

Genera of soil *Ascomycota* and an account on soil-inhabiting species isolated from Thailand

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Citation – Yasanthika WAE, Chethana KWT, Fatimah Al-Otibi, Wanasinghe DN, Tennakoon DS, Samarakoon MC, Bhat DJ, Ren GC, de Silva NI, Ekanayaka AH, Thakshila SAD, Farias ARG, Hyde KD 2025 – Genera of soil *Ascomycota* and an account on of soil-inhabiting species isolated from Thailand. Mycosphere 16(1), 1530–1860, Doi 10.5943/mycosphere/16/1/10

Abstract

Ascomycota is the most abundant fungal group in soils worldwide. They play a vital role in ecosystem functioning in edaphic habitats. Numerous studies over the past two decades have provided information about belowground taxa, though much of it is scattered across various publications. We have compiled a taxonomic outline and comprehensive notes, most with line drawings, for 270 *Ascomycota* genera found in soils worldwide. The majority belong to *Sordariomycetes* (45%), *Dothideomycetes* (28%), and *Eurotiomycetes* (15%), commonly found in forests, cultivated lands, and urban soils. Thailand, being a tropical country with high biodiversity, has limited studies on soil fungi. Fungal studies have mainly focused on agricultural and forest soils, with around 132 genera reported over the past two decades. Therefore, we investigated *Ascomycota* species from three different soil ecosystems in Thailand. Samples were collected from caves, forests and urban areas to capture a variety of genera present. Species isolation was conducted using the soil dilution and soil baiting methods, followed by a polyphasic approach for species identification, which included morphological characterization and phylogenetic analyses using maximum likelihood and Bayesian methods. Our study reveals 30 species, including nine new species and 21 host and geographical records from soil in Thailand. Commonly recovered genera include *Curvularia*, *Paraconiothyrium*, *Pyrenochaetopsis*, *Stachybotrys* and *Microascus*, while *Anteaglonium*, *Diaporthospora*, *Neoceratosperma*, *Paraleptospora* and *Pararoussoella* are

Submitted: 16 February 2025; **Accepted:** 09 April 2025; **Published:** 27 May 2025

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Accepted by: Ishara S. Manawasinghe

newly reported from soil. Thai caves hold unexploited fungal diversity and urban soil fungi require further exploration due to their ecological roles and potential health risks. Compared to neighboring countries, fungal research in Thailand remains limited, particularly in caves, urban areas and hot springs. Expanding investigations across diverse habitats will enhance our understanding of soil *Ascomycota* and their ecological significance. This compilation serves as a key resource for taxonomists and researchers studying soil fungi.

Keywords – 9 new taxa – culture dependent methods – *Dothideomycetes* – *Eurotiomycetes* – soil fungi – *Sordariomycetes*

INTRODUCTION

Soil is a heterogeneous medium that is composed of diverse biological, chemical, and physical processes. Thus, it becomes a dynamic living ecosystem, providing niches for a wide range of inhabitants (Bridge & Spooner 2001, Wagg et al. 2019, Thies & Grossman 2023). Fungi, one of the dominant colonizers in soil, are eukaryotic microorganisms that play a key role in functional and structural stability in edaphic habitats (Finlay & Thorn 2019, Tedersoo et al. 2021, Niego et al. 2023a). They function as pathogens, saprobes, and mutualists, contributing to nutrient cycling, plant nutrition, and disease dynamics (Niego et al. 2023b). Their filamentous growth enhances soil aggregation, and they secrete hydrophobic compounds that influence water infiltration (Ritz & Young 2004, Tedersoo et al. 2014, Wu et al. 2019). The value of fungi to the global economy has been estimated at 54.57 trillion USD based on the major individual products and services of fungi (Niego et al. 2023b, Hyde et al. 2023, Sun et al. 2025).

Identifying and naming fungal groups are important for estimating their numbers (Phukhamsakda et al. 2022, Senanayake et al. 2022), diversity, and functions in soil. The global fungal number is estimated to be around 11.7–13.2 million (Wu et al. 2019), yet only 3–8% have been described at the species level (Blackwell 2011, Tedersoo et al. 2020, Hyde et al. 2024b), where *Ascomycota* is considered as the most species rich phylum, with 93,000 described species (Senanayake et al. 2022, Wijayawardene et al. 2022) that belong to nearly 6600 genera (Maharachchikumbura et al. 2021). Fungi are the second most species-rich group in soil, accounting for 90% of the total fungal numbers (Anthony et al. 2023), while *Ascomycota* becomes is the most widely distributed group in global soils (Tedersoo et al. 2021).

Detecting soil fungi is, however, challenging. Two primary methods are available: culture-dependent and culture-independent approaches (Yasanthika et al. 2022b). Culture-independent methods utilize high-throughput sequencing (HTS) technology to identify taxonomic groups, abundance, community compositions, and unculturable fractions in soil (Wu et al. 2019, Tedersoo et al. 2020). However, HTS identifications are typically limited to higher taxonomic levels. In contrast, culture-dependent methods are integral in identifying the species, as they provide morphological evidence along with living and dry cultures for further studies (Chethana et al. 2020, Senanayake et al. 2020b, Yasanthika et al. 2022b, Hongsanan et al. 2023). The soil dilution series, direct plating, and baiting methods have commonly been used in recent studies (Senanayake et al. 2020b). Using suitable soil fungal isolation methods along with appropriate growth conditions is vital to obtain a diverse collection of fungal strains. Most current research relies on HTS methods, and the potential of culture-dependent methods is often overlooked (Frąc et al. 2018, Mueller et al. 2004, Wijayawardene et al. 2021, 2024). As a result, the proportion of cultured fractions remains comparatively low (Wu et al. 2019, Chethana et al. 2020). During the past two decades, new species and genera have been discovered using morpho-molecular studies in world soils (Valenzuela-Lopez et al. 2018, Zhang et al. 2017b, 2023d, 2024b, Hou et al. 2020, Chethana et al.

2020, Wijayawardene et al. 2021, Yasanthika et al. 2022b). However, compiled information on soil fungal genera has not been recently updated (Yasanthika et al. 2022b). Thus, in this study, we provide an updated taxonomic outline and in-depth account of 270 soil-associated *Ascomycota* genera worldwide.

Based on current data, we can predict that soil is a potential substrate for studying fungal taxonomy and diversity (Fr  c et al. 2019, Tedersoo et al. 2021, Habib et al. 2025). However, below-ground fungi are distributed diversely across various ecosystems worldwide, each with distinct nutritional levels and structures to which fungi have uniquely adapted (Garrett 2016, Tedersoo et al. 2014, 2021, 2022). They are sensitive to changes in soil ecosystems that are influenced by natural and human activities such as drought, heat, land cover change, and human population pressures (Baldrian et al. 2022a, Tedersoo et al. 2022, Zhang et al. 2023d). Recent studies have predominantly focused on global soil fungi, while country-specific studies are relatively limited (Tedersoo et al. 2021, 2022, Yasanthika et al. 2023). Above-ground fungi are well-studied in regions such as Australia, China, Europe, North America, South Africa and Thailand, whereas below-ground fungi are less explored in these areas (Hyde et al. 2020b, 2024a, Shen et al. 2024). Different countries have diverse ecosystems, with the tropical regions exhibiting particularly high soil fungal diversity (Hawksworth 2001, Tedersoo et al. 2022).

Thailand has a tropical climate rich in biodiversity (Baimai 2010). Current estimates indicate that 55–96% of fungi from northern Thailand are new to science (Hyde et al. 2018), suggesting a high potential for soil fungal diversity (Amma et al. 2018). A HTS-based study by Farias et al. (2023) collected soil samples from different land use types in Thailand, revealing 18,209 fungal operational taxonomic units (OTUs), with *Ascomycota* being the dominant group, comprising 9,529 OTUs. Hyde et al. (2018) emphasized the need for proper sampling strategies and exploration of the understudied hosts/substrates to discover the missing fungal diversity in Thailand (Hyde et al. 2018). Despite extensive studies on aboveground fungi, the fungal species present in Thai soil remains poorly explored (Tedersoo et al. 2014, Amma et al. 2018, Hyde et al. 2018).

Most research has focused on agricultural lands or forest ecosystems, identifying common fungal groups, such as *Aspergillus*, *Chaetomium*, *Cladosporium*, *Curvularia*, *Fusarium*, *Penicillium*, *Trichoderma*, and *Talaromyces* (Manoch 1987, 1998, Pornsuriya et al. 2008, 2011, Puangsombat et al. 2010, Eamvijarn et al. 2013, Manoch et al. 2013, Liamthong et al. 2017, Seephueak et al. 2019, Wingfield et al. 2021, Maneeboon et al. 2023). However, there is a shortfall in studying the uncommon groups inhabiting the soil. Given its tropical climate, Thailand has a diverse range of disturbed and undisturbed ecosystems that could harbor rare species (Amma et al. 2018, Farias et al. 2023). Therefore, we selected three understudied soil-based ecosystems in Thailand, forests, caves and urban environments, to identify their uncommon *Ascomycota* groups.

Thailand has significant forest cover that receives high to moderate precipitation. There are mainly two forest types: evergreen and deciduous, both characterized by dense vegetation that retain favorable amounts of water and organic matter (Pomoim et al. 2022, Limsakul et al. 2023, Kruasilp et al. 2024). Those soils replenish the nutritional requirements of fungi, *i.e.*, organic carbon, nitrogen, phosphorus and potassium, contributing to high fungal diversity (Bridge & Spooner 2001, Tsai et al. 2007, Tedersoo et al. 2022, Liao et al. 2025). It is believed that higher soil fungal diversity is found in tropical and deciduous forests, shrubs, and grasslands (Taylor & Sinsabaugh 2015, Satyanarayana et al. 2019). In global tropical forest soils, *Ascomycota* are prevalent, with *Archaeorhizomycetes*, *Dothideomycetes*, *Eurotiomycetes*, *Orbiliomycetes*, and *Sordariomycetes* classes being highly abundant (Taylor & Sinsabaugh 2015, Tedersoo et al. 2014). While *Ascomycota* dominate the phyllosphere, data on soil-dwelling taxa in the tropical forest in Thailand are lacking (Izuno et al. 2016, Senanayake et al. 2016). Some studies have identified

species belonging to *Aspergillus*, *Penicillium*, and *Fusarium*, highlighting the need to explore uncommon groups (Norphanphoun et al. 2016, Amma et al. 2018). Thus, we studied uncommon *Ascomycota* from undisturbed forests in northern and southern regions of Thailand.

Natural caves are widely spread in Thailand (Martin & Ritchie 2020). Karst cave ecosystems are characterized by dark, relatively cool, humid, nutrient-limited conditions, where fungi have adapted to extreme oligotrophic environments (Preedanon et al. 2023, Suetrong et al. 2023). Typically, these caves contain thin layers of soil and exhibit extensive spatial heterogeneity (Suetrong et al. 2023). Natural caves can be disturbed by farming, tourism, and changes in water flow, which can negatively impact the highly adapted cave organisms (Bai et al. 2020, Ren et al. 2021). Species of *Allophoma*, *Arthroderma*, *Aspergillus*, *Fusarium*, *Penicillium*, *Pyrenochaetopsis*, *Trichoderma*, and *Tritirachium*, have been isolated from cave soils globally (Castrillón et al. 1976, Taylor et al. 2013, Cunha et al. 2020, Zhang et al. 2021, Preedanon et al. 2023). However, studies on cave-dwelling fungi remain scarce globally (Ren et al. 2021). Although new animal and insect species have been discovered in Thai caves (Bolger & Ellis 2015, Preedanon et al. 2023, Deharveng et al. 2023), studies on associated fungal species are limited (Preedanon et al. 2023). Thus, we have investigated soil *Ascomycota* from undisturbed and disturbed cave ecosystems in Thailand.

Soils affected by rapid urbanization, industrialization, and agriculture undergo nutritional fluctuations, which in turn affect their fungal inhabitants (Zhang et al. 2019a, Rusterholz & Baur 2023). Thailand is rapidly urbanizing, but the fungi inhabiting urban areas remain poorly studied. Simmons (2004) reported that urban soils in Thailand may contain significant amounts of organic and inorganic pollutants. Fungal groups that can thrive in these conditions are beneficial for maintaining soil health (Zhang et al. 2019b). Previous studies have indicated that cultivated and urban soil ecosystems generally have low species richness (Taylor & Sinsabaugh 2015, Satyanarayana et al. 2019). Thus, we have selected urban areas in northern Thailand to study below-ground *Ascomycota*.

During our study of *Ascomycota* species inhabiting soils, we have focused on three distinct soil-based localities (forests, caves and urban areas) in Thailand. To obtain a more diverse fungal collection, we aimed to collect samples from both disturbed and undisturbed habitats within these ecosystems. This study provides a comprehensive taxonomic investigation of 30 *Ascomycota* fungal species.

MATERIALS AND METHODS

Outline and the generic notes of soil *Ascomycota*

The taxonomic outline and comprehensive notes for soil-inhabiting *Ascomycota* genera worldwide are provided. These notes cover 270 genera and include morphological descriptions, updated phylogenies, and ecological data. The species reported from the soil are listed under each note. Line drawings are provided for selected genera to illustrate their morphological characteristics. The scattered information is gathered from journal articles, books, and credible websites. The total number of species in each genus is obtained from recently updated articles, Index Fungorum (2025), Species Fungorum (2025), or the recent outline by Hyde et al. (2024c).

Sample collections

Soil samples were collected from three types of ecosystems in Thailand, viz. forests, caves and urban areas (Figure 1), totaling 17 sites. The forest sites include five undisturbed forests in Chiang Rai, Chiang Mai and Krabi Provinces. The cave sites include seven caves located in Chiang Rai

and Chiang Mai Provinces. Six of these caves, associated with temples, were disturbed by human activities, while one cave was undisturbed. Urban soil samples were collected from five sites in Chiang Rai City, which are disturbed by human and industrial activities. The detailed information on all the collection sites is mentioned in Table 1.

Table 1 The details of the collection sites selected in the study

Sampling site	Disturbed or Undisturbed	Location	Latitude (N)	Longitude (E)	Elevation
Forest 1	Undisturbed	Mushroom Research Centre, Mae Taeng District, Chiang Mai	19.21450	98.59530	1440 m
Forest 2	Undisturbed	Khao Phanom District, Krabi	8.38110	98.92860	181 m
Forest 3	Undisturbed	Chiang Rai	20.04780	99.76190	863 m
Forest 4	Undisturbed	Omkoi District, Chiang Mai	17.71450	98.42860	935 m
Forest 5	Undisturbed	Omkoi District, Chiang Mai	17.71450	98.26190	1388 m
Cave 1	Disturbed	Fish cave temple (Wat Tham Pla), Chiang Rai	20.32861	99.86368	440 m
Cave 2	Disturbed	Tham Tu Pu Cave (Buddha image cave), Chiang Rai	19.92541	99.80296	424 m
Cave 3	Disturbed	Buddha Cave (What Tham Phra), Chiang Rai	19.91752	99.78893	425 m
Cave 4	Disturbed	Tham Muang On cave, Mae On District, Chiang Mai	18.78630	99.23805	496 m
Cave 5	Disturbed	Chiang Dao cave, Chiang Dao District, Chiang Mai	19.40041	98.92937	451 m
Cave 6	Disturbed	What Tham Tap Tao, Chai Prakan District, Chiang Mai	19.66267	99.11757	598 m
Cave 7	Undisturbed	What Tham Pha Tong cave, Chiang Rai	20.09185	99.90389	430 m
Site 1	Disturbed	Construction site, Mae Fah Luang Hospital, Chiang Rai	20.03127	99.88018	398 m
Site 2	Disturbed	Car park and garden in a café, Chiang Rai	19.98344	99.89216	384 m
Site 3	Disturbed	Roadsides and markets near Chiang Rai	19.96700	99.85591	393 m
Site 4	Disturbed	Public roadsides, Chiang Rai	19.90903	99.83518	398 m
Site 5	Disturbed	Public roadsides, Chiang Rai	19.82715	99.75745	407 m

As forests, caves and urban sites have spatial differences, we have used two slightly different collection methods.

- 1. Tropical forest ecosystems:** Initially, a 50 m² area was selected as the collecting site in the forest. The 20 random trees were selected, each at least 8 m apart within the site. As illustrated in Figure 2, below each tree, two soil subsamples were collected from a 5 cm diameter range and a depth of 5–10 cm, located 1–1.5 m apart from the trunk in opposite directions. The litter around the selected trees was removed prior soil collection. Each sample included both the organic and upper mineral layers. Samples were collected using soil augers or shovels. The 40 subsamples were then mixed into a composite sample and carried in sterilized, and labeled Ziploc polyethylene bags into the laboratory.

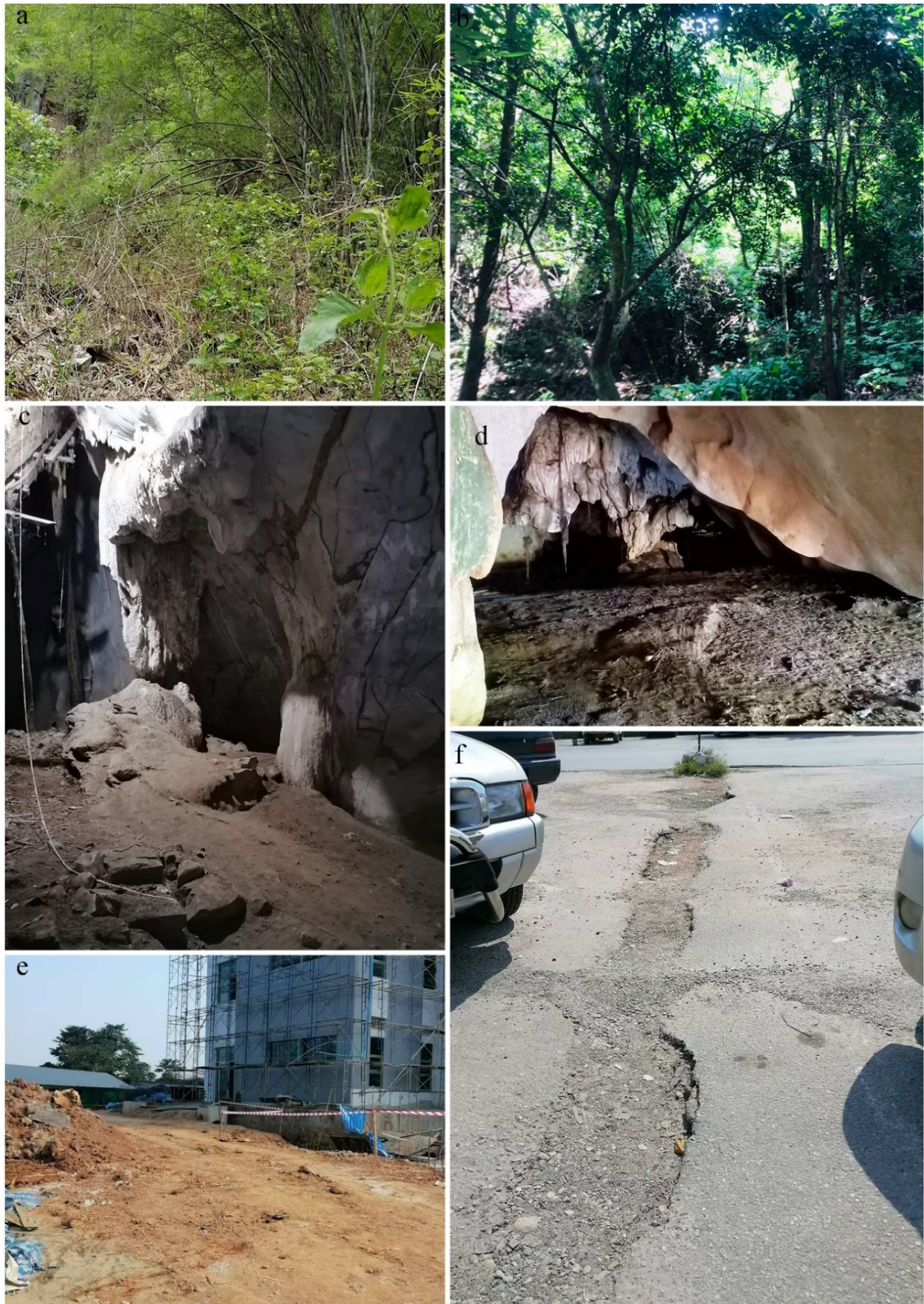


Figure 1 – Three types of soil-based localities selected for soil sample collection. a, b Undisturbed forest habitats. c An undisturbed cave. d A disturbed cave. e, f Disturbed sites in urban areas.

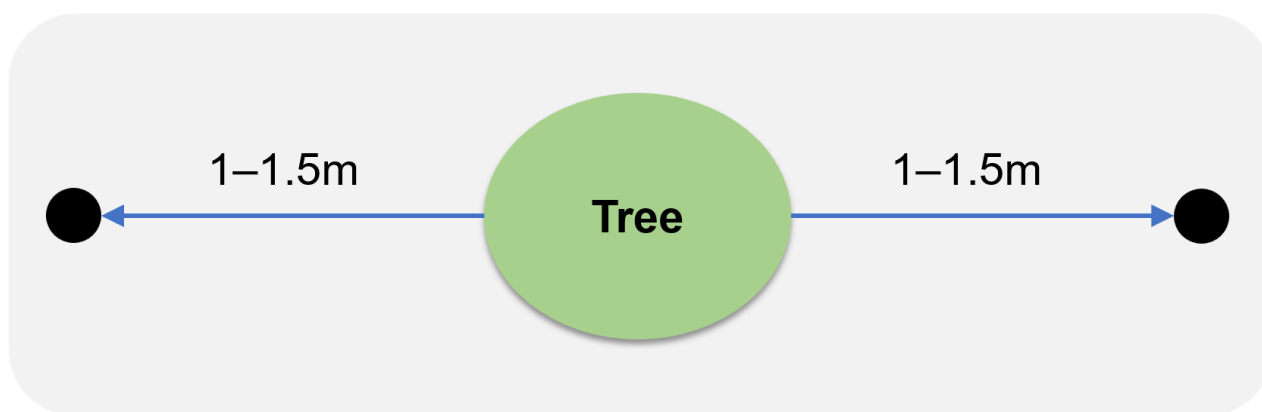


Figure 2 – Samples were collected 1–1.5 m apart from the tree trunk, in opposite directions.

2. **Cave ecosystems:** The litter, other materials or gravel on the surface was removed from the collection site, and soil samples were collected using a soil auger or shovel up to a 10 cm depth from the soil surface. From each site, four subsamples were collected and carried in sterilized, labeled Ziploc polyethylene bags into the laboratory.
3. **Urban environment:** The litter layer, gravel, and other non-soil material on the surface were removed from the collecting site, and soil samples were collected using a soil auger or shovel up to a 10 cm depth from the soil surface. From each site, four subsamples were collected and carried in sterilized, labeled Ziploc polyethylene bags into the laboratory.

The metadata, such as elevation, latitude, and longitude, were recorded from each collection site. Samples were stored at 4 °C once they were taken to the laboratory. The samples were set to reach the room temperature before further analyses.

Isolations and morphological studies

Ascomycetes were isolated using serial dilution method described in Yasanthika et al. (2020). After obtaining pure colonies on the PDA (Potato Dextrose Agar) media, cultures were incubated at 25 °C to facilitate sporulation. Reproductive structures bearing mycelium parts were removed with a needle and placed in a drop of distilled water on a slide for morphological observation. Photomicrographs of fungal structures were captured using a stereomicroscope (SteREO Discovery v8) attached to an Axio Cam ERc5s and on a Canon EOS 600D camera (Canon, Tokyo, Japan) mounted on a Nikon ECLIPSE Ni-u compound microscope. Tarosoft (R) Image Frame Work program was used to do the measurements of photos. Photo plates were made with Adobe Photoshop CS6 Extended version 13.0.1 (Adobe Systems, USA). Living cultures were deposited at the Mae Fah Luang University Culture Collection (MFLUCC), Chiang Rai, Thailand, and dried culture specimens at the Mae Fah Luang University Herbarium (Herb. MFLU). Faces of Fungi numbers were registered as described by Jayasiri et al. (2015).

DNA extraction, PCR amplification, sequencing, and phylogenetic analyses

Scraped fungal mycelia were used for DNA extraction using a Biospin fungus genomic DNA kit (BioFlux®), China, following the manufacturer's protocol. Polymerase chain reactions (PCR) were performed using Small nuclear ribosomal subunit rDNA (SSU), internal transcribed spacer region (ITS), and large nuclear ribosomal subunit rDNA (LSU) regions; that were amplified using primer pairs NS1/ NS4 (White et al. 1990), ITS5/ ITS4 (White et al. 1990), and LR0R/LR5 (Vilgalys & Hester 1990), respectively. Protine coding gene regions, RNA polymerase II second

largest subunit (*RPB2*) and Glyceraldehyde-3- Phosphate Dehydrogenase (*GAPDH*), were amplified using fRPB2-5F/fRPB2-7cR (Liu et al. 1999) and GDP 1/GDP 2 (Berbee et al. 1999) primers, respectively. The translation elongation factor 1-alpha gene (*TEF1-α*), was amplified using two primer pairs, EF1-983f/EF1-2218R (Rehner & Buckley 2005) and EF1-728F/EF-2 (O'Donnell et al. 1998, Carbone & Kohn 1999). For β-tubulin (*TUB2*) gene region, three primer pairs were used: Bt2a/ Bt2b, T1/ Bt2b (Glass & Donaldson 1995) and Btub2fd/ Btub4rd (Woudenberg et al. 2009). PCR was carried out in a 25 μL reaction volume containing 12.5 μL of 2 × Power Taq PCR MasterMix (a premixed and ready-to-use solution, including 0.1 Units/μL Taq DNA Polymerase, 500 μM dNTP Mixture each (dATP, dCTP, dGTP, dTTP), 20 mM Tris-HCl pH 8.3, 100 mM KCl, 3 mM MgCl₂, stabilizer and enhancer), 1 μL of each primer, 1 μL genomic DNA extract and 8.5 μL double distilled water. The PCR thermal cycles for SSU, LSU, ITS, *TEF1-α* (983F/EF1-2218R), *TUB2* (Btub2fd/ Btub4rd), and *RPB2* (5F/fRPB2-7cR) gene regions were followed as described in Chen et al. (2015). The PCR thermal cycles, for *GAPDH* described in Marin-Felix et al. (2017b), for *TUB2* (Bt2a/ Bt2b) described in Zhang et al. (2021c), and for *TEF1-α* (EF1-728F/ EF-2), and *TUB2* (T1/ bt2b) described in Zhang et al. (2022e) were followed. The PCR products were purified and sequenced at Biogenomed Co., Ltd. in South Korea. The newly produced sequence data were subjected to BLASTn searches against the non-redundant GenBank nucleotide database (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>) to determine the reference sequences for phylogenies. Raw forward and reverse sequences were assembled using BioEdit v.7.2.5 (Hall 2004). Based on BLASTn search results and recently published data, the reference sequences were downloaded and aligned using the MAFFT v.7.110 online program (<http://mafft.cbrc.jp/alignment/server/>) (Katoh et al. 2019) and further were refined by BioEdit 7.2.3 (Hall 1999). Single and/or multi-gene phylogenetic analyses were performed to determine the taxonomic placements of newly generated isolates. Thereby, new species and host, geographical records were determined (Jeewon & Hyde 2016, Senanayake et al. 2020, Jayawardena et al. 2021b)

Maximum likelihood (ML) trees were generated using the IQ-Tree web server (<http://iqtree.cibiv.univie.ac.at/>) with bootstrap support obtained from 1,000 pseudoreplicates (Nguyen et al. 2015, Chernomor et al. 2016). The best evolutionary models for phylogenetic analyses were selected independently for each locus using MrModeltest v. 3.7 (Posada & Crandall 1998) under the Akaike Information Criterion (AIC). Bayesian analyses were conducted with MrBayes v. 3.2.7a (Huelsenbeck & Ronquist 2001) to evaluate posterior probabilities (PP) (Rannala & Yang 1996, Zhaxybayeva & Gogarten 2002), with four simultaneous Markov Chain Monte Carlo (MCMC) runs with predefined generations. The convergence of the PP for each dataset will be assessed by visualizing log files with Tracer version 1.7 (Rambaut et al. 2018). The first twenty-five percent of the trees, representing the burn-in phase of the analyses, will be discarded. The remaining trees were used to calculate posterior probabilities in the majority rule consensus tree. Phylograms were visualized with FigTree v1.4.0 (Rambaut 2012), and trees were edited by Microsoft PowerPoint. After the phylogenetic placement, newly generated sequence data were deposited in the NCBI, GenBank.

