq PCR MasterMix (a premix and ready to use solution, including 0.1 Units/µl Taq DNA Polymerase, 500 µM dNTP Mixture each (dATP, dCTP, dGTP, dTTP) (Bioteke Co., China), 1 µl of each forward and reverse primers (stock concentration 10 pM) and 1 µl of DNA template. The polymerase chain reaction (PCR) thermal cycle programmes for ITS, LSU, SSU and *tef1-α* genes amplification were adjusted as described in Tennakoon et al. (2022). To check the quality of PCR products, agarose gel electrophoresis (1%) was conducted. The purified PCR products were subjected for sequencing at Sangon Biotech (Shanghai) Co., Ltd, China. Generated sequences were deposited in GenBank and accession numbers were listed (Table 1).

Phylogenetic analyses

The obtained sequences were initially assembled (forward and reverse sequences) using SeqMan v. 7.0.0 (DNASTAR, Madison, WI). Assembled sequences were subjected to BLAST search in GenBank to obtain strains which have high similarities (https://blast.ncbi.nlm.nih.gov/). In addition, some other sequences for taxa in Melanommataceae were obtained using recent publications (Kularathnage et al. 2022; Gao et al. 2023). In total, 85 isolates were used for phylogenetic analyses including *Hysterium angustatum* (MFLU 16-1179) as the outgroup taxon. The combined dataset comprised four genes, ITS, LSU, SSU and *tef1-α*. Single gene sequences were aligned with MAFFT v.7.490 online application (Katoh and Standley 2013) (https://mafft.cbrc.jp/alignment/software/) and manually improved in necessary places. Aligned sequences were combined using BioEdit v.7.2.5 (Hall 1999).

The concatenated aligned dataset was analysed separately using Maximum Likelihood (ML) and Bayesian Inference (BI). Maximum Likelihood analysis was performed using the online portal CIPRES Science Gateway v. 3.3 (Miller et al. 2010), with RAxML-HPC v.8 on XSEDE (8.2.12) tool (Stamatakis et al. 2008; Stamatakis 2014) using the GTR+I+G model of nucleotide evolution. Evolutionary models for each barcode were determined using MrModelTest v. 2.3 (Nylander 2004) under the Akaike Information Criterion (AIC).

MrBayes 3.2.1 (Ronquist et al. 2012) was used to analyse Bayesian Inference phylogenies and was run with four chains of 3,000,000 generations and trees were sampled every 100th generation. The initial 20% of sampled data

Table 1. GenBank and culture collection accession numbers of species included in the phylogenetic study. The newly-generated sequences are shown in bold face.

Fungal Species	Strain/Voucher No.	GenBank Accession Number			
		ITS	LSU	SSU	*tef*–1α
Alpinaria rhododendri	KT 2520	LC203335	LC203360	LC203314	LC203388
Aposphaeria corallinolutea	MFLU 15-2752	KY554202	KY554197	KY554200	KY554205
A. corallinolutea	GLMC 1355	MT153708	MT156159	–	–
Bertiella ellipsoidea	MFLU 16-0583	KX765261	KX765262	–	–
B. ellipsoidea	MFLUCC 17-2015	MG543922	MG543913	–	–
B. fici	MFLUCC 20-0229	–	MW063223	MW079351	MW183786
B. fici	NCYUCC 19-0260	–	MW063224	MW079352	MW183787
B. fici	NCYUCC 19-0290	–	MW063225	MW079353	MW183788
B. fici	**CMUB 40045**	**–**	**PP460772**	**PP460764**	**PP475453**
B. macrospora	IL 5005	–	GU385150	–	–
B. macrospora	SMH 3953	–	–	–	GU327744
Beverwykella pulmonaria	CBS 283.53	KY189974	GU301804	–	–
Byssosphaeria diffusa	AFTOL ID 1588	–	DQ678071	DQ678019	DQ677915
By. diffusa	CBS 250.62	–	–	GU205239	–
By. jamaicana	SMH 1403	–	GU385152	–	GU327746
By. jamaicana	SMH 3085	–	GU385154	–	–
By. jamaicana	SMH 3464	–	GU385153	–	–
By. macarangae	MFLUCC 17-2655	MH389782	MH389778	MH389780	MH389784
By. musae	MFLUCC 11-0146	KP744435	KP744477	KP753947	MH581149
By. phoenicis	ZHKUCC 21-0122	ON180685	ON180683	ON180691	ON243583
By. phoenicis	ZHKUCC 21-0123	ON180686	ON180684	ON180692	ON243584
By. rhodomphala	SMH3086	–	GU385155	–	–
By. rhodomphala	ANM 942	–	GU385160	–	–
By. rhodomphala	SMH 3402	–	GU385170	–	–
By. rhodomphala	GKM L153N	–	GU385157	–	GU327747
By. salebrosa	SMH 2387	–	GU385162	–	GU327748
By. schiedermayeriana	SMH 1816	–	GU385159	–	–
By. schiedermayeriana	SMH 1269	–	GU385158	–	–
By. schiedermayeriana	SMH 3157	–	GU385163	–	GU327745
By. siamensis	MFLUCC 10-0099	–	KT289895	KT289897	–
By. siamensis	MFLUCC 17-1800	MG543923	MG543914	MG543917	–
By. siamensis	**HFJAU10336**	**PP460780**	**PP460773**	**PP460765**	**PP475454**
By. taiwanense	MFLUCC 17-2643	MH389783	MH389779	MH389781	MH389785
By. villosa	GKM 204 N	–	GU385151	–	GU327751
By. poaceicola	**HFJAU10337**	**PP460781**	**PP460774**	**PP460766**	**PP475455**
By. poaceicola	**HFJAU10338**	**PP460782**	**PP460775**	**PP460767**	**PP475456**
Fusiconidium aquaticum	KUMCC 15-0300	–	KX641894	KX641895	KX641896
F. mackenziei	MFLUCC 14-0434	–	KX611112	KX611114	KX611118
Herpotrichia herpotrichoides	GKM 212N	–	GU385169	–	–
H. herpotrichoides	SMH 5167	–	GU385175	–	–
H. macrotricha	GKM 196N	–	GU385176	–	GU327755
H. macrotricha	SMH 269	–	GU385177	–	–
H. macrotricha	SMH 269	–	GU385177	–	GU327756
H. vaginatispora	MFLUCC 13-0865		KT934252	KT934256	KT934260

Fungal Species	Strain/Voucher No.	GenBank Accession Number			
		ITS	LSU	SSU	*tef*–1α
H. xiaokongense	KUMCC 21-0004	–	MZ408889	MZ408891	MZ394066
H. zingiberacearum	**HFJAU10332**	**PP460783**	**PP460776**	**PP460768**	**PP475457**
H. zingiberacearum	**HFJAU10333**	**PP460784**	**PP460777**	**PP460769**	**PP475458**
H. zingiberacearum	**HFJAU10334**	**PP460785**	**PP460778**	**PP460770**	**PP475459**
Hysterium angustatum	MFLU 16-1179	KX611363	KX611364	KX611365	–
Marjia tianschanica	TASM 6120	MG828909	MG829019	MG829126	MG829206
M. tianschanica	TASM 6121	MG828910	MG829020	MG829127	MG829206
Marjia uzbekistanica	TASM 6122	MG828911	MG829021	MG829128	MG829208
Melanocucurbitaria uzbekistanica	MFLUCC 17-0829	MG828912	MG829022	MG829129	MG829209
Melanodiplodia tianschanica	TASM 6111	MG828914	MG829023	MG829130	MG829210
Me. tianschanica	TASM 6112	MG828915	MG829024	MG829131	MG829211
Me. tianschanica	MFLUCC 17-0805	MG828913	MG829025	MG829132	MG829212
Melanomma japonicum	KT 3425	LC203320	LC203338	LC203292	LC203367
Mel. populicola	CBS 543.70	NR_170056	NG_075164	NG_070237	–
Mel. populicola	CPC 27203	MT223817	MT223910	–	–
Mel. populicola	CBS 350 82	MT223815	JF740265	–	–
Mel. populicola	CBS 130330	–	JF740328	–	–
Mel. populicola	**HFJAU10335**	**PP460786**	**PP460779**	**PP460771**	**PP475460**
Mel. pulvis pyrius	KT 2110	LC203322	LC203340	LC203294	LC203368
Mel. pulvis pyrius	KT 2113	LC203323	LC203341	LC203295	LC203369
Mel. pulvis pyrius	AH 375	LC203324	LC203342	LC203296	LC203370
Mel. pulvis pyrius	KH 27	LC203325	LC203343	LC203297	LC203371
Mel. pulvis-pyrius	CBS 124080	MH863349	GU456323	GU456302	GU456265
Monoseptella rosae	MFLUCC 17-0815	MG828916	MG829026	MG829133	MG829213
Mo. rosae	TASM 6114	MG828917	MG829027	MG829134	MG829214
Mo. tuberculata	CBS 256.84	–	GU301851	–	GU349006
Muriformistrickeria rubi	MFLUCC 15-0681	–	KT934253	KT934257	KT934261
Petrakia irregularis	CBS 306.67	NR_164281	MH870670	–	–
Phragmocephala atra	MFLUCC 15-0021	KP698721	KP698725	KP698729	–
P. garethjonesii	MFLUCC 15-0018	KP698722	KP698726	KP698730	–
Pleotrichocladium opacum	CBS 450.70	MH859791	KY853524	–	–
Pl. opacum	CBS 709.92	KY853464	KY853526	–	–
Pseudostrickeria rosae	MFLUCC 17-0643	MG828954	MG829065	MG829169	MG829234
Ps. mutabilis	SMH 1541	–	GU385209	–	–
Sarimanas pseudofluviatile	KT 760	LC001717	LC001714	LC001711	–
S. shirakamiense	KT 3000	–	LC001715	LC001712	–
Seifertia azaleae	DAOM 239136	–	EU030276	–	–
Se. shangrilaensis	MFLUCC 16-0238	–	KU954100	KU954101	KU954102
Uzbekistanica rosae-hissaricae	MFLUCC 17-0819	MG828976	MG829087	MG829187	MG829242
U. rosae-hissaricae	MFLUCC 17-0820	GU269840	MG829088	MG829188	MG829243
Xenostigmina zilleri	CBS 115685	GU269840	GU253857	LC203316	GU384553

Abbreviations: ANM, A.N. Miller; AFTOL, Assembling the Fungal Tree of Life project; CBS, Centraalbureau voor Schimmelcultures, Utrecht, The Netherlands; CPC, Working collection of Pedro Crous housed at CBS; DAOM, Plant Research Institute, Department of Agriculture (Mycology), Ottawa, Canada; GLMC, culture collections of the Senckenberg Museum of Natural History Görlitz, Germany; GKM, G.K. Mugambi; IL, I. Lopez; KUMCC, Culture Collection of Chinese Academy of Sciences, Kunming, China; KH, K. Hirayama; KT, K. Tanaka; MFLU, Mae Fah Luang University; MFLUCC, Mae Fah Luang University Culture Collection; NCYUCC, National Chiayi University Culture Collection, China; SMH, S.M. Huhndorf; ZHKUCC, Zhongkai University of Agriculture and Engineering Culture Collection, China.

were discarded as burn-in. The phylograms were visualised using the FigTree v.1.4.0 tool (Rambaut 2012) and reorganised in Adobe Illustrator® CS3 (Version 15.0.0, Adobe®, San Jose, CA). The alignments and sequences were deposited in TreeBASE, submission ID: 31212 (http://www.treebase.org/) and GenBank (https://www.ncbi.nlm.nih.gov/), respectively.

Geographical distribution and host associations of melanommataceous species

We enumerated 340 species of Melanommataceae, grouped into 36 genera, along with their geographic distribution and host associations. The necessary data were obtained from published books, publications in reputable journals, Species Fungorum (https://www.speciesfungorum.org), MycoBank (https://www.mycobank.org/), the U.S. National Fungus Collections Fungus-Host Database (Farr and Rossman 2024) and online sources (Catalogue of Life Checklist). The gathered data were mentioned with appropriate references (Table 2). In total, 296 articles were studied for information on the 340 melanommataceous species that are currently legitimate (Table 2) and accessed through Google Scholar searches. MycoBank (https://www.mycobank.org/) was used to illustrate the nomenclature validity of the taxa. However, numerous species have not been verified using molecular data, so most species should be correctly identified, based on modern taxonomic concepts. Therefore, the distribution may vary slightly.

The distribution map was prepared using MapChart programme (https://www.mapchart.net/index.html), a platform from which a personalised map of the world using different colours can be generated. The Sankey diagram was created to show the species distribution through plant host families using the free online tool SankeyMATIC by Steve Bogart (www.sankeymatic.com).

Results

Phylogenetic analyses

Phylogenetic analyses of combined LSU, SSU, ITS and *tef1-α* sequences comprised 3480 characters including gaps. *Hysterium angustatum* (MFLU 16-1179) was used as the outgroup taxon. The RAxML analysis of the combined dataset yielded a best scoring tree (Fig. 3). The final ML optimisation likelihood value was -16620.192034. There were 35.32% undetermined characters or gaps and 1071 distinct alignment patterns. Estimated base frequencies were A = 0.247534, C = 0.235205, G = 0.272353, T = 0.244907; substitution rates AC = 1.775315, AG = 3.161447, AT = 1.766474, CG = 1.002405, CT = 11.511066, GT = 1.000; proportion of invariable sites I = 0.535605; gamma distribution shape parameter α = 0.513218. The Bayesian analysis has resulted in 30,000 trees after 3,000,000 generations. Bootstrap support values for ML higher than 70% and BYPP greater than 0.90 are given above each branch respectively (Fig. 3). All analyses (ML and BYPP) showed similar topologies and concurred with previous studies (Pem et al. 2019; Kularathnage et al. 2022; Gao et al. 2023).

