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A review of recently introduced *Aspergillus*, *Penicillium*, *Talaromyces* and other *Eurotiales* species

C.M. Visagie[1*], N. Yilmaz[1], S. Kocsubé[2,3], J.C. Frisvad[4], V. Hubka[5,6], R.A. Samson[7], J. Houbraken[7*]

[1]*Department of Biochemistry, Genetics and Microbiology, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria, South Africa;* [2]*Department of Microbiology, Faculty of Science and Informatics, University of Szeged, 6726 Szeged, Hungary;* [3]*ELKH-SZTE Pathomechanisms of Fungal Infections Research Group, University of Szeged, 6726 Szeged, Hungary;* [4]*Department of Biotechnology and Biomedicine, Søltofts Plads, Building 221, Technical University of Denmark, Lyngby, DK-2800 Kgs, Denmark;* [5]*Department of Botany, Faculty of Science, Charles University, Prague, Czech Republic;* [6]*Laboratory of Fungal Genetics and Metabolism, Institute of Microbiology, Czech Academy of Sciences, Prague, Czech Republic;* [7]*Westerdijk Fungal Biodiversity Institute, Utrecht, The Netherlands*

**Corresponding authors*: C.M. Visagie, cobus.visagie@fabi.up.ac.za; J. Houbraken, j.houbraken@wi.knaw.nl

Abstract: The order *Eurotiales* is diverse and includes species that impact our daily lives in many ways. In the past, its taxonomy was difficult due to morphological similarities, which made accurate identification of species difficult. This situation improved and stabilised with recent taxonomic and nomenclatural revisions that modernised *Aspergillus*, *Penicillium* and *Talaromyces*. This was mainly due to the availability of curated accepted species lists and the publication of comprehensive DNA sequence reference datasets. This has also led to a sharp increase in the number of new species described each year with the accepted species lists in turn also needing regular updates. The focus of this study was to review the 160 species described between the last list of accepted species published in 2020 until 31 December 2022. To review these species, single-gene phylogenies were constructed and GCPSR (Genealogical Concordance Phylogenetic Species Recognition) was applied. Multi-gene phylogenetic analyses were performed to further determine the relationships of the newly introduced species. As a result, we accepted 133 species (37 *Aspergillus*, two *Paecilomyces*, 59 *Penicillium*, two *Rasamsonia*, 32 *Talaromyces* and one *Xerochrysium*), synonymised 22, classified four as doubtful and created a new combination for *Paraxerochrysium coryli*, which is classified in *Xerochrysium*. This brings the number of accepted species to 453 for *Aspergillus*, 12 for *Paecilomyces*, 535 for *Penicillium*, 14 for *Rasamsonia*, 203 for *Talaromyces* and four for *Xerochrysium*. We accept the newly introduced section *Tenues* (in *Talaromyces*), and series *Hainanici* (in *Aspergillus* sect. *Cavernicolarum*) and *Vascosobrinhoana* (in *Penicillium* sect. *Citrina*). In addition, we validate the invalidly described species *Aspergillus annui* and *A. saccharicola*, and series *Annuorum* (in *Aspergillus* sect. *Flavi*), introduce a new combination for *Dichlaena lentisci* (type of the genus) and place it in a new section in *Aspergillus* subgenus *Circumdati*, provide an updated description for *Rasamsonia oblata*, and list excluded and recently synonymised species that were previously accepted. This study represents an important update of the accepted species lists in *Eurotiales*.

Key words: Accepted species list, *Aspergillaceae*, DNA barcodes, new taxa, nomenclature, *Penicillaginaceae*, phylogenetic species concept, *Thermoascaceae*, *Trichocomaceae*.

Taxonomic novelties: New sections: *Aspergillus* section *Dichlaena* Visagie, Kocsubé & Houbraken. **New series:** *Aspergillus* series *Annuorum* J.J. Silva, B.T. Iamanaka, Frisvad. **New species:** *Aspergillus annui* J.J. Silva, M.H.P. Fungaro, Frisvad, M.H. Taniwaki & B.T. Iamanaka; *Aspergillus saccharicola* J.J. Silva, Frisvad, M.H.P. Fungaro, M.H. Taniwaki & B.T. Iamanaka. **New combinations:** *Aspergillus lentisci* (Durieu & Mont.) Visagie, Malloch, L. Kriegsteiner, Samson & Houbraken; *Xerochrysium coryli* (Crous & Decock) Visagie & Houbraken.

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INTRODUCTION

Eurotiales is one of the most diverse orders of fungi and includes genera such as *Aspergillus*, *Penicillium*, *Paecilomyces* and *Talaromyces*. Species identification in these speciose genera has been very difficult in the past. Recent taxonomic and nomenclatural studies have modernised the morphology-based classifications to the extent that these genera now have one of the most modern taxonomies of all fungi. The basis and main driving force for this are the so-called 'accepted species lists'. Nomenclators such as MycoBank (https://www.mycobank.org/) list more than 3 000 names of *Eurotiales*. However, many of these names belong to other genera, were considered synonyms of accepted species, or remain unrecognisable because old descriptions were insufficient for recognition and/or no material is available. Knowledge of a genus at a given time was traditionally published in monographs that contained descriptions for all species and keys for their identification. Pitt (1980), in his monograph on *Penicillium* and its associated sexual (teleomorphic) genera *Eupenicillium* and *Talaromyces*, published a review of the recognised names and listed synonyms and excluded names that he considered indeterminate. This overview was later extended to the 'Names in Current Use' published by Pitt & Samson (1993) for *Trichocomaceae* and updated by Pitt *et al.* (2000). These lists were based on the morphological species concept used at the time, and did not include comments on taxonomy. The main aim of these lists was to record information on species that were 'accepted' in these genera, and the purpose was not to formally conserve or reject names as allowed for by the International Code of Nomenclature for algae, fungi, and plants (ICNafp; Turland *et al.* 2018). The authors of these lists were aware that taxonomy may change as species concepts evolve, and when new concepts were adopted, old names may be accepted in the future. This happened when Houbraken & Samson (2011) revised the taxonomy of *Trichocomaceae* and classified the species into three families: *Aspergillaceae* (*Aspergillus*, *Hamigera*, *Leiothecium*, *Monascus*, *Penicilliopsis*,

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Penicillium, *Phialomyces*, *Sclerocleista*, *Warcupiella* and *Xeromyces*), *Thermoascaceae* (*Byssochlamys/Paecilomyces* and *Thermoascus*) and *Trichocomaceae* (*Rasamsonia*, *Sagenomella*, *Talaromyces*, *Thermomyces*, and *Trichocoma*). They proposed the adoption of *Aspergillus* and *Penicillium* over their associated sexual genera, pre-empting the move to a single name nomenclature for fungi (McNeill *et al.* 2012), and reclassified several other sexual and asexual genera (*e.g. Chromocleista*, *Eupenicillium*, *Eladia*, *Hemicarpenteles*, *Torulomyces* and *Thysanophora* were considered synonymous with *Penicillium*). These changes were mainly based on phylogenetic analyses, which have become standard practise to study the relationships between and within these genera.

In the following years, accepted species lists for *Aspergillus*, *Penicillium* and *Talaromyces* were published (Samson *et al.* 2014, Visagie *et al.* 2014, Yilmaz *et al.* 2014), representing the first modern lists for fungi to incorporate DNA sequence data into decision-making. Several recommendations were made, from how to work with these genera or describe new species to the procedures required to identify strains more precisely, including the use of the recommended DNA barcode markers β-tubulin (*BenA*; for *Penicillium* and *Talaromyces*) or calmodulin (*CaM*; for *Aspergillus*). These recommendations were supported by the metadata associated with each name entry, including authority, citation, MycoBank number, type, ex-type, subgeneric classification and GenBank accession numbers for DNA sequences obtained from ex-type cultures. As with previous lists (Pitt & Samson 1993, Pitt *et al.* 2000), excluded names were not formally rejected. This approach, together with the wealth of reference data released, resulted in a strong backbone for these genera on which taxonomic revisions of specific groups could be built. It also facilitated the description of new species and their comparison with close relatives, leading to the description of many new species. For this reason, Houbraken *et al.* (2020) updated the accepted species lists of *Aspergillus* (increased from 339 to 446 species), *Penicillium* (increased from 354 to 483 species), *Talaromyces* (increased from 88 to 171 species) and expanded the list to include other *Eurotiales* (but excluding *Elaphomycetaceae*). Houbraken *et al.* (2020) also reintroduced a series classification in *Aspergillus* and *Penicillium*. This taxonomic rank provides information on what functional characters the species might have and is useful in phenotype-based identification. In addition, the current series classification makes it even easier than before to compare putative new species and their close relatives. Since 2020, 160 new species were described in *Eurotiales*. The focus of this study was to review these and provide comments and opinions on them.

MATERIALS AND METHODS

Phylogenetic analyses

Phylogenies were calculated for all species described since Houbraken *et al.* (2020), with datasets compiled to represent the genera, sections and/or series these belong to. Datasets (see Table 1 & Suppl. Table S1) were assembled using DNA reference sequences obtained from NCBIs GenBank nucleotide database (https://www.ncbi.nlm.nih.gov/genbank/) and included the internal transcribed spacer rDNA region (ITS), 28S large subunit (LSU), beta-tubulin (*BenA*), calmodulin (*CaM*), and RNA polymerase II second largest subunit (*RPB2*).

Datasets were aligned in MAFFT v. 7.490 (Katoh & Standley 2013) using the G-INS-i option. For multigene phylogenies, datasets were concatenated in Geneious Prime v. 2023.0.1 (Biomatters, NZ). Partitionfinder v. 2.1.1 (Lanfear *et al.* 2017) was used to select the partitioning schemes and nucleotide substitution models for each alignment, with exons, introns, and codon positions treated as independent datasets. Maximum Likelihood phylogenies were computed in IQ-TREE v. 2.1.3 (Minh *et al.* 2020) with support in nodes calculated using UFBoot (Hoang *et al.* 2018) ultrafast bootstrapping with 1 000 replicates, as implemented in IQ-TREE. Phylogenies were visualised in TreeViewer v. 2.0.1 (https://treeviewer.org) and further edited for publication in Affinity Publisher v. 2.0.3 [Serif (Europe) Ltd, Nottingham, UK]. Here we use a phylogenetic species concept and apply Genealogical Concordance Phylogenetic Species Recognition (GCPSR; Taylor *et al.* 2000).

Morphology

Descriptions were made following the recommendations of Samson *et al.* (2014) and Visagie *et al.* (2014). Strains were inoculated at three-equidistant points onto Czapek yeast autolysate agar (CYA), CYA with 5 % NaCl (CYAS), CYA with 20 % sucrose (CY20S), malt extract agar (MEA), yeast extract sucrose agar (YES), dichloran 18 % glycerol agar (DG18), oatmeal agar (OA), and Creatine sucrose agar (CREA). These were incubated at 25 °C for 7 d, with additional CYA plates incubated at 20, 30 and 37 °C. A subset of plates were incubated for longer periods to observe possible sexual states. After incubation, the species were characterised based on their growth rates, colony characteristics and microscopic features. Colonies were photographed using a Sony A6400 camera and a Sony SEL50M28 lens (Tokyo, Japan). Microscopic observations were made using a Nikon SMZ25 stereomicroscope (Tokyo, Japan) and Zeiss AXIO Imager.A2 compound microscope (Carl Zeiss CMP, Göttingen, Germany), both equipped with Nikon DS-Ri2 cameras and using Nikon Elements D v. 5.11 software. The photoplates were created in Affinity Photo v. 2.0.3 [Serif (Europe), Nottingham, UK].

RESULTS

Phylogenetic analyses

All alignments, partitioning schemes, model tests, and phylogenetic trees were deposited in the University of Pretoria research data repository hosted on Figshare (doi: 10.25403/UPresearchdata.23723277). The phylogenies largely confirmed the novelty of the newly introduced species, with some exceptions commented on using notes in the species list below (Figs 1–33, Suppl. Figs S1–S30).

TAXONOMY

Here we present new additions and changes to the list of accepted species published in Houbraken *et al.* (2020) and provide an overview of the 160 species described (51 *Aspergillus*, three *Emericella*, one *Neosartorya*, two *Paecilomyces*, one *Paraxerochrysium*, 64 *Penicillium*, two *Rasamsonia*, 35 *Talaromyces* and one *Xerochrysium*) and the new genus *Paraxerochrysium*. At the continental level, species were described from Africa (n = 28), Asia (n = 57), Europe (n = 36), North America (n = 15), Oceania (n = 21) and South America (n = 19).

Table 1. List of species described since Houbraken *et al.* (2020), and reviewed in the current study.

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
Aspergillus agricola	A2-A		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987060	–	–	Singh *et al.* (2020)
	BC09-F		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987065	–	–	Singh *et al.* (2020)
	C3-J		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987059	–	–	Singh *et al.* (2020)
	E13-L		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987064	–	–	Singh *et al.* (2020)
	EC37-C		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987066	–	–	Singh *et al.* (2020)
	J11-B		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987062	–	–	Singh *et al.* (2020)
	J11-C		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987063	–	–	Singh *et al.* (2020)
	J15-H		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987061	–	–	Singh *et al.* (2020)
	NRRL 66869	T	*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987053	–	–	Singh *et al.* (2020)
	NRRL 66870		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987054	–	–	Singh *et al.* (2020)
	NRRL 66871		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987055	–	–	Singh *et al.* (2020)
	NRRL 66872		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987056	–	–	Singh *et al.* (2020)
	NRRL 66873		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987057	–	–	Singh *et al.* (2020)
	Sanpatong22		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987068	–	–	Singh *et al.* (2020)
	Sukhothai19		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987067	–	–	Singh *et al.* (2020)
	TXA35-K		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987058	–	–	Singh *et al.* (2020)
	Ubon3		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987069	–	–	Singh *et al.* (2020)
Aspergillus alboluteus	CBS 145854		*Circumdati*	*Flavipedes*	*Spelaei*	USA	Air (indoor)	MW448664	MW478498	MW478512	MW478533	–	Sklenář *et al.* (2021)
	CBS 145855	T	*Circumdati*	*Flavipedes*	*Spelaei*	USA	Air (outdoor)	MW448663	MW478497	MW478511	MW478532	–	Sklenář *et al.* (2021)
	CBS 145859		*Circumdati*	*Flavipedes*	*Spelaei*	USA	Airconditioner	MW448662	MW478496	MW478510	MW478531	–	Sklenář *et al.* (2021)
	CBS 147065		*Circumdati*	*Flavipedes*	*Spelaei*	Nigeria	Unknown	MW448666	MW478500	MW478514	MW478535	–	Sklenář *et al.* (2021)
	CCF 5849		*Circumdati*	*Flavipedes*	*Spelaei*	USA	Storage room	MW448665	MW478499	MW478513	MW478534	–	Sklenář *et al.* (2021)
	CMW 56637		*Circumdati*	*Flavipedes*	*Spelaei*	Botswana	Soil (bat cave)	MW480881	MW480789	MW480707	MW480791	–	Sklenář *et al.* (2021)
Aspergillus alboviridis	CBS 142665	T	*Circumdati*	*Flavipedes*	*Spelaei*	Spain	Dung (herbivor)	LT798909	LT798936	LT798937	LT798938	–	Sklenář *et al.* (2021)
Aspergillus annui	IBT 36122	T	*Circumdati*	*Flavi*	*Annuorum*	Brazil	Sweet paprika	OP691228	ON529842	ON529841	ON529843	–	Silva *et al.* (2022)
	IBT 36123		*Circumdati*	*Flavi*	*Annuorum*	Brazil	Sweet paprika	–	ON643012	ON643060	ON642964	–	Silva *et al.* (2022)
	IBT 36124		*Circumdati*	*Flavi*	*Annuorum*	Brazil	Sweet paprika	–	–	–	–	–	Silva *et al.* (2022)
Aspergillus arizonicus	CCF 5341	T	*Fumigati*	*Fumigati*	*Neoglabri*	USA	Air (hospital)	OK322364	OK334128	OK334127	OK334129	–	Crous *et al.* (2021b)
Aspergillus banksianus	FRR 6047	T	*Fumigati*	*Fumigati*	*Brevipedes*	Australia	Soil under *Banksia integrifolia*	MH280013	MT184780	MT184786	MT184792	–	Crous *et al.* (2020b)
Aspergillus barbosae	CBS 145863	T	*Circumdati*	*Terrei*	*Terrei*	Brazil	Indoor environment	LR536042	LR031377	LR031392	LR031407	–	Barbosa *et al.* (2018)
	URM 5870		*Circumdati*	*Terrei*	*Terrei*	Brazil	Industrial castor cake	LR536043	LR031378	LR031393	LR031408	–	Barbosa *et al.* (2018)
	URM 7011		*Circumdati*	*Terrei*	*Terrei*	Brazil	Soil	LR536041	LR031376	LR031391	LR031406	–	Barbosa *et al.* (2018)
Aspergillus burnettii	CBS 146237	T	*Circumdati*	*Flavi*	*Alliacei*	Australia	Soil	MK429758	MT211761	MT211762	MT211763	–	Gilchrist *et al.* (2020)
Aspergillus curvatus	EMCCN 2213	T	*Circumdati*	*Circumdati*	*Steyniorum*	Egypt	Water (alkaline lake)	MN006961	–	–	–	–	Al-Bedak (2020a)
Aspergillus gaarensis	AUMC 11046	T	*Circumdati*	*Circumdati*	*Steyniorum*	Egypt	Soil (lake)	MN648408	–	–	–	–	Al-Bedak (2020b)
Aspergillus guangdongensis	CGMCC 3.19704	T	*Nidulantes*	*Ochraceorosei*	*Funiculosi*	China	Soil	MN640760	MN635246	MN635257	MN635269	–	Sun *et al.* (2022a)
Aspergillus guangxiensis	CGMCC 3.19709	T	*Nidulantes*	*Sparsi*	*Conjuncti*	China	Soil	MN640765	MN635251	MN635262	MN635274	–	Sun *et al.* (2022a)
	CGMCC 3.19710		*Nidulantes*	*Sparsi*	*Conjuncti*	China	Soil	MN640766	MN635252	MN635263	MN635275	–	Sun *et al.* (2022a)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
Aspergillus hainanicus	CGMCC 3.20888	T	*Nidulantes*	*Cavernicolarum*	*Hainanici*	China	Soil	OM414846	OM475626	OM475630	OM475634	–	Wang & Zhuang (2022b)
Aspergillus hydei	KUMCC 18-0196	T	*Circumdati*	*Nigri*	*Japonici*	China	Air (outdoor)	MT152332	MT161679	MT178247	MT384370	–	Doilom *et al.* (2020)
Aspergillus inusitatus	CBS 147044	T	*Circumdati*	*Flavipedes*	*Spelaei*	Tunisia	Soil	MW448669	MW478502	MW478517	MW478542	–	Sklenář *et al.* (2021)
Aspergillus jilinensis	CGMCC 3.18132		*Circumdati*	*Terrei*	*Terrei*	China	Soil	KX443223	KX443161	KX443192	–	–	Huang *et al.* (2020)
	CGMCC 3.18134	T	*Circumdati*	*Terrei*	*Terrei*	China	Soil	KX443224	KX443162	KX443193	–	–	Huang *et al.* (2020)
Aspergillus kumbius	FRR 6049	T	*Circumdati*	*Circumdati*	*Sclerotiorum*	Australia	Soil (pasture)	MT179307	MT184782	MT184788	MT184794	–	Crous *et al.* (2020b)
Aspergillus lannaensis	SDBR-CMUO 6		*Nidulantes*	*Ochraceorosei*	*Funiculosi*	Thailand	Soil	–	MW219782	MW219780	MW219784	–	Boonmee *et al.* (2021)
	SDBR-CMUO 8	T	*Nidulantes*	*Ochraceorosei*	*Funiculosi*	Thailand	Soil	–	MW219783	MW219781	MW219785	–	Boonmee *et al.* (2021)
Aspergillus lanuginosus	NRRL 4610	T	*Circumdati*	*Flavipedes*	*Spelaei*	Haiti	Soil	EF669604	EU014080	EF669562	EF669646	–	Sklenář *et al.* (2021)
Aspergillus lebretii	URM 8450		*Cremei*	*Cremei*	*Wentiorum*	Brazil	Air (outdoor)	ON862927	OP672381	OP290539	OP290510	–	Alves *et al.* (2022b)
	URM 8451	T	*Cremei*	*Cremei*	*Wentiorum*	Brazil	Air (outdoor)	ON862928	OP672382	OP290540	OP290511	–	Alves *et al.* (2022b)
Aspergillus lentisci	CBS 150189	T	*Circumdati*	*Dichlaena*	–	Portugal	*Pistacia* leaf	OR142402	OR145977	OR145992	OR146003	OR142413	Present study
	DTO 426-F1		*Circumdati*	*Dichlaena*	–	Portugal	*Pistacia* leaf	OR142405	OR145976	OR145991	OR146002	OR142414	Present study
	DTO 426-F2		*Circumdati*	*Dichlaena*	–	Portugal	*Pistacia* leaf	OR142404	OR145975	OR145990	OR146001	OR142415	Present study
	DTO 426-F3		*Circumdati*	*Dichlaena*	–	Portugal	*Pistacia* leaf	OR142409	OR145978	OR145993	OR146004	OR142416	Present study
Aspergillus limoniformis	CGMCC 3.19323	T	*Polypaecilum*	*Polypaecilum*	*Canini*	China	Bat guano	MK329066	MK336093	–	MK335972	–	Zhang *et al.* (2020)
	LC12610		*Polypaecilum*	*Polypaecilum*	*Canini*	China	Bat guano	MK329067	MK336094	–	MK335973	–	Zhang *et al.* (2020)
Aspergillus luteorubrus	CBS 146723	T	*Fumigati*	*Fumigati*	*Fennelliarum*	Australia	Soil	MT179305	MT184781	MT184787	MT184793	–	Crous *et al.* (2020b)
Aspergillus magnus	UAMH 1324	T	*Circumdati*	*Candidi*	*Candidi*	Canada	Mouse	ON156376	ON164570	ON164619	ON164517	–	Glässnerová *et al.* (2022)
Aspergillus malvicolor	CBS 146724	T	*Circumdati*	*Circumdati*	*Sclerotiorum*	Australia	Soil under *Arachis hypogaea*	MT179308	MT184784	MT184790	MT184796	–	Crous *et al.* (2020b)
Aspergillus marneyi	BRIP 71536a	T	*Circumdati*	*Terrei*	*Terrei*	Australia	Crown of *Medicago sativa*	OL691080	OL741659	–	OL741656	–	Tan & Shivas (2022)
Aspergillus montoensis	BRIP 71717	T	*Circumdati*	*Terrei*	*Terrei*	Australia	Root of *Vigna radiata*	OK441076	OK533535	–	OK509073	–	Tan *et al.* (2021)
Aspergillus nanangensis	CBS 146238	T	*Circumdati*	*Janorum*	*Janorum*	Australia	Soil	MK979278	MT184783	MT184789	MT184795	–	Crous *et al.* (2020b)
Aspergillus neoterreus	CGMCC 3.20891	T	*Circumdati*	*Terrei*	*Terrei*	China	Soil	OM414849	OM475629	OM475633	OM475637	–	Wang & Zhuang (2022b)
Aspergillus neotritici	CBS 129260		*Circumdati*	*Candidi*	*Candidi*	USA	Soil	ON156397	ON164591	ON164632	ON164541	–	Glässnerová *et al.* (2022)
	CBS 129307		*Circumdati*	*Candidi*	*Candidi*	Unknown	Soil	ON156398	ON164592	ON164633	ON164542	–	Glässnerová *et al.* (2022)
	CBS 133055		*Circumdati*	*Candidi*	*Candidi*	Japan	Unknown	ON156395	ON164587	ON164628	ON164537	–	Glässnerová *et al.* (2022)
	CBS 266.81		*Circumdati*	*Candidi*	*Candidi*	India	*Triticum aestivum* grains	LT626958	EU076293	EU076305	MN969098	–	Glässnerová *et al.* (2022)
	CCF 1649		*Circumdati*	*Candidi*	*Candidi*	Czech Republic	Flour	FR733810	LT627024	FR751427	LT627025	–	Glässnerová *et al.* (2022)
	CCF 3314		*Circumdati*	*Candidi*	*Candidi*	Czech Republic	Air (outdoor)	FR733812	LT627022	FR751426	LT627023	–	Glässnerová *et al.* (2022)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
	CCF 3853	T	*Circumdati*	*Candidi*	*Candidi*	Czech Republic	Human toenail	FR727136	FR775327	HE661598	LT627021	–	Glässnerová *et al.* (2022)
	CCF 4030		*Circumdati*	*Candidi*	*Candidi*	Czech Republic	Vermicompost	FR733814	LT627018	FR751425	LT627019	–	Glässnerová *et al.* (2022)
	CCF 4653		*Circumdati*	*Candidi*	*Candidi*	Czech Republic	Human toenail	HG915890	HG916674	HG916677	LT627020	–	Glässnerová *et al.* (2022)
	CCF 4658		*Circumdati*	*Candidi*	*Candidi*	Czech Republic	Human toenail	HG915891	HG916675	HG916676	LT627026	–	Glässnerová *et al.* (2022)
	CCF 4914		*Circumdati*	*Candidi*	*Candidi*	USA	Air (hospital)	ON156392	ON164556	ON164605	ON164503	–	Glässnerová *et al.* (2022)
	CCF 6202		*Circumdati*	*Candidi*	*Candidi*	USA	Air (house)	ON156396	ON164588	ON164629	ON164538	–	Glässnerová *et al.* (2022)
	CCF 6397		*Circumdati*	*Candidi*	*Candidi*	Czech Republic	Human abdominal cavity	ON156394	ON164589	ON164630	ON164539	–	Glässnerová *et al.* (2022)
	IBT 12659		*Circumdati*	*Candidi*	*Candidi*	USA	Soil (kangaroo rat burrow)	ON156393	ON164557	ON164606	ON164504	–	Glässnerová *et al.* (2022)
Aspergillus okavangoensis	CMW 56636	T	*Circumdati*	*Flavipedes*	*Flavipedes*	Botswana	Soil (bat cave)	MW480880	MW480788	MW480706	MW480790	–	Visagie *et al.* (2021)
Aspergillus oxumiae	CCDCA 11546	T	*Circumdati*	*Nigri*	*Japonici*	Brazil	Soil under *Agave sisalana*	MN431160	–	MN531842	MN521389	–	Crous *et al.* (2020b)
Aspergillus phialiformis	CGMCC 3.19314	T	*Polypaecilum*	*Polypaecilum*	*Canini*	China	Rock	MK329068	MK336095	–	MK335974	–	Zhang *et al.* (2020)
	LC12537		*Polypaecilum*	*Polypaecilum*	*Canini*	China	Rock	MK329069	MK336096	–	MK335975	–	Zhang *et al.* (2020)
Aspergillus phialosimplex	CGMCC 3.19637	T	*Polypaecilum*	*Polypaecilum*	*Canini*	China	Plant debris	MK329070	MK336097	–	MK335976	–	Zhang *et al.* (2020)
	LC12625		*Polypaecilum*	*Polypaecilum*	*Canini*	China	Animal faeces	MK329071	MK336098	–	MK335977	–	Zhang *et al.* (2020)
	LC12658		*Polypaecilum*	*Polypaecilum*	*Canini*	China	Plant root	MK329072	MK336099	–	MK335978	–	Zhang *et al.* (2020)
Aspergillus qilianyuensis	CGMCC 3.20889	T	*Nidulantes*	*Nidulantes*	*Versicolores*	China	Soil	OM414847	OM475627	OM475631	OM475635	–	Wang & Zhuang (2022b)
Aspergillus recifensis	CBS 145864	T	*Circumdati*	*Terrei*	*Nivei*	Brazil	Soil	LR536036	LR031370	LR031385	LR031400	–	Barbosa *et al.* (2018)
	URM 2803		*Circumdati*	*Terrei*	*Nivei*	Brazil	Bird food	LR536040	LR031375	LR031390	LR031405	–	Barbosa *et al.* (2018)
	URM 3371		*Circumdati*	*Terrei*	*Nivei*	Brazil	Bird food	–	KR051530	–	–	–	Barbosa *et al.* (2018)
	URM 3571		*Circumdati*	*Terrei*	*Nivei*	Brazil	Water from tank	LR536039	LR031373	LR031388	LR031403	–	Barbosa *et al.* (2018)
	URM 5262		*Circumdati*	*Terrei*	*Nivei*	Brazil	Soil (rhizosphere of Croton sp)	LR536037	LR031371	LR031386	LR031401	–	Barbosa *et al.* (2018)
	URM 5461		*Circumdati*	*Terrei*	*Nivei*	Brazil	Water from pool	LR536038	LR031372	LR031387	LR031402	–	Barbosa *et al.* (2018)
	URM 6628		*Circumdati*	*Terrei*	*Nivei*	Brazil	Soil	LR536035	LR031369	LR031384	LR031399	–	Barbosa *et al.* (2018)
Aspergillus rouenensis	CBS 149067	T	*Polypaecilum*	*Polypaecilum*	*Salinarum*	France	*Quercus bore* dust of *Xestobium rufovillosum*	ON603782	ON605641	ON653193	ON653194	–	Crous *et al.* (2022)
	CBS 149068		*Polypaecilum*	*Polypaecilum*	*Salinarum*	France	*Quercus bore* dust of *Xestobium rufovillosum*	–	ON605642	–	–	–	Crous *et al.* (2022)
Aspergillus saccharicola	IBT 36125		*Circumdati*	*Flavi*	*Flavi*	Brazil	Sugarcane	–	ON642978	ON643026	ON642930	–	Silva *et al.* (2022)
	IBT 36126	T	*Circumdati*	*Flavi*	*Flavi*	Brazil	Sugarcane	OP611470	ON529845	ON529844	ON529846	–	Silva *et al.* (2022)
	IBT 36127		*Circumdati*	*Flavi*	*Flavi*	Brazil	Sugarcane	–	ON642982	ON643030	ON642934	–	Silva *et al.* (2022)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
Aspergillus sakultaensis	AUMC 13885	T	*Circumdati*	*Flavipedes*	*Flavipedes*	Egypt	Water	MK391495	–	–	–	–	Zhori *et al.* (2020)
Aspergillus sibiricus	CBS 143307	T	*Fumigati*	*Fumigati*	*Unilaterales*	Russia	Soil (cole mine)	MG587008	MG722970	MG722971	MG710809	–	Iliushin (2022)
Aspergillus sichuanensis	CGMCC 3.19705	T	*Nidulantes*	*Aenei*	*Aenei*	China	Soil	MN640761	MN635247	MN635258	MN635270	–	Sun *et al.* (2022a)
	CGMCC 3.19706		*Nidulantes*	*Aenei*	*Aenei*	China	Soil	MN640762	MN635248	MN635259	MN635271	–	Sun *et al.* (2022a)
	CGMCC 3.19708		*Nidulantes*	*Aenei*	*Aenei*	China	Soil	MN640764	MN635250	MN635261	MN635273	–	Sun *et al.* (2022a)
Aspergillus sigarelli	CBS 141579	T	*Nidulantes*	*Usti*	*Calidousti*	China	Cigarette	MN640758	MN635244	MN635255	MN635267	–	Sun *et al.* (2020c)
Aspergillus telluris	CGMCC 3.19701	T	*Polypaecilum*	*Polypaecilum*	*Canini*	China	Soil	MN640767	MN635253	MN635264	MN635276	–	Sun *et al.* (2022a)
	CGMCC 3.19702		*Polypaecilum*	*Polypaecilum*	*Canini*	China	Soil	MN640768	MN635254	MN635265	MN635277	–	Sun *et al.* (2022a)
	CGMCC 3.19703		*Polypaecilum*	*Polypaecilum*	*Canini*	China	Soil	MN640769	MN635243	MN635266	MN635278	–	Sun *et al.* (2022a)
Aspergillus tenebricus	CBS 147048	T	*Circumdati*	*Candidi*	*Candidi*	South Africa	Soil	ON156389	ON164584	ON164623	ON164532	–	Glässnerová *et al.* (2022)
	CBS 147376		*Circumdati*	*Candidi*	*Candidi*	Australia	Soil	ON156390	ON164585	ON164624	ON164533	–	Glässnerová *et al.* (2022)
	DTO 440-E2		*Circumdati*	*Candidi*	*Candidi*	Australia	Soil	ON156391	ON164586	ON164625	ON164534	–	Glässnerová *et al.* (2022)
Aspergillus tibetensis	CGMCC 3.19707	T	*Nidulantes*	*Aenei*	*Aenei*	China	Soil	MN640763	MN635249	MN635260	MN635272	–	Sun *et al.* (2022a)
Aspergillus toxicus	A34-N		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987102	–	–	Singh *et al.* (2020)
	BG14-F		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987108	–	–	Singh *et al.* (2020)
	BRG3458A		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987090	–	–	Singh *et al.* (2020)
	BRG3458H		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987095	–	–	Singh *et al.* (2020)
	BRG3458J		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987096	–	–	Singh *et al.* (2020)
	BRG5138J		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987097	–	–	Singh *et al.* (2020)
	CR10-G		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987105	–	–	Singh *et al.* (2020)
	CR20-D		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987098	–	–	Singh *et al.* (2020)
	CR24-F		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987103	–	–	Singh *et al.* (2020)
	D16-J		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987099	–	–	Singh *et al.* (2020)
	D25-A-S		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987100	–	–	Singh *et al.* (2020)
	E21-B		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987101	–	–	Singh *et al.* (2020)
	EC24-C		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987106	–	–	Singh *et al.* (2020)
	EC49-L		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987107	–	–	Singh *et al.* (2020)
	J15-B		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987104	–	–	Singh *et al.* (2020)
	K44-K		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987085	–	–	Singh *et al.* (2020)
	K849-B		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987086	–	–	Singh *et al.* (2020)
	NRRL 66868	T	*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987092	–	–	Singh *et al.* (2020)
	NRRL 66897		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987091	–	–	Singh *et al.* (2020)
	NRRL 66899		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987093	–	–	Singh *et al.* (2020)
	NRRL 66900		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987094	–	–	Singh *et al.* (2020)
	TX04A5-B		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987089	–	–	Singh *et al.* (2020)
	TX07CB73-I		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987087	–	–	Singh *et al.* (2020)
	TXLaFeria2-F		*Circumdati*	*Flavi*	*Flavi*	USA	Soil (maize field)	–	–	MN987088	–	–	Singh *et al.* (2020)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
Aspergillus vinaceus	ITAL 47.456	T	*Circumdati*	*Nigri*	*Nigri*	Brazil	Grapes (*Vitis labrusca*)	MN575692	MN583579	MN583580	MN583581	–	Silva *et al.* (2020)
Aspergillus xishaensis	CGMCC 3.20890	T	*Circumdati*	*Flavipedes*	*Flavipedes*	China	Soil	OM414848	OM475628	OM475632	OM475636	–	Wang & Zhuang (2022b)
Paecilomyces clematidis	CBS 148466	T	–	–	–	Czech Republic	Root of *Clematis*	MZ923760	MZ927740	MZ927738	OL332316	–	Spetik *et al.* (2022)
	MEND-F-0561		–	–	–	Czech Republic	Root of *Clematis*	MZ923761	MZ927741	MZ927739	OL332317	–	Spetik *et al.* (2022)
Paecilomyces penicilliformis	CCF 5755	T	–	–	–	USA	Air (pharmacy)	LR679769	LR679768	LR778299	–	–	Crous *et al.* (2020b)
	CCF 6350		–	–	–	USA	Juice (peach-mango)	LR736038	LR778163	LR778165	–	–	Crous *et al.* (2020b)
Paraxerochrysium coryli	CBS 148314	T	–	–	–	Belgium	Hazelnut (*Corylus avellana*)	OK664748	OK651216	–	OK651178	OK663787	Crous *et al.* (2021b)
Penicillium allaniae	BRIP 74886a	T	*Aspergilloides*	*Exilicaulis*	*Restricti*	Australia	Soil	OP903476	OP921959	OP921957	OP921958	OP925816	Tan & Shivas (2022)
	BRIP 74899		*Aspergilloides*	*Exilicaulis*	*Restricti*	Australia	Unknown	OP903475	OP921956	OP921954	OP921955		Tan & Shivas (2022)
Penicillium allsoppiae	CBS 138943	T	*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140830	JX140992	JX157384	KP016895	–	Visagie & Yilmaz (2022)
	CBS 138945		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140822	JX141004	JX157399	KP016910	–	Visagie & Yilmaz (2022)
	CN 086C6		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	MW364385	MW357820	MW357831	MW357840	–	Visagie & Yilmaz (2022)
	CN 086C7		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	MW364386	MW357821	MW357832	MW357841	–	Visagie & Yilmaz (2022)
	CN 086C8		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	MW364387	MW357822	–	MW357842	–	Visagie & Yilmaz (2022)
Penicillium anthracinoglaciei	EXF-11216		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Cryoconite	–	MT080468	MT080527	MT080509	–	Perini *et al.* (2023)
	EXF-11218		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Cryoconite	–	MT080469	MT080528	MT080510	–	Perini *et al.* (2023)
	EXF-11222		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Cryoconite	–	MT080472	MT080531	MT080511	–	Perini *et al.* (2023)
	EXF-11226		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Supraglacial water	–	MT080475	MT080534	MT080512	–	Perini *et al.* (2023)
	EXF-11230		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Supraglacial water	–	MT080479	MT080538	MT080508	–	Perini *et al.* (2023)
	EXF-11232		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Supraglacial water	–	MT080481	MT080540	MT080513	–	Perini *et al.* (2023)
	EXF-11233		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Supraglacial water	–	MT080482	MT080541	MT080514	–	Perini *et al.* (2023)
	EXF-11237		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Cryoconite	–	MT080483	MT080542	MT080515	–	Perini *et al.* (2023)
	EXF-11240		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Cryoconite	–	MT080485	MT080544	MT080516	–	Perini *et al.* (2023)
	EXF-11241		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Clear ice	–	MT080486	MT080545	MT080517	–	Perini *et al.* (2023)
	EXF-11443	T	*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Dark ice	–	MT080493	MT080552	MT080519	–	Perini *et al.* (2023)
	EXF-11444		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Dark ice	–	MT080494	MT080553	MT080520	–	Perini *et al.* (2023)
	EXF-11445		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Dark ice	–	MT080495	MT080554	MT080521	–	Perini *et al.* (2023)
	EXF-11448		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Cryoconite	–	MT080498	MT080557	MT080522	–	Perini *et al.* (2023)
	EXF-11451		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Cryoconite	–	MT080501	MT080560	MT080523	–	Perini *et al.* (2023)
	EXF-11453		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Clear ice	–	MT080503	MT080562	MT080524	–	Perini *et al.* (2023)
	EXF-11454		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Clear ice	–	MT080504	MT080563	MT080525	–	Perini *et al.* (2023)
	EXF-11456		*Penicillium*	*Brevicompacta*	*Brevicompacta*	Greenland	Clear ice	–	MT080506	MT080565	MT080526	–	Perini *et al.* (2023)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
Penicillium aquadulcis	CNUFC JT1301	T	*Aspergilloides*	*Citrina*	*Westlingiorum*	Republic of Korea	Water	OK356194	OK105100	OK105102	–	–	Nguyen *et al.* (2021b)
	CNUFC JT1302		*Aspergilloides*	*Citrina*	*Westlingiorum*	Republic of Korea	Water	OK356195	OK105101	OK105103	–	–	Nguyen *et al.* (2021b)
Penicillium archerae	BRIP 72549c	T	*Aspergilloides*	*Exilicaulis*	*Restricti*	Australia	Soil	OP903477	OP921961	–	OP921960	–	Tan & Shivas (2022)
Penicillium aspericonidium	CBS 141832	T	*Aspergilloides*	*Charlesia*	*Indica*	Australia	Soil	MT309657	MT302240	–	MT302224	–	Sun *et al.* (2021)
Penicillium ausonanum	FMR 16948	T	*Aspergilloides*	*Lanata-Divaricata*	*Dalearum*	Spain	Fluvial sediment	LR655808	LR655809	LR655810	LR655811	–	Torres-Garcia *et al.* (2022)
Penicillium barbosae	URM 7705	T	*Aspergilloides*	*Sclerotiorum*	*Adametziorum*	Brazil	Soil	MW191494	MG452818	MW183245	LR898886	–	Ramos *et al.* (2021)
	URM 7824		*Aspergilloides*	*Sclerotiorum*	*Adametziorum*	Brazil	Soil	MW191495	MG452819	MW183246	LR898887	–	Ramos *et al.* (2021)
Penicillium cerradense	UB23977	T	*Aspergilloides*	*Citrina*	*Sumatraensia*	Brazil	Soil	MT006126	MT416533	MT416534	MT416532	–	Andrade *et al.* (2021)
	DCFS6b		*Aspergilloides*	*Citrina*	*Sumatraensia*	Brazil	Soil	MT006127	MT416536	MT416537	MT416535	–	Andrade *et al.* (2021)
Penicillium claroviride	CMW 56197	T	*Penicillium*	*Canescentia*	*Atroveneta*	South Africa	Soil	MT949909	MT957414	MT957456	MT957482	–	Visagie & Yilmaz (2022)
	CMW 56198		*Penicillium*	*Canescentia*	*Atroveneta*	South Africa	Soil	MT949910	MT957415	MT957457	MT957483	–	Visagie & Yilmaz (2022)
Penicillium doidgeae	CBS 138947	T	*Penicillium*	*Canescentia*	*Atroveneta*	South Africa	Mite from *Protea repens* infructescens	JX140804	JX141006	JX157413	KP016915	–	Visagie & Yilmaz (2022)
	CBS 138948		*Penicillium*	*Canescentia*	*Atroveneta*	South Africa	Mite from *Protea repens* infructescens	JX140805	JX141007	JX157414	KP016916	–	Visagie & Yilmaz (2022)
Penicillium donggangicum	AS 3.15900	T	*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	China	Soil	MW946996	MZ004914	MZ004918	MW979253	–	Xu *et al.* (2022)
Penicillium eickerii	CBS 138939	T	*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Mite from *Protea repens* infructescens	JX140824	JX140979	JX157365	KP016876	–	Visagie & Yilmaz (2022)
	CBS 138940		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Bract from *Protea repens* infructescens	JX140825	JX140980	JX157366	KP016877	–	Visagie & Yilmaz (2022)
Penicillium elizabethiae	NRRL 917	T	*Penicillium*	*Canescentia*	*Canescentia*	Scotland	Soil	KP016840	KJ866964	KJ867021	KP016918	–	Visagie & Yilmaz (2022)
Penicillium ezekielii	CBS 149115	T	*Aspergilloides*	*Cinnamopurpurea*	*Jiangxiensia*	Indonesia	*Zea mays* kernels	ON723772	ON920778	ON920781	ON920784	ON911289	Tan *et al.* (2022)
	CBS 149114		*Aspergilloides*	*Cinnamopurpurea*	*Jiangxiensia*	Indonesia	*Zea mays* kernels	ON723771	ON920777	ON920780	ON920783	ON911288	Tan *et al.* (2022)
	DTO 463-A7		*Aspergilloides*	*Cinnamopurpurea*	*Jiangxiensia*	Nigeria	*Oryza sativa* kernels	ON723773	ON920779	ON920782	–	ON911290	Tan *et al.* (2022)
Penicillium ferraniaense	CBS 147594		*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	Italy	Compost	MW694952	MW689337	MW689339	MW689341	–	Crous *et al.* (2021a)
	CBS 147595	T	*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	Italy	Compost	MW694951	MW689336	MW689338	MW689340	–	Crous *et al.* (2021a)
Penicillium fusiforme	CBS 250.66	T	*Aspergilloides*	*Charlesia*	*Fellutana*	The Netherlands	Unknown	MT309668	MT302253	MT302220	MT302236	–	Sun *et al.* (2021)
Penicillium gercinae	URM 8348	T	*Aspergilloides*	*Ramigena*	*Georgiensia*	Brazil	Soil	MW648591	MW646389	MW646391	MW646393	–	Alves *et al.* (2022a)
Penicillium guarroi	FMR 17747	T	*Aspergilloides*	*Gracilenta*	*Estinogena*	Spain	Fluvial sediment	LR814139	LR814134	LR814140	LR814145	–	Torres-Garcia *et al.* (2022)
Penicillium hepuense	AS 3.16039	T	*Aspergilloides*	*Lanata-Divaricata*	*Oxalica*	China	Soil	MW946994	MZ004912	MZ004916	MW979254	–	Xu *et al.* (2022)
	AS 3.16040		*Aspergilloides*	*Lanata-Divaricata*	*Oxalica*	China	Soil	MW946995	MZ004913	MZ004917	MW979255	–	Xu *et al.* (2022)
Penicillium irregulare	FMR 17859	T	*Penicillium*	*Canescentia*	*Canescentia*	Spain	Fluvial sediment	LR814181	LR814144	LR814151	LR814182	–	Torres-Garcia *et al.* (2022)
Penicillium jenningsiae	BRIP 45936a	T	*Aspergilloides*	*Citrina*	*Sumatraensia*	Australia	Compost	–	OL741657	–	OL741660	–	Tan & Shivas (2022)
Penicillium jiaozhouwanicum	AS 3.16027		*Aspergilloides*	*Lanata-Divaricata*	*Oxalica*	China	Soil	OM203537	OM220087	OM220088	OM220089	–	Xu *et al.* (2022)
	AS 3.16038	T	*Aspergilloides*	*Lanata-Divaricata*	*Oxalica*	China	Soil	MW946993	MZ004911	MZ004915	MW979252	–	Xu *et al.* (2022)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
Penicillium kalander	CMW 56202	T	*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	South Africa	Soil	MT949914	MT957421	MT957461	MT957487	–	Visagie & Yilmaz (2022)
	CMW 56203		*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	South Africa	Soil	MT949915	MT957422	MT957462	MT957488	–	Visagie & Yilmaz (2022)
	CMW 56204		*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	South Africa	Soil	MT949916	MT957423	MT957463	MT957489	–	Visagie & Yilmaz (2022)
	CMW 56205		*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	South Africa	Soil	MT949917	MT957424	MT957464	MT957490	–	Visagie & Yilmaz (2022)
	CMW 56390		*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	South Africa	Soil	MT949918	MT957425	MT957465	MT957491	–	Visagie & Yilmaz (2022)
Penicillium krskae	CBS 147776	T	*Aspergilloides*	*Exilicaulis*	*Restricta*	Austria	Air (indoor)	MW794123	MW774594	MW774595	MW774593	–	Labuda *et al.* (2021)
Penicillium limae	URM 7706	T	*Aspergilloides*	*Sclerotiorum*	*Adametziorum*	Brazil	Soil	MW191493	MG452820	MW183244	LR898888	–	Ramos *et al.* (2021)
Penicillium linzhiense	Z863	T	*Penicillium*	*Canescentia*	*Canescentia*	China	Soil	MT461156	MT461157	MT461162	–	–	Liang *et al.* (2021)
Penicillium longiconidiophorum	CBS 141831	T	*Aspergilloides*	*Charlesia*	*Phoenicea*	Madagascar	Soil	MT309669	MT302254	MT302221	MT302237	–	Sun *et al.* (2021)
	DTO 092-C6		*Aspergilloides*	*Charlesia*	*Phoenicea*	Madagascar	Soil	MT309670	MT302255	MT302222	MT302238	–	Sun *et al.* (2021)
Penicillium mattheeae	CMW 56195		*Aspergilloides*	*Aspergilloides*	*Saturniformia*	South Africa	Soil	MT949905	MT957409	MT957452	MT957478	–	Visagie & Yilmaz (2022)
	CMW 56388	T	*Aspergilloides*	*Aspergilloides*	*Saturniformia*	South Africa	Soil	MT949904	MT957408	MT957451	MT957477	–	Visagie & Yilmaz (2022)
	CMW 56633		*Aspergilloides*	*Aspergilloides*	*Saturniformia*	South Africa	Soil	MT949906	MT957410	MT957453	MT957479	–	Visagie & Yilmaz (2022)
Penicillium melanosporum	CBS 146938	T	*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	Spain	Soil	LR655192	LR655196	LR655200	LR655204	–	Rodriguez-Andrade *et al.* (2021)
Penicillium michoacanense	FMR 17612	T	*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	Mexico	Soil	LR655194	LR655198	LR655202	LR655206	–	Rodriguez-Andrade *et al.* (2021)
Penicillium neoherquei	CBS 148692	T	*Aspergilloides*	*Sclerotiorum*	*Herqueorum*	USA	White mushroom sporocarp	MW341222	OL840853	OL840855	MW349119	–	Crous *et al.* (2022)
Penicillium newtonturnerae	BRIP 74909a	T	*Aspergilloides*	*Lanata-Divaricata*	*Simplicissima*	Australia	Soil	OP903478	OP921964	OP921962	OP921963	OP925817	Tan & Shivas (2022)
Penicillium nordestinense	CBS 564.85		*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	Brazil	Pollen samples inside nests of (*Melipona scutellaris*)	OV312015	MH846596	MH846609	MH846584	–	Barbosa *et al.* (2022)
	URM 8423	T	*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	Brazil	Pollen samples inside nests of (*Melipona scutellaris*)	OV265270	OV265324	OV265272	OM927721	–	Barbosa *et al.* (2022)
	URM 8424		*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	Brazil	Pollen samples inside nests of (*Melipona scutellaris*)	OV265271	OV265337	OV265273	OM927721	–	Barbosa *et al.* (2022)
Penicillium outeniquaense	CMW 56387	T	*Aspergilloides*	*Citrina*	*Westlingiorum*	South Africa	Soil	MT949903	MT957405	MT957450	MT957476	–	Visagie & Yilmaz (2022)
Penicillium poederi	CBS 147622	T	*Aspergilloides*	*Torulomyces*	*Torulomyces*	Iceland	Volcanic soil	MF611757	MF611760	MF611763	MF611766	–	Kirchmair *et al.* (2022)
	CBS 147623		*Aspergilloides*	*Torulomyces*	*Torulomyces*	Iceland	Volcanic soil	MF611758	MF611761	MF611764	MF611767	–	Kirchmair *et al.* (2022)
	CBS 147624		*Aspergilloides*	*Torulomyces*	*Torulomyces*	Iceland	Volcanic soil	MF611759	MF611762	MF611765	MF611768	–	Kirchmair *et al.* (2022)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
Penicillium pole-evansii	CBS 138946	T	*Penicillium*	*Canescentia*	*Atroveneta*	South Africa	Bract from *Protea repens* infructescens	JX140831	JX141005	JX157412	KP016911	–	Visagie & Yilmaz (2022)
Penicillium rotoruae	CBS 145838	T	*Aspergilloides*	*Lanata-Divaricata*	*Rolfsiorum*	New Zealand	*Pinus radiata* timber on ground	MN315103	MN315104	MN315102	MT240842	–	O'Callahan *et al.* (2020)
Penicillium saanichanum	DAOMC 251850	T	*Aspergilloides*	*Cinnamopurpurea*	*Idahoensia*	Canada	House dust	KY469059	KY469096	KY469020	MN795070	–	Crous *et al.* (2020a)
Penicillium sanjayi	NFCCI 5017	T	*Aspergilloides*	*Citrina*	*Vascosobrinhoana*	India	Soil	MZ571358	MZ558484	MZ558492	MZ558482	–	Ashtekar *et al.* (2022)
	NFCCI 5018		*Aspergilloides*	*Citrina*	*Vascosobrinhoana*	India	Soil	MZ571359	MZ558485	MZ558493	MZ558483	–	Ashtekar *et al.* (2022)
Penicillium scottii	CBS 138935		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Air (outdoor)	JX140823	JX140977	JX157351	KP016863	–	Visagie & Yilmaz (2022)
	CBS 138937		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140826	JX140978	JX157355	KP016867	–	Visagie & Yilmaz (2022)
	CBS 138941		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Air (outdoor)	JX140827	JX140981	JX157371	KP016882	–	Visagie & Yilmaz (2022)
	CBS 138944		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Bract from *Protea repens* infructescens	JX140820	JX141002	JX157396	KP016907	–	Visagie & Yilmaz (2022)
	CBS 138951	T	*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140812	JX140991	JX157383	KP016894	–	Visagie & Yilmaz (2022)
	CV0939		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140814	JX140994	JX157386	KP016897	–	Visagie & Yilmaz (2022)
	IBT 31903		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Bract from *Protea repens* infructescens	JX140821	JX141003	JX157397	KP016908	–	Visagie & Yilmaz (2022)
	IBT 31904		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	KP016833	JX140995	JX157387	KP016898	–	Visagie & Yilmaz (2022)
	IBT 31906		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140815	JX140996	JX157388	KP016899	–	Visagie & Yilmaz (2022)
	IBT 31907		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	KP016832	JX140988	JX157378	KP016889	–	Visagie & Yilmaz (2022)
	IBT 31908		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140816	JX140997	JX157389	KP016900	–	Visagie & Yilmaz (2022)
	IBT 31909		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	KP016834	JX140998	JX157390	KP016901	–	Visagie & Yilmaz (2022)
	IBT 31910		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140817	JX140999	JX157391	KP016902	–	Visagie & Yilmaz (2022)
	IBT 31911		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140818	JX141000	JX157392	KP016903	–	Visagie & Yilmaz (2022)
	IBT 31912		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140808	JX140984	JX157374	KP016885	–	Visagie & Yilmaz (2022)
	IBT 31913		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140811	JX140990	JX157382	KP016893	–	Visagie & Yilmaz (2022)
	IBT 31914		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140813	JX140993	JX157385	KP016896	–	Visagie & Yilmaz (2022)
	IBT 31915		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140807	JX140982	JX157372	KP016883	–	Visagie & Yilmaz (2022)
	IBT 31916		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140809	JX140985	JX157375	KP016886	–	Visagie & Yilmaz (2022)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
	IBT 31917		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140810	JX140987	JX157377	KP016888	–	Visagie & Yilmaz (2022)
	IBT 31918		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140828	JX140986	JX157376	KP016887	–	Visagie & Yilmaz (2022)
	IBT 31919		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	KP016831	JX140983	JX157373	KP016884	–	Visagie & Yilmaz (2022)
	IBT 31922		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Mite from *Protea repens* infructescens	JX140819	JX141001	JX157394	KP016905	–	Visagie & Yilmaz (2022)
	IBT 31953		*Penicillium*	*Canescentia*	*Canescentia*	South Africa	Soil	JX140829	JX140989	JX157379	KP016890	–	Visagie & Yilmaz (2022)
Penicillium setosum	CBS 144865	T	*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	India	*Withania somnifera*	KT852579	MF184995	MH105905	–	–	Barbosa *et al.* (2022)
	CBS 576.70		*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	Mexico	Soil	–	MH846595	MH846608	MH846583	–	Barbosa *et al.* (2022)
	DTO 284-F3		*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	India	*Withania somnifera*	–	MH846594	MH846607	MH846582	–	Barbosa *et al.* (2022)
	PPRI 20582		*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	South Africa	Insect	MK450718	MK451255	MK451649	–	–	Barbosa *et al.* (2022)
	PPRI 6371		*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	South Africa	Scarabid larvae	MK450717	MK451227	MK451648	MK450852	–	Barbosa *et al.* (2022)
Penicillium sexuale	CBS 146939	T	*Aspergilloides*	*Crypta*	*Crypta*	Spain	Soil	LR655195	LR655199	LR655203	LR655207	–	Rodriguez-Andrade *et al.* (2021)
Penicillium siccitolerans	FMR 17381	T	*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	Spain	Soil	LR655193	LR655197	LR655201	LR655205	–	Rodriguez-Andrade *et al.* (2021)
Penicillium sicoris	FMR 18076	T	*Penicillium*	*Paradoxa*	*Atramentosa*	Spain	Fluvial sediment	LR884497	LR884494	LR884496	LR884495	–	Torres-Garcia *et al.* (2022)
Penicillium silybi	CBS 147777	T	*Aspergilloides*	*Exilicaulis*	*Restricta*	USA	Milk thistle (*Silybum marianum*)	KF367458	MW774592	MW774591	AB860248	–	Labuda *et al.* (2021)
Penicillium soli	KUMCC 18-0202	T	*Aspergilloides*	*Lanata-Divaricata*	*Janthinella*	China	Soil	MT152337	MT161681	MT178249	MT384372	–	Doilom *et al.* (2020)
Penicillium stangiae	URM 8347	T	*Aspergilloides*	*Lanata-Divaricata*	*Dalearum*	Brazil	Soil	MW648590	MW646388	MW646390	MW646392	–	Alves *et al.* (2022a)
Penicillium subfuscum	CMW 56196	T	*Aspergilloides*	*Lanata-Divaricata*	*Simplicissima*	South Africa	Soil	MT949907	MT957412	MT957454	MT957480	–	Visagie & Yilmaz (2022)
	CN 014A6		*Aspergilloides*	*Lanata-Divaricata*	*Simplicissima*	South Africa	Soil	MW329997	MW340969	MW340970	MW340971	–	Visagie & Yilmaz (2022)
Penicillium submersum	FMR 17140	T	*Penicillium*	*Robsamsonia*	*Urticicola*	Spain	Fluvial sediment	LR814194	LR814187	LR814188	LR814195	–	Torres-Garcia *et al.* (2022)
Penicillium taurinense	CBS 145672	T	*Penicillium*	*Robsamsonia*	*Glandicolarum*	Italy	Chestnut mill	MF595981	MF595977	MF595979	MT253108	–	Crous *et al.* (2020b)
	CBS 145673		*Penicillium*	*Robsamsonia*	*Glandicolarum*	Italy	Chestnut mill	MF595982	MF595978	MF595980	–	–	Crous *et al.* (2020b)
Penicillium tealii	BRIP 72734c	T	*Aspergilloides*	*Cinnamopurpurea*	*Jiangxiensia*	Australia	Dead spider	OP101639	OP039547	–	OP039546	–	Tan *et al.* (2022)
	BRIP 72735b		*Aspergilloides*	*Cinnamopurpurea*	*Jiangxiensia*	Australia	Dead spider	OP101642	OP039553	–	OP039552	–	Tan *et al.* (2022)
	BRIP 72742b		*Aspergilloides*	*Cinnamopurpurea*	*Jiangxiensia*	Australia	Dead spider	OP101643	OP039554	–	OP039546	–	Tan *et al.* (2022)
	BRIP 72731b		*Aspergilloides*	*Cinnamopurpurea*	*Jiangxiensia*	Australia	Dead spider	OP101641	OP039551	–	OP039555	–	Tan *et al.* (2022)
	BRIP 72732b		*Aspergilloides*	*Cinnamopurpurea*	*Jiangxiensia*	Australia	Dead spider	OP101640	OP039549	–	OP039559	–	Tan *et al.* (2022)
Penicillium tirolense	CBS 147625	T	*Aspergilloides*	*Torulomyces*	*Torulomyces*	Austria	Sporocarp of *Serpula lacrymans*	MW145398	MW143069	MW143068	MW143067	–	Kirchmair *et al.* (2022)
Penicillium tolerans	BRIP 64090a	T	*Aspergilloides*	*Aspergilloides*	*Sclerotiorum*	Australia	Soil	OK639006	OL741658	–	–	–	Tan & Shivas (2022)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
Penicillium ucsense	CBS 146492	T	*Aspergilloides*	*Lanata-Divaricata*	*Oxalica*	Brazil	Intestinal tract of *Anobium punctatum* larva	OM914583	ON024157	ON024158	ON024159	–	Lenz *et al.* (2022)
Penicillium ulleungdoense	KACC 48990	T	*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	Republic of Korea	Root of *Phedimus takesimensis*	MN640087	MN737487	MN745074	MN756007	–	Choi *et al.* (2020)
	KACC 48991		*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	Republic of Korea	Root of *Sedum oryzifolium*	MN640088	MN737488	MN745075	MN756008	–	Choi *et al.* (2020)
	KACC 48992		*Aspergilloides*	*Sclerotiorum*	*Sclerotiorum*	Republic of Korea	Root of *Aster spathulifolius*	MN640089	MN737489	MN745076	MN756009	–	Choi *et al.* (2020)
Penicillium umkhoba	CMW 56199		*Aspergilloides*	*Sclerotiorum*	*Herqueorum*	South Africa	Soil	MT949911	MT957416	MT957458	MT957484	–	Visagie & Yilmaz (2022)
	CMW 56200	T	*Aspergilloides*	*Sclerotiorum*	*Herqueorum*	South Africa	Soil	MT949912	MT957417	MT957459	MT957485	–	Visagie & Yilmaz (2022)
	CMW 56201		*Aspergilloides*	*Sclerotiorum*	*Herqueorum*	South Africa	Soil	MT949913	MT957418	MT957460	MT957486	–	Visagie & Yilmaz (2022)
Penicillium uttarakhandense	NFCCI 4808	T	*Aspergilloides*	*Lanata-Divaricata*	*Simplicissima*	India	Soil (garden)	MN967315	MN972443	MN972445	MN972447	–	Crous *et al.* (2021a)
	NFCCI 4809		*Aspergilloides*	*Lanata-Divaricata*	*Simplicissima*	India	Soil (garden)	MN967316	MN972444	MN972446	MN972448	–	Crous *et al.* (2021a)
Penicillium vaccaeorum	CBS 110.64		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Turkey	Soil	–	JN606829	JN606533	–	–	Torres-Garcia *et al.* (2022)
	CBS 118020		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Canada	Ants	–	JN606832	JN606536	–	–	Torres-Garcia *et al.* (2022)
	CBS 118024		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Canada	Ants	–	JN606833	JN606537	–	–	Torres-Garcia *et al.* (2022)
	CBS 127029		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Argentina	Soil	–	JN606814	JN606544	–	–	Torres-Garcia *et al.* (2022)
	CBS 135118		*Aspergilloides*	*Citrina*	*Roseopurpurea*	South Africa	Soil	JX140867	JX141019	JX141510	MN418449	–	Torres-Garcia *et al.* (2022)
	CBS 135119		*Aspergilloides*	*Citrina*	*Roseopurpurea*	South Africa	Soil	JX140865	JX141020	JX141511	MK461491	–	Torres-Garcia *et al.* (2022)
	CBS 148.83	T	*Aspergilloides*	*Citrina*	*Roseopurpurea*	Spain	Soil	JN617689	JN606835	JN606543	JN606614	–	Torres-Garcia *et al.* (2022)
	CBS 300.67		*Aspergilloides*	*Citrina*	*Roseopurpurea*	The Netherlands	Soil	–	JN606841	JN606561	–	–	Torres-Garcia *et al.* (2022)
	CBS 441.88		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Chile	Soil	–	JN606846	JN606568	–	–	Torres-Garcia *et al.* (2022)
	CBS 643.73		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Canada	Soil	–	JN606853	JN606576	–	–	Torres-Garcia *et al.* (2022)
	CBS 644.73		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Canada	Soil	–	JN606854	JN606577	–	–	Torres-Garcia *et al.* (2022)
	CBS 685.85		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Spain	Soil	JN617711	JN606855	JN606578	–	–	Torres-Garcia *et al.* (2022)
	CV1865		*Aspergilloides*	*Citrina*	*Roseopurpurea*	South Africa	Soil	JX140866	JX141021	JX157340	MK461547	–	Torres-Garcia *et al.* (2022)
	FMR 17531		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Spain	Fluvial sediment	LR814213	LR814203	LR814204	–	–	Torres-Garcia *et al.* (2022)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
	FMR 17534		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Spain	Fluvial sediment	OU375272	OU375168	OU375273	–	–	Torres-Garcia *et al.* (2022)
	FMR 17616		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Spain	Fluvial sediment	LR814217	LR814212	LR814218	–	–	Torres-Garcia *et al.* (2022)
	FMR 17967		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Spain	Fluvial sediment	LR814235	LR814226	LR814227	–	–	Torres-Garcia *et al.* (2022)
	FMR 18100		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Spain	Fluvial sediment	LR814241	LR814234	LR814242	–	–	Torres-Garcia *et al.* (2022)
	FMR 18123		*Aspergilloides*	*Citrina*	*Roseopurpurea*	Spain	Fluvial sediment	LR814273	LR814265	LR814264	–	–	Torres-Garcia *et al.* (2022)
Penicillium vallebormidaense	CBS 147064	T	*Aspergilloides*	*Exilicaulis*	*Erubescentia*	Italy	Compost	MT316359	MW115862	MW115863	MW115864	–	Crous *et al.* (2020a)
Penicillium vickeryae	BRIP 72552a	T	*Aspergilloides*	*Lanata-Divaricata*	*Simplicissima*	Australia	Soil	OP903479	OP921966	–	OP921965	–	Tan & Shivas (2022)
Penicillium vietnamense	VTCC 930029	T	*Aspergilloides*	*Charlesia*	*Indica*	Vietnam	Sea water	MT102836	MT230561	ON209438	MT222288	–	Nguyen & Pham (2022)
Penicillium xyleborini	CMW 56800	T	*Penicillium*	*Ramosum*	*Soppiorum*	South Africa	Beetle (*Xyleborinus saxesenii*)	MW504356	MW480817	MW480823	MW480824	–	Visagie & Yilmaz (2022)
Rasamsonia oblata	IMI 288719	T	–	–	–	Australia	Spoiled baby food	LC546718	LC546729	LC546740	–	–	Yanai *et al.* (2020)
	CBS 258.87	T	–	–	–	Australia	Spoiled baby food	OR142403	OR145988	OR145994	–	–	Present study
Rasamsonia sabulosa	ATCC 56984	T	–	–	–	Australia	Spoiled fruit juice	LC546720	LC546726	LC546742	–	–	Yanai *et al.* (2020)
Talaromyces africanus	CBS 147340	T	–	*Trachyspermi*	–	South Africa	House dust	OK339610	OK338782	OK338808	OK338833	–	Pyrri *et al.* (2021)
Talaromyces albisclerotius	CBS 141839	T	–	*Trachyspermi*	–	China	Soil	MN864276	MN863345	MN863322	MN863334	–	Sun *et al.* (2020b)
Talaromyces aspriconidius	CBS 141835	T	–	*Talaromyces*	–	China	Soil	MN864274	MN863343	MN863320	MN863332	–	Sun *et al.* (2020b)
Talaromyces atkinsoniae	BRIP 72528a	T	–	*Talaromyces*	–	Australia	Gills of *Marasmius crinisequi*	OP059084	OP087524	–	OP087523	–	Tan *et al.* (2022)
Talaromyces aureolinus	AS 3.15864		–	*Talaromyces*	–	China	Soil	MK837954	MK837938	MK837946	MK837962	–	Wei *et al.* (2021)
	AS 3.15865		–	*Talaromyces*	–	China	Soil	MK837953	MK837937	MK837945	MK837961	–	Wei *et al.* (2021)
	NM6-1		–	*Talaromyces*	–	China	Soil	MN059095	MN059093	MN059094	MN059096	–	Wei *et al.* (2021)
Talaromyces bannicus	AS 3.15862	T	–	*Talaromyces*	–	China	Soil	MK837955	MK837939	MK837947	MK837963	–	Wei *et al.* (2021)
Talaromyces brevis	CBS 141833	T	–	*Talaromyces*	–	China	Soil	MN864269	MN863338	MN863315	MN863328	–	Sun *et al.* (2020b)
	CBS 118436		–	*Talaromyces*	–	Marocco	Soil	MN864271	MN863340	MN863317	MN863330	–	Sun *et al.* (2020b)
	DTO 307-C1		–	*Talaromyces*	–	Turkey	Soil	MN864270	MN863339	MN863316	MN863329	–	Sun *et al.* (2020b)
Talaromyces calidominioluteus	CBS 113167		–	*Trachyspermi*	–	Unknown	Air (indoor)	OK339611	OK338785	OK338816	OK338836	–	Pyrri *et al.* (2021)
	CBS 147313	T	–	*Trachyspermi*	–	The Netherlands	Melon (imported from Brazil)	OK339612	OK338786	OK338817	OK338837	–	Pyrri *et al.* (2021)
	CBS 147341		–	*Trachyspermi*	–	Iran	Grapevine	OK339602	OK338788	KU711896	OK338839	–	Pyrri *et al.* (2021)
	CBS 147342		–	*Trachyspermi*	–	Thailand	House dust	OK339600	KP330045	OK338815	OK338835	–	Pyrri *et al.* (2021)
	DTO 265-H8		–	*Trachyspermi*	–	Iran	Grapevine	OK339601	OK338787	KU711894	OK338838	–	Pyrri *et al.* (2021)
	DTO 266-A5		–	*Trachyspermi*	–	Iran	Grapevine	OK339603	OK338789	KU711900	OK338840	–	Pyrri *et al.* (2021)
	DTO 269-H1		–	*Trachyspermi*	–	Thailand	House dust	KJ775721	KJ775214	–	–	–	Pyrri *et al.* (2021)
	DTO 269-H4		–	*Trachyspermi*	–	Thailand	House dust	KJ775722	KJ775215	–	–	–	Pyrri *et al.* (2021)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
	DTO 270-A1		–	*Trachyspermi*	–	Thailand	House dust	KJ775728	KJ775221	–	–	–	Pyrri *et al.* (2021)
	DTO 270-C3		–	*Trachyspermi*	–	Thailand	House dust	KJ775733	KJ775226	–	–	–	Pyrri *et al.* (2021)
	DTO 390-E9		–	*Trachyspermi*	–	Nigeria	Cocoa beans	MN788104	MN787900	MN787896	OK338847	–	Pyrri *et al.* (2021)
	DTO 390-F1		–	*Trachyspermi*	–	Nigeria	Cocoa beans	MN788103	MN787901	MN787895	OK338848	–	Pyrri *et al.* (2021)
	DTO 390-I9		–	*Trachyspermi*	–	Nigeria	Cocoa beans	MN788115	MN787911	MN787885	OK338849	–	Pyrri *et al.* (2021)
	DTO 391-A5		–	*Trachyspermi*	–	Nigeria	Cocoa beans	MN788111	MN787914	MN787883	OK338850	–	Pyrri *et al.* (2021)
Talaromyces cavernicola	URM 8448	T	–	*Talaromyces*	–	Brazil	Air (cave)	ON862935	OP672383	OP290543	OP290515	–	Alves *et al.* (2022b)
	URM 8449		–	*Talaromyces*	–	Brazil	Air (cave)	ON862936	OP672384	OP290544	OP290516	–	Alves *et al.* (2022b)
Talaromyces chongqingensis	CBS 270.35		–	*Trachyspermi*	–	China	Soil	OK339609	OK338781	OK338807	OK338832	–	Zhang *et al.* (2021b)
	CGMCC 3.20482	T	–	*Trachyspermi*	–	China	Soil	MZ358001	MZ361343	MZ361350	MZ361357	–	Zhang *et al.* (2021b)
	CS26-63		–	*Trachyspermi*	–	China	Soil	MZ358002	MZ361344	MZ361351	MZ361358	–	Zhang *et al.* (2021b)
	CS26-73		–	*Trachyspermi*	–	China	Soil	MZ358003	MZ361345	MZ361352	MZ361359	–	Zhang *et al.* (2021b)
	CS26-75		–	*Trachyspermi*	–	China	Soil	MZ358004	MZ361346	MZ361353	MZ361360	–	Zhang *et al.* (2021b)
	NRRL 1064		–	*Trachyspermi*	–	China	Soil	KM066172	KM066129				Zhang *et al.* (2021b)
Talaromyces gaditanus	CBS 104.71		–	*Trachyspermi*	–	The Netherlands	Tulip	OK339614	OK338792	OK338820	OK338852	–	Pyrri *et al.* (2021)
	CBS 144771		–	*Trachyspermi*	–	The Netherlands	Sputum of cystic fibroses patient	OK339616	OK338794	OK338822	OK338842	–	Pyrri *et al.* (2021)
	CBS 169.81	T	–	*Trachyspermi*	–	Spain	Air	MH861318	OK338775	OK338802	OK338827	–	Pyrri *et al.* (2021)
	CBS 442.89		–	*Trachyspermi*	–	Denmark	Soil	OK339615	OK338793	OK338821	OK338853	–	Pyrri *et al.* (2021)
	CBS 444.89		–	*Trachyspermi*	–	Denmark	Cranberry (imported from USA)	OK339597	OK338776	OK338803	OK338828	–	Pyrri *et al.* (2021)
	CBS 996.72		–	*Trachyspermi*	–	The Netherlands	Jute sugar bag	MH860641	OK338774	OK338813	OK338826	–	Pyrri *et al.* (2021)
	CBS 138.84		–	*Trachyspermi*	–	Spain	Apple (*Malus sylvestris*)	OK339604	OK338791	OK338819	OK338851	–	Pyrri *et al.* (2021)
Talaromyces germanicus	CBS 147314	T	–	*Trachyspermi*	–	Germany	Indoor environment	OK339619	OK338799	OK338812	OK338845	–	Pyrri *et al.* (2021)
Talaromyces ginkgonis	CGMCC 3.20698	T	–	*Talaromyces*	–	China	Fruit of *Ginkgo biloba*	OL638158	OL689844	OL689846	OL689848	–	Wang & Zhuang (2022a)
Talaromyces gwangjuensis	CNUFC WT19-1	T	–	*Purpurei*	–	Republic of Korea	Freshwater	MK766233	MZ318448	–	MK912174	–	Nguyen *et al.* (2021a)
	CNUFC WT19-2		–	*Purpurei*	–	Republic of Korea	Freshwater	MK766234	MZ318449	–	MK912175	–	Nguyen *et al.* (2021a)
Talaromyces haitouensis	AS 3.16101	T	–	*Talaromyces*	–	China	Soil	MZ045695	MZ054634	MZ054637	MZ054631	–	Han *et al.* (2021)
Talaromyces koreanus	CNUFC YJW2-13	T	–	*Helici*	–	Republic of Korea	Freshwater	MZ315100	MZ318450	MZ332529	MZ332533	–	Nguyen *et al.* (2021a)
	CNUFC YJW2-14		–	*Helici*	–	Republic of Korea	Freshwater	MZ315101	MZ318451	MZ332530	MZ332534	–	Nguyen *et al.* (2021a)
Talaromyces nanjingensis	CCTCC-M-2012167	T	–	*Talaromyces*	–	China	Soil	MW130720	MW147759	MW147760	MW147762	–	Sun *et al.* (2022b)
Talaromyces peaticola	CGMCC 3.18620	T	–	*Trachyspermi*	–	China	Soil (peat)	MF135613	MF284705	MF284703	MF284704	–	Tian *et al.* (2021)
	CGMCC 3.18767		–	*Trachyspermi*	–	China	Soil (peat)	MF960857	MF960859	MF960861	MF960863	–	Tian *et al.* (2021)
	CGMCC 3.18768		–	*Trachyspermi*	–	China	Soil (peat)	MF960858	MF960860	MF960862	MF960864	–	Tian *et al.* (2021)