Outline of *Ascomycota* from soil

The outline follows the latest *Outline of Fungi and fungus-like organisms* in Hyde et al. (2024c)

Phylum: *Ascomycota* Caval.-Sm
 Subphylum: *Pezizomycotina* O.E. Erikss. & Winka
 Class: *Dothideomycetes* O.E. Erikss. & Winka

- Subclass: ***Dothideomycetidae*** P.M. Kirk, P.F. Cannon, J.C. David & Stalpers ex C.L. Schoch, Spatafora, Crous & Shoemaker
- Order: ***Cladosporiales*** Abdollahz. & Crous
- Family: ***Cladosporiaceae*** Chalm. & R.G. Archibald
Cladosporium Link
- Order: ***Mycosphaerellales*** (Nannf.) P.F. Cannon
- Family: ***Dissoconiaceae*** Crous & de Hoog
Ramichloridium Stahel ex de Hoog
- Family: ***Extremaceae*** Quaedvl. & Crous
Pseudoramichloridium Cheewangkoon & Crous
- Family: ***Mycosphaerellaceae*** Lindau
Neoceratosperma Crous & Cheew.
- Family: ***Piedraiaceae*** Viégas ex Cif., Bat. & S. Camposa
Piedraia Fonseca & Leão
- Family: ***Saccoltheciaceae*** Bonord.
Aureobasidium Viala & G. Boyer
- Family: ***Teratosphaeriaceae*** Crous & U. Braun
Acidiella Hujislová & M. Kolařík
Devriesia Seifert & N.L. Nick
- Subclass: ***Pleosporomycetidae*** C.L. Schoch, Spatafora, Crous & Shoemaker
- Order: ***Pleosporales*** Luttrell ex M.E. Barr
- Family: ***Acrocalymmaceae*** Crous & Trakun.
Acrocalymma Alcorn & J.A.G. Irwin
- Family: ***Amorosiaceae*** Thambug. & K.D. Hyde
Amorocoelophoma Jayasiri, E.B.G. Jones & K.D. Hyde
- Family: ***Anteagloniaceae*** K.D. Hyde, J.K. Liu & A. Mapook
Anteaglonium Mugambi & Huhndorf
- Family: ***Astrosphaeriellaceae*** Phook. & K.D. Hyde (=Caryosporaceae) Huang Zhang, K.D. Hyde & Ariyaw.)
Pithomyces Berk. & Broome
- Family: ***Coniothyriaceae*** W.B. Cooke
Coniothyrium Corda
- Family: ***Corynesporascaceae*** Sivan.

Corynespora Güssow

Family: ***Cucurbitariaceae*** G. Winter (= *Fenestellaceae* M.E. Barr)
Neocucurbitaria Wanas., E.B.G. Jones & K.D. Hyde

Family: ***Dictyosporiaceae*** Boonmee & K.D. Hyde
Neodendryphiella Iturrieta-González

Family: ***Didymellaceae*** Gruyter, Aveskamp & Verkley (= *Microsphaeropsidaceae* Qian Chen et al.)
Ascochyta Lib. (= *Heracleicola* Tibpromma, Camporesi & K.D. Hyde)
Cumuliphoma Valenz.-Lopez, Stchigel, Crous, Guarro & Cano
Didymella Sacc. ex D. Sacc.
Ectophoma Valenz.-Lopez, Cano, Crous, Guarro & Stchigel
Epicoccum Link
Juxtiphoma Valenzuela-Lopez, Cano, Crous, Guarro & Stchigel
Neoascochyta Q. Chen & L. Cai
Neodidymelliopsis Q. Chen & L. Cai
Nothophoma Q. Chen & L. Cai
Paraboeremia Q. Chen & L. Cai
Pseudoascochyta Valenz.-Lopez, Stchigel, Cano-Canals, Guarro & Cano
Remotididymella Valenz.-Lopez, Crous, Cano, Guarro & Stchigel
Stagonosporopsis Died.
Vandijkomycella Hern.-Restr., L.W. Hou, L. Cai & Crous
Xenodidymella Q. Chen & L. Cai

Family: ***Didymosphaeriaceae*** Munk
Alloconiothyrium Verkley, Göker & Stielow
Bimuria D. Hawksw
Didymocrea Kowalski
Neptunomyces M. Gonçalves, T. Vicente & A. Alves
Paraconiothyrium Verkley
Phaeodothis Syd. & P. Syd.
Pseudopithomyces Ariyaw. & K.D. Hyde
Spegazzinia Sacc.

Family: ***Latoruaceae*** Crous
Latorua Crous
Matsushimamyces Rahul Sharma & Rohit Sharma
Multiverruca H.Y. Wang, Y.F. Han & Z.Q. Liang
Polyschema H.P. Upadhyay

Family: ***Lentimurisporaceae*** N.G. Liu, J.K. Liu & K.D. Hyde
Bahusandhika Subram

Family: ***Leptosphaeriaceae*** M.E. Barr

Leptosphaeria Ces. & De Not.

Family: ***Neocamarosporiaceae*** Wanas., Wijayaw., Crous & K.D. Hyde
Neocamarosporium Crous & M.J. Wingf.

Family: ***Nigrogranaceae*** Jaklitsch & Voglmayr
Nigrograna Gruyter, Verkley & Crous

Family: ***Phaeosphaeriaceae*** M.E. Barr
Paraleptospora Mapook & K.D. Hyde
Setophoma Gruyter, Aveskamp & Verkley

Family: ***Pleosporaceae*** Nitschke
Alternaria Nees
Bipolaris Shoemaker
Curvularia Boedijn
Pyrenophora Fr.

Family: ***Pseudopyrenochaetaceae*** Valenz.-López, Crous, Stchigel, Guarro & J.F. Cano
Pseudopyrenochaeta Valenzuela-López, Crous, Stchigel, Guarro & Cano

Family: ***Pyrenochaetopsidaceae*** Valenz.-López, Crous, Cano, Guarro & Stchigel
Neopyrenochaeta Valenz.-Lopez, Crous, Stchigel, Guarro & Cano
Pyrenochaetopsis Gruyter, Aveskamp & Verkley

Family: ***Roussoellaceae*** Jian K. Liu, Phook., D.Q. Dai & K.D. Hyde
Neoroussoella Jian K. Liu, Phook. & K.D. Hyde
Pararoussoella Wanas., E.B.G. Jones & K.D. Hyde
Roussoella Sacc.

Family: ***Sporormiaceae*** Munk
Preussia Fuckel
Westerdykella Stolk

Family: ***Tetraplophaeriaceae*** Kaz. Tanaka & K. Hiray
Tetraploa Berk. & Broome

Family: ***Torulaceae*** Corda
Torula Pers.

Pleosporales genera *incertae sedis*

Setophaeosphaeria Crous & Y. Zhang ter

Dothideomycetes* orders *incertae sedis

Order: ***Botryosphaeriales*** C.L. Schoch, Crous & Shoemaker
Botryosphaeriaceae Theiss. & H. Syd. (= *Endomelanconiopsidaceae* Tao Yang & Crous)
Lasiodiplodia Ellis & Everh.

Order: ***Eremomycetales*** Crous, Spatafora, Haridas & I.V. Grig.
Family: ***Eremomycetaceae*** Malloch & Cain
Arthrographis G. Cochet ex Sigler & J.W. Carmich
Rhexothecium Samson & Mouch

Order: ***Muyocoprionales*** Mapook, Boonmee & K.D. Hyde
Family: ***Muyocoprionaceae*** K.D. Hyde
Arxiella Papendorf
Leptodiscella Papendorf

Order: ***Phaeotrichales*** Ariyaw., Jian K. Liu & K.D. Hyde
Family: ***Phaeotrichaceae*** Cain
Phaeotrichum Cain & M.E. Barr

Order: ***Trypetheliales*** Lücking Aptroot & Sipman.
Family: ***Trypetheliaceae*** Zenker (= *Arthopyreniaceae* Walt. Watson)
Aptrootia Lücking & Sipman

Order: ***Venturiales*** Y. Zhang ter, C.L. Schoch & K.D. Hyde
Family: ***Sympoventuriaceae*** Y. Zhang ter, C.L. Schoch & K.D. Hyde
Guizhoumyces T.P. Wei & Y.L. Jiang
Matsushimaea Subram.
Scolecobasidium E.V. Abbott
Verruconis Samerp., H.J. Choi, van den Ende, Horré & de Hoog

Dothideomycetes* families *incertae sedis

Family: ***Pseudorobillardaceae*** Crous
Pseudorobillarda M. Morelet

Dothideomycetes* genera *incertae sedis

Bahusakala Subram.
Monodictys S. Hughes

Class: ***Eurotiomycetes*** Tehler ex O.E. Eriksson & K. Winka
Subclass: ***Chaetothyriomycetidae*** Doweld
Order: ***Chaetothyriales*** M.E. Barr
Family: ***Herpotrichiellaceae*** Munk

Cladophialophora Borelli
Exophiala J.W. Carmich.
Phialophora Medlar
Rhinoctadiella Nannf.
Veronaea Cif. & Montemart.

Subclass: ***Eurotiomycetidae*** Geiser & Lutzoni
Order: ***Eurotiales*** G.W. Martin ex Benny & Kimbr.
Family: ***Aspergillaceae*** Link (= *Monascaceae* J. Schröt.)
Aspergillus P. Micheli ex Haller
Hamigera Stolk & Samson
Penicillium Link

Family: ***Thermoascaceae*** Apinis
Paecilomyces Bainier
Thermoascus Miehe

Family: ***Trichocomaceae*** E. Fisch.
Sagenomella W. Gams
Talaromyces C.R. Benj.

Order: ***Onygenales*** Cif. ex Benny & Kimbr.
Family: ***Ajellomycetaceae*** Unter., J.A. Scott & Sigler
Blastomyces Gilchrist & W.R. Stokes (= *Ajellomyces* McDonough & A.L. Lewis; *Emmonsia* Cif. & Montemart.)
Emergomyces Dukik, Sigler & de Hoog
Emmonsiiellopsis Y. Marín, Stchigel

Family: ***Arthrodermataceae*** Currah
Arthroderma Curr. & Berk.
Ctenomyces Eidam
Microsporium Gruby
Nannizzia Stockdale
Trichophyton Malmsten

Family: ***Gymnoascaceae*** Baran.
Arachniotus J. Schröt
Gymnascella Peck
Gymnoascoideus G.F. Orr, K. Roy & G.R. Ghosh
Gymnoascus Baran.
Kraurogymnocarpa Udagawa & Uchiyama
Narasimhella Thirumalachar & Mathur.
Pseudoarachniotus Kuehn
Sporendonema Desm

Family: ***Malbrancheaceae*** Kandemir & de Hoog

Malbranchea Sacc.

Family: ***Neogymnomycetaceae*** Kandemir & de Hoog
Auxarthronopsis Sharma
Canomyces Rahul Sharma & Shouche
Currahmyces Rahul Sharma & Shouche
Renispora Sigler & J.W. Carmich.

Family: ***Onygenaceae*** Berk.
Amauroascus J. Schröt.
Aphanoascus Zukal
Brunneospora Guarro & Punsola
Coccidioides G.W. Stiles
Keratinophyton Randhawa & Sandhu
Pectinotrichum Varsavsky & G.F. Orr
Pseudoamauroascus Cano, M. Solé & Guarro

Family: ***Spiromastigoidaceae*** Guarro, Cano & Stchigel.
Pseudospiromastix Guarro, Stchigel & Cano
Spiromastigoides Doweld

Class: ***Lecanoromycetes*** O.E. Erikss. & Winka
Subclass ***Ostropomycetidae*** V. Reeb, Lutzoni & Cl. Roux
Order: ***Graphidales*** Bessey

Family: ***Diploschistaceae*** Zahlbr.
Diploschistes Norman

Class: ***Leotiomyces*** O.E. Erikss. & Winka
Order: ***Helotiales*** Nannf. ex Korf & Lizoň (= *Cyttariales* Luttr. ex Gamundi)
Family: ***Amorphothecaceae*** Parbery
Amorphotheca Parbery

Family: ***Discinellaceae*** Ekanayaka & K.D. Hyde
Acidea Hujslová & M. Kolařík

Family: ***Hyphodiscaceae*** Ekanayaka & K.D. Hyde
Soosiella Hujslova & M. Kolarik

Family: ***Myxotrichaceae*** Currah
Byssosascus Arx
Myxotrichum Kunze
Oidiodendron Robak

Family: ***Sclerotiniaceae*** Whetzel ex Whetzel

Botrytis P. Micheli ex Pers.
Sclerotinia Fuckel

***Helotiales* genera incertae sedis**

Cadophora Lagerb. & Melin
Scytalidium Pesante

Class: ***Lichinomycetes*** V. Reeb, Lutzoni & Cl. Roux
Order: ***Geoglossales*** Zheng Wang, C.L. Schoch & Spatafora
Family: ***Geoglossaceae*** Corda
Hemileucoglossum Arauzo

Class: ***Orbiliomycetes*** O.E. Erikss. & Baral
Order: ***Orbiliales*** Baral, O.E. Erikss., G. Marson & E. Weber
Family: ***Orbiliaceae*** Nannf.
Arthrobotrys Corda

Class: ***Pezizomycetes*** O.E. Erikss. & Winka
Order: ***Pezizales*** J. Schröt.
Family: ***Ascodesmidaceae*** J. Schröt.
Cephaliophora Thaxt.

Family: ***Pezizaceae*** Dumort. (= *Carbomycetaceae* Trappe)
Peziza Dill. ex Fr.

Family: ***Pyronemataceae*** Corda (= *Otidea* Eckblad)
Lotinia Pérez-Butrón

Class: ***Sordariomycetes*** O.E. Erikss. & Winka
Subclass: ***Diaporthomycetidae*** Senan., Maharachch. & K.D. Hyde
Order: ***Calosphaeriales*** M.E. Barr
Family: ***Calosphaeriaceae*** Munk
Jattaea Berl.

Family: ***Pleurostomataceae*** Réblová, L. Mostert, W. Gams & Crous
Pleurostoma Tul. & C. Tul

Order: ***Diaporthales*** Nannf.
Family: ***Diaporthosporaceae*** C.M. Tian & Q. Yang
Diaporthospora C.M. Tian & Q. Yang

Order: ***Magnaporthales*** Thongk., Vijaykr. & K.D. Hyde
Family: ***Magnaporthaceae*** P.F. Cannon
Falciphoriella M. Hern.-Restr. & Crous

Order: **Myrmecridiales** Crous
Family: **Myrmecridiaceae** Crous
Myrmecridium Arzanlou, W. Gams & Crous

Order: **Ophiostomatales** Benny & Kimbr.
Family: **Ophiostomataceae** Nannf.
Leptographium Lagerb. & Melin (= *Grosmannia* Gold.)
Sporothrix Hektoen & C.F. Perkins

Diaporthomycetidae families *incertae sedis*

Family: **Trichosphaeriaceae** G. Winter (= *Plectosphaerellaceae* W. Gams, Summerb. & Zare)
Brunneochlamydosporium Giraldo López & Crous
Chordomyces Bilanenko, Georgieva & Grum-Grzhim
Furcasterigmium Giraldo López & Crous
Fuscohypha Giraldo López & Crous
Gibellulopsis Bat. & H. Maia
Lectera P.F. Cannon
Paramusicillium Giraldo López & Crous
Phialoparvum Giraldo López & Crous
Plectosphaerella Kleb.
Sayamraella Giraldo López & Crous
Sodiomyces A.A. Grum-Grzhim
Stachylidium Link, Mag. Gesell. naturf. Freunde
Summerbellia Giraldo López & Crous
Verticillium Nees

Trichosphaeriaceae genera *incertae sedis*
Acrostalagmus Corda

Subclass: **Hypocreomycetidae** O.E. Erikss. & Winka
Order: **Coronophorales** Nannf.
Family: **Ceratostomataceae** G. Winter
Dactylidispota Y. Marín, Stchigel
Echinusithecra Y. Marín
Vittatispora Chaudhary P.

Order: **Glomerellales** Chadeff. ex Réblová, W. Gams & Seifert
Family: **Glomerellaceae** Locq. ex Seifert & W. Gams
Colletotrichum Corda

Order: **Hypocreales** Lindau
Family: **Acremoniopsidaceae** M. Li, M. Raza & L. Cai
Acremoniopsis A. Giraldo, Gené & Guarro

Family: **Bionectriaceae** Samuels & Rossman

Acremonium Link
Amphichorda Fr.
Clonostachys Corda
Emericellopsis J.F.H. Beyma

Family: ***Clavicipitaceae*** (Lindau) Earle ex Rogerson
Keithomyces Samson, Luangsa-ard & Houbraken
Marquandomyces Samson, Houbraken & Luangsa-ard
Metapochonia Kepler, S.A. Rehner & Humber
Metarhizium Sorokīn (= *Chamaeleomyces* Sigler; = *Metacordyceps* G.H. Sung, J.M. Sung, Hywel Jones & Spatafora; = *Nomuraea* Maubl.; = *Stereocrea* Syd. & P. Syd.)
Pochonia Bat. & O.M. Fonseca
Romanoa Thirum.

Family: ***Cordycipitaceae*** Kreisel ex G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora
Beauveria Vuill.
Cordyceps (Fr.) Link (= *Isaria* Pers.; = *Microhilum* H.Y. Yip & A.C Rath)
Gamszarea Z.F. Zhang & L. Cai
Lecanicillium W. Gams & Zare
Simplicillium W. Gams & Zare

Family: ***Hypocreaceae*** De Not.
Kiflimonium Summerb., J.A. Scott, Guarro & Crous
Trichoderma Pers.

Family: ***Myrotheciomycetaceae*** Crous
Trichothecium Link

Family: ***Nectriaceae*** Tul. & C. Tul.
Calonectria De Not.
Cylindrocladiella Boesew.
Fusarium Link
Mariannaea G. Arnaud ex Samson
Nectria (Fr.) Fr.
Neocosmospora E.F. Sm.
Paracremonium L. Lombard & Crous

Family: ***Ophiocordycipitaceae*** G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora
Purpureocillium Luangsa-ard, Hywel-Jones, Houbraken & Samson
Ophiocordyceps Petch
Tolypocladium W. Gams

Family: ***Polycephalomycetaceae*** G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora
Polycephalomyces Kobayasi

- Family: ***Stachybotryaceae*** L. Lombard & Crous
Brevistachys L. Lombard & Crous
Didymostilbe Henn.
Memnoniella Höhn.
Myrothecium Tode
Stachybotrys Corda
- Order: ***Microascales*** Luttr. ex Benny & Kimbr.
- Family: ***Ceratocystidaceae*** Locq. ex Réblová, W. Gams & Seifert
Ceratocystis Ellis & Halst.
- Family: ***Graphiaceae*** De Beer
Graphium Corda
- Family: ***Microascaceae*** Luttr. ex Malloch
Acaulium Sopp
Cephalotrichum Link
Gamsia M. Morelet
Lomentospora Hennebert & B.G. Desai
Microascus Zukal
Petriella Curzi
Pseudallescheria Negroni & I. Fisch.
Scopulariopsis Bainier
Scedosporium Sacc. ex Castell. & Chalm.
Wardomyces F.T. Brooks & Hansf.
Wardomycopsis Udagawa & Furuya
Yunnanina H.Z. Kong
- Triadelphiaceae*** Y.Z. Lu, J.K. Liu, Z.L. Luo & K.D. Hyde
Triadelphia Shearer & J.L. Crane
- Subclass: ***Sordariomycetidae*** O.E. Erikss & Winka (= *Meliolomycetidae* P.M. Kirk & K.D. Hyde)
- Order: ***Cephalothecales*** Maharachch. & K.D. Hyde
- Family: ***Cephalothecaceae*** Höhn.
Victoriomyces D. Davolos, B. Pietrangeli, A.M. Persiani & O. Maggi
- Order: ***Chaetosphaeriales*** Huhndorf, A.N. Mill. & F.A. Fernández
- Family: ***Chaetosphaeriaceae*** Réblová, M.E. Barr & Samuels
Caligospora Réblová
Chaetosphaeria Tul. & C. Tul.
Chloridium Link (*Chloridium*=*Gonytrichum*)
Dinemasporium Lév.
Kionochaeta P.M. Kirk & B. Sutton
Menispora Pers.

Thozetella Kuntze
Verhulstia Hern.-Restr.

Order: ***Coniochaetales*** Huhndorf, A.N. Mill. & F.A. Fernández
(= *Cordanales* M. Hern.-Rest. & Crous)

Family: ***Coniochaetaceae*** Malloch & Cain
Coniochaeta (Sacc.) Cooke

Family: ***Cordanaceae*** Nann.
Cordana Preuss

Order: ***Sordariales*** Chad. ex D. Hawksw. & O.E. Erikss.

Family: ***Chaetomiaceae*** G. Winter
Achaetomium J.N. Rai, Tewari & Mukerji
Arxotrichum A. Nováková & M. Kolařík
Chaetomium Kunze
Humicola Traaen
Staphylotrichum J.A. Mey. & Nicot
Stellatospora T. Ito & A. Nakagiri
Thielavia Zopf
Trichocladium Harz

Family: ***Diplogelasinosporaceae*** Y. Marin & Stchigel
Diplogelasinospora Cain

Family: ***Naviculisporaceae*** Y. Marin & Stchigel
Naviculispora Stchigel, Y. Marín, Cano & Guarro

Family: ***Podosporaceae*** X. Wei Wang & Houbraken
Cladorrhinum Sacc. & Marchal
Podospora Ces.
Triangularia Boedijn (= *Apiosordaria* Arx & W. Gams)

Family: ***Schizotheciaceae*** Y. Marin & Stchigel
Jugulospora N. Lundq.,
Lundqvistomyces Y. Marin & Stchigel

Family: ***Sordariaceae*** G. Winter
Boothiella Lodhi & Mirza
Neurospora Shear & B.O. Dodge (= *Gelasinospora* Dowding)
Pseudoneurospora Dania García, Stchigel & Guarro
Sordaria Ces. & De Not.

Sordariales genera *incertae sedis*
Eosphaeria Höhn.

Subclass: ***Xylariomycetidae*** O.E. Erikss & Winka
Order: ***Amphisphaeriales*** D. Hawksw. & O.E. Erikss.
Family: ***Apiosporaceae*** K.D. Hyde, J. Fröhl., Joanne E. Taylor & M.E. Barr
Arthrinium Kunze
Nigrospora Zimm.

Family: ***Beltraniaceae*** Nann.
Beltraniella Subram.

Family: ***Sporocadaceae*** Corda
Bartalinia Tassi
Broomella Sacc.
Neopestalotiopsis Maharachch., K.D. Hyde & Crous
Robillarda Sacc.

Order: ***Xylariales*** Nannf.
Family: ***Coniocessiaceae*** Asgari & Zare
Coniocessia Dania García, Stchigel, D. Hawksw. & Guarro

Family: ***Hansfordiaceae*** Crous
Hansfordia S. Hughes

Family: ***Microdochiaceae*** Hern.-Restr., Crous & J.Z. Groenew.
Idriella P.E. Nelson & S. Wilh. (= *Monographella* Petr.)
Microdochium Syd.

Family: ***Xylariaceae*** Tul. & C. Tul.
Ascotricha Berk.
Coniolariella Asgari & Zare
Xylaria Hill ex Schrank

Sordariomycetes orders *incertae sedis*

Order: ***Amplistromatales*** M.J. D'souza, Maharachch. & K.D. Hyde
Family: ***Amplistromataceae*** Huhndorf, A.N. Mill., Greif & Samuels
Acidothrix Hujšlová & M. Kolařík

Subphylum ***Saccharomycotina*** O.E. Erikss. & Winka
Class: ***Dipodascomycetes*** M. Groenew., Hittinger, Opulente & A. Rokas
Order: ***Dipodascales*** M. Groenew., Hittinger, Opulente & A. Rokas
Family: ***Trichomonascaceae*** Kurtzman & Robnett
Trichomonascus H.S. Jackson emend. Kurtzman & Robnett
Zygoascus M.T. Sm.

Class: ***Pichiomycetes*** M. Groenew., Hittinger, Opulente & A. Rokas
Order: ***Pichiales*** M. Groenew., Hittinger, Opulente & A. Rokas
Family: ***Pichiaceae*** Zender
Ogataea Y. Yamada, K. Maeda & Mikata
Pichia E.C. Hansen

Class: ***Saccharomycetes*** O.E. Erikss. & Winka
Order: ***Ascoideales*** J.H. Schaffner
Family: ***Saccharomycopsidaceae*** Arx & Van der Walt
Saccharomycopsis Schiønning

Order: ***Saccharomycodales*** M. Groenew., Hittinger, Opulente & A. Rokas
Family: ***Saccharomycodaceae*** Kudryavtsev
Hanseniaspora Zikes

Ascomycota genera *incertae sedis*
Effetia Bartoli, Maggi & Persiani
Heterocephalum Thaxt.
Gilmaniella G.L. Barron
Phaeotrichoconis Subram.
Solosympodiella Matsush.

Genera notes and the taxonomy of soil *Ascomycota*

Ascomycota Caval.-Sm.

Pezizomycotina O.E. Erikss. & Winka

Dothideomycetes O.E. Erikss & Winka

Dothideomycetidae P.M. Kirk, P.F. Cannon, J.C. David & Stalpers ex C.L. Schoch, Spatafora, Crous & Shoemaker

Cladosporiales Abdollahz. & Crous

Cladosporiaceae Chalm. & R.G. Archibald

Cladosporium Link, Mag. Gesell. naturf. Freunde, Berlin 7: 37 (1816) [1815]

Fig. 3

For synonyms for each genus, see Species Fungorum (2025)

Index Fungorum number: IF 7681; Facesoffungi number: FoF 06967

Link (1816) introduced *Cladosporium*, with *C. cladosporioides* as the type species. The genus comprises three major complexes: *C. cladosporioides*, *C. herbarum*, and *C. sphaerospermum* (Dugan et al. 2008, Bensch et al. 2012). Currently, around 200 species are listed in the Species Fungorum (2025). The asexual morph is hyphomycetous, having coronate conidiogenous loci and catenate conidia with hila, consisting of a convex central dome surrounded by a raised periclinal rim (Bensch et al. 2012). Arrangements of conidial chains facilitate the mass spreading of conidia over long distances. Species can be found as plant endophytes, human and plant pathogens, and also as hyper-parasites on other fungi (Schubert & Braun 2005, Bensch et al. 2012). They have a worldwide distribution, including air, animals, food, sludge, soil, and water (Domsch et al. 1993,

Bensch et al. 2012, Ma et al. 2017). Species exhibit halotolerance, osmotolerance, thermotolerance, and psychrophilic properties (Ma et al. 2017, Jayawardena et al. 2018, Kularathnage et al. 2025).