According to the phylogeny, our collection HFJAU10336, HFJAU10337 and HFJAU10338 cluster within *Byssosphaeria* species. HFJAU10337 and

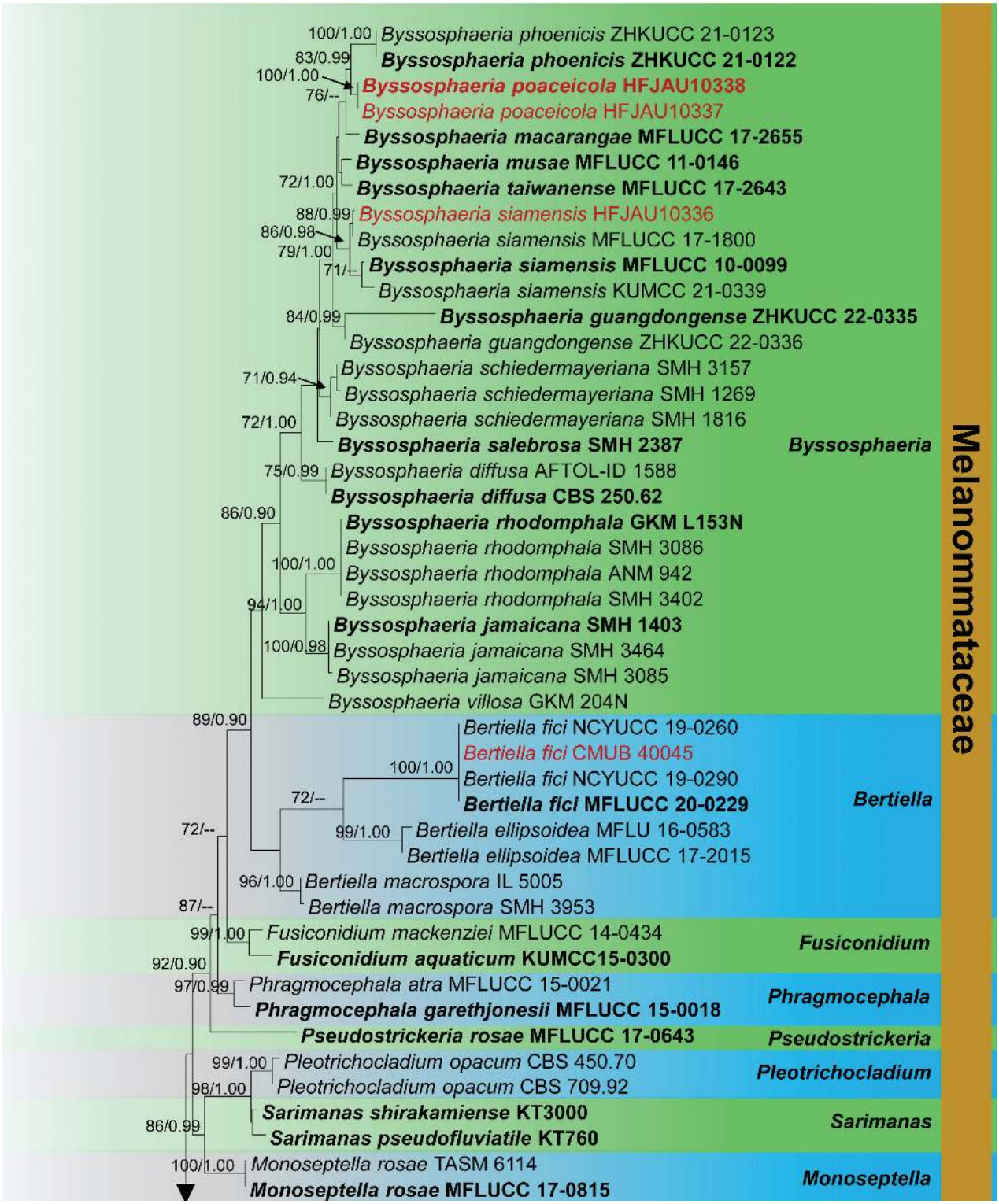

Figure 3. Phylogram generated from Maximum Likelihood analysis is based on combined LSU, SSU, ITS and *tef1-α* sequence data. The tree is rooted with *Hysterium angustatum* (MFLU 16-1179). The new isolates are in red and ex-type strains are indicated in bold face. Bootstrap support values ≥ 70% from the Maximum Likelihood (ML) and Bayesian Posterior Probabilities (BYPP) values ≥ 0.90 are given above the nodes, respectively.

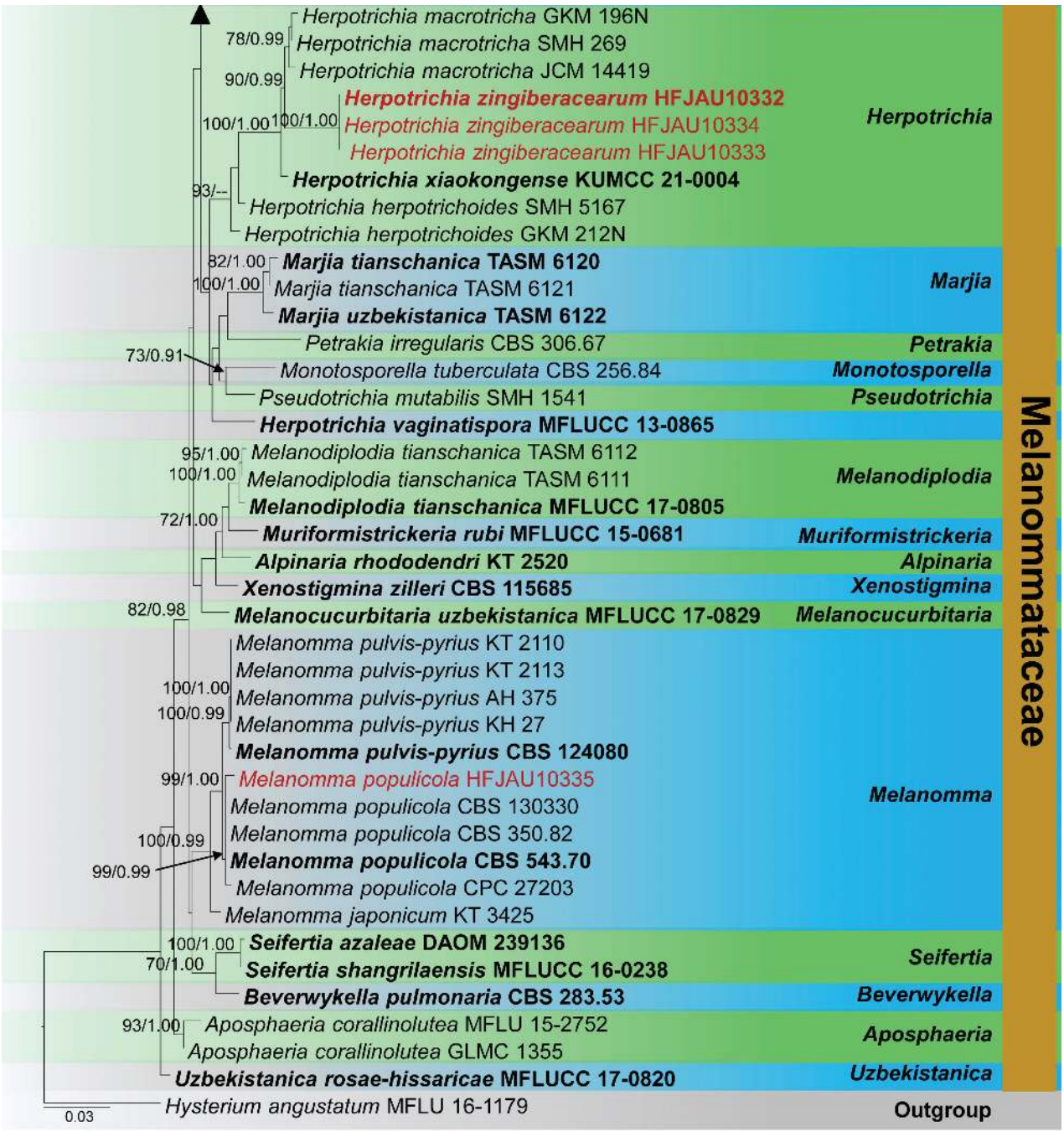

Figure 3. Continued.

HFJAU10338 cluster together and show an independent lineage, sister to *B. phoenicis* isolates (ZHKUCC 21-0122 and ZHKUCC 21-0123) with 83% ML and 0.99 BYPP statistical support. The isolate HFJAU10336 clusters with *B. siamensis* isolates (MFLUCC 10-0099, MFLUCC 17-1800 and KUMCC 21-0339) in a monophyletic clade. In addition, CBUB 40045 groups with *Bertiella fici* in a 100% ML and 1.00 BYPP supported clade. Three isolates (HFJAU10332, HFJAU10333 and HFJAU10334) cluster with *Herpotrichia* species, and show a close phylogenetic relationship with *H. melanotricha* (GKM 196N, SMH 269 and JCM 14419). As well as HFJAU10335 groups with *Melanomma populicola* (CBS 130330, CBS 350.82, CBS 543.70 and CPC 272203) in a 99% ML and 0.99 BYPP supported clade.

Table 2. Host association and geographical distribution of reported melanommataceous species.

Species	Host	Host family	Locality	References
Alpinaria rhododendri	*Rhododendron* sp.	Ericaceae	Austria and Japan	Hashimoto et al. (2017); Jaklitsch and Voglmayr (2017)
Aposphaeria allantella	*Solanum tuberosum*	Solanaceae	Germany	Farr and Rossman (2024)
Aposphaeria anomala	Unidentified host	–	Italy	Farr and Rossman (2024)
Aposphaeria arachidis	*Arachis hypogaea*	Fabaceae	India	Kulkarni (1974); Mathur (1979); Farr and Rossman (2024)
Aposphaeria bambusae	*Bambusa* sp.	Poaceae	Brazil	Bresadola (1926); Farr and Rossman (2024)
Aposphaeria bombacis	*Bombax macrocarpum*	Malvaceae	Germany	Diedicke (1912)
Aposphaeria brunneotincta	*Castanea vesca*	Fagaceae	The United States	Thaxter (1922)
Aposphaeria buddlejae	*Buddleja davidii*	Buddlejaceae	Ukraine	Farr and Rossman (2024)
Aposphaeria calligoni	*Calligonum aphyllum*	Polygonaceae	Kazakhstan	Farr and Rossman (2024)
Aposphaeria canavaliae	*Canavalia* sp.	Fabaceae	Fiji	Massee (1906); Dingley et al. (1981); Farr and Rossman (2024)
Aposphaeria caraganae	*Caragana arborescens*	Fabaceae	Russia	Farr and Rossman (2024)
Aposphaeria caricicola	*Carex rossii*	Cyperaceae	The United States	Farr and Rossman (2024)
Aposphaeria caulina	*Cerefolium sylvestre*	Apiaceae	Finland	Karsten (1905)
Aposphaeria charticola	–	–	The United States	Saccardo (1911)
Aposphaeria cladoniae	*Cladonia fimbriata*	Cladoniaceae	Germany	Allescher (1896)
Aposphaeria conica	*Quercus* sp.	Fagaceae	Italy	Saccardo and Traverso (1910)
Aposphaeria corallinolutea	*Fraxinus excelsior* and *Kerria japonica*	Oleaceae and Rosaceae	The Netherlands	De Gruyter et al. (2013)
Aposphaeria dendrophomoides	*Corylus avellana*	Betulaceae	Italy	Saccardo (1921)
Aposphaeria denudata	*Cydonia vulgaris*	Rosaceae	Hungary	Saccardo and Traverso (1910)
Aposphaeria desertorum	*Haloxylon aphyllum*	Amaranthaceae	Kazakhstan	Farr and Rossman (2024)
Aposphaeria elymi	*Elymus arenarius*	Poaceae	Germany	Diedicke (1912)
Aposphaeria ephedrae	*Ephedra* sp.	Ephedraceae	Kazakhstan and Ukraine	Hayova and Minter (2009); Farr and Rossman (2024)
Aposphaeria epicorticalis	*Corylus avellana*	Betulaceae	Italy	Saccardo (1921)
Aposphaeria eragrostidis	*Eragrostis* sp.	Poaceae	Eritrea, Ethiopia and Iraq	Castellani and Ciferri (1950); Farr and Rossman (2024)
Aposphaeria eurotiae	*Eurotia eversmanniana*	Amaranthaceae	Kazakhstan	Farr and Rossman (2024)
Aposphaeria ferrum-equinum	Unidentified host	–	Italy	Tassi (1900)
Aposphaeria freticola	*Fagus* sp. and *Nothofagus antarctica*	Fagaceae, Nothofagaceae	Argentina, Chile and Poland	Farr (1973); Mulenko et al. (2008); Farr and Rossman (2024)
Aposphaeria gallicola	Unidentified host	–	Italy	Farr and Rossman (2024)
Aposphaeria gregaria	*Salix* sp.	Salicaceae	Germany	Diedicke (1912)
Aposphaeria halimodendri	*Halimodendron halodendron*	Fabaceae	Ukraine	Farr and Rossman (2024)
Aposphaeria haloxyli	*Haloxylon aphyllum*	Amaranthaceae	Kazakhstan	Farr and Rossman (2024)
Aposphaeria hapalophragmii	*Hapalophragmium acaciae*	Fabaceae	Somalia	Trotter (1931); Mujica and Vergara (1945); Farr and Rossman (2024)

Species	Host	Host family	Locality	References
Aposphaeria henryana	*Salix alba*	Salicaceae	Italy	Farr and Rossman (2024)
Aposphaeria heveae	*Hevea brasiliensis*	Euphorbiaceae	Sri Lanka	Petch (1917)
Aposphaeria hippuridis	*Hippuris vulgaris*	Plantaginaceae	Germany	Ade (1923)
Aposphaeria hospitae	*Kleinhovia* sp.	Malvaceae	Sri Lanka	Tassi (1900)
Aposphaeria humicola	Unidentified host	–	The Netherlands	Oudemans (1902)
Aposphaeria ilicis	*Ilex aquifolium*	Aquifoliaceae	Germany	Diedicke (1912)
Aposphaeria iliensis	*Halimodendron halodendron*	Fabaceae	Kazakhstan	Farr and Rossman (2024)
Aposphaeria jubaeae	*Jubaea spectabilis*	Arecaceae	Chile	Spegazzini (1921); Farr (1973); Mujica and Vergara (1945); Farr and Rossman (2024)
Aposphaeria kiefferiana	*Quercus* sp.	Fagaceae	Italy	Farr and Rossman (2024)
Aposphaeria kravtzevii	*Eurotia eversmanniana*	Amaranthaceae	Kazakhstan	Farr and Rossman (2024)
Aposphaeria lentisci	*Pistacia* sp.	Anacardiaceae	Greece and Spain	Urries (1957); Pantidou (1973); Farr and Rossman (2024)
Aposphaeria lignicola	*Acacia arabica*	Fabaceae	Pakistan	Ahmad (1964)
Aposphaeria major	*Rubus parviflorus*	Rosaceae	The United States	Sydow and Sydow (1907)
Aposphaeria majuscula	*Vitis vinifera*	Vitaceae	France	Saccardo and Trotter (1913)
Aposphaeria martinii	*Sabal* sp.	Arecaceae	United States	Farr and Rossman (2024)
Aposphaeria mediella	*Pinus* sp.	Pinaceae	Greece, Finland and Poland	Karsten (1884); Pantidou (1973); Mulenko et al. (2008); Farr and Rossman (2024)
Aposphaeria melaleucae	*Melaleuca leucadendra*	Myrtaceae	Australia	Hennings (1903); Shivas and Alcorn (1996); Farr and Rossman (2024)
Aposphaeria mesembryanthemi	*Mesembryanthemum* sp.	Aizoaceae	Portugal	Costa and Camara (1952)
Aposphaeria mojunkumica	*Haloxylon aphyllum*	Amaranthaceae	Kazakhstan	Farr and Rossman (2024)
Aposphaeria montbretiae	*Crocosmia* sp.	Iridaceae	Azerbaijan and Georgia	Siemaszko (1923)
Aposphaeria musarum	*Musa sapientum*	Musaceae	Argentina	Farr (1973); Farr and Rossman (2024)
Aposphaeria nigra	*Betula alba*	Betulaceae	Germany	Diedicke (1912)
Aposphaeria oxalidis	*Oxalis tuberosa*	Oxalidaceae	Bolivia	Farr and Stevenson (1963); Farr and Rossman (2024)
Aposphaeria pakistanica	Unidentified host	–	Pakistan	Ahmad (1971)
Aposphaeria phellodendri	*Phellodendron amurense*	Rutaceae	Ukraine	Farr and Rossman (2024)
Aposphaeria pinea	*Pinus sylvestris*	Pinaceae	France and Germany	Saccardo (1884); Mulenko et al. (2008); Farr and Rossman (2024)
Aposphaeria pini-densiflorae	*Pinus densiflora*	Pinaceae	Japan	Sawada (1950); Farr and Rossman (2024)
Aposphaeria polonica	*Tilia platyphyllos*	Pinaceae	Poland	Mulenko et al. (2008); Farr and Rossman (2024)
Aposphaeria populea	*Populus* sp.	Salicaceae	The United Kingdom	Smith and Ramsbottom (1914); Dennis (1986)
Aposphaeria pulviscula	*Fagus sylvatica* and *Salix* sp.	Fagaceae and Salicaceae	Austria, France, Iceland, Italy, the Netherlands and Ukraine	Saccardo (1880); Spaulding (1961); Sutton (1980); Farr and Rossman (2024)