Table 1. (Continued).

Species	Strain	Status	Subgenus	Section	Series	Country	Substrate	ITS	*BenA*	*CaM*	*RPB2*	LSU	Citation
Talaromyces penicillioides	AS 3.15822	T	–	*Talaromyces*	–	China	Soil	MK837956	MK837940	MK837948	MK837964	–	Wei *et al.* (2021)
Talaromyces pernambucoensis	URM 6894	T	–	*Trachyspermi*	–	Brazil	Soil	LR535947	LR535945	LR535946	LR535948	–	Crous *et al.* (2019)
Talaromyces phuphaphetensis	TBRC 16281	T	–	*Trachyspermi*	–	Thailand	Soil (cave)	ON692803	ON706960	ON706962	ON706964	–	Nuankaew *et al.* (2022)
Talaromyces pulveris	CBS 146831	T	–	*Purpurei*	–	France	Bore dust of deathwatch beetle (*Xestobium rufovillosum*) infesting floorboards (*Quercus* wood)	MW175345	MW173136	MW173099	MW173115	–	Crous *et al.* (2020a)
Talaromyces resedanus	CBS 181.71	T	–	*Subinflati*	–	Seychelles	Soil	MN864280	MN863349	MN863326	MN969214	–	Sun *et al.* (2020b)
Talaromyces rosarhiza	GUCC 190040.1	T	–	*Talaromyces*	–	China	Endophyte of *Rosa roxburghii*	MZ221603	MZ333143	MZ333137	MZ333141	–	Zhang *et al.* (2021a)
	GUCC 197011.1		–	*Talaromyces*	–	China	Endophyte of *Rosa roxburghii*	MZ221604	MZ333144	MZ333138	MZ333142	–	Zhang *et al.* (2021a)
Talaromyces rufus	CBS 141834	T	–	*Talaromyces*	–	China	Soil	MN864272	MN863341	MN863318	MN863331	–	Sun *et al.* (2020b)
	DTO 274-C5		–	*Talaromyces*	–	Republic of Korea	Soil	MN864273	MN863342	MN863319	–	–	Sun *et al.* (2020b)
Talaromyces samsonii	CBS 137.84	T	–	*Trachyspermi*	–	Spain	Apple (*Malus sylvestris*)	MH861709	OK338798	OK338824	OK338844	–	Pyrri *et al.* (2021)
	CBS 147356		–	*Trachyspermi*	–	The Netherlands	Soil	OK339598	OK338777	OK338804	OK338829	–	Pyrri *et al.* (2021)
	CBS 147357		–	*Trachyspermi*	–	Greece	Air (indoor)	OK339599	OK338778	OK338805	OK338830	–	Pyrri *et al.* (2021)
Talaromyces santanderensis	HF05	T	–	*Talaromyces*	–	Colombia	Soil (cacao field)	OP082331	OP067657	OP067656	OP067655	–	Guerra Sierra *et al.* (2022)
Talaromyces satunensis	TBRC 16246	T	–	*Trachyspermi*	–	Thailand	Soil (cave)	ON692804	ON706961	ON706963	–	–	Nuankaew *et al.* (2022)
Talaromyces saxoxalicus	MUM20.30	T	–	*Purpurei*	–	Portugal	Limestone walls	MT039882	MT052003	–	MT052004	–	Trovao *et al.* (2021)
Talaromyces shilinensis	CGMCC 3.20699	T	–	*Talaromyces*	–	China	Rotten twig	OL638159	OL689845	OL689847	OL689849	–	Wang & Zhuang (2022a)
Talaromyces sparsus	AS 3.15880	T	–	*Talaromyces*	–	China	Soil	MK837958	MK837942	MK837950	MK837966	–	Wei *et al.* (2021)
Talaromyces teleomorphus	CNUFC YJW2-5	T	–	*Helici*	–	Republic of Korea	Freshwater	MZ315102	MZ318452	MZ332531	MZ332535	–	Nguyen *et al.* (2021a)
	CNUFC YJW2-6		–	*Helici*	–	Republic of Korea	Freshwater	MZ315103	MZ318453	MZ332532	MZ332536	–	Nguyen *et al.* (2021a)
Talaromyces tenuis	CBS 141840	T	–	*Tenues*	–	China	Soil	MN864275	MN863344	MN863321	MN863333	–	Sun *et al.* (2020b)
Talaromyces wushanicus	CGMCC 3.20481	T	–	*Talaromyces*	–	China	Soil	MZ356356	MZ361347	MZ361354	MZ361361	–	Zhang *et al.* (2021b)
	CS17-04		–	*Talaromyces*	–	China	Soil	MZ356357	MZ361348	MZ361355	MZ361362	–	Zhang *et al.* (2021b)
	CS17-06		–	*Talaromyces*	–	China	Soil	MZ356358	MZ361349	MZ361356	MZ361363	–	Zhang *et al.* (2021b)
Talaromyces yunnanensis	KUMCC 18-0208	T	–	*Talaromyces*	–	China	Soil	MT152339	MT161683	MT178251	–	–	Doilom *et al.* (2020)
Talaromyces zhenhaiensis	AS 3.15693		–	*Talaromyces*	–	China	Soil	KY007094	KY007110	KY007102	KY112592	–	Han *et al.* (2021)
	AS 3.16102	T	–	*Talaromyces*	–	China	Soil	MZ045697	MZ054636	MZ054639	MZ054633	–	Han *et al.* (2021)

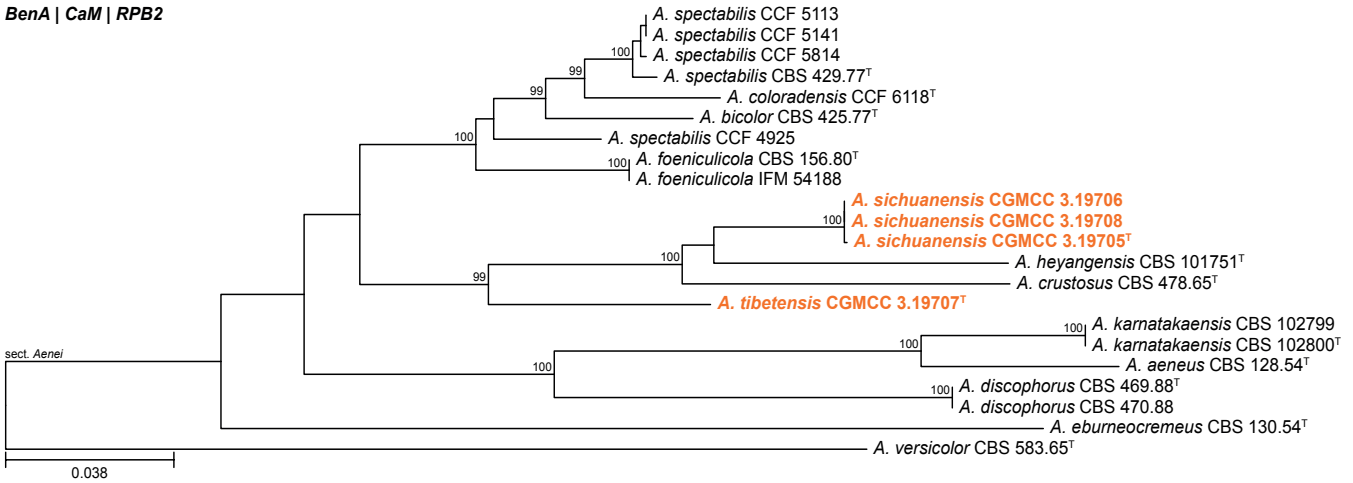

Fig. 1. Phylogenetic tree of *Aspergillus* section *Aenei* series *Aenei* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. versicolor*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S1.

These originated from 42 countries with most coming from China (n = 39), Australia (n = 20), South Africa (n = 16), Brazil (n = 16), Spain (n = 12), and the USA (n = 8). Species were described from a wide range of substrates, mainly soil (n = 91), plant material (n = 15), food and feed (n = 14), air (n = 12) and indoor environments (n = 8). Of the 160, 22 were classified as synonyms and four as doubtful species. Ten were invalidly described. Two of these names are validated below, the remaining eight are considered synonyms or doubtful species. We consider the four combinations introduced by Pitt & Hocking (2022) contradictory to our view on *Aspergillus* and the sexual (teleomorphic) genera associated with it (Samson *et al.* 2014, Kocsube *et al.* 2016). We also document species that were previously accepted but then subsequently reduced as synonyms due to various taxonomic revisions. Finally, species accepted in Houbraken *et al.* (2020) for which no DNA sequence data are available are now listed as doubtful. Taking these changes into account, we currently accept 453 *Aspergillus*, 12 *Paecilomyces*, 535 *Penicillium*, 14 *Rasamsonia*, 203 *Talaromyces* and four *Xerochrysium* species.

Aspergillus* series *Annuorum J.J. Silva, Iamanaka & Frisvad ***ser. nov.*** MycoBank MB 849339. Fig. 6 & Suppl. Fig. S6.
Synonym: *Aspergillus* ser. *Annuorum* [*nom. inval*. Art. 40.1 (Shenzhen)] J.J. Silva, Fungaro, Frisvad, Taniwaki & Iamanaka, J. Fungi 8 (no 1279): 14. 2022. MycoBank MB 845971.

In: *Aspergillus* subgen. *Circumdati* sect. *Flavi*.

Typus: *Aspergillus annui* J.J. Silva, Fungaro, Frisvad, Taniwaki & Iamanaka [MB 849336].

Etymology: Named after *Aspergillus annui*.

Description: See Silva *et al.* (2022).

Aspergillus annui J.J. Silva, Fungaro, Frisvad, Taniwaki & Iamanaka, ***sp. nov.*** MycoBank MB 849336. Fig. 6 & Suppl. Fig. S6.
Synonym: *Aspergillus annui* [*nom. inval*. Art. 40.7 & Art. 40.8 (Shenzhen)] J.J. Silva, Fungaro, Frisvad, Taniwaki & Iamanaka, J. Fungi 8 (no 1279): 14. 2022. MycoBank MB 845969.

In: *Aspergillus* subgen. *Circumdati* sect. *Flavi* ser. *Annuorum*.

DNA barcodes: ITS = OP691228; *BenA* = ON529842; *CaM* = ON529841; *RPB2* = ON529843.

Etymology: The specific epithet refers to the substrate from which it was isolated, paprika pepper (*Capsicum annuum*).

Typus: **Brazil**, São Paulo State, São Paulo City, 23°35'29.7"S 46°40'52.1"W, sweet paprika pepper (*Capsicum annuum*), 6 Apr. 2017, isol. C.A. Yasumura (**holotype** IBT 36122 preserved as a metabolically inactive culture, culture ex-type 365-IT-PPK = IBT 36122).

Description: See Silva *et al.* (2022).

Notes: This species was invalidly described because Silva *et al.* (2022) cited two holotypes and failed to mention that the holotype was metabolically inactive. This also means that series *Annuorum* introduced for *A. annui* is invalid. Here we validate both the species and the series.

Aspergillus saccharicola J.J. Silva, Frisvad, Fungaro, Taniwaki & Iamanaka, ***sp. nov.*** MycoBank MB 849338. Fig. 6 & Suppl. Fig. S6.
Synonym: *Aspergillus saccharicola* [*nom. inval*. Art. 40.7 & Art. 40.8 (Shenzhen)] J.J. Silva, Frisvad, M.H.P. Fungaro, M.H. Taniwaki & B.T. Iamanaka, J. Fungi 8 (no 1279): 16. 2022. MycoBank MB 845970.

In: *Aspergillus* subgen. *Circumdati* sect. *Flavi* ser. *Flavi*.

DNA barcodes: ITS = OP611470; *BenA* = ON529845; *CaM* = ON529844; *RPB2* = ON529846.

Etymology: The specific epithet refers to the substrate from which it was isolated, sugarcane (*Saccharum officinarum*).

Typus: **Brazil**, São Paulo State, São Paulo City, 23°35'29.7"S 46°40'52.1"W, sugarcane (*Saccharum officinarum*), 14 Sep. 2011, isol. B.T. Imanaka (**holotype** IBT 36126 preserved as a metabolically inactive culture, culture ex-type 117-IT-SGC = IBT 36126).

Description: See Silva *et al.* (2022).

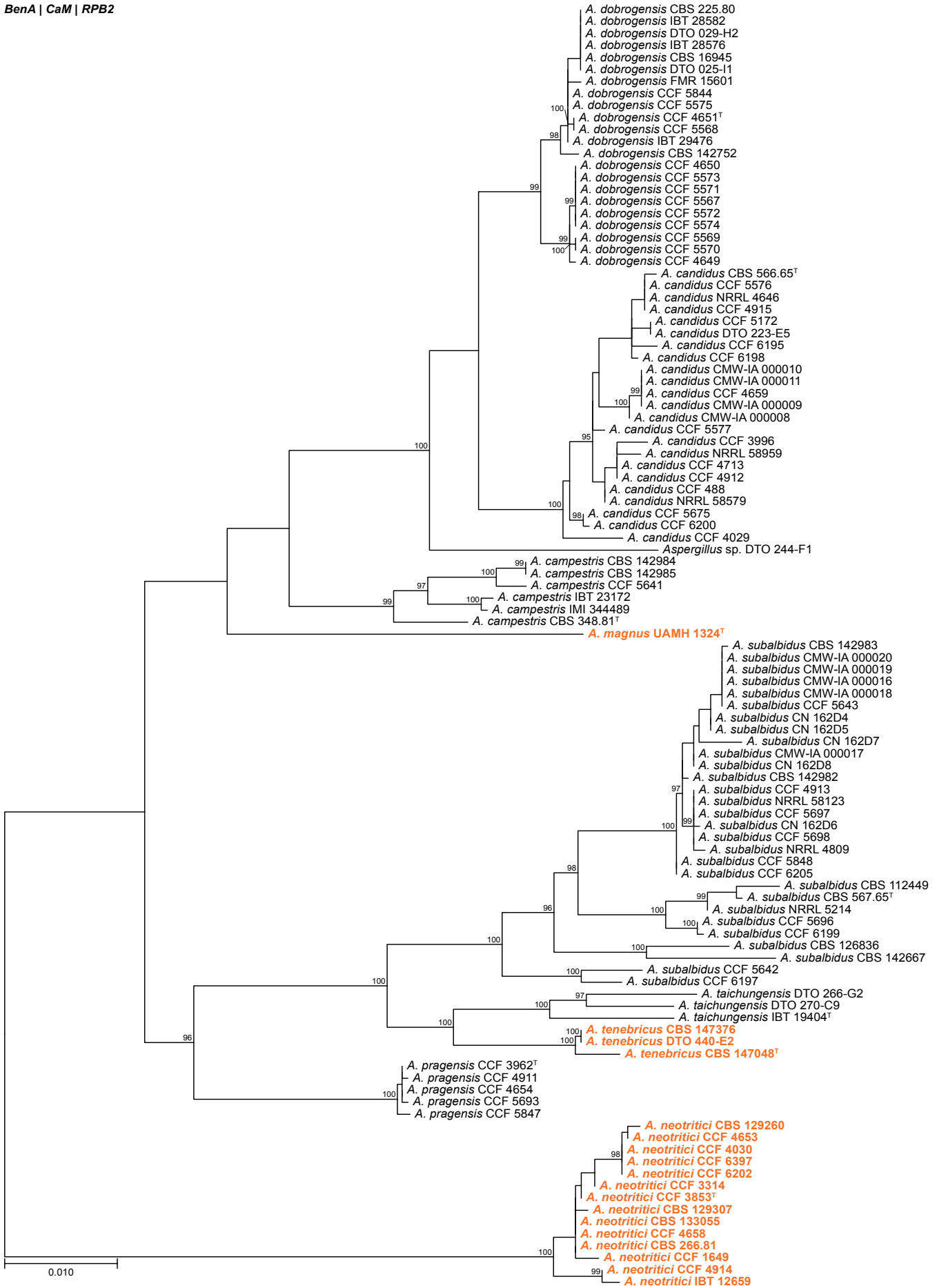

Fig. 2. Phylogenetic tree of *Aspergillus* section *Candidi* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. neotritici*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S2.