Table 2 *Cladosporium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cladosporium cladosporioides</i>	Denmark	Pea field soil	Bensch et al. (2012)
<i>C. cladosporioides</i>	Brazil	ND	
<i>C. longissimum</i>	Papua New Guinea	Soil along coral reef coast	
<i>C. oxysporum</i>	China	Terracotta sculpture site	
<i>C. pseudocladosporioides</i>	Chile	ND	
<i>C. sphaerospermum</i>	Antarctic	Ornithogenic soil near a lake	
<i>C. tenuissimum</i>	Indonesia	Bat cave	
<i>C. cladosporioides</i>	China	Plateau soils	Ma et al. (2017)
<i>C. herbarum</i>			
<i>C. neopsychrotolerans</i>			
<i>C. paralimoniforme</i>			
<i>C. prolongatum</i>			
<i>C. sinuatum</i>			
<i>C. tianshanense</i>			
<i>C. verruculosum</i>			
<i>C. fuscoviride</i>	Spain	Garden soil	Iturrieta-González et al. (2021)
<i>C. pseudotenellum</i>	Papua New Guinea	Coral reef coast soil	Zalar et al. (2007)
<i>Cladosporium</i> sp.	Canada	ND	
<i>C. sphaerospermum</i>	Brazil	Cave soil	Dutra et al. (2023)

(ND= The information is not available)

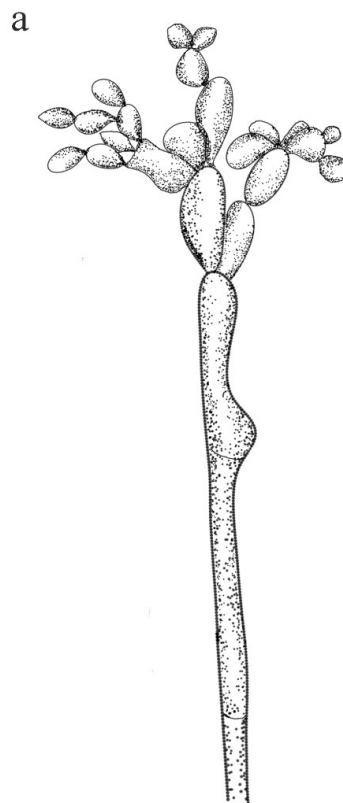


Figure 3 – *Cladosporium cladosporioides* a. Conidiophores and conidia. Redrawn from Domsch et al. (1993).

Dissoconiaceae Crous & de Hoog

Ramichloridium Stahel ex de Hoog, Stud. Mycol. 15: 59 (1977)

Fig. 4

Index Fungorum number: IF 9690; Facesoffungi number: FoF 06941

de Hoog (1977) introduced *Ramichloridium* and typified by *R. apiculatum*. Species Fungorum (2025) lists 23 species under this genus, while seven species have molecular data (Hongsanan et al. 2020a). Arzanlou et al. (2007) provided a morphological and phylogenetic revision (based on LSU and ITS gene regions) for *Ramichloridium* with a key to ramichloridium-like genera. This is an anamorphic genus with a hyphomycetous asexual morph. It is characterized by having dark brown, straight, unbranched, or rarely branched, thick-walled conidiophores with continuous or several additional thin septa. Conidiogenous cells are polyblastic, terminal, integrated, smooth, thick-walled, golden-brown, apical part sub-hyaline with sympodial proliferation, straight or flexuous, geniculate or nodose, conspicuous; scars are crowded or scattered, unthickened, unpigmented to faintly pigmented, or slightly prominent denticles. Conidia are solitary, aseptate to 1-septate, sub-hyaline to pale brown, smooth to coarsely verrucose, thin-walled, obovate, obconical or globose to ellipsoidal fusiform with a somewhat prominent, slightly pigmented hilum and conidial secession is schizolytic (de Hoog 1977). Species are found in various habitats, including air, plants and soil, as endophytes, saprobes and plant and human pathogens recorded in Saudi Arabia, China, Denmark, UK, India, Malaysia and Seychelles (Arzanlou et al. 2007, Hongsanan et al. 2020a, Salvatore et al. 2022). *Ramichloridium apiculatum* produces a rapicone that leads to post-harvest losses in apples and pears (Salvatore et al. 2022).

Table 3 *Ramichloridium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Ramichloridium apiculatum</i>	Georgia	Forest soil	Arzanlou et al. (2007)
<i>R. apiculatum</i>	Pakistan	ND	

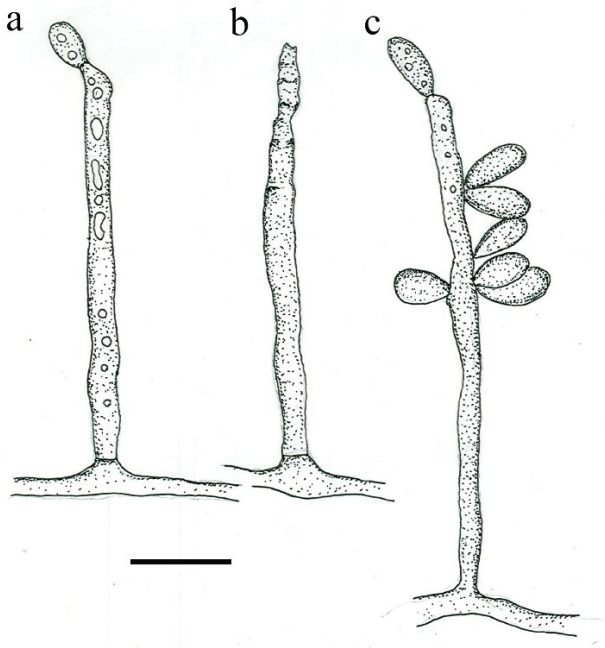


Figure 4 – *Ramichloridium apiculatum* (CBS 156.59) a–c Conidiophores with sympodial proliferating conidiogenous cells and conidia. Scale bar: a–c = 10 µm. Redrawn from Arzanlou et al. (2007).

Pseudoramichloridium Cheewangkoon & Crous, Persoonia 23: 75 (2009).

Fig. 5

Index Fungorum number: IF 513854; Facesoffungi number: FoF 06851

Pseudoramichloridium was established by Cheewangkoon et al. (2009) with *P. henryi* as the designated type. Currently, three species are listed under *Pseudoramichloridium* (Species Fungorum 2025); two species with molecular data. Cheewangkoon et al. (2009) provided the phylogenetic analyses based on LSU to infer its placement in *Teratosphaeriaceae*. The genus was subsequently transferred to *Extremaceae* based on the phylogenetic revision of Quaedvlieg et al. (2014). The asexual morph is hyphomycetous and characterized by unbranched, slightly thick-walled, darker conidiophores with sympodially proliferating, polyblastic, integrated, terminal, conidiogenous cells. Conidia are subhyaline to pale brown, aseptate, obovoid to fusiform, thin-walled and smooth to slightly verruculose. The sexual morph of the genus is not determined yet. These species have been recorded from plants and soil from Australia, Brazil and China (Arzanlou et al. 2007, Cheewangkoon et al. 2009, Jiang et al. 2017b).

Table 4 *Pseudoramichloridium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudoramichloridium brasilianum</i>	Brazil	Forest soil	Arzanlou et al. (2007), Cheewangkoon et al. (2009)
<i>P. xinjiangense</i>	China	Park soil	Jiang et al. (2017b)

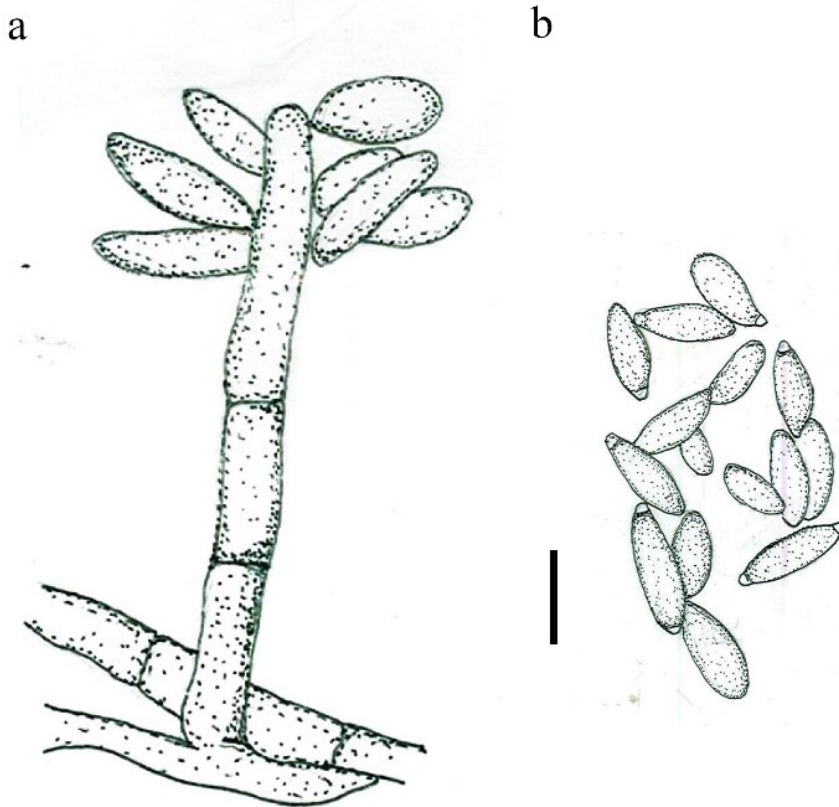


Figure 5 – *Pseudoramichloridium henryi* (CBS 124775). a Conidiophores. b Conidiogenous cells and conidia. Scale bar: a, b = 10 µm. Redrawn from Cheewangkoon et al. (2009).

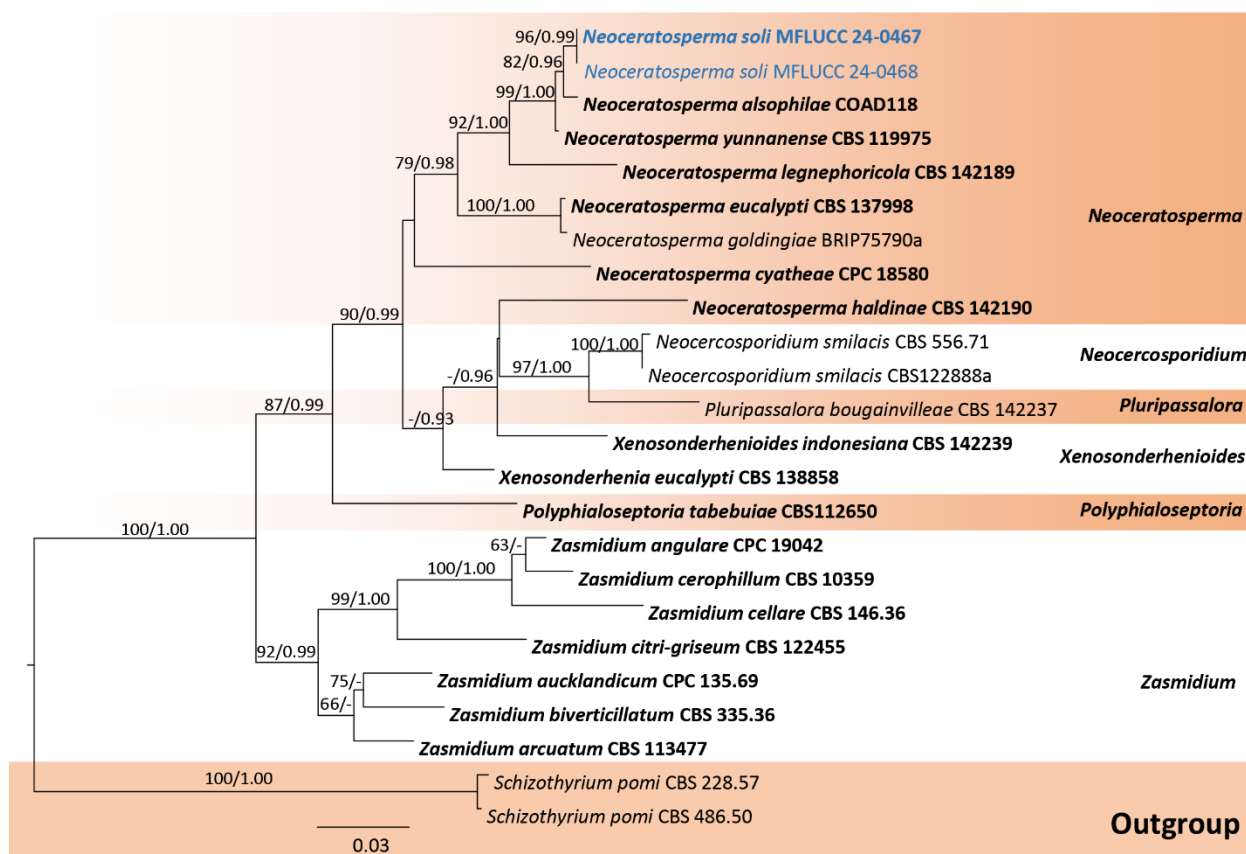


Figure 6 – The best-scoring maximum likelihood tree is generated from the combined LSU and ITS sequence data for selected species in *Mycosphaerellaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Schizothyrium pomi* (CBS 228.57 and CBS 486.50). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 1344 bp, and single gene alignments are ITS: 503 bp, and LSU: 841 bp. A final ML optimization likelihood value of -7424.047814. The matrix had 383 distinct alignment patterns with 8.5% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.236, C = 0.249, G = 0.295, T = 0.220; substitution rates AC = 1.00000, AG = 1.74503, AT = 1.00000, CG = 1.00000, CT = 5.60171, GT = 1.00000; gamma distribution shape parameter α = 0.407.

Mycosphaerellaceae Lindau

Neoceratosperma Crous & Cheew., Persoonia 32: 257. 2014.

Index Fungorum number: IF 808935; Facesoffungi number: FoF 08516

Crous et al. (2014a) introduced *Neoceratosperma* with the type species, *N. eucalypti*. The genus comprises seven species (Species Fungorum 2025), and all of them have molecular data. The asexual morph consists of conidiophores that are reduced to brown, verruculose, sub-cylindrical conidiogenous cells, and conidia that are solitary, rarely in unbranched chains, subcylindrical, medium brown to dark brown, verruculose, warty, distoseptate with an obtuse apex and a truncate base (Crous et al. 2014a). The species have been reported from Australia, Brazil, China, Laos and Thailand associated with living and dead leaves (Videira et al. 2017). The genus has not been reported from soil previously.

Neoceratosperma soli Yasanthika & K.D. Hyde, sp. nov.

Index Fungorum number: IF903421; Faces of Fungi number: FoF 16701

Fig. 7.

Etymology – The specific epithet "*sol*i", from Latin, refers to the isolated soil, the substrate of which the holotype was collected.

Holotype – MFLU 25-0126

Sexual morph: Undetermined. Asexual morph: *Conidiophores* $6\text{--}8 \times 4\text{--}6 \mu\text{m}$ ($\bar{x} = 7 \times 4.5 \mu\text{m}$, $n = 15$), solitary, erect, semi- to macronematous, straight, hyaline to pale brown, septate, branched, smooth. *Conidiogenous cells* terminal in conidiophores, intercalary in prostrate hyphae, smooth, sometimes verruculose, monoblastic, rarely polyblastic, sympodially proliferating through rim-like previous conidiogenous loci, thick-walled, pale brown. *Conidia* $5\text{--}16 \times 3\text{--}8 \mu\text{m}$ ($\bar{x} = 10 \times 6 \mu\text{m}$, $n = 25$), solitary or occasionally in chains, subcylindrical to dumbbell-shaped, hyaline to subhyaline, smooth to verruculose, rounded to thin at apex, rounded or enlarged at base, 0–3-distoseptate, constricted at septa with an inconspicuous hilum at base.

Culture characteristics – *Colonies* on PDA at 25 °C become 2–2.5 cm diam., after seven days, olive-brown to dark brown surface, reverse dark brown, flat, irregular filiform margin. *Mycelium* 2–3 μm ($\bar{x} = 2.5 \mu\text{m}$, $n = 25$), immersed to superficial, hyaline to subhyaline or pale brown, branched hyphae, smooth to course-surfaced, thick-walled, septate, sporulated after 4 weeks.

Material examined – Thailand, Chiang Rai, Buddha Cave (What Tham Phra), on soil, 99.788928N, 19.9175247E, 425m, 21 June 2021, W.A. Erandi Yasanthika, (MFLU 25-0126, holotype), ex-type living culture 48-cv8-64 = MFLUCC 24-0467. *ibid.* (MFLU 25-0127, isotype), living culture 48b-cv8-64b = MFLUCC 24-0468.

GenBank numbers – MFLUCC 24-0467: LSU: PQ578016, ITS: PQ578006; MFLUCC 24-0468 LSU: PQ590756, ITS: PQ590758

Notes – Based on morpho-molecular results, *Neoceratosperma soli* (MFLUCC 24-0467 and MFLUCC 24-0468) are introduced as a new species. The multi-gene phylogeny (Figure 6) shows that our species produced an independent clade sister to *Neoceratosperma alsophilae* with 82% ML and 0.96 BYPP statistical support. We compared the nucleotides across the ITS (+5.8S) region of *N. soli* with *N. alsophilae*, resulting in 8/469 (1.7 %) (including gaps) differences. However, only sexual morph has been reported in *N. alsophilae*, thus, comparing the morphology of our species was not possible (Guatimosim et al. 2016). The other two adjacent species have asexual morphs; of these, *N. yunnanensis* has cylindrical to long obclavate, filiform, 0–6 eu- or distoseptate conidia with a short-obconical, truncate base and rounded apex (Guatimosim et al. 2016), and *N. legnephricola* has cylindrical, straight or curved, 0–10-distoseptate conidia with obconically truncate base and conically truncate apex (Videira et al. 2017). In contrast, our species has sub-cylindrical to dumbbell-shaped, hyaline to subhyaline, 0–3-distoseptate conidia with a rounded to thin apex and a rounded, enlarged base. Considering the multi-gene phylogeny and the distinct morphology, we confirm *N. soli* as a new species isolated from disturbed cave soil. This is the first report of a *Neoceratosperma* species from soil, as this genus was previously found associated with plants (Crous et al. 2014a, Guatimosim et al. 2016, Videira et al. 2017).

***Piedraiaceae* Viégas ex Cif., Bat. & S. Camposa**

Piedraia Fonseca & Leão, Memórias do Instituto Oswaldo Cruz 21 (suppl. 4): 125 (1928). Fig. 8

Index Fungorum number: IF 4098; Facesoffungi number: FoF 06139

Fonseca & Areakio (1928) introduced *Piedraia*, with *P. hortae* as the type species. Currently, two species are present in the genus (Species Fungorum 2025), and both of them have molecular data. Initially, the genus was placed in *Piedraiaceae* (Ciferri et al. 1956), but based on phylogeny Crous et al. (2009) placed it under *Teratosphaeriaceae*. However, Hongsanan et al. (2020a) and other subsequent studies suggested *Piedraia* in *Piedraiaceae*. The sexual morph of *P. hortae* is described as having ascostroma singly or in groups with loculi containing asci that contain 1–8 protunicate oval asci, whose wall disappears with spore maturity. Asci bear fusiform, sometimes straight, but usually curved or S-shaped, aseptate, and hyaline to slightly dark pigmented ascospores with a filiform appendage at both ends (Takashio & Vanbreuseghem 1971).

Piedraia includes human pathogens that can infect the scalp and hair. The genus is distributed in Brazil, Indonesia, Surinam and Venezuela and have been isolated from crops, dead *Homo sapiens*, mammalian hair, soil and stagnant water (Muggia et al. 2008, Hongsanan et al. 2020a, Pem et al. 2024).

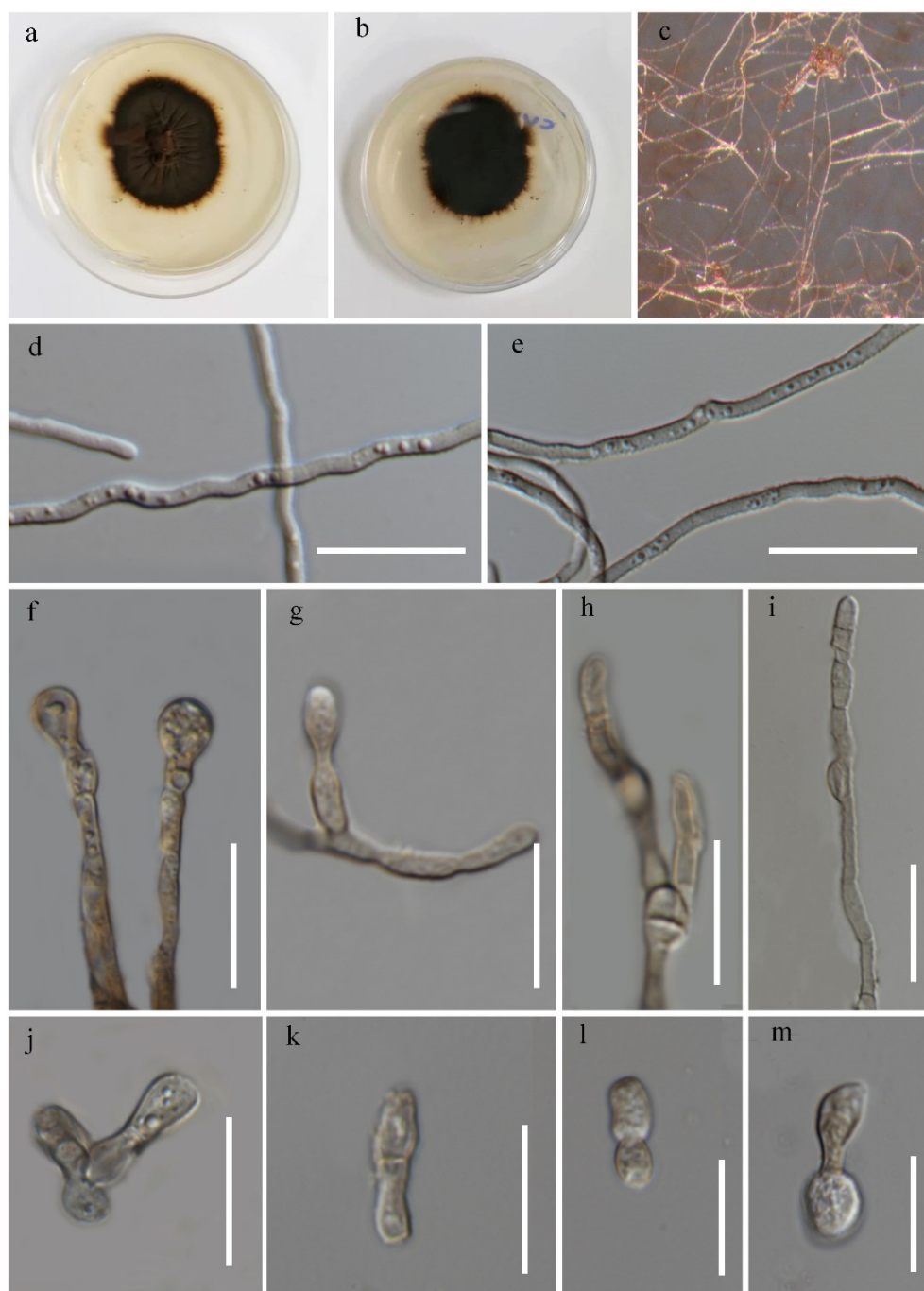


Figure 7 – *Neoceratosperma soli* (MFLU 25-0126, Holotype). a, b Culture characters on PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d Immature hyphae. e Mature hyphae. f–i Conidiophores with conidiogenous cells. j–m Conidia. Scale bars: d–m = 20 μ m.

Table 5 *Piedraia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Piedraia hortae</i>	Nigeria	A market	Nwokeoma et al. (2017)

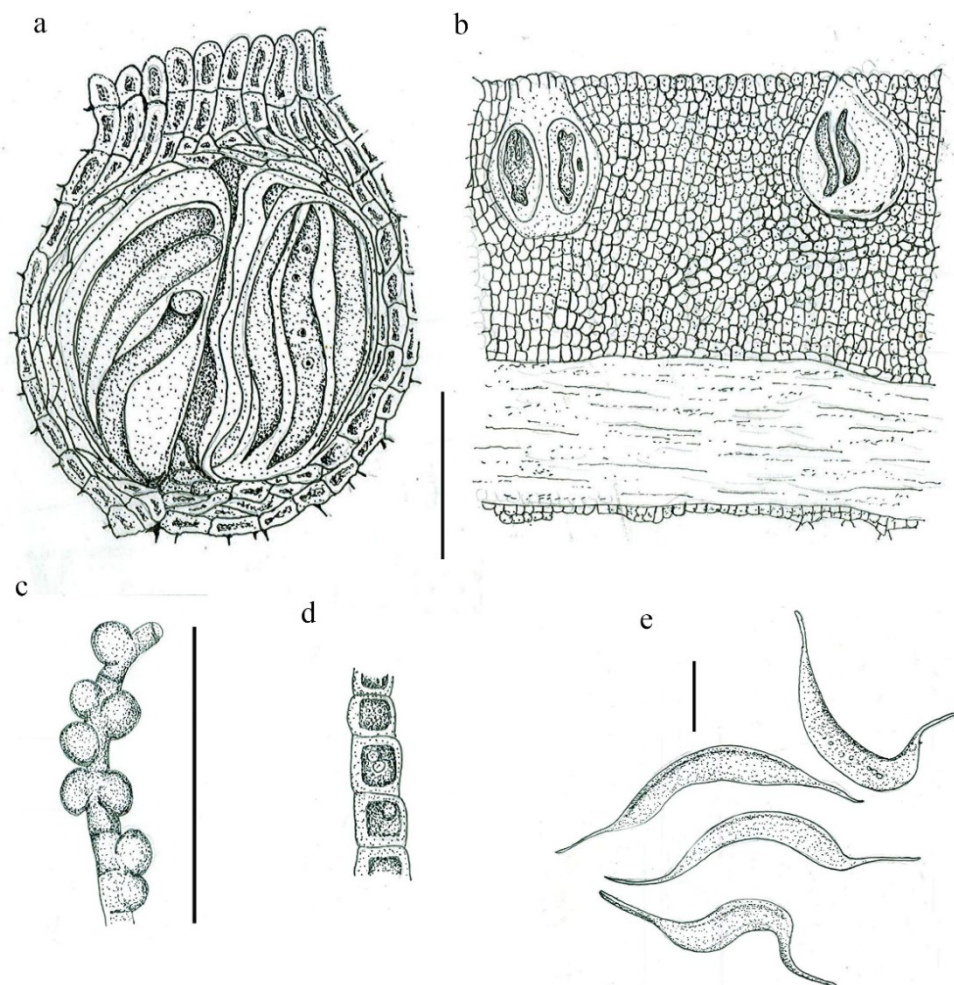


Figure 8 – *Piedraia hortae*. a Vertical section of an ascoma. b Stroma on human hair. c Peripilar nodules grown on hypha. d Hypha on the culture. e Ascospores. Scale bars: a–e = 20 µm. Redrawn from Hongsanan et al. (2020a).

Saccoltheciaceae Bonord.

Aureobasidium Viala & G. Boyer, Rev. gén. Bot. 3: 371(1891).

Index Fungorum number: IF 7297; Facesoffungi number: FoF 00098

Aureobasidium was introduced by Viala & Boyer (1891) with *Aureobasidium vitis* as the type species. Currently, there are 36 species listed in Species Fungorum (2025), while 28 have molecular data (Tan & Steinrucken 2024). Thambugala et al. (2014) placed *Aureobasidium*, *Saccolthecium* and five other genera in *Aureobasidiaceae*, which was introduced by Ciferri (1958). Based on phylogeny, later studies have placed *Aureobasidium* in *Dothioraceae* (Jones et al. 2019, Lee et al. 2021), however, some studies have shown that *Aureobasidiaceae* was introduced earlier by Bonorden (1864) as *Saccoltheciaceae* to accommodate *Saccolthecium*. As a result, *Aureobasidium* is currently placed in *Saccoltheciaceae* (Hongsanan et al. 2020a, Calabon et al. 2023). The asexual morph is characterized by acervular to sporodochial, amphigenous, substomatal conidiomata with hyaline, cylindrical, clavate or globose, holoblastic, and polyblastic conidiogenesis cells. Conidia are hyaline to dark brown, ellipsoidal to spherical, reniform to sickle-shaped, aseptate with cylindrical and obtuse ends (Thambugala et al. 2014). *Aureobasidium* species have been identified as endophytes, saprobes and pathogens associated with plants and human

pathogens recorded from air, clinical laboratory samples, glass, marine sediments, marshland, soil, stone and water (Zain et al. 2009, Arzanlou 2012, Wu et al. 2023, Pem et al. 2024). They have been reported from several countries, including China, the Czech Republic, India, Korea, Romania, Spain, the Netherlands and the USA. These species are utilized as biocontrol agents and for producing biodegradable extracellular polysaccharides (Arzanlou 2012, Wu et al. 2023).