Species	Host	Host family	Locality	References
Aposphaeria punicina	*Punica granatum*	Lythraceae	China and Malta	Saccardo (1915); Tai (1979)
Aposphaeria purpurascens	*Acer pseudoplatanus*	Sapindaceae	Italy	Peyronel (1915)
Aposphaeria ramalinae	*Ramalina* sp. (lichen)	–	France	Pitard and Harmand (1911)
Aposphaeria reaumuriae	*Reaumuria* sp.	Tamaricaceae	Azerbaijan	Farr and Rossman (2024)
Aposphaeria rhois	*Rhus oxyacantha*	Anacardiaceae	Libya	El-Buni and Rattan (1981); Trotter (1912)
Aposphaeria rostrata	Unidentified host	–	The Netherlands	Oudemans (1902)
Aposphaeria rubefaciens	*Salix* sp.	Salicaceae	Italy and the Netherlands	Bubák and Kabát (1905)
Aposphaeria rudis	*Picea excelsa*	Pinaceae	Finland	Karsten (1905)
Aposphaeria salicis	*Salix* sp.	Salicaceae	Germany and India	Diedicke (1912); Mathur (1979)
Aposphaeria salicum	*Salix viminalis*	Salicaceae	Germany	Sydow and Sydow (1903)
Aposphaeria santolinae	*Santolina chamaecyparissus*	Asteraceae	Ukraine	Farr and Rossman (2024)
Aposphaeria sepulta	*Citrus aurantium*	Rutaceae	Italy	Saccardo (1884)
Aposphaeria sequoiae	*Sequoia* sp.	Cupressaceae	Denmark	Lind (1913)
Aposphaeria silenes	*Silene otites*	Caryophyllaceae	Russia	Farr and Rossman (2024)
Aposphaeria sphaerospora	*Betula alba*	Betulaceae	Italy	Peyronel (1918)
Aposphaeria striolata	*Populus deltoides*	Salicaceae	The United States	Saccardo (1916)
Aposphaeria taquarae	Bambusoideae sp.	Poaceae	Brazil	Viégas (1945)
Aposphaeria tiliana	*Tilia cordata*	Malvaceae	Ukraine	Gucevic (1977)
Aposphaeria tragopogonis	*Tragopogon dubius*	Asteraceae	Romania	Sandu-Ville and Mititiuc (1971)
Aposphaeria turmalis	*Diospyros virginiana*	Ebenaceae	The United States	Ellis and Everhart (1902); Cash (1952)
Aposphaeria ulmicola	*Ulmus* sp.	Ulmaceae	The United Kingdom	Saccardo (1884)
Aposphaeria zeae	*Zea mays*	Poaceae	Azerbaijan and Georgia	Farr and Rossman (2024)
Asymmetricospora calamicola	*Calamus caryotoides*	Arecaceae	Australia	Fröhlich and Hyde (1998); Zhang et al. (2012)
Bertiella botryosa	*Ulmus* sp.	Ulmaceae	The United States	Morgan (1904)
Bertiella ellipsoidea	Unidentified host	–	Thailand	Hyde et al. (2016)
Bertiella fici	*Cinnamomum verum*, *Ficus septica*	Lauraceae, Moraceae	China and Thailand	Tennakoon et al. (2021); this study
Bertiella gelatinosa	Unidentified host	–	Brazil	Almeida et al. (2017)
Bertiella rhodospila	*Cyrilla* sp., *Populus* sp. and *Quercus* sp.	Cyrillaceae, Fagaceae and Salicaea	The United States	Barr et al. (1986)
Bertiella striatispora	Unidentified host	–	India	Niranjan and Sarma (2019)
Bicrouania maritima	*Atraphaxis spinosa* and *Halimione portulacoides*	Amaranthaceae, Polygonaceae	France and Uzbekistan	Kohlmeyer and Volkmann-Kohlmeyer (1990); Gafforov (2017)
Byssosphaeria alnea	*Alnus* sp.	Betulaceae	The United States	Barr (1984); Farr and Rossman (2024)
Byssosphaeria erumpens	*Litsea* sp.	Lauraceae	China	Chen and Hsieh (2004); Li and Zhuang (2008); Farr and Rossman (2024)

Species	Host	Host family	Locality	References
Byssosphaeria erythrinae	*Erythrina indica*	Fabaceae	France	Barr (1984)
Byssosphaeria guangdongense	*Phoenix roebelenii*	Arecaceae	China	Xiong et al. (2023)
Byssosphaeria hainanensis	Unidentified host	–	China	Li and Zhuang (2008)
Byssosphaeria jamaicana	*Bambusa* sp., *Quercus* sp. and *Salix* sp.	Fagaceae and Poaceae, Salicaceae	China, Czech Republic, Jamaica and Mexico	Barr (1984); Sivanesan and Hsieh (1989); Wang et al. (2004); Medel (2007); Farr and Rossman (2024)
Byssosphaeria juniperi	*Juniperus* sp.	Cupressaceae	The United States	Wang et al. (2004); Farr and Rossman (2024)
Byssosphaeria macarangae	*Macaranga tanarius*	Euphorbiaceae	China	Tennakoon et al. (2018)
Byssosphaeria musae	*Musa* sp.	Musaceae	Thailand	Liu et al. (2015); Farr and Rossman (2024)
Byssosphaeria oviformis	*Saccharum arundinaceum*	Poaceae	China and Jamaica	Barr (1984); Lu et al. (2000); Wong and Hyde (2001); Farr and Rossman (2024)
Byssosphaeria phoenicis	*Phoenix roebelenii*	Arecaceae	China	Kularathnage et al. (2022)
Byssosphaeria poaceicola	*Arundo pliniana*	Poaceae	China	This study
Byssosphaeria rhodomphala	*Acer pseudoplatanus* and *Populus* sp.	Salicaceae and Sapindaceae	Brazil, China, Poland and the United States	Cooke (1887); Scheuer and Chlebicki (1997); Reblova (1997); Chen and Hsieh (2004); Wang et al. (2004)
Byssosphaeria salebrosa	*Vaccinium* sp.	Ericaceae	The United States	Barr (1984); Barr et al. (1986); Farr and Rossman (2024)
Byssosphaeria schiedermayriana	*Sambucus nigra*	Adoxaceae	Austria	Barr (1984)
Byssosphaeria semen	*Pyrus americana*	Rosaceae	The United States	Barr (1984)
Byssosphaeria siamensis	*Pandanus* sp. and *Citrus trifoliata*	Pandanaceae and Rutaceae	China and Thailand	Tian et al. (2015); Hyde et al. (2018); Farr and Rossman (2024); this study
Byssosphaeria taiwanense	*Macaranga tanarius*	Euphorbiaceae	China	Tennakoon et al. (2018)
Byssosphaeria xestothele	*Cornus florida* and *Robinia pseudoacacia*	Cornaceae and Fabaceae	Sweden and the United States	Barr (1984); Eriksson (2014); Farr and Rossman (2024)
Calyptronectria argentinensis	*Foeniculum piperitum* and *Manihot carthaginensis*	Apiaceae, Euphorbiaceae	Argentina	Spegazzini (1909); Farr (1973); Farr and Rossman (2024)
Calyptronectria indica	*Annona squamosa*	Annonaceae	India	Pande (2008)
Calyptronectria platensis	*Manihot carthagenensis*	Euphorbiaceae	Argentina	Spegazzini (1909); Farr (1973); Farr and Rossman (2024)
Camposporium antennatum	*Acacia aulacocarpa*, *Caesalpinia echinata*, *Cinnamomum japonicum*, *Cocos nucifera*, *Drymophloeus pachycladus*, *Eucalyptus globulus*, *Ficus erecta*, *Laurus nobilis*, *Machilus* sp., *Mucuna ferruginea*, *Neolitsea scrobiculata*, *Phoenix hanceana*, *Pinus massoniana*, *Quercus* sp. and *Trachycarpus fortunei*	Arecaceae, Fabaceae, Fagaceae, Lauraceae, Moraceae, Myrtaceae, and Pinaceae	California, China, the United Kingdom and Venezuela	Harkness (1884); Lu et al. (2000); Castaneda-Ruiz et al. (2003); Farr and Rossman (2024)
Camposporium appendiculatum	Unidentified host	–	China	Hyde et al. (2020)

Species	Host	Host family	Locality	References
Camposporium atypicum	*Mesua ferrea*	Calophyllaceae	India	Koukol and Delgado (2021)
Camposporium cambrense	*Alnus* sp., *Carpinus betulus*, *Fagus* sp., *Freycinetia anksia*, *Laurus nobilis* and *Quercus* sp.	Betulaceae, Fagaceae, Lauraceae, and Pandanaceae	China, New Zealand, Poland, Russia and the United Kingdom	Hughes (1951); Whitton et al. (2002); Mulenko et al. (2008); Farr and Rossman (2024)
Camposporium chinense	Unidentified host	–	China	Xu et al. (2021)
Camposporium dulciaquae	Unidentified host	–	Thailand	Calabon et al. (2021)
Camposporium fusisporum	*Pandanus* sp.	Pandanaceae	Brunei	Whitton et al. (2002)
Camposporium himalayanum	*Phoenix* sp.	Arecaceae	India	Adamcik et al. (2015)
Camposporium hyalinum	*Elaeagnus macrophylla*, and *Fagus* sp.	Elaeagnaceae and Fagaceae	The United Kingdom	Abdullah (1980); Kirk and Spooner (1984)
Camposporium hyderabadense	*Borassus flabellifer*, *Machilus thunbergii* and *Mucuna ferruginea*	Arecaceae, Fabaceae, and Lauraceae	China, India and Japan	Rao and Rao (1964); Ichinoe (1971); Farr and Rossman (2024)
Camposporium indicum	*Borassus flabellifer*	Arecaceae	India	Rao and Rao (1964)
Camposporium japonicum	*Acacia confusa*, *Betula pendula*, *Cinnamomum japonicum*, *Freycinetia arborea*, *Litchi chinensis*, *Machilus thunbergii*, *Mucuna ferruginea*, *Paulownia kawakamii* and *Quercus* sp.	Betulaceae, Lauraceae, Pandanaceae, Paulowniaceae, and Sapindaceae	China and Japan	Ichinoe (1971); Matsushima (1980); Farr and Rossman (2024)
Camposporium laundonii	*Aralia elata*, *Pasania edulis* and *Rosa* sp.	Araliaceae, Fagaceae, and Rosaceae	Japan and New Zealand	Ellis (1976); Watanabe (1993); Farr and Rossman (2024)
Camposporium lycopodiellae	*Lycopodiella inundata*	Lycopodiaceae	Germany	Hyde et al. (2020)
Camposporium marylandicum	Unidentified host	–	The United States	Shearer (1974)
Camposporium microsporum	*Borassus flabellifer*	Arecaceae	India	Rao and Rao (1964)
Camposporium multiseptatum	Unidentified host	–	China	Hyde et al. (2020)
Camposporium ontariense	*Acer saccharum* and *Freycinetia arborea*	Sapindaceae and Pandanaceae	Canada and the United States	Matsushima (1983); Whitton et al. (2002)
Camposporium pellucidum	*Betula pendula*, *Caesalpinia echinata*, *Carpodetus serratus*, *Elaeagnus* sp., *Fagus* sp., *Laurus* sp., *Pasania glabra*, *Picea abies*, *Rhopalostylis* sp. and *Sorbus aucuparia*	Areceae, Betulaceae, Elaeagnaceae, Fabaceae, Lauraceae, Pinaceae, Rosaceae, and Rousseaceae	Brazil, Japan, Poland, New Zealand, Russia and the United Kingdom	Hughes (1951); Matsushima (1983); Mulenko et al. (2008); Farr and Rossman (2024)
Camposporium quercicola	*Quercus germana*	Fagaceae	Mexico	Mercado Sierra et al. (1995)
Camposporium ramosum	*Freycinetia* sp.		Australia and the United States	Whitton et al. (2002)
Camposporium scolecosporium	Unidentified host	–	Papua New Guinea	Kobayasi (1971)
Camposporium septatum	Unidentified host	–	Thailand	Hyde et al. (2020)
Camposporium valdivianum	*Sophora microphylla*	Fabaceae	The United States	Koukol and Delgado (2021)

Species	Host	Host family	Locality	References
Camposporium verruculosum	*Clematis vitalba*	Ranunculaceae	Italy	Koukol and Delgado (2021)
Dematiomelanomma yunnanense	*Hypericum monogynum* and *Rubus parvifolius*	Hypericaceae and Rosaceae	China	Gao et al. (2023)
Exosporiella fungorum	*Thelephora* sp. (leathery earthfans/ mushroom sp.)	–	Sweden	Karsten (1892)
Fusiconidium mackenziei	*Clematis vitalba*	Ranunculaceae	Italy	Li et al. (2017)
Herpotrichia alligata	*Opuntia* sp.	Cactaceae	Sweden and the United States	Barr (1992); Farr and Rossman (2024)
Herpotrichia alpincola	*Aconitum* sp.	Ranunculaceae	Hungary and Slovakia	Rehm (1906)
Herpotrichia arizonica	*Carnegiea gigantea*	Cactaceae	The United States	Barr (1992); Farr and Rossman (2024)
Herpotrichia australis	*Sclerocarya caffra*	Anacardiaceae	South Africa	Bose (1961)
Herpotrichia bakeri	*Sambucus javanica*	Viburnaceae	Philippines	Teodoro (1937); Farr and Rossman (2024)
Herpotrichia bambusana	*Bambusa vulgaris*	Poaceae	Brazil	Hennings (1908); Eriksson and Yue (1998)
Herpotrichia boldoae	*Boldea fragrans* and *Peumus boldus*	Monimiaceae	Chile	Spegazzini (1910); Mujica and Vergara (1945); Spaulding (1961); Farr (1973); Farr and Rossman (2024)
Herpotrichia brasiliensis	Unidentified host	–	Brazil	Rick (1933)
Herpotrichia brenckleana	*Urtica gracilis*	Urticaceae	Sweden	Eriksson (2014); Farr and Rossman (2024
Herpotrichia caesalpiniae	*Caesalpinia sepiaria*	Fabaceae	South Africa	Doidge (1948); Sivanesan (1971)
Herpotrichia calamicola	*Calamus caryotoides*	Arecaceae	Australia	Fröhlich and Hyde (2000); Farr and Rossman (2024)
Herpotrichia callimorpha	*Chamaenerion angustifolium*, *Salix* sp. and *Xanthophyllum flavescens*	Onagraceae, Polygalaceae, and Salicaceae	Denmark and India	Munk (1957); Rabenhorst (1869); Pande (2008); Farr and Rossman (2024)
Herpotrichia caulogena	*Silene nutans*	Caryophyllaceae	Luxembourg	Feltgen (1903)
Herpotrichia chilensis	*Proustia pungens*	Asteraceae	Chile	Feltgen (1903); Farr (1973); Farr and Rossman (2024)
Herpotrichia cirrhostoma	Unidentified host	–	Sri Lanka	Berkeley and Broome (1873); Petch (1912)
Herpotrichia dalisayi	Unidentified host	–	The Philippines	Hyde and Aptroot (1998)
Herpotrichia decidua	Unidentified host	–	The United States	Barr (1992); Farr and Rossman (2024)
Herpotrichia detzneriae	*Detzneria tubata*	Plantaginaceae	Papua New Guinea	Kobayasi (1971); Shaw (1984); Farr and Rossman (2024)
Herpotrichia diffusa	*Juglans cinerea* and *Populus* sp.	Juglandaceae	Palestine and the United States	Ellis and Everhart (1892); Ellis (1895)
Herpotrichia ellisii	*Abies* sp.	Pinaceae	Canada	Barr (1992); Farr and Rossman (2024)
Herpotrichia ephedrae	*Ephedra distachya*	Ephedraceae	France	Kuhnholtz-Lordat and Barry (1949)
Herpotrichia fusispora	Unidentified host	–	China	Chen and Hsieh (2004); Farr and Rossman (2024)
Herpotrichia gelasinosporoides	Soil	–	India	Von Arx (1981)
Herpotrichia henkeliana	*Phragmites communis*	Poaceae	Germany	Sydow and Sydow (1921)