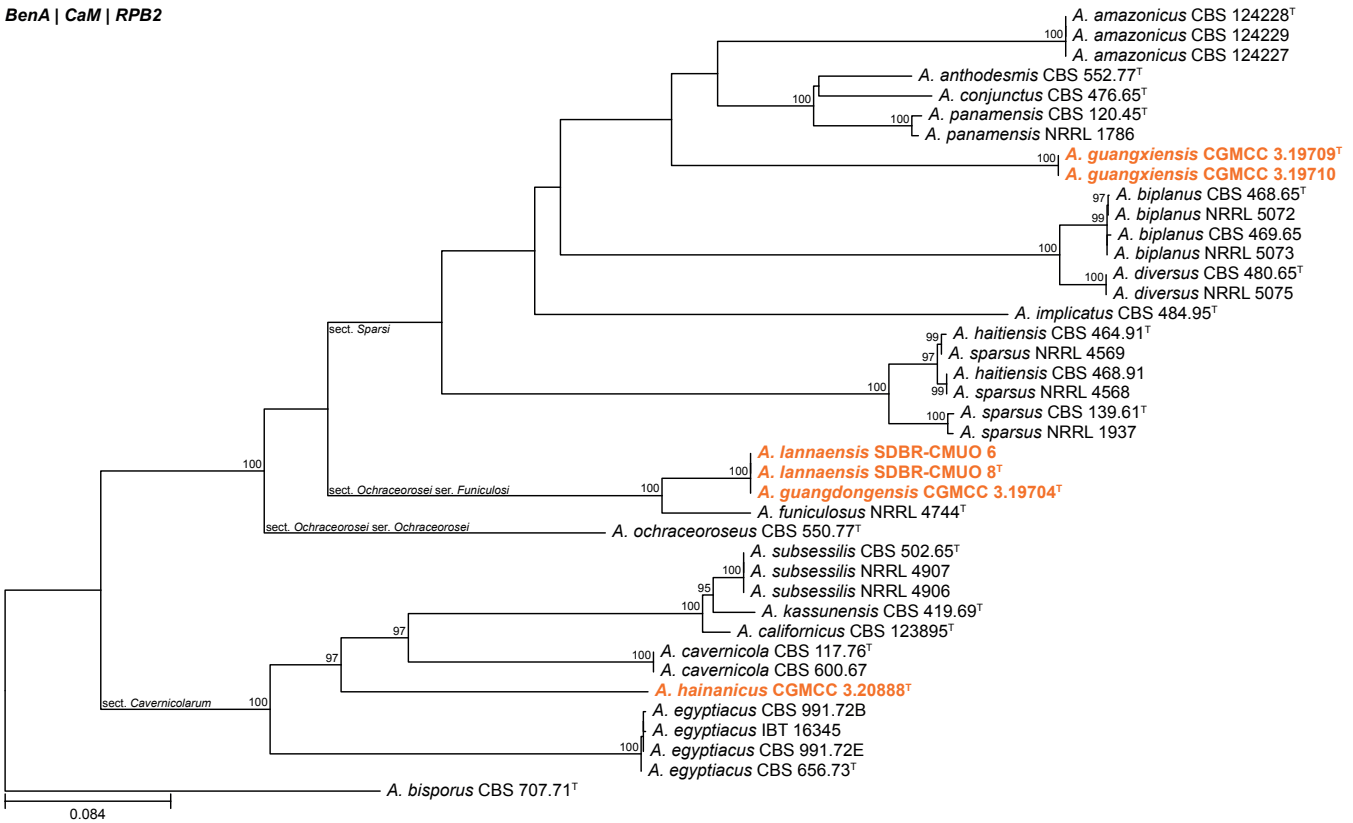

Fig. 3. Phylogenetic tree of *Aspergillus* sections *Cavernicolarum*, *Ochraceorosei* and *Sparsi* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. bisporus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S3.

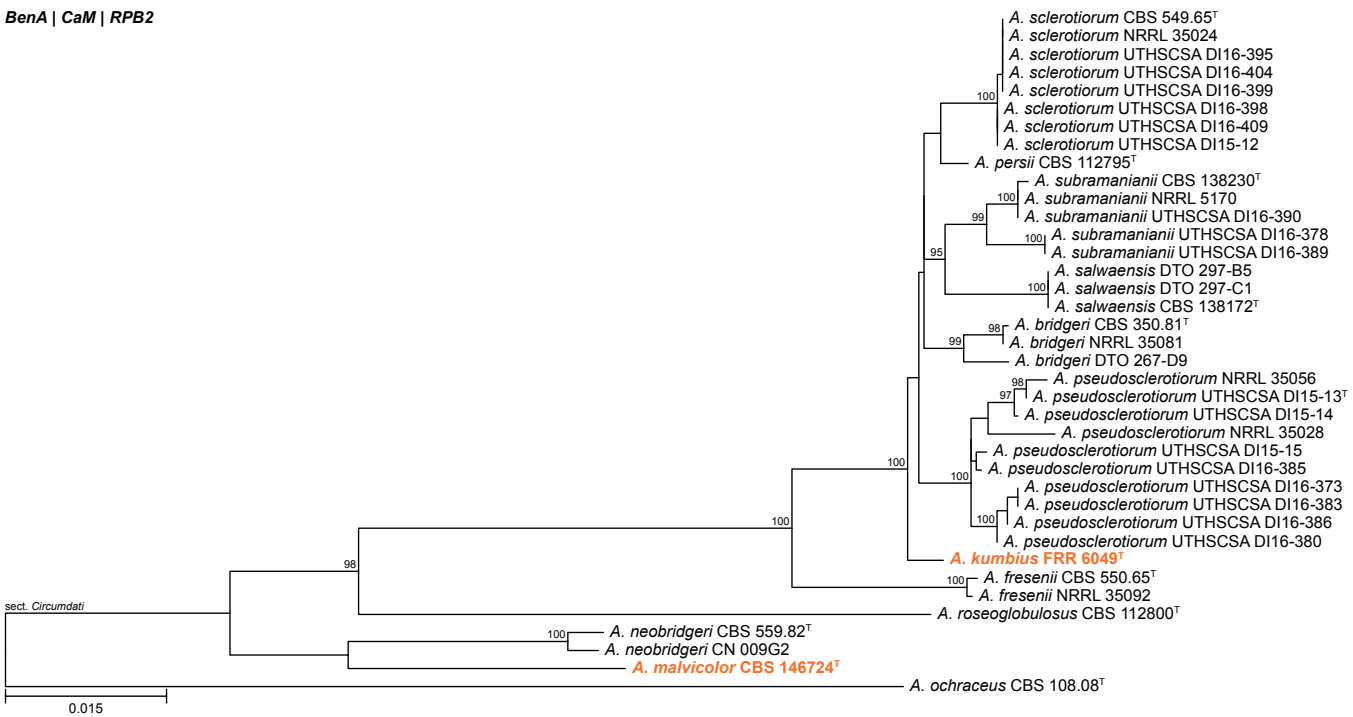

Fig. 4. Phylogenetic tree of *Aspergillus* section *Circumdati* series *Sclerotiorum* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. ochraceus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S4.

Notes: This species was invalidly described because Silva *et al.* (2022) cited two holotypes and failed to mention that the holotype was metabolically inactive. Here we validate the species.

Aspergillus* section *Dichlaena Visagie, Kocsubé & Houbraken, ***sect. nov.*** MycoBank MB 849488. Fig. 14.

In: *Aspergillus* subgenus *Circumdati*.

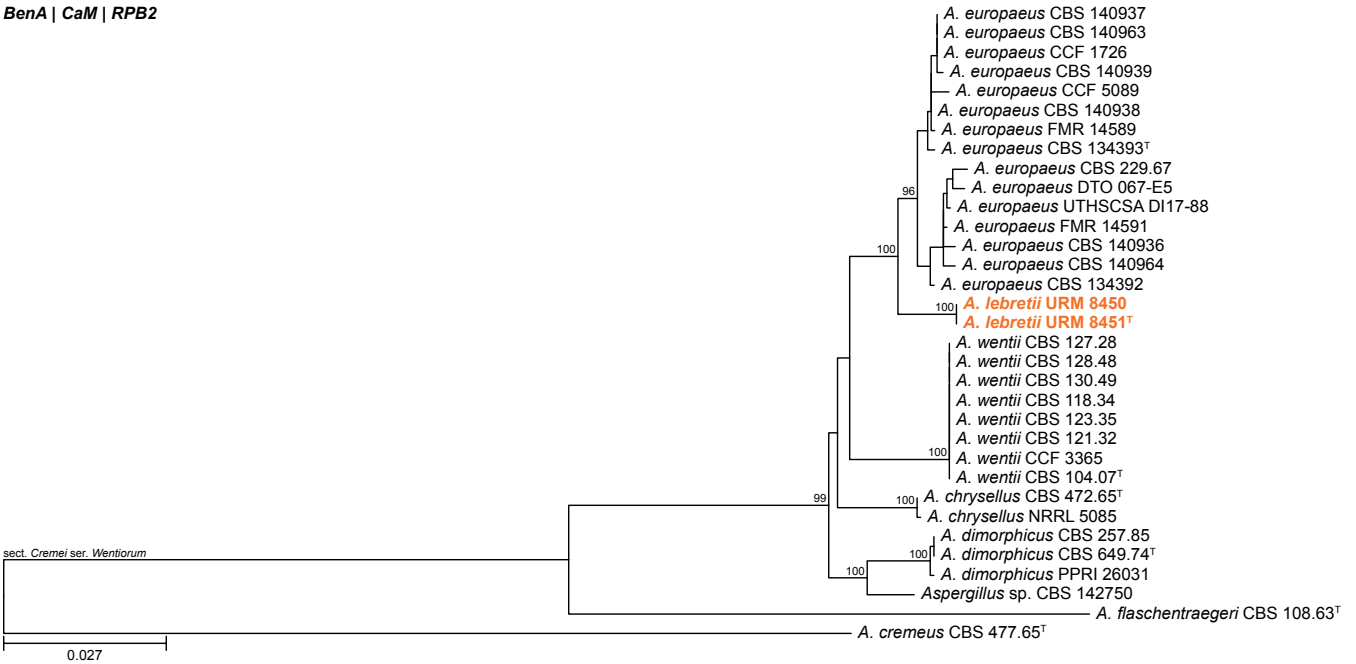

Fig. 5. Phylogenetic tree of *Aspergillus* section *Cremei* series *Wentiorum* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. cremeus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S5.

Etymology: Named after the genus *Dichlaena.*

Typus: *Aspergillus lentisci* (Durieu & Mont.) Visagie, Malloch, L. Kriegsteiner, Samson & Houbraken [MB 849485].

Description: We follow the Malloch & Cain (1972) description of *Dichlaena* and apply this to the section.

Notes: The genus *Dichlaena* is synonymised with *Aspergillus*. *Aspergillus lentisci* (bas. *Dichlaena lentisci*) strains resolve as a distinct clade, with section *Petersoniorum* (subg. *Circumdati*) members being the closest relatives (Fig. 14). *Aspergillus lentisci* strains are strongly xerophilic, similar to *Aspergillus* sections *Aspergillus* and *Restricti*, while section *Petersoniorum* species also grow well on low water activity media. We thus introduce this as a new section. The section is based on the single species, *Aspergillus lentisci*. The sexual state for this xerophilic species has not been observed in culture, but was documented in detail by Malloch & Cain (1972) who observed it from leaves, twigs and dung. Three other species have been described in *Dichlaena*. *Dichlaena bovina* [MB 329872] was considered a synonym of *Thielavia bovina* [MB 240118] by Malloch & Cain (1973), while we consider *Dichlaena indica* [MB 127024] and *Dichlaena pterodontis* [MB 312952] doubtful species with no material available for study.

Aspergillus lentisci (Durieu & Mont.) Visagie, Malloch, L. Kriegsteiner, Samson & Houbraken ***comb. nov.*** MycoBank MB 849485. Figs 34 & 35.
Basionym: *Dichlaena lentisci* Durieu & Mont., Expl. Sci. l'Algérie 1 (11): 405. 1849. MycoBank MB 249716.

In: *Aspergillus* subgen. *Circumdati* sect. *Dichlaena*

DNA barcodes: ITS = OR142402; *BenA* = OR145977; *CaM* = OR145992; *RPB2* = OR146003; LSU = OR142413.

Typus: Durieu & Mont., Expl. Sci. l'Algérie 1 (11): 405, tab. 22 bis, fig. 2, **lectotype** designated here, MBT10014202. **Portugal**, Aljezur, *Pistacia* leaf, Apr. 2019, coll. L. Kriegsteiner, isol. R.A. Samson [**epitype** designated here, CBS H-25292 (dried culture of CBS 150189), MBT10014196, culture ex-epitype CBS 150189 = DTO 426-E9].

Additional strains examined: **Portugal**, Aljezur, *Pistacia* leaf, Apr. 2019, coll. L. Kriegsteiner, isol. R.A. Samson, cultures DTO 426-F1, DTO 426-F2, and DTO 426-F3.

Colony diam, 25 °C (7 d, in mm): CYA no growth; MEA no growth; OA no growth; YES no growth; MY20 no growth; MY40 microcolonies–6; MY50G 5–10. After 14 d (in mm): CYA no growth; MEA no growth; OA microcolonies–6; YES no growth; MY20 no growth to microcolonies; MY40 9–17; MY50G 13–20; DG18 5–13; CREA no growth.

Colony characters (25 °C, 14 d): DG18, colonies floccose; mycelial areas white to yellowish; ascocarp bearing stromata light yellow to orange yellow to greyish yellow (4A4–6–B6), globose, sclerotiod, 600–1 200(–1 900) µm; sporulation absent to sparse, becoming moderate with prolonged incubation, white to cream; exudate sometimes present, clear; soluble pigment brown, inconspicuous; reverse yellowish white (4A2) to light brown to yellowish brown to brown (5D7–E8–6E8). MY50G, colonies floccose; mycelial areas white to yellowish; ascocarp bearing stromata light yellow to orange yellow to greyish yellow (4A4–6–B6), globose, sclerotiod, 600–1 200(–1 900) µm; sporulation sparse, white to cream; exudate absent; soluble pigment absent; reverse yellowish white (4A2) to greyish orange (5B6). MY40, colonies floccose; mycelial areas white to yellowish; sporulation absent; exudate absent; soluble pigment absent.

Micromorphology: *Conidial heads* radiate; *conidiophores* uniseriate; *stipes* hyaline, minor proportion pigmented, smooth, 200–830 × 4–8

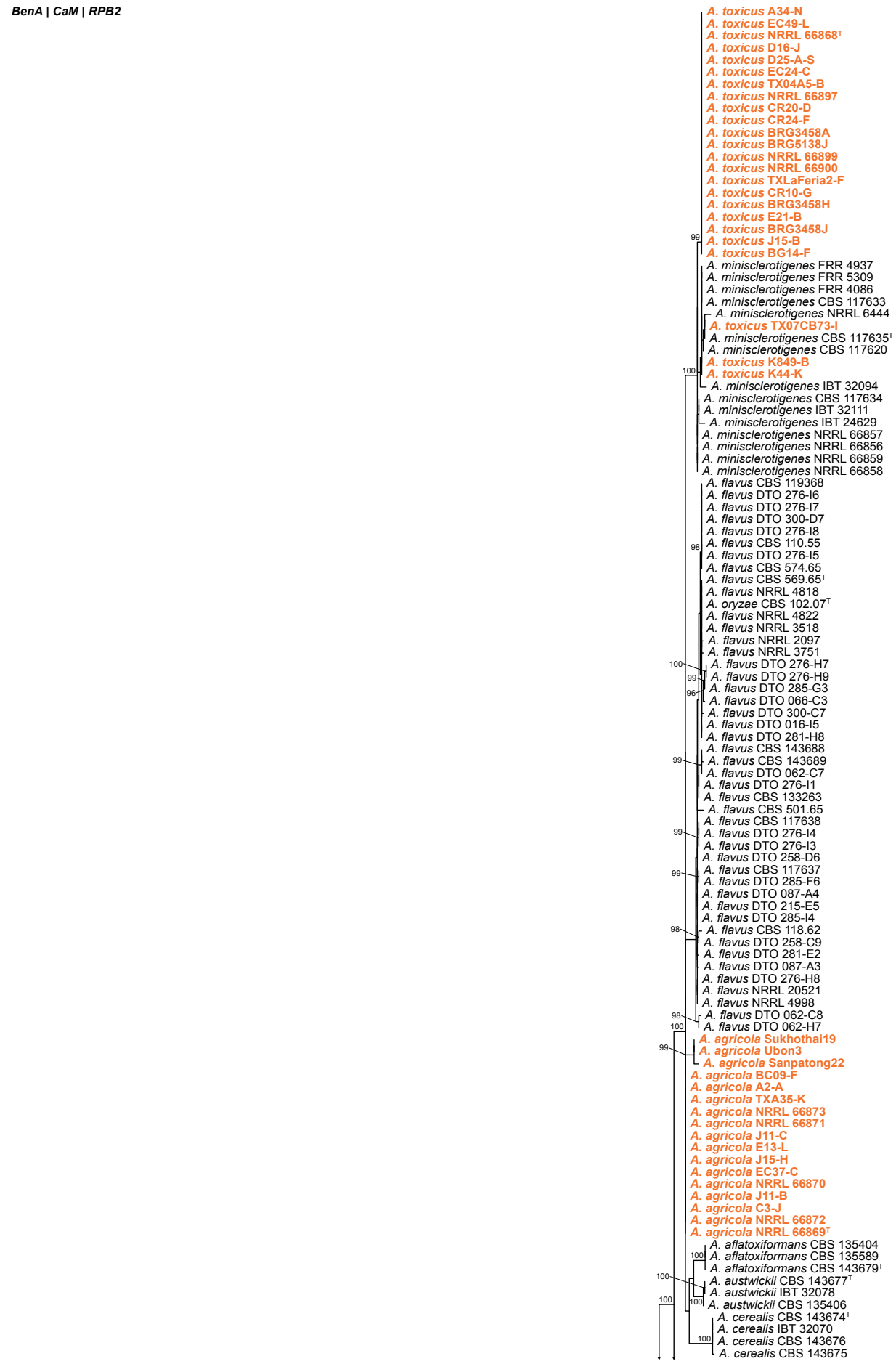

Fig. 6. Phylogenetic tree of *Aspergillus* section *Flavi* series *Alliacei* and *Flavi* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was midpoint rooted. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. Representative strains are indicated by superscript R. See Suppl. Fig. S6.

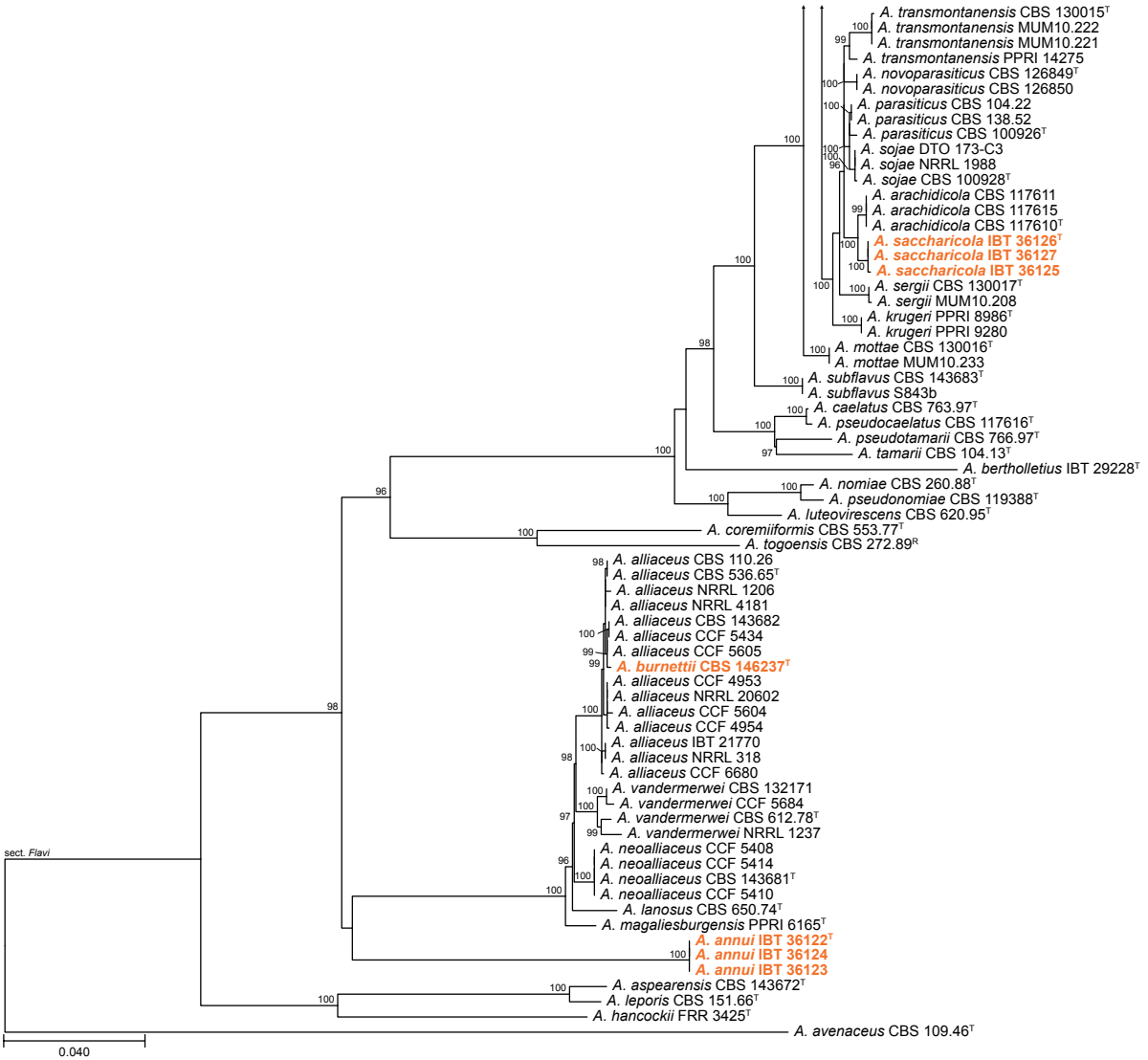

Fig. 6. (Continued).

µm; *vesicles* subglobose, sometimes clavate, phialides cover 50–75 % of head, 11–22(–32) µm wide; *phialides* ampulliform, 6.5–13 × 2.5–4(–4.5) µm; *conidia* globose to subglobose, some tapering towards one end, rough to echinulate, 3.5–5 × 3–4.5 (4.25 ± 0.27 × 3.88 ± 0.27, n = 50) µm, length/width 0.91 ± 0.1. *Ascomata* not produced in culture, in nature *fide* Malloch & Cain (1972), 'arising from coiled or twisted initials at one to three points in the stroma, completely filling the stroma at maturity, irregular in shape, colorless to pale yellow; stroma tissue hard and stony, of two types when young; stromal cells of the outer tissue pale yellow, very thick-walled, pyriform to globose, often nearly open at one end, about 5–13 µm in diameter; stromal cells of the inner tissue hyaline, very thick-walled (but thinner-walled than those of the outer tissue), irregular in shape, usually elongated, often greater than 40 µm length, up to 15 µm broad; ascocarp peridium hyaline to pale yellow, consisting of a filamentous tissue with a membranous "backing"; asci irregularly disposed, ellipsoidal, short-stipitate, eight-spored, evanescent, 9 × 7 µm [*fide* Von Höhnel (1910)]; ascospores oblate, hyaline, smooth, with an inconspicuous equatorial band, 3.0–4.2 × 2.0–3.5 µm'.

Rasamsonia oblata (Pitt & A.D. Hocking) Yanai & Udagawa, Jap. J. Mycol. 61: 93. 2020. MycoBank MB 836491. Figs 28, 36 & Suppl. Fig. S26.

Basionym: Penicillium oblatum Pitt & A.D. Hocking, Mycologia 77: 810. 1985. MycoBank MB 104603.

DNA barcodes: ITS = LC546718; *BenA* = LC546729; *CaM* = LC546740.

Typus: **Australia**, New South Wales, Sydney, from spoiled baby food, 1979, isol. A.D. Hocking (**holotype** FRR 2234, culture ex-type CBS 258.87 = IMI 288719 = NBRC 33091).

Colony diam, 25 °C (7 d, in mm): CYA 20 °C 8–9; CYA 8–9; CYA 30 °C 10–12; CYA 37 °C 4–5; CYAS no growth; CREA no growth; DG18 14–15; MEA 29–32; OA 22–23; YES 9–10.

Colony characters: CYA 25 °C, 7 d: Colonies low, plane; margins low, narrow, entire; mycelia white; texture funiculose; sporulation very sparse, conidia *en masse* not determined; soluble pigments absent; exudates absent; reverse pale yellow (3A2). MEA 25 °C, 7 d: Colonies deep, plane; margins subsurface, wide; mycelia white; texture funiculose; sporulation sparse to moderately dense, conidia *en masse* Brown to Dark Blonde (5D4); soluble pigments absent; exudates absent. YES 25 °C, 7 d: Colonies deep, plane; margins moderately deep, narrow, entire; mycelia white; texture funiculose; sporulation very sparse, conidia *en masse* not determined; soluble pigments absent; exudates absent; reverse pale yellow (4A2). DG18 25 °C, 7 d: Colonies low, plane; margins low, narrow, entire; mycelia white; texture funiculose; sporulation very sparse, conidia *en masse* not determined; soluble pigments absent; exudates

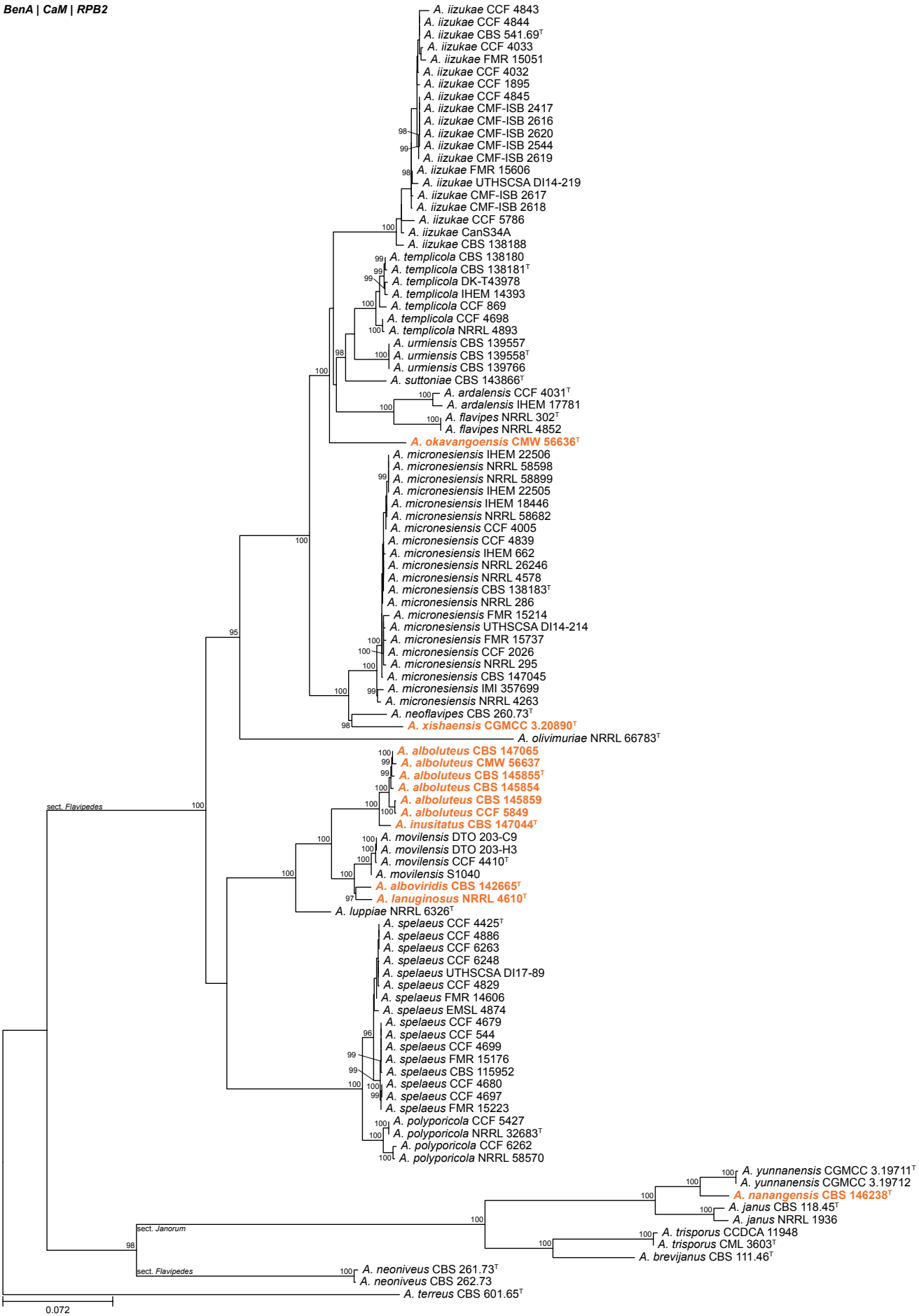

Fig. 7. Phylogenetic tree of *Aspergillus* sections *Flavipedes* and *Janorum* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. terreus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S7.

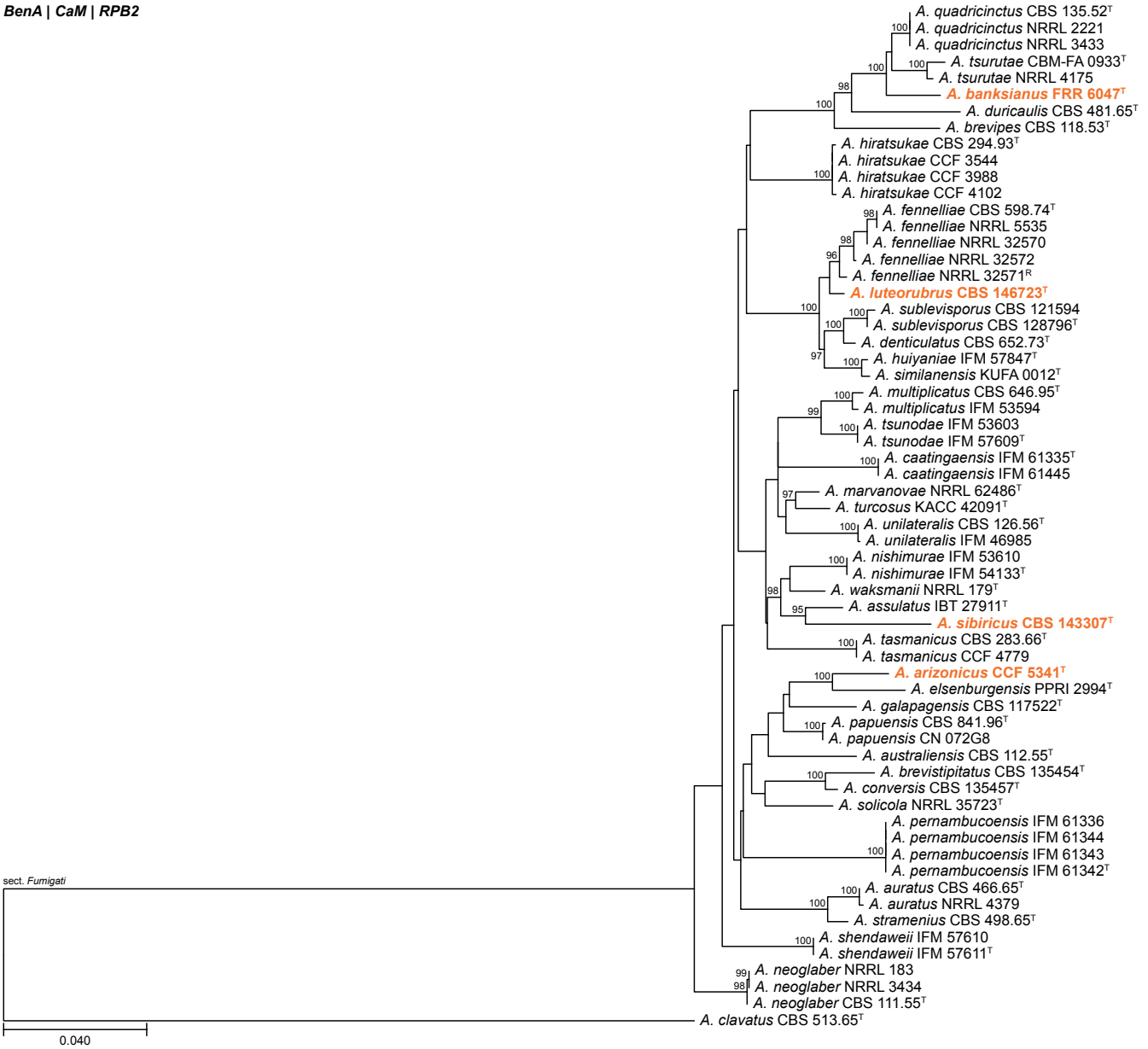

Fig. 8. Phylogenetic tree of *Aspergillus* section *Fumigati* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. clavatus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. Representative strains are indicated by superscript R. See Suppl. Fig. S8.

absent; reverse pale yellow (3A2). OA 25 °C, 7 d: Colonies low, plane; margins subsurface, wide; mycelia white; texture funiculose; sporulation sparse to moderately dense, conidia *en masse* Brown to Dark Blonde (5D4); soluble pigments absent; exudates absent.

Micromorphology: *Conidiophores* monoverticillate, small proportion biverticillate; *stipes* rough walled, some finely roughened, non-vesiculate, 10–28 × 2.5–3 µm; *metulae* 2–3 per stipe, 9.5–14 × 2.5–3 µm; *phialides* acerose, in verticils of 3–6, smooth to roughened, 7–8.5(–9.5) × 2–3 µm; conidia smooth, broadly ellipsoid, some subglobose, 2–2.5 × 1.5–2 µm (2.14 ± 0.1 × 1.67 ± 0.1), average width/length = 0.78, n = 50, connected in chains with distinct connectors, connected on short end.

Notes: Pitt & Hocking (1985a) described *Penicillium oblatum* and referred to it as an interface species, noting that its 'rough-walled stipes bearing appressed monoverticillate penicilli and its brown, often oblate conidia distinguish it from other Penicillia', but that its conidial and phialide shape preclude it from *Paecilomyces* or *Geosmithia*. Both Samson *et al.* (2011) and Yilmaz *et al.* (2014) mentioned that the ex-type strain (CBS 258.87) was contaminated and was not representative of the original description. Recently, Yanai *et al.* (2020) analysed sequences generated for *P. oblatum* (ex-type strains IMI 288719 and NBRC 33091) and *P. sabulosum* (ex-type strain ATCC 56984; CBS 261.87 is contaminated), showed that they belong to *Rasamsonia*, and provided new combinations as *R. oblata* and *R. sabulosa*. They also provided new morphological descriptions in Japanese. We were able to purify CBS 258.87 and provide an English description above based on this strain.

Xerochrysium coryli (Crous & Decock) Visagie & Houbraken, ***comb. nov.*** MycoBank MB 849335. Fig. 16.
Basionym: Paraxerochrysium coryli Crous & Decock, Persoonia 47: 261. 2021. MycoBank MB 841830.

DNA barcodes: ITS = OK664748; *BenA* = OK651216; *RPB2* = OK651178.

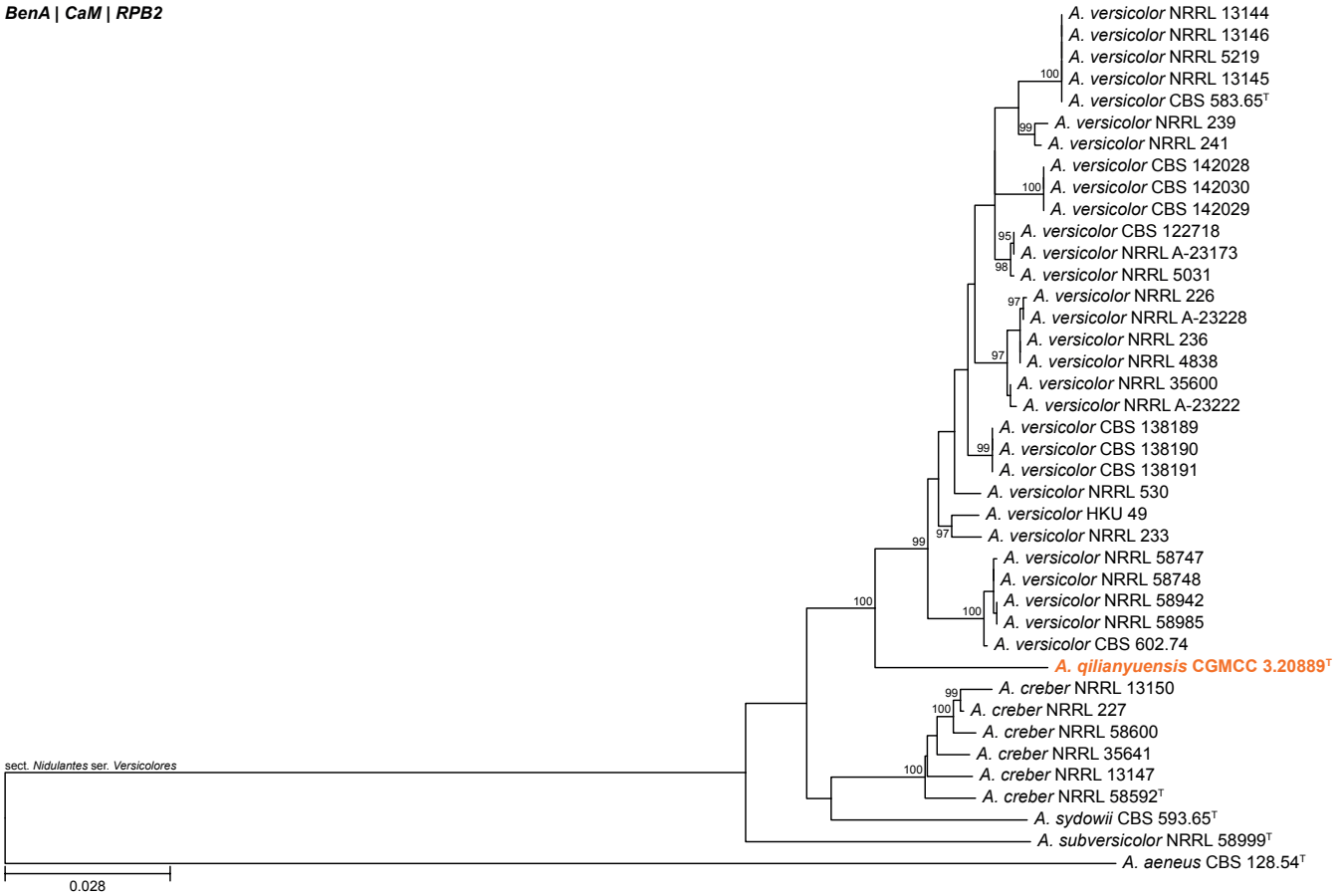

Fig. 9. Phylogenetic tree of *Aspergillus* section *Nidulantes* series *Versicolores* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. aeneus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S9.

Typus: **Belgium**, Louvain-la-Neuve, from dry hazelnut (*Corylus avellana*), Feb. 2021, C. Decock (**holotype** CBS H-24853, culture ex-type CBS 148314 = CPC 41272 = MUCL 58103).

Description: See Crous *et al.* (2021b).

Notes: A multigene phylogenetic analysis of *Aspergillaceae* based on *BenA*, *RPB2*, ITS and LSU showed that *Paraxerochrysium coryli* resolves as a unique species inside *Xerochrysium* (Fig. 16). We thus synonymise *Paraxerochrysium* with *Xerochrysium* and provide a new combination here.

Current *Eurotiales* families, genera and subgeneric classifications (* indicates recently introduced sections or series)

Aspergillaceae
- *Aspergillago*
- *Aspergillus*
  - subgenus *Aspergillus*
    - section *Aspergillus*
      - series *Aspergillus*, *Chevalierorum*, *Leucocarpi*, *Rubri*, *Tamarindosolorum*, *Teporium* and *Xerophili*
    - section *Restricti*
      - series *Halophilici*, *Penicillioides*, *Restricti* and *Vitricolarum*
  - subgenus *Circumdati*
    - section *Candidi*
      - series *Candidi*
    - section *Circumdati*
      - series *Circumdati*, *Sclerotiorum* and *Steyniorum*
    - section *Dichlaena**
    - section *Flavi*
      - series *Alliacei*, *Annuorum**, *Avenacei*, *Bertholletiarum*, *Coremiiformes*, *Flavi*, *Kitamyces*, *Leporum* and *Nomiarum*
    - section *Flavipedes*
      - series *Flavipedes*, *Neonivei*, *Olivimuriarum* and *Spelaei*
    - section *Janorum*
      - series *Janorum*
    - section *Nigri*
      - series *Carbonarii*, *Heteromorphi*, *Homomorphi*, *Japonici* and *Nigri*
    - section *Petersoniorum*
      - series *Petersoniorum*
    - section *Robusti*
      - series *Robusti*
    - section *Tannerorum*
      - series *Tannerorum*
    - section *Terrei*
      - series *Ambigui*, *Nivei* and *Terrei*
  - subgenus *Cremei*
    - section *Cremei*

series *Arxiorum*, *Brunneouniseriati*, *Cremei*, *Inflati*, *Pulvini* and *Wentiorum*
subgenus *Fumigati*
section *Cervini*
series *Acidohumorum* and *Cervini*
section *Clavati*
series *Clavati*
section *Fumigati*
series *Brevipedes*, *Fennelliarum*, *Fumigati*, *Neoglabri*, *Spathulati*, *Thermomutati*, *Unilaterales* and *Viridinutantes*
section *Vargarum*
series *Vargarum*
subgenus *Nidulantes*
section *Aenei*
series *Aenei*
section *Bispori*
series *Bispori*
section *Cavernicolarum*
series *Cavernicolarum*, *Egyptiaci* and *Hainanici**
section *Nidulantes*
series *Aurantiobrunnei*, *Multicolores*, *Nidulantes*, *Speluncei*, *Stellati*, *Unguium* and *Versicolores*
section *Ochraceorosei*
series *Funiculosi* and *Ochraceorosei*
section *Raperorum*
series *Raperorum*
section *Silvatici*
series *Silvatici*
section *Sparsi*
series *Biplani*, *Conjuncti*, *Implicati* and *Sparsi*
section *Usti*
series *Calidousti*, *Deflecti*, *Monodiorum* and *Usti*
subgenus *Polypaecilum*
section *Polypaecilum*
series *Canini*, *Kalimarum*, *Noonimiarum*, *Polypaecilum*, *Salinarum* and *Whitfieldiorum*
Evansstolkia
Hamigera
Leiothecium
Monascus
Paraxerochrysium
Penicilliopsis
Penicillium
subgenus *Aspergilloides*
section *Alfrediorum*
series *Alfrediorum*
section *Aspergilloides*
series *Fortuita*, *Glabra*, *Hoeksiorum*, *Improvisa*, *Kiamaensia*, *Livida*, *Longicatenata*, *Pinetorum*, *Quercetorum*, *Saturniformia*, *Spinulosa*, *Sublectatica*, *Thiersiorum*, *Thomiorum* and *Verhageniorum*
section *Charlesia*
series *Costaricensia*, *Fellutana*, *Indica* and *Phoenicea*
section *Cinnamopurpurea*
series *Cinnamopurpurea*, *Idahoensia*, *Jiangxiensia* and *Nodula*
section *Citrina*
series *Citrina*, *Copticolarum*, *Euglauca*, *Gallaica*, *Paxillorum*, *Roseopurpurea*, *Sheariorum*, *Sumatraensia*, *Vascosobrinhoana** and *Westlingiorum*
section *Crypta*
series *Crypta*
section *Eremophila*
series *Eremophila*
section *Exilicaulis*
series *Alutacea*, *Citreonigra*, *Corylophila*, *Erubescentia*, *Lapidosa* and *Restricta*
section *Gracilenta*
series *Angustiporcata*, *Estinogena*, *Gracilenta* and *Macrosclerotiorum*
section *Griseola*
series *Griseola*
section *Inusitata*
series *Inusitata*
section *Lanata-Divaricata*
series *Dalearum*, *Janthinella*, *Oxalica*, *Rolfsiorum* and *Simplicissima*
section *Lasseniorum*
series *Lasseniorum*
section *Ochrosalmonea*
series *Ochrosalmonea*
section *Ramigena*
series *Georgiensia and Ramigena*
section *Sclerotiorum*
series *Adametziorum*, *Herqueorum* and *Sclerotiorum*
section *Stolkia*
series *Stolkia*
section *Thysanophora*
series *Thysanophora*
section *Torulomyces*
series *Torulomyces*
subgenus *Penicillium*
section *Brevicompacta*
series *Brevicompacta*, *Buchwaldiorum*, *Olsoniorum* and *Tularensia*
section *Canescentia*
series *Atroveneta* and *Canescentia*
section *Chrysogena*
series *Aethiopica*, *Chrysogena*, *Crustacea*, *Goetziorum* and *Persicina*
section *Eladia*
series *Eladia*
section *Fasciculata*
series *Camembertiorum*, *Corymbifera*, *Gladioli*, *Verrucosa and Viridicata*
section *Formosana*
series *Formosana*
section *Osmophila*
series *Osmophila* and *Samsoniorum*
section *Paradoxa*
series *Atramentosa* and *Paradoxa*
section *Penicillium*

series *Clavigera*, *Digitata*, *Italica*, *Penicillium* and *Sclerotigena*
section *Ramosum*
series *Lanosa*, *Raistrickiorum*, *Scabrosa*, *Soppiorum* and *Virgata*
section *Robsamsonia*
series *Claviformia*, *Glandicolarum*, *Robsamsonia* and *Urticicola*
section *Roquefortorum*
series *Roquefortorum*
section *Turbata*
series *Turbata*
Phialomyces
Pseudohamigera
Pseudopenicillium
Sclerocleista
Warcupiella
Xerochrysium
Xeromyces
incertae sedis
Dendrosphaera
Penicillaginaceae
Penicillago
Thermoascaceae
Paecilomyces
Thermoascus
Trichocomaceae
Acidotalaromyces
Ascospirella
Rasamsonia
Sagenomella
Talaromyces
section *Bacillispori*
section *Helici*
section *Islandici*
section *Purpurei*
section *Subinflati*
section *Talaromyces*
section *Tenues**
section *Trachyspermi*
Thermomyces
Trichocoma

List of species described since Houbraken *et al.* (2020)

Aspergillus agricola [*nom. inval*. Art. 40.8 (Shenzhen)] P. Singh, K.A. Callicott, M.J. Orbach & P.J. Cotty, Front. Microbiol. 11, 1236: 7. 2020. [MB 830377]. — Type: NRRL 66869 (holotype). Ex-type: NRRL 66869 = CR9-G = A2400. Infragen. class.: subgen. *Circumdati* sect. *Flavi* ser. *Flavi*. DNA barcodes: ITS = n.a.; *BenA* = n.a.; *CaM* = MN987053; *RPB2* = n.a.