Table 6 *Aureobasidium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Aureobasidium pullulans</i>	Egypt	Valley area-Wadi Houf	Zain et al. (2009)

Teratosphaeriaceae Crous & U. Braun

Acidiella Hujšlová & M. Kolařík, Fungal Diversity 58: 39 (2013).
Index Fungorum number: IF 564518; Facesoffungi number: FoF 06992

Fig. 9

Hujšlová et al. (2013) erected *Acidiella* based on the LSU phylogeny and morphological characters, with *A. bohémica* as the type species. Currently, five species are listed in the Species Fungorum (2025), all of them with molecular data. The asexual morph is hyphomycetous, producing velvety black colonies, consisting of septate, branched, hyaline, or pale brown hyphae. Conidial formation occurs through fragmentation, resulting in oblong or swollen arthroconidia with truncated ends (Hujšlová et al. 2013). The sexual morph is presently unknown. These species have been recorded from mine spoil, soil, and the wall of a cooling tower in the Czech Republic, Poland and the USA (Hujšlová et al. 2014, Crous et al. 2017b, Kolařík et al. 2021, Pem et al. 2024).

Table 7 *Acidiella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Acidiella bohémica</i>	Czech Republic	Acidic soil in a Kaolin quarry	Hujšlová et al. (2013)

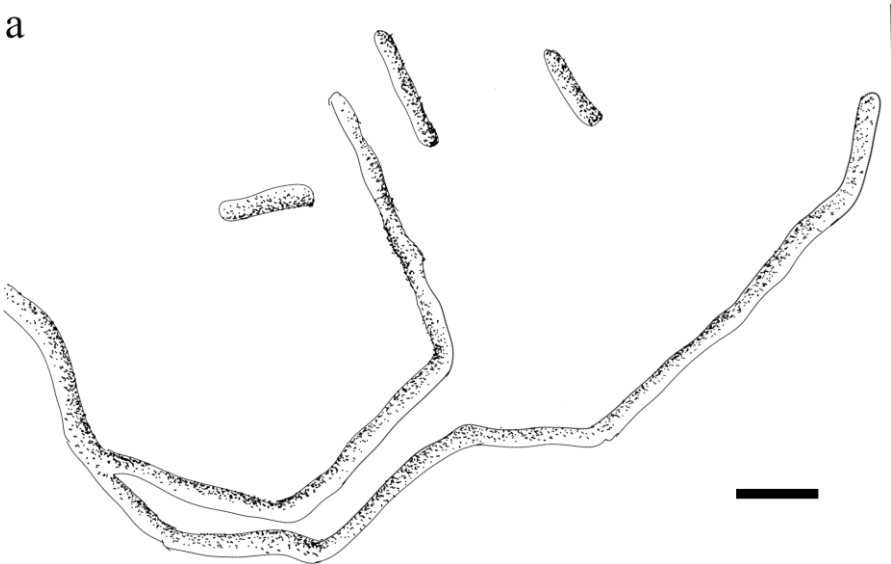


Figure 9 – *Acidiella bohémica* (CBS 132721). a Conidiogenesis and the arthroconidia. Scale bar: a = 10 µm. Redrawn from Hujšlová et al. (2013).

Devriesia Seifert & N.L. Nick., Can. J. Bot. 82(7): 919 (2004)

Fig. 10

Index Fungorum number: IF 28865; Facesoffungi number: FoF 07006

Devriesia was established by Seifert et al. (2004) based on the ITS phylogeny, accommodating the type species *D. staurophora*. Currently, 12 species have been listed in the genus, while eight species have molecular data (Species Fungorum 2025). The asexual morph is hyphomycetous with mononematous, pale brown, unbranched or sparingly branched conidiophores with a stipe, and holoblastic, polyblastic, or sometimes monoblastic conidiogenous cells. *Devriesia* has two types of conidia, ramoconidia that are slightly pigmented with a cylindrical to fusiform base, and the septate, subhyaline conidia arranged in dry acropetal chains (Seifert et al. 2004). The sexual morph has not yet been discovered. Species have been isolated from dead plant leaves, house dust, rocks and soils in Balears, Canada, Japan and the UK (Seifert et al. 2004, Pem et al. 2024).

Table 8 *Devriesia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Devriesia acadiensis</i>	Canada	Heat-treated soil in blueberry fields	Seifert et al. (2004)
<i>D. shelburniensis</i>			
<i>D. thermoturans</i>			
<i>D. chlamydospora</i>	Japan	Garden soil	



Figure 10 – *Devriesia staurophora* (DAOM 230744) a Conidiophores and ramoconidia. Redrawn from Seifert et al. (2004).

Order: Pleosporales Luttrell ex M.E. Barr

Acrocalymmaceae

Acrocalymma Alcorn & J.A.G. Irwin, Trans. Br. mycol. Soc. 88(2): 163 (1987)

Index Fungorum number: IF 11008; Facesoffungi number: FoF 07097

Acrocalymma was established by Alcorn & Irwin (1987), assigning *A. medicaginis* as the type species. Based on morphology coupled with ITS and LSU based phylogeny, Trakunyingcharoen et al. (2014) introduced *Acrocalymmaceae* to accommodate *Acrocalymma*. Recently, Tennakoon et al. (2021) and Liu & Zeng (2022) provided phylogenetic and morphological analyses for this genus. Currently, 18 species have been listed in the Species Fungorum (2025), and all of them have molecular data. The asexual morph possesses solitary, papillate, globose pycnidia that bear holoblastic conidiogenous cells and aseptate, hyaline,

cylindrical conidia with a helmet-shaped mucilaginous appendage at each end (Alcorn & Irwin 1987, Jayasiri et al. 2019). The sexual morph has ostiolate ascomata, 8-spored asci containing fusiform ascospores with hyaline sheath (Shoemaker et al. 1991). *Acrocalymma arengae*, *A. chuxiongense*, *A. hongheense*, *A. pterocarpi* and *A. walker* have been reported as sexual morphs (Liu & Zeng 2022). *Acrocalymma* species are recorded as pathogens and saprobes from terrestrial and aquatic plants and soil in Australia, China, Korea and Thailand (Das et al. 2020a, Tennakoon et al. 2021, Konta et al. 2023, Pem et al. 2024, Manawasinghe et al. 2025).

Table 9 *Acrocalymma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Acrocalymma guizhouense</i>	China	Rhizosphere soil of <i>Perilla frutescens</i>	Shao et al. (2022a)
<i>A. pterocarpi</i>	Korea	Field soil	Das et al. (2020a)

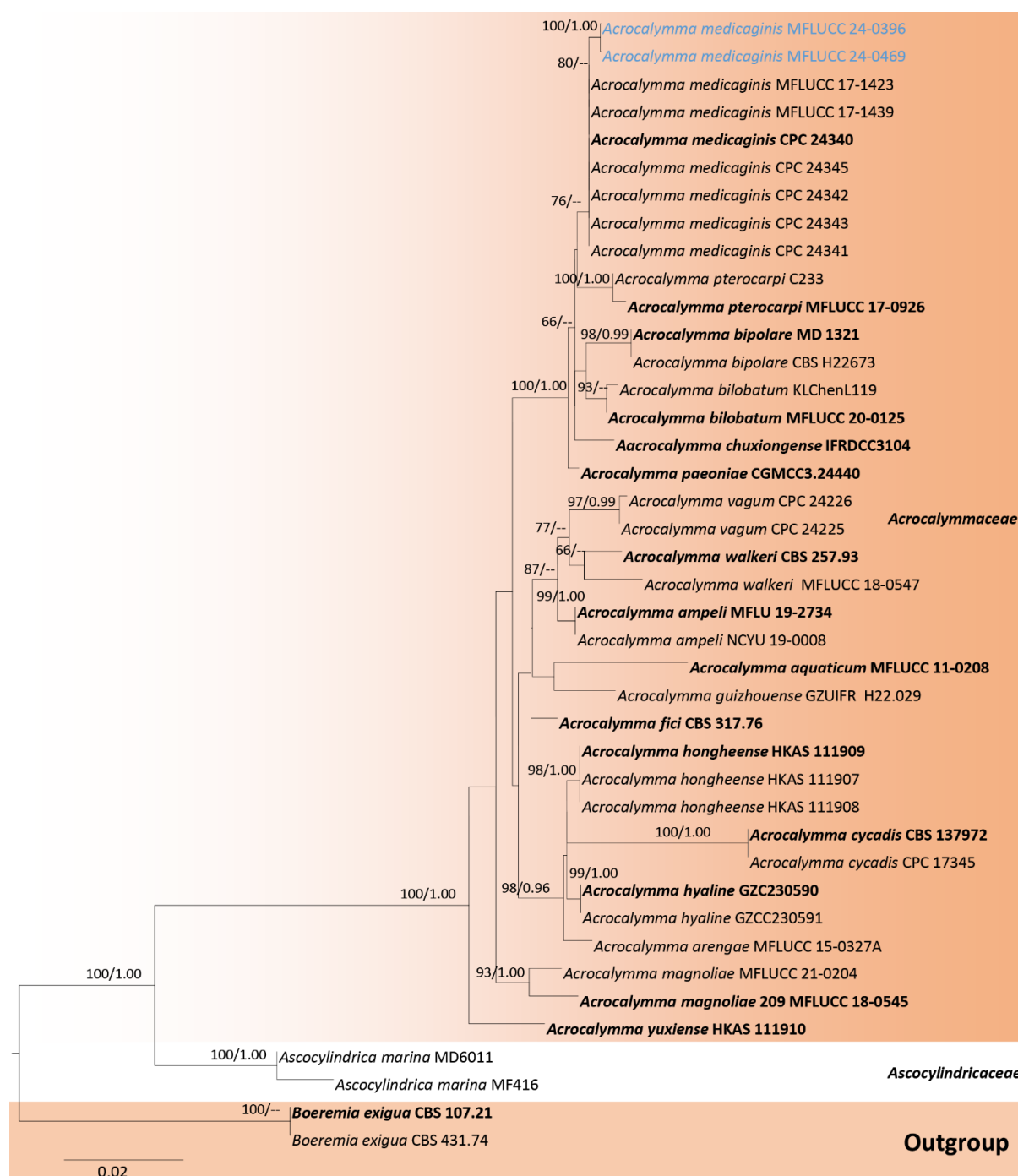


Figure 11 – The best-scoring maximum likelihood tree generated of the combined SSU, LSU and ITS sequence data for selected genera in *Acrocalymma* spp. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Boeremia exigua* (CBS 431.74 and CBS 431.74) strains. The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 1327 bp, and single gene alignments are ITS: 497 bp, and LSU: 830 bp. A final ML optimization likelihood value of - 7424.047814. The matrix had 272 distinct alignment patterns with 16.86% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.250, C = 0.250, G = 0.250, T = 0.250; substitution rates AC = 3.55168, AG = 3.55906, AT = 3.55168, CG = 1.00000, CT = 11.54762, GT = 1.00000; gamma distribution shape parameter $\alpha = 0.738$.

Acrocalymma medicaginis Alcorn & J.A.G. Irwin, Trans. Br. mycol. Soc. 88(2): 163 (1987). Fig.12

Index Fungorum number: IF 130085; Facesoffungi number: FoF 07099

Sexual morph: *Ascomata*: 47–150 × 52–91 μm ($\bar{x} = 82 \times 67 \mu\text{m}$, $n = 10$), semi-immersed to erumpent, solitary or in groups, obpyriform to ovoid. *Peridium* 7–12 μm ($\bar{x} = 9 \mu\text{m}$) wide, inner subhyaline to golden-brown cell layers and hyaline outer cell layers, composed cells of *textura angularis*. *Asci* 52–39 $\mu\text{m} \times 8$ –12 μm ($\bar{x} = 45 \times 9 \mu\text{m}$, $n = 20$), fissitunicate, clavate, hyaline, curved to straight, 8-spored, short-stalked. *Ascospores* 8–16.5 $\mu\text{m} \times 3$ –5 μm ($\bar{x} = 11 \times 4.5 \mu\text{m}$, $n = 20$), biseriata, fusiform, hyaline, straight to slightly curved, 1-septate, constricted at the septum, thick-walled. Asexual morph: Undetermined.

Culture characteristics – Colonies grew on PDA at 25 °C reached 4 cm in diam., within 14 days, circular, flat, entire-margined, white surface became whitish red when mature, reverse white, became crimson at the center with yellowish-red outer ring when mature. *Mycelium* 1.5–3 μm ($\bar{x} = 2 \mu\text{m}$, $n = 25$), superficial to semi-immersed, hyaline, smooth-walled, septate, sporulated after three weeks.

Material examined – Thailand, Chiang Mai Province, Mae On District, Tham Muang On cave, on soil, 99.238054 N, 18.7862964 E, 496 m, 9 May 2022, W.A. Erandi Yasanthika, (MFLU 25-0116), living culture 58-cv20-17 = MFLUCC 24-0396. *ibid.* (MFLU 25-0117), living culture 58b-cv20-17b=MFLUCC 24-0469.

GenBank numbers – MFLUCC 24-0396: SSU: PQ559869, LSU: PQ559854, ITS: PQ559850; MFLUCC 24-0469: LSU: PQ572138, ITS: PQ570529

Notes – *Acrocalymma medicaginis* was introduced by Alcorn & Irwin (1987) from root and crown rotting of *Medicago sativa* (*Fabaceae*) in Australia. It has later been isolated from dead stems of *Chromolaena odorata* in Thailand (Mapook et al. 2020) and dead culms of herbaceous plants in China (Zhang et al. 2024b). In the phylogenetic analyses (Figure 11), our strains (MFLUCC 24-0396 and MFLUCC 24-0469) grouped with *A. medicaginis* with 76% ML statistical support. However, the Bayesian value was less than 0.90. Our isolates (MFLUCC 24-0396 and MFLUCC 24-0469) are morphologically similar to *A. medicaginis* by having 8-spored, fissitunicate, cylindric-clavate, straight or slightly curved, short stalked asci and ascospores with 1–2-seriate, hyaline, straight or slightly curved, and two-celled constricted at the septum (Alcorn & Irwin 1987). However, our collection is slightly different from the type species by having thick-walled ascospores. Thus, this species seems to be a complex which requires detailed research. Based on morphology and multi-gene phylogeny, we confirmed our collection isolated from disturbed cave soils in Thailand as *A. medicaginis*. It is the first *A. medicaginis* strain reported from Thai soils and the first member of this genus associated with the cave environment.

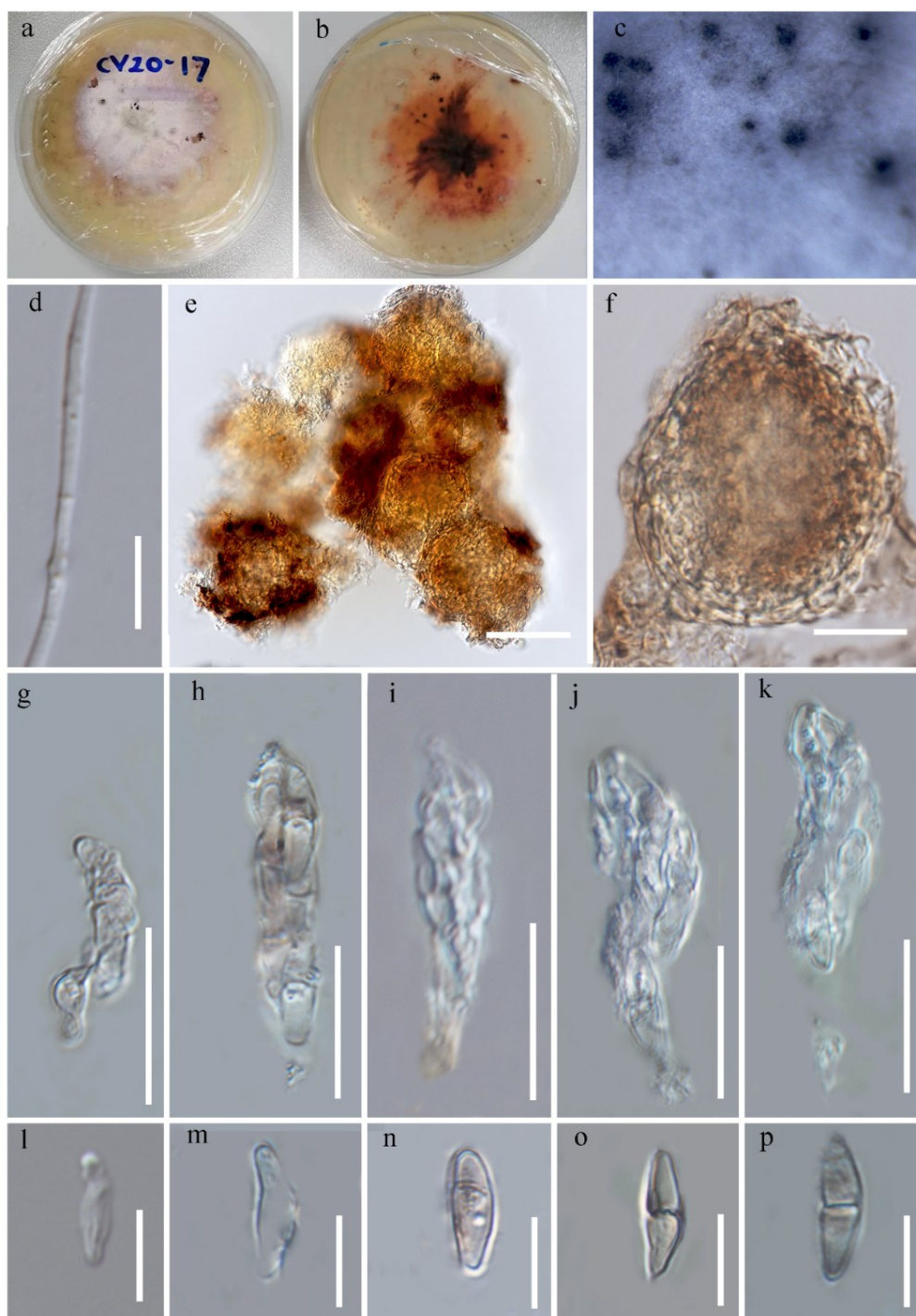


Figure 12 – *Acrocalymma medicaginis* (MFLU 25-0116). a, b Culture characters on PDA (b = reverse). c Sporulated colony with ascomata. d Mature hyphae. e Ascomata. f Ascomatal wall. g–k Asci. l–p Ascospores. Scale bars: e = 50 μ m, f, g–k = 20 μ m, d, l–p = 10 μ m, k–o = 5 μ m.

Amorosiaceae Thambug. & K.D. Hyde

Amorocoelophoma Jayasiri, E.B.G. Jones & K.D. Hyde, *Mycosphere* 10 (1): 25 (2019)

Index Fungorum number: IF 555529; Facesoffungi number: FoF 05230

Amorocoelophoma was introduced by Jayasiri et al. (2019) based on SSU, ITS, LSU and *TEF1- α* sequences and the morphological evidence. Currently, four *Amorocoelophoma* species are listed in the Species Fungorum (2025), and they are supported with molecular data. The asexual morph is characterized by the solitary to gregarious, ovoid to globose, brown, pycnidia covered with hyaline to pale brown, septate, branched hyphal growth as a layer with outer brown layer and

the pycnidia wall having thick, two layers, inner hyaline, *textura angularis*, 1–2 cell layers and outer *textura angularis*, brown, 1–2 cell layers. Conidiogenous cells are phialidic, doliiform, hyaline, smooth-walled and hyaline, cylindrical, aseptate, smooth- and thin-walled conidia with guttules that are concentrated at the ends (Jayasiri et al. 2019). Most of the species are recorded from leaf spots, associated with leaf lesions, fallen pods and soil from China, New Zealand and Thailand (Jayasiri et al. 2019, Ariyawansa et al. 2020, Crous et al. 2021c).

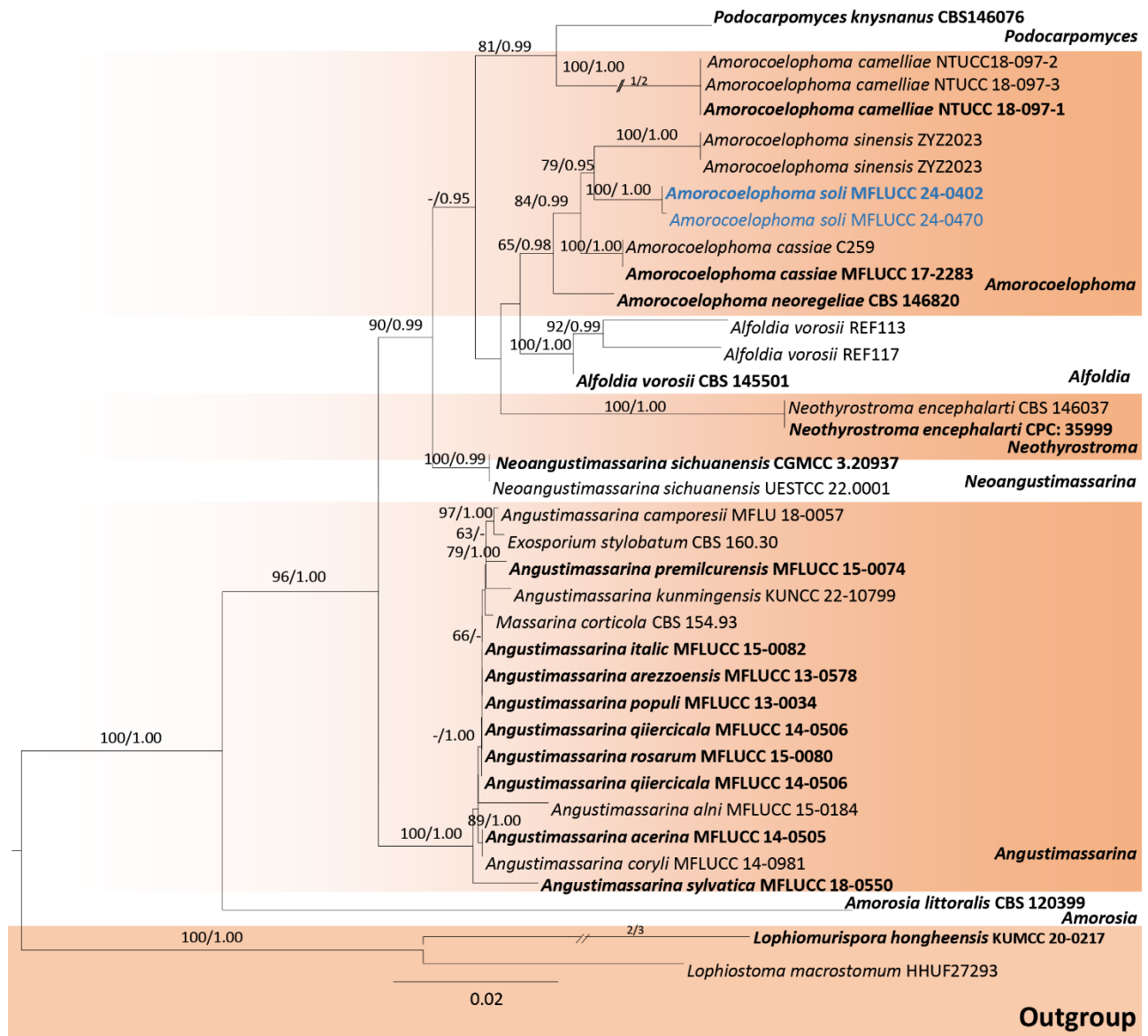


Figure 13 – The best-scoring maximum likelihood tree generated of the combined SSU, ITS and LSU sequence data for selected genera in *Amorosiaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Lophiomurispora hongheensis* KUMCC 20-0217 and *Lophiostoma macrostomum* HHUF27293. The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 2430 bp, and single gene alignments are SSU: 1018 bp, ITS: 552 bp, and LSU: 860 bp. A final ML optimization likelihood value of -7424.047814. The matrix had 585 distinct alignment patterns with 22.01% % undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.253032, C = 0.219699, G = 0.273895, T = 0.253374, substitution rates AC = 2.142025, AG = 3.315365, AT =

2.376966, CG = 1.013124, CT = 10.058142, GT = 1.000000; gamma distribution shape parameter $\alpha = 0.678674$.

Table 10 *Amorocoelophoma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Amorocoelophoma sinensis</i>	China	Guizhou Wildlife Park	Zhang et al. (2024b)

Amorocoelophoma soli Yasanthika & K.D. Hyde, sp. nov.

Fig. 14

Index Fungorum number: IF903040; Facesoffungi number: FoF 16702

Etymology – The specific epithet "*soli*", from Latin, refers to the soil, the substrate of which the holotype was collected.

Holotype – MFLU 25-0121

Sexual morph: *Ascomata* 80–150 × 100–480 µm ($\bar{x}$ = 108 × 257 µm, n = 5), mostly solitary, immersed or semi-immersed, globose to subglobose, light brown, *pseudoparenchymatous-walled*. *Asci* 15–30 × 3–7.5 µm ($\bar{x}$ = 20 × 4.5 µm, n = 10), 8-spored, bitunicate, fissitunicate, cylindrical to clavate, slightly curved, pedicellate, rounded at the apex. *Ascospores* 6–8 × 3–4 µm ($\bar{x}$ = 7 × 3.5 µm, n = 15), bi-seriate to tri-seriate, partially overlapping, hyaline, aseptate, ellipsoidal to reniform, thick-walled. Asexual morph: Undetermined.

Culture characteristics – Colonies on PDA at 25 °C reached 3.5 cm in diam., within 14 days, circular, flat, irregularly-margined, brownish grey surface, became greyish brown center and whitish to ivory at periphery when mature, reverse yellowish brown, dark brown center, yellow middle ring and whitish yellow periphery. *Mycelium* 1–3.5 µm ($\bar{x}$ = 2.5 µm), superficial to semi-immersed, hyaline to pale brown, smooth-walled, septate, sporulated after 4 weeks on PDA.

Material examined – Thailand, Chiang Rai, What Tham Pha Tong cave, on soil, 99.9038925 N, 20.0918488 E, 430 m, 28 Aug 2022, W.A. Erandi Yasanthika (MFLU 25-0121, holotype), ex-type living culture 88-cv23-12 = MFLUCC 24-0402. *ibid.* (MFLU 25-0122, isotype), living culture 88b-cv23-12b = MFLUCC 24-0470.

GenBank numbers – MFLUCC 24-0402: SSU: PQ573489, LSU: PQ570690, ITS: PP993906; MFLUCC 24-0470: SSU: PQ576457 LSU: PQ576474, ITS: PQ576414.

Notes – In this study, we introduce *Amorocoelophoma soli* from undisturbed cave soils in Thailand. According to the phylogeny (Figure 13), our strains (MFLUCC 24-0402 and MFLUCC 24-0470) cluster with *Amorocoelophoma cassiae* (MFLUCC 17-2283, C259), *A. neoregeliae* (CBS 146820) and *A. sinensis* (CGMCC 3.25499), and form a sister lineage to *A. sinensis* (CGMCC 3.25499) with 79% ML and 0.95 BYPP statistical support. However, in our tree, *A. camelliae* does not group with other *Amorocoelophoma* species, similar to Zhang et al. (2024b). We compared the nucleotides across the ITS (+5.8S) gene region of *Amorocoelophoma soli* (MFLUCC 24-0402 and MFLUCC 24-0470) with *A. cassiae* and *A. neoregeliae*. There are 23/ 465 (4%) (including gaps) differences between *Amorocoelophoma soli* and *A. cassiae*, while 27/ 376 (7%) (including gaps) with *A. neoregeliae* and 31/ 472 (6%) (including gaps) with *A. sinensis*. *Amorocoelophoma cassiae*, *A. neoregeliae* and *A. sinensis* have been recorded from their asexual morphs, and our collection reports the first sexual morph in this genus (Jayasiri et al. 2019, Ariyawansa et al. 2020). *Amorocoelophoma camelliae* was recorded on leaves of *Camellia sinensis* in China (Taiwan) (Ariyawansa et al. 2020), *A. cassiae* on fallen pods in Thailand (Jayasiri et al. 2019) and *A. neoregeliae* on leaf spots in New Zealand (Crous et al. 2021c), while *A. sinensis* has been reported from soil in China (Zhang et al. 2024b). Thus, based on both morphology and multi-gene phylogeny *Amorocoelophoma soli* is introduced as a new species, and interestingly, it is the first *Amorocoelophoma* species documented from soils in Thailand.