Species	Host	Host family	Locality	References
Herpotrichia herbarum	*Achillea millefolium*	Asteraceae		Wehmeyer (1952); Barr (1992)
Herpotrichia herpotrichoides	*Carya* sp., *Epilobium* sp., *Rhododendron hirsutum*, *Ribes* sp. and *Rubus* sp.	Ericaceae, Juglandaceae, Grossulariaceae, Onagraceae, and Rosaceae	Austria, Denmark, Germany, Poland, the United States and the United Kingdom	Cannon (1982); Barr (1984); Cannon et al. (1985); Mulenko et al. (2008); Zhang et al. (2012); Tian et al. (2015); Farr and Rossman (2024)
Herpotrichia hippocrateae	*Hippocratea grahamii*	Celastraceae	India	Tilak and Talde (1975); Pande (2008)
Herpotrichia indica	*Duranta plumieri*	Verbenaceae	India	Anahosur (1970); Pande (2008); Farr and Rossman (2024)
Herpotrichia laricina	*Larix decidua*	Pinaceae	Luxembourg	Feltgen (1901)
Herpotrichia leptospora	Unidentified host	–	–	Kirschstein (1911)
Herpotrichia lignicola	Unidentified host	–	Belgium	Bose (1961)
Herpotrichia macrotricha	*Acer spicatum*, *Agropyron repens*, *Agrostis alba*, *Arundinaria* sp., *Carex* sp., *Cocos nucifera*, *Eupatorium formosanum*, *Fagus sylvatica*, *Fraxinus* sp., *Rubus* sp. and *Solidago* sp.	Arecaceae, Asteraceae, Cupressaceae, Cyperaceae, Fagaceae, Oleaceae, Poaceae, Rosaceae, and Sapindaceae	China, India, the United Kingdom and the United States	Dennis (1978); Saccardo (1883); Barr (1968, 1984); Pande (2008); Chen and Hsieh (2004); Farr and Rossman (2024)
Herpotrichia mangrovei	Unidentified host	–	China	Jones and Vrijmoed (2003)
Herpotrichia melanotricha	*Hevea brasiliensis*	Euphorbiaceae	Congo	Saccas (1954)
Herpotrichia millettiae	*Millettia* sp.	Fabaceae	Malaysia	Sivanesan (1971)
Herpotrichia monospermatis	*Butea monosperma*	Fabaceae	India	Pande (2008); Farr and Rossman (2024)
Herpotrichia mulleri	*Artemisia nilagirica* and *Butea monosperma*	Asteraceae, Fabaceae	India	Pande (2008); Farr and Rossman (2024)
Herpotrichia myriangii	*Carica papaya*	Caricaceae	Java	Raciborski (1909)
Herpotrichia nectrioides	Melastomataceae sp.	Melastomataceae	Brazil	Rehm (1901)
Herpotrichia nigra	*Abies* sp., *Calocedrus decurrens*, *Cedrus libani*, *Chamaecyparis nootkatensis*, *Juniperus* sp., *Phyllodoce* sp., *Picea* sp., *Pinus* sp., *Pseudotsuga menziesii* and *Rhododendron* sp.	Cupressaceae, Ericaceae, and Pinaceae	Austria, Canada, France, Germany, Italy, Norway, Poland, Switzerland, Turkey, Ukraine and the United States	Shaw (1973); Ginns (1986); French (1989); Farr and Rossman (2024)
Herpotrichia nigrotuberculata	*Elaeis guineensis* and *Phyllostachys reticulata*	Arecaceae and Poaceae	Japan and Tanzania	Pirozynski (1972); Farr and Rossman (2024)
Herpotrichia nypicola	*Nypa fruticans*	Arecaceae	Malaysia	Hyde et al. (1999); Farr and Rossman (2024)
Herpotrichia occulta	*Eucalyptus* sp.	Myrtaceae	Brazil	Rick (1933)
Herpotrichia ochrostoma	*Fraxinus excelsior*	Oleaceae	Luxembourg	Feltgen (1903)
Herpotrichia palmicola	*Calamus caryotoides*, *Daemonorops* sp. and *Licuala ramsayi*	Arecaceae	Australia and China	Hyde et al. (1999); Fröhlich and Hyde 2000; Zhuang (2001); Farr and Rossman (2024)
Herpotrichia pandei	*Saccharum spontaneum*	Poaceae	India	Bose (1961)
Herpotrichia petrakiana	*Fagus sylvatica*	Fagaceae	–	Bose (1961)

Species	Host	Host family	Locality	References
Herpotrichia philippinensis	*Alstonia scholaris*	Apocynaceae	The Philippines	Rehm (1914); Teodoro (1937); Farr and Rossman (2024)
Herpotrichia pinetorum	*Herpotrichia pinetorum*	Pinaceae	Austria and India	Winter (1885); Mueller (1958); Petrak (1962); Farr and Rossman (2024)
Herpotrichia quinqueseptata	*Abies lasiocarpa*, *Larix europaea*, *Picea* sp. and *Populus tremula*	Pinaceae and Salicaceae	Canada, Czech Republic, Germany, Sweden and the United States	Shaw (1973); Minter (1981); Ginns (1986); Eriksson (2014); Farr and Rossman (2024)
Herpotrichia rara	*Tanacetum vulgare*	Asteraceae	Germany	Kirschstein (1935)
Herpotrichia rhenana	*Epilobium angustifolium*, *Rhododendron hirsutum* and *Ribes* sp.	Ericaceae, Grossulariaceae, and Onagraceae	Austria and the United States	Fuckel (1870); Remler (1979); Farr and Rossman (2024)
Herpotrichia rhodospiloides	*Populus deltoides*	Salicaceae	The United States	Peck (1909)
Herpotrichia rhodosticta	*Carex paniculata* and *Populus* sp.	Cyperaceae and Salicaceae	Germany and the United States	Saccardo (1882); Samuels (1976); Farr and Rossman (2024)
Herpotrichia setosa	*Betula glandulosa* and *Myrica gale*	Betulaceae and Myricaceae	Canada and Ireland	Barr (1992); Farr and Rossman (2024)
Herpotrichia striatispora	Soil	–	South Africa	Papendorf and Arx (1966)
Herpotrichia symphoricarpi	*Symphoricarpos* sp.	Caprifoliaceae	The United States	Barr (1984); Farr and Rossman (2024)
Herpotrichia tenuispora	*Urtica dioica*	Urticaceae	Germany	Kirschstein (1906)
Herpotrichia vaginatispora	*Trifolium* sp.	Fabaceae	Italy	Tian et al. (2015)
Herpotrichia villosa	Unidentified host	–	Brazil	Samuels and Müller (1978)
Herpotrichia xiaokongensis	*Prunus* sp.	Rosaceae	China	Hyde et al. (2021)
Herpotrichia zingiberacearum	*Hedychium coronarium*	Zingiberaceae	China	This study
Mamillisphaeria dimorphospora	Unidentified host	–	Australia	Hyde et al. (1996)
Marjia tianshanica	*Cerasus tianshanica*	Rosaceae	Uzbekistan	Wanasinghe et al. (2018)
Marjia uzbekistanica	*Rosa* sp.	Rosaceae	Uzbekistan	Wanasinghe et al. (2018)
Melanocamarosporioides ugamica	*Lonicera altmannii*	Caprifoliaceae	Uzbekistan	Pem et al. (2019)
Melanocamarosporium galiicola	*Galium* sp.	Rubiaceae	Italy	Wijayawardene et al. (2016)
Melanocucurbitaria uzbekistanica	*Acer pubescens*	Sapindaceae	Uzbekistan	Wanasinghe et al. (2018)
Melanodiplodia tianschanica	*Rosa* sp.	Rosaceae	Uzbekistan	Wanasinghe et al. (2018)
Melanomma acanthophilum	*Cereus quisco*	Cactaceae	Chile	Spegazzini (1923); Farr (1973); Farr and Rossman (2024)
Melanomma afflatum	Unidentified host	–	The United States	Shear (1941)
Melanomma anceps	Unidentified host	–	Jawa	Höhnel (1909)
Melanomma andinum	*Bulnesia retamo*	Zygophyllaceae	Argentina	Spegazzini (1909); Farr (1973); Farr and Rossman (2024)
Melanomma artemisiae-maritimae	*Artemisia maritima*	Asteraceae	Russia	Lobik (1927); Farr and Rossman (2024)
Melanomma aspegrenii	*Carpinus betulus*, *Cornus* sp. and *Fagus sylvatica*	Betulaceae, Cornaceae, and Fagaceae	Poland	Fuckel (1870); Mulenko et al. (2008); Farr and Rossman (2024)

Species	Host	Host family	Locality	References
Melanomma aurantiicola	*Citrus* sp.	Rutaceae	Paraguay	Spegazzini (1920); Farr (1973); Farr and Rossman (2024)
Melanomma aurantiiphila	*Citrus* sp.	Rutaceae	Paraguay	Spegazzini (1920); Farr (1973); Farr and Rossman (2024)
Melanomma australiense	Unidentified host	–	Australia	Hyde and Goh (1999)
Melanomma brachythele	*Sambucus* sp.	Adoxaceae	The United Kingdom	Saccardo (1878)
Melanomma bubakii	*Campanula stricta*	Campanulaceae	Turkey	Bubák (1914)
Melanomma cacheutense	*Baccharis glutinosa*	Asteraceae	Argentina	Spegazzini (1909); Farr (1973); Farr and Rossman (2024)
Melanomma caesalpiniae	*Caesalpinia cearense*	Fabaceae	Brazil	Hennings (1908)
Melanomma caryophagum	*Carya* sp. and *Juglans* sp.	Juglandaceae	The United States	Fairman (1921)
Melanomma castillejae	*Castilleja pallida*	Orobanchaceae	Siberia	Farr and Rossman (2024)
Melanomma ceratoniae	*Ceratonia siliqua*	Fabaceae	Spain	Farr and Rossman (2024)
Melanomma chilense	*Proustia pungens*	Asteraceae	Chile	Spegazzini (1910); Farr (1973); Farr and Rossman (2024)
Melanomma citricola	*Citrus medica*	Rutaceae	Bangladesh and India	Sydow et al. (1911); Rao (1969); Farr and Rossman (2024)
Melanomma conjunctum	*Thuja plicata*	Cupressaceae	The United States	Farr and Rossman (2024)
Melanomma cryptostegiae	*Cryptostegia grandiflora*	Apocynaceae	India	Pande (2008); Farr and Rossman (2024)
Melanomma cucurbitarioideum	*Pentaphylloides fruticosa*	Rosaceae	China	Yuan and Barr (1994); Farr and Rossman (2024)
Melanomma dactylosporum	Unidentified host	–	Brazil	Rehm (1901)
Melanomma dinghuense	Unidentified host	–	China	Inderbitzin and Huang (2001)
Melanomma distinctum	*Pentaphylloides fruticosa*	Rosaceae	Russia	Vasilyeva (1987)
Melanomma drimydis	*Drymis* sp.	Winteraceae	Brazil	Rehm (1901)
Melanomma dryinum	*Quercus* sp.	Fagaceae	Belgium	Mouton (1900)
Melanomma dzungaricum	*Eurotia eversmanniana*	Amaranthaceae	Kazakhstan	Vasilyeva (1987)
Melanomma ebeni	*Ebenus stellata*	Fabaceae	Iran	González Fragoso (1918)
Melanomma epiphytica	*Bambusa* sp.	Poaceae	Indonesia	Raciborski (1909); Eriksson and Yue (1998); Farr and Rossman (2024)
Melanomma gigantica	Unidentified host	–	India	Pande (1979)
Melanomma glumarum	*Oryza sativa*	Poaceae	China, India, Japan and the Philippines	Watson (1971); Reinking (1919); Farr and Rossman (2024)
Melanomma gregarium	*Populus* sp.	Salicaceae	The United States	Cash (1953); Farr and Rossman (2024)
Melanomma halimodendri	*Halimodendron halodendron*	Fabaceae	Kazakhstan	Farr and Rossman (2024)
Melanomma haloxyli	*Haloxylon aphyllum*	Amaranthaceae	Kazakhstan	Farr and Rossman (2024)
Melanomma helianthemi	*Helianthemum rupifragum*	Cistaceae	Ukraine	Gucevic (1969)
Melanomma heraclei	*Heracleum pubescens*	Apiaceae	Ukraine	Dudka et al. (2004); Farr and Rossman (2024)
Melanomma herpotrichum	*Populus* sp.	Salicaceae	Luxembourg	Feltgen (1903)
Melanomma japonicum	*Fagus crenata*	Fagaceae	Japan	Hashimoto et al. (2017); Farr and Rossman (2024)

Species	Host	Host family	Locality	References
Melanomma jenynsii	Unidentified host	–	The United Kingdom	Saccardo (1883)
Melanomma juniperi	*Juniperus virginiana*	Cupressaceae	The United States	Fairman (1905); Cash (1953); Farr and Rossman (2024)
Melanomma langloisii	*Salix nigra*	Salicaceae	The United States	Farr and Rossman (2024)
Melanomma lithophilae	*Sobolewskia lithophila*	Apocynaceae	Ukraine	Dudka et al. (2004); Farr and Rossman (2024)
Melanomma longicolle	*Acer* sp. and *Citrus limon*	Aceraceae and Rutaceae	Italy and the United Kingdom	Saccardo (1875); Farr and Rossman (2024)
Melanomma marathawadense	On paper	–	India	Tilak and Kale (1970)
Melanomma margaretae	*Dryas octopetala*	Rosaceae	Poland	Mulenko et al. (2008); Farr and Rossman (2024)
Melanomma martinianum	Unidentified host	–	New Zealand	Saccardo (1883)
Melanomma mate	*Ilex paraguensis*	Aquifoliaceae	Argentina	Spegazzini (1908); Farr (1973); Farr and Rossman (2024)
Melanomma medium	*Acer negundo*, *Calligonum* sp. and *Tamarix* sp.	Sapindaceae and Tamaricaceae	Canada, Italy and the United Kingdom	Saccardo (1878); Farr (1973); Farr and Rossman (2024)
Melanomma mindorense	*Arenga mindorensis*	Arecaceae	The Philippines	Rehm (1913)
Melanomma mojunkumica	*Haloxylon aphyllum*	Amaranthaceae	Kazakhstan	Farr and Rossman (2024)
Melanomma moravicum	Unidentified host	–	Slovakia	Farr and Rossman (2024)
Melanomma mutabile	*Solanum dulcamara*	Solanaceae	Luxembourg	Feltgen (1901)
Melanomma myricae	*Myrica gale*	Myricaceae	Sweden	Eriksson (2014); Farr and Rossman (2024)
Melanomma nigriseda	*Fagus* sp.	Fagaceae	The United States	Fairman (1922)
Melanomma obliterans	Unidentified host	–	The United Kingdom	Saccardo (1883)
Melanomma obtusissimum	Unidentified host	–	Cuba	Farr and Rossman (2024)
Melanomma oryzae	*Oryza sativa*	Poaceae	Japan	Farr and Rossman (2024)
Melanomma oxysporum	*Quercus* sp.	Fagaceae	The United States	Hawksworth (1985)
Melanomma panici-miliacei	*Panicum miliaceum*	Poaceae	Siberia	Farr and Rossman (2024)
Melanomma philippinense	Unidentified host	–	The Philippines	Sydow and Sydow (1914)
Melanomma populicola	*Cornus* sp., *Fagus sylvatica*, *Picea abies*, *Populus* sp., *Quercus* sp. and *Sorbus aucuparia*	Cornaceae, Fagaceae, Pinaceae, Rosaceae, and Salicaceae	China, Croatia, Germany and the Netherlands	Crous et al. (2020); Farr and Rossman (2024); this study
Melanomma praeandinum	*Salvia gilliesii*	Lamiaceae	Argentina	Spegazzini (1909); Farr (1973); Farr and Rossman (2024)
Melanomma pulveracea	Unidentified host	–	China	Teng (1936)
Melanomma pulvis-pyrius	*Acer* sp., *Albizia julibrissin*, *Alhagi* sp., *Alnus* sp., *Berberis* sp., *Betula* sp., *Bupleurum fruticosum*, *Campsis radicans*, *Carpinus betulus*, *Celtis australis*, *Corylus* sp., *Larix decidua* and *Pinus sylvestris*	Apiaceae, Betulaceae, Berberidaceae, Bignoniaceae, Cannabaceae, Fabaceae, Pinaceae, and Sapindaceae	Canada, Czech Republic, Japan, Poland, Russia, Scotland, Sweden and Ukraine	Mulenko et al. (2008); Hashimoto et al. (2017); Crous et al. (2020); Farr and Rossman (2024)