Synonym of: ***Aspergillus flavus*** Link, Mag. Ges. Naturf. Freunde Berlin 3: 16. 1809. [MB 209842].

Notes: This species was invalidly described. The *CaM* phylogeny resolved this species within *A. flavus* (Suppl. Fig. S6). We therefore consider it a synonym of *A. flavus* and choose not to validate this species.

Aspergillus alboluteus F. Sklenar, Jurjević, Ezekiel, Houbraken & Hubka, Stud. Mycol. 99 (no. 100120): 19. 2021. [MB 839382]. — Type: PRM 952200 (holotype). Ex-type: CBS 145855 = EMSL 2420 = CCF 5695 = IFM 66815. Infragen. class.: subgen. *Circumdati* sect. *Flavipedes* ser. *Spelaei*. DNA barcodes: ITS = MW448663; *BenA* = MW478497; *CaM* = MW478511; *RPB2* = MW478532.

Aspergillus alboviridis J.P.Z. Siqueira, Gene, F. Sklenar & Hubka, Stud. Mycol. 99 (no. 100120): 19. 2021. [MB 821808]. — Type: CBS H-23128 (holotype). Ex-type: CBS 142665 = FMR 15175 = CCF 6049 = IFM 66819. Infragen. class.: subgen. *Circumdati* sect. *Flavipedes* ser. *Spelaei*. DNA barcodes: ITS = LT798909; *BenA* = LT798936; *CaM* = LT798937; *RPB2* = LT798938.

Aspergillus annui J.J. Silva, Fungaro, Frisvad, Taniwaki & Iamanaka, published here. [MB 849336]. — Type: IBT 36122 (holotype). Ex-type: 365-IT-PPK = IBT 36122. Infragen. class.: subgen. *Circumdati* sect. *Flavi* ser. *Annuorum*. DNA barcodes: ITS = OP691228; *BenA* = ON529842; *CaM* = ON529841; *RPB2* = ON529843.

Notes: This species was invalidly described in Silva *et al.* (2022) and is validated above.

Aspergillus arizonicus Jurjević, Glässnerová, Yaguchi & Hubka, Persoonia 47: 273. 2021. [MB 841359]. — Type: PRM 954611 (holotype). Ex-type: CCF 5341 = CBS 148476 = IFM 66805 = EMSL 2204. Infragen. class.: subgen. *Fumigati* sect. *Fumigati* ser. *Neoglabri*. DNA barcodes: ITS = OK322364; *BenA* = OK334128; *CaM* = OK334127; *RPB2* = OK334129.

Aspergillus banksianus Pitt, Persoonia 44: 355. 2020. [MB 835223]. — Type: DAR 85042 (holotype). Ex-type: FRR 6047 = MST FP2248. Infragen. class.: subgen. *Fumigati* sect. *Fumigati* ser. *Brevipedes*. DNA barcodes: ITS = MH280013; *BenA* = MT184780; *CaM* = MT184786; *RPB2* = MT184792.

Aspergillus barbosae A.C.R. Barros-Correia, R.N. Barbosa, Houbraken & Souza-Motta, Mycol. Prog. 19: 892. 2020. [MB 830077]. — Type: URM 93046 (holotype). Ex-type: URM 5930 = CBS 145863. Infragen. class.: subgen. *Circumdati* sect. *Terrei* ser. *Terrei*. DNA barcodes: ITS = LR536042; *BenA* = LR031377; *CaM* = LR031392; *RPB2* = LR031407.

Aspergillus burnettii Pitt, Fungal Genet. Biol. 143 (no. 103435): 5. 2020. [MB 835453]. — Type: DAR 84902 (holotype). Ex-type: CBS 146237 = FRR 5400 = MST FP2249. Infragen. class.: subgen. *Circumdati* sect. *Flavi* ser. *Alliacei*. DNA barcodes: ITS = MK429758; *BenA* = MT211761; *CaM* = MT211762; *RPB2* = MT211763.

Synonym of: ***Aspergillus alliaceus*** Thom & Church, Aspergilli: 163. 1926. [MB 256402].

Notes: *BenA* and *CaM* phylogenies resolved *A. burnettii* inside *A. alliaceus*, while *RPB2* resolved it on an unsupported distinct branch (Suppl. Fig. S6). As a result, we consider *A. burnetti* a synonym of *A. alliaceus*.

Aspergillus chiangmaiensis S. Khuna, N. Suwannarach & S. Lumyong, Front. Microbiol. 12, 705896: 6. 2021. [MB 830887]. — Type: SDBR-CMUI4 (holotype). Ex-type: TBRC 10407. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Nigri*. DNA barcodes: ITS = MK457198; *BenA* = MK457200; *CaM* = MK457199; *RPB2* = MK457203.

Synonym of: ***Aspergillus tubingensis*** Mosseray, La Cellule 43: 245. 1934. [MB 255209] (Bian *et al.* 2022).

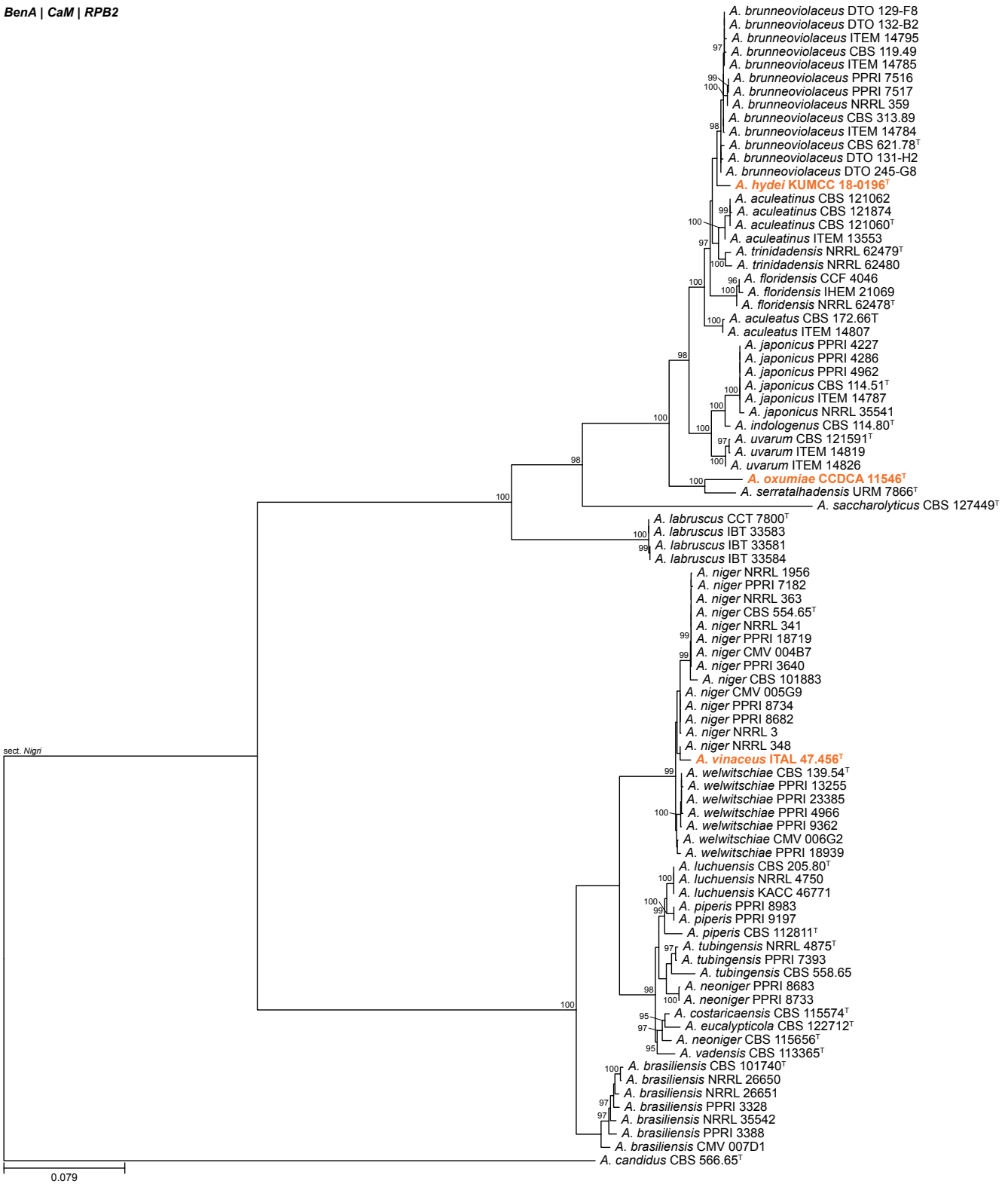

Fig. 10. Phylogenetic tree of *Aspergillus* section *Nigri* series *Japonici* and *Nigri* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. candidus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S10.

Notes: Khuna *et al.* (2021) introduced *A. chiangmaiensis* based on DNA sequences that are of low quality and the species was subsequently considered a synonym of *A. tubingensis* by Bian *et al.* (2022).

Aspergillus curvatus Al-Bedak & Moubasher, Asian J. Mycol. 3: 327. 2020. [MB 557788]. — Type: AUMC 11038 (holotype). Ex-type: EMCCN 2213. Infragen. class.: subgen. *Circumdati* sect. *Circumdati* ser. *Steyniorum*. DNA barcodes: ITS = MN006961; *BenA* = n.a.; *CaM* = n.a.; *RPB2* = n.a.

Notes: Doubtful species. This species was described with only an ITS sequence. Based on sequence alignments, the ITS sequence is potentially of low-quality. We obtained a culture of the ex-type strain but this unfortunately represented a different species. As we could not confirm the status of *A. curvatus*, we consider it a doubtful species (Suppl. Fig. S4). Two identifiers

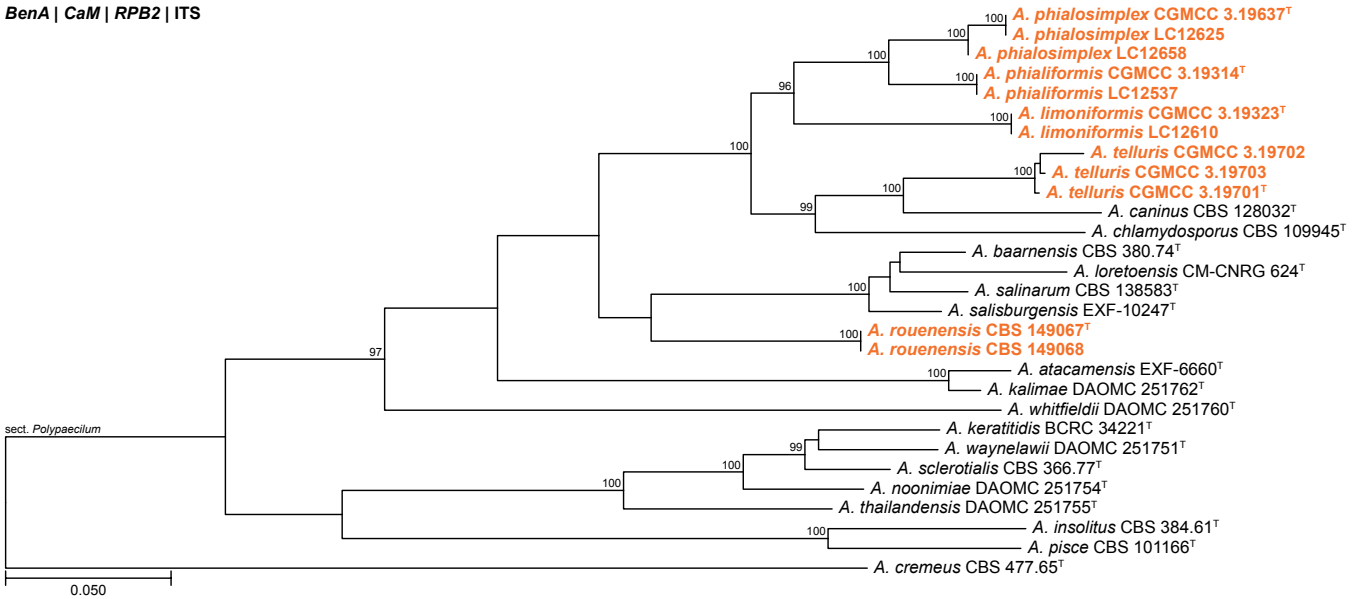

Fig. 11. Phylogenetic tree of *Aspergillus* section *Polypaecilum* based on a concatenated dataset of *BenA*, *CaM*, *RPB2*, and ITS. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. cremeus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S11.

were cited in the protologue. IF 557788 (= MB 557788) was listed first and is thus the one that is permanently associated with the name. MycoBank MB 831990 should not be used.

Aspergillus gaarensis [*nom. inval*. Art. 40.7 (Shenzhen)] Al-Bedak & Moubasher, Stud. Fungi 5: 61. 2020. [MB 833223]. — Type: AUMC 11046 = EMCCN 2221 (holotype). Ex-type: AUMC 11046 = EMCCN 2221. Infragen. class.: subgen. *Circumdati* sect. *Circumdati* ser. *Steyniorum*. DNA barcodes: ITS = MN648408; *BenA* = n.a.; *CaM* = n.a.; *RPB2* = n.a.

Notes: Doubtful species. This species was invalidly described with only an ITS sequence to support it. However, based on sequence alignments it was potentially a low-quality sequence. We obtained a culture of the ex-type strain but this unfortunately represented a different species. As we could not confirm the status of *A. gaarensis*, we consider it a doubtful species (Suppl. Fig. S4) and choose not to validate this species.

Aspergillus guangdongensis B.D. Sun, X.Z. Jiang & A.J. Chen, J. Fungi 8 (no 1205): 4. 2022. [MB 837898]. — Type: HMAS 248373 (holotype). Ex-type: CGMCC 3.19704 = MN 014767. Infragen. class.: subgen. *Nidulantes* sect. *Ochraceorosei* ser. *Funiculosi*. DNA barcodes: ITS = MN640760; *BenA* = MN635246; *CaM* = MN635257; *RPB2* = MN635269.

Synonym of: ***Aspergillus lannaensis*** Suwannar., S. Khuna & Lumyong, Fungal Divers. 111: 145. 2021. [MB 838058].

Notes: Phylogenies resolved *A. lannaensis* and *A. guangdongensis* in the same clade (Fig. 3 & Suppl. Fig. S3) and we consider them synonyms with *A. lannaensis* having priority over *A. guangdongensis*.

Aspergillus guangxiensis B.D. Sun, X.Z. Jiang & A.J. Chen, J. Fungi 8 (no 1205): 9. 2022. [MB 837899]. — Type: HMAS 248372 (holotype). Ex-type: CGMCC 3.19709 = MN 115635. Infragen. class.: subgen. *Nidulantes* sect. *Sparsi* ser. *Conjuncti*. DNA barcodes: ITS = MN640765; *BenA* = MN635251; *CaM* = MN635262; *RPB2* = MN635274.

Aspergillus hainanicus X.C. Wang & W.Y. Zhuang, J. Fungi 8 (225): 9. 2022. [MB 570967]. — Type: HMAS 247855 (holotype). Ex-type: CGMCC 3.20888. Infragen. class.: subgen. *Nidulantes* sect. *Cavernicolarum* ser. *Hainanici*. DNA barcodes: ITS = OM414846; *BenA* = OM475626; *CaM* = OM475630; *RPB2* = OM475634.

Aspergillus hydei Doilom, Front. Microbiol. 11 (no. 585215): 4. 2020. [MB 557860]. — Type: MFLU 20-0430 (holotype). Ex-type: KUMCC 18-0196. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Japonici*. DNA barcodes: ITS = MT152332; *BenA* = MT161679; *CaM* = MT178247; *RPB2* = MT384370.

Notes: The phylogenetic trees are not well-resolved (Fig. 10 & Suppl. Fig. S10), and further studies including additional strains and/or extended datasets are needed. Here, we give benefit of doubt to the publisher.

Aspergillus inusitatus F. Sklenar, C. Silva Pereira, Houbraken & Hubka, Stud. Mycol. 99: 20. 2021. [MB 839383]. — Type: PRM 954606 (holotype). Ex-type: CBS 147044 = DTO 121-G5 = CCF 6552. Infragen. class.: subgen. *Circumdati* sect. *Flavipedes* ser. *Spelaei*. DNA barcodes: ITS = MW448669; *BenA* = MW478502; *CaM* = MW478517; *RPB2* = MW478542.

Aspergillus jilinensis X.Z. Jiang, Mycoscience 61: 207. 2020. [MB 819490]. — Type: HMAS 247010 (holotype). Ex-type: CGMCC 3.18134. Infragen. class.: subgen. *Circumdati* sect. *Terrei* ser. *Terrei*. DNA barcodes: ITS = KX443224; *BenA* = KX443162; *CaM* = KX443193; *RPB2* = n.a.

Aspergillus kumbius Pitt, Persoonia 44: 359. 2020. [MB 835225]. — Type: DAR 85044 (holotype). Ex-type: FRR 6049 = MST FP2250. Infragen. class.: subgen. *Circumdati* sect. *Circumdati* ser. *Sclerotiorum*. DNA barcodes: ITS = MT179307; *BenA* = MT184782; *CaM* = MT184788; *RPB2* = MT184794.

Aspergillus lannaensis Suwannar., S. Khuna & Lumyong, Fungal Divers. 111: 145. 2021. [MB 838058]. — Type: SDBR-CMUO 8

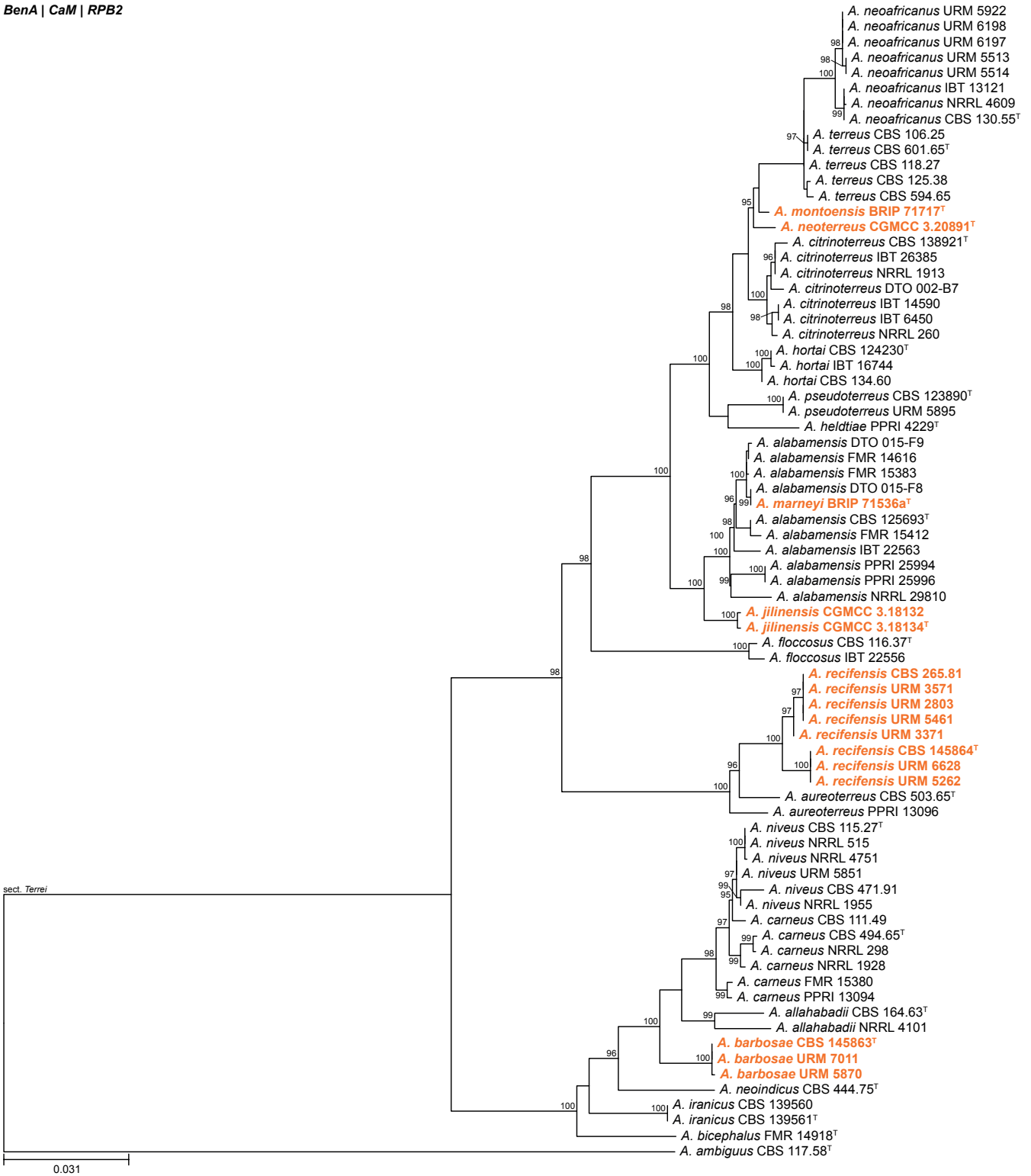

Fig. 12. Phylogenetic tree of *Aspergillus* section *Terrei* series *Nivei* and *Terrei* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. ambiguus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S12.

(holotype). Ex-type: SDBR-CMUO 8. Infragen. class.: subgen. *Nidulantes* sect. *Ochraceorosei* ser. *Funiculosi*. DNA barcodes: ITS = n.a.; *BenA* = MW219783; *CaM* = MW219781; *RPB2* = MW219785.

Aspergillus lanuginosus F. Sklenar & Hubka, Stud. Mycol. 99: 20. 2021. [MB 839384]. — Type: PRM 954608 (holotype). Ex-type: NRRL 4610 = IMI 350352 = CCF 4551 = IFM 66818. Infragen. class.: subgen. *Circumdati* sect. *Flavipedes* ser. *Spelaei*. DNA barcodes: ITS = EF669604; *BenA* = EU014080; *CaM* = EF669562; *RPB2* = EF669646.

Aspergillus lebretii V.C.S. Alves, J.D.P. Bezerra & R.N. Barbosa, Fungal Syst. Evol. 10: 144. 2022. [MB 846119]. — Type: URM 95150 (holotype). Ex-type: URM 8451 = FCCUFG 09. Infragen. class.: subgen. *Cremei* sect. *Cremei* ser. *Wentiorum*. DNA barcodes: ITS = ON862928; *BenA* = OP672382; *CaM* = OP290540; *RPB2* = OP290511.

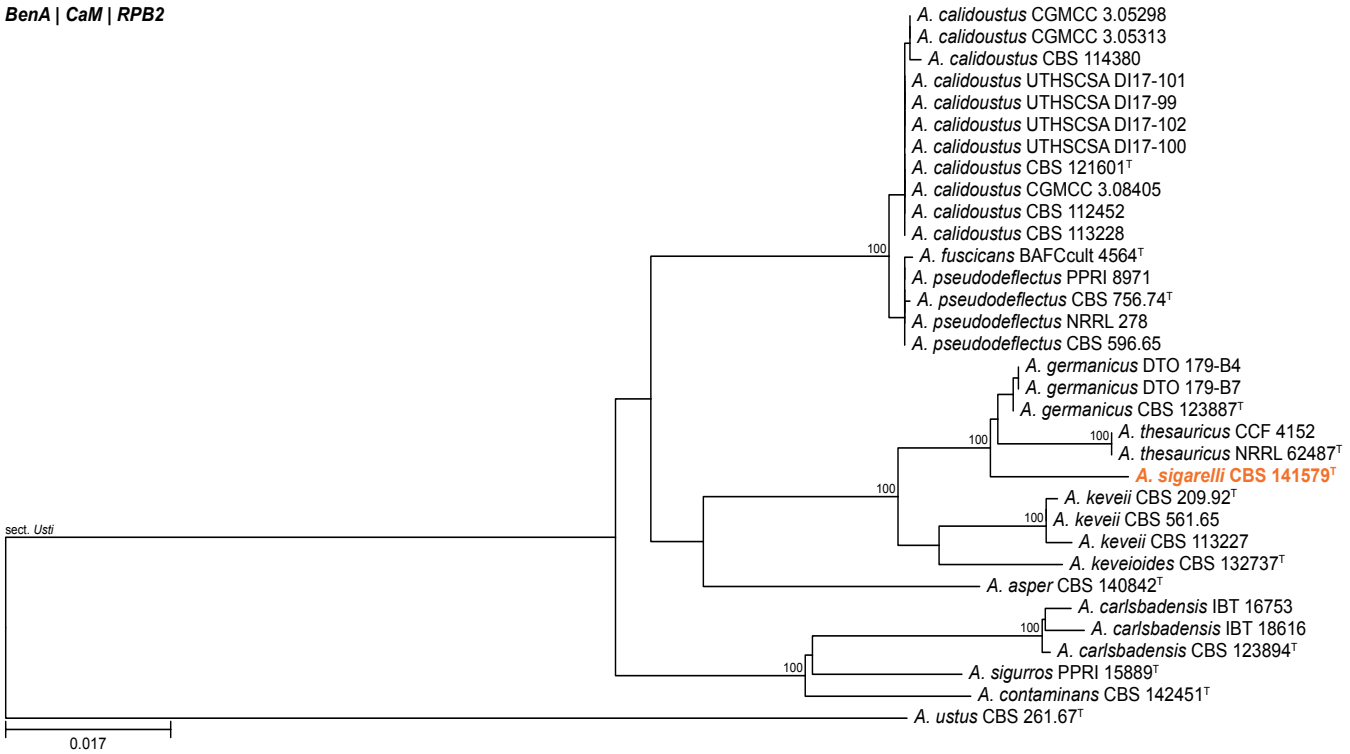

Fig. 13. Phylogenetic tree of *Aspergillus* section *Usti* series *Calidousti* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. ustus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S13.

Aspergillus lentisci (Durieu & Mont.) Visagie, Malloch, L. Kriegsteiner, Samson & Houbraken, published here. [MB 849485]. Basionym: *Dichlaena lentisci* Durieu & Mont., Expl. Sci. l'Algérie 1: 405. 1849. [MB 249716]. — Type: Durieu & Mont., Expl. Sci. l'Algérie 1 (11): 405, tab. 22 bis, fig. 2 (lectotype), CBS H-25292 (epitype). Ex-epitype: CBS 150189. Infragen. class.: subgen. *Circumdati* sect. *Dichlaena* ser. *Dichlaena*. DNA barcodes: ITS = OR142402; *BenA* = OR145977; *CaM* = OR145992; *RPB2* = OR146003.

Aspergillus limoniformis Z.F. Zhang & L. Cai, Fungal Divers. 106: 77. 2021. [MB 556394]. — Type: HMAS 248014 (holotype). Ex-type: CGMCC 3.19323 = LC126098. Infragen. class.: subgen. *Polypaecilum* sect. *Polypaecilum* ser. *Canini*. DNA barcodes: ITS = MK329066; *BenA* = MK336093; *CaM* = n.a.; *RPB2* = MK335972.

Aspergillus luteorubrus Pitt, Persoonia 44: 361. 2020. [MB 835226]. — Type: DAR 85045 (holotype). Ex-type: CBS 146723 = FRR 5427 = MST FP2246. Infragen. class.: subgen. *Fumigati* sect. *Fumigati* ser. *Fennelliarum*. DNA barcodes: ITS = MT179305; *BenA* = MT184781; *CaM* = MT184787; *RPB2* = MT184793.

Synonym of: ***Aspergillus fennelliae*** Kwon-Chung & S.J. Kim, Mycologia 66: 629. 1974. [MB 309218].

Notes: Even though the multigene phylogeny resolves *A. luteorubrus* basal to *A. fennelliae*, both the *BenA* and *RPB2* phylogenies places it intermixed with strains of the latter (Fig. 8 & Suppl. Fig. S8). We thus consider it a synonym.

Aspergillus magnus Glässnerová & Hubka, Stud. Mycol. 102: 38. 2022. [MB 844202]. — Type: PRM 956934 (holotype). Ex-type: UAMH 1324 = IBT 14560. Infragen. class.: subgen. *Circumdati* sect. *Candidi* ser. *Candidi*. DNA barcodes: ITS = ON156376; *BenA* = ON164570; *CaM* = ON164619; *RPB2* = ON164517.

Aspergillus malvicolor A.D. Hocking, Persoonia 44: 363. 2020. [MB 835227]. — Type: DAR 85046 (holotype). Ex-type: CBS 146724 = FRR 2383 = MST FP2244. Infragen. class.: subgen. *Circumdati* sect. *Circumdati* ser. *Sclerotiorum*. DNA barcodes: ITS = MT179308; *BenA* = MT184784; *CaM* = MT184790; *RPB2* = MT184796.

Aspergillus marneyi Y.P. Tan, Bishop-Hurley, E. Lacey & R.G. Shivas, Index Austral. Fungi 3: 1. 2022. [MB 900143]. — Type: BRIP 71536a (holotype). Ex-type: BRIP 71536a. Infragen. class.: subgen. *Circumdati* sect. *Terrei* ser. *Terrei*. DNA barcodes: ITS = OL691080; *BenA* = OL741659; *CaM* = n.a.; *RPB2* = OL741656.

Synonym of: ***Aspergillus alabamensis*** Balajee, Baddley, Frisvad & Samson, Eukar. Cell 8: 720. 2009. [MB 543648].

Notes: Phylogenies resolve *A. marneyi* inside the *A. alabamensis* clade (Fig. 12 & Suppl. Fig. S12). We thus consider it a synonym.

Aspergillus montoensis Y.P. Tan, Bishop-Hurley, S.M. Thompson & R.G. Shivas, Index Fungorum 503: 1. 2021. [MB 558828]. — Type: BRIP 64553a (holotype). Ex-type: BRIP 64553a = CBS 149107. Infragen. class.: subgen. *Circumdati* sect. *Terrei* ser. *Terrei*. DNA barcodes: ITS = OK441076; *BenA* = OK533535; *CaM* = n.a.; *RPB2* = OK509073.

Notes: Both the ITS and *BenA* sequences are identical to *A. terreus*, but *RPB2* resolves it distinct from *A. terreus* as a close relative of *A. citrinoterreus* (Fig. 12 & Suppl. Fig. S12). Further studies including additional strains and/or extended datasets are needed. Here, we give benefit of doubt to the publisher.

Aspergillus nanangensis Pitt, Persoonia 44: 365. 2020. [MB 836001]. — Type: DAR 84903 (holotype). Ex-type: CBS 146238 = FRR 6048 = MST FP2251. Infragen. class.: subgen.

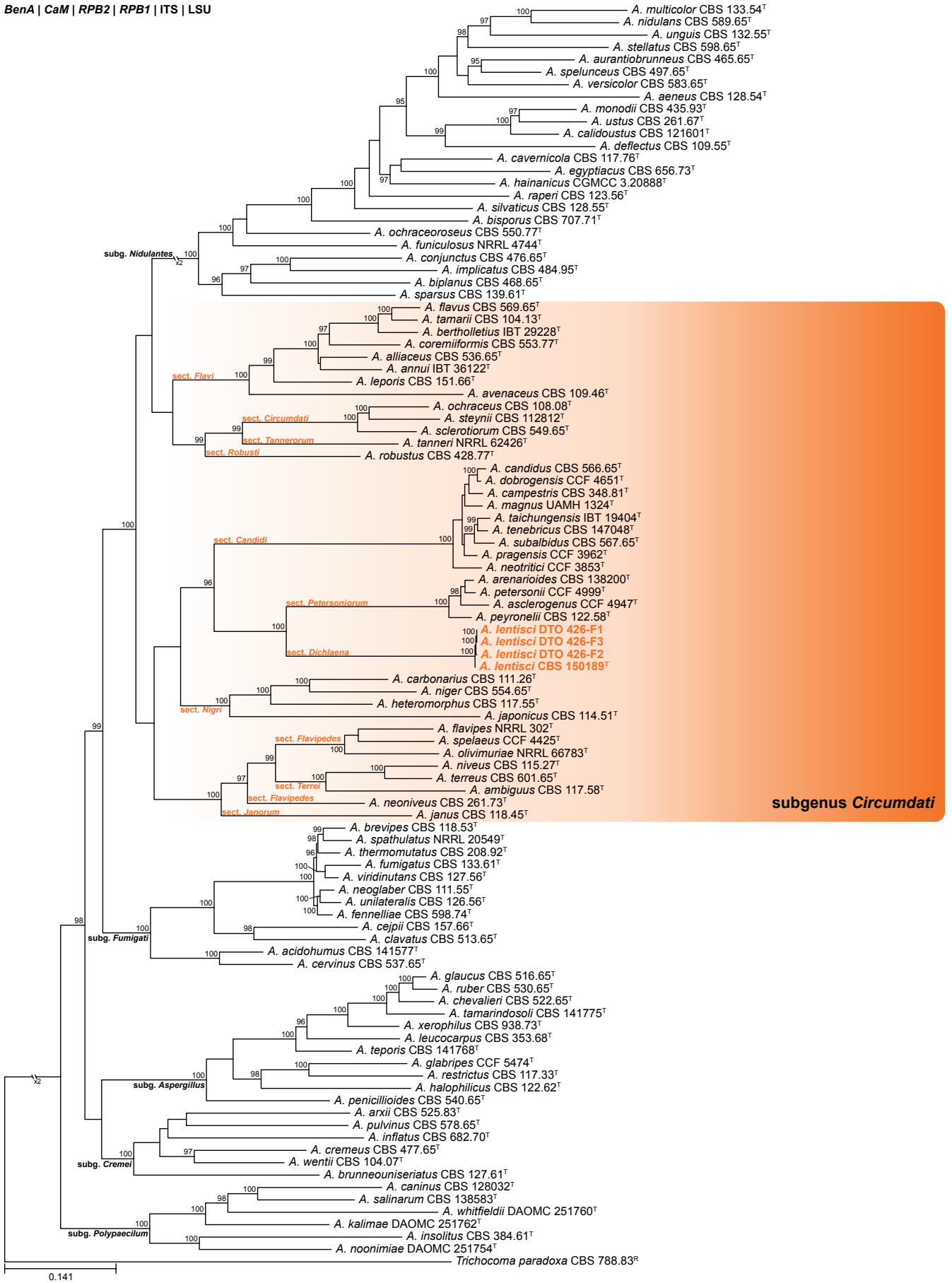

Fig. 14. Phylogenetic tree showing the relationship of *Dichlaena* within *Aspergillus* based on a concatenated dataset of *BenA*, *CaM*, *RPB2*, *RPB1*, ITS and LSU. Strains of recently described species are shown in bold coloured text. The tree was rooted to *Trichocoma paradoxa*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. Representative strains are indicated by superscript R.

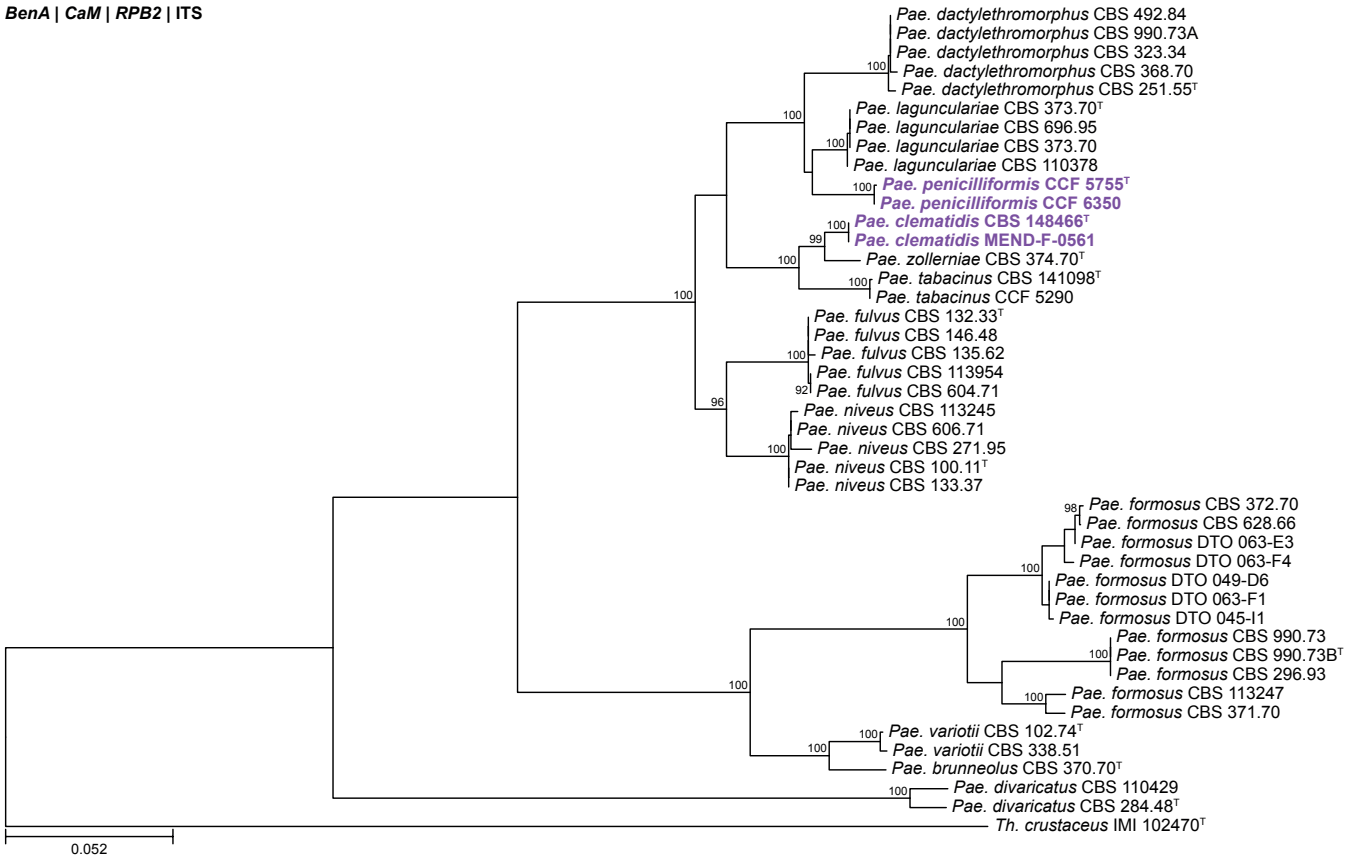

Fig. 15. Phylogenetic tree of *Paecilomyces* based on a concatenated dataset of *BenA*, *CaM*, *RPB2* and ITS. Strains of recently described species are shown in bold coloured text. The tree was rooted to *Thermoascus crustaceus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S14.

Circumdati sect. *Janorum* ser. *Janorum*. DNA barcodes: ITS = MK979278; *BenA* = MT184783; *CaM* = MT184789; *RPB2* = MT184795.

Aspergillus neoterreus X.C. Wang and W.Y. Zhuang, J. Fungi 8 (3, no. 225): 10. 2022. [MB 570968]. — Type: HMAS 247856 (holotype). Ex-type: CGMCC 3.20891. Infragen. class.: subgen. *Nidulantes* sect. *Terrei* ser. *Terrei*. DNA barcodes: ITS = OM414849; *BenA* = OM475629; *CaM* = OM475633; *RPB2* = OM475637.

Notes: The phylogenetic trees are not well-resolved (Fig. 12 & Suppl. Fig. S12), and further studies including additional strains and/or extended datasets are needed. Here, we give benefit of doubt to the publisher.

Aspergillus neotritici Glässnerová & Hubka, Stud. Mycol. 102: 38. 2022. [MB 844204]. — Type: PRM 956940 (holotype). Ex-type: CCF 3853 = IBT 32725. Infragen. class.: subgen. *Circumdati* sect. *Candidi* ser. *Candidi*. DNA barcodes: ITS = FR727136; *BenA* = FR775327; *CaM* = HE661598; *RPB2* = LT627021.

Notes: This new name was introduced for the invalid *A. tritici* [*nom. inval*. Art. 8.1, Art. 8.4, Art 40.1, Art. 40.4 (Shenzhen)] by Glässnerová *et al.* (2022).

Aspergillus okavangoensis Visagie & Nkwe, Fungal Syst. Evol. 8: 85. 2021. [MB 840269]. — Type: PREM 63212 (holotype). Ex-type: CBS 147420 = CMW 56636 = CN073A3 = DN24. Infragen. class.: subgen. *Circumdati* sect. *Flavipedes* ser. *Flavipedes*. DNA barcodes: ITS = MW480880; *BenA* = MW480788; *CaM* = MW480706; *RPB2* = MW480790.

Aspergillus oxumiae C.N. Figueiredo, L.S. Sales, Y.F. Figueiredo, J.P. Andrade & J.T. De Souza, Persoonia 44: 357. 2020. [MB 832766]. — Type: HURB 22369 (holotype). Ex-type: CCDCA 11546 = UFLA115. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Japonici*. DNA barcodes: ITS = MN431160; *BenA* = MN521388; *CaM* = MN531842; *RPB2* = MN521389.

Aspergillus pakistanicus [*nom. inval*. Art. 40.7 & Art. 40.8 (Shenzhen)] Abrar, Mughal & S. Sarwar, Appl. Ecol. Environm. Res. 18: 3797. 2020. [MB 830877]. — Type: AA100717 (holotype). Ex-type: AA100717. Infragen. class.: subgen. *Circumdati* sect. *Flavi* ser. *Flavi*. DNA barcodes: ITS = n.a.; *BenA* = n.a.; *CaM* = n.a.; *RPB2* = n.a.