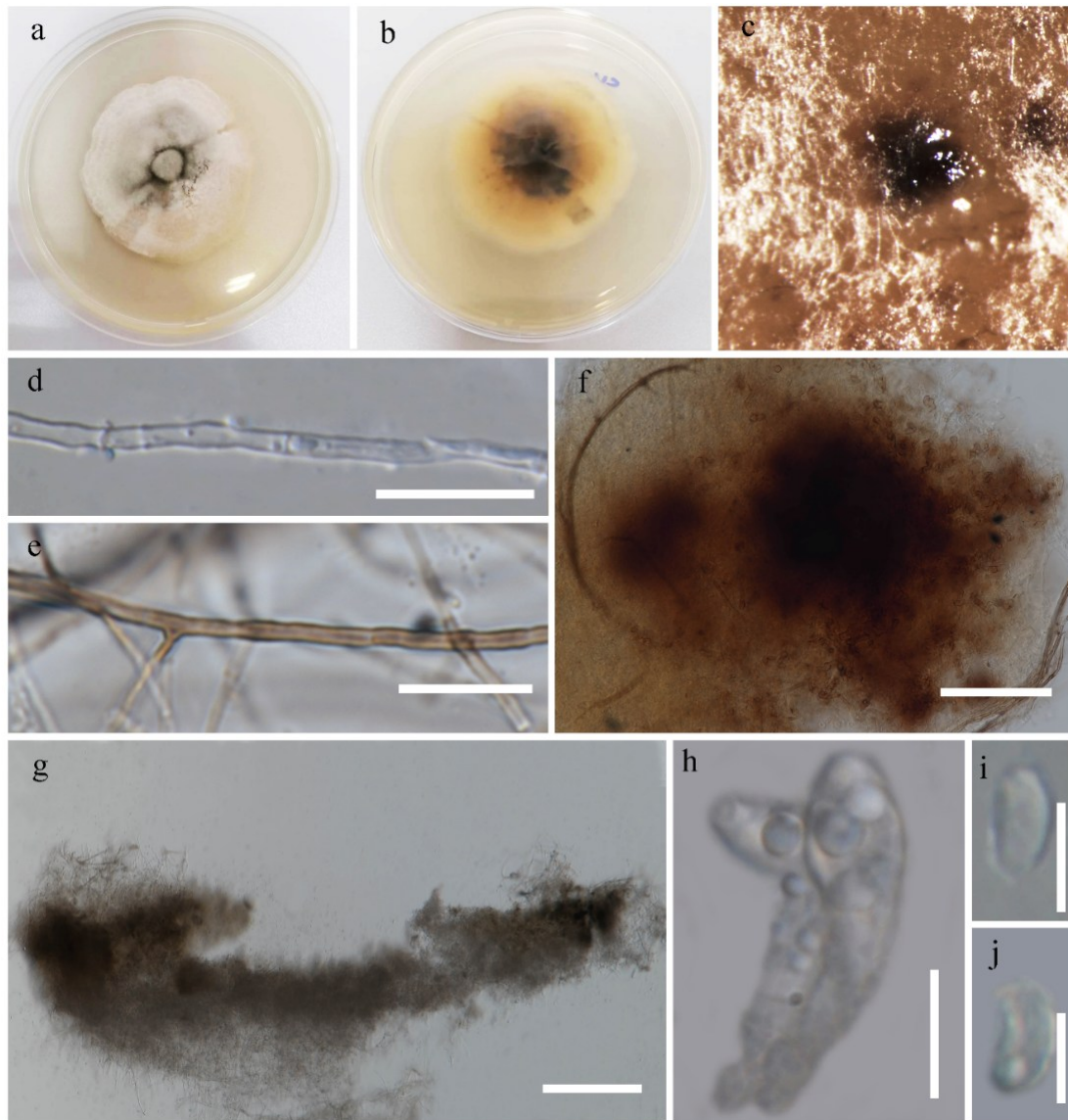


Figure 14 – *Amorocoelophoma soli* (MFLU 25-0121, holotype). a, b Culture characters on the PDA (b = reverse). c Sporulated colony with ascoma. d, e Hyphae. f Ascomata. g. Vertical cross-section of Ascomata. h Asci. i, m Ascospores. Scale bars: f, g = 100 μ m, e = 20 μ m, d, h = 10 μ m, i, j = 5 μ m.

Anteagloniaceae K.D. Hyde, J.K. Liu & A. Mapook

Anteaglonium Mugambi & Huhndorf, Syst. Biodiv. 7(4): 460 (2009)

Index Fungorum number: IF 541631; Facesoffungi number: FoF 06701

Anteaglonium was introduced with the type species, *A. abbreviatum*, which was previously known as *Glonium abbreviatum* (Mugambi & Huhndorf 2009). Based on the phylogenetic revision of Hyde et al. (2013), *Anteagloniaceae* was erected while accommodating *Anteaglonium* as the type genus. There are 11 species listed in the Species Fungorum (2025), and all of them have molecular data. Both asexual and sexual morphs have been identified in *Anteaglonium*, and the genus was initially distinguished by its smaller ascomata, elongate or globose, small ascospores that are less than 8 μ m long except for *A. latirostrum* (22–28 μ m) (Mugambi & Huhndorf 2009, Jaklitsch et al. 2018). However, the subsequent species discovered in the genus have globose ascomata, often with raised, laterally compressed apices that are absent in the initially identified members (Carneiro de Almeida et al. 2014). Species are found on dead wood and leaves collected in Greece, Kenya, Pennsylvania, Spain, Thailand and the USA. There is no previous record of the genus from soil habitats (Zhang et al. 2023a).

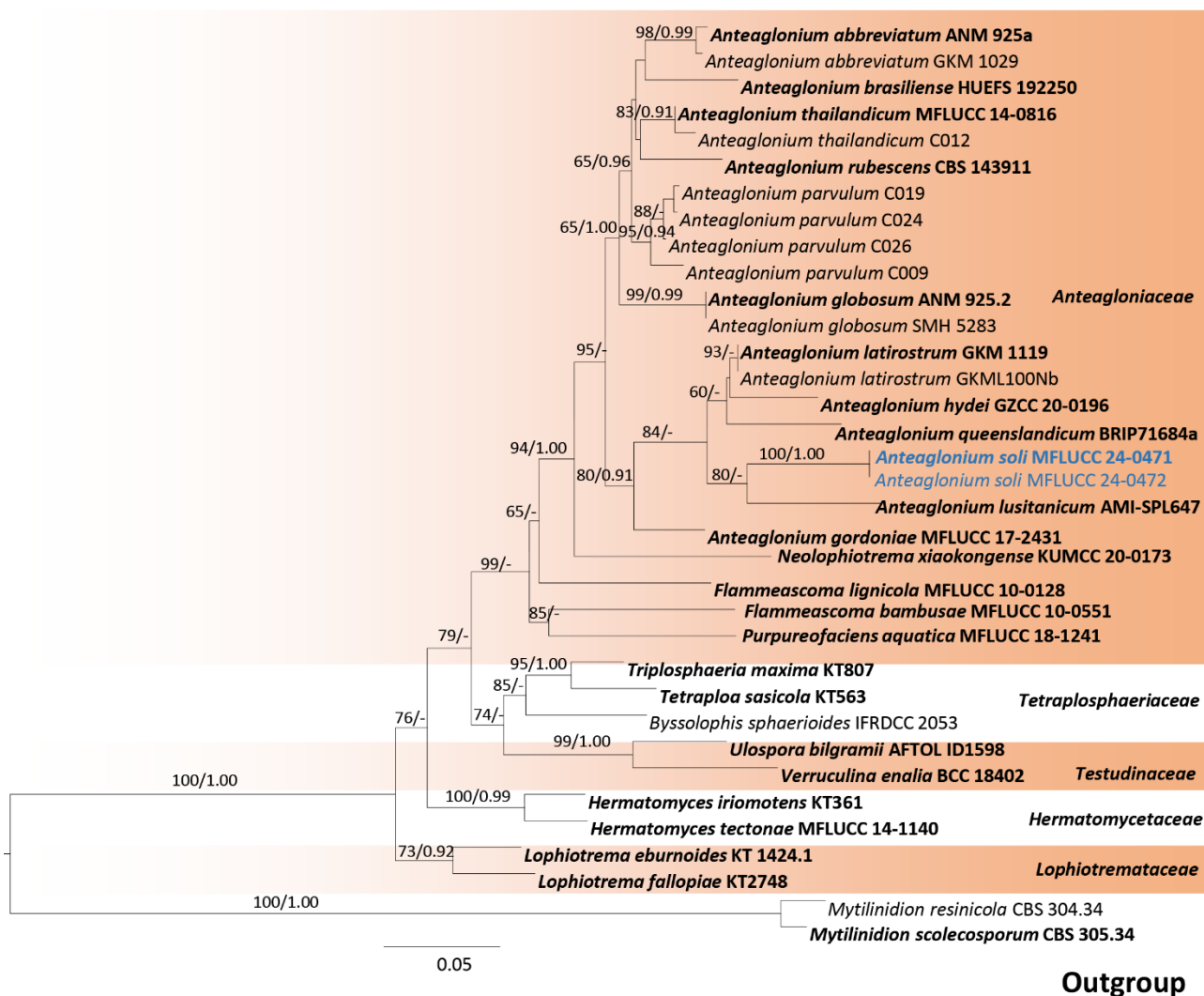


Figure 15 – The best-scoring maximum likelihood tree generated of the combined ITS, SSU, LSU, *TEF1-α* and *RPB2* sequence data for *Anteagloniaceae* and selected genera in adjacent families. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Mytilinidion resinicola* (CBS 304. 34) and *Mytilinidion scolecosporem* (CBS 305. 34). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 3784 bp, and single gene alignments are SSU: 976bp, ITS: 537 bp, LSU: 645 bp, *TEF1-α*:726bp, *RPB2*:900bp. A final ML optimization likelihood value of -16854.010. The matrix had 585 distinct alignment patterns with 42.65% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.250, C = 0.250, G = 0.250, T = 0.250, substitution rates AC = 1.00000, AG = 3.66088, AT = 1.00000, CG = 1.00000, CT = 8.41951, GT = 1.000000; gamma distribution shape parameter $\alpha = 0.502$.

Anteaglonium soli Yasanthika & K.D. Hyde, sp. nov.

Fig. 16

Index Fungorum number: IF903422; Facesoffungi number: FoF 16703

Etymology – The specific epithet “*soli*”, from Latin, refers to the soil, the substrate of which the holotype was collected.

Holotype – MFLU 25-0165

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 30–75 × 25–65 μm ($\bar{x} = 50 \times 40 \mu\text{m}$, $n = 10$), pycnidial, dark brown to black, globose, aggregated or rarely solitary, superficial to semi-immersed. *Conidiomata* wall comprising brown to hyaline cells of *textura angularis*.

Conidiogenous cells 1.5–3 × 1–2.5 µm ($\bar{x}$ = 2 × 2 µm, n = 15), hyaline, phialidic, ampulliform, smooth-walled. *Conidia* 1–3 × 1–2.5 µm ($\bar{x}$ = 2 × 1.5 µm, n = 25), hyaline, thick-walled, rough, aseptate, ellipsoidal to globose or obovoid, occasionally rounded apex, tapering at the base, sometimes with 1–2 lateral protuberances.

Culture characteristics – Colonies on the PDA at 25 °C reached 3.5 cm in diam., Within 14 days, circular, flat, entire-margined, initially greyish white, becoming brown to greyish brown, reverse dark brown center, light brown middle rind and dark brown periphery. *Mycelium* 1–2.5 µm ($\bar{x}$ = 1.5 µm, n = 25), superficial to semi-immersed, hyaline to pale brown, septate, thick-walled, sporulated after six weeks on PDA.

Material examined – Thailand, Chiang Mai, Mae On District, Tham Muang On cave, on soil, 99.238054 N, 18.7862964 E, 496 m, 9 May 2022, W.A. Erandi Yasanthika (MFLU 25-0165, Holotype), ex-type living culture 62-cv20-14 = MFLUCC 24-0471. *ibid.* (MFLU 25-0166, isotype), living culture 62b-cv20-14b = MFLUCC 24-0472.

GenBank numbers – MFLUCC 24-0471: LSU: PQ578018, ITS: PQ578017; MFLUCC 24-0472: LSU: PQ590757, ITS: PQ590759

Notes – The combined ITS, SSU, LSU, *TEF1-α* and *RPB2* phylogenetic tree in Figure 15 shows that our species (MFLUCC 24-0471 and MFLUCC 24-0472) clustered within *Anteaglonium*, producing a distinct branch sister to *A. lusitanicum* with 80% ML statistical support, and BYPP value was less than 0.90. The nucleotides across the ITS (+5.8S) gene region of our species was compared with *A. lusitanicum*, which showed 66/537 (12.29%) (including gaps) basepair differences. However, only the sexual morph was reported for *A. lusitanicum*. Thus, morphological comparison with our species was not possible (Tan et al. 2022). Mostly, other *Anteaglonium* species were also reported as sexual morphs, while *A. rubescens*, *A. parvulum* and *A. thailandicum* were reported in their asexual morphs (Jayasiri et al. 2016, Jaklitsch et al. 2018). *Anteaglonium thailandicum* and *A. parvulum* have globose conidiogenous cells and globose conidia that are rounded at both ends (Jayasiri et al. 2016), and *A. rubescens* has lageniform to ampulliform or subglobose conidiogenous cells and subglobose to globose or ellipsoid conidia with 1–2(3) guttules (Jaklitsch et al. 2018). Our species is different from the above three by having ampulliform conidiogenous cells and ellipsoidal to globose or obovoid, eguttulate conidia, occasionally with a rounded apex and tapering at the base. Along with multi-gene phylogeny and morphology, we introduce *Anteaglonium soli* from disturbed cave soils in Thailand. This genus has mainly been isolated as plant saprobes (Boehm et al. 2009, Jayasiri et al. 2016, Jaklitsch et al. 2018, Tan et al. 2022), hence, this becomes the first member isolated from soil habitats.

Astrosphaeriellaceae Phook. & K.D. Hyde (=Caryosporaceae Huang Zhang, K.D. Hyde & Ariyaw.)

Pithomyces Berk. & Broome, J. Linn. Soc., Bot. 14: 100 (1873).

Index Fungorum number: IF 9412; Facesoffungi number: FoF 03611

Pithomyces was introduced by Berkeley & Broome (1873), typified with *Pithomyces flavus*. There are 45 species listed in the Species Fungorum (2025), and six of them have molecular data (Hongsanan et al. 2020a). The asexual morph is hyphomycetous, comprising mononematous, micronematous conidiophores, mostly intercalary, sometimes denticulate, producing mono or polyblastic, hyaline to light brown, aseptate conidiogenous cells. Conidia are solitary, brown to black, obovate to oblong, verruculose, with transverse, dark septa. The sexual morph is characterized by solitary to gregarious, erumpent to superficial ascomata, with a *textura angularis* to *textura prismatica* cell wall, and bitunicate, fissitunicate, 8-spored asci, with overlapping bi-seriate, pale brown to brown, fusiform ascospores. Species are globally reported, including China, Cuba, India, Thailand and the USA, that are associated with aquatic, soil and terrestrial habitats as saprobes (Wanasinghe et al. 2018a, Pem et al. 2024).

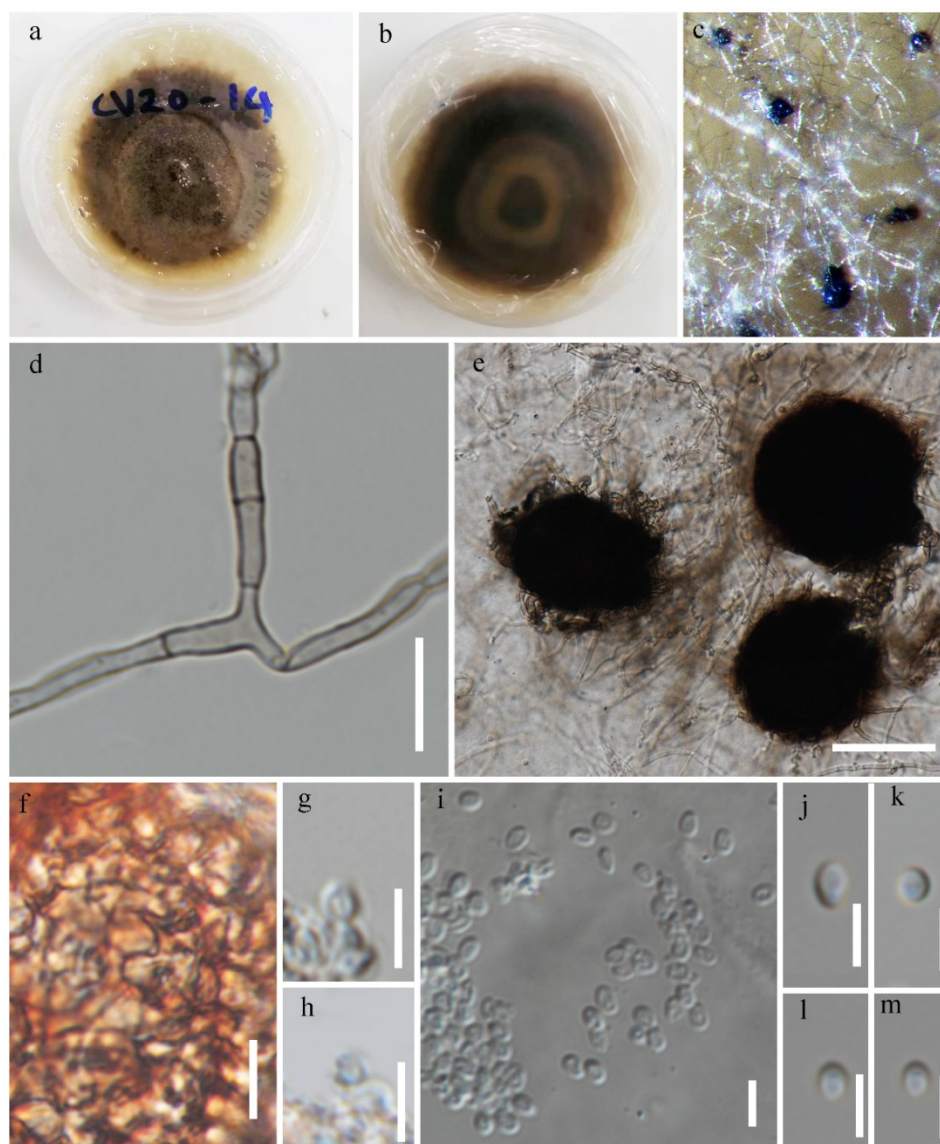


Figure 16 – *Anteaglonium soli* (MFLU 25-0165, Holotype). a, b Culture characters on the PDA (b = reverse). d. Hypha e. Pycnidia. f. Pycnidia wall g, h Conidiogenous cells. i–m. Conidia. Scale bars: e =20 μ m, d = 10 μ m, f–m =5 μ m.

Table 11 *Pithomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pithomyces longiclavisporus</i>	China	Warm temperate area	Liu & Zhang (2007)
<i>P. pallidus</i>			
<i>P. pavgii</i>			

***Coniothyriaceae* W.B. Cooke**

Coniothyrium Corda, Icon. fung. (Prague) 4: 38 (1840).

Index Fungorum number: IF 7765; Facesoffungi number: FoF 08171

Coniothyrium was introduced by Corda (1840) and is typified by *C. palmarum*. Currently, 457 species are included in this genus, and only six the molecular data (Hongsanan et al. 2020a). By providing a comprehensive phylogeny of the combined LSU and ITS sequence data, de Gruyter et al. (2013) accommodate *Coniothyrium* in *Coniothyriaceae*, while erecting this as the type genus of the family. The asexual morph is characterized by pycnidial conidiomata that have broadly, flask-shaped conidiogenous cells and light to dark brown, two-celled conidia. This genus is known

as saprobes or plant pathogens, and some have been found in air and soil habitats with worldwide distribution (de Gruyter et al. 2013).

Table 12 *Coniothyrium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Coniothyrium multiporum</i>	India	Saline soil	de Gruyter et al. (2013)

Corynesporascaceae Sivan., Mycological Research 100: 786 (1996).

Corynespora Güssow, Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz 16: 10 (1906).

Index Fungorum number: IF 7795; Facesoffungi number: FoF 06663

Corynespora was introduced by Güssow (1906) with *C. cassicola* as the type species. Studies have identified *Corynespora* as a polyphyletic genus (Crous et al. 2015b, Hyde et al. 2016, Voglmayr & Jaklitsch 2017), while the phylogenetic revision of Voglmayr & Jaklitsch (2017) transferred several *Corynespora* species to *Helminthosporium*. There are 129 valid species in the genus, however, 13 species have molecular data (Liu et al. 2023a). Thus, more collections are required to build an in-depth phylogeny in the genus. Most of the species have been identified based on the morphological characteristics (Hongsanant et al. 2020a). Most species occur on plant leaves, roots, stems, dead twigs and trunks and have also been reported from human skin, nematode cysts and soils, where they can be saprobes or pathogens (Dixon et al. 2009, Pem et al. 2024). The pathogenic mode causes leaf spots, and is a significant plant pathogenic genus that causes target spot disease worldwide (Koenning et al. 2006, Schlub et al. 2009, Fulmer et al. 2012).

Table 13 *Corynespora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Corynespora cassicola</i>	Thailand	Agricultural field	Kamolmanit et al. (2013)

Cucurbitariaceae G. Winter (= *Fenestellaceae* M.E. Barr)

Neocucurbitaria Wanas., E.B.G. Jones & K.D. Hyde, Mycosphere 8(3): 408 (2017).

Index Fungorum number: IF 552832; Facesoffungi number: FoF 02902

Neocucurbitaria was introduced by Wanasinghe et al. (2017a) with morpho-molecular (LSU, SSU and ITS) analyses while accommodating *N. unguis-hominis* as the type species. The genus comprises 29 species (Species Fungorum 2025), and all have been supported with molecular data. The coelomycetous asexual morph is pycnidial, globose to sub-globose, with hyaline, septate, doliiform to cylindrical conidiogenous cells, and hyaline, aseptate, cylindrical or ellipsoidal, smooth-walled conidia. The sexual morph is characterized by black, superficial to semi-immersed, globose, ostiolate ascomata with a peridium comprised of *textura angularis* cells. Asci are 8-spored, bitunicate, fissitunicate, cylindrical, short-pedicellate, comprising muriform, mostly ellipsoidal ascospores with 6–8 transverse septa and a longitudinal septum (Sutton 1980, Wanasinghe et al. 2017a). Species have been isolated from Australia, Italy, Spain, the Netherlands and the USA. In addition, they have been recorded as saprobes on leaves and wood, from human lungs, corneal scrapings and wounds, sea water and one species from soil (Wanasinghe et al. 2017a, Valenzuela-Lopez et al. 2018, Pem et al. 2024).

Table 14 *Neocucurbitaria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Neocucurbitaria cava</i>	Germany	ND	Valenzuela-Lopez et al. (2018)

Neodendryphiella Iturrieta-González, Dania García & Gené, MycoKeys 37: 25 (2018) Fig. 17
Index Fungorum number: IF 824664; Facesoffungi number: FoF 08214

Iturrieta-González et al. (2018) introduced *Neodendryphiella* based on morpho-molecular analyses (ITS and LSU), with the type species, *N. tarraconensi* (Iturrieta-González et al. 2018). *Neodendryphiella* presently comprises four species in Species Fungorum (2025), and all of them have molecular data. The asexual morph is hyphomycetous and has conidiophores that are subhyaline to brown, smooth to verrucose, semi-macronematous to macronematous, mononematous, erect, or slightly flexuous, cylindrical, septate and unbranched or branched towards the apical region. Conidiogenous cells are integrated, terminal or intercalary, and produce conidia in acropetal branched chains. Of these, ramoconidia are pale brown, aseptate or septate, smooth to verruculose cylindrical or subcylindrical, while conidia are blastocatenate, pale brown, aseptate or septate, verruculose to verrucose, ellipsoidal, doliiform and clavate. The sexual morph remains undiscovered. *Neodendryphiella* species have been reported from dung, dead stems, leaves and soil in China, Italy, Mexico and Spain (Iturrieta-González et al. 2018, Dong et al. 2023, Pem et al. 2024).

Table 15 *Neodendryphiella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Neodendryphiella</i> <i>michoacanensis</i>	Mexico	City area	Iturrieta-González et al. (2018)
<i>N. tarraconensis</i>	Spain	Garden	

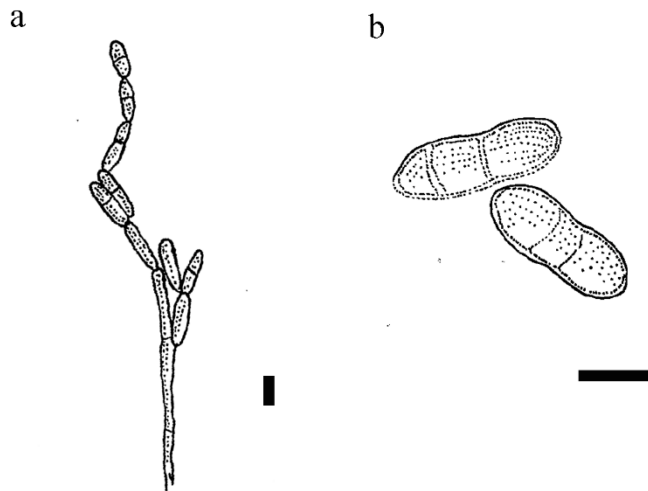


Figure 17 – *Neodendryphiella tarraconensi* (FMR 16234) a Conidiophores. b Conidia. Scale bars: a, b = 10 µm. Redrawn from Iturrieta-González et al. (2018).

Didymellaceae Gruyter, Aveskamp & Verkley (= *Microsphaeropsidaceae* Qian Chen et al.)

Ascochyta Lib., Plantae Cryptogamae, quas in Arduenna collegit Fasc. 1: 8 (1830).

Index Fungorum number: IF 7239; Facesoffungi number: FoF 07121

Ascochyta was introduced by Klotzsch (1830), and *A. pisi* is designated as the type species (Boerema & Bollen 1975). Currently, 25 species are valid under the genus, and all of them have molecular data (Gomzhina & Gasich 2024). The asexual morph of this genus has pycnidial, subglobose or ampulliform to mammiform, superficial or immersed, solitary, or confluent conidiomata with an ostiolate or poroid opening. Conidiogenous cells are annellidic or phialidic,

and conidia are hyaline or slightly coloured (yellow to pale brown), variably-shaped (ovoid, oblong, subcylindrical, ellipsoidal, cymbiform or allantoid), mostly uniseptate, sometimes 2–3-septate, eguttulate or guttulate. The sexual morph has pseudothecial, immersed or erumpent, subglobose to flattened, or irregular, solitary or confluent, and ostiolate ascomata. Asci are bitunicate, 8-spored, subcylindrical to subclavate, or saccate. Pseudoparaphyses present but disappear at maturity and ascospores are ovoid to ellipsoidal, slightly biconic, hyaline to yellowish and become brown after release, 1–3-septate and constricted at the septum (Mel’nik 2000, Chen et al. 2015). Some *Ascochyta* species are plant pathogens of cereal crops and legumes, and several species show host specificity on *Campanulaceae*, *Chenopodiaceae*, *Leguminosae*, *Poaceae*, *Solanaceae* and *Umbelliferae* (Valenzuela-Lopez et al. 2018, Hongsanan et al. 2020a). It is a ubiquitous genus with a global distribution, occurring in aquatic and terrestrial environments including dead stems, leaves and soils (Hou et al. 2020a, Pem et al. 2024).