Species	Host	Host family	Locality	References
Melanomma pyriostictum	Unidentified host	–	The United Kingdom	Cooke (1887)
Melanomma rhododendri	*Rhododendron* sp.	Ericaceae	Austria, Belgium, Germany, Italy, Luxembourg, the Netherlands, Switzerland, the United Kingdom and the United States	Rehm (1881, 1906); Bommer and Rousseau (1890); Farr and Rossman (2024)
Melanomma ribis	*Ribes* sp.	Grossulariaceae	The United States	Barr (1990)
Melanomma rubicundum	*Lythrum* sp.	Lythraceae	Sweden	Bommer and Rousseau (1890); Farr and Rossman (2024)
Melanomma sanguinarium	Unidentified host	–	–	Saccardo (1878)
Melanomma saviczii	*Thymus pseudohumillimus*	Lamiaceae	Ukraine	Dudka et al. (2004); Farr and Rossman (2024)
Melanomma scrophulariae	*Scrophularia rupestris*	Scrophulariaceae	Ukraine	Gucevic (1967)
Melanomma sordidissimum	*Eriobotrya japonica*	Rosaceae	Argentina	Spegazzini (1909); Farr (1973); Farr and Rossman (2024)
Melanomma sparsum	*Abies* sp.	Pinaceae	Switzerland	Fuckel (1873)
Melanomma spiniferum	*Morus alba*	Moraceae	The United States	Cash (1953); Farr and Rossman (2024)
Melanomma subandinum	*Atriplex pamparum*	Amaranthaceae	Argentina	Cash (1953); Farr and Rossman (2024)
Melanomma subdispersum	*Betula* sp., and *Fagus* sp.	Betulaceae and Fagaceae	Canada, Ireland, Poland, and the United Kingdom	Conners (1967); Mulenko et al. (2008); Farr and Rossman (2024)
Melanomma submojunkumica	*Haloxylon aphyllum*	Amaranthaceae	Kazakhstan	Farr and Rossman (2024)
Melanomma thespesiae	*Thespesia* sp.	Malvaceae	India	Farr and Rossman (2024)
Melanomma trevoae	*Trevoa trinervia*	Rhamnaceae	Chile	Farr (1973); Farr and Rossman (2024)
Melanomma vile	*Quercus* sp.	Fagaceae	Sweden	Fuckel (1870)
Melanomma xylariae	Unidentified host	–	Brazil	Höhnel (1907)
Monoseptella rosae	*Rosa* sp.	Rosaceae	Uzbekistan	Wanasinghe et al. (2018)
Muriformistrickeria rosae	*Rosa* sp.	Rosaceae	Italy	Wanasinghe et al. (2018)
Muriformistrickeria rubi	*Rubus* sp.	Rosaceae	Italy	Tian et al. (2015)
Navicella costaricensis	Unidentified host	–	The United States	El-Shafie et al. (2005)
Navicella diabola	*Castanopsis* sp.	Fagaceae	China	Aptroot (2003)
Navicella pallida	*Elaeocarpus* sp.	Elaeocarpaceae	Papua New Guinea	Aptroot and Iperen (1998)
Navicella pileata	*Fraxinus* sp., *Salix fragilis*, *Tilia* sp. and *Quercus* sp.	Fagaceae, Malvaceae, Oleaceae, and Salicaceae	Finland, Lithuania and Norway	Fabre (1879); Holm and Holm (1988); Farr and Rossman (2024)
Navicella xinjiangensis	*Lonicera hispida*, *Haloxylon ammodendron*	Amaranthaceae and Caprifoliaceae	China	Yuan and Zhao (1994); Farr and Rossman (2024)
Neobyssosphaeria clematidis	*Clematis vitalba*	Ranunculaceae	The United Kingdom	Phukhamsakda et al. (2020)

Species	Host	Host family	Locality	References
Petrakia aesculi	*Aesculus turbinata*	Sapindaceae	Japan	Jaklitsch and Voglmayr (2017)
Petrakia deviata	*Acer campestre*	Sapindaceae	Georgia and Switzerland	Watzl (1937); Gross et al. (2017)
Petrakia echinata	*Acer* sp.	Sapindaceae	Italy, Slovakia, Switzerland and the United States	Sydow and Sydow (1913); Li et al. (2016a); Gross et al. (2017); Farr and Rossman (2024)
Petrakia fagi	*Fagus crenata*	Fagaceae	Japan	Beenken et al. (2020)
Petrakia greenei	*Acer saccharinum*	Sapindaceae	The United States	Beenken et al. (2020)
Petrakia irregularis	*Acer pseudoplatanus*	Sapindaceae	The Netherlands and Poland	Mulenko et al. (2008); Farr and Rossman (2024)
Petrakia juniperi	*Juniperus* sp.	Cupressaceae	Germany	Bedlan (2017)
Petrakia liobae	*Fagus sylvatica*	Fagaceae	Switzerland	Beenken et al. (2020)
Petrakia minima	*Fagus japonica*	Fagaceae	Japan	Hashimoto et al. (2017); Beenken et al. (2020)
Petrakia paracochinensis	*Miscanthus floridulus*	Poaceae	China	Wong et al. (2002)
Phragmocephala atra	*Rhopalostylis sapida* and *Urtica* sp.	Arecaceae, Urticaceae	New Zealand and the United Kingdom	Mason and Hughes (1951); McKenzie et al. (1992)
Phragmocephala elegans	*Gymnanthes lucida*	Euphorbiaceae	Brazil and Cuba	Castañeda (1985)
Phragmocephala elliptica	*Elaeagnus* sp., *Filipendula denudata*, *Laurus* sp. *Quercus robur* and *Sambucus* sp.	Adoxaceae, Elaeagnaceae, Fagaceae, Lauraceae, and Rosaceae	Canada, Russia, Ukraine and the United Kingdom	Hughes (1979); Dennis (1986); Holubtsova and Andrianova (2008); Farr and Rossman (2024)
Phragmocephala garethjonesii	Unidentified host	–	China	Su et al. (2015)
Phragmocephala glanduliformis	*Corticium coronatum*, *Picea obovate* and *Quercus* sp.	Corticiaceae, Fagaceae, and Pinaceae	Austria	Hughes (1955); Farr and Rossman (2024)
Phragmocephala hughesii	Unidentified host	–	China	Wu and Zhuang (2005)
Phragmocephala minima	*Abies balsamea* and *Fagus sylvatica*	Fagaceae and Pinaceae	Canada and the United Kingdom	Mason and Hughes (1951); Conners (1967)
Phragmocephala prolifera	*Populus tremuloides* and *Urtica dioica*	Salicaceae and Urticaceae	Belgium and Canada	Hughes (1979); Farr and Rossman (2024)
Phragmocephala stemphylioides	*Carya* sp., *Cistus* sp. and *Pistacia lentiscus*	Anacardiaceae, Cistaceae, and Juglandaceae	Brazil, Canada, China and Italy	Hughes (1958); Zhuang (2005); Lunghini et al. (2013); Farr and Rossman (2024)
Phragmotrichum andamanense	*Strobilanthes* sp.	Acanthaceae	India	Bhat and Kendrick (1993)
Phragmotrichum chailletii	*Abies* sp. and *Picea* sp.	Pinaceae	Canada, Switzerland, Romania and the United States	Kunze and Schmidt (1823); Ginns (1986); Farr and Rossman (2024)
Phragmotrichum karstenii	*Acer platanoides*	Sapindaceae	Finland	Sutton and Pirozynski (1965)
Phragmotrichum rivoclarinum	*Acer* sp., *Alnus* sp. and *Salix* sp.	Betulaceae, Salicaceae, and Sapindaceae	Canada, Italy and the United Kingdom	Sutton and Pirozynski (1966); Ginns (1986); Farr and Rossman (2024)
Phragmotrichum vassiljevae	*Alnus kamtschatica*	Betulaceae	Russia	Melnik (1984)

Species	Host	Host family	Locality	References
Pleotrichocladium opacum	Soil	–	Spain	Hernández-Restrepo et al. (2017)
Praetumpfia obducens	*Fraxinus excelsior*	Oleaceae	Austria and Sweden	Jaklitsch and Voglmayr (2017)
Pseudobyssosphaeria bambusae	*Bamboo* sp.	Poaceae	Thailand	Hyde et al. (2018)
Pseudostrickeria muriformis	*Origanum vulgare*	Lamiaceae	Italy	Tian et al. (2015)
Pseudostrickeria ononidis	*Ononis spinosa*	Fabaceae	Italy	Tian et al. (2015)
Pseudostrickeria rosae	*Rosa* sp.	Rosaceae	Italy	Wanasinghe et al. (2018)
Sarimanas pseudofluviatile	Unidentified host	–	Japan	Liu et al. (2015)
Sarimanas shirakamiense	*Swida controversa*	Cornaceae	Japan	Liu et al. (2015)
Seifertia alpina	*Rhododendron ponticum*	Ericaceae	Austria	Beenken et al. (2020)
Seifertia azaleae	*Ledum groenlandicum*, *Leucopogon costatus* and *Rhododendron* sp.	Ericaceae	Australia, Canada, China, Germany, Italy, Japan, the Netherlands, New Zealand, Panama, Switzerland, the United Kingdom and the United States	White and Hamilton (1935); Partridge and Morgan-Jones (2002); Farr and Rossman (2024)
Seifertia shangrilaensis	*Rhododendron decorum*	Ericaceae	China	Li et al. (2016b)
Tumularia aquatica	*Alnus glutinosa*, *Phragmites* sp. and *Quercus* sp.	Betulaceae, Fagaceae, and Poaceae	South Africa and the United Kingdom	Sivanesan (1984); Marvanová and Descals (1987); Farr and Rossman (2024)
Tumularia tuberculata	*Fagus sylvatica*, *Quercus* sp.	Fagaceae	Hungary	Gönczöl (1976)
Uzbekistanica pruni	*Prunus armeniaca*	Rosaceae	Russia	Hyde et al. (2020)
Uzbekistanica rosae-hissaricae	*Rosa* sp.	Rosaceae	Uzbekistan	Wanasinghe et al. (2018)
Uzbekistanica vitis-viniferae	*Vitis vinifera*	Vitaceae	Ukraine	Crous et al. (2020)
Uzbekistanica yakutkhanika	*Rosa* sp.	Rosaceae	Uzbekistan	Wanasinghe et al. (2018)
Xenostigmina aceris	*Acer macrophyllum*	Sapindaceae	The United States	Hashimoto et al. (2017)

Taxonomy

Bertiella (Sacc.) Sacc

Notes. *Bertiella* was established by Saccardo and Sydow (1899) to include *B. macrospora* as the type species. The species have superficial ascomata, cylindrical-clavate asci and hyaline, 1-septate (when immature) and pale brown, 3-septate (when mature) ascospores (Tian et al. 2015; Hongsanan et al. 2020). To the present time, there are six *Bertiella* species in Species Fungorum (2024). Of them, molecular data are available only for three species. *Bertiella* species have been reported from six different plant families, Cyrillaceae, Fagaceae, Lauraceae, Moraceae, Salicaceae and Ulmaceae (Fig. 10).

Bertiella fici **Tennakoon, C.H. Kuo & K.D. Hyde, Fungal Diversity 108: 29 (2021)**
Index Fungorum: IF555314
Facesoffungi Number: FoF09317
Fig. 4

Description. ***Saprobic*** on dead leaves of *Cinnamomum verum* J. Presl (Lauraceae). **Sexual morph:** ***Ascomata*** 160–220 × 230–280 µm ($\bar{x}$ = 180 × 240 µm, n = 15), solitary or scattered, semi-immersed to superficial, appeared as black dots on host surface, globose to subglobose, glabrous, unilocular, ostiolate. ***Peridium*** 12–20 µm wide, thick-walled, carbonaceous, composed of several layers of brown to dark brown pseudoparenchymatous cells, cells towards the inside hyaline, arranged in a ***textura angularis***, fusing at the outside indistinguishable from the host tissues. ***Hamathecium*** comprising numerous, 1–2 µm wide, hyaline, septate, cellular pseudoparaphyses. ***Asci*** 50–60 × 7.5–8.5 µm ($\bar{x}$ = 52 × 7.8 µm, n = 20), 8-spored, bitunicate, fissitunicate, cylindrical to cylindrical-clavate, short pedicellate, apically rounded, with a distinct ocular chamber. ***Ascospores*** 14–18 × 4–5 µm ($\bar{x}$ = 15 × 4.2 µm, n = 40), overlapping, 1–2-seriate, fusi-

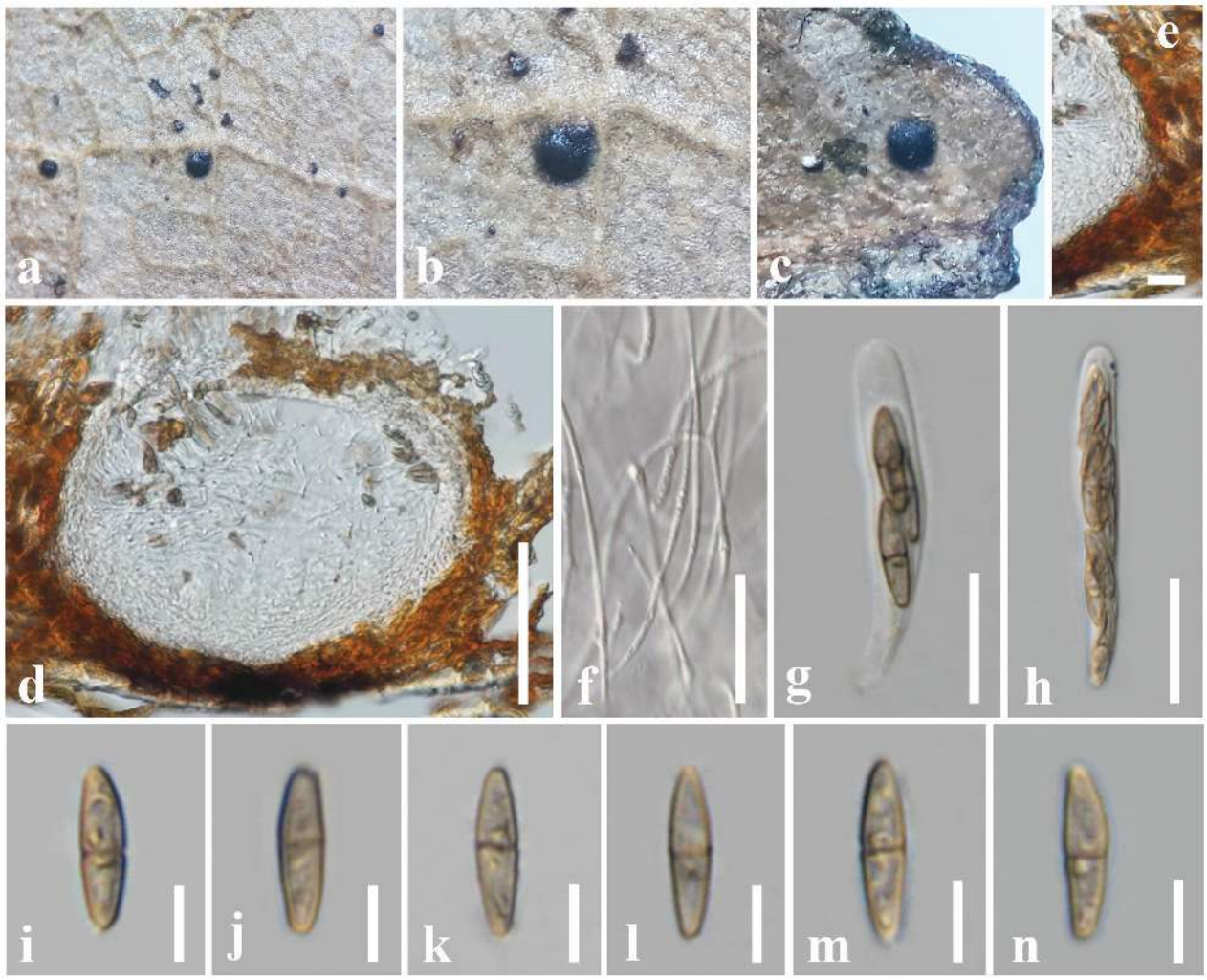

Figure 4. *Bertiella fici* (CMUB 40045, new host record) **a** appearance of ascomata on the host **b, c** close-up of ascomata **d** vertical section of an ascoma **e** peridium **f** pseudoparaphyses **g, h** asci **i–n** ascospores. Scale bars: 75 µm (**d**); 10 µm (**e**); 20 µm (**f–h**); 7 µm (**i–n**).

form, initially hyaline, becoming yellowish-brown at maturity, 1-septate, slightly curved, slightly constricted at the septum, guttulate, smooth-walled. **Asexual morph:** Undetermined.