Notes: The species was invalidly described. Only an SSU (18S small subunit nrDNA) sequence is available for this species (GenBank MK371711). Even though it is unique, there are very little SSU data available for *Aspergillus*, and we therefore decided not to validate the species here.

Aspergillus phialiformis Z.F. Zhang & L. Cai, Fungal Divers. 106: 79. 2021. [MB 556395]. — Type: HMAS 248017 (holotype). Ex-type: CGMCC 3.19314 = LC12536. Infragen. class.: subgen. *Polypaecilum* sect. *Polypaecilum* ser. *Canini*. DNA barcodes: ITS = MK329068; *BenA* = MK336095; *CaM* = n.a.; *RPB2* = MK335974.

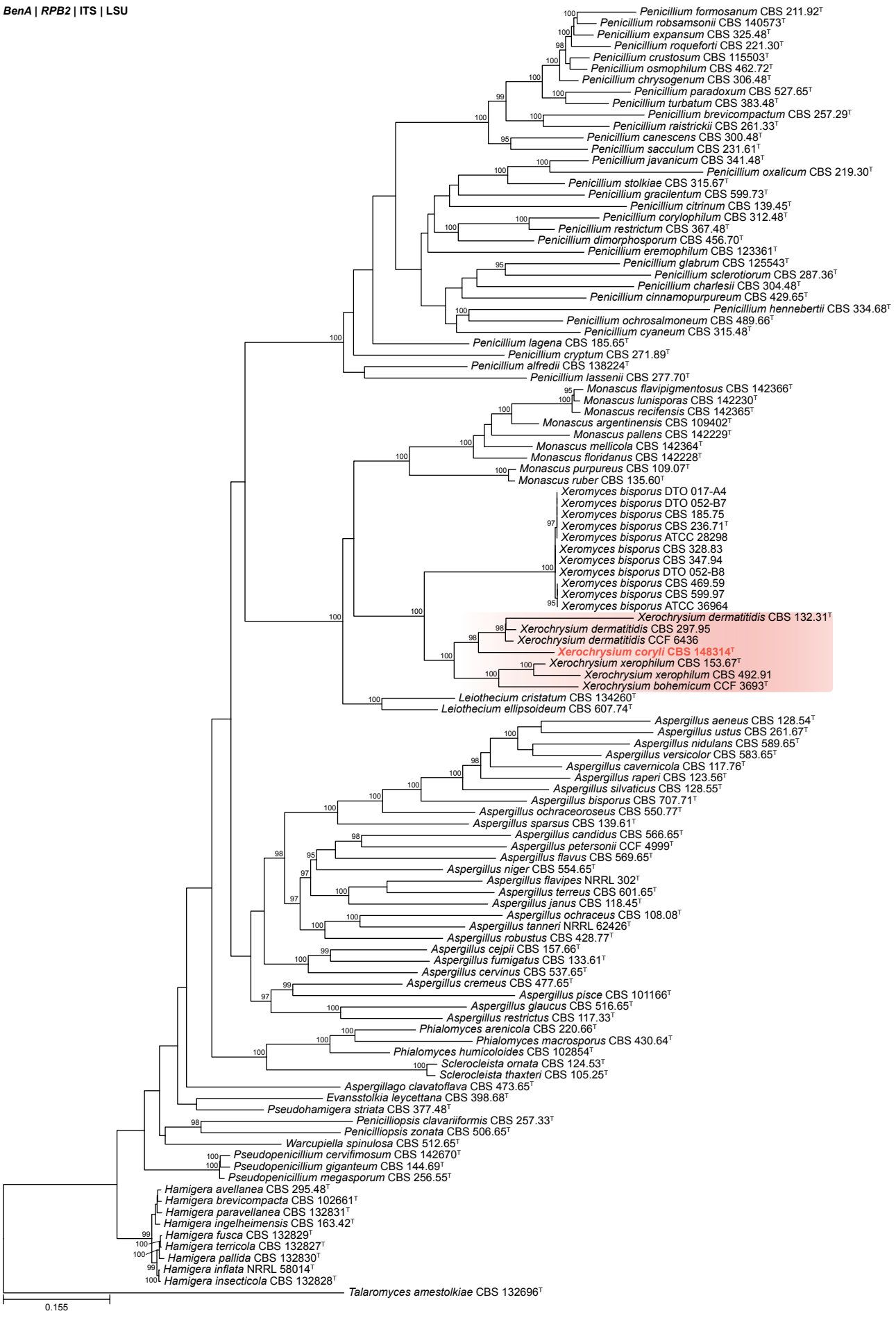

Fig. 16. Phylogenetic tree showing the relationship of *Xerochrysium coryli* (bas. *Paraxerochrysium coryli*) within *Aspergillaceae* based on a concatenated dataset of *BenA*, *RPB2*, ITS and LSU. Strains of recently described species are shown in bold coloured text. The tree was rooted to *Talaromyces amestolkiae*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T.

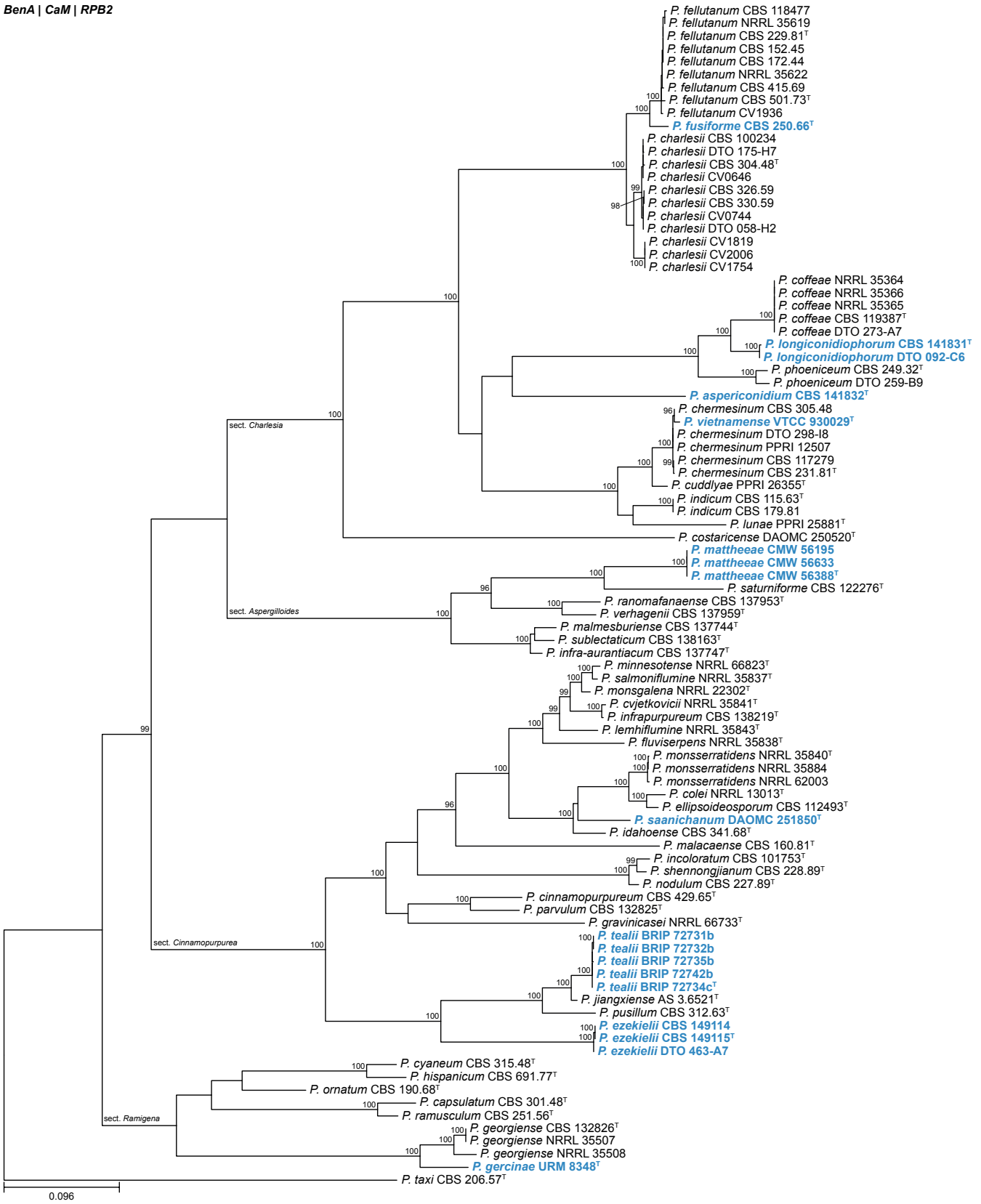

Fig. 17. Phylogenetic tree of *Penicillium* sections *Aspergilloides*, *Charlesia*, *Cinnamopurpurea* and *Ramigena* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *P. taxi*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S15.

Aspergillus phialosimplex Z.F. Zhang & L. Cai, Fungal Divers. 106: 79. 2021. [MB 556396]. — Type: HMAS 248007 (holotype). Ex-type: CGMCC 3.19637 = LC12578. Infragen. class.: subgen. *Polypaecilum* sect. *Polypaecilum* ser. *Canini*. DNA barcodes: ITS = MK329070; *BenA* = MK336097; *CaM* = n.a.; *RPB2* = MK335976.

Aspergillus pseudopiperis S. Khuna, N. Suwannarach & S. Lumyong, Front. Microbiol. 12, 705896: 6. 2021. [MB 830888]. — Type: SDBR-CMUI1 (holotype). Ex-type: TBRC 10408. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Nigri*. DNA barcodes: ITS = n.a.; *BenA* = MK457194; *CaM* = MK457193; *RPB2* = MK457196.

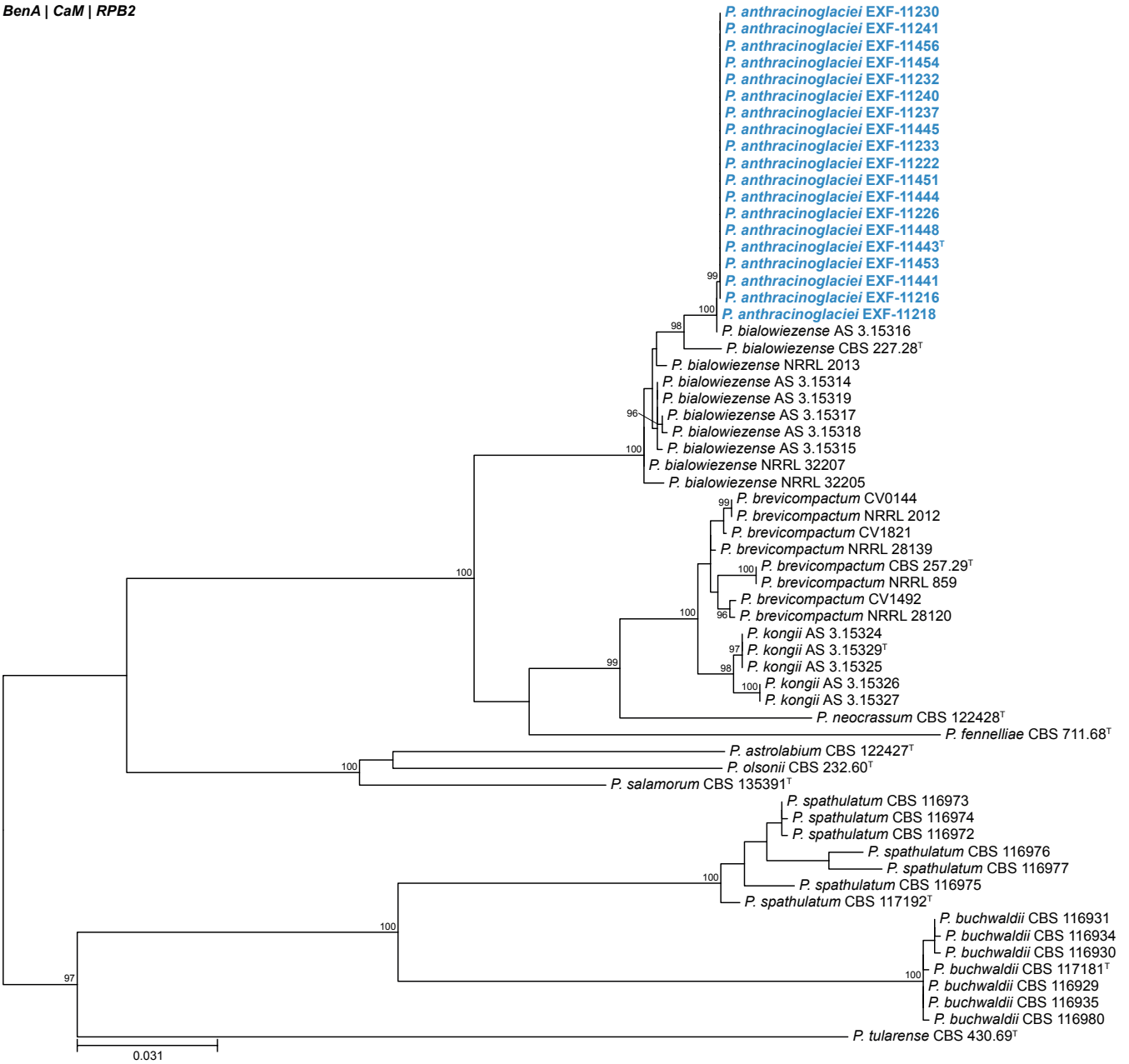

Fig. 18. Phylogenetic tree of *Penicillium* section *Brevicompacta* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *P. tularense*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S16.

Synonym of: ***Aspergillus tubingensis*** Mosseray, La Cellule 43: 245. 1934. [MB 255209] (Bian *et al.* 2022).

Notes: Khuna *et al.* (2021) introduced this species based on DNA sequences that are of low quality and the species was subsequently considered a synonym of *A. tubingensis* by Bian *et al.* (2022).

Aspergillus pseudotubingensis S. Khuna, N. Suwannarach & S. Lumyong, Front. Microbiol. 12, 705896: 9. 2021. [MB 830889]. — Type: SDBR-CMUO2 (holotype). Ex-type: TBRC 10409. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Nigri*. DNA barcodes: ITS = n.a.; *BenA* = MK457206; *CaM* = MK457205; *RPB2* = MK457208.

Notes: Doubtful species. Khuna *et al.* (2021) introduced this species based on DNA sequences that are of low quality and its taxonomic position was subsequently considered doubtful by Bian *et al.* (2022).

Aspergillus qilianyuensis X.C. Wang & W.Y. Zhuang, J. Fungi 8 (225): 12. 2022. [MB 570969]. — Type: HMAS 247857 (holotype). Ex-type: CGMCC 3.20889. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = OM414847; *BenA* = OM475627; *CaM* = OM475631; *RPB2* = OM475635.

Aspergillus recifensis A.C.R. Barros-Correia, R.N. Barbosa, Houbraken & Souza-Motta, Mycol. Prog. 19: 894. 2020. [MB 830081]. — Type: URM 93050 (holotype). Ex-type: URM 6605 = CBS 145864. Infragen. class.: subgen. *Circumdati* sect. *Terrei* ser. *Nivei*. DNA barcodes: ITS = LR536036; *BenA* = LR031370; *CaM* = LR031385; *RPB2* = LR031400.

Aspergillus rouenensis Crous & Decock, Persoonia 48: 289. 2022. [MB 844262]. — Type: CBS H-24987. Ex-type: CBS 149067 = CPC 41585 = MUCL 58110. Infragen. class.:

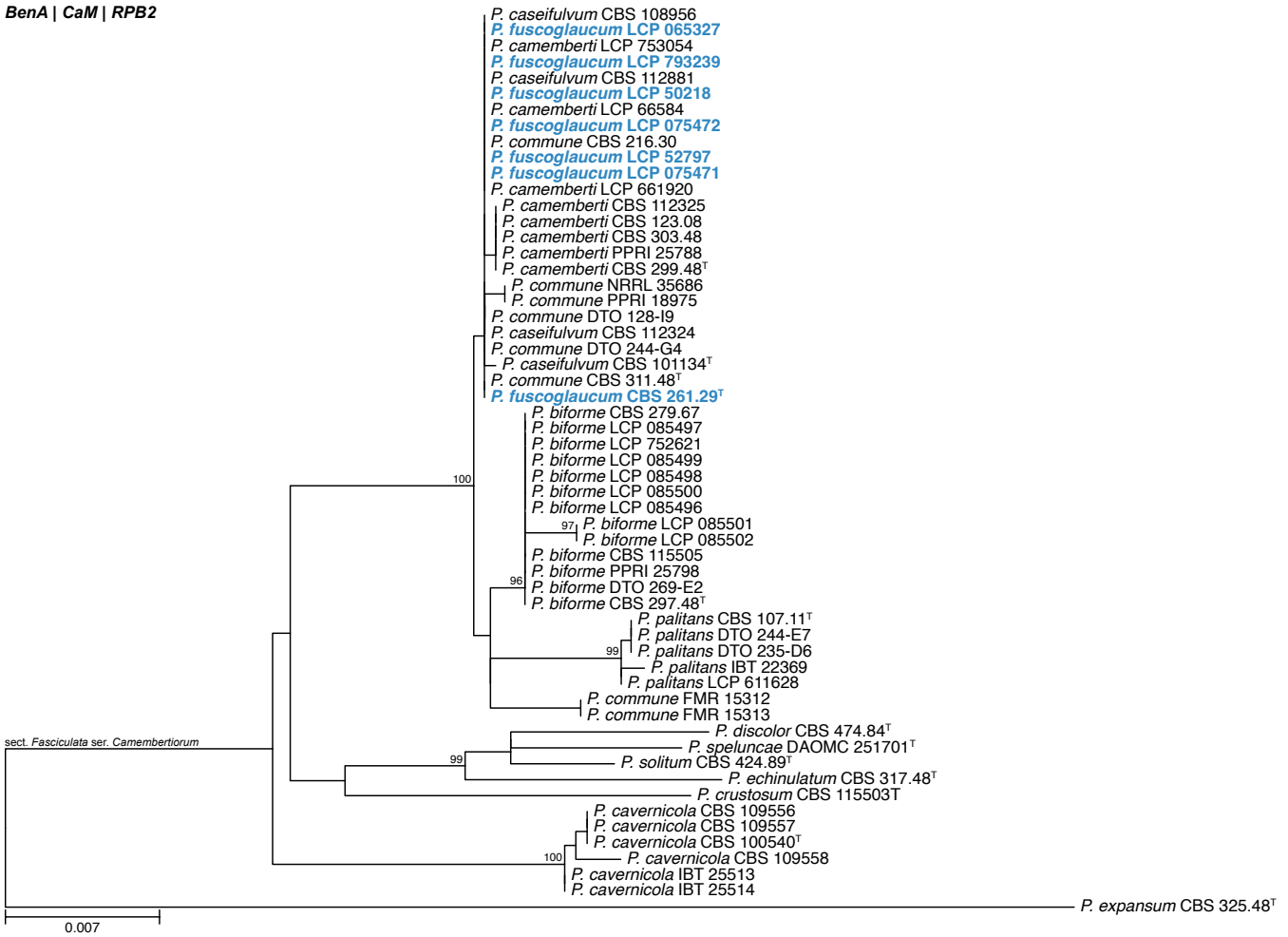

Fig. 19. Phylogenetic tree of *Penicillium* section *Fasciculata* series *Camembertiorum* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *P. expansum*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S17.

subgen. *Polypaecilum* sect. *Polypaecilum* ser. *Salinarum*. DNA barcodes: ITS = ON603782; *BenA* = ON605641; *CaM* = ON653193; *RPB2* = ON653194.

Aspergillus saccharicola J.J. Silva, Frisvad, M.H.P. Fungaro, M.H. Taniwaki & B.T. Iamanaka, published here. [MB 849338]. — Type: IBT 36126 (holotype). Ex-type: 117-IT-SGC = IBT 36126. Infragen. class.: subgen. *Circumdati* sect. *Flavi* ser. *Flavi*. DNA barcodes: ITS = OP611470; *BenA* = ON529845; *CaM* = ON529844; *RPB2* = ON529846.

Notes: This species was invalidly described in Silva *et al.* (2022) and is validated above.

Aspergillus sakultaensis [*nom. inval*. Art. 40.8 (Shenzhen)] Al-Bedak, Zohri & Abdel-Kareem, J. Environm. Stud. 20: 23. 2020. [MB 831480]. — Type: UMC 13885 (holotype). Ex-type: AUMC 13885. Infragen. class.: subgen. *Circumdati* sect. *Flavipedes* ser. *Flavipedes*. DNA barcodes: ITS = MK391495; *BenA* = n.a.; *CaM* = n.a.; *RPB2* = n.a.

Synonym of: ***Aspergillus templicola*** Visagie, Hirooka & Samson, Stud. Mycol. 78: 103. 2014. [MB 809191].

Notes: *Aspergillus sakultaensis* was described with only an ITS sequence to support it, but this is identical to *A. templicola* (Suppl. Fig. S7). As a result, we consider it a synonym of the latter.

Aspergillus sibiricus V.A. Iliushin, Phytotaxa 531: 68. 2022. [MB 841752]. — Type: LE F-341005 (holotype). Ex-type: CBS 143307. Infragen. class.: subgen. *Fumigati* sect. *Fumigati* ser. *Unilaterales*. DNA barcodes: ITS = MG587008; *BenA* = MG722970; *CaM* = MG722971; *RPB2* = MG710809.

Aspergillus sichuanensis B.D. Sun, X.Z. Jiang & A.J. Chen, J. Fungi 8 (no 1205): 10. 2022. [MB 837900]. — Type: HMAS 248374 (holotype). Ex-type: CGMCC 3.19706 = MN 18437. Infragen. class.: subgen. *Nidulantes* sect. *Aenei* ser. *Aenei*. DNA barcodes: ITS = MN640762; *BenA* = MN635248; *CaM* = MN635259; *RPB2* = MN635271.

Aspergillus sigarelli B.D. Sun, Houbraken, A.J. Chen and Samson, Int. J. Syst. Evol. Microbiol. 70: 9. 2020. [MB 833129]. — Type: CBS H-22725 (holotype). Ex-type: CBS 141579 = DTO 348-D4 = CGMCC 3.03936. Infragen. class.: subgen. *Nidulantes* sect. *Usti* ser. *Calidousti*. DNA barcodes: ITS = MN640758; *BenA* = MN635244; *CaM* = MN635255; *RPB2* = MN635267.

Aspergillus telluris B.D. Sun, X.Z. Jiang & A.J. Chen, Phytotaxa 455: 146. 2020. [MB 834494]. — Type: HMAS 248375 (holotype). Ex-type: CGMCC 3.19701. Infragen. class.: subgen. *Polypaecilum* sect. *Polypaecilum* ser. *Canini*. DNA barcodes: ITS = MN640767; *BenA* = MN635253; *CaM* = MN635264; *RPB2* = MN635276.

Fig. 20. Phylogenetic tree of *Penicillium* section *Canescentia* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was midpoint rooted. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S18.

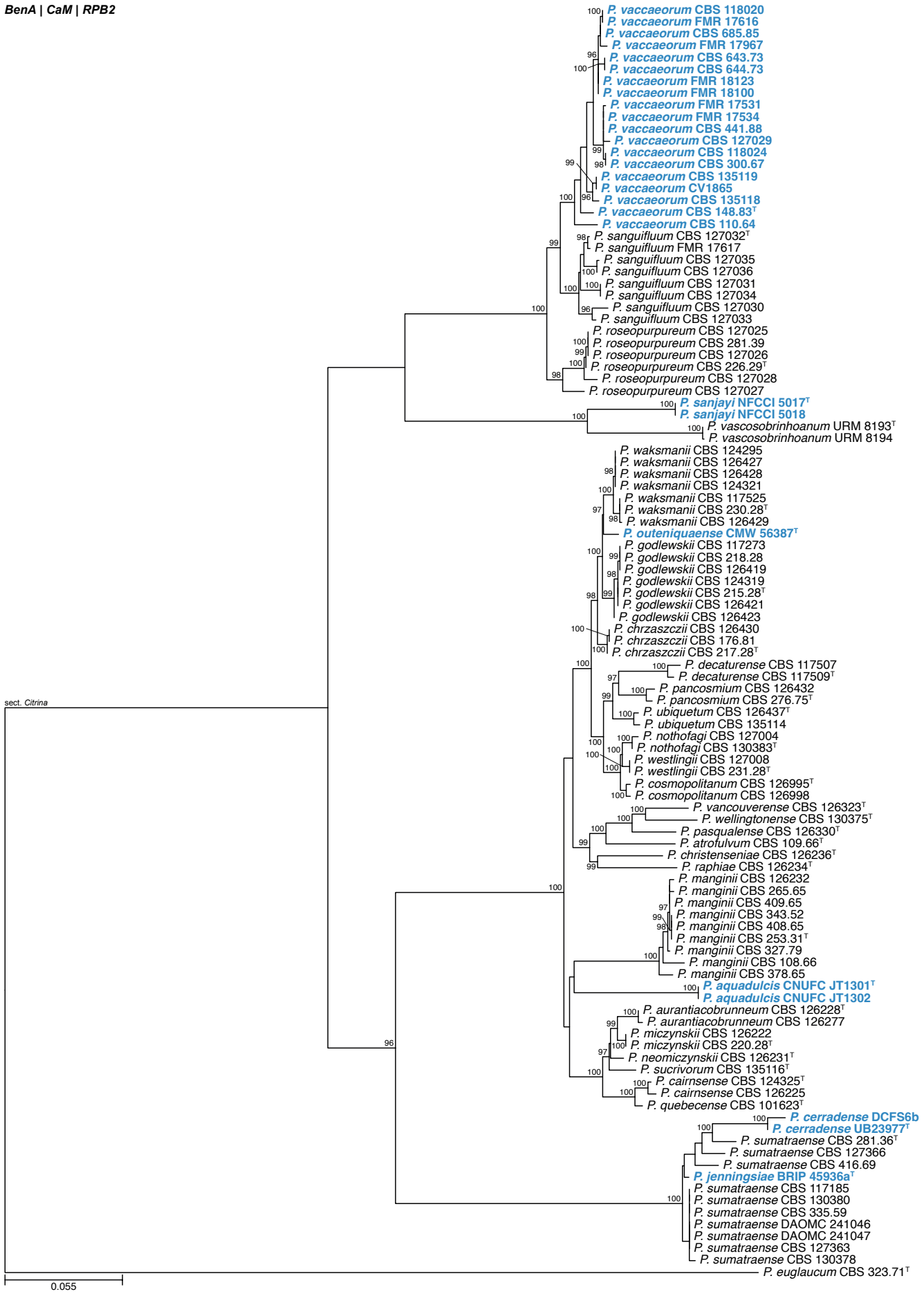

Fig. 21. Phylogenetic tree of *Penicillium* section *Citrina* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *P. euglaucum*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S19.

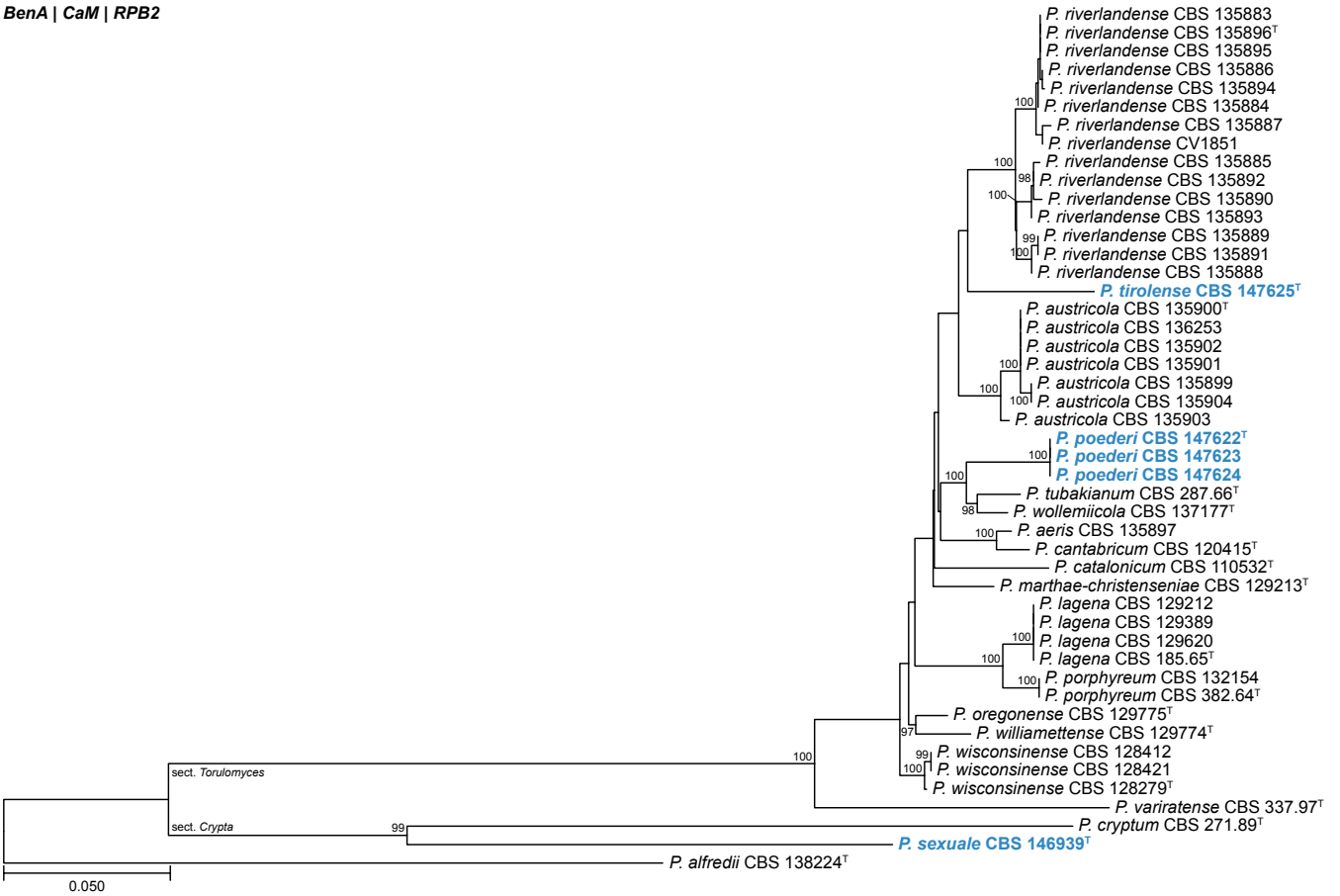

Fig. 22. Phylogenetic tree of *Penicillium* sections *Crypta* and *Torulomyces* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *P. alfredii*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S20.

Aspergillus tenebricus Houbraken, Glässnerová & Hubka, Stud. Mycol. 102: 45. 2022. [MB 844203]. — Type: PRM 957108 (holotype). Ex-type: CBS 147048 = DTO 337-H7. Infragen. class.: subgen. *Circumdati* sect. *Candidi* ser. *Candidi*. DNA barcodes: ITS = ON156389; *BenA* = ON164584; *CaM* = ON164623; *RPB2* = ON164532.

Aspergillus tibetensis B.D. Sun, X.Z. Jiang & A.J. Chen, J. Fungi 8 (no 1205): 12. 2022. [MB 837901]. — Type: HMAS 248371 (holotype). Ex-type: CGMCC 3.19707 = MN 110445. Infragen. class.: subgen. *Nidulantes* sect. *Aenei* ser. *Aenei*. DNA barcodes: ITS = MN640763; *BenA* = MN635249; *CaM* = MN635260; *RPB2* = MN635272.

Aspergillus toxicus [*nom. inval*. Art. 40.8 (Shenzhen)] P. Singh, K.A. Callicott, M.J. Orbach & P.J. Cotty, Front. Microbiol. 11, 1236: 10. 2020. [MB 832486]. — Type: NRRL 66898 (holotype). Ex-type: NRRL 66898 = A5-B-S = A2406. Infragen. class.: subgen. *Circumdati* sect. *Flavi* ser. *Flavi*. DNA barcodes: ITS = n.a.; *BenA* = n.a.; *CaM* = MN987092; *RPB2* = n.a.

Synonym of: ***Aspergillus minisclerotigenes*** Vaamonde, Frisvad & Samson, Int. J. Syst. Evol. Microbiol. 58: 733. 2008. [MB 505188].

Notes: This species was invalidly described. The *CaM* phylogeny resolved this species within the *A. minisclerotigenes* clade (Suppl. Fig. S6) and we thus consider this species to be a synonym of the latter and, therefore, choose not to validate this species.

Aspergillus vinaceus Ferranti, Iamanaka, Frisvad, O. Puel & J.J. da Silva, J. Fungi 6 (no. 371): 14. 2020. [MB 833399]. — Type: ITAL 47.456 (holotype). Ex-type: ITAL 47.456 = IBT 35556. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Nigri*. DNA barcodes: ITS = MN575692; *BenA* = MN583579; *CaM* = MN583580; *RPB2* = MN583581.

Synonym of: ***Aspergillus niger*** Tiegh., Ann. Sci. Nat., Bot., ser. 58: 240. 1867. [MB 284309].

Notes: Phylogenies resolved *A. vinaceus* in the *A. niger* clade (Fig. 10 & Suppl. Fig. S10), similar to the results found during a recent revision of series *Nigri* (Bian *et al.* 2022).

Aspergillus xishaensis X.C. Wang & W.Y. Zhuang, J. Fungi 8 (225): 13. 2022. [MB 570970]. — Type: HMAS 247858 (holotype). Ex-type: CGMCC 3.20890. Infragen. class.: subgen. *Circumdati* sect. *Flavipedes* ser. *Flavipedes*. DNA barcodes: ITS = OM414848; *BenA* = OM475628; *CaM* = OM475632; *RPB2* = OM475636.

Emericella sydowii (Bainier & Sartory) Pitt & A.D. Hocking, Fungi and Food Spoilage. 4th Ed.: 611. 2022. [MB 838069]. Basionym: *Sterigmatocystis sydowii* Bainier & Sartory, Ann. Mycol. 11: 25. 1913. [MB 197979] — Type: IMI 211384.

Synonym of: ***Aspergillus sydowii*** (Bainier & Sartory) Thom & Church, The Aspergilli: 147. 1926. [MB 279636]. — Type: IMI 211384. Ex-type: CBS 593.65 = NRRL 250 = IMI 211384 = NRRL 254. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = EF652450;

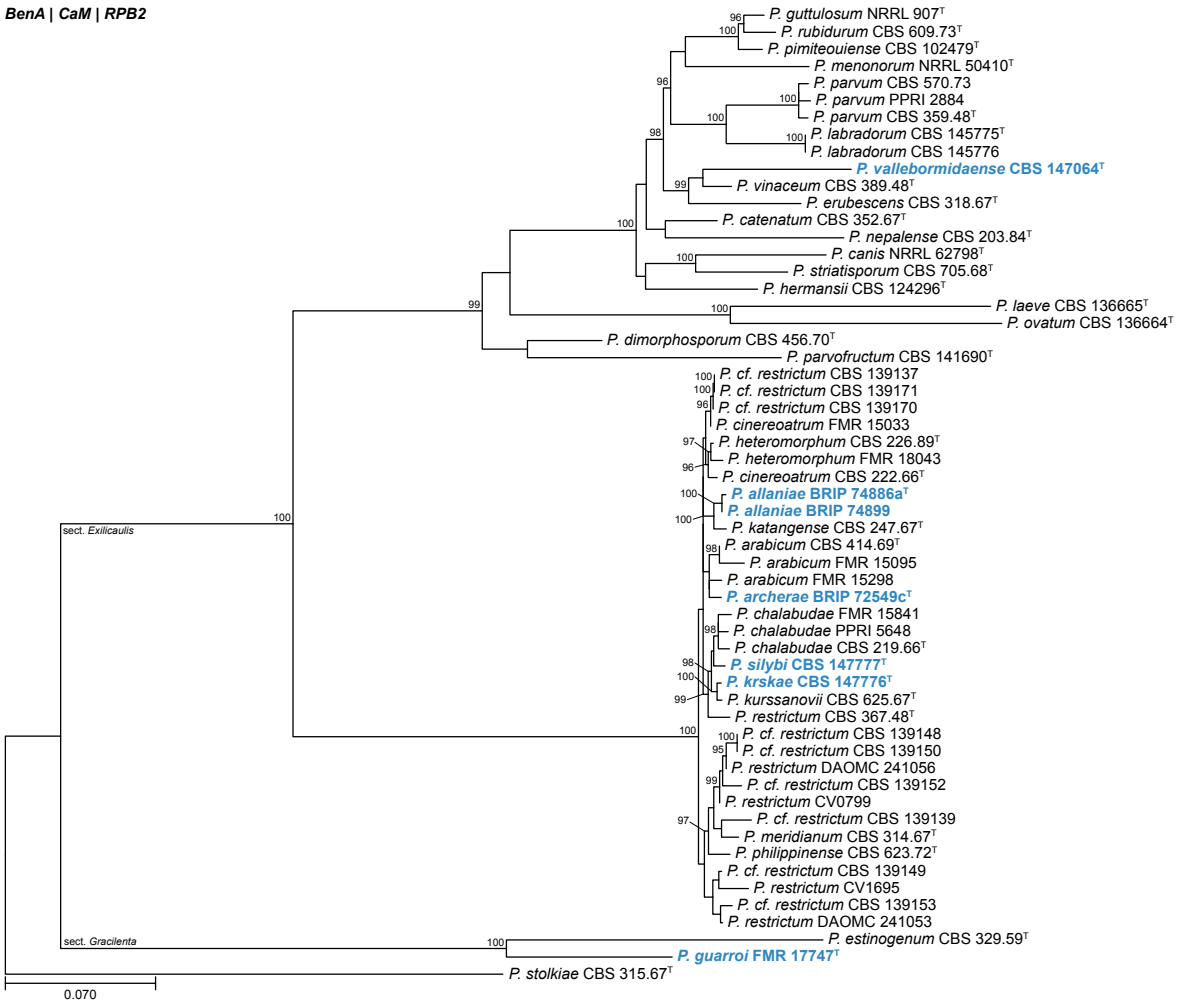

Fig. 23. Phylogenetic tree of *Penicillium* sections *Exilicaulis* and *Gracilenta* based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *P. stolkiae*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S21.

BenA = EF652274; *CaM* = EF652362; *RPB2* = EF652186.

Notes: Pitt & Hocking (2022) introduced this new combination to accommodate *A. sydowii* in *Emericella*. The genus *Emericella* is considered a synonym of *Aspergillus* (Samson *et al.* 2014). We therefore do not accept this new combination and consider it a synonym of *Aspergillus sydowii*.

Emericella versicolor (Vuill.) Pitt & A.D. Hocking, Fungi and Food Spoilage. 4th Ed.: 611. 2022. [MB 838068]. Basionym: *Sterigmatocystis versicolor* Vuill., Erreur Dét. Asp. Paras. Homme: 15. 1903. [MB 233198]. — Type: CBS 583.65 (holotype).

Synonym of: ***Aspergillus versicolor*** (Vuill.) Tirab., Ann. Bot. (Roma) 7: 9. 1908. [MB 172159]. — Type: CBS 583.65. Ex-type: CBS 583.65 = NRRL 238 = ATCC 9577 = IFO 33027 = IMI 229970 = JCM 10258 = QM 7478 = Thom 5519.57 = WB 238. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = EF652442; *BenA* = EF652266; *CaM* = EF652354; *RPB2* = EF652178.

Notes: Pitt & Hocking (2022) introduced this new combination to accommodate *A. versicolor* in *Emericella*. The genus *Emericella* is considered a synonym of *Aspergillus* (Samson *et al.* 2014). We therefore do not accept this new combination and consider this species a synonym of *Aspergillus versicolor*.

Emericella usta (Bainier) Pitt & A.D. Hocking, Fungi and Food Spoilage. 4th Ed.: 611. 2022. [MB 838032]. Basionym: *Sterigmatocystis usta* Bainier, Bull. Soc. Bot. France 28: 78. 1881. [MB 536545]. — Type: IMI 211805 (holotype).

Synonym of: ***Aspergillus ustus*** (Bainier) Thom & Church, The Aspergilli: 152. 1926. [MB 281216]. — Type: IMI 211805. Ex-type: CBS 261.67 = NRRL 275 = ATCC 1041 = ATCC 16818 = IMI 211805 = QM 7477 = WB 275. Infragen. class.: subgen. *Nidulantes* sect. *Usti* ser. *Usti*. DNA barcodes: ITS = EF652455; *BenA* = EF652279; *CaM* = EF652367; *RPB2* = EF652191.

Notes: Pitt & Hocking (2022) introduced this new combination to accommodate *A. ustus* in *Emericella*. The genus *Emericella* is considered a synonym of *Aspergillus* (Samson *et al.* 2014). We therefore do not accept this new combination and consider this species a synonym of *Aspergillus ustus*.

Neosartorya clavata (Desm.) Pitt & A.D. Hocking, Fungi and Food Spoilage. 4th Ed.: 611. 2022. [MB 838031]. — Type: IMI 15949 (holotype).

Synonym of: ***Aspergillus clavatus*** Desm., Ann. Sci. Nat., Bot., ser. 2: 71. 1834. [MB 211530]. — Type: IMI 15949. Ex-type: CBS 513.65 = NRRL 1 = ATCC 1007 = ATCC 9598 = ATCC 9602 = CECT2674 = DSM 816 = IMI 15949 = LSHBA c .86 = LSHBA c .95 = MIT213 = NCTC 3887 = NCTC 9 = NCTC 978 = NRRL 1656 = QM 1276 = QM 7404 = Thom 107 = WB

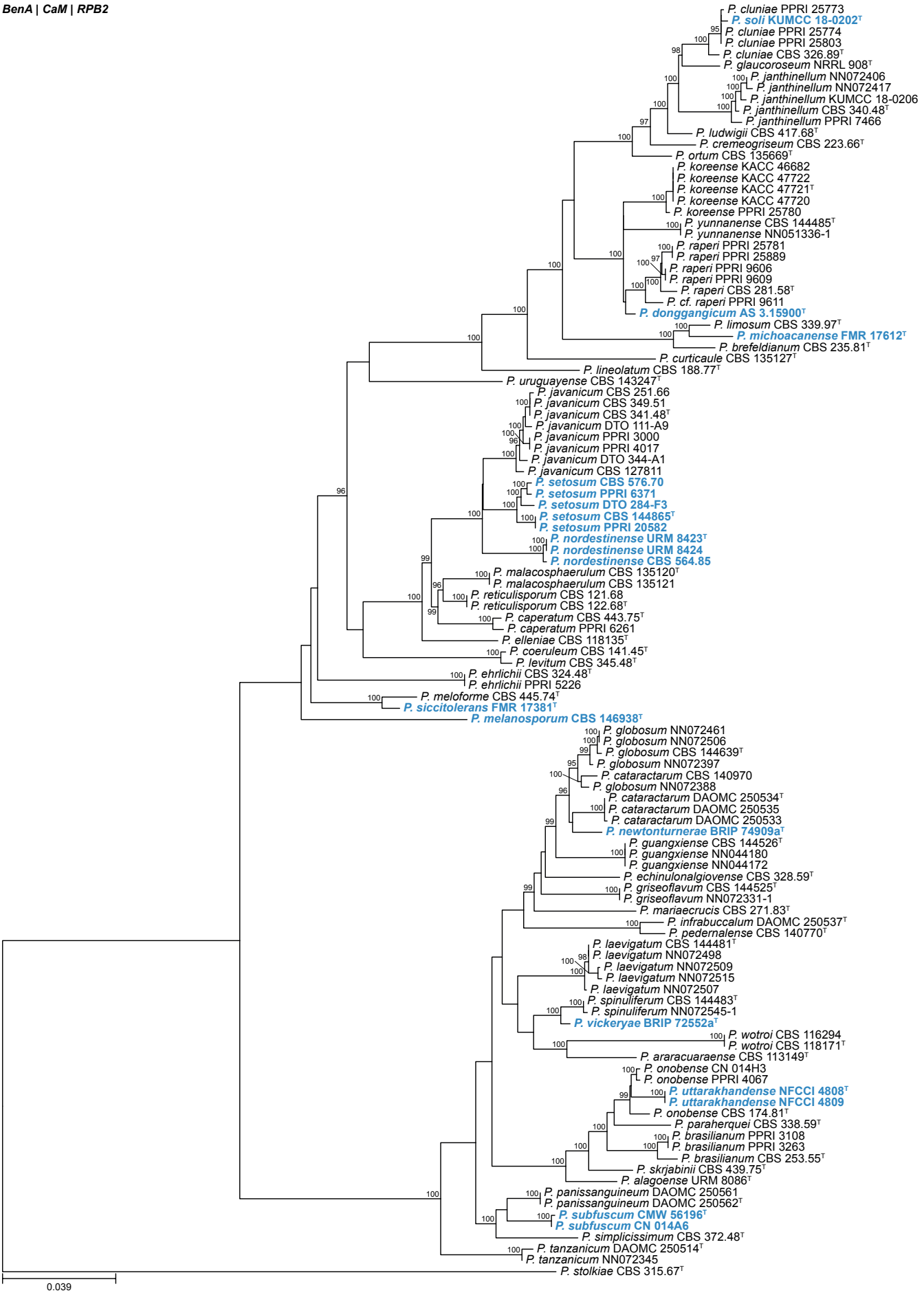

Fig. 24. Phylogenetic tree of *Penicillium* section *Lanata-Divaricata* series *Janthinella* and *Simplicissima*, based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *P. stolkiae*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S22.