Table 16 *Ascochyta* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Ascochyta clinopodiicola</i>	USA	Canyonlands National Park	Hou et al. (2020b)
<i>A. benningiorum</i> <i>A. syringae</i>	The Netherlands	Garden soil	Hou et al. (2020a)

Cumuliphoma Valenz.-Lopez, Stchigel, Crous, Guarro & Cano, Stud. Mycol. 90: 38 (2017).

Index Fungorum number: IF 819878; Facesoffungi number: FoF 08220;

Cumuliphoma was introduced by Valenzuela-Lopez et al. (2018) with comprehensive multi-loci phylogenetic analyses (LSU, ITS, *TUB2* and *RPB2*) and morphology. This genus is typified by *Cumuliphoma omnivirens*. It currently comprises four species (Species Fungorum 2025), and molecular data is provided for all of them. The asexual morph is characterized by brown, globose, glabrous, pycnidial conidiomata that are mostly confluent, and hyaline, ellipsoidal to cylindrical, smooth-walled and aseptate conidia. The sexual morph is not reported. Chlamydospores are absent in most species and have only been observed in *C. omnivirens*. *Cumuliphoma* is reported from human clinical samples, plant materials and soil habitats in Belgium, China, India and the USA (Valenzuela-Lopez et al. 2018).

Table 17 *Cumuliphoma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cumuliphoma indica</i>	Papua New Guinea	Varirata National Park	Valenzuela-Lopez et al. (2018)

Cumuliphoma indica Valenz.-Lopez, Stchigel, Crous, Guarro & Cano, Stud. Mycol. 90: 38 (2017) Fig. 19

Index Fungorum number: IF 819880, Faces of Fungi number: FoF 16704

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 110–120 × 100–110 µm ($\bar{x}$ = 113 × 107.5 µm, n = 10), pycnidial, mostly in groups, rarely solitary, superficial to semi-immersed, dark brown to black, globose, glabrous. *Conidiomata wall* 12.5–18 µm ($\bar{x}$ = 15 µm, n = 10), thick, composed of cells of *textura angularis*. *Conidiogenous cells* 3.5–5 × 2–3.5 µm ($\bar{x}$ = 4 × 2.5 µm, n = 10), hyaline, phialidic, ampulliform, smooth-walled. *Conidia* 2.5–4 × 1.5–2.5 µm ($\bar{x}$ = 3.5 × 2 µm, n = 25), hyaline, aseptate, thick-walled, ellipsoidal to sub-cylindrical, guttulate. *Chlamydospores* absent.

Culture characteristics – *Colonies* on PDA become 4–5 cm diam., after seven days at 25 °C, dark brown to dark grey, reverse brownish grey at the center and dark brown at the edge, undulate-margined, flat, powdery surface. *Hyphae* 2.5–5 µm ($\bar{x}$ = 4 µm, n = 20), hyaline to pale brown, smooth, thin-walled, septate.

Material examined – Thailand, Chiang Rai, What Tham Pha Tong cave, on soil, 99.9038925 N, 20.0918488 E, 430 m, 28 Aug 2022, W.A. Erandi Yasanthika (MFLU 25-0118), living culture 80-cv23-18 = MFLUCC 24-0397.

GenBank numbers – MFLUCC 24-0397: LSU: PQ560071, ITS: PQ560064, *TUB2*: PV535934.

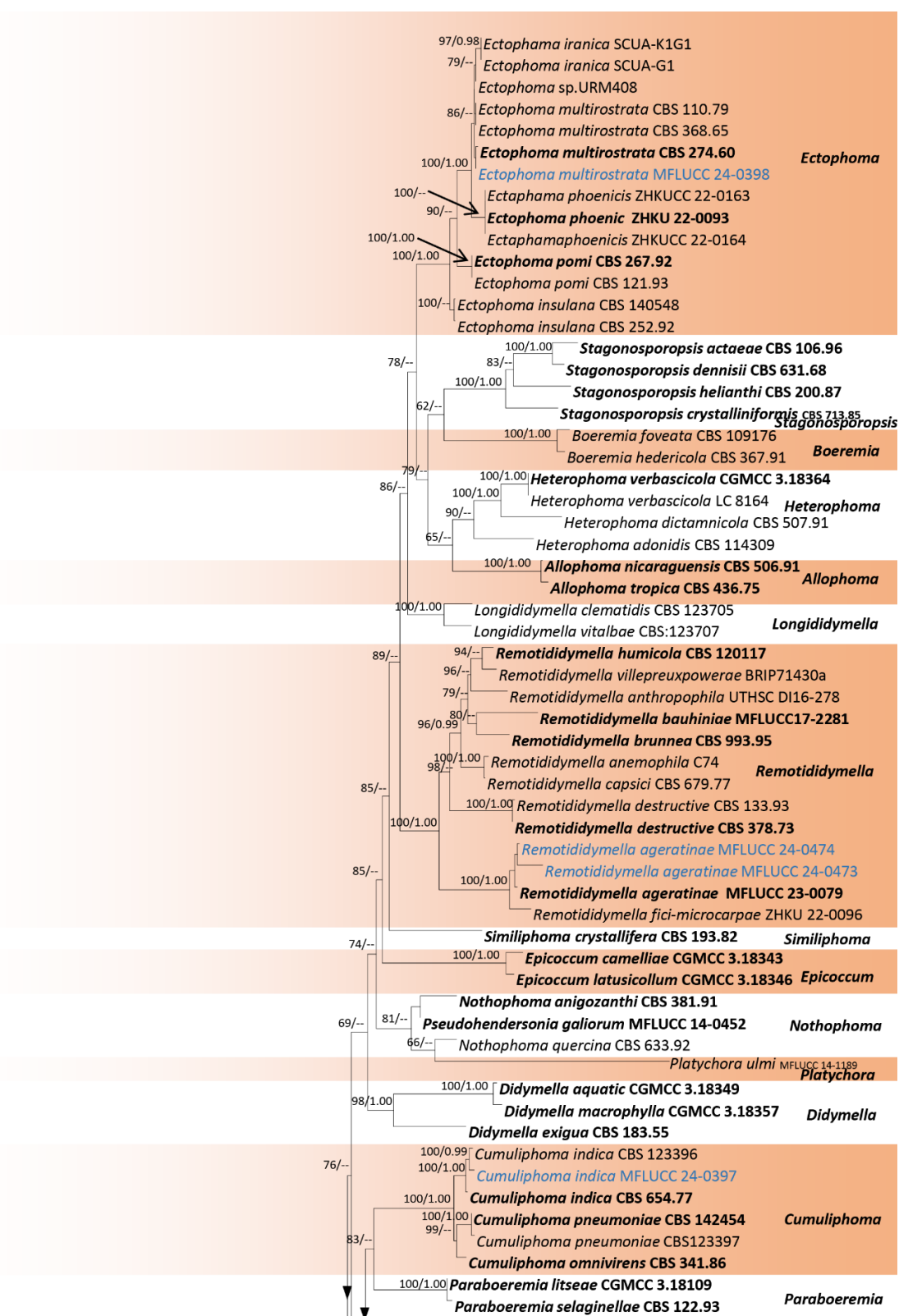


Figure 18 – The best-scoring maximum likelihood tree generated using the combined, ITS, LSU, *RPB2* and *TUB2* sequence data of *Didymellaceae* taxa. Bootstrap support values of maximum

likelihood greater than or equal to 60% and Bayesian posterior probabilities (BYPP) greater than or equal to 0.90 are indicated above the nodes. Newly added strains are in blue, and ex-type strains are in bold. The tree is rooted to *Leptosphaeria conoidea* (CBS 616.75) and *L. doliolum* (CBS 505.75). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 2305 bp, and single gene alignments are ITS: 493 bp, *TUB2*: 312, *LSU*: 904 bp and *RPB2*: 596. The matrix had 1046 distinct alignment patterns, with 24.36% undetermined characters and gaps. Estimated base frequencies were as follows: A = 0.238174, C = 0.244190, G = 0.276056, T = 0.241580; substitution rates AC = 1.788747, AG = 6.334550, AT = 2.067321, CG = 0.907644, CT = 13.561340, GT = 1.000000; gamma distribution shape parameter α = 0.572158.



Figure 18 – Continued

Notes – *Cumuliphoma indica* was introduced by Valenzuela-Lopez et al. (2018) from an unidentified substrate in India and soils in Papua New Guinea. Based on the combined *LSU*, *ITS*, *RPB2* and *TUB2* phylogeny (Figure 18), our strain (MFLUCC 24-0397) grouped with *C. indica* (CBS 654.77) with 100% ML and 1.00 BYPP support. However, *C. lijiangensis* (YMF1.05096) was not included in our analyses as the sequences were not available in GenBank (Chen et al. 2023). When comparing each gene region of our strain (MFLUCC 24-0397) with those of the type species (CBS 654.77), they showed 100% similarity. Our isolate also has similar morphological

characteristics to the type species, including phialidic, hyaline conidiogenous cells and hyaline, aseptate, guttulate conidia (Valenzuela-Lopez et al. 2018). However, the type species has globose to ampulliform conidiogenous cells and smooth- and thin-walled, ellipsoidal to cylindrical conidia, whereas our strain has only ampulliform conidiogenous cells and thick-walled, ellipsoidal to sub-cylindrical conidia (Valenzuela-Lopez et al. 2018). Based on morphology and multi-gene phylogeny, we confirm our strain as *Cumuliphoma indica*. This study reveals the first record of *Cumuliphoma indica* from Thailand soils associated with undisturbed cave environments.

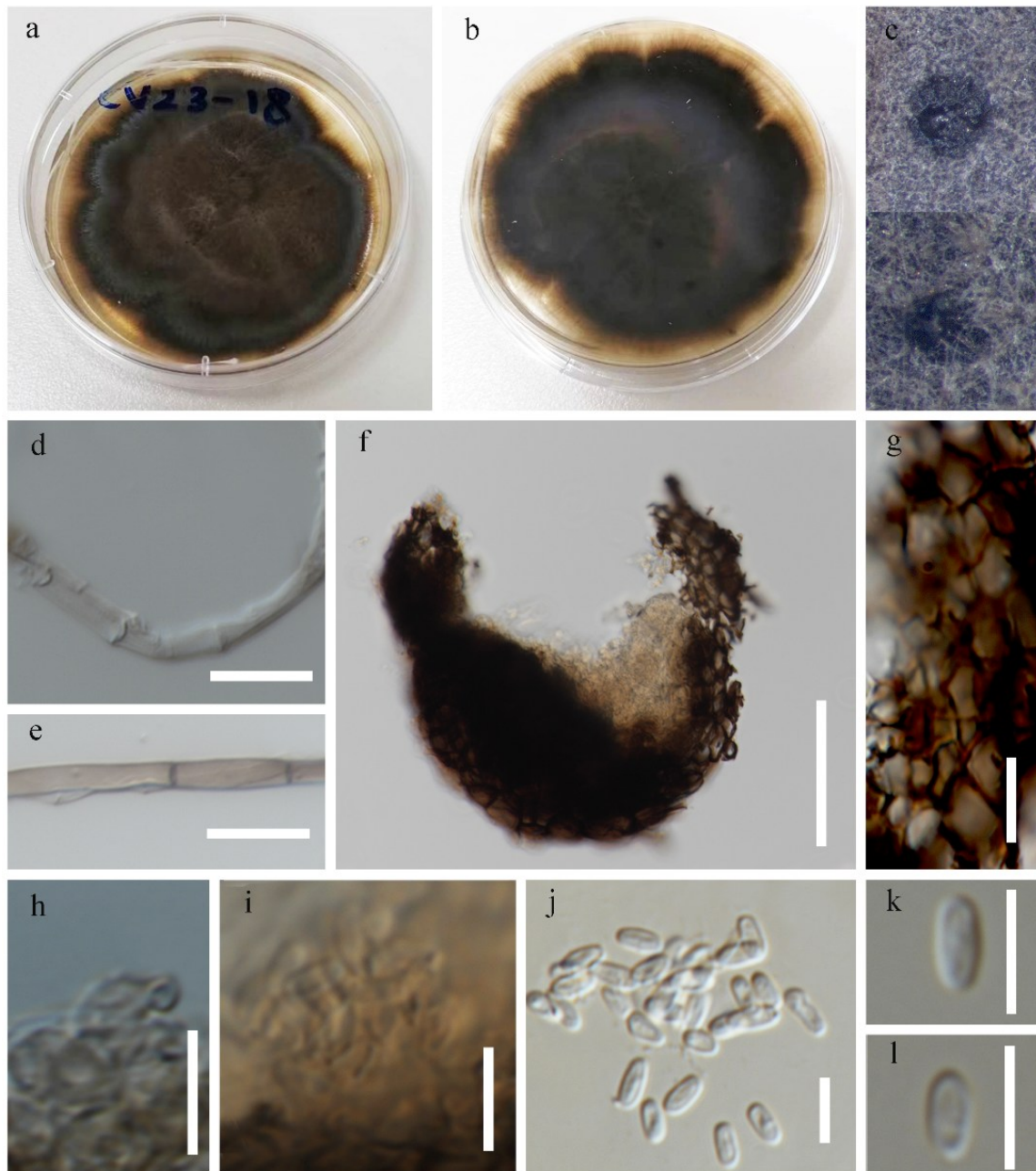


Figure 19 – *Cumuliphoma indica* (MFLU 25-0118). a, b Culture characters on the PDA (b = reverse). d Immature hypha e Mature hyphae. f Pycnidia. g Conidiomata wall h, i Conidiogenous cells. j–l Conidia. Scale bars: d, e =15 µm, f, g = 10 µm, h–l =5 µm.

Didymella Sacc. ex Sacc. Syll. Fung. 1: 545 (1882).

Index Fungorum number: IF 1548; Facesoffungi number: FoF 07278

Saccardo (1882) introduced *Didymella* and accepted *Didymella exigua* as the type species. There are 438 *Didymella* species epithets listed in the Species Fungorum (2025). However, based on the morpho molecular study of Chen et al. (2015), restricted *Didymella* as a monophyletic genus, which currently includes 87 species. The asexual morph is characterized by pycnidial, subglobose to ellipsoidal or irregular, superficial or immersed, ostiolate or poroid conidiomata. Conidiogenous cells are phialidic, hyaline, smooth, flask-shaped, ampulliform or doliiform and produce aseptate, hyaline variably shaped (ellipsoidal to subglobose, cylindrical, oblong, ovoid, sometimes allantoid) and mostly guttulate conidia. The sexual morph has pseudothecial, immersed or erumpent, (sub-)globose to flattened, solitary or confluent, ostiolate ascomata with 2–5(–8)-layered, pseudoparenchymatous cell wall. Asci are bitunicate, 8-spored, cylindrical to clavate or saccate, comprising hyaline or brownish, ellipsoidal to cymbiform, uniseptate ascospores that are constricted at the septum (Chen et al. 2015, Jayasiri et al. 2017). Most species produce chlamydospores, allowing them to survive in the soil for several years after the decay of the host tissues (Tivoli & Banniza 2007, Hou et al. 2020). Most of the species are ubiquitous, and present as pathogens, endophytes and saprobes in soils and some inorganic substrates, such as asbestos, cement, and paint (Chen et al. 2015, Jayasiri et al. 2017).

Table 18 *Didymella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Didymella degraaffiae</i>	The Netherlands	Garden soil	Hou et al. (2020a)
<i>D. mitis</i>	South Africa	Near a city, Namibia desert	Hou et al. (2020b)
<i>D. prolaticolla</i>	Namibia	Desert	
<i>D. guttulata</i>	Zimbabwe	Deciduous forest	
<i>D. calidophila</i>	Egypt	ND	Chen et al. (2015)

Ectophoma Valenz.-Lopez, Cano, Crous, Guarro & Stchigel, Stud. Mycol. 90: 34 (2017).

Index Fungorum number: IF 819952; Facesoffungi number: FoF 08221

Ectophoma was introduced by Valenzuela-Lopez et al. (2018) based on morphology and multi-gene phylogeny (LSU, ITS, *TUB2* and *RPB2*) in *Didymellaceae* to accommodate two species, *E. multirostrata* and *E. pomi*. The type species is *Ectophoma multirostrata*, which was previously known as *Phoma multirostrata* (Aveskamp et al. 2010, Valenzuela-Lopez et al. 2018). Currently, seven *Ectophoma* species are listed in the Species Fungorum (2025), and all have molecular data. The sexual morph is unknown, and the asexual morph is characterized by pycnidial, brown to dark brown conidiomata with one or more short necks and phialidic, hyaline conidiogenous cells that produce aseptate, hyaline, oblong to ellipsoidal, smooth-walled, guttulate conidia. Species have been isolated from soil and different woody and herbaceous plants and fruits as saprobe, endophyte or opportunistic plant pathogens from Greece, India, Iran, South Africa, and the Netherlands and one species has been reported from soil (Valenzuela-Lopez et al. 2018, Larki et al. 2019, Kularathnage et al. 2023).

Table 19 *Ectophoma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Ectophoma multirostrata</i>	India	Poultry farm	Valenzuela-Lopez et al. (2018)

Ectophoma multirostrata (P.N. Mathur, S.K. Menon & Thirum.) Valenz.-Lopez, Cano, Crous, Guarro & Stchigel, Stud. Mycol. 90: 34 (2017) Fig. 20

Index Fungorum number: IF 819953, Faces of Fungi number: FoF 11508

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 125–130 × 108–112 µm ($\bar{x}$ = 128 × 110 µm, n = 10), pycnidial, solitary and confluent, superficial, brownish-black, globose to subglobose, apapillate, glabrous, with pycnidial wall of *textura angularis*. *Conidiogenesis cells* 3–4 × 1.5–3.5 µm ($\bar{x}$ = 3.5 × 2.5 µm, n = 10), hyaline, phialidic, smooth-walled. *Conidia* 4–4.5 × 1–2.5 µm ($\bar{x}$ = 3 × 1.5 µm, n = 25), hyaline, oval, ellipsoidal to subcylindrical, mostly with 1–2 polar guttules or eguttulate, smooth-walled. *Chlamydospores* not present.

Culture characteristics – *Colonies* on PDA become 3–4 cm diam., after seven days at 25 °C, whitish grey surface, reverse brown-black, undulate-margined, flat woolly surface. *Hyphae* hyaline, aseptate, becoming pale brown and septate, when mature, smooth, thin-walled 1.5–5 µm ($\bar{x}$ = 3 µm, n = 20) wide.

Material examined – Thailand, Chiang Rai city, on soil (near a Café), 19.983438 N, 99.892159 E, 384 m, 17 Oct 2022, W.A. Erandi Yasanthika (MFLU25-0178); living culture 109-u3-1 = MFLUCC 24-0398.

GenBank numbers – MFLUCC 24-0398: LSU: PQ559824, ITS: PQ559838, *RPB2*: PV523931, *TUB2*: PV535933.

Notes – Multi-gene phylogeny (LSU, ITS, *RPB2* and *TUB2*) in Figure 18 confirms that our strain (MFLUCC 24-0398) grouped with *Ectophoma multirostrata* with 100% ML and 1.00 BYPP statistical support. In our analyses (Figure 18), *E. myriophyllana* YMF1.05050 (Chen et al. 2023) has not been included as the sequences were unavailable in GenBank. Each gene region showed 100% similarity when compared between our strain (MFLUCC 24-0398) and those of the type species of *Ectophoma multirostrata* (CBS 274. 60). Further, our strain has comparable morphology with the type species, including globose to subglobose, glabrous, solitary and confluent pycnidia and hyaline, oval, ellipsoidal to subcylindrical, mostly 1–2 polar guttules, and sometimes eguttulate conidia (Boerema et al. 2004, Valenzuela-Lopez et al. 2018). By considering the morphology and phylogenetic evidence, we confirm our isolate (MFLUCC 24-0398) as *E. multirostrata*. This species has previously been reported from poultry farm soil in India and the stem of *Cucumis sativus* in the Netherlands (Valenzuela-Lopez et al. 2018). This study investigates the first record of *E. multirostrata* from Thailand from urban soils.

Epicoccum Link, Mag. Gesell. naturf. Freunde, Berlin 7: 32 (1816) [1815].

Index Fungorum number: IF 8188; Facesoffungi number: FoF 08222

Epicoccum was introduced by Link (1815) with its type species *E. nigrum*. Currently, 149 species are listed in the Species Fungorum (2025), and there are 43 species with molecular data (Wang et al. 2024b). The asexual morph has sporodochia on cultures and natural substrates. Conidia are globose to pyriform with a funnel-shaped base and broad attachment scar (Domsch et al. 1993). Chen et al. (2015) further specified the morphology as irregular, pycnidial conidiomata and subcylindrical-shaped conidia. Culture sporulation can be induced by black light. Most of the *Epicoccum* species are plant pathogens and can also be endophytes (Chen et al. 2015) and are associated with air, animals, aquatic habitats, humans and soil (Abdel-Azeem et al. 2021). Species are distributed in China, Egypt, Indonesia, Italy, Korea, Romania, Papua New Guinea and the USA (Guiraud et al. 1995, Samiksha & Sanjeev 2021, Tian et al. 2024).

Table 20 *Epicoccum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Epicoccum brahmansense</i>	Papua New Guinea	Tropical forest	Hou et al. (2020b)

<i>E. draconis</i>	Korea	Tobacco field	Ayim et al. (2020)
<i>E. mackenziei</i>	Kashmir valley	Agricultural soil	Amin et al. (2024)
<i>E. nigrum</i>	ND	Dead Sea valley	Guiraud et al. (1995)
<i>E. pimprinum</i>	India	ND	Aveskamp et al. (2010)
<i>E. sorghi</i>	Papua New Guinea	Near a national park	
<i>E. tobaicum</i>	Indonesia	Heath soil	Hou et al. (2020b)

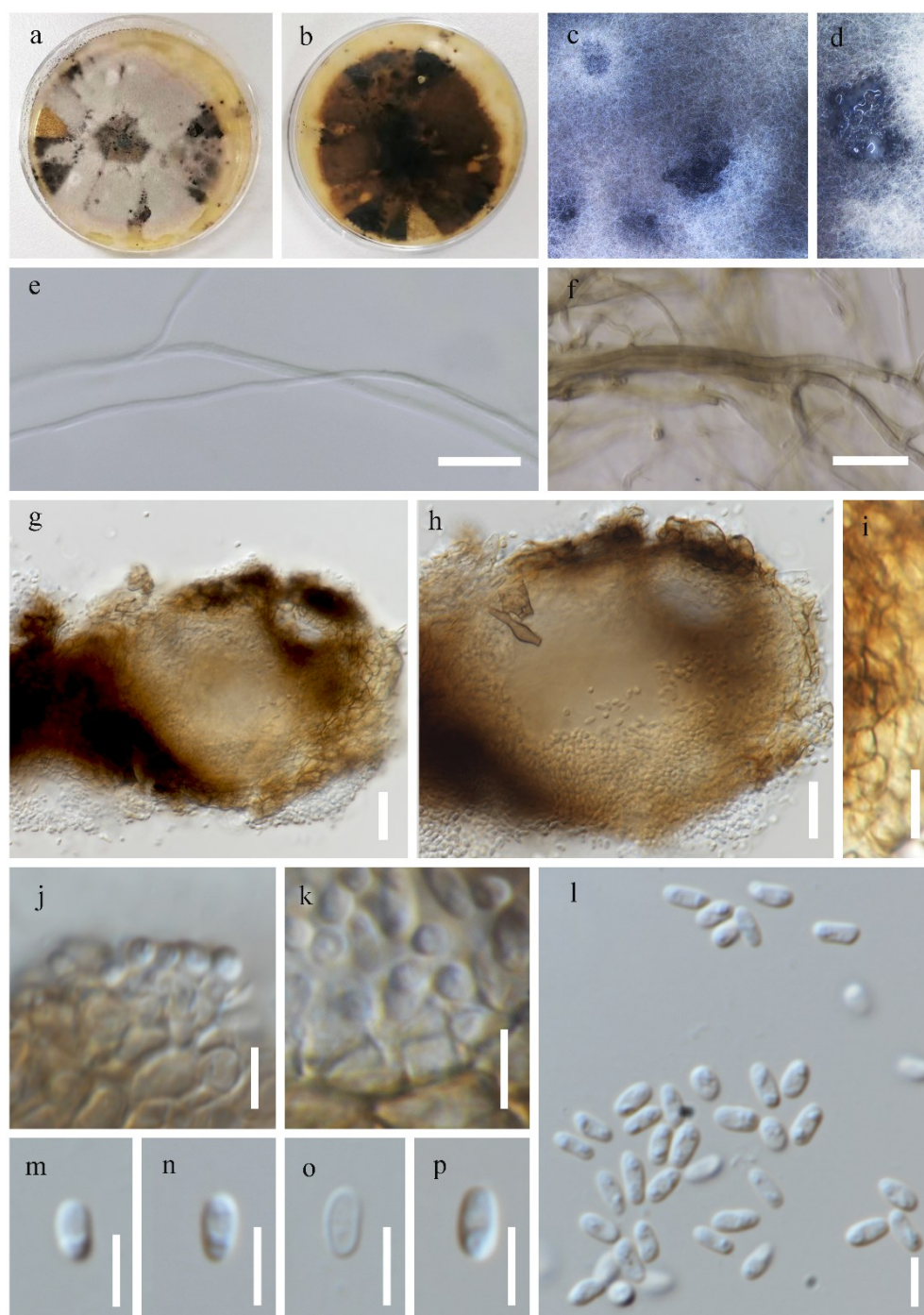


Figure 20 – *Ectophoma multirostrata* (MFLU 25-0178). a, b Culture characters on the PDA (b = reverse). c, d. Pycnidia form on the culture. e Immature hypha. f. Mature hyphae. g. Pycnidia. h. Pycnidia with conidial matrix and conidia i. Pycnidial wall. j, k. Conidiogenous cells. l–p. Conidia. Scale bars: d, e, g = 20 μ m, i = 10 μ m, j–p = 5 μ m.

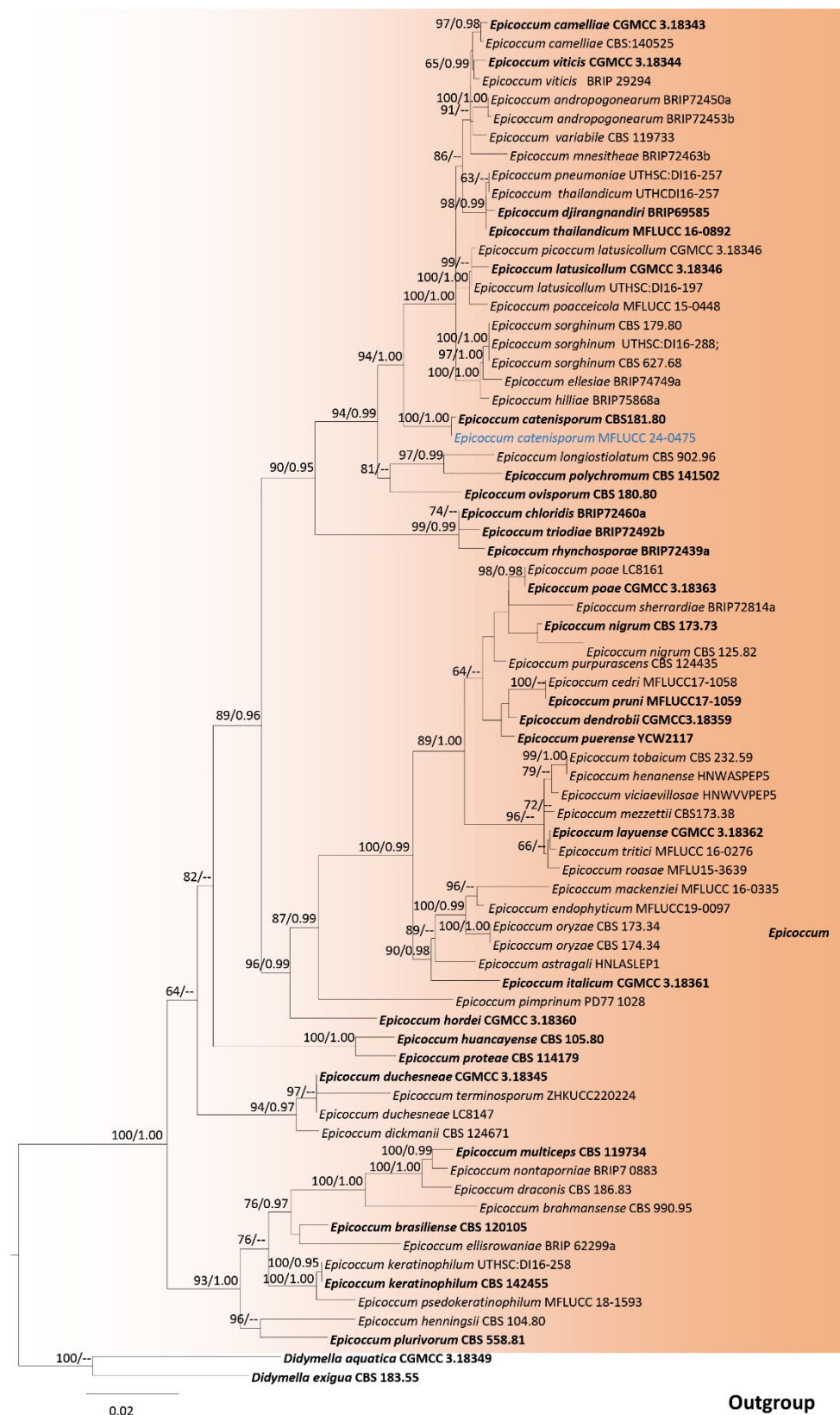


Figure 21 – The best-scoring maximum likelihood tree generated of the combined LSU and ITS, *RPB2* and *TUB2* sequence data for *Epicoccum*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Didymella aquatica* (CGMCC 3.18349) and *D. exigua* (CBS 183.55). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate

length of the combined alignment is 2531 bp, and single gene alignments are ITS: 469 bp, LSU: 871 bp, *TUB2*: 306 and *RPB2*: 885bp. The matrix had 632 distinct alignment patterns with 22.49% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.250, C = 0.250 G = 0.250, T = 0.250; substitution rates AC = 1.00000, AG = 4.26929, AT = 1.00000, CG = 1.00000, CT = 9.28992, GT = 1.00000; gamma distribution shape parameter α = 0.794.