Material examined. Thailand, Chiang Rai, Doi Mae Salong Mountain, on a dead leaf of *Cinnamomum verum* (Lauraceae), 15 June 2020, D. S. Tennakoon, DMS002 (CMUB 40045).

Known hosts. *Cinnamomum verum* and *Ficus septica* (Tennakoon et al. 2021; this study).

Known distribution. China and Thailand (Tennakoon et al. 2021; this study)

Notes. *Bertiella fici* was introduced by Tennakoon et al. (2021) from dead leaves of *Ficus septica* in China. The morphological characteristics of our collection (CMUB 40045) tally well with the *B. fici* in having solitary or scattered, semi-immersed to superficial ascomata, cylindrical to cylindrical-clavate asci and yellowish-brown, 1-septate ascospores with overlapping size ranges (Tennakoon et al. 2021). Multi-gene phylogeny (LSU, SSU, ITS and *tef1-α*) also indicates that our collection nested with *B. fici* isolates in a 100% ML and 1.00 BYPP supported clade. This was further confirmed by having only two nucleotide differences in the LSU and SSU genes between our collection and the type of *Bertiella fici*. Thus, we conclude our collection as a new host record of *Bertiella fici* from *Cinnamomum verum*. In addition, this is the first *Bertiella fici* record from Thailand.

Byssosphaeria Cooke

Notes. Cooke and Plowright (1879) established *Byssosphaeria* to accommodate *B. keithii* as the type species. *Byssosphaeria* species have superficial ascomata with bright yellow, orange or red flat apices around the ostiole, with dependent hyphal appendages that merge with the subiculum below and hyaline ascospores (Tian et al. 2015; Tennakoon et al. 2018). Species have cosmopolitan distribution as saprobes in various plant substrates (e.g. dead leaves, wood). As well, *Byssosphaeria* species have been reported from 15 plant families (Fig. 10). Currently, there are 18 accepted species in Species Fungorum (2024).

Byssosphaeria poaceicola Tennakoon & D.M. Hu, sp. nov.

Index Fungorum: IF901733
Facesoffungi Number: FoF15542
Fig. 5

Etymology. Named after the host family (Poaceae) where this fungus was collected.

Holotype. HFJAU10338.

Description. ***Saprobic*** on dead stem of *Arundo pliniana* Turra (Poaceae). **Sexual morph:** ***Ascomata*** 550–650 × 600–800 µm ($\bar{x}$ = 610 × 715 µm, n = 10), solitary to gregarious, superficial, dark brown to black, setose, coriaceous, unilocular, globose to subglobose, non-papillate, apex rounded with an orange to yellow ostiole, ostiole central, with pore-like opening, periphysate. ***Peridium*** 30–45 µm wide, thick-walled, composed of 6–7 layers of dark brown cells, orange to yellow near ostiole, arranged in ***textura angularis***. ***Hamathecium*** 1–2.5 µm wide, com-

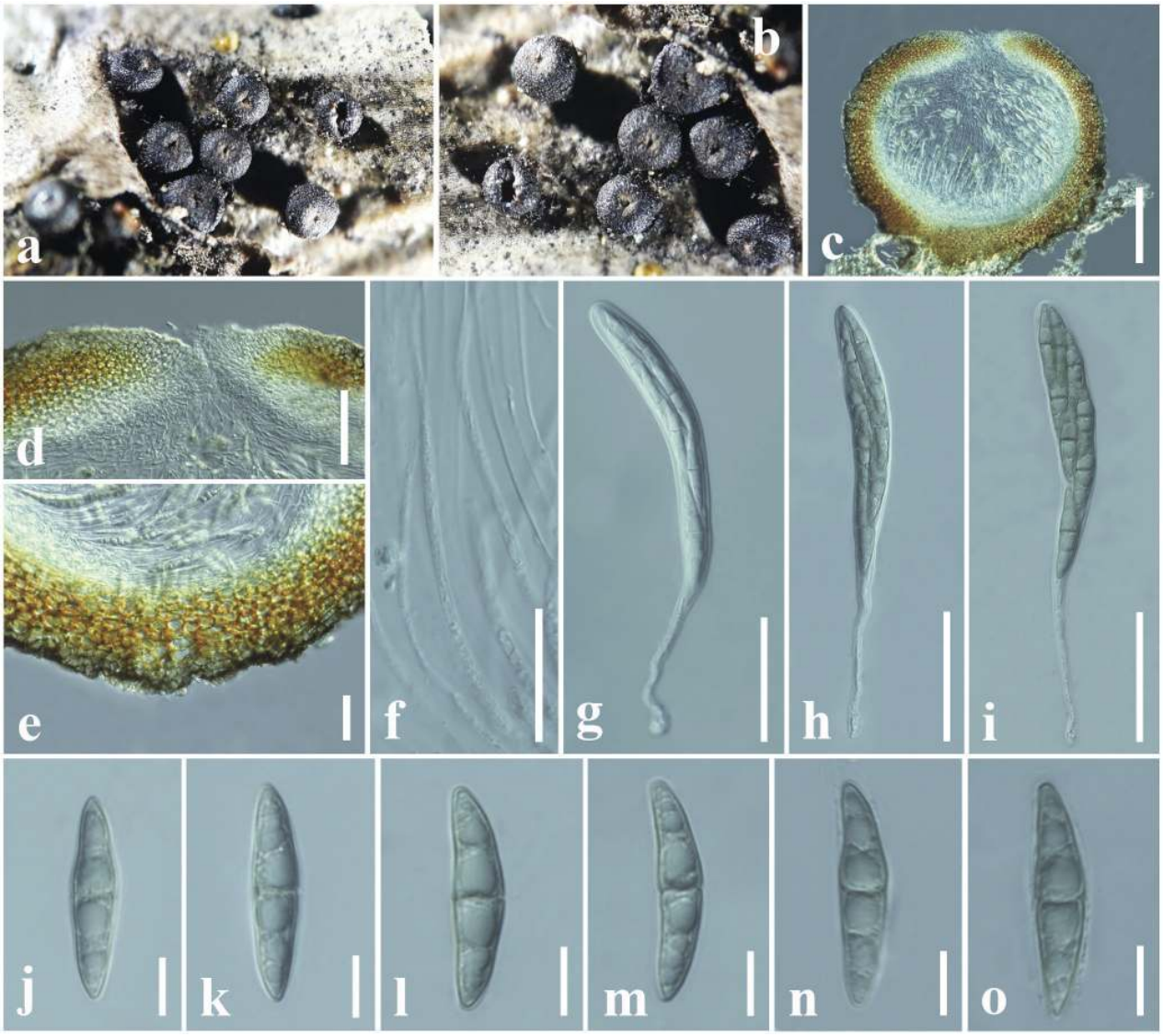

Figure 5. *Byssosphaeria poaceicola* (HFJAU10338, holotype) **a, b** appearance of ascomata on the host **c** vertical section of an ascoma **d** ostiole **e** peridium **f** pseudoparaphyses **g–i** asci **j–o** ascospores. Scale bars: 200 µm (**c**); 20 µm (**d, e**); 50 µm (**f–i**); 10 µm (**j–o**).

prising dense, filiform, anastomosing, septate, trabeculate pseudoparaphyses, embedded in a gelatinous matrix. ***Asci*** 165–180 × 12–15 µm ($\bar{x}$ = 171 × 13 µm, n = 20), 8-spored, bitunicate, fissitunicate, cylindrical clavate, apically rounded, long pedicellate (30–40 µm), with an indistinct ocular chamber. ***Ascospores*** 32–40 × 7–8 µm ($\bar{x}$ = 36 × 7.5 µm, n = 30), overlapping, 1–2-seriate, ellipsoid to fusiform, initially hyaline, pale brown when mature, 1-septate, constricted at the septum, slightly curved, guttulate, smooth-walled. ***Asexual morph:*** Undetermined.

Material examined. China, Yunnan Province, Kunming, on a dead stem of *Arundo pliniana* (Poaceae), 22 July 2016, D. S. Tennakoon, KDS30 (HFJAU10338, ***holotype***); *ibid.* 28 August 2016, KDS29 (HFJAU10337, ***paratype*).**

Notes. In the combined LSU, SSU, ITS and *tef1-α* phylogenetic analysis, two strains of *Byssosphaeria poaceicola* (HFJAU10337 and HFJAU10338) formed a monophyletic clade sister to *By. phoenicis* strains (ZHKUCC 21-0122 and ZHKUCC 21-012) with 83% ML and 0.99 BYPP statistical support. Morphologically,

they share similarities in having superficial, dark brown to black, coriaceous, non-papillate ascomata, cylindrical clavate asci and ellipsoid to fusiform, 1-septate, pale brown ascospores (Kularathnage et al. 2022). Although *Byssosphaeria poaceicola* can be distinguished from *By. phoenicis* in their size differences of asci (165–180 × 12–15 µm vs. 100–160 × 10–15 µm) and ascospores (32–40 × 7–8 µm vs. 25–30 × 5–7 µm) (Kularathnage et al. 2022). In addition, a comparison of the 497 nucleotides across the ITS (+5.8S) gene region of *By. poaceicola* and *By. phoenicis* shows 16 base pair differences (3.21%). It is interesting to notice that the *Byssosphaeria* species have not been collected much from Poaceae hosts, except for bamboo species (Jiang et al. 2022). Based on this finding, it appears that *Byssosphaeria* species can adapt to a variety of habitats, although there are limited studies to investigate their diversity on various hosts and regions.

***Byssosphaeria siamensis* Boonmee, Q. Tian & K.D. Hyde, Fungal Diversity 74: 283 (2015)**

Index Fungorum: IF551430

Facesoffungi Number: FoF01026

Fig. 6

Description. ***Saprobic*** on dead stem of *Citrus trifoliata* L. (Rutaceae). **Sexual morph:** ***Ascomata*** 250–400 × 300–500 µm ($\bar{x}$ = 320 × 410 µm, n = 10), solitary to gregarious, superficial, dark brown to black, setose, coriaceous, unilocular, globose to subglobose, non-papillate, apex rounded with an orange to yellow ostiole, ostiole central, with pore-like opening. ***Peridium*** 20–35 µm wide, thick-walled, composed of several layers of dark brown cells, orange to yellow near ostiole, arranged in ***textura angularis*** to ***textura prismatica***. ***Hamathecium*** 1–2.5 µm wide, comprising dense, filiform, anastomosing, septate, pseudoparaphyses, embedded in a gelatinous matrix. ***Asci*** 110–130 × 11–13 µm ($\bar{x}$ = 120 × 12 µm, n = 20), 8-spored, bitunicate, fissitunicate, cylindrical clavate, apically rounded, long pedicellate (20–35 µm), with an ocular chamber. ***Ascospores*** 30–40 × 6.5–8 µm ($\bar{x}$ = 31 × 7 µm, n = 30), overlapping, 1–2-seriate, ellipsoid to fusiform, initially hyaline, pale brown when mature, 1-septate, constricted at the septum, slightly curved, smooth-walled or verrucose. **Asexual morph:** Undetermined.

Material examined. China, Yunnan Province, Kunming, on a dead stem of *Citrus trifoliata* (Rutaceae), 27 July 2016, D. S. Tennakoon, KDS27 (HFJAU10336).

Known hosts. *Citrus trifoliata* (this study).

Known distribution. China, Thailand (Tian et al. 2015; Hyde et al. 2018; this study).

Notes. The morphological characteristics of our collection (HFJAU10336) similar to the type of *Byssosphaeria siamensis* in their superficial, dark brown to black, setose, non-papillate ascomata, cylindrical clavate asci and ellipsoid to fusiform, pale brown, 1-septate ascospores (Tian et al. 2015). In addition, both share overlapping size ranges of asci (110–130 × 11–13 µm vs. 112–148 × 10–16 µm) and ascospores (30–40 × 6.5–8 µm vs. 40.5–50 × 7–11 µm) (Tian et al. 2015). However, our collection is lacking a mucilaginous sheath which is present in the type species (Tian et al. 2015). According to the multi-gene phylogeny, our collection nested with *By. siamensis* isolates in 86% ML and 0.98 BYPP supported

Figure 6. *Byssosphaeria siamensis* (HFJAU10336, new host record) **a** appearance of ascomata on the host **b** close-up of ascomata **c** vertical section of an ascoma **d** ostiole **e** peridium **f** pseudoparaphyses **g, h** asci **i–m** ascospores. Scale bars: 200 µm (**c**); 20 µm (**d, e**); 50 µm (**f–h**); 10 µm (**i–m**).

clade and close to the isolate MFLUCC 17-1800 with 88% ML, 0.99 BYPP support. Therefore, based on both morphology and phylogeny evidence, we introduce our collection as a new host record of *B. siamensis* from *Citrus trifoliata* in China.

Herpotrichia Fuckel

Notes. The diverse genus *Herpotrichia* was established by Fuckel (1868) to include two species, *H. rhenana* and *H. rubi*, but without designating a type species. Thus, Bose (1961) assigned *H. rhenana* as the lectotype. Subsequently, Holm (1979) assigned *H. herpotrichoides* (synonymous with *H. rubi*) as the

generic type (Cannon 1982). The species have erumpent to superficial ascomata, clavate to cylindrical asci with hyaline to pale brown, 1-septate ascospores (Sivanesan 1984; Tian et al. 2015). The asexual morph is pyrenochaeta-like with or without setae on the surface of the pycnidia (Sivanesan 1984; Hongsanan et al. 2020). *Herpotrichia* species have been reported as saprobes, mostly in dead wood substrates in 34 plant families (Fig. 10).

Herpotrichia zingiberacearum **Tennakoon & D.M. Hu, sp. nov.**
Index Fungorum: IF901734
Facesoffungi Number: FoF15543
Fig.7

Etymology. Named after the host family (Zingiberaceae) where this fungus was collected.

Holotype. HFJAU10332.