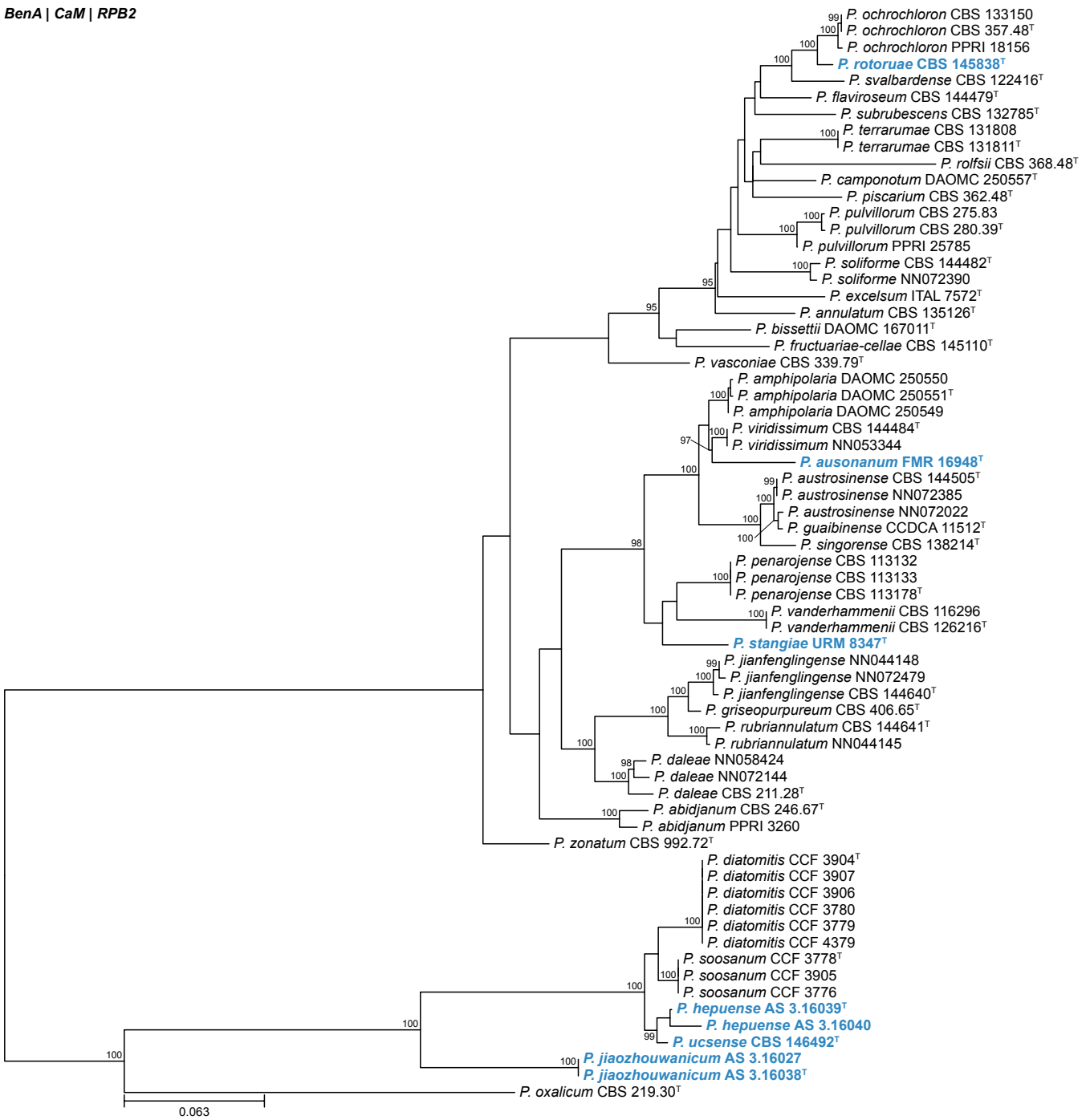

Fig. 25. Phylogenetic tree of *Penicillium* section *Lanata-Divaricata* series *Dalearum*, *Oxalica* and *Rolfsiorum*, based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to the series *Oxalica* clade. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S23.

1. Infragen. class.: subgen. *Fumigati* sect. *Clavati* ser. *Clavati*. DNA barcodes: ITS = EF669942; *BenA* = EF669802; *CaM* = EF669871; *RPB2* = EF669730.

Notes: Pitt & Hocking (2022) introduced this new combination to accommodate *A. clavatus* in *Neosartorya*. The genus *Neosartorya* is considered a synonym of *Aspergillus* (Samson *et al.* 2014). We therefore do not accept this new combination and consider it a synonym of *Aspergillus clavatus*.

Paecilomyces clematidis Spetik, Eichmeier, Gramaje & Berraf-Tebbal, Phytotaxa 559: 242. 2022. [MB 843540]. — Type: BRNU 677844 (holotype). Ex-type: CBS 148466 = MEND-F-0560. DNA barcodes: ITS = MZ923760; *BenA* = MZ927740; *CaM* = MZ927738; *RPB2* = OL332317.

Paecilomyces penicilliformis Jurjević & Hubka, Persoonia 44: 431. 2020. [MB 834874]. — Type: BPI 911216 (holotype). Ex-type: CCF 5755 = CBS 146003 = EMSL 3392. DNA barcodes: ITS = LR679769; *BenA* = LR679768; *CaM* = LR778299; *RPB2* = n.a.

Paraxerochrysium Crous & Decock, Persoonia 47: 261. 2021. [MB 841829]

Synonym of: ***Xerochrysium*** Pitt, IMA Fungus 4 (2): 236. 2013. [MB 807003].

Notes: See notes for *Xerochrysium coryli* above.

Paraxerochrysium coryli Crous & Decock, Persoonia 47: 261. 2021. [MB 841830]. — Type: CBS H-24853 (holotype). Ex-type: CBS

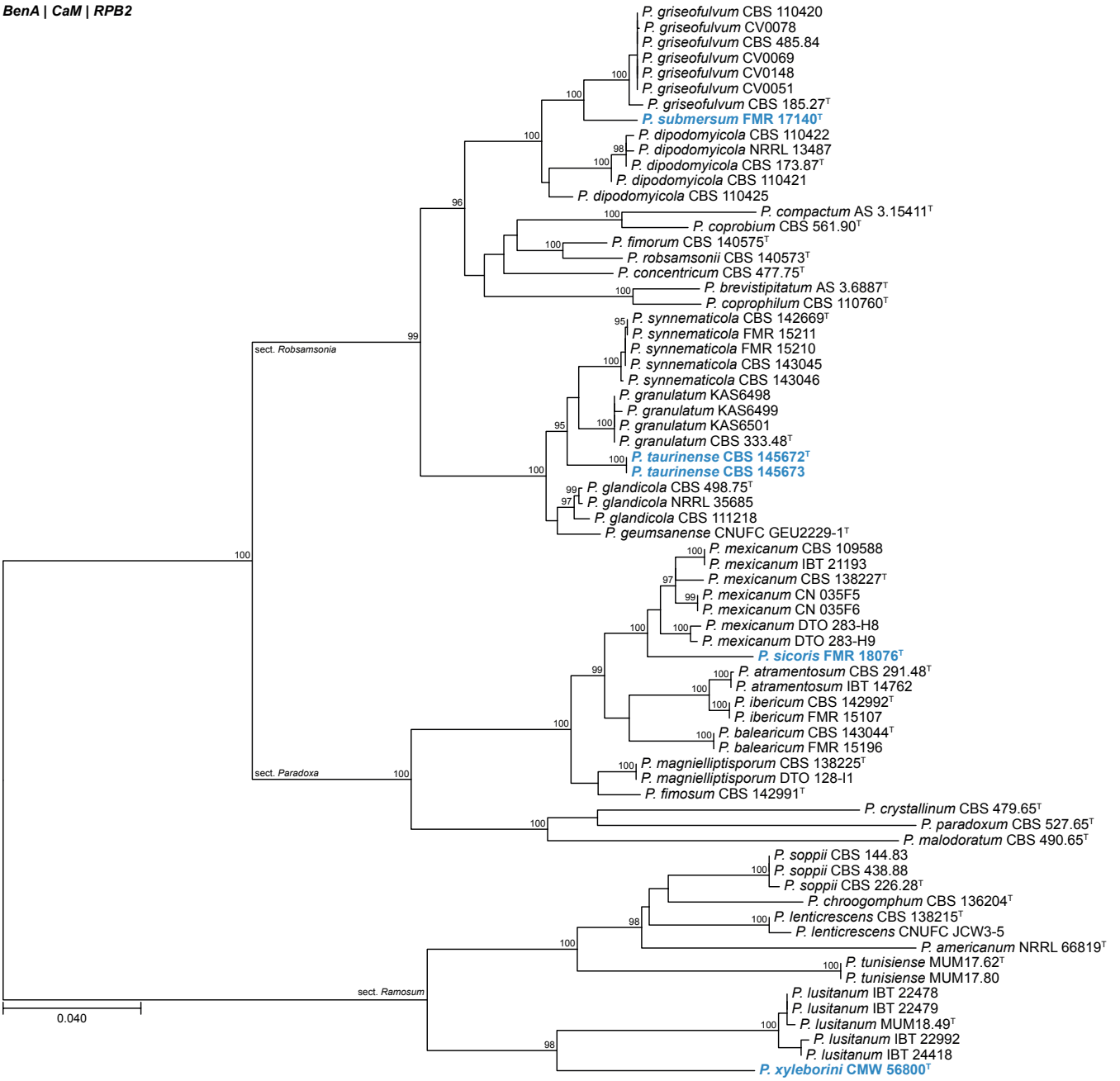

Fig. 26. Phylogenetic tree of *Penicillium* sections *Paradoxa*, *Ramosum* and *Robsamsonia*, based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was midpoint rooted. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S24.

148314 = CPC 41272 = MUCL 58103. DNA barcodes: ITS = OK664748; *BenA* = OK651216; *CaM* = n.a.; *RPB2* = OK651178.

Notes: See notes for *Xerochrysium coryli* above.

Penicillium allaniae Y.P. Tan, Bishop-Hurley, Marney, R.G. Shivas, Index Austral. Fungi 3: 6. 2022. [MB 900139]. — Type: BRIP 74886a (holotype). Ex-type: BRIP 74886a. Infragen. class.: subgen. *Aspergilloides* sect. *Exilicaulis* ser. *Restricta*. DNA barcodes: ITS = OP903476; *BenA* = OP921959; *CaM* = OP921957; *RPB2* = OP921958.

Notes: Since Houbraken *et al.* (2020), *P. allaniae*, *P. archerae*, *P. krskae* and *P. silybi* were introduced bringing the number of accepted species in series *Restricta* to thirteen. However, the series clearly needs a taxonomic revision (Fig. 23 & Suppl. Fig. S21) as noted by Visagie *et al.* (2016). In the meantime, we accept the four recently introduced species.

Penicillium allsoppiae Visagie, A. Visagie, Frisvad & K. Jacobs, Persoonia 46: 176. 2021. [MB 834426]. — Type: CBS H-22036 (holotype). Ex-type: CBS 138943 = DAOM 241348 = DTO 182-D5 = CV 931. Infragen. class.: subgen. *Penicillium* sect. *Canescentia* ser. *Canescentia*. DNA barcodes: ITS = JX140830; *BenA* = JX140992; *CaM* = JX157384; *RPB2* = KP016895.

Penicillium anthracinoglaciei Perini, Frisvad & Zalar, Microbial Ecol. 86: 287. 2022 (2023). [MB 835602]. — Type: EXF-11443H (Holotype). Ex-type: EXF-11443 = IBT 34739. Infragen. class.: subgen. *Penicillium* sect. *Brevicompacta* ser. *Brevicompacta*. DNA barcodes: ITS = n.a.; *BenA* = MT080493; *CaM* = MT080552; *RPB2* = MT080519.

Notes: The phylogenetic relationship between *P. anthracinoglaciei* and *P. bialowiezense* is unresolved and needs further study (Fig. 18 & Suppl. Fig. S16).

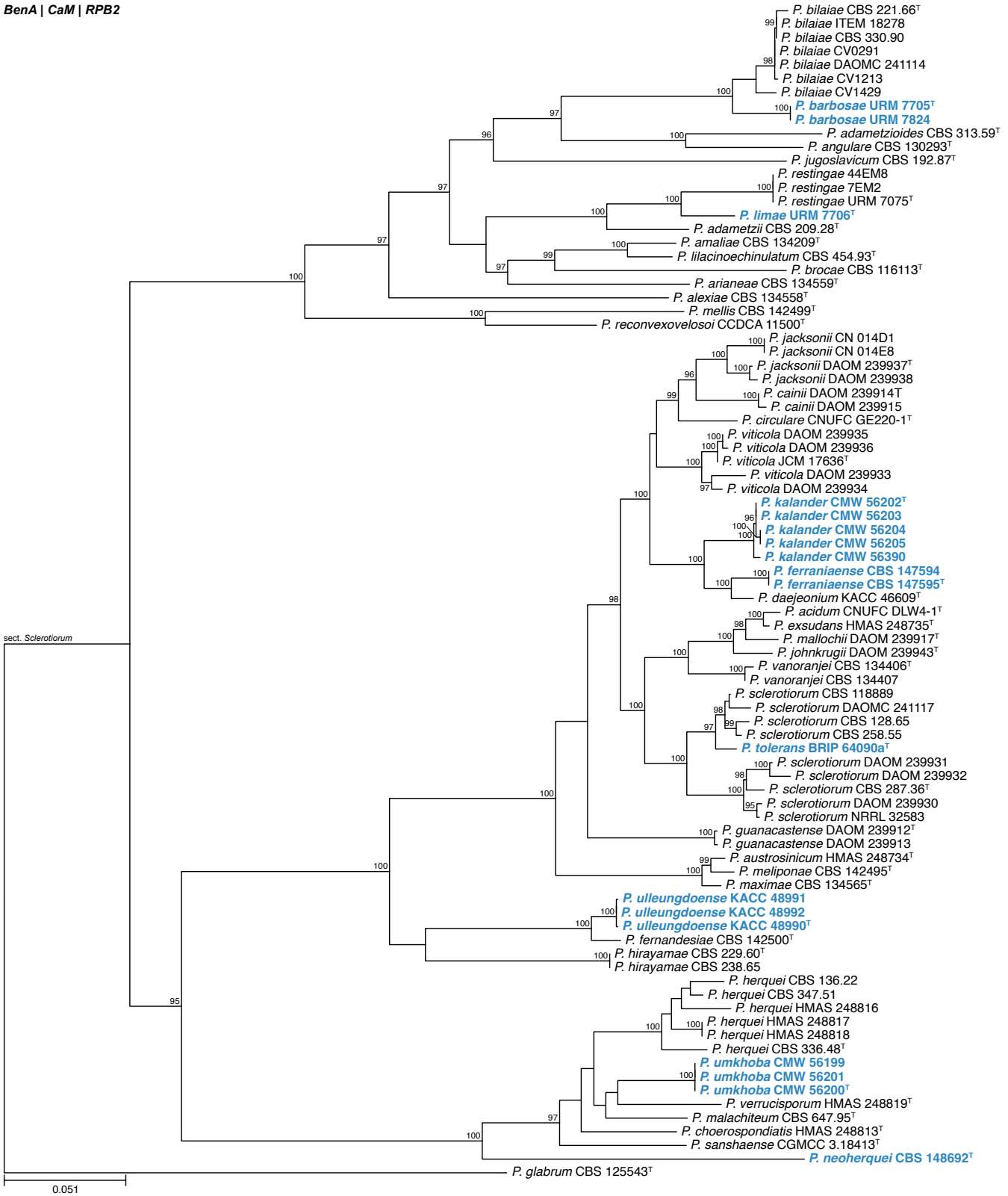

Fig. 27. Phylogenetic tree of *Penicillium* section *Sclerotiorum*, based on a concatenated dataset of *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *P. glabrum*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S25.

Penicillium aquadulcis Hyang B. Lee & T.T.T. Nguyen, Mycobiology 49: 542. 2021. [MB 556953]. — Type: CNUFC HT19009 (holotype). Ex-type: CNUFC JT1301. Infragen. class.: subgen. *Aspergilloides* sect. *Citrina* ser. *Westlingiorum*. DNA barcodes: ITS = OK356194; *BenA* = OK105100; *CaM* = OK105102; *RPB2* = n.a.

Penicillium archerae Y.P. Tan, Bishop-Hurley, R.G. Shivas, Index Austral. Fungi 3: 7. 2022. [MB 900140]. — Type: BRIP 72549c (holotype). Ex-type: BRIP 72549c. Infragen. class.: subgen. *Aspergilloides* sect. *Exilicaulis* ser. *Restricta*. DNA barcodes: ITS = OP903477; *BenA* = OP921961; *CaM* = n.a.; *RPB2* = OP921960.

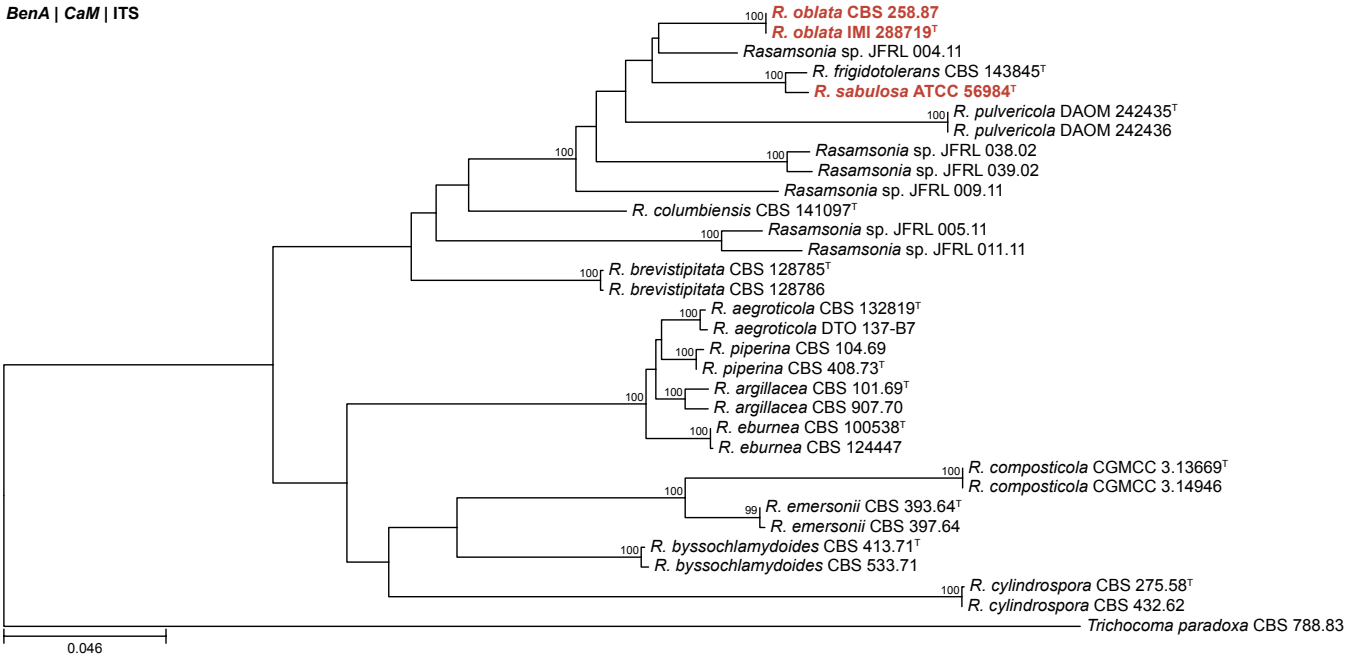

Fig. 28. Phylogenetic tree of *Rasamsonia*, based on a concatenated dataset of *BenA*, *CaM* and ITS. Strains of recently described species are shown in bold coloured text. The tree was rooted to *Trichocoma paradoxa*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S26.

Notes: Since Houbraken *et al.* (2020), *P. allaniae*, *P. archerae*, *P. krskae* and *P. silybi* were introduced bringing the number of accepted species in series *Restricta* to thirteen. However, the series clearly needs a taxonomic revision (Fig. 23 & Suppl. Fig. S21) as noted by Visagie *et al.* (2016). In the meantime, we accept the four recently introduced species.

Penicillium aspericonidium B.D. Sun, A.J. Chen & Houbraken, Mycol. Prog. 20: 1387. 2021. [MB 838211]. — Type: CBS H-22830 (holotype). Ex-type: CBS 141832 = DTO 030-C5. Infragen. class.: subgen. *Aspergilloides* sect. *Charlesia* ser. *Phoenicea*. DNA barcodes: ITS = MT309657; *BenA* = MT302240; *CaM* = n.a.; *RPB2* = MT302224.

Penicillium ausonanum Torres-Garcia, Gené & Dania García, MycoKeys 86: 119. 2022. [MB 840556]. — Type: CBS H-24781 (holotype). Ex-type: CBS 148237 = FMR 16948. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Dalearum*. DNA barcodes: ITS = LR655808; *BenA* = LR655809; *CaM* = LR655810; *RPB2* = LR655811.

Penicillium barbosae S. Ramos, R. Cruz, R.N. Barbosa & Houbraken, Mycol. Prog. 20: 828. 2021. [MB 837908]. — Type: URM 94474 (holotype). Ex-type: URM 7705. Infragen. class.: subgen. *Aspergilloides* sect. *Sclerotiorum* ser. *Adametziorum*. DNA barcodes: ITS = MW191494; *BenA* = MG452818; *CaM* = MW183245; *RPB2* = LR898886.

Penicillium cerradense Cruvinel, P.O. Magalh. & Pinho, Sci. Rep. 11 (no. 17861): 2. 2021. [MB 835241]. — Type: UB23977 (holotype). Ex-type: DCFS6a. Infragen. class.: subgen. *Aspergilloides* sect. *Citrina* ser. *Westlingiorum*. DNA barcodes: ITS = MT006126; *BenA* = MT416533; *CaM* = MT416534; *RPB2* = MT416532.

Synonym of: ***Penicillium sumatraense*** [as '*sumatrense*'] Szilvinyi, Archiv. Hydrobiol. 14 Suppl. 6: 535. 1936. [MB 319297].

Notes: *Penicillium cerradense* belongs to the *P. sumatraense* clade and is thus considered a synonym (Fig. 21 & Suppl. Fig. S19).

Penicillium claroviride Visagie & Yilmaz, Mycologia 115: 90. 2022. [MB 844184]. — Type: PREM 63221 (holotype). Ex-type: CMW 56197 = CBS 147458 = CN014D2. Infragen. class.: subgen. *Penicillium* sect. *Canescentia* ser. *Atroveneta*. DNA barcodes: ITS = MT949909; *BenA* = MT957414; *CaM* = MT957456; *RPB2* = MT957482.

Penicillium doidgeae Visagie, Frisvad & K. Jacobs, Persoonia 46: 176. 2021. [MB 834427]. — Type: CBS H-22038 (holotype). Ex-type: CBS 138947 = IBT 31950 = DAOM 241107 = DTO 183-G7 = CV 2189. Infragen. class.: subgen. *Penicillium* sect. *Canescentia* ser. *Atroveneta*. DNA barcodes: ITS = JX140804; *BenA* = JX141006; *CaM* = JX157413; *RPB2* = KP016915.

Penicillium donggangicum L. Wang, PeerJ 10 (e13224): 8. 2022. [MB 841518]. — Type: HMAS 350265 (holotype). Ex-type: AS 3.15900. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Janthinella*. DNA barcodes: ITS = MW946996; *BenA* = MZ004914; *CaM* = MZ004918; *RPB2* = MW979253.

Penicillium eickeri Visagie, Frisvad & K. Jacobs, Persoonia 46: 179. 2021. [MB 834428]. — Type: CBS H-22034 (holotype). Ex-type: CBS 138939 = IBT 31921 = DAOM 241352 = DTO 181-G3 = CV 475. Infragen. class.: subgen. *Penicillium* sect. *Canescentia* ser. *Canescentia*. DNA barcodes: ITS = JX140824; *BenA* = JX140979; *CaM* = JX157365; *RPB2* = KP016876.

Penicillium elizabethiae Visagie & Frisvad, Persoonia 46: 179. 2021. [MB 834432]. *Basionym*: *Penicillium echinatum* E. Dale, Ann. Mycol. 24: 137. 1926. (*nom. illegit*. Art. 53.1; *non* Rivolta (1873). [MB 505484]. — Type: CBS H-22052 (holotype). Ex-type: NRRL 917 = MUCL 29170 = IBT 21955 = DTO 189-B8. Infragen. class.: subgen. *Penicillium* sect. *Canescentia*

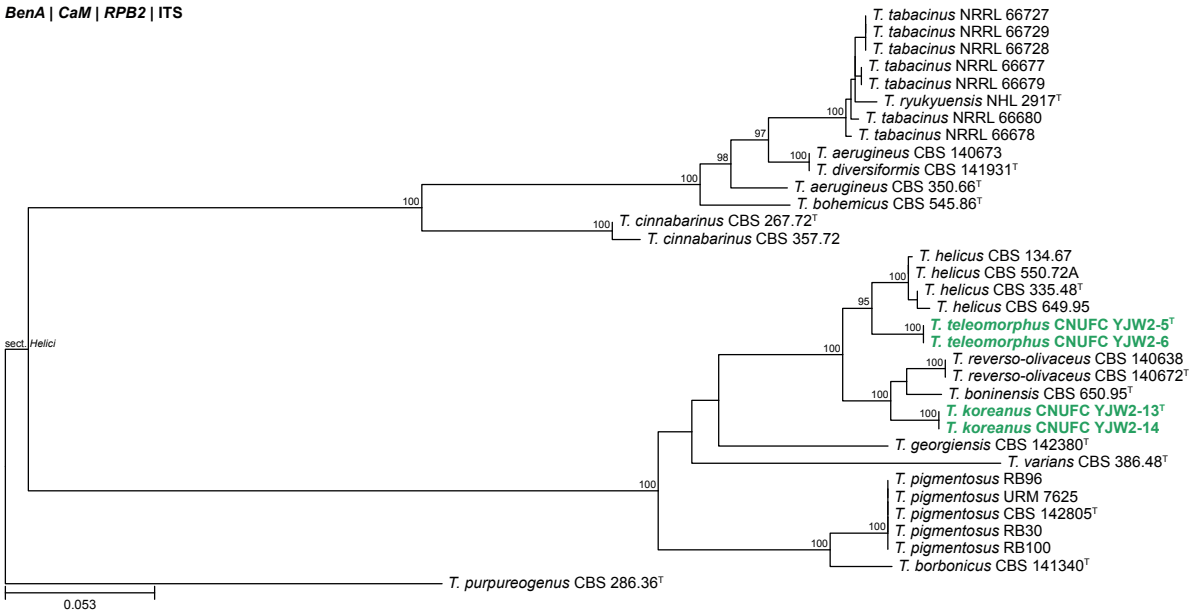

Fig. 29. Phylogenetic tree of *Talaromyces* section *Helici*, based on a concatenated dataset of *BenA*, *CaM*, *RPB2*, and ITS. Strains of recently described species are shown in bold coloured text. The tree was rooted to *T. purpureogenus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S27.

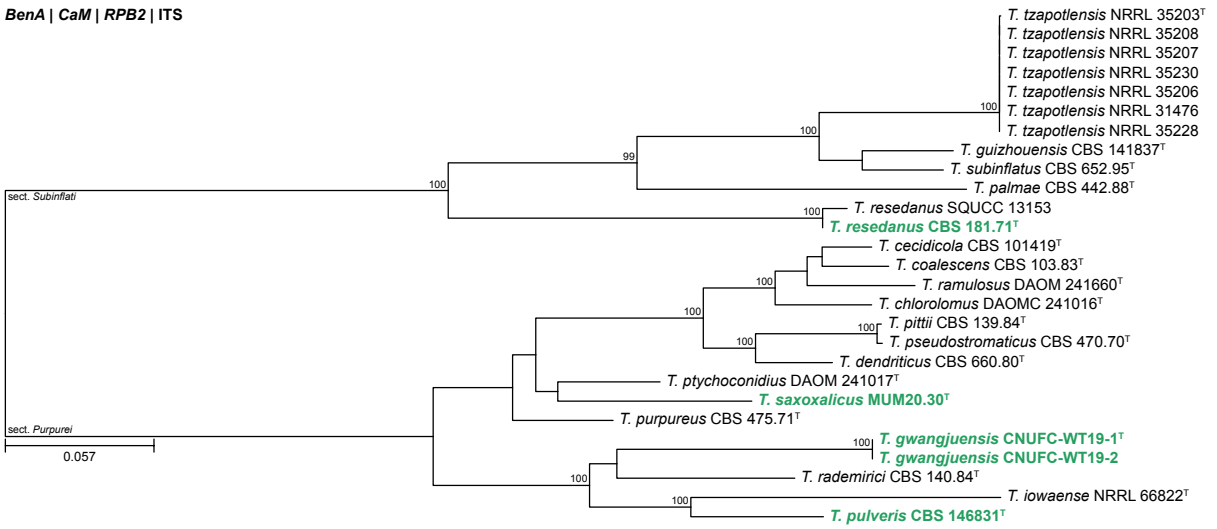

Fig. 30. Phylogenetic tree of *Talaromyces* sections *Purpurei* and *Subinflati*, based on a concatenated dataset of *BenA*, *CaM*, *RPB2*, and ITS. Strains of recently described species are shown in bold coloured text. The tree was midpoint rooted. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S28.

ser. *Canescentia*. DNA barcodes: ITS = KP016840; *BenA* = KJ866964; *CaM* = KJ867021; *RPB2* = KP016918.

Notes: *Penicillium elizabethiae* was introduced for the illegitimate *P. echinatum* E. Dale.

Penicillium ezekielii Houbraken & Oyedele, Persoonia 49: 309. 2022. [MB 844770]. — Type: CBS H-25015 (holotype). Ex-type: CBS 149115 = DTO 065-D2. Infragen. class.: subgen. *Aspergilloides* sect. *Cinnamopurpurea* ser. *Jiangxiensia*. DNA barcodes: ITS = ON723772; *BenA* = ON920778; *CaM* = ON920781; *RPB2* = ON920784.

Penicillium ferraniaense Houbraken & Di Piazza, Persoonia 46: 491. 2021. [MB 839119]. — Type: CBS H-24757 (holotype). Ex-type: CBS 147595 = DTO 400-D8. Infragen. class.: subgen. *Aspergilloides* sect. *Sclerotiorum* ser. *Sclerotiorum*. DNA barcodes: ITS = MW694951; *BenA* = MW689336; *CaM* = MW689338; *RPB2* = MW689340.

Penicillium fuscoglaucum Biourge, La Cellule 33: 128. 1923. [MB 265659]. — Type: Belgium, source and collection date unknown, P. Biourge [Biourge, La Cellule 33: Pl. col. I. dr., n°4; Pl. noire II, fig. 9. 1923, **lectotype** designated here, MBT10014260); CBS H-15446 (dried culture), **epitype** designated here, MBT10014261]. Ex-epitype: CBS 261.29 = IMI 092259 = LSHB P81 = MUCL 28651 = NRRL 892 = CBS 122423 = DTO 461-D2. Infragen. class.: subgen. *Penicillium* sect. *Fasciculata* ser. *Camembertiorum*. DNA barcodes: ITS = MH855062; *BenA* = OR206420; *CaM* = OR206421; *RPB2* = OR206422.

Notes: Giraud *et al.* (2010) and Ropars *et al.* (2020) considered *P. fuscoglaucum* as a distinct species, closely related to *P. camemberti*, and suggested that *P. caseifulvum* (CBS 101134T)

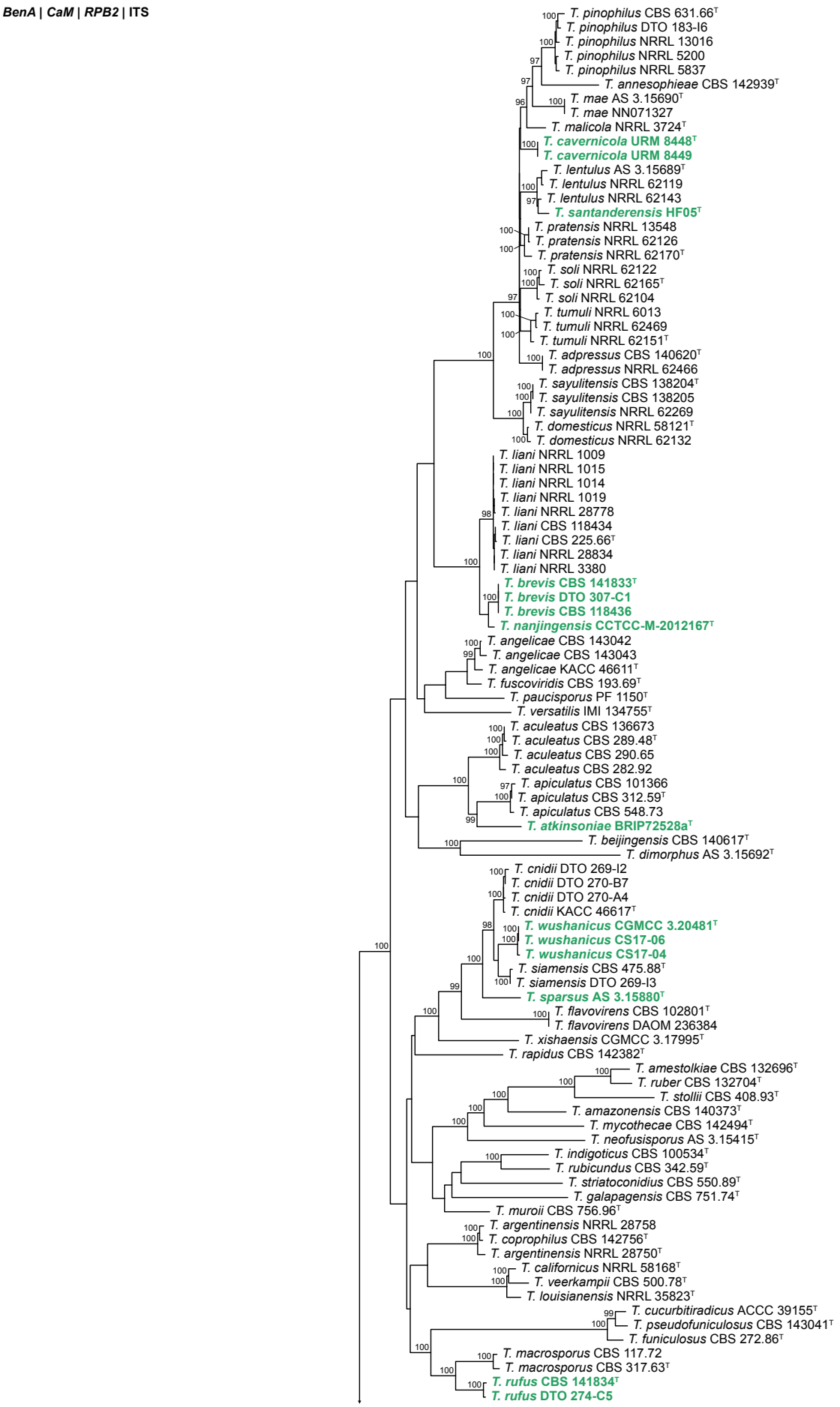

Fig. 31. Phylogenetic tree of *Talaromyces* section *Talaromyces*, based on a concatenated dataset of *BenA*, *CaM*, *RPB2*, and ITS. Strains of recently described species are shown in bold coloured text. The tree was rooted to *T. helicus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. See Suppl. Fig. S29.

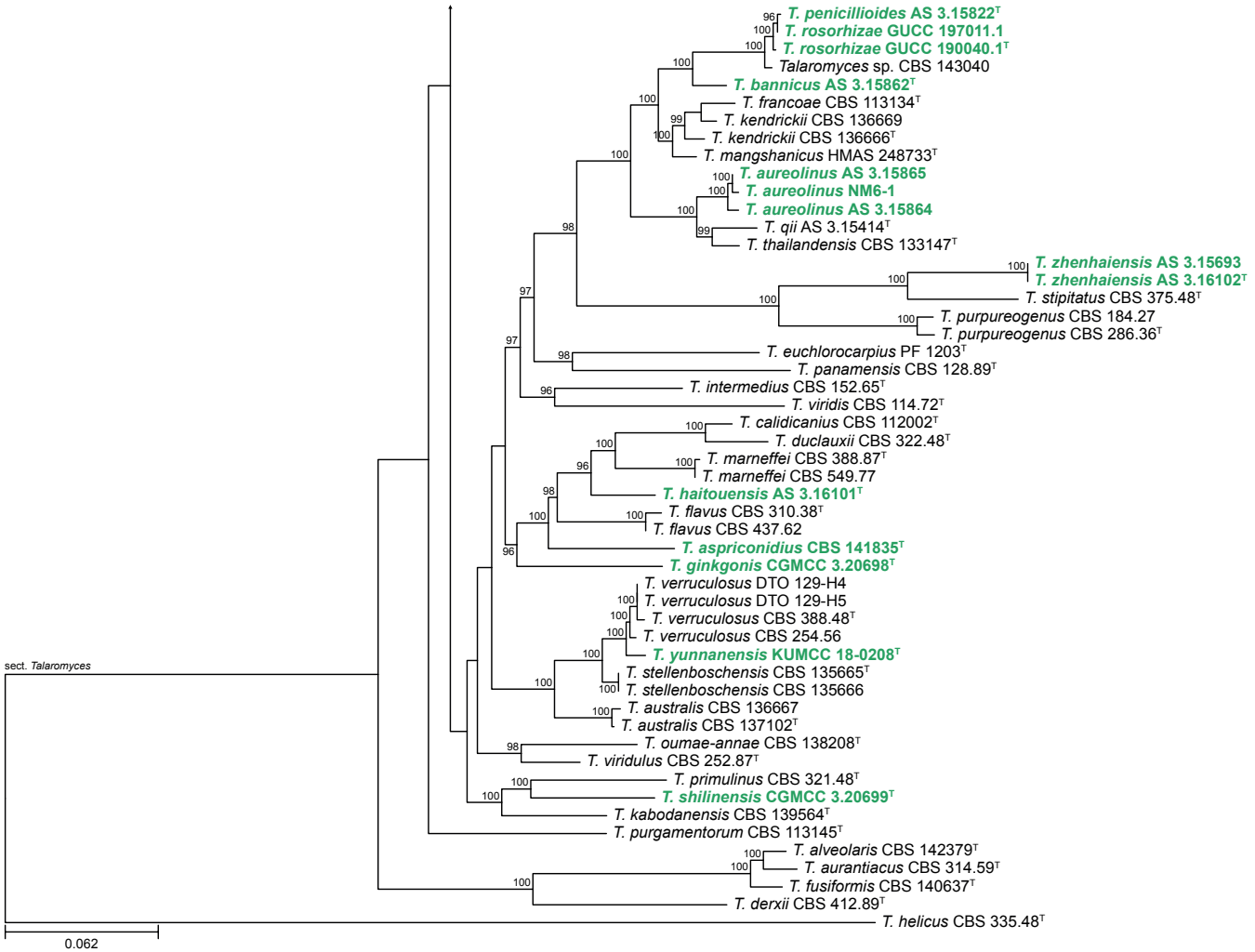

Fig. 31. (Continued).

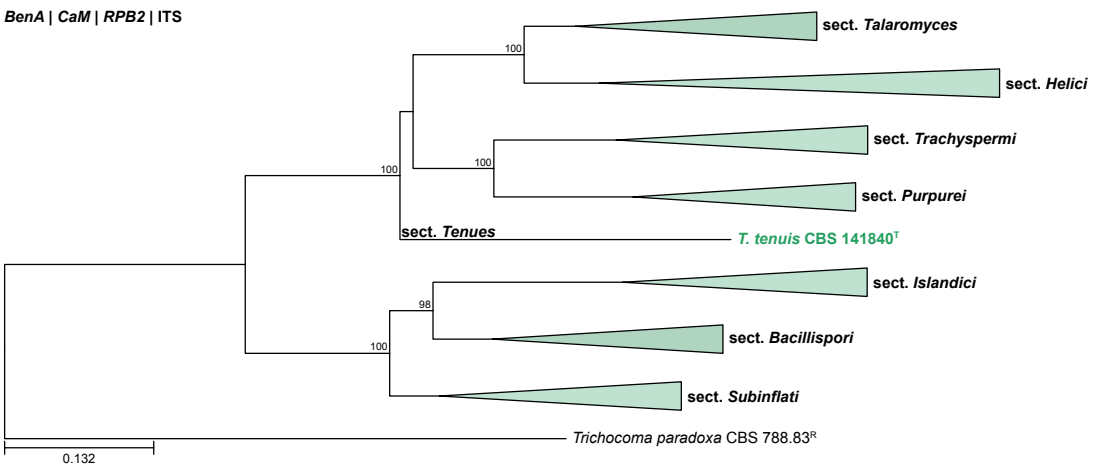

Fig. 32. Phylogenetic tree of *Talaromyces* showing the phylogenetic relationship of the recently introduced section *Tenues*, based on a concatenated dataset of *BenA*, *CaM*, *RPB2*, and ITS. Strains of recently described species are shown in bold coloured text. The tree was rooted to *Trichocoma paradoxa*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. Representative strains are indicated by superscript R. See Suppl. Fig. S30.

is a variety, *P. camemberti* var. '*caseifulvum*'. Following Frisvad & Samson (2004), we disagree with the idea of introducing varieties in *Penicillium*. We accept *P. camemberti*, *P. caseifulvum* and *P. commune*, as suggested in the taxonomy of Frisvad & Samson (2004), but also tentatively accept *P. fuscoglaucum* and *P. biforme* following the taxonomic insights of Ropars *et al.* (2020). The taxonomies of Frisvad & Samson (2004) and Ropars *et al.* (2020) are not congruent and a taxonomic revision is therefore needed to resolve relationships and species boundaries within the clade (see Fig. 19 & Suppl. Fig. S17), noting that *P. camemberti*, and maybe also *P. caseifulvum*, are domesticated species related to cheese production (Bodinaku *et al.* 2019, Ropars *et al.* 2020).