Epicoccum catenisorum Valenz.-Lopez, Stchigel, Crous, Guarro & Cano, Stud. Mycol. 90: 30 (2017) Fig. 22

Index Fungorum number: IF 819762, Facesoffungi number: FoF 16706

Sexual morph: Undetermined. Asexual morph: Chlamydosporous. *Chlamydospores* 4.5–11.5 × 4–9 μm ($\bar{x}$ = 8 × 6 μm , n = 25), brown, globose to subglobose or ellipsoidal, terminal or intercalary, produced from mature hyphae, solitary, or simple or branched chains, smooth-walled.

Culture characteristics – *Colonies* on PDA become 3–4 cm diam. after 7 days at 25 °C, whitish brown at the center, white at the middle and brownish at the edge, reverse brownish orange, undulate-margined, raised surface. *Hyphae* hyaline and become sub-hyaline to brown when mature, septate, 1.5–4.5 μm ($\bar{x}$ = 3 μm) wide, superficial to semi-immersed, branched, immature hyphae become pale brown, septate when mature.

Material examined – Thailand, Chiang Rai city, on soil (near a Café), 19.983438N, 99.892159E, 384 m, 17 Oct 2022, W.A. Erandi Yasanthika (MFLU 25-0128), living culture 111-u3-7 = MFLUCC 24-0475.

GenBank numbers – MFLUCC 24-0475: LSU: PQ568013, ITS: PQ567558, *RPB2*: PV615281 *TUB2*: PV535935.

Notes – According to multi-gene phylogeny (Figure 21), our strain (MFLUCC 24-0475) grouped with the type species of the *Epicoccum catenisorum* with 100% ML, 1.00 BYPP statistical support. Each gene region of our strain and the type species showed that they have 100% similarity. *Epicoccum catenisorum* was introduced by Valenzuela-Lopez et al. (2018) from a leaf spot of *Oryza sativa* in Guinea-Bissau, and it has later been isolated from tea plant leaves in China (Wang et al. 2024b). The type species is characterized by brown to dark brown, solitary, superficial and immersed glabrous, subglobose pycnidia and phialidic, hyaline, smooth-walled, doliiform or ampulliform conidiogenous cells and aseptate, hyaline, smooth- and thin-walled, ovoid or ellipsoidal, guttulate conidia (Valenzuela-Lopez et al. 2018). However, our collection only produced chlamydospores without forming other asexual or sexual structures. Comparing the chlamydospore characteristics, we observed that our isolate is similar to the type species by having dark brown, smooth- and thick-walled, ellipsoidal to ovoid chlamydospores singly or in chains (Valenzuela-Lopez et al. 2018). Based on the results, we confirm our collection (MFLUCC 24-0475) as *Epicoccum catenisorum* collected in an urban area in Thailand. This becomes the first record of the species present in the soil.

Juxtiphoma Valenzuela-Lopez, Cano, Crous, Guarro & Stchigel, Stud. Mycol. 90: 40 (2017) Fig. 23

Index Fungorum number: IF 821111; Facesoffungi number: FoF 08224

Juxtiphoma was erected by Valenzuela-Lopez et al. (2018) using morphology and multi-gene phylogeny (LSU, ITS, *RPB2* and *TUB2*). The type species is designated as *J. eupyrena* isolated from *Solanum tuberosum* (Saccardo 1879). *Juxtiphoma* has three species listed in the Species Fungorum (2025), all of which are supported by molecular data. The asexual morph is characterized by pycnidial conidiomata, aseptate, hyaline, smooth- and thin-walled, ovoid, ellipsoidal or cylindrical, biguttulate conidia. Chlamydospores are aseptate, ochraceous-brown and single or in chains. Species are recorded from various soils, including volcanic, steam- and formalin-treated soils and activated sludge. These species have been isolated from soils in China, Germany, Iceland, India, Malaysia, the British Isles, the Netherlands, and the USA (Domsch et al. 1993, Valenzuela-Lopez et al. 2018, Hou et al. 2020). *Juxtiphoma eupyrena* inhabits mostly soil saprobic fungi, however also can cause damping off of seedlings and woody plants (Boerema et al. 2004).

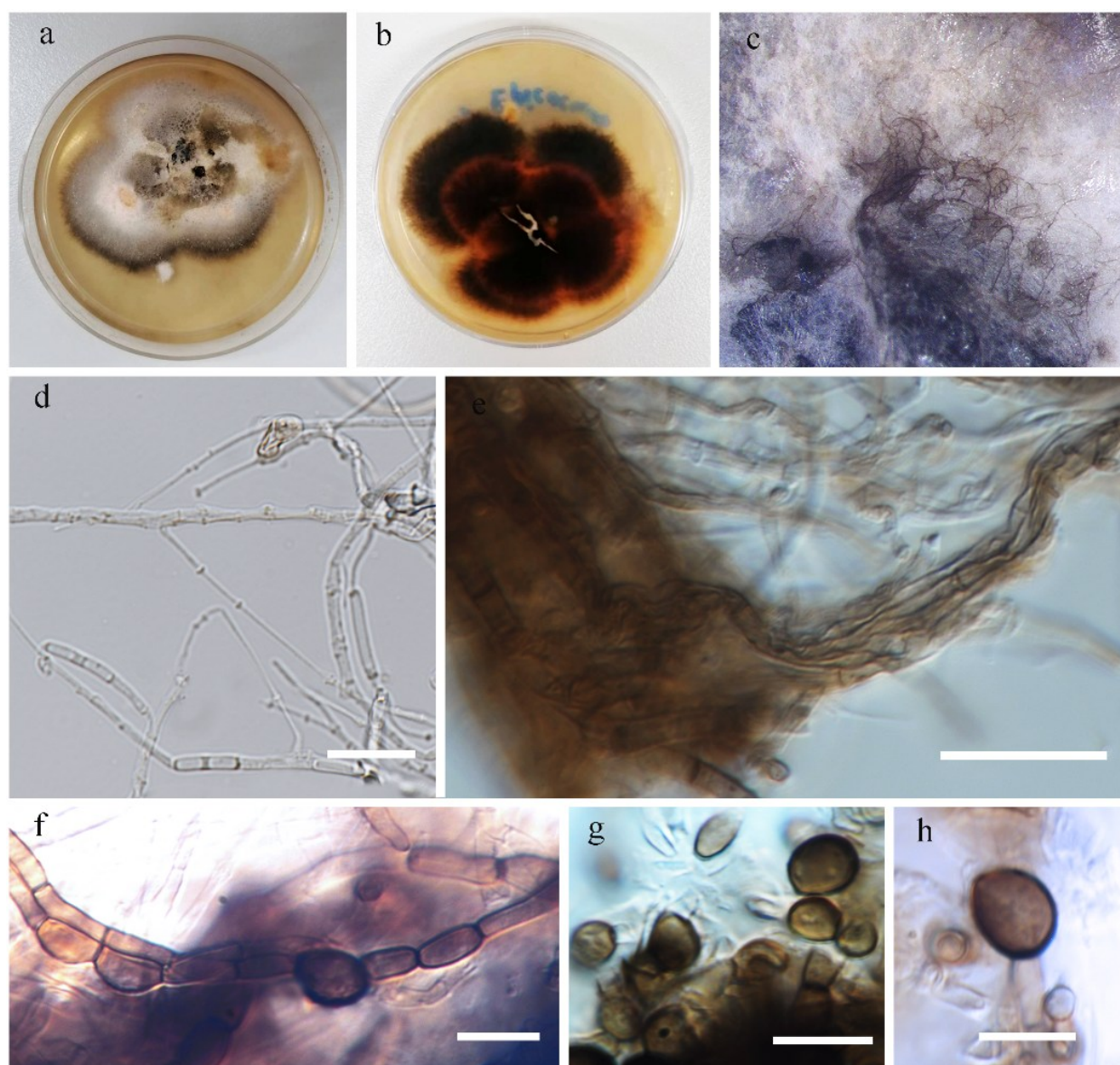


Figure 22 – *Epicoccum catenisporem* (MFLU 25-0128) a, b culture characters on PDA (b = reverse). c Mycelia appear in the colony. d Immature aseptate hyphae e Mature septate hyphae. f Intercalary chained chlamydospores. g Solitary chlamydospores. h Solitary terminal chlamydospores formation. Scale bars: d, e = 20 μm , f–h = 10 μm .

Table 21 *Juxtiphoma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Juxtiphoma eupyrena</i>	Germany	Wheat field soil	Domsch et al. (1993)
<i>J. kolkmaniorum</i>	Canada	Cave	Hou et al. (2020a),
<i>J. kolkmaniorum</i>	Germany	Wheat field soil	Valenzuela-Lopez et al. (2018)
<i>J. kolkmaniorum</i>	The Netherlands	Garden soil	
<i>J. yunnanensis</i>	China	Contaminated soil	Yasanthika et al. (2021)

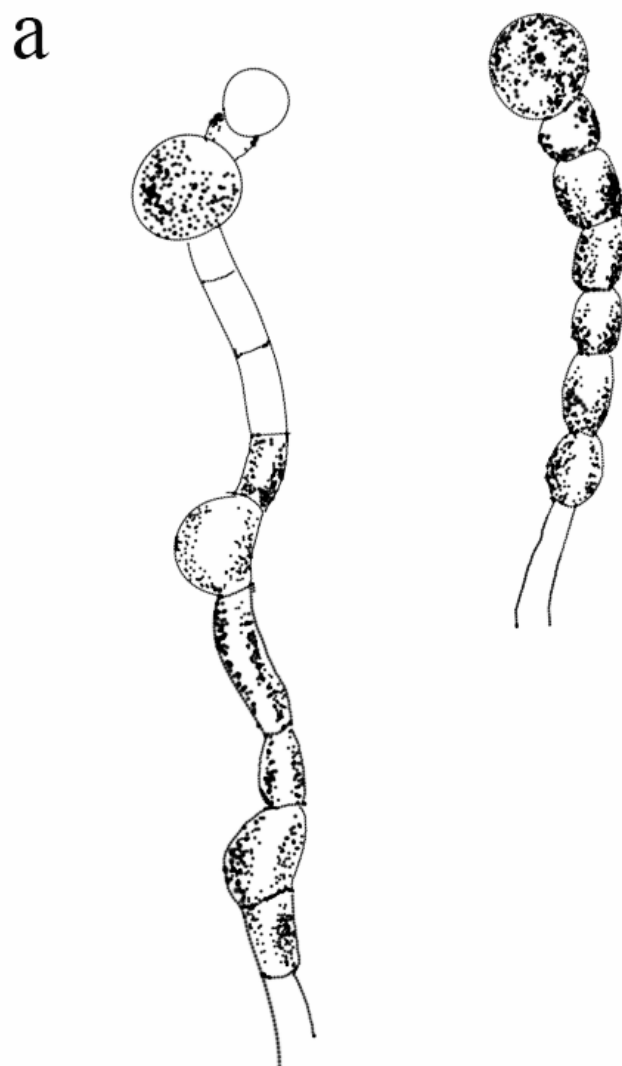


Figure 23 – *Juxtiphoma eupyrena*. a Chlamydospores. Redrawn from Domsch et al. 1980

Neoascochyta Q. Chen & L. Cai, Stud. Mycol. 82: 198 (2015).

Fig. 24

Index Fungorum number: IF 814064; Facesoffungi number: FoF 07462

Neoascochyta was introduced by Chen et al. (2015) based on LSU, ITS, *RPB2* and *TUB2* phylogeny and morphological support, accommodating *N. exitialis* as the type species. The genus comprises 21 species (Species Fungorum 2025), and all of them are supported by molecular data. *Neoascochyta* and *Ascochyta* have similar morphology but are phylogenetically distinct (Chen et al. 2015). The asexual morph is characterized by pycnidial, globose to subglobose, or irregular, superficial or immersed, ostiolate conidiomata, and pseudoparenchymatous pycnidial wall. Conidiogenous cells are phialidic, globose to flask-shaped, short obpyriform, or ampulliform to doliiform and produce variably shaped (fusoid to cylindrical, obclavate-ovoid to ellipsoidal), hyaline, smooth- and thin-walled, uniseptate or aseptate, eguttulate or guttulate conidia. The sexual morph has pseudothecial immersed or erumpent, solitary or confluent, globose to subglobose, and ostiolate ascomata. Asci are cylindrical to subclavate, slightly curved, short pedicellate or sessile, 8-spored, bitunicate, and cylindrical to ovoid, ellipsoidal, hyaline, 1-septate ascospores that are constricted at the septum (Chen et al. 2015). *Neoascochyta* species occur in clinical samples, dead and living plant materials and two species from soil in Argentina, China, Germany, Italy, New Zealand, Norway and the USA (Chen et al. 2015, Valenzuela-Lopez et al. 2018, Pem et al. 2024).

Table 22 *Neosascochyta* species isolated from soil

Species	Country	Habitat or soil type		References
<i>Neosascochyta humicola</i>	USA	Near a city		Hou et al. (2020b)
<i>N. soli</i>	China	Kuankuoshui Geopark	National	Valenzuela-Lopez et al. (2018)

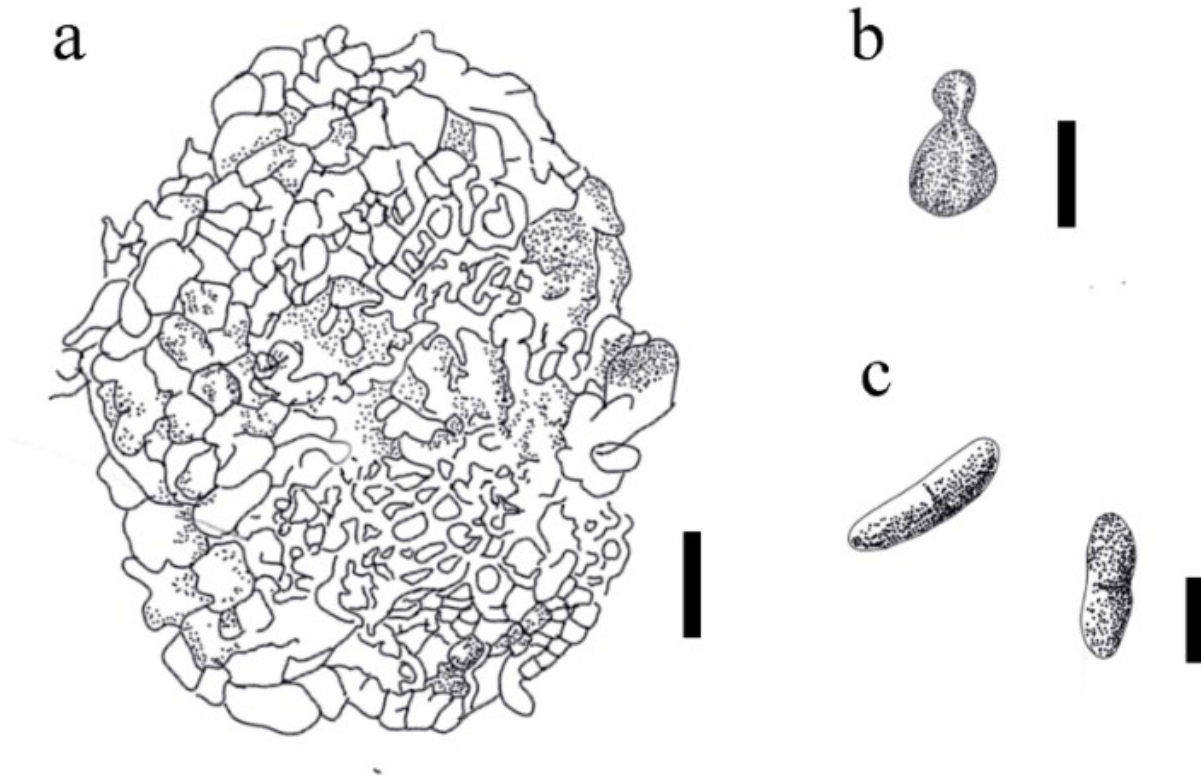


Figure 24 – *Neosascochyta exitialis* (CBS 389.86). a Pycnidial section. b Conidiogenous cell. c Conidia. Scale bars: a = 20 µm, b, c = 10 µm. Redrawn from Chen et al. (2015).

Neodidymelliopsis Qian Chen & L. Cai, Stud. Mycol. 82: 207 (2015). Fig. 25
Index Fungorum number: IF 814066; Facesoffungi number: FoF 07518
Chen et al. (2015) introduced *Neodidymelliopsis* with its type species *N. cannabis*, based on LSU, ITS, *RPB2* and *TUB2* phylogeny and morphological support. *Neodidymelliopsis* comprises 15 species (Species Fungorum 2025), and all of them have molecular data. The asexual morph has pycnidial, globose to subglobose, superficial or immersed, ostiolate, conidiomata with an elongated neck and pseudoparenchymatous wall. Conidiogenous cells are phialidic, hyaline, smooth, flask-shaped, ampulliform to short cylindrical, that produce smooth- and thin-walled, hyaline to pale brown, or pale yellowish, aseptate to 1-septate, guttulate conidia in variable shapes (ovoid to ellipsoidal, cylindrical, allantoid). The sexual morph has pseudothecial, immersed or erumpent, subglobose to pyriform, solitary or confluent, ostiolate ascomata having filamentous, aseptate to 3-septate pseudoparaphyses. Asci are cylindrical to clavate, sessile or stipitate, 8-spored, bitunicate and sub-ovoid to oblong, ellipsoidal, hyaline, smooth, 1 to 3-septate, ascospores constricted at the septum. Chlamydospores that are globose to oval, single or in chains can also be present (Chen et al. 2015). The species have been reported from clinical samples (human eye and respiratory tract),

dead plant materials and one species from soil, which are found in Canada, Israel, the Netherlands, the UK, and the USA (Valenzuela-Lopez et al. 2018, Pem et al. 2024).

Table 23 *Neodidymelliopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>N. longicolla</i>	Israel	A desert	Chen et al. (2017)

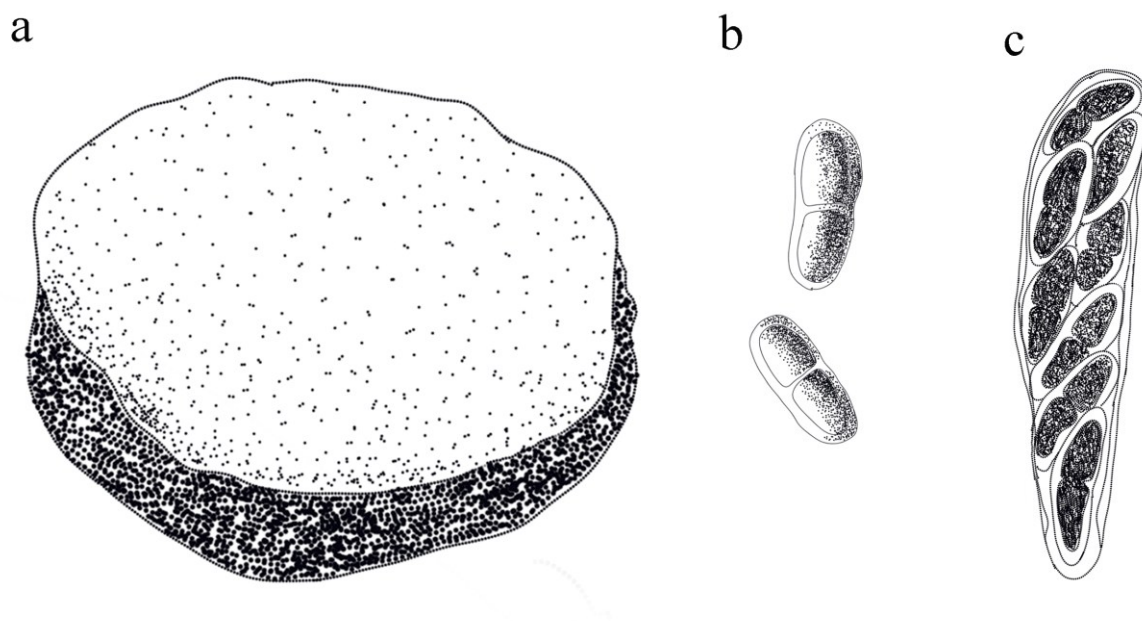


Figure 25 – *Neodidymelliopsis cannabis* a Conidiomata. b Conidia. c Ascus and ascospores. Redrawn from McPartland (1994).

Nothophoma Qian Chen & L. Cai, Stud. Mycol. 82: 212 (2015).

Index Fungorum number: IF 814060; Facesoffungi number: FoF 08227

Chen et al. (2015) introduced *Nothophoma* to accommodate several *Phoma* species based on morpho-molecular (LSU, ITS, *RPB2* and *TUB2*) support, with *Nothophoma infossa* being accepted as the type species. The genus currently comprises 23 species (Species Fungorum 2025), while all of them have molecular data. The asexual morph is characterized by pycnidial, superficial or immersed, globose to elongated, or irregular conidiomata, with phialidic, hyaline, smooth, ampulliform to doliiform conidiogenous cells. Conidia are hyaline, sometimes brown, aseptate, smooth- and thin-walled, with variable shapes (ovoid, oblong to ellipsoidal), eguttulate or guttulate. The sexual morph remains undetermined. These species include saprobes and pathogens that occur on plants, the human body, litter and soil detected in India, the Netherlands, the USA and Ukraine (Chen et al. 2015, Valenzuela-Lopez et al. 2018, Pem et al. 2024).

Table 24 *Nothophoma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Nothophoma brennandiae</i>	The Netherlands	Garden	Hou et al. (2020a)
<i>N. raii</i>	India	Industrial area	Crous et al. (2017a)

Paraboeremia Qian Chen & L. Cai, Stud. Mycol. 82: 183 (2015).

Fig. 26

Index Fungorum number: IF 814061; Facesoffungi number: FoF 08228

Paraboeremia was erected by Chen et al. (2015) and typified with *P. selaginellae*. This genus has 11 species (Species Fungorum 2025), all of which are available with molecular data. Morphologically, *Paraboeremia* is similar to *Boeremia* but has a distinct phylogeny (Chen et al. 2015). The asexual morph has pycnidial, globose to subglobose, irregular-shaped conidiomata. Conidiogenous cells are hyaline, phialidic, globose to flask-shaped and produce hyaline or sometimes greenish, ellipsoidal or curved, smooth- and thin-walled, aseptate, guttulate conidia. The sexual morph has pseudothecial, subglobose to pyriform, ostiolate ascomata, containing 8-spored, bitunicate asci. Ascospores are hyaline, subcylindrical, 1-septate, and constricted at the septum (Chen et al. 2015, Hongsanan et al. 2020a). Species have been isolated from plant materials and soil in China, the Netherlands and the USA (Hou et al. 2020a, Pem et al. 2024).

Table 25 *Paraboeremia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Paraboeremia litseae</i>	The Netherlands	Garden soil	Hou et al. (2020a)
<i>P. putaminum</i>			
<i>P. rekkeri</i>			
<i>P. truiniarum</i>			

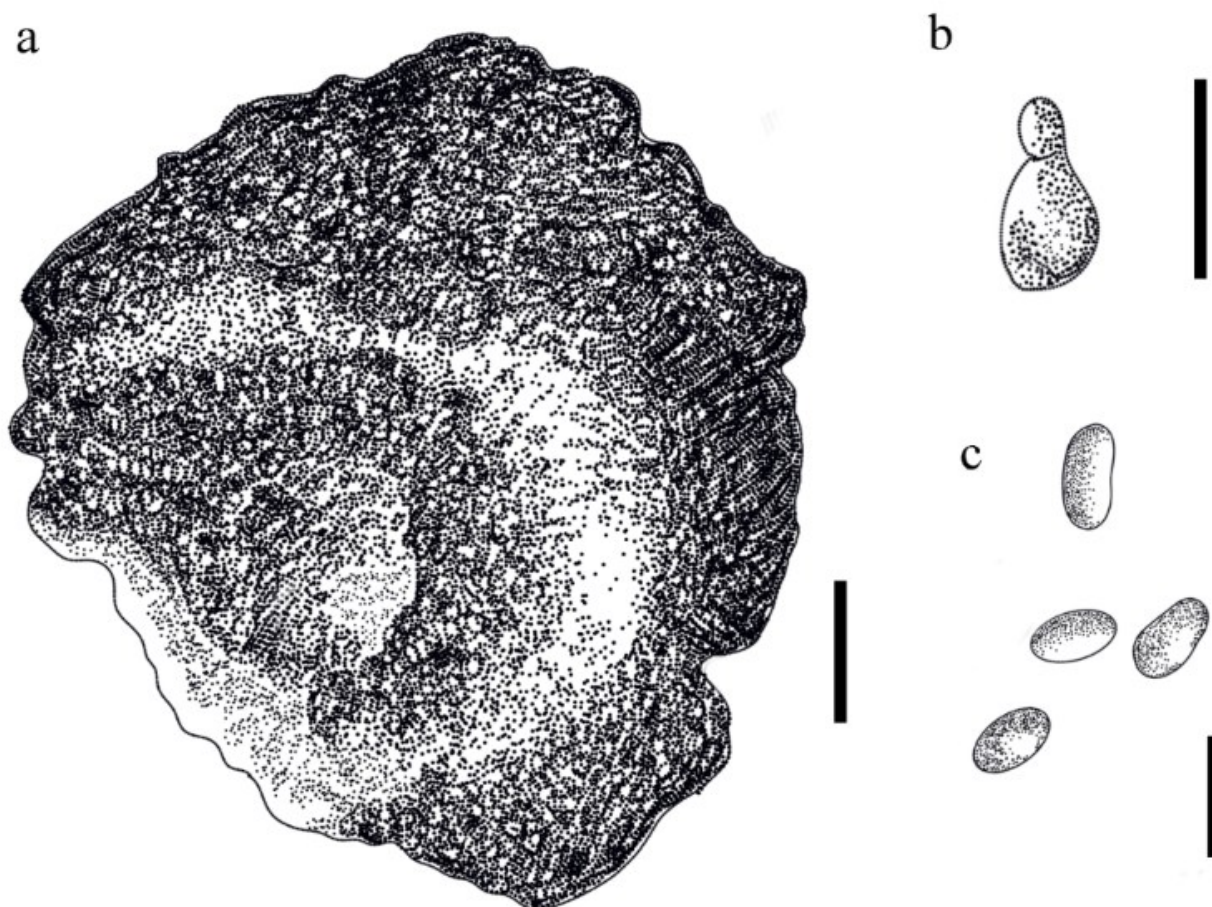


Figure 26 – *Paraboeremia selaginellae* (CBS 122.93). a Pycnidium. b Conidiogenous cell. c Conidia. Scale bars a= 100 µm, b = 10 µm, c = 5 µm. Redrawn from Chen et al. (2015).