Description. ***Saprobic*** on dead stem of *Hedychium coronarium* J. Koenig (Zingiberaceae). **Sexual morph:** ***Ascomata*** 250–350 × 240–320 µm ($\bar{x}$ = 298 × 262 µm, n = 10), solitary to clustered, superficial, dark brown to black, setose, coriaceous, unilocular, globose to subglobose, rounded apex broadly cap-like, ostiolate. ***Peridium*** 15–25 µm wide, thick-walled, composed of 4–5 layers of dark brown to black cells, arranged in ***textura angularis***. ***Hamathecium*** 1–3 µm wide, comprising dense, filiform, anastomosing, septate, branched pseudoparaphyses, embedded in a gelatinous matrix. ***Asci*** 85–98 × 10–14 µm ($\bar{x}$ = 94 × 12 µm, n = 20), 8-spored, bitunicate, fissitunicate, cylindrical clavate, apically rounded, short pedicellate, with an ocular chamber. ***Ascospores*** 25–30 × 5–6 µm ($\bar{x}$ = 28 × 5.2 µm, n = 30), overlapping, 1–2-seriate, fusoid with narrowly rounded ends, hyaline, 1-septate, straight to slightly curved, constricted at the septum, with large guttules, surrounded by an expanded gelatinous sheath pointed at both ends, 2.5–4 µm wide, smooth-walled. **Asexual morph:** Undetermined.

Material examined. China, Yunnan Province, Kunming, on a dead stem of *Hedychium coronarium* (Zingiberaceae), 20 July 2016, D. S. Tennakoon, KDS12 (HFJAU10332, ***holotype***); *ibid.* 21 August 2016, KDS13 (HFJAU10333, ***paratype***); *ibid.* 25 August 2016, KDS18 (HFJAU10334, ***paratype***).

Notes. *Herpotrichia zingiberacearum* is isolated from the dead stem of *Hedychium coronarium* (Zingiberaceae). The newly-generated sequences *H. zingiberacearum* (LSU, SSU, ITS and *tef1-α*) formed a monophyletic clade closely related to *H. macrotricha* with 90% ML and 0.99 BYPP statistical support. Morphologically, they share similarities in having dark brown to black, setose, coriaceous ascomata, cylindrical clavate asci and hyaline, 1-septate ascospores (Mugambi and Huhndorf 2009). However, *H. zingiberacearum* can be distinguished from *H. macrotricha* in their smaller asci (85–98 × 10–14 µm vs. 115–145 × 11–13 µm) and ascospores (25–30 × 5–6 µm vs. 30–35 × 4–6 µm) (Tanaka and Hosoya 2006). On the other hand, *H. zingiberacearum* (HFJAU10332) differs from *H. macrotricha* (GKM 196N) by a comparison of the 694 nucleotides across the *tef1-α* gene region which shows 20 base pair differences (3.02%). This finding addresses future studies to explore the diversity of *Herpotrichia* species in different geographic regions and host plants, as these species have not previously been described from Zingiberaceae hosts (Table 2).

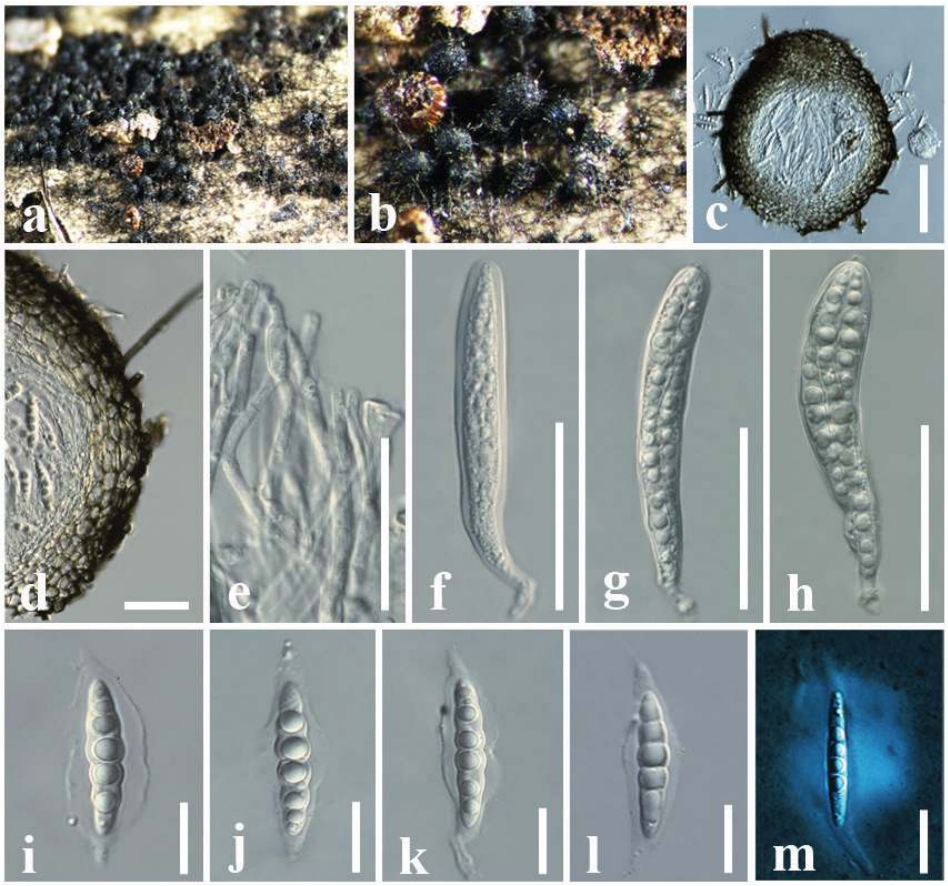

Figure 7. *Herpotrichia zingiberacearum* (HFJAU10332, holotype) **a, b** appearance of ascomata on the host **c** vertical section of an ascoma **d** peridium **e** pseudoparaphyses **f–h** asci **i–l** ascospores **m** ascospore stained in Indian ink showing a mucilaginous sheath. Scale bars: 100 µm (**c**); 20 µm (**d**); 50 µm (**e–h**); 15 µm (**i–m**).

***Melanomma* Nitschke ex Fuckel**

Notes. *Melanomma* was validly established by Fuckel (1870) with *M. pulvis-pyrius* as the type species. These species have cosmopolitan distribution worldwide and characterised in having carbonaceous ascomata and hyaline or brown, 2–3-septate ascospores (Tian et al. 2015; Crous et al. 2020). The asexual morph can be either coelomycetes or hyphomycetes (Hyde et al. 2011). Currently, 94 species are accepted in this genus (Species Fungorum 2024) and have been reported from 39 plant families (Fig. 10).

***Melanomma populicola* Crous & R.K. Schumach, Fungal Systematics and Evolution 6: 201 (2020)**
Index Fungorum: IF552757
Facesoffungi Number: FoF2887
Fig. 8

Basionym. *Aposphaeria populina* Died., Krypt.-Fl. Brandenburg (Leipzig) 9: 206 (1912).

Synonym. *Melanomma populinum* (Died.) Phukhams. & K.D. Hyde [as '*populina*'], Fungal Diversity 83: 49. 2017.

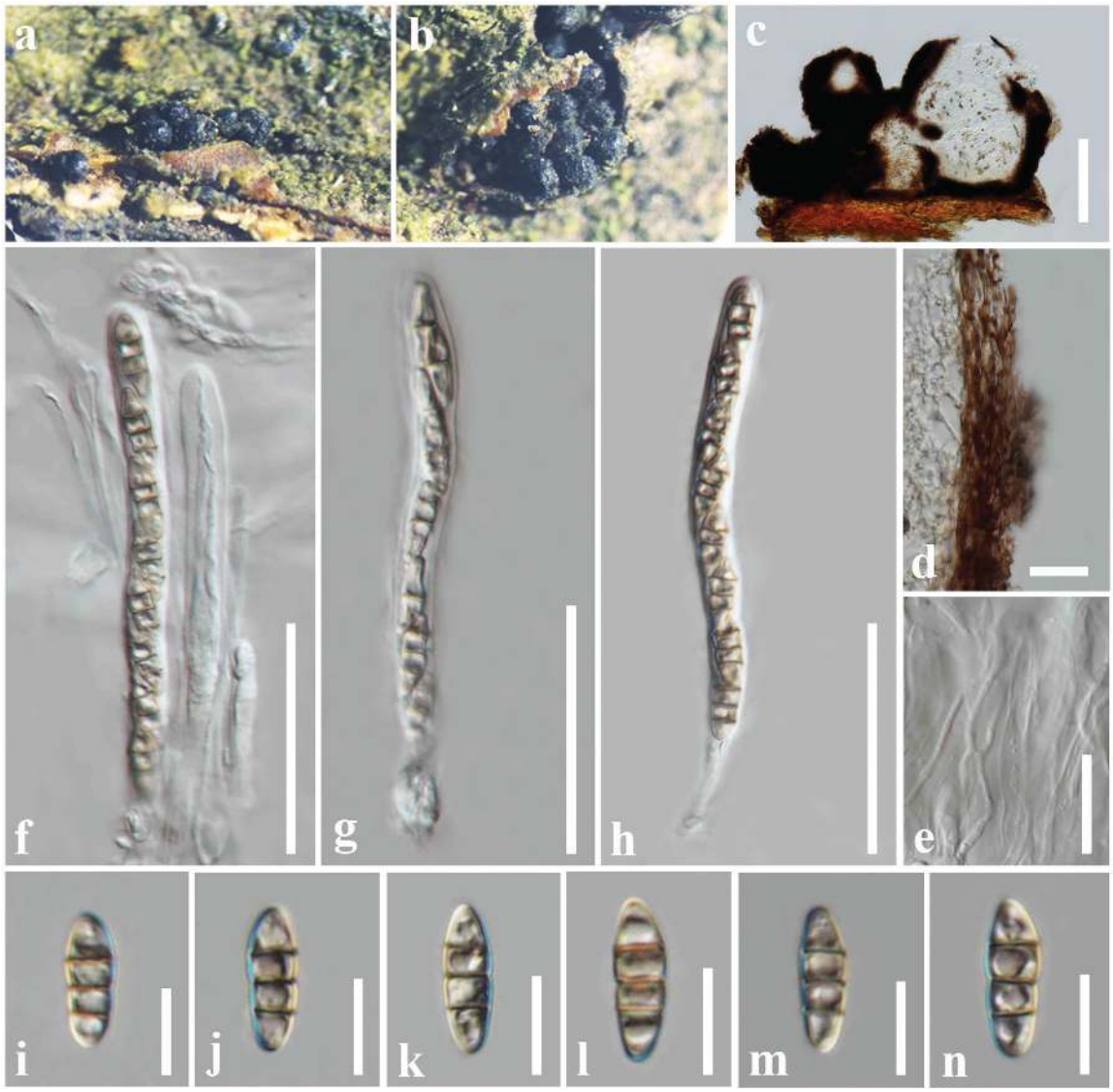

Figure 8. *Melanomma populicola* (HFJAU10335, new host record) **a** appearance of ascomata on the host **b** close-up of ascoma **c** vertical section of an ascoma **d** peridium **e** pseudoparaphyses **f–h** asci **i–n** ascospores. Scale bars: 75 µm (**c**); 10 µm (**d**); 40 µm (**e–h**); 10 µm (**i–n**).

Description. ***Saprobic*** on dead stem of *Fagus sylvatica* L. (Fagaceae). **Sexual morph:** ***Ascomata*** 130–200 × 200–300 µm ($\bar{x}$ = 150 × 255 µm, n = 15), solitary or scattered, immersed, erumpent through host surface, black, multi-loculate, globose to subglobose, ostiolate. ***Peridium*** 10–15 µm wide, thick-walled, carbonaceous, composed of several layers of light brown to dark brown pseudoparenchymatous cells, cells towards the inside hyaline, arranged in a ***textura angularis***, fusing at the outside indistinguishable from the host tissues. ***Hamathecium*** comprising numerous, 1–2 µm wide, hyaline, septate, filiform pseudoparaphyses. ***Asci*** 80–110 × 6–8 µm ($\bar{x}$ = 96 × 7 µm, n = 20), 8-spored, bitunicate, fissitunicate, cylindrical, apically rounded, short pedicellate with furcate end, with an indistinct ocular chamber. ***Ascospores*** 13–17 × 4–5.2 µm ($\bar{x}$ = 15 × 4.8 µm, n = 35), overlapping, 1–2-seriate, ellipsoid, initially hyaline, becoming light brown at maturity, 3-septate, straight to slightly curved, slightly constricted at the septa, guttulate, smooth-walled. **Asexual morph:** See Crous et al. (2020).

Material examined. China, Kunming, on a dead stem of *Fagus sylvatica* (Fagaceae), 25 July 2016, D. S. Tennakoon, KDS25 (HFJAU10335).

Known hosts. *Populus canadensis*, *Picea abies*, *Quercus* sp., *Sorbus aucuparia* (Crous et al. 2020; this study).

Known distribution. China, Germany, The Netherlands (Crous et al. 2020; this study).

Notes. *Melanomma populicola* was introduced by Diedicke (1912) as *Aposphaeria populina*, which was a phoma-like species collected from *Populus canadensis*. An epitype for *A. populina* was established by De Gruyter et al. (2013). Tibpromma et al. (2017) synonymised *A. populina* under *Melanomma* and erected as *M. populina*. Subsequently, this was validated by Crous et al. (2020) and erected as *M. populicola*. Morphological characteristics of our collection (HFJAU10335) fit well with the *M. populicola* in having black, globose to subglobose ascomata, cylindrical, apically rounded asci and ellipsoid, 3-septate, light brown ascospores. In addition, there are overlapping size ranges of asci (80–110 × 6–8 µm vs. 91–106 × 6.5–7.5 µm) and ascospores (13–17 × 4–5.2 µm vs. 15.1 × 5 µm) (Crous et al. 2020). Multi-gene phylogeny also shows that our collection groups with *M. populicola* isolates in a 99% ML and 0.99 BYPP supported clade. Therefore, we introduce our collections as a new host record of *M. populicola* from *Fagus sylvatica*.

Geographical distribution and host associations of melanommataceous species

Based on the data collected, it appears that the members of Melanommataceae are widely distributed around the world, comprising subtropical, tropical and temperate regions, such as Austria, Australia, Brazil, Canada, Finland, Germany, Japan, India, Thailand, Papua New Guinea, South Africa, Ukraine and the United States). The highest number of species have been reported from the United States (48 species). This is followed by China (35 species), Italy (30 species), India (25 species), Germany (23 species) and the United Kingdom (22 species) (indicated by red areas, Fig. 9). Moreover, Japan (17 species), Brazil (16 species), Ukraine (16 species), Canada (15 species), Kazakhstan (13 species), Poland (13 species) and Austria (11 species) are indicated by green areas (Fig. 9). Twenty-four countries have the species number range between 3 and 10, for instance Argentina, Russia and Sweden (10 species), Uzbekistan (9 species), Australia, France and Switzerland (8 species), Chile (7 species), Luxembourg, New Zealand, the Philippines and Thailand (6 species), Finland (5 species), Belgium and South Africa (4 species) and three species in nine countries (Azerbaijan, Czechia, Denmark, Georgia, Hungary, Papua New Guinea, Slovakia, Spain and Sri Lanka) (indicated by blue areas, Fig. 9). In addition, 36 countries reported two or a single species (indicated by yellow areas, Fig. 9). This may be because those countries have very limited taxonomic investigations on melanommataceous species. Consequently, it would be important to conduct more comprehensive collections, carry out more taxonomic studies and identify the species in those poorly-explored countries (e.g. African continent). In Asia, the highest number of melanommataceous species have reported from China, India and Thailand (Fig. 9), while Austria, Germany, Italy, Poland and the United Kingdom in Europe also have high numbers.