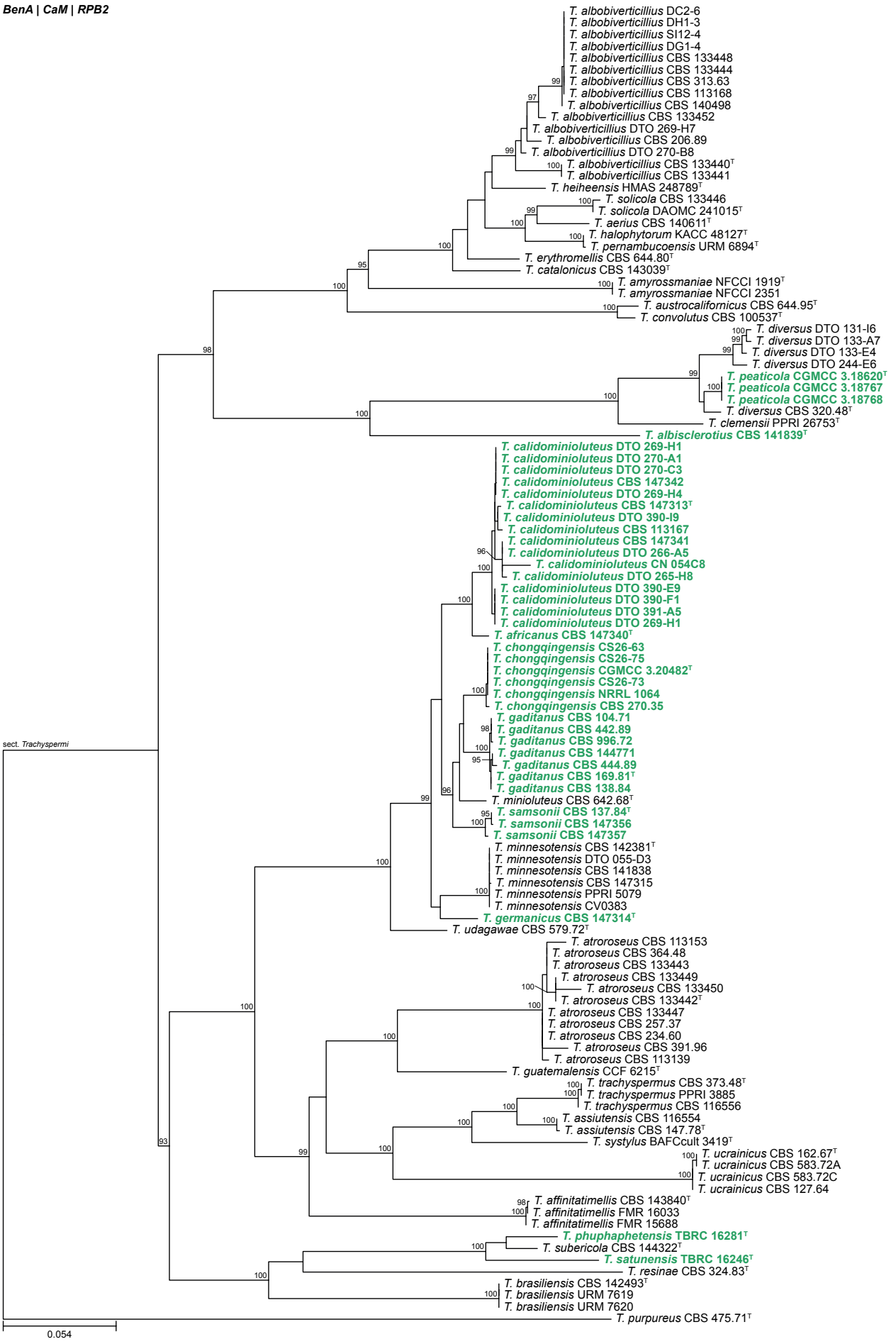

Fig. 33. Phylogenetic tree of *Talaromyces* section *Trachyspermi*, based on a concatenated dataset of *BenA*, *CaM* and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *T. purpureus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T.

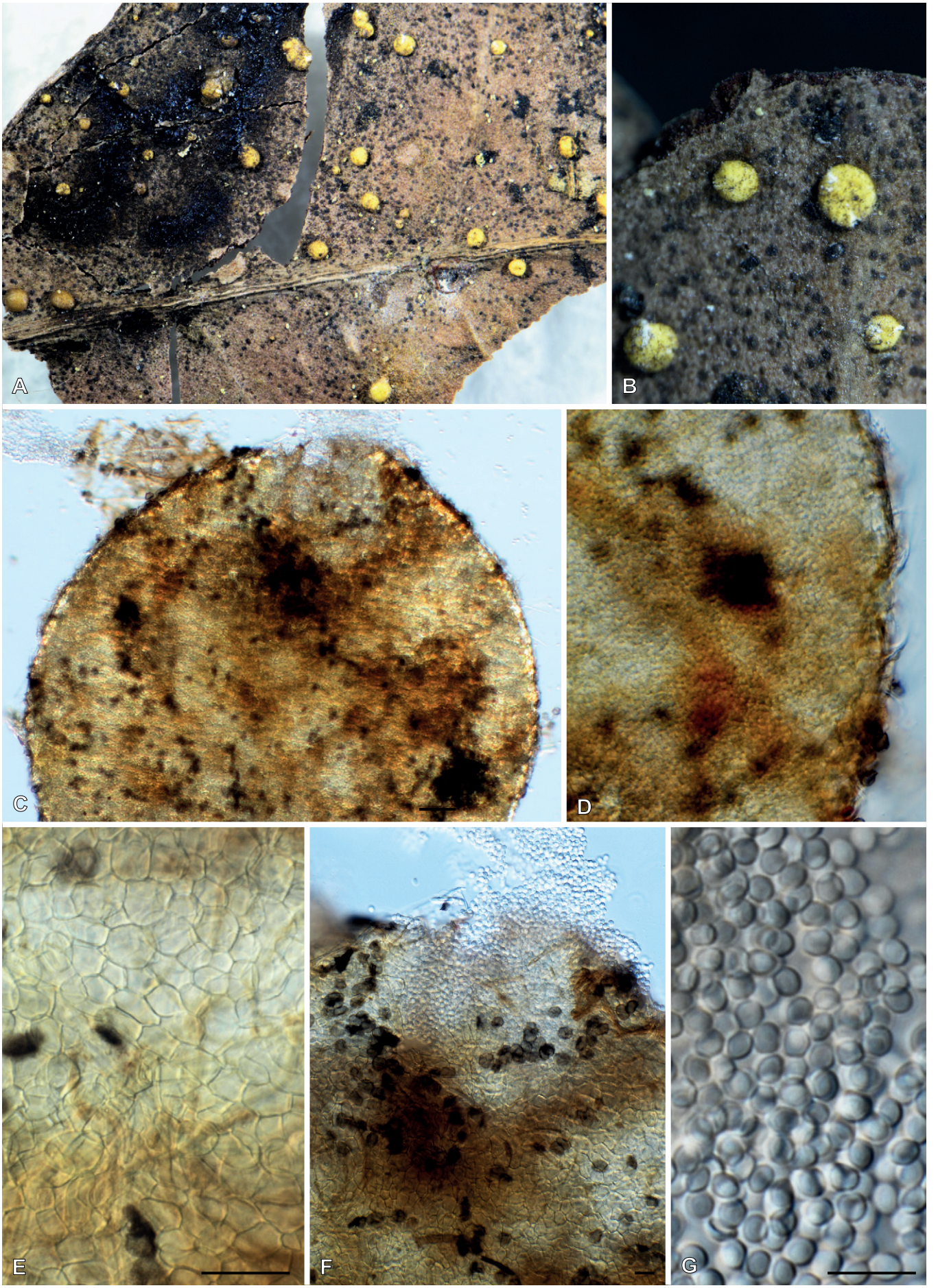

Fig. 34. *Aspergillus lentisci* in nature. **A, B.** Ascomata on dried leaf material. **C, D.** Ascomata observed under light microscope. **E.** Outer cell layer of ascomata. **F.** Ascospores released from ascomata. **G.** Ascospores. Scale bars = 10 µm.

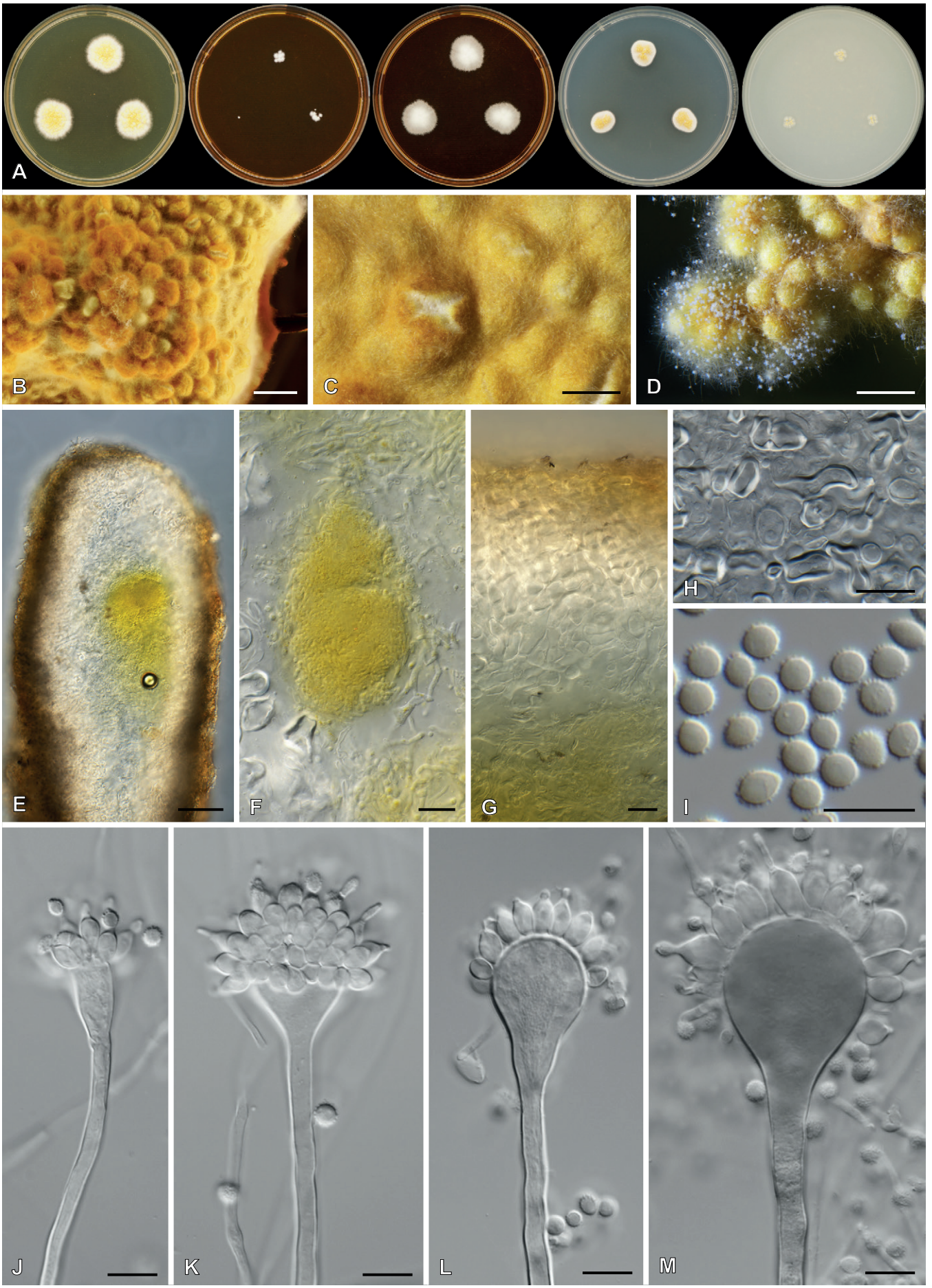

Fig. 35. *Aspergillus lentisci* in culture. **A.** Colonies on, from left to right, MY50G, MY20, MY40, DG18 and OA. **B–D.** Colony overview on DG18 showing sclerotia and conidiophores (D). **E, F.** Section of sclerotia showing potential early development of asci and ascomata. **G.** Section of sclerotia showing its wall structure. **H.** Hülle cells from sclerotia. **I.** Conidia**. J–M.** Conidiophores. Scale bars: B = 2 mm; C, D = 500 µm; E = 50 µm; F–H = 20 µm; I–M = 10 µm.

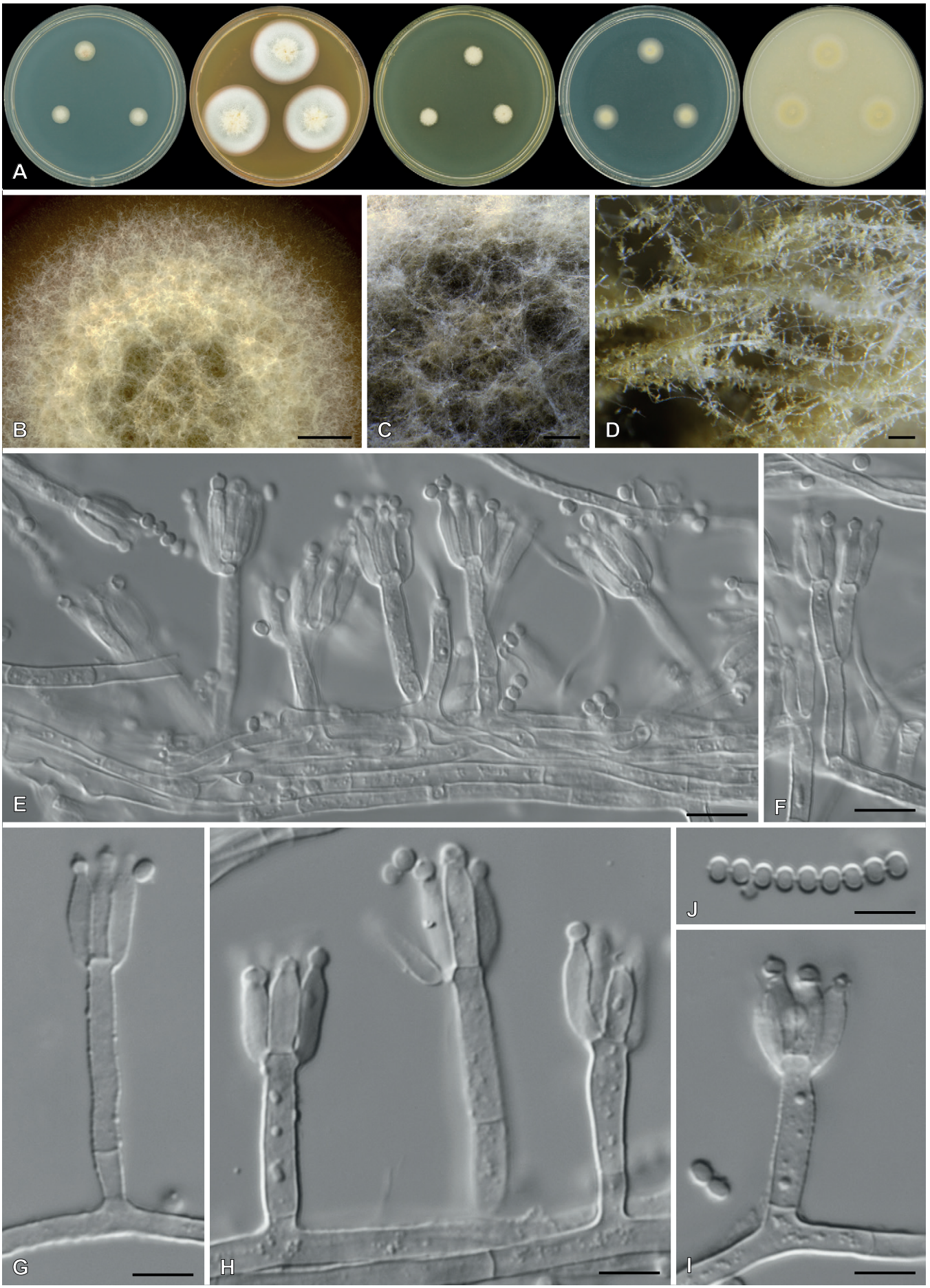

Fig. 36. *Rasamsonia oblata*. **A.** Colonies on, from left to right, CYA, MEA, YES, DG18 and OA. **B–D.** Colony overview on MEA (B) and OA (C, D). **E–I.** Conidiophores. **J.** Conidia. Scale bars: B = 2.5 mm; C, D = 1 mm; E–J = 10 µm.

Penicillium fusiforme B.D. Sun, A.J. Chen & Houbraken, Mycol. Prog. 20: 1389. 2021. [MB 838212]. — Type: CBS H-22840 (holotype). Ex-type: CBS 250.66 = DTO 035-D7. Infragen. class.: subgen. *Aspergilloides* sect. *Charlesia* ser. *Fellutana*. DNA barcodes: ITS = MT309668; *BenA* = MT302253; *CaM* = MT302220; *RPB2* = MT302236.

Penicillium gercinae A.L. Alves, A.C.S. Santos, R.N. Barbosa, C.M. Souza-Motta, R.F.R. Melo, P.V. Tiago, Acta Bot. Brasil 36 (e2022abb0006): 10. 2022. [MB 841260]. — Type: URM 94476 (holotype). Ex-type: URM 8348. Infragen. class.: subgen. *Aspergilloides* sect. *Ramigena* ser. *Georgiensia*. DNA barcodes: ITS = MW648591; *BenA* = MW646389; *CaM* = MW646391; *RPB2* = MW646393.

Penicillium guarroi Torres-Garcia, Gené & Dania García, MycoKeys 86: 121. 2022. [MB 840567]. — Type: CBS H-24782 (holotype). Ex-type: CBS 148238 = FMR 17747. Infragen. class.: subgen. *Aspergilloides* sect. *Gracilenta* ser. *Estinogena*. DNA barcodes: ITS = LR814139; *BenA* = LR814134; *CaM* = LR814140; *RPB2* = LR814145.

Penicillium hepuense L. Wang, PeerJ 10 (e13224): 11. 2022. [MB 841525]. — Type: HMAS 350263 (holotype). Ex-type: AS 3.16039 = TT2-4X3. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Oxalica*. DNA barcodes: ITS = MW946994; *BenA* = MZ004912; *CaM* = MZ004916; *RPB2* = MW979254.

Penicillium irregulare Torres-Garcia, Gené & Dania García, MycoKeys 86: 125. 2022. [MB 840558]. — Type: CBS H-24783 (holotype). Ex-type: CBS 148240 = FMR 17859. Infragen. class.: subgen. *Penicillium* sect. *Canescentia* ser. *Canescentia*. DNA barcodes: ITS = LR814181; *BenA* = LR814144; *CaM* = LR814151; *RPB2* = LR814182.

Penicillium jenningsiae Y.P. Tan, Bishop-Hurley, E. Lacey & R.G. Shivas, Index Austral. Fungi 3: 8. 2022. [MB 900141]. — Type: BRIP 45936a (holotype). Ex-type: BRIP 45936a. Infragen. class.: subgen. *Aspergilloides* sect. *Citrina* ser. *Sumatraensia*. DNA barcodes: ITS = n.a.; *BenA* = OL741657; *CaM* = n.a.; *RPB2* = OL741660.

Synonym of: ***Penicillium sumatraense*** [as '*sumatrense*'] Szilvinyi, Archiv. Hydrobiol. 14 Suppl. 6: 535. 1936. [MB 319297].

Notes: *Penicillium jenningsiae* belongs to the *P. sumatraense* clade and is thus considered a synonym. (Fig. 21 & Suppl. Fig. S19)

Penicillium jiaozhouwanicum L. Wang, PeerJ 10 (e13224): 13. 2022. [MB 841531]. — Type: HMAS 350262 (holotype). Ex-type: AS 3.16038 = 0801H2-2. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Oxalica*. DNA barcodes: ITS = MW946993; *BenA* = MZ004911; *CaM* = MZ004915; *RPB2* = MW979252.

Penicillium kalander Visagie & Yilmaz, Mycologia 115: 95. 2022. [MB 844185]. — Type: PREM 63223 (holotype). Ex-type: CMW 56202 = CN014E1. Infragen. class.: subgen. *Aspergilloides* sect. *Sclerotiorum* ser. *Sclerotiorum*. DNA barcodes: ITS = MT949914; *BenA* = MT957421; *CaM* = MT957461; *RPB2* = MT957487.

Penicillium krskae Labuda, Kubátová, C. Schüller & J. Strauss, J. Fungi 7 (7, no. 557): 7. 2021. [MB 839112]. — Type: PRM 955188 (holotype). Ex-type: CBS 147776 = BiMM-F280 = CCF 6561. Infragen. class.: subgen. *Aspergilloides* sect. *Exilicaulis* ser. *Restricta*. DNA barcodes: ITS = MW794123; *BenA* = MW774594; *CaM* = MW774595; *RPB2* = MW774593.

Notes: Since Houbraken *et al.* (2020), *P. allaniae*, *P. archerae*, *P. krskae* and *P. silybi* were introduced bringing the number of accepted species in series *Restricta* to thirteen. However, the series clearly needs a taxonomic revision (Fig. 23 & Suppl. Fig. S21) as noted by Visagie *et al.* (2016). In the meantime, we accept the four recently introduced species.

Penicillium limae S. Ramos, R. Cruz, C. Souza-Motta & N. Tinti, Mycol. Prog. 20: 831. 2021. [MB 837909]. — Type: URM 94475 (holotype). Ex-type: URM 7706. Infragen. class.: subgen. *Aspergilloides* sect. *Sclerotiorum* ser. *Adametziorum*. DNA barcodes: ITS = MW191493; *BenA* = MG452820; *CaM* = MW183244; *RPB2* = LR898888.

Penicillium linzhiense H-K. Wang & R. Jeewon, Front. Cell. Infect. Microbiol. 10 (no 6045044): 4. 2021. [MB 838576]. — Type: CCTCC-M 2019870 (holotype). Ex-type: CCTCC-M 2019870. Infragen. class.: subgen. *Penicillium* sect. *Canescentia* ser. *Canescentia*. DNA barcodes: ITS = MT461156; *BenA* = MT461157; *CaM* = MT461162; *RPB2* = n.a.

Penicillium longiconidiophorum B.D. Sun, A.J. Chen & Houbraken, Mycol. Prog. 20: 1389. 2021. [MB 838213]. — Type: CBS H-22829 (holotype). Ex-type: CBS 141831 = DTO 088-C1. Infragen. class.: subgen. *Aspergilloides* sect. *Charlesia* ser. *Phoenicea*. DNA barcodes: ITS = MT309669; *BenA* = MT302254; *CaM* = MT302221; *RPB2* = MT302237.

Penicillium mattheeae Visagie & Yilmaz, Mycologia 115: 97. 2022. [MB 844186]. — Type: PREM 63219 (holotype). Ex-type: CMW 56388 = CBS 147415 = CN014C5. Infragen. class.: subgen. *Aspergilloides* sect. *Aspergilloides* ser. *Saturniformia*. DNA barcodes: ITS = MT949904; *BenA* = MT957408; *CaM* = MT957451; *RPB2* = MT957477.

Penicillium melanosporum Rodr.-Andr., Cano & Stchigel, J. Fungi 7 (2, no. 126): 5. 2021. [MB 835938]. — Type: CBS H-24465 (holotype). Ex-type: CBS 146938 = FMR 17424. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Janthinella*. DNA barcodes: ITS = LR655192; *BenA* = LR655196; *CaM* = LR655200; *RPB2* = LR655204.

Penicillium michoacanense Rodr.-Andr., Cano & Stchigel, J. Fungi 7 (2, no. 126): 8. 2021. [MB 835940]. — Type: CBS H-24467 (holotype). Ex-type: FMR 17612. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Janthinella*. DNA barcodes: ITS = LR655194; *BenA* = LR655198; *CaM* = LR655202; *RPB2* = LR655206.

Penicillium neoherquei Labuda, Kubátová, Nebesářová, Oberlies & Raja, Persoonia 48: 339. 2022. [MB 842267]. — Type: PRM 956035 (holotype). Ex-type: CBS 148692 = CCF 6604. Infragen. class.: subgen. *Aspergilloides* sect. *Sclerotiorum* ser. *Herqueorum*. DNA barcodes: ITS = MW341222; *BenA* = OL840853; *CaM* = OL840855; *RPB2* = MW349119.

Penicillium newtonturnerae Y.P. Tan, Bishop-Hurley, Marney & R.G. Shivas, Index Austral. Fungi 3: 10. 2022. [MB 900142]. — Type: BRIP 74909a (holotype). Ex-type: BRIP 74909a. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Simplicissima*. DNA barcodes: ITS = OP903478; *BenA* = OP921964; *CaM* = OP921962; *RPB2* = OP921963.

Penicillium nordestinense J.E.F. Santos & R.N. Barbosa, Acta Bot. Brasil 36 (e2021abb0390): 4. 2022. [MB 845495]. — Type: URM 83558 (holotype). Ex-type: URM 8423. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Janthinella*. DNA barcodes: ITS = OV265270; *BenA* = OV265324; *CaM* = OV265272; *RPB2* = OM927721.

Penicillium outeniquaense Visagie & Yilmaz, Mycologia 115: 97. 2022. [MB 844187]. — Type: PREM 63218 (holotype). Ex-type: CMW 56387 = CBS 147414 = CN014C2. Infragen. class.: subgen. *Aspergilloides* sect. *Citrina* ser. *Westlingiorum*. DNA barcodes: ITS = MT949903; *BenA* = MT957405; *CaM* = MT957450; *RPB2* = MT957476.

Penicillium poederi Kirchm. & Neuh., Fungal Syst. Evol. 10: 92. 2022. [MB 845496]. — Type: IBF2017/0007 (holotype). Ex-type: CBS 147622 = SF014017 = Bq214. Infragen. class.: subgen. *Aspergilloides* sect. *Torulomyces ser. Torulomyces*. DNA barcodes: ITS = MF611757; *BenA* = MF611760; *CaM* = MF611763; *RPB2* = MF611766.

Penicillium pole-evansii Visagie, Frisvad & K. Jacobs, Persoonia 46: 179. 2021. [MB 834429]. — Type: CBS H-22037 (holotype). Ex-type: CBS 138946 = IBT 31929 = DAOM 241106 = DTO 183-D5 = CV 1758. Infragen. class.: subgen. *Penicillium* sect. *Canescentia* ser. *Atroveneta*. DNA barcodes: ITS = JX140831; *BenA* = JX141005; *CaM* = JX157412; *RPB2* = KP016911.

Penicillium rotoruae O'Callahan & Vaidya, Curr. Microbiol. 77: 4131. 2020. [MB 834084]. — Type: NZFS 4797 (holotype). Ex-type: CBS 145838 = NMI V19/026738. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Rolfsiorum*. DNA barcodes: ITS = MN315103; *BenA* = MN315104; *CaM* = MN315102; *RPB2* = MT240842.

Penicillium saanichanum Visagie, Assabgui & Seifert, Persoonia 45: 373. 2020. [MB 835962]. — Type: DAOM 745787 (holotype). Ex-type: DAOMC 251850 = KAS 6184. Infragen. class.: subgen. *Aspergilloides* sect. *Cinnamopurpurea* ser. *Idahoensia*. DNA barcodes: ITS = KY469059; *BenA* = KY469096; *CaM* = KY469020; *RPB2* = MN795070.

Penicillium sanjayi Rajeshk., Visagie, N. Ashtekar & Yilmaz, Mycol. Prog. 21 (4, no. 42): 5. 2022. [MB 840642]. — Type: AMH 10349 (holotype). Ex-type: NFCCI 5017. Infragen. class.: subgen. *Aspergilloides* sect. *Citrina* ser. *Vascosobrinhoana*. DNA barcodes: ITS = MZ571358; *BenA* = MZ558484; *CaM* = MZ558492; *RPB2* = MZ558482.

Notes: The identifier "MB 840643" cited in Ashtekar *et al.* (2022) is that of the series *Vascosobrinhoana* introduced in the same publication, but the species is nevertheless validly published (Art. F.5.6 San Juan Chapter F) (May *et al.* 2019) since "MB 840642" was issued by MycoBank prior to the publication of the name.

Penicillium scottii Visagie, Frisvad & K. Jacobs, Persoonia 46: 182. 2021. [MB 834430]. — Type: CBS H-22040 (holotype). Ex-type: CBS 138951 = IBT 31905 = DTO 185-F8 = CV 930. Infragen. class.: subgen. *Penicillium* sect. *Canescentia* ser. *Canescentia*. DNA barcodes: ITS = JX140812; *BenA* = JX140991; *CaM* = JX157383; *RPB2* = KP016894.

Penicillium setosum T.K. George, Houbraken, L. Mathew & M.S. Jisha, Acta Bot. Brasil 36 (e2021abb0390): 6. 2022. [MB 842377]. — Type: CBS H-24872 (holotype). Ex-type: CBS 144865 = DTO 455-G4 = WSR 62 = MCC 1370 = NCFT NO 8222.16 = AMH-9974. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Janthinella*. DNA barcodes: ITS = KT852579; *BenA* = MF184995; *CaM* = MH105905; *RPB2* = n.a.

Notes: In the original description (George *et al.* 2018), *P. setosum* was invalidly described because it was not stated that the holotype was preserved as a metabolically inactive culture. The name was subsequently validated by Barbosa *et al.* (2022).

Penicillium sexuale Rodr.-Andr., Cano & Stchigel, J. Fungi 7 (2, no. 126): 10. 2021. [MB 835941]. — Type: CBS H-24468 (holotype). Ex-type: CBS 146939 = FMR 17380. Infragen. class.: subgen. *Aspergilloides* sect. *Crypta* ser. *Crypta*. DNA barcodes: ITS = LR655195; *BenA* = LR655199; *CaM* = LR655203; *RPB2* = LR655207.

Penicillium siccitolerans Rodr.-Andr., Cano & Stchigel, J. Fungi 7 (2, no. 126): 7. 2021. [MB 835939]. — Type: CBS H-24466 (holotype). Ex-type: FMR 17381. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Janthinella*. DNA barcodes: ITS = LR655193; *BenA* = LR655197; *CaM* = LR655201; *RPB2* = LR655205.

Penicillium sicoris Torres-Garcia, Gené & Dania García, MycoKeys 86: 127. 2022. [MB 840559]. — Type: CBS H-24784 (holotype). Ex-type: CBS 148241 = FMR 18076. Infragen. class.: subgen. *Penicillium* sect. *Paradoxa* ser. *Atramentosa*. DNA barcodes: ITS = LR884497; *BenA* = LR884494; *CaM* = LR884496; *RPB2* = LR884495.

Penicillium silybi Labuda, Kubátová, Raja & Oberlies, J. Fungi 7 (7, no. 557): 9. 2021. [MB 839113]. — Type: PRM 955189 (holotype). Ex-type: CBS 147777 = G85 = CCF 6562. Infragen. class.: subgen. *Aspergilloides* sect. *Exilicaulis* ser. *Restricta*. DNA barcodes: ITS = KF367458; *BenA* = MW774592; *CaM* = MW774591; *RPB2* = AB860248.

Notes: Since Houbraken *et al.* (2020), *P. allaniae*, *P. archerae*, *P. krskae* and *P. silybi* were introduced bringing the number of accepted species in series *Restricta* to thirteen. However, the series clearly needs a taxonomic revision (Fig. 23 & Suppl. Fig. S21) as noted by Visagie *et al.* (2016). In the meantime, we accept the four recently introduced species.

Penicillium soli Doilom, C.F. Liao & D. Pem, Front. Microbiol. 11 (no. 585215): 13. 2020. [MB 557862]. — Type: MFLU 20-0432 (holotype). Ex-type: KUMCC 18-0202. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Janthinella*. DNA barcodes: ITS = MT152337; *BenA* = MT161681; *CaM* = MT178249; *RPB2* = MT384372.

Synonym: *Penicillium cluniae* [*nom. inval*. Art. 40.7 (Shenzhen)] Quintan., Avances en Alimentation y Mechora Animal 30: 174. 1990. [MB 130240].

Notes: Phylogenies resolved *P. soli* in the *P. cluniae* clade (Fig. 24 & Suppl. Fig. S22). The exception was *RPB2*. Pairwise comparisons showed that the ex-type sequences of both species were identical for *BenA*, but that there was some variation between them for *CaM* and *RPB2*. This suggests that they belong to the same species. *Penicillium cluniae* was previously included in the accepted species lists (Visagie *et al.* 2014, Houbraken *et al.* 2020), but was invalidly described by Quintanilla (1990) because no collection or herbarium was specified with the "1532" type designation. Consequently, we reduce *P. cluniae* as a synonym of *P. soli*.

Penicillium stangiae A.L. Alves, A.C.S. Santos, R.N. Barbosa, C.M. Souza-Motta, R.F.R. Melo, P.V. Tiago, Acta Bot. Brasil 36: e2022abb0006: 10. 2022. [MB 841261]. — Type: URM 94477 (holotype). Ex-type: URM 8347. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Dalearum*. DNA barcodes: ITS = MW648590; *BenA* = MW646388; *CaM* = MW646390; *RPB2* = MW646392.

Penicillium subfuscum Visagie & Yilmaz, Mycologia 115: 99. 2022. [MB 844188]. — Type: PREM 63220 (holotype). Ex-type: CMW 56196 = CBS 147455 = CN014C9. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Simplicissima*. DNA barcodes: ITS = MT949907; *BenA* = MT957412; *CaM* = MT957454; *RPB2* = MT957480.

Penicillium submersum Torres-Garcia, Gené & Dania García, MycoKeys 86: 129. 2022. [MB 840560]. — Type: CBS H-24785 (holotype). Ex-type: CBS 148242 = FMR 17140. Infragen. class.: subgen. *Penicillium* sect. *Robsamsonia* ser. *Urticicola*. DNA barcodes: ITS = LR814194; *BenA* = LR814187; *CaM* = LR814188; *RPB2* = LR814195.

Penicillium taurinense S. Prencipe, Houbraken & D. Spadaro, Persoonia 44: 435. 2020. [MB 834715]. — Type: CBS H-24332 (holotype). Ex-type: CBS 145672 = DTO 333-B8 = CAS16. Infragen. class.: subgen. *Penicillium* sect. *Robsamsonia* ser. *Glandicolarum*. DNA barcodes: ITS = MF595981; *BenA* = MF595977; *CaM* = MF595979; *RPB2* = MT253108.

Penicillium tealii Y.P. Tan, Bishop-Hurley, Marney & R.G. Shivas, Persoonia 49: 307. 2022. [MB 845000]. — Type: BRIP 72734c (holotype). Ex-type: BRIP 72734c. Infragen. class.: subgen. *Aspergilloides* sect. *Cinnamopurpurea* ser. *Jiangxiensia*. DNA barcodes: ITS = OP101639; *BenA* = OP039547; *CaM* = n.a.; *RPB2* = OP039546.

Penicillium tirolense Kirchm., Embacher & Neuh., Fungal Syst. Evol. 10: 96. 2022. [MB 845496]. — Type: IBF2019/0162 (holotype). Ex-type: CBS 147625 = SF014017. Infragen. class.: subgen. *Aspergilloides* sect. *Torulomyces* ser. *Torulomyces*. DNA barcodes: ITS = MW145398; *BenA* = MW143069; *CaM* = MW143068; *RPB2* = MW143067.

Penicillium tolerans Y.P. Tan, Bishop-Hurley, E. Lacey, Grice & R.G. Shivas, Index Austral. Fungi 3: 12. 2022. [MB 900151]. — Type: BRIP 64090a (holotype). Ex-type: BRIP 64090a. Infragen. class.: subgen. *Aspergilloides* sect. *Sclerotiorum* ser. *Sclerotiorum*. DNA barcodes: ITS = OK639006; *BenA* = OL741658; *CaM* = n.a.; *RPB2* = n.a.

Synonym of: ***Penicillium sclerotiorum*** J.F.H. Beyma, Zentralbl. Bakteriol. Parasitenk., Abt. 2 96: 418. 1937. [MB 277708].

Notes: Species classified in *Penicillium* section *Sclerotiorum* were reviewed in Rivera & Seifert (2011) and Visagie *et al.* (2013), both who accepted a broad concept of *P. sclerotiorum*. Phylogenetically, the strains considered to belong to *P. sclerotiorum* can be divided into two clades, but without a taxonomic revision of the species, we consider *P. tolerans* to be a synonym of the former. (Fig. 27 & Suppl. Fig. S25)

Penicillium ucsense A. Lenz & Houbraken, Antonie van Leeuwenhoek 115: 9. 2022. [MB 839721]. — Type: CBS H-24331 (holotype). Ex-type: CBS 146492 = DTO 426-B1 = IOC 4717 = 2HH. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Oxalica*. DNA barcodes: ITS = OM914583; *BenA* = ON024157; *CaM* = ON024158; *RPB2* = ON024159.

Synonym of: ***Penicillium hepuense*** L. Wang, PeerJ 10 (e13224): 11. 2022. [MB 841525].

Notes: Phylogenies resolved *P. ucsense* and *P. hepuense* in the same clade (Fig. 25 & Suppl. Fig. S23). Both were introduced in 2022, but *P. hepuense* was published first (2022/05/06 *vs* 2022/06/09) and thus has priority over *P. ucsense*.

Penicillium ulleungdoense D.H. Choi & J.G. Kim, Mycobiology 49: 48. 2021. [MB 835474]. — Type: KACC 48990 (holotype). Ex-type: KACC 48990. Infragen. class.: subgen. *Aspergilloides* sect. *Sclerotiorum* ser. *Sclerotiorum*. DNA barcodes: ITS = MN640087; *BenA* = MN737487; *CaM* = MN745074; *RPB2* = MN756007.

Penicillium umkhoba Visagie & Yilmaz, Mycologia 115: 101. 2022. [MB 844189]. — Type: PREM 63222 (holotype). Ex-type: CMW 56200 = CBS 147457 = CN014D5. Infragen. class.: subgen. *Aspergilloides* sect. *Sclerotiorum* ser. *Herqueorum*. DNA barcodes: ITS = MT949912; *BenA* = MT957417; *CaM* = MT957459; *RPB2* = MT957485.

Penicillium uttarakhandense Rajeshk., N. Ashtekar, Visagie, G. Anand & Yilmaz, Persoonia 46: 493. 2021. [MB 834093]. — Type: AMH 10225 (holotype). Ex-type: NFCCI 4808. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Simplicissima*. DNA barcodes: ITS = MN967315; *BenA* = MN972443; *CaM* = MN972445; *RPB2* = MN972447.

Notes: The phylogenetic relationship between *P. brasilianum*, *P. onobense*, *P. paraherquei* and *P. skrjabinii* is unresolved (Fig. 24 & Suppl. Fig. S22). Further studies including additional strains and/or extended datasets are needed. Here, we give benefit of doubt to the publisher.

Penicillium vaccaeorum Quintan., Mycopathologia 80: 77. 1982. [MB 109999]. — Type: CBS 148.83 (holotype). Ex-type: CBS 148.83 = DTO 009-E2 = CECT 2753. Infragen. class.: subgen. *Aspergilloides* sect. *Citrina* ser. *Roseopurpurea*. DNA barcodes: ITS = JN617689; *BenA* = JN606835; *CaM* = JN606543; *RPB2* = JN606614.

Notes: Considered a synonym of *P. sanguifluum* by Houbraken, Frisvad & Samson (2011), this old name was more recently re-introduced by Torres-Garcia *et al.* (2022).

Penicillium valleboromidaense R.N. Barbosa & J.D.P. Bezerra, Persoonia 45: 371. 2020. [MB 837659]. — Type: CBS H-24527 (holotype). Ex-type: CBS 147064 = DTO 402-H5.

Infragen. class.: subgen. *Aspergilloides* sect. *Exilicaulis* ser. *Erubescentia*. DNA barcodes: ITS = MT316359; *BenA* = MW115862; *CaM* = MW115863; *RPB2* = MW115864.

Penicillium vickeryae Y.P. Tan & R.G. Shivas, Index Austral. Fungi 3: 10. 2022. [MB 900144]. — Type: BRIP 72552a (holotype). Ex-type: BRIP 72552a. Infragen. class.: subgen. *Aspergilloides* sect. *Lanata-Divaricata* ser. *Simplicissima*. DNA barcodes: ITS = OP903479; *BenA* = OP921966; *CaM* = n.a.; *RPB2* = OP921965.

Penicillium vietnamense [*nom. inval*. Arts 40.7 & 40.8 (Shenzhen)] V.D. Nguyen & T.T. Pham, Mycobiology 50: 157. 2022. [MB 840587]. — Type: VTCC 930029 (holotype). Ex-type: VTCC 930029 = NTU DW14M = NITIA DW14M. Infragen. class.: subgen. *Aspergilloides* sect. *Charlesia* ser. *Indica*. DNA barcodes: ITS = MT102836; *BenA* = MT230561; *CaM* = ON209438; *RPB2* = MT222288.

Synonym of: ***Penicillium chermesinum*** Biourge, Cellule 33: 284. 1923. [MB 260472].

Notes: This species was invalidly described. Phylogenies resolved *P. vietnamense* inside *P. chermesinum* (Fig. 17 & Suppl. Fig. S15), and even though *CaM* was not yet available for analysis, we consider *P. vietnamense* a synonym of *P. chermesinum*. We therefore choose not to validate this species.

Penicillium xyleborini Visagie & W.J. Nel, Persoonia 47: 349. 2021. [MB 840990]. — Type: PREM 63078 (holotype). Ex-type: CMW 56800 = CN001D4. Infragen. class.: subgen. *Penicillium* sect. *Ramosum* ser. *Soppiorum*. DNA barcodes: ITS = MW504356; *BenA* = MW480817; *CaM* = MW480823; *RPB2* = MW480824.

Rasamsonia oblata (Pitt & A.D. Hocking) Yanai & Udagawa, Jap. J. Mycol. 61: 93. 2020. [MB 836491]. Basionym: *Penicillium oblatum* Pitt & A.D. Hocking, Mycologia 77: 810. 1985. [MB 104603]. — Type: FRR 2234. Ex-type: CBS 258.87 = IMI 288719 = NBRC 33091. DNA barcodes: ITS = LC546718; *BenA* = LC546729; *CaM* = LC546740; *RPB2* = n.a.

Notes: *Penicillium oblatum* was considered a doubtful species by Yilmaz *et al.* (2014), because sequence data obtained for the ex-type strain CBS 258.87 (= FRR 2234) indicated it as a close relative of *T. dendriticus*, but its morphology clearly did not match the original description of Pitt & Hocking (1985a). The species was recently revised based on sequences from IMI 288719 and NBRC 33091 (both ex-type strains), which showed that it represents a unique species in *Rasamsonia* (Yanai *et al*. 2020). *Penicillium oblatum* was described as strictly monoverticillate (Pitt & Hocking 1985a), with some subterminal metulae produced. However, Yanai *et al*. (2020) description of *P. oblatum* based on IMI 288719 showed both mono- and biverticillate conidiophores.

Rasamsonia sabulosa (Pitt & A.D. Hocking) Yanai & Udagawa, Jap. J. Mycol. 61: 96. 2020. [MB 836492]. Basionym: *Penicillium sabulosum* Pitt & A.D. Hocking, Mycologia 77: 810. 1985. [MB 104604]. — Type: FRR 2743. Ex-type: ATCC 56984 = FRR 2743 = IMI 288715. DNA barcodes: ITS = LC546720; *BenA* = LC546726; *CaM* = LC546742; *RPB2* = n.a.

Notes: *Penicillium sabulosum* and *P. corynephorum* (CBS 256.87^{T}) were until recently considered synonyms of *P. smithii* (CBS 276.83^{T}) (Visagie *et al.* 2016). *Penicillium sabulosum* was reviewed by Yanai *et al.* (2020) using ATCC 56984 and they showed it is a unique *Rasamsonia* species, and a new combination was subsequently made. Morphologically, *P. sabulosum* was described as growing slowly on CYA at 25 °C (3–6 mm) (Pitt & Hocking 1985a), while *P. corynephorum* grows 32–40 mm (Pitt & Hocking 1985b) and *P. smithii* 30–35 mm (after 2 wk) (Quintanilla 1982). Additionally, *P. sabulosum* has roughened phialides which was not reported for the other species. *Penicillium smithii* (section *Exilicaulis*) remains an accepted species with *P. corynephorum* its synonym.

Talaromyces africanus Houbraken, Pyrri & Visagie, J. Fungi 7 (11, no. 993): 10. 2021. [MB 841228]. — Type: CBS H-24874 (holotype). Ex-type: CBS 147340 = DTO 179-C5 = KAS 3859. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = OK339610; *BenA* = OK338782; *CaM* = OK338808; *RPB2* = OK338833.

Talaromyces albisclerotius B.D. Sun, A.J. Chen, Houbraken & Samson, MycoKeys 68: 88. 2020. [MB 833135]. — Type: CBS H-22837 (holotype). Ex-type: CBS 141839 = DTO 340-G5. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = MN864276; *BenA* = MN863345; *CaM* = MN863322; *RPB2* = MN863334.

Talaromyces aspriconidius B.D. Sun, A.J. Chen, Houbraken & Samson, MycoKeys 68: 90. 2020. [MB 833134]. — Type: CBS H-22833 (holotype). Ex-type: CBS 141835 = DTO 340-F8. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MN864274; *BenA* = MN863343; *CaM* = MN863320; *RPB2* = MN863332.

Talaromyces atkinsoniae Y.P. Tan, Bishop-Hurley, Bransgr. & R.G. Shivas, Persoonia 49: 323. 2022. [MB 845020]. — Type: BRIP 72528a (holotype). Ex-type: BRIP 72528a. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = OP059084; *BenA* = OP087524; *CaM* = n.a.; *RPB2* = OP087523.

Talaromyces aureolinus L. Wang, Mycologia 113: 495. 2021. [MB 831405]. — Type: HMAS 248136 (holotype). Ex-type: AS 3.15865. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MK837953; *BenA* = MK837937; *CaM* = MK837945; *RPB2* = MK837961.

Talaromyces bannicus L. Wang, Mycologia 113: 498. 2021. [MB 831406]. — Type: HMAS 248133 (holotype). Ex-type: AS 3.15862. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MK837955; *BenA* = MK837939; *CaM* = MK837947; *RPB2* = MK837963.

Talaromyces brevis B.D. Sun, A.J. Chen, Houbraken & Samson, MycoKeys 68: 92. 2020. [MB 833132]. — Type: CBS H-22833 (holotype). Ex-type: CBS 141833. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MN864269; *BenA* = MN863338; *CaM* = MN863315; *RPB2* = MN863328.