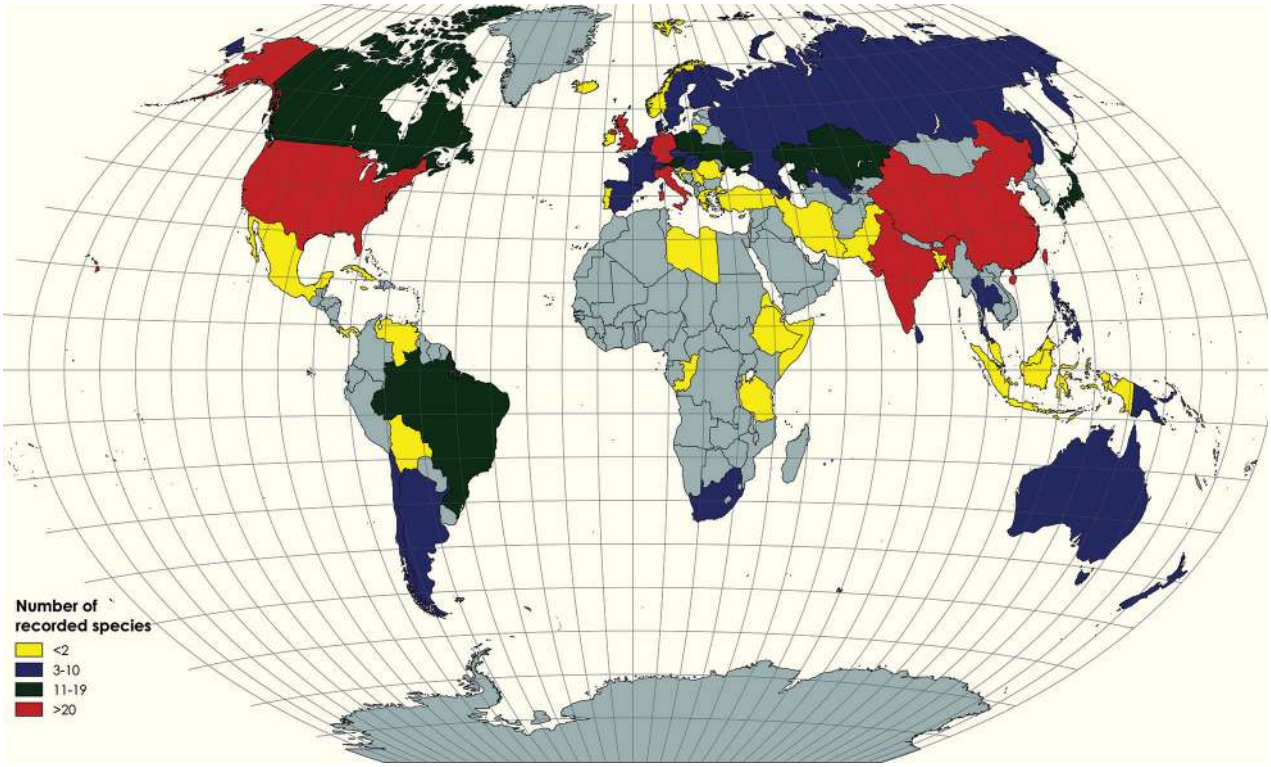

Figure 9. Distribution of so far reported species in Melanommataceae worldwide. Colour gradient shows the number of recorded species from lowest (yellow) to highest (red) and no records (grey).

Some species exist over multiple continents, while others appear to have limited distribution and are currently reported from one or a few countries (Fig. 9). Nine species of Melanommataceae are intercontinental and occur on more than five countries. Some highly diverse species include *Aposphaeria pulviscula*, *Camposporium cambrense*, *C. pellucidum*, *Herpotrichia herpotrichoides*, *H. nigra*, *H. quinqueseptata*, *Melanomma pulvis-pyrius*, *M. rhododendri* and *Seifertia azaleae* (Table 2). As well, nine species have been reported from four countries (*Byssosphaeria jamaicana*, *By. rhodomphala*, *Camposporium antennatum*, *Herpotrichia macrotricha*, *Melanomma glumarum*, *M. subdispersum*, *Petrakia echinata*, *Phragmocephala elliptica* and *Phragmotrichum chailletii*) and nine species from three countries (*Aposphaeria eragrostidis*, *A. freticola*, *A. mediella*, *Camposporium hyderabadense*, *Melanomma medium*, *M. populicola*, *Navicella pileata*, *Phragmocephala stemphylioides* and *Phragmotrichum rivoclarinum*). In contrast, the distribution of 313 species has been limited to two or to one country, based on the current information. We believe that the distribution of those species may be much higher with future collections and taxonomical investigations.

When focusing on the host association of melanommataceous species, most of have been discovered in decaying wood or submerged woody substrates (e.g. *Aposphaeria corallinolutea*, *A. rudis*, *Asymmetricospora calamicola*, *Bertiella ellipsoidea*, *Byssosphaeria juniperi*, *Calyptronectria argentinensis*, *Camposporium chinense*, *C. marylandicum*, *Herpotrichia alpincola*, *Marjia uzbekistanica*, *Melanomma dinghuense*, *Phragmocephala garethjonesii* and *Sarimanas pseudofluviatile*) (Table 2). Some species have been recorded from decaying leaves (e.g. *Bertiella fici*, *Byssosphaeria musae*, *Phragmocephala elegans*). As

well, it is noteworthy to mention that some species have been recorded from soil (e.g. *Herpotrichia gelasinosporoides*, *H. striatispora* and *Pleotrichocladium opacum*). In addition, *Aposphaeria ramalinae* has been collected from a lichen species (*Ramalina implectens*) in France (Pitard and Harmand 1911) and *Exosporiella fungorum* from a mushroom species (*Thelephora* sp. fibre vase or earth fan mushroom) in Sweden (Karsten 1892).

According to the host associations, some species of Melanommataceae are highly diverse and have been collected from more than 10 host species (e.g. *Camposporium antennatum*, *C. japonicum*, *C. pellucidum*, *Herpotrichia macrotricha*, *H. nigra* and *Melanomma pulvis-pyrius*), while some are from more than five host species (e.g. *Camposporium cambrense*, *Herpotrichia herpotrichoides*, *Melanomma populicola* and *Phragmocephala elliptica*). The highest number of melanommataceous species have reported from the plant family Fagaceae (32 species). The most common Fagaceae hosts are *Fagus* spp. (e.g. *F. crenata*, *F. sylvatica*) and *Quercus* species (e.g. *Q. germana*). This is followed by Fabaceae (24 species), Rosaceae (23 species), Salicaceae (22 species), Poaceae (19 species), Pinaceae and Arecaceae (18 species), Sapindaceae (16 species), Betulaceae (15 species), Amaranthaceae (12 species), Asteraceae (10 species), Ericaceae (9 species), Cupressaceae, Euphorbiaceae and Lauraceae (7 species), Rutaceae (6 species) and Malvaceae, Oleaceae and Pandanaceae (5 species) (Fig. 10). In addition, a range of 2–5 species have recorded from 30 plant families and single melanommataceous species have reported from 35 plant families. Thus, up to date, the species of the family have been reported from 82 plant families. However, some species have been collected from unidentified hosts and, thus, their host association remained unresolved (e.g. *Aposphaeria anomala*, *A. pakistanica*, *Bertiella ellipsoidea*, *B. gelatinosa*, *Camposporium appendiculatum* and *C. chinense*). The host specificity for most of the species has not yet been clarified, as they have been recorded from various plant families. Though, it was noted by Jaklitsch and Voglmayr (2017) that *Praetumpfia obducens* may be host specific to *Fraxinus* species.

Discussion

The members of Melanommataceae have been well-studied in last two decades, leading to many exciting discoveries (17 new genera and 76 new species), which may be mostly linked to the progress made in the DNA sequence data. The initial classification of these species was primarily based on morphological characteristics (e.g. globose or depressed ascomata, trabeculate pseudoparaphyses, fissitunicate asci, pigmented ascospores) associated with hand drawings (Saccardo 1883; Winter 1885; Morgan 1904; Spegazzini 1909; Shear 1941). However, morphology-based identification is challenging since most species can share similar characteristics, which may lead to misinterpretations. Thus, a combination of DNA-based molecular phylogeny and morphological traits has become a widely accepted tool for current fungal classifications (Tian et al. 2015; Hashimoto et al. 2017; Jaklitsch and Voglmayr 2017; Purahong et al. 2017; Kularathnage et al. 2022). Mostly, the large subunit (28S, LSU), small subunit (18S, SSU), internal transcribed spacers (ITS1–5.8S–ITS2), translation elongation factor 1 gene (*tef1-α*) and RNA polymerase second largest subunit (*rpb2*) molecular markers have been used in current phylogenetic

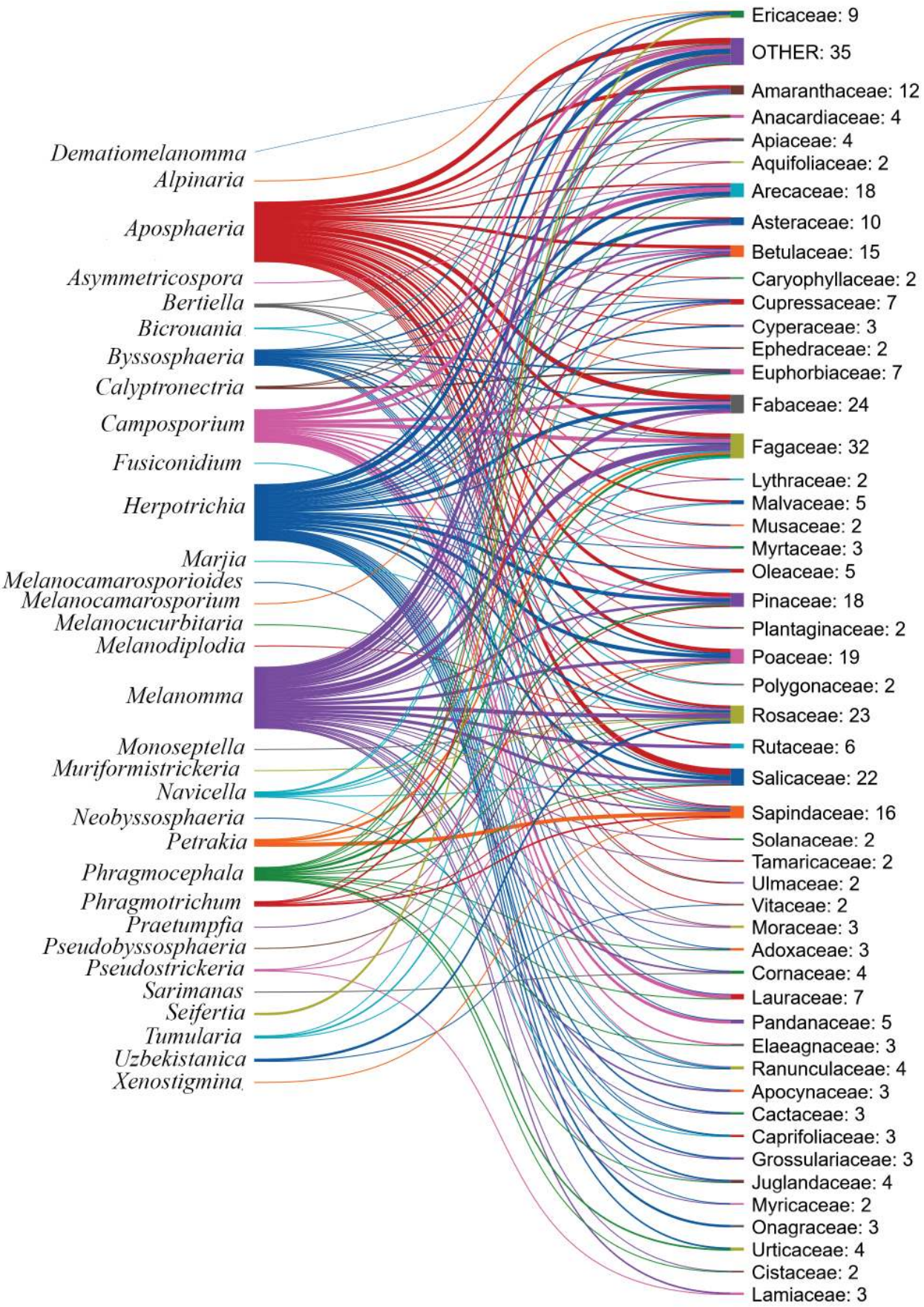

Figure 10. The melanommataceous species distribution through plant host families.

analyses of Melanommataceae (Tian et al. 2015; Tennakoon et al. 2018; Pem et al. 2019; Kularathnage et al. 2022).

Melanommataceae genera are highly varied, both morphologically and phylogenetically. Of them, some are highly diverse with numerous species (e.g. *Aposphaeria*: 83 species, *Melanomma*: 81 species, *Herpotrichia*: 61 species, *Camposporium*: 25 species, *Byssosphaeria*: 18 species and *Petrakia*: 10 species), while some have fewer species (*Phragmocephala*: 9 species, *Bertiella*: 6 species, *Navicella*: 5 species, *Phragmotrichum*: 5 species, *Uzbekistanica*: 4 species, *Calyptronectria*: 3 species, *Pseudostrickeria*: 3 species, *Seifertia*: 3 species, *Marjia*: 2 species, *Muriformistrickeria*: 2 species, *Sarimanas*: 2 species, and *Tumularia*: 2 species). In addition, some genera are monotypic and need more collections for their expansion (e.g. *Alpinaria*, *Asymmetricospora*, *Bicrouania*, *Dematiomelanomma*, *Exosporiella*, *Fusiconidium*, *Mamillisphaeria*, *Melanocamarosporioides*, *Melanocamarosporium*, *Melanocucurbitaria*, *Melanodiplodia*, *Monoseptella*, *Neobyssosphaeria*, *Pleotrichocladium*, *Praetumpfia*, *Pseudobyssosphaeria* and *Xenostigmina*). However, it is noteworthy to mention that some genera currently lack molecular data and, thus, their phylogenetic position is uncertain (e.g. *Asymmetricospora*, *Bicrouania*, *Calyptronectria*, *Exosporiella*, *Mamillisphaeria* and *Navicella*) (Hongsanan et al. 2020). As well, only two species of *Aposphaeria* have molecular data out of the 84 species listed in the Species Fungorum (2024). Consequently, to resolve their phylogenetic placements, further collections and investigations are essentially required.

In this study, we introduced two new species and three new host records collected from China and Thailand. The new species, *Byssosphaeria poaceicola* and *Herpotrichia zingiberacearum* can be distinguished from related species in their morphology and DNA molecular data. The morphological characteristics of the new host records strongly tally with their type species and phylogeny analyses also provide evidence for their placements. These new host records also demonstrate their adaptability to a broad range of habitats and there could be many more. Thus, many fungal species and host associations are waiting for us and we should undertake further explorations.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

Conceptualisation, D.S.T. N.I.d.S. and D.M.H; methodology, D.S.T. and N.I.d.S; software, D.S.T. and N.I.S.; validation, K.M.T., N.I.d.S., H.Y.S., N.S., F.S.C. and D.M.H; formal analysis, D.S.T. and N.I.d.S; investigation, K.M.T., N.I.d.S., H.Y.S., N.S., F.S.C. and D.M.H; resources, D.S.T; data curation, D.S.T. and N.I.d.S; writing – original draft preparation, D.S.T., K.M.T., N.I.d.S., N.S. and D.M.H; writing – review and editing, K.M.T., N.I.d.S., H.Y.S., N.S., F.S.C. and D.M.H; supervision, D.M.H; project administration, D.M.H; funding acquisition, D.M.H. All authors have read and agreed to the published version of the manuscript.

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Data availability

All of the data that support the findings of this study are available in the main text.

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