Talaromyces calidominioluteus Houbraken & Pyrri, J. Fungi 7 (11, no. 993): 14. 2021. [MB 841229]. — Type: CBS H-24875 (holotype). Ex-type: CBS 147313 = DTO 052-G3. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = OK339612; *BenA* = OK338786; *CaM* = OK338817; *RPB2* = OK338837.

Talaromyces cavernicola V.C.S. Alves, J.D.P. Bezerra & R.N. Barbosa, Fungal Syst. Evol. 10: 157. 2022. [MB 846125]. — Type: URM 95155 (holotype). Ex-type: URM 8448 = FCCUFG 11. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = ON862935; *BenA* = OP672383; *CaM* = OP290543; *RPB2* = OP290515.

Talaromyces chongqingensis X.C. Wang & W.Y. Zhuang, Biology 10: 10. 2021. [MB 570851]. — Type: HMAS 247849 (holotype). Ex-type: CGMCC 3.20482. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = MZ358001; *BenA* = MZ361343; *CaM* = MZ361350; *RPB2* = MZ361357.

Talaromyces gaditanus (C. Ramírez & A.T. Martínez) Houbraken & Soccio, J. Fungi 7 (11, no. 993): 17. 2021. [MB 841226]. Basionym: *Penicillium gaditanum* C. Ramírez & A.T. Martínez, Mycopathologia 74: 165. 1981. [MB 112521]. — Type: IJFM 5146 (holotype). Ex-type: CBS 169.81 = DTO 228-B8 = ATCC 42230 = IMI 253792 = VKM F-2188 = IJFM 5146. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = MH861318; *BenA* = OK338775; *CaM* = OK338802; *RPB2* = OK338827.

Notes: *Penicillium gaditanum* was considered a synonym of *T. minioluteus* by Yilmaz *et al.* (2014). A recent revision of *T. minioluteus* and related species revealed that *P. gaditanum* is a distinct species and was therefore combined in *Talaromyces* as *T. gaditanus* (Pyrri *et al.* 2021).

Talaromyces germanicus Houbraken & Pyrri, J. Fungi 7 (11, no. 993): 19. 2021. [MB 841227]. — Type: CBS H-24876 (holotype). Ex-type: CBS 147314 = DTO 055-D1. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = OK339619; *BenA* = OK338799; *CaM* = OK338812; *RPB2* = OK338845.

Talaromyces ginkgonis W.C. Wang & W.Y. Zhuang, J. Fungi 8 (7, no. 647): 7. 2022. [MB 570954]. — Type: HMAS 247853 (holotype). Ex-type: CGMCC 3.20698. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = OL638158; *BenA* = OL689844; *CaM* = OL689846; *RPB2* = OL689848.

Talaromyces gwangjuensis Hyang B. Lee & T.T.T. Nguyen, J. Fungi 7 (9, no. 722): 8. 2021. [MB 554801]. — Type: CNUFC HT19191 (holotype). Ex-type: CNUFC WT19-1. Infragen. class.: sect. *Purpurei*. DNA barcodes: ITS = MK766233; *BenA* = MZ318448; *CaM* = n.a.; *RPB2* = MK912174.

Talaromyces haitouensis L. Wang, J. Fungi 8 (1, no. 36): 3. 2021. [MB 570868]. — Type: HMAS 350335 (holotype). Ex-type: AS 3.16101 = HR1-7. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MZ045695; *BenA* = MZ054634; *CaM* = MZ054637; *RPB2* = MZ054631.

Talaromyces koreanus [as '*koreana*'] Hyang B. Lee, J. Fungi 7 (9, no. 722): 9. 2021. [MB 648574]. — Type: CNUFC HT19213 (holotype). Ex-type: CNUFC YJW2-13. Infragen. class.: sect. *Helici*. DNA barcodes: ITS = MZ315100; *BenA* = MZ318450; *CaM* = MZ332529; *RPB2* = MZ332533.

Talaromyces nanjingensis X.R. Sun, X.Q. Wu & W. Wei, J. Fungi 8 (2, no. 155): 18. 2022. [MB 837590]. — Type: CCTCC-M 2012167 (holotype). Ex-type: CCTCC-M 2012167. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MW130720; *BenA* = MW147759; *CaM* = MW147760; *RPB2* = MW147762.

Notes: The phylogenies of *T. nanjingensis* and its close relatives *T. brevis* and *T. liani* proved to be problematic (Fig. 31 & Suppl. Fig. S29). *BenA* resolved *T. nanjingensis* and *T. liani* as close relatives, while *T. brevis* is distantly related. Based on *CaM*, *T. nanjingensis*, *T. liani* and *T. brevis* are phylogenetically similar species. Finally, *T. nanjingensis* and *T. brevis* share *RPB2* sequences, and these species are closely related to *T. liani*. A taxonomic revision including a broader strain sampling is required to assess this species complex, but for the time being, we accept *T. nanjingensis* as a distinct species.

Talaromyces peaticola Jian Q. Tian & Jing Z. Sun, Stud. Fungi 6: 396. 2021. [MB 553909]. — Type: HMAS 247296 (holotype). Ex-type: CGMCC 3.18620. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = MF135613; *BenA* = MF284705; *CaM* = MF284703; *RPB2* = MF284704.

Synonym of: ***Talaromyces diversus*** (Raper & Fennell) Samson, Yilmaz & Frisvad, Stud. Mycol. 70: 175. 2011. [MB 560649].

Notes: The *BenA* phylogeny resolved *T. peaticola* inside *T. diversus* (Fig. 33 & Suppl. Fig. S30) and we thus consider it a synonym of the latter.

Talaromyces penicillioides L. Wang, Mycologia 113: 501. 2021. [MB 831407]. — Type: HMAS 248132 (holotype). Ex-type: AS 3.15822. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MK837956; *BenA* = MK837940; *CaM* = MK837948; *RPB2* = MK837964.

Talaromyces phuphaphetensis Nuankaew, Chuaseehar. & Somrith., J. Fungi 8 (8: no. 825): 7. 2022. [MB 844613]. — Type: BBH 49306 (holotype). Ex-type: TBRC 16281 = CV00299. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = ON692803; *BenA* = ON706960; *CaM* = ON706962; *RPB2* = ON706964.

Talaromyces pulveris Crous, Persoonia 45: 293. 2020. [MB 837837]. — Type: CBS H-24417 (holotype). Ex-type: CBS 146831 = CPC 38523 = MUCL pd8781 = DTO 432-H1. Infragen. class.: sect. *Purpurei*. DNA barcodes: ITS = MW175345; *BenA* = MW173136; *CaM* = MW173099; *RPB2* = MW173115.

Talaromyces resedanus (McLennan & Ducker) A.J. Chen, Houbraken & Samson, MycoKeys 68: 96. 2020. [MB 811695]. Basionym: *Penicillium resedanum* McLennan & Ducker, Austral. J. Bot. 2: 360. 1954. [MB 302422] — Type: IMI 062877 (holotype). Ex-type: CBS 181.71 = DTO 376-A7 = ATCC 22356 = FRR 578 = IMI 062877 = NRRL 578. Infragen. class.: sect. *Subinflati*. DNA barcodes: ITS = MN431413; *BenA* = MN969436; *CaM* = MN969355; *RPB2* = MN969214.

Notes: Although an ITS sequence resolved *P. resedanum* in *Talaromyces*, Yilmaz *et al.* (2014) considered it a doubtful species because the CBS strain was not viable. The strain was subsequently successfully revived and formally combined as *Talaromyces resedanus* by Sun *et al.* (2020a). The identifier "MB 302422" cited in Sun *et al.* (2020a) is that of the basionym (*P. resedanum*), but the species is still validly published (Art. F.5.6 San Juan Chapter F) (May *et al.* 2019) because "MB 811695" was issued by MycoBank prior to the publication of the name. Sun *et al.* (2020a) considered *T. omanensis* (SQUCC 13153^{T}) as synonym of *T. resedanus* based on morphology and DNA sequence data, which we follow here.

Talaromyces rosorhizae [as '*rosarhiza*'] [*nom. inval*. Art. 40.8 (Shenzhen)] H. Zhang & Y.L. Jiang, Biodivers. Data J. 9 (e70088): 11. 2021. [MB 662132]. — Type: GUCC 190040.1 (holotype). Ex-type: GUCC 190040.1. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MZ221603; *BenA* = MZ333143; *CaM* = MZ333137; *RPB2* = MZ333141.

Synonym of: ***Talaromyces penicillioides*** L. Wang, Mycologia 113: 501. 2021. [MB 831407].

Notes: This species was invalidly described. Phylogenies resolved *T. rosorhizae* and *T. penicillioides*, both introduced in 2021, in the same clade (Fig. 31 & Suppl. Fig. S29). We therefore choose not to validate this species.

Talaromyces rufus B.D. Sun, A.J. Chen, Houbraken & Samson, MycoKeys 68: 99. 2020. [MB 833133]. — Type: CBS H-22832 (holotype). Ex-type: CBS 141834 = DTO 349-D7 = CGMCC 3.13203. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MN864272; *BenA* = MN863341; *CaM* = MN863318; *RPB2* = MN863331.

Talaromyces samsonii (Quintan.) Houbraken & Pyrri, J. Fungi 7 (11, no. 993): 25. 2021. [MB 841230]. Basionym: *Penicillium samsonii* Quintan., Mycopathologia 91: 69. 1985. [MB 105614] — Type: CBS H-24877 (holotype). Ex-type: CBS 137.84 = DTO 304-C3 = DTO 169-G6 = CECT 2772 = IMI 282404 = IMI 327872. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = MH861709; *BenA* = OK338798; *CaM* = OK338824; *RPB2* = OK338844.

Notes: *Penicillium samsonii* was considered a synonym of *T. minioluteus* by Yilmaz *et al.* (2014). A recent revision of *T. minioluteus* and related species showed that *P. samsonii* is a distinct species and therefore combined in *Talaromyces* as *T. samsonii* (Pyrri *et al.* 2021).

Talaromyces santanderensis [*nom. inval*. Art. 40.8 (Shenzhen)] B.E. Guerra-Sierra & L.A. Arteaga-Figueroa, J. Fungi 8 (10, no. 1042): 5. 2022. [MB 845323]. — Type: CBUDES:UDES:3068 (holotype). Ex-type: HF05. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = OP082331; *BenA* = OP067657; *CaM* = OP067656; *RPB2* = OP067655.

Synonym of: ***Talaromyces lentulus*** X.-Z. Jiang & L. Wang, Sci. Rep. 8 (no. 4932): 3. 2018. [MB 824519].

Notes: This species was invalidly described. All phylogenies resolve *T. santanderensis* inside the *T. lentulus* clade (Fig. 31 & Suppl. Fig. S29). We consider *T. santaderensis* a synonym of *T. lentulus* and therefore choose not to validate this species.

Talaromyces satunensis Nuankaew, Chuaseehar. & Somrith., J. Fungi 8 (8: no. 825): 8. 2022. [MB 844614]. — Type: BBH 49305 (holotype). Ex-type: TBRC 16246 = CV00055. Infragen. class.: sect. *Trachyspermi*. DNA barcodes: ITS = ON692804; *BenA* = ON706961; *CaM* = ON706963; *RPB2* = n.a.

Talaromyces saxoxalicus J. Trovão, F. Soares, I. Tiago & A. Portugal, Int. J. Syst. Evol. Microbiol. 71 (12, no. 5175): 4. 2021. [MB 834608]. — Type: MUM-H 20.30 (holotype). Ex-type: MUM 20.30. Infragen. class.: sect. *Purpurei*. DNA barcodes: ITS = MT039882; *BenA* = MT052003; *CaM* = n.a.; *RPB2* = MT052004.

Talaromyces shilinensis X.C. Wang & W.Y. Zhuang, J. Fungi 8 (7, no. 647): 10. 2022. [MB 570955]. — Type: HMAS 247854 (holotype). Ex-type: CGMCC 3.20699. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = OL638159; *BenA* = OL689845; *CaM* = OL689847; *RPB2* = OL689849.

Talaromyces sparsus L. Wang, Mycologia 113: 501. 2021. [MB 831409]. — Type: HMAS 248135 (holotype). Ex-type: AS 3.16003. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MT077182; *BenA* = MT083924; *CaM* = MT083925; *RPB2* = MT083926.

Talaromyces teleomorphus [as ‚*teleomorpha*'] Hyang B. Lee, Frisvad, P.M. Kirk, H.J. Lim & T.T.T. Nguyen, J. Fungi 7 (9, no. 722): 11. 2021. [MB 648560]. — Type: CNUFC HT19251 (holotype). Ex-type: CNUFC YJW2-5. Infragen. class.: sect. *Helici*. DNA barcodes: ITS = MZ315102; *BenA* = MZ318452; *CaM* = MZ332531; *RPB2* = MZ332535.

Talaromyces tenuis B.D. Sun, A.J. Chen, Houbraken & Samson, MycoKeys 68: 86. 2020. [MB 833136]. — Type: CBS H-22838 (holotype). Ex-type: CBS 141840 = DTO 340-G9. Infragen. class.: sect. *Tenues*. DNA barcodes: ITS = MN864275; *BenA* = MN863344; *CaM* = MN863321; *RPB2* = MN863333.

Talaromyces wushanicus X.C. Wang & W.Y. Zhuang, Biology 10 (8, no. 745): 15. 2021. [MB 570852]. — Type: HMAS 247848 (holotype). Ex-type: CGMCC 3.20481. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MZ356356; *BenA* = MZ361347; *CaM* = MZ361354; *RPB2* = MZ361361.

Talaromyces yunnanensis Doilom & C.F. Liao, Front. Microbiol. 11 (no. 585215): 18. 2020. [MB 557863]. — Type: MFLU 20-0434 (holotype). Ex-type: KUMCC 18-0208. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MT152339; *BenA* = MT161683; *CaM* = MT178251; *RPB2* = n.a.

Talaromyces zhenhaiensis L. Wang, J. Fungi 8 (1, no. 36): 7. 2021. [MB 570869]. — Type: HMAS 350336 (holotype). Ex-type: AS 3.16102 = ZH3-18. Infragen. class.: sect. *Talaromyces*. DNA barcodes: ITS = MZ045697; *BenA* = MZ054636; *CaM* = MZ054639; *RPB2* = MZ054633.

Xerochrysium bohemicum Kubátová & Hubka, Persoonia 46: 519. 2021. [MB 839239]. — Type: PRM 954080. Ex-type: CCF 3693 = CBS 147157. DNA barcodes: ITS = MW798184; *BenA* = n.a.; *CaM* = n.a.; *RPB2* = n.a.

Xerochrysium coryli (Crous & Decock) Visagie & Houbraken, published here. [MB 849335]. Basionym: *Paraxerochrysium coryli* Crous & Decock, Persoonia 47: 261. 2021. [MB 841830]. — Type: CBS H-24853 (holotype). Ex-type: CBS 148314 = CPC 41272 = MUCL 58103. DNA barcodes: ITS = OK664748; *BenA* = OK651216; *CaM* = n.a.; *RPB2* = OK651178.

Notes: See notes for *Xerochrysium coryli* above in the description.

Accepted species published before 2020 not included in Houbraken *et al.* (2020)

The following species were not included the list published by Houbraken *et al.* (2020).

Aspergillus coreanus S.B. Hong, Frisvad & Samson, Int. J. Syst. Evol. Microbiol. 56: 485. 2006. [MB 521268]. — Type: CBS 117059 (holotype). Ex-type: CBS 117059 = NRRL 35590 = KACC 41659. Infragen. class.: subgen. *Fumigati* sect. *Fumigati* ser. *Fumigati*. DNA barcodes: ITS = JN943570; *BenA* = AY870758; *CaM* = AY870718; *RPB2* = n.a.

Species with no or inconclusive sequence data available

The following species were accepted by Houbraken *et al.* (2020). However, since no sequence data are available for these, we exclude these names until their phylogenetic relationships can be verified.

Aspergillus argenteus [as *'argentum'*] J.N. Rai & H.J. Chowdhery, Kavaka 7: 19. 1980. [MB 116063]. — Type: MLLU 104. Ex-type: unknown.

Aspergillus beijingensis D.M. Li, Y. Horie, Yu X. Wang & R.Y. Li, Mycoscience 39: 299. 1998. [MB 446575]. — Type: CBM FD-285. Ex-type: CBM FD-285.

Aspergillus collembolorum Dörfelt & A.R. Schmidt, Mycol. Res. 109: 956, figs 1–9. 2005. [MB 344420]. — Type: Russia: Kaliningrad (Koenigsberg), in succinum Balticum, in exemplare subordines Entomobryomorpha (Collembola), C. & H. W. Hoffeins (coll. Hoffeins, Hamburg, no. 805, holotypus). Ex-type: unknown.

Aspergillus crassihyphae Wadhwani & N. Mehrotra, Indian Bot. Reporter: 52. 1985. [MB 105070]. — Type: unknown. Ex-type: unknown.

Aspergillus curviformis H.J. Chowdhery & J.N. Rai, Nova Hedwigia 32: 231. 1980. [MB 118396]. — Type: unknown. Ex-type: unknown.

Aspergillus ellipsoideus J.N. Rai & H.J. Chowdhery, Kavaka 7: 17. 1980. [MB 116064]. — Type: MLLU 107. Ex-type: unknown.

Aspergillus maritimus Samson & W. Gams, Adv. Pen. Asp. Syst.: 43. 1986. [MB 114709]. — Type: CBS 186.77. Ex-type: CBS 186.77.

Aspergillus qizutongii D.M. Li, Y. Horie, Yu X. Wang & R.Y. Li, Mycoscience 39: 301. 1998. [MB 446576]. — Type: CBM FD-284. Ex-type: CBM FD-284.

Aspergillus raianus [as *'raianum'*] H.J. Chowdhery, Curr. Sci. 48: 953. 1979. [MB 309239]. — Type: MLLU 110. Ex-type: unknown.

Aspergillus subunguis Wadhwani, Dudeja & M.P. Srivast., Curr. Sci. 53: 443. 1984. [MB 105934]. — Type: IMI 254637. Ex-type: IMI 254637.

Aspergillus tapirirae C. Ram & A. Ram, Atti Reale Accad. Sci. Napoli: 100. 1972. [MB 309245]. — Type: IMUFPe 2175. Ex-type: unknown.

Aspergillus vinosobubalinus Udagawa, Kamiya & Kaori Osada, Trans. Mycol. Soc. Japan 34: 255. 1993. [MB 361186]. — Type: CBM BF-33501. Ex-type: CBM BF-33501.

Aspergillus wangduanlii D.M. Li, Y. Horie, Yu X. Wang & R.Y. Li, Mycoscience 39: 302. 1998. [MB 447107]. — Type: CBM FD-283. Ex-type: CBM FD-283.

Penicilliopsis africana Samson & Seifert, Adv. Pen. Asp. Syst.: 408. 1985. [MB 114759]. — Type: unknown. Ex-type: unknown.

Penicilliopsis pseudocordyceps H.M. Hsieh & Y.M. Ju, Mycologia 9: 541. 2002. [MB 484663]. — Type: HAST (Taiwan) Hsieh & Ju 89112611. Ex-type: BCRC 33730.

Penicillium asymmetricum (Subramanian & Sudha) Houbraken & Samson, Stud. Mycol. 70: 47. 2011. [MB 561963]. Basionym: *Thysanophora asymmetrica* Subram. & Sudha, Kavaka 13: 88. 1985. [MB 135502]. — Type: unknown. Ex-type: unknown.

Penicillium coniferophilum Houbraken & Samson, Stud. Mycol. 70: 47. 2011. [MB 561968]. Basionym: *Thysanophora striatispora* G.L. Barron & W.B. Cooke, Mycopathologia et Mycologia Applicata 40 (3-4): 353. 1970. [MB 324607]. — Type: unknown. Ex-type: unknown.

Penicillium glaucoalbidum (Desmazières) Houbraken & Samson, Stud. Mycol. 70: 47. 2011. [MB 561965]. Basionym: *Sclerotium glaucoalbidum* Desm., Ann. Sci. Nat. Bot. 16: 329. 1851. [MB 212120]. — Type: unknown. Ex-type: unknown.

Penicillium longisporum (W.B. Kendr.) Houbraken & Samson, Stud. Mycol. 70: 47. 2011. [MB 561966]. Basionym: *Thysanophora longispora* W.B. Kendr., Can. J. Bot. 39 (4): 826. 1961. [MB 340086]. — Type: DAOM 63073. Ex-type: CBS 354.62 = DAOM 63073 = MUCL 4168.

Phialomyces fusiformis G. Delgado & Decock, Mycologia 95: 896. 2003. [MB 489106]. — Type: MUCL 43747. Ex-type: MUCL 43747.

Thermoascus taitungiacus K.Y. Chen & Z.C. Chen, Mycotaxon 60: 226. 1996. [MB 436720]. — Type: TAI-Mycology K-Y Chen 8709-2. Ex-type: unknown.

Species in Houbraken *et al.* (2020) synonymised afterwards

Aspergillus amoenus M. Roberg, Hedwigia 70: 138. 1931. [MB 250654]. — Type: Munster, isol. *ex Berberis* sp. fruit, M. Roberg (type locality, this specimen was not deposited into herbarium). Ex-type: NRRL 4838 = CBS 111.32. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = EF652480; *BenA* = JN853946; *CaM* = JN854035; *RPB2* = JN853824.

Synonym of: ***Aspergillus versicolor*** (Vuill.) Tirab., Ann. Bot. (Roma) 7: 9. 1908. [MB 172159] (Sklenář *et al.* 2022).

Aspergillus austroafricanus Ž. Jurjević, S.W. Peterson & B.W. Horn, IMA Fungus 3: 67. 2012. [MB 800597]. — Type: BPI 880914. Ex-type: CBS 145748 = NRRL 233 = DTO 225-D8. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = JQ301891; *BenA* = JN853963; *CaM* = JN854025; *RPB2* = JN853814.
Synonym of: ***Aspergillus versicolor*** (Vuill.) Tirab., Ann. Bot. (Roma) 7: 9. 1908. [MB 172159] (Sklenář *et al.* 2022).

Aspergillus capensis Visagie, Hirooka & Samson, Stud. Mycol. 78: 105. 2014. [MB 809193]. — Type: CBS H-21810. Ex-type: CBS 138188 = DTO 179-E6. Infragen. class.: subgen. *Circumdati* sect. *Flavipedes* ser. *Flavipedes*. DNA barcodes: ITS = KJ775550; *BenA* = KJ775072; *CaM* = KJ775279; *RPB2* = KP987020.
Synonym of: ***Aspergillus iizukae*** Sugiy., J. Fac. Sci. Univ. Tokyo, Sect. 3 9: 390. 1967. [MB 326636] (Sklenář *et al.* 2021).

Aspergillus costaricensis [as '*costaricaensis*'] Samson & Frisvad, Stud. Mycol. 50: 52. 2004. [MB 369151]. — Type: CBS H-13437. Ex-type: CBS 115574 = IBT 23401 = CECT 20579 = ITEM 7555. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Nigri*. DNA barcodes: ITS = DQ900602; *BenA* = FJ629277; *CaM* = FN594545; *RPB2* = HE984361.
Synonym of: ***Aspergillus tubingensis*** Mosseray, La Cellule 43: 245. 1934. [MB 255209] (Bian *et al.* 2022).

Aspergillus cvjetkovicii Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 69. 2012. [MB 800599]. — Type: BPI 880909. Ex-type: NRRL 227 = CBS 599.65. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = EF652440; *BenA* = EF652264; *CaM* = EF652352; *RPB2* = EF652176.
Synonym of: ***Aspergillus creber*** Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 69. 2012. [MB 800598] (Sklenář *et al.* 2022).

Aspergillus fructus Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 70. 2012. [MB 800600]. — Type: BPI 880915. Ex-type: NRRL 239 = CBS 584.65. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = EF652449; *BenA* = EF652273; *CaM* = EF652361; *RPB2* = EF652185.
Synonym of: ***Aspergillus versicolor*** (Vuill.) Tirab., Ann. Bot. (Roma) 7: 9. 1908. [MB 172159] (Sklenář *et al.* 2022).

Aspergillus griseoaurantiacus Visagie, Hirooka & Samson, Stud. Mycol. 78: 112. 2014. [MB 809197]. — Type: CBS H-21814. Ex-type: CBS 138191 = DTO 267D8. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = KJ775553; *BenA* = KJ775086; *CaM* = KJ775357; *RPB2* = KU866988.
Synonym of: ***Aspergillus versicolor*** (Vuill.) Tirab., Ann. Bot. (Roma) 7: 9. 1908. [MB 172159] (Sklenář *et al.* 2022).

Aspergillus hongkongensis C.C. Tsang, T.W.S. Hui, K.C. Lee, J.H.K. Chen, A.H.Y. Ngan, E.W.T. Tam, J.F.W. Chan, A.L. Wu, M. Cheung, B.P.H. Tse, A.K.L. Wu, C.K.C. Lai, D.N.C. Tsang, T.L. Que, C.W. Lam, K.Y. Yuen, S.K.P. Lau & P.C.Y. Woo, Diagn. Microbiol. Infect. Dis. 84: 130. 2016. [MB 810279]. — Type: NBRC H-13268. Ex-type: CBS 145671 = HKU49 = NBRC 110693 = NCPF 7870 = BCRC FU30360 = DTO 351-C3. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = AB987907; *BenA* = LC000552; *CaM* = MN969320; *RPB2* = LC000578.
Synonym of: ***Aspergillus versicolor*** (Vuill.) Tirab., Ann. Bot. (Roma) 7: 9. 1908. [MB 172159] (Sklenář *et al.* 2022).

Aspergillus jensenii Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 70. 2012. [MB 800601]. — Type: BPI 880910. Ex-type: NRRL 58600. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = JQ301892; *BenA* = JN854007; *CaM* = JN854046; *RPB2* = JN853835.
Synonym of: ***Aspergillus creber*** Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 69. 2012. [MB 800598] (Sklenář *et al.* 2022).

Aspergillus neoniger Varga, Frisvad & Samson, Stud. Mycol. 69: 16. 2011. [MB 560390]. — Type: CBS H-20630. Ex-type: CBS 115656 = NRRL 62634. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Nigri*. DNA barcodes: ITS = FJ491682; *BenA* = FJ491691; *CaM* = FJ491700; *RPB2* = KC796429.
Synonym of: ***Aspergillus tubingensis*** Mosseray, La Cellule 43: 245. 1934. [MB 255209] (Bian *et al.* 2022).

Aspergillus pepii Despot, Kocsubé, Varga & Klarić, Mycol. Prog. 16: 67. 2017. [MB 817073]. — Type: SZMC 23791 (holotype). Ex-type: CBS 142028 = MFBF AV11051B IX = SZMC 22333. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = KU613368; *BenA* = KU613371; *CaM* = KU613365; *RPB2* = n.a.
Synonym of: ***Aspergillus versicolor*** (Vuill.) Tirab., Ann. Bot. (Roma) 7: 9. 1908. [MB 172159] (Sklenář *et al.* 2022).

Aspergillus piperis Samson & Frisvad, Stud. Mycol. 50: 57. 2004. [MB 500009]. — Type: CBS H-13434. Ex-type: CBS 112811 = IBT 24630 = IBT 26239 = NRRL 62631. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Nigri*. DNA barcodes: ITS = EU821316; *BenA* = FJ629303; *CaM* = EU163267; *RPB2* = KC796427.
Synonym of: ***Aspergillus luchuensis*** Inui, Journal of the Faculty of Science, Imperial University of Tokyo 15: 469. 1901. [MB 151291] (Bian *et al.* 2022).

Aspergillus protuberus Munt.-Cvetk., Mikrobiologia 5: 119. 1968. [MB 326650]. Basionym: *Aspergillus versicolor* var. *protuberus* (Munt.-Cvetk.) Kozak., Mycological Papers 161: 139. 1989. [MB 127752]. — Type: CBS 602.74. Ex-type: CBS 602.74 = NRRL 3505 = ATCC 18990 = QM 9804. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = EF652460; *BenA* = EF652284; *CaM* = EF652372; *RPB2* = EF652196.
Synonym of: ***Aspergillus versicolor*** (Vuill.) Tirab., Ann. Bot. (Roma) 7: 9. 1908. [MB 172159] (Sklenář *et al.* 2022).

Aspergillus puulaauensis Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 71. 2012. [MB 800602]. — Type: BPI 880911. Ex-type: CBS 145750 = NRRL 35641 = DTO 225-G5. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = JQ301893; *BenA* = JN853979; *CaM* = JN854034; *RPB2* = JN853823.
Synonym of: ***Aspergillus creber*** Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 69. 2012. [MB 800598] (Sklenář *et al.* 2022).

Aspergillus tabacinus Nakaz., Y. Takeda, Simo & A. Watan., J. Agric. Chem. Soc. Japan 10: 177. 1934. [MB 539544]. — Type: CBS H-24287. Ex-type: CBS 122718 = NRRL 4791 = IFO 4098 = QM 9766 = WB 4791. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = EF652478; *BenA* = EF652302; *CaM* = EF652390; *RPB2* = EF652214.

Synonym of: ***Aspergillus versicolor*** (Vuill.) Tirab., Ann. Bot. (Roma) 7: 9. 1908. [MB 172159] (Sklenář *et al.* 2022).

Aspergillus tennesseensis Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 73. 2012. [MB 800604]. — Type: BPI 880917. Ex-type: CBS 145752 = NRRL 13150 = DTO 225-F5. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = JQ301895; *BenA* = JN853976; *CaM* = JN854017; *RPB2* = JN853806. (Sklenář *et al.* 2022)

Synonym of: ***Aspergillus creber*** Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 69. 2012. [MB 800598] (Sklenář *et al.* 2022).

Aspergillus venenatus Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 73. 2012. [MB 800605]. — Type: BPI 880916. Ex-type: CBS 145753 = NRRL 13147 = DTO 225-F4. Infragen. class.: subgen. *Nidulantes* sect. *Nidulantes* ser. *Versicolores*. DNA barcodes: ITS = JQ301896; *BenA* = JN854003; *CaM* = JN854014; *RPB2* = JN853803.

Synonym of: ***Aspergillus creber*** Jurjevic, S.W. Peterson & B.W. Horn, IMA Fungus 3: 69. 2012. [MB 800598] (Sklenář *et al.* 2022).

Aspergillus welwitschiae (Bres.) Henn. apud Wehmer, Centralbl. Bak- teriol. Parasitenk., 2. Abth. 18: 294. 1907. [MB 490584]. Basionym: *Ustilago welwitschiae* Bres., Bol. Soc. Brot. 11: 68. 1893. [MB 176748]. — Type: CBS 139.54. Ex-type: CBS 139.54. Infragen. class.: subgen. *Circumdati* sect. *Nigri* ser. *Nigri*. DNA barcodes: ITS = FJ629340; *BenA* = MN969369; *CaM* = KC480196; *RPB2* = MN969100.

Synonym of: ***Aspergillus niger*** Tiegh., Ann. Sci. Nat., Bot. ser. 5 8: 240. 1867. [MB 284309] (Bian *et al.* 2022).

Penicillium cluniae [*nom. inval*. Arts 40.7 (Shenzhen)] Quintan., Av. Aliment. Mejora Anim. 30: 174. 1990. [MB 130240].

Synonym of: ***Penicillium soli*** Doilom, C.F. Liao & D. Pem, Front. Microbiol. 11 (no. 585215): 13. 2020. [MB 557862] (this paper).

Talaromyces omanensis Halo, Maharachch., Al-Yahyai & Al-Sadi, Phytotaxa 404: 192. 2019. [MB 830302]. — Type: SQU H-106 (holotype). Ex-type: SQUCC 13153. Infragen. class.: sect. *Subinflati*. DNA barcodes: ITS = MH784402; *BenA* = MH794502; *CaM* = MH794503; *RPB2* = n.a.

Synonym of: ***Talaromyces resedanus*** (McLennan & Ducker) A.J. Chen, Houbraken & Samson, MycoKeys 68: 96. 2020. [MB 811695] (Sun *et al.* 2020a).

DISCUSSION

In this study, we review *Eurotiales* species described since the previous accepted species list by Houbraken *et al.* (2020) up until 31 December 2022. Species were revised based on a phylogenetic species concept and the application of Genealogical Concordance Phylogenetic Species Recognition (GCPSR; Taylor *et al.* 2000), which is the most widely used species concept in *Eurotiales.* However, we believe that the polyphasic approach (or consilient concept of species) provides a holistic view of species and therefore consider it important to include morphology and, where possible, extrolite (secondary metabolite) as well as whole-genome sequence data, which will play an important role in the near future. Taxonomists dealing with *Eurotiales* have historically kept classifications practical and useful to the end user, an approach that has served the community dealing with these important fungi well. In case of doubt about the delimitation of species during this review, we have given preference to the publisher and accepted the name. However, we have classified newly published species as synonyms when the currently available data clearly do not support their novelty, while in cases where species were published without or with poor quality sequence data, we considered them doubtful because their future identification would not be possible. This follows Charles Thom's idea that a species is only useful if others can identify it (Thom 1954). During this study, several trends were noted where descriptions can go wrong. We discuss these trends in more detail below and provide recommendations to avoid them in the future.

The ICNafp (Turland *et al.* 2018) governs the naming of fungi and sets out the rules for the valid and legitimate publication of names. Of the 160 new *Eurotiales* names introduced, 10 were invalid because they either did not comply with Art. 40.7 (the single herbarium, collection or institution in which the type is conserved must be specified), Art. 40.8 (the protologue must include a statement that the culture is preserved in a metabolically inactive state), or in some cases both. In addition to ICNafp, there are other helpful resources to guide valid publication of names. These include 'The Code Decoded' (Turland 2019) and several publications on behalf of the International Commission on the Taxonomy of Fungi (ICTF) outlining the best practises for describing a new species (Sigler & Hawksworth 1987, Seifert & Rossman 2010, Aime *et al.* 2021).

DNA sequence comparisons have become the most important tool for the classification and identification of fungal species. A reliable and complete reference database is crucial for this approach. The openly available and mostly complete ex-type DNA sequence reference sets (Samson *et al.* 2014, Visagie *et al.* 2014, Yilmaz *et al.* 2014, Houbraken *et al.* 2020) for ITS, *BenA*, *CaM* and *RPB2* are a great resource. However, as critical as they may be, the ex-type sequences only serve as anchor points for the species, while additional sequences are needed to capture infraspecies variation and delimit species. Bian *et al.* (2022), Glässnerová *et al.* (2022) and Sklenář *et al.* (2022) emphasise the importance of these sequences, which should preferably come from strains isolated from different substrates and (ecological) regions. We therefore recommend not to compare putative new species only with ex-type strains in phylogenies where more extensive data is available as this does not provide information on species boundaries and can lead to incorrect conclusions. An example where this was a problem was the description of *Penicillium tolerans* as a close relative of *P. sclerotiorum* (Tan & Shivas 2022). The latter was subject to several taxonomic revisions with phylogenies that placed *P. sclerotiorum* strains into two closely related clades. However, both Rivera & Seifert (2011) and Visagie *et al.* (2013) concluded that from a morphological and ecological point of view there is no reason to consider these clades as separate species. In the case of *P. tolerans*, the ex-type strain (BRIP 64090a) resolves into the clade without the *P. sclerotiorum* ex-type strain (CBS 287.36) (Fig. 27). The phylogenies presented by Tan & Shivas (2022) did not include a comparison with all closely related sequences and left unmentioned their conclusions about these other '*P. sclerotiorum*'

strains and the reasons why the clade with *P. tolerans* should be considered distinct. In view of this, we consider *P. tolerans* a synonym of *P. sclerotiorum*.

Homology searches are a popular tool to quickly identify strains at the species level and generally works well if you get hits with well curated sequences. If a search does not find highly similar sequences, this may be due to several reasons. The sequence in question could belong to an unsequenced described species, represent an unsequenced genotype of an existing species or indicate a new species. The list of accepted species is very informative because, at least for *Eurotiales*, we can practically ignore the names not accepted and we have reference sequences of all known species. Dissimilarity higher than 4 %, especially in *CaM* and *RPB2*, is a relatively safe indication of new species in *Aspergillus* (Bian *et al.* 2022). Nevertheless, the results of homology searches should be interpreted with caution and should not be confused with phylogenetic relatedness. We recommend to always confirm new species or genotypes by phylogenetic analyses and not to rely only on homology search results.

Examples of low-quality sequence data used for species descriptions were noted for several recently described species. This has already been discussed for fungi (Nilsson *et al.* 2017) and remains problematic, even though careful contig assembly and proper trimming and base-calling should resolve this issue. In our analyses, the ITS alignments generated for *Aspergillus* sect. *Circumdati* revealed suspect sequences for both *A. curvatus* and *A. gaarensis*. Similarly, the sequences available for the recently published *A. pseudopiperis* and *A. pseudotubingensis* were considered to be of low quality (Bian *et al.* 2022), while Visagie *et al.* (2021) illustrated the same problem in the descriptions of *P. attenuatum*, *P. ochotense* and *P. piltunense* (Kirichuk, Pivkin & Matveeva 2016). *Aspergillus pseudopiperis* were considered a synonym of *A. tubingensis* (Bian *et al.* 2022), while *P. attenuatum*, *P. ochotense* and *P. piltunense* was considered synonyms of *P. antarcticum* (Visagie *et al.* 2021). In most cases, however, low-quality sequences make classification and future identification impossible, so that the species must be considered doubtful.

As mentioned above, the phylogenetic species concept and the application of GCPSR is important for the taxonomy of *Eurotiales* within our preferred consilient concept of species. GCPSR has largely proven to be a consistent approach to defining species boundaries. In principle, a species is delimited in the narrowest sense at the most recent node that forms consistently between different gene phylogenies (Taylor *et al.* 2000). In *Eurotiales*, the four most commonly used gene regions are ITS, *BenA*, *CaM* and *RPB2*, and we recommend that these are at least sequenced when describing new species. Recently, several *Eurotiales* species were introduced that lacked an ITS sequence, the official DNA barcode for fungi (Schoch *et al.* 2012). Admittedly, ITS is generally not informative at the species level, but we consider it good practice to sequence ITS at least for the ex-type strain of a new species. Several species have also been introduced without sequence data for all recommended genes. We cannot stress enough how important this is for the taxonomy of *Eurotiales* at a time when mycologists are struggling with the implications of the 'Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their utilisation under the Convention on Biological Diversity' and the interpretation by governments that restricts and, in many cases, prohibits the exchange of strains between mycologists from different countries. The ICNafp (Rec. 8B.1) recommends that strains of new species should be deposited in two recognised public culture or genetic resource collections, preferably in different countries. It is not inconceivable that strain sharing will become even more complicated in the future, making taxonomic revisions more difficult. This is a complex issue, but we recommend looking for ways to enable sharing of strains. Nevertheless, we believe it is critical that new species are described with as much data as possible, not only to prove conclusively that the proposed species are indeed new, but also to avoid a future in which species might be classified as doubtful because no material is available for study or a lack of data on the species renders it unrecognisable, as was the case with the many doubtful species described in the late 1800s, what Pitt (1980) called the 'dark ages'.

The introduction of species with a single isolate is not ideal, but it is also not considered a problem, provided it is clearly unique based on all available data, which at least includes *BenA*, *CaM* and *RPB2*. Of course, there is always the risk that a species is not new when future data are collected. Currently, 467 of the 1 279 recognised *Eurotiales* species are known from only the ex-type strain and 219 species for which one additional reference sequence is available in GenBank. For *Aspergillus*, 143 of 453 accepted species are represented by the ex-type strain only, while an additional strain was sequenced for 93; for *Penicillium*, 175 of 535 accepted species are represented by the ex-type strain only, while an additional strain was sequenced for 75; and for *Talaromyces*, 88 of 203 accepted species are represented by the ex-type strain only, while an additional strain was sequenced for 34. Thus, for a considerable proportion of accepted species, we have little knowledge about infraspecific variability and thus also species boundaries, and much remains to be done to capture them. We therefore recommend that when isolating these poorly sequenced species, *BenA*, *CaM* and *RPB2* sequences be generated and the strains deposited in recognised culture collections or, if this is not possible, the strains be shared with taxonomists working on these genera. Because of the uncertainty that a lack of DNA reference data can cause, we also recommend that workers who are uncertain about the identity of a species ask a taxonomist specialising in these fungi for a second opinion or advice.

Throughout the history of these genera, the way we describe species has evolved, bringing with it many taxonomic changes. The one thing that has remained is the community of collaborators who have adhered to best practises and worked together to create a standard for *Eurotiales* that serves everyone and provides a solid taxonomic basis for the study of these species. We believe that our recommendations will help to expand this community and provide further stability to the taxonomy of *Eurotiales*.

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DECLARATION ON CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Supplementary Material: https://studiesinmycology.org/

Fig. S1. Phylogenetic trees of *Aspergillus* section *Aenei* series *Aenei* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. versicolor*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S2. Phylogenetic trees of *Aspergillus* section *Candidi* series *Candidi* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. neotritici*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S3. Phylogenetic trees of *Aspergillus* sections *Cavernicolarum*, *Ochraceorosei* and *Sparsi* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. bisporus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S4. Phylogenetic trees of *Aspergillus* section *Circumdati* series *Sclerotiorum* based on *BenA*, *CaM*, and *RPB2*, and series *Steynii* based on ITS. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. ochraceus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S5. Phylogenetic trees of *Aspergillus* section *Cremei* series *Wentiorum* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. cremeus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S6. Phylogenetic trees of *Aspergillus* section *Flavi* series *Alliacei* and *Flavi* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was rooted to *A. avenaceus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T. Representative strains are indicated by R.

Fig. S7. Phylogenetic trees of *Aspergillus* section *Flavipedes* based on *BenA*, *CaM*, *RPB2* and ITS. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. terreus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S8. Phylogenetic trees of *Aspergillus* section *Fumigati* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. clavatus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S9. Phylogenetic trees of *Aspergillus* section *Nidulantes* series *Versicolores* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. aeneus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S10. Phylogenetic trees of *Aspergillus* section *Nigri* series *Japonici* and *Nigri* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. candidus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S11. Phylogenetic trees of *Aspergillus* section *Polypaecilum* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. cremeus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S12. Phylogenetic trees of *Aspergillus* section *Terrei* series *Nivei* and *Terrei* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. ambiguus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S13. Phylogenetic trees of *Aspergillus* section *Usti* series *Calidousti* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *A. ustus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S14. Phylogenetic trees of *Paecilomyces* based on *BenA*, *CaM* and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *Thermoascus crustaceus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S15. Phylogenetic trees of *Penicillium* sections *Aspergilloides*, *Charlesia*, *Cinnamopurpurea* and *Ramigena* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *P. taxi*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S16. Phylogenetic trees of *Penicillium* section *Brevicompacta* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *P. tularense* (except *RPB2* that was midpoint rooted). UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S17. Phylogenetic trees of *Penicillium* section *Fasciculata* series *Camembertiorum* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *P. expansum*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S18. Phylogenetic trees of *Penicillium* section *Canescentia* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was midpoint rooted. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S19. Phylogenetic trees of *Penicillium* section *Citrina* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *P. euglaucum*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S20. Phylogenetic trees of *Penicillium* sections *Crypta* and *Torulomyces* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *P. alfredii*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S21. Phylogenetic trees of *Penicillium* sections *Exilicaulis* and *Gracilenta* based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *P. stolkiae*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S22. Phylogenetic trees of *Penicillium* section *Lanata-Divaricata* series *Janthinella* and *Simplicissima*, based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *P. stolkiae*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S23. Phylogenetic trees of *Penicillium* section *Lanata-Divaricata* series *Dalearum*, *Oxalica* and *Rolfsiorum*, based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to the series *Oxalica* clade. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S24. Phylogenetic trees of *Penicillium* sections *Paradoxa*, *Ramosum* and *Robsamsonia*, based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. The tree was midpoint rooted. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S25. Phylogenetic trees of *Penicillium* section *Sclerotiorum*, based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *P. glabrum*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S26. Phylogenetic trees of *Rasamsonia*, based on *BenA*, *CaM* and ITS. Strains of recently described species are shown in bold coloured text. The tree was rooted to *Trichocoma paradoxa*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by superscript T. Representative strains are indicated by R.

Fig. S27. Phylogenetic trees of *Talaromyces* section *Helici*, based on *BenA*, *CaM* and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *T. purpureogenus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S28. Phylogenetic trees of *Talaromyces* section *Purpurei and Subinflati*, based on *BenA*, *CaM*, and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were midpoint rooted. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S29. Phylogenetic trees of *Talaromyces* section *Talaromyces*, based on *BenA*, *CaM* and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *T. helicus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Fig. S30. Phylogenetic trees of *Talaromyces* section *Trachyspermi*, based on *BenA*, *CaM* and *RPB2*. Strains of recently described species are shown in bold coloured text. Trees were rooted to *T. purpureus*. UltraFast Bootstrap support values higher than 95 % are shown at relevant branches. Ex-type strains are indicated by T.

Table S1. List of reference species used for comparisons in this study.