Pseudoascochyta Valenzuela-Lopez, Stchigel, Cano-Canals, Guarro & Cano, Persoonia 37: 255 (2016). Fig. 27

Index Fungorum number: IF 817646; Facesoffungi number: FoF 08232;

Crous et al. (2016) introduced *Pseudoascochyta* based on LSU, ITS, *RPB2* and *TUB2* with morphological illustrations, and *P. pratensis* is accommodated as the type species. Two species are currently listed in this genus (Species Fungorum 2025), and both are supported with molecular data. The asexual morph has brown to dark brown, globose, solitary pycnidia with *textura angularis* walls. Conidiogenous cells are hyaline, enteroblastic, phialidic, globose to flask-shaped, thin-walled, and produce hyaline, cylindrical, 1-septate, guttulate conidia. The sexual morph is unreported (Crous et al. 2016, Hongsanan et al. 2020a). This genus has been found in plant material and one species has been reported from soil (Crous et al. 2016, Pem et al. 2024).

Table 26. *Pseudoascochyta* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudoascochyta pratensis</i>	Spain	ND	Crous et al. (2016)

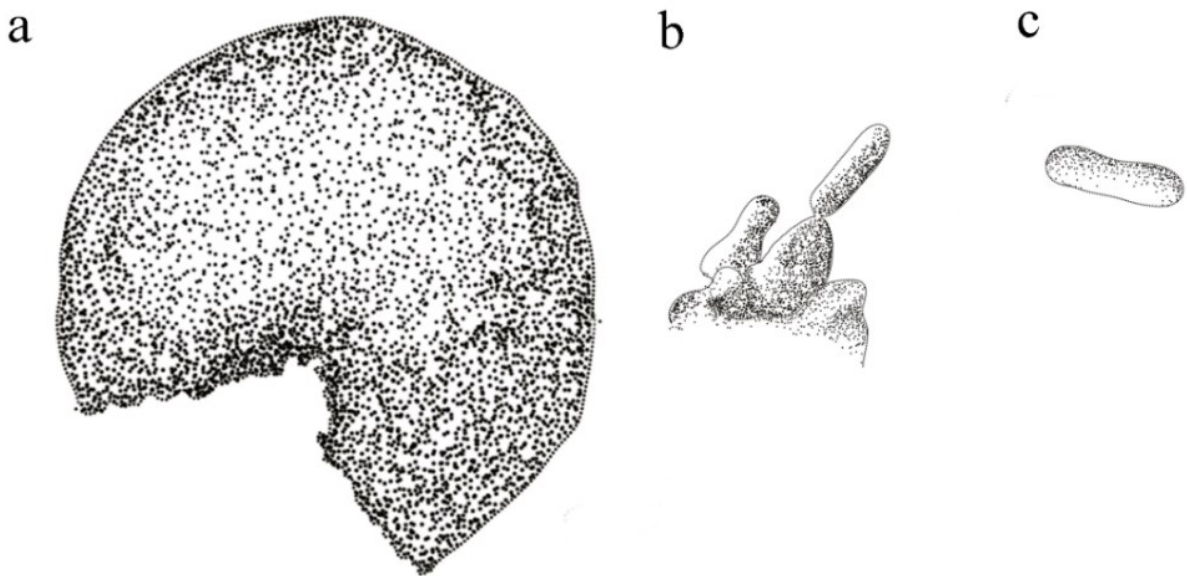


Figure 27 – *Pseudoascochyta pratensis* (CBS H-22735). a Pycnidium. b Conidiogenous cells. c Conidium. Redrawn from Crous et al. (2016).

Remotididymella Valenzuela-Lopez, Crous, Cano, Guarro & Stchigel, Stud. Mycol. 90: 35 (2017)

Index Fungorum number: IF 819990; Facesoffungi number: FoF 08233

Remotididymella was introduced by Valenzuela-Lopez et al. (2018) with the multigene phylogenetic analyses in *Didymellaceae*, and *Remotididymella destructiva* is accepted as the type species. The Species Fungorum (2025) lists 11 species under *Remotididymella*, and all are supported by molecular data. The asexual morph is characterized by the pycnidial conidiomata with brown to dark brown, mostly glabrous, globose or irregularly-shaped and pycnidial wall of *textura angularis*. It has phialidic, hyaline, smooth-walled conidiogenous cells and hyaline, aseptate, allantoid or cylindrical, guttulate conidia. The sexual morph is characterized by immersed or superficial, scattered or aggregated, globose, conical-globose to lenticular ascomata and 8-spored, bitunicate, fissitunicate, clavate to short cylindrical asci, that contain hyaline, overlapping 2–3-seriate, fusiform, 1–3-septate ascospores. *Chlamydospores* appear in intercalary or terminal,

verruculose or incidentally tuberculate in subhyaline to dark brown (Valenzuela-Lopez et al. 2018, Hou et al. 2020b). *Remotididymella* has been recorded as plant saprobes and pathogens from *Ageratina adenophora*, *Bauhinia* sp., *Capsicum annuum*, *Lycopersicon* sp., and *Solanum* sp., human clinical samples and soil (Valenzuela-Lopez et al. 2018, Yang et al. 2021a, Kularathnage et al. 2023). These species are distributed in China, Guadeloupe, Papua New Guinea, Thailand, Fiji and the USA (Hou et al. 2020b, Yang et al. 2021a, Kularathnage et al. 2023).

Table 27 *Remotididymella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Remotididymella brunnea</i>	Papua New Guinea	Tropical forest	Hou et al. (2020b)
<i>R. humicola</i>	Puerto Rico	Onion field	

Remotididymella ageratinae H.B. Zhang, A.L. Yang & L. Chen, Int. J. Syst. Evol. Microbiol. 71(1, no. 004572): 10 (2021) Fig. 28

Index Fungorum number: IF 833832; Facesoffungi number: FoF 16705

Sexual morph: *Ascomata* 80–100 × 125–132 µm ($\bar{x}$ = 88 × 128 µm, n = 10), globose to subglobose, brown to dark brown, papillate, aggregated, with *ascomata wall* composed pale brown cells of *textura angularis*. *Asci* 32–43 × 5–10 µm ($\bar{x}$ = 37 × 8 µm, n = 15), hyaline, bitunicate, clavate to short cylindrical. *Ascospores* 11–14 × 4–6 µm ($\bar{x}$ = 12 × 5 µm, n = 25), biseriate, hyaline, smooth, ellipsoidal, slightly curved, pointed apex and a broadly pointed to curved base, 1-septate, constricted at the septum, sometimes guttulate. Asexual morph: Chlamydosporous. *Chlamydospores* 10–20 × 7–17 µm ($\bar{x}$ = 13 × 11 µm, n = 20), hyaline, become brown when mature, intercalary, branched chains, verruculose, rough, globose to subglobose or cylindrical, thick-walled.

Culture characteristics – *Colonies* on PDA become 2–3 cm diam., after seven days at 25 °C, whitish brown to grey, reverse brownish orange to dark brown, undulate-margined, raised surface. *Hyphae* 1.5–3.5 µm ($\bar{x}$ = 2.5 µm) wide, hyaline to pale brown, thick-walled, septate, become brown when mature.

Material examined – Thailand, Chiang Rai Province, Chiang Rai, Fish cave temple (Wat Tham Pla), on soil in a cave, 99.863679 N, 20.328605 E, 440m, 8 February 2021, W.A. Erandi Yasanthika (MFLU 25-0132), living culture 32-cv4-72= MFLUCC 24-0473. *ibid.* a public roadside, 19.909030 N, 99.835183E, 398m, 17 Oct 2022, W.A. Erandi Yasanthika (MFLU 25-0133), living culture 3-Rd7=MFLUCC 24-0474

GenBank numbers – MFLUCC 24-0473: LSU: PQ568011, ITS: PQ567556, *RPB2*: PV523930; MFLUCC 24-0474: LSU: PQ568012, ITS: PQ567557, *RPB2*: PV523928, *TUB2*: PV523929.

Notes – Based on the combined LSU, ITS, *RPB2* and *TUB2* phylogeny in Figure 18, our strains (MFLUCC 24-0473 and MFLUCC 24-0474), grouped with *Remotididymella ageratinae* (MFLUCC 23-0079) with 100% ML, 1.00 BYPP statistical support. We were unable to include *R. hydrillana* (YMF1.05022) (Chen et al. 2023) in the phylogenetic analyses as the sequences were unavailable in GenBank. The comparison of each gene region between our strain and the type of *R. ageratinae* (MFLUCC 23-0079) showed that they have 100% similarity. Our isolates are morphologically similar to *R. ageratinae* (MFLUCC 23-0079) by having aggregated, globose or irregular, papillate ascomata, clavate to cylindrical asci and ellipsoidal, 1-septate, ascospores that are slightly constricted at the septum (Yang et al. 2021a). In contrast to the type species, we observed guttulate ascospores and chlamydospores in our isolate. *Remotididymella ageratinae* was introduced by Yang et al. (2021a) from leaf spots in *Ageratina adenophora* in China and has also been reported from dead leaves of *Nayariophyton zizyphifolium* in Thailand (Karunarathna et al. 2024). Based on morphology and phylogeny, we confirm our collection as *R. ageratinae* from the

soil collected from a disturbed cave and a public roadside in Thailand. Thus, this accounts for its first record from soil habitats.

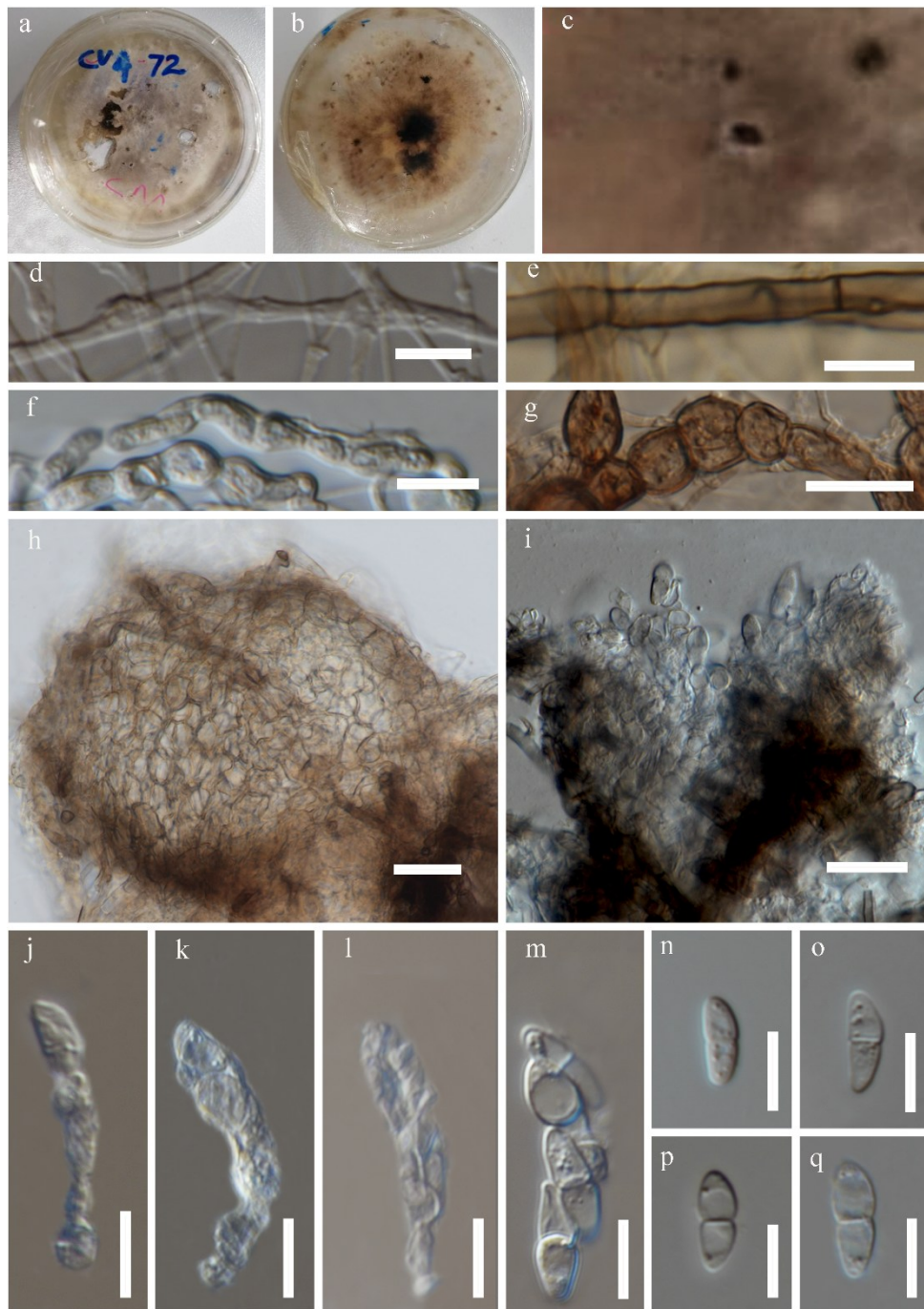


Figure 28 – *Remotididymella ageratinae* (MFLU 25-0132). a, b Culture characters on the PDA (b = reverse). c Ascomata forming on culture. d Immature hypha. e. Mature, pigmented hyphae. f, g. Chlamydospores. h, i Ascomata and wall j–m Asci. n–q Ascospores. Scale bars: g–i = 20 μ m, d–f, j–q = 10 μ m.

Stagonosporopsis Died. emend. Aveskamp et al., Stud. Mycol. 65: 44 (2010).

Index Fungorum number: IF 10059; Facesoffungi number: FoF 00160

Stagonosporopsis was introduced by Diedicke (1912) with the type species, *S. hortensis*. Its placement in *Didymellaceae* was confirmed using phylogenetic analyses (LSU, ITS and *TUB2*) by Aveskamp et al. (2010). There are 43 *Stagonosporopsis* species in the Species Fungorum (2025), while 32 have molecular data (Chen et al. 2023). The asexual morph possesses conidiomata that are

pycnidial, superficial or immersed, globose to subglobose, ostiolate or poroid with pseudoparenchymatous pycnidial walls. Conidiogenous cells are phialidic, hyaline, ampulliform or doliiform, and produce dimorphic conidia, of which the majority are hyaline, smooth-walled, aseptate and ellipsoidal to subglobose. The sexual morph occurs only in culture and is characterized by pseudothecial ascomata having a globose to subglobose shape and sometimes with a conical neck. Asci are cylindrical or subclavate, 8-spored, biseriate, containing ellipsoidal, fusiform or obovoid, 1-septate, guttulate ascospores (Chen et al. 2015, Hongsanan et al. 2020a). Species exist as pathogens and saprobes on plant materials and soil in Germany, New Zealand, Sweden and the Netherlands (Chen et al. 2015, Hou et al. 2020a).

Table 28 *Stagonosporopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Stagonosporopsis rhizophila</i>	China	Rhizospheric soil	Wei et al. (2021)
<i>S. stuijvenbergii</i>	The Netherlands	A garden soil	Hou et al. (2020a)
<i>S. weymaniae</i>			

Vandijkomycella Hern.-Restr., L.W. Hou, L. Cai & Crous, MycoKeys 65: 86 (2020) Fig. 29
Index Fungorum number: IF 833205; Facesoffungi number: FoF 08849

Vandijkomycella was erected by Hou et al. (2020a) based on the multi-loci phylogeny of ITS, LSU, *RPB2* and *TUB2* genes, and *V. joseae* is designated as the type species. The genus has two species (Species Fungorum 2025) and is supported by molecular data. Both of these were isolated from soil (Hongsanan et al. 2020a, Hou et al. 2020a). The asexual morph is characterized by pycnidial conidiomata with longer whitish hyphal outgrowths. Conidiogenous cells are phialidic, giving rise to hyaline, smooth and thin-walled, aseptate, ovoid, oblong or ellipsoidal conidia. The sexual morph has not been observed (Hongsanan et al. 2020a, Hou et al. 2020a).

Table 29 *Vandijkomycella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Vandijkomycella joseae</i>	The Netherlands	A garden soil	Hou et al. (2020a)
<i>V. snoekiae</i>			

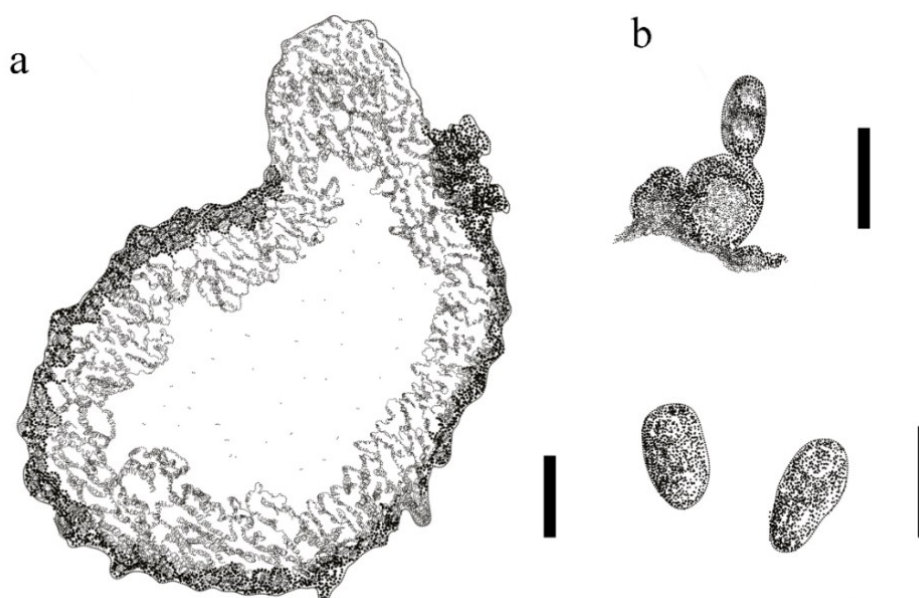


Figure 29 – *Vandijkomycella joseae* (CBS 143011). a Section of a pycnidium. b Conidiogenous cell. c Conidia. Scale bars a = 10 µm, b, c = 5 µm. Redrawn from Hou et al. (2020a).

Xenodidymella Qian Chen & L. Cai, Studies in Mycology 82: 205 (2015)
 Fig. 30

Index Fungorum number: IF814065; Facesoffungi number: FoF08236

Chen et al. (2015) erected *Xenodidymella* with morpho-molecular (LSU, ITS, *RPB2* and *TUB2*) evidence while accommodating the type species, *X. applanata* (Chen et al. 2015). The Species Fungorum (2025) lists 12 species under *Xenodidymella*, and all of them have molecular data. The asexual morph is characterized by pycnidial, globose to subglobose, superficial or immersed, solitary or confluent, and ostiolate conidiomata. Conidiogenous cells are phialidic, hyaline, globose to flask-shaped, or ampulliform and conidia are variably shaped, hyaline, ellipsoidal to allantoid, subcylindrical, oblong, pyriform, and usually aseptate to 1-septate, mostly guttulate. The sexual morph is pseudothecial, immersed or erumpent, globose to subglobose, ostiolate or poroid ascomata. Asci are cylindrical to sub-clavate, 8-spored, bitunicate, and ascospores are hyaline, obovoid to oblong, clavate, ellipsoidal, 1-septate, and constricted at the septum. Chlamydospores are brown, intercalary, unicellular, globose to subglobose, and arranged in spiral chains (Chen et al. 2015, Hongsanan et al. 2020a). Several species cause plant diseases, and some have been investigated from living and dead plant parts, while two species were found associated with soil. *Xenodidymella humicola* has been found in soil and has also been found as an opportunistic pathogen on roots (Boerema et al. 2004). The members are distributed in France, Italy, the Netherlands and the USA (Hongsanan et al. 2020a).

Table 30 *Xenodidymella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Xenodidymella humicola</i>	India	Forest	Kayang (2006)
<i>X. weymaniae</i>	The Netherlands	A garden	Hou et al. (2020a)

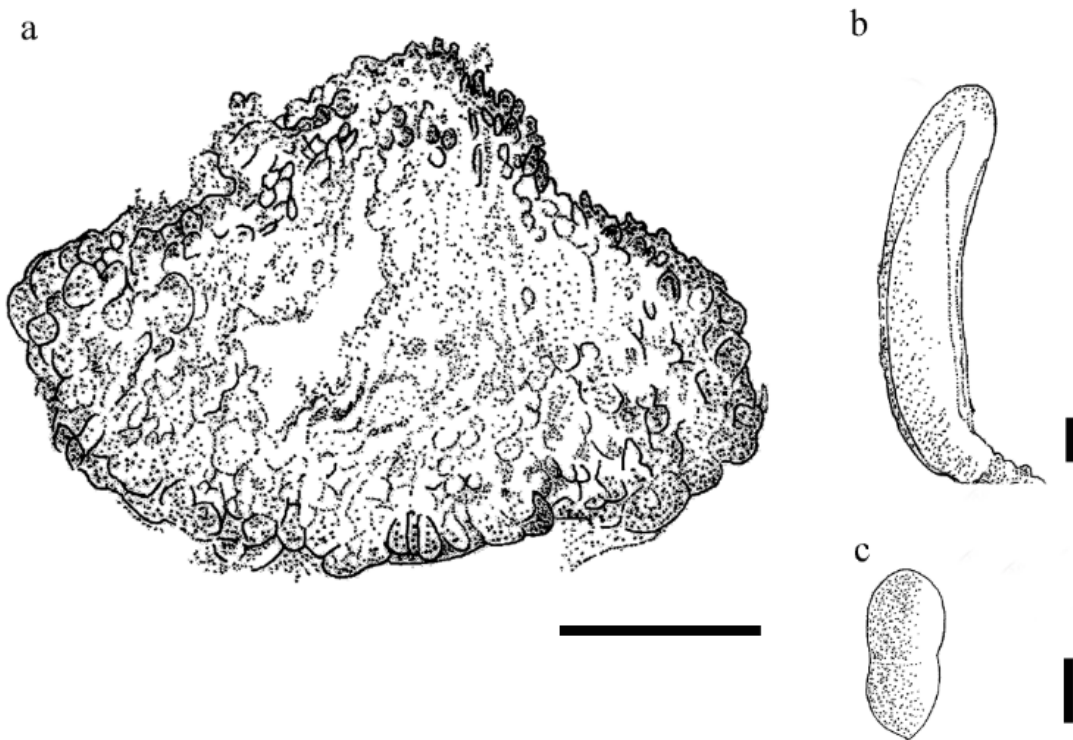


Figure 30 – *Xenodidymella applanata* (M0275818). a Section of pseudothecium. b. Asci. c. Ascospore. Scale bars: a = 50 μm, b, c =5 μm. Redrawn from Chen et al. (2015).

Didymosphaeriaceae Munk

Alloconiothyrium Verkley, Göker & Stielow, Persoonia 32: 33 (2014)
 Fig. 31

Index Fungorum number: IF800756; Facesoffungi number: FoF 00028

Alloconiothyrium was erected by Verkley et al. (2014), and *A. aptrootii* was designated as the type species. Currently, three species are listed under *Alloconiothyrium* (Species Fungorum 2025), and all of them have molecular data. The sexual morph is still undetermined. The asexual morph is characterized by pycnidial or eustromatic conidiomata, with holoblastic and annellidic conidiogenous cells. Conidia are olivaceous-brown and irregular in outline with a roughened surface. Species have been isolated from *C. sinensis* and *Encephalartos* leaves, and one species from soil (Verkley et al. 2014, Ariyawansa et al. 2020).

Table 31 *Alloconiothyrium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Alloconiothyrium aptrootii</i>	Papua New Guinea	A park	Verkley et al. (2014)

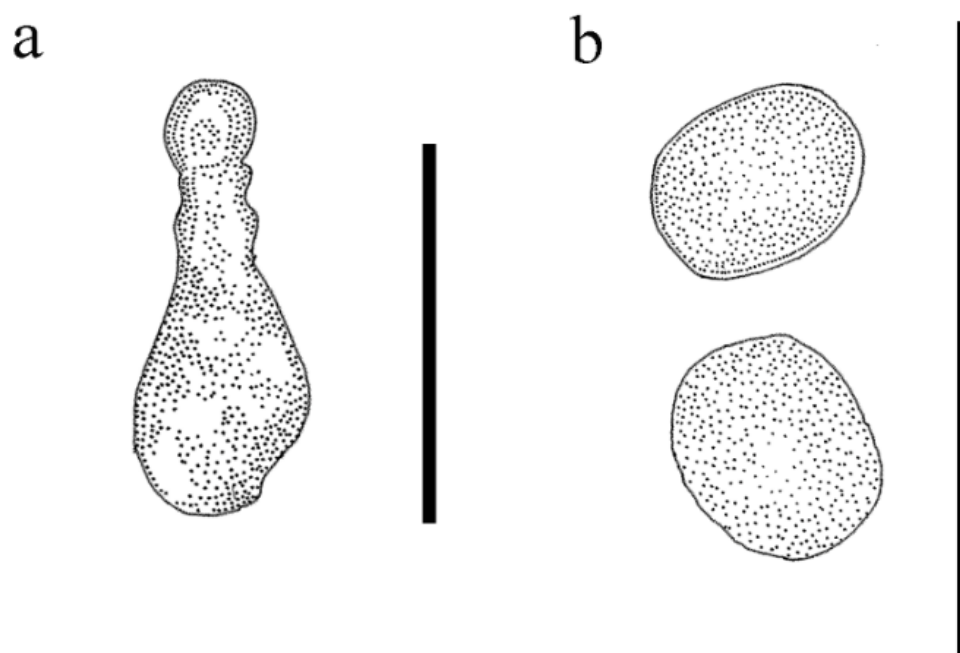


Figure 31 – *Alloconiothyrium aptrootii* (CBS 980.95). a Conidiogenous cell. b Conidia. Scale bar: a, b = 10 µm. Redrawn from Verkley et al. (2014).

Bimuria D. Hawksw., Chea & Sheridan, N.Z. J Bot. 17(3): 267 (1979)

Fig. 32

Index Fungorum number: IF574; Facesoffungi number: FoF 00032

Bimuria was introduced by Hawksworth et al. (1979) and typified by *B. novae-zelandiae*. Presently, *Bimuria* has two species (Species Fungorum 2025), and both of them with molecular data. Initially, the genus was placed in *Pleosporaceae* and Barr (1987) transferred it to *Phaeosphaeriaceae*. Then, Lumbsch & Huhndorf (2007) placed this genus in *Melanommataceae*, and subsequently, Schoch et al. (2009) transferred it to *Montagnulaceae*. *Montagnulaceae* was synonymized under *Didymosphaeriaceae*, thus, this genus is currently considered a member of *Didymosphaeriaceae* (Wanasinghe et al. 2016, 2018b, Phookamsak et al. 2019). Wijesinghe et al. (2020) provided a combined ITS, LSU, and *TEF1-α* phylogeny and morphological characterization while introducing a second species to this genus. The asexual morph is characterized by pycnidial conidiomata that are superficial to semi-immersed with a thick wall comprising textura angularis cells. Conidiogenous cells are enteroblastic, phialidic, and produce pale brown to hyaline, oblong to

cylindrical, 1-septate, smooth and thin-walled conidia. The sexual morph has singular, globose ascomata, comprising 2-spored, bitunicate, clavate asci, with dark brown, verrucose ascospores. (Hawksworth 1979, Wijesinghe et al. 2020). Species have been found in soil and decaying leaves from New Zealand and Oman (Hawksworth et al. 1979, Wijesinghe et al. 2020).

Table 32 *Bimuria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Bimuria novae-zelandiae</i>	New Zealand	Arable soil	Gonçalves et al. (2020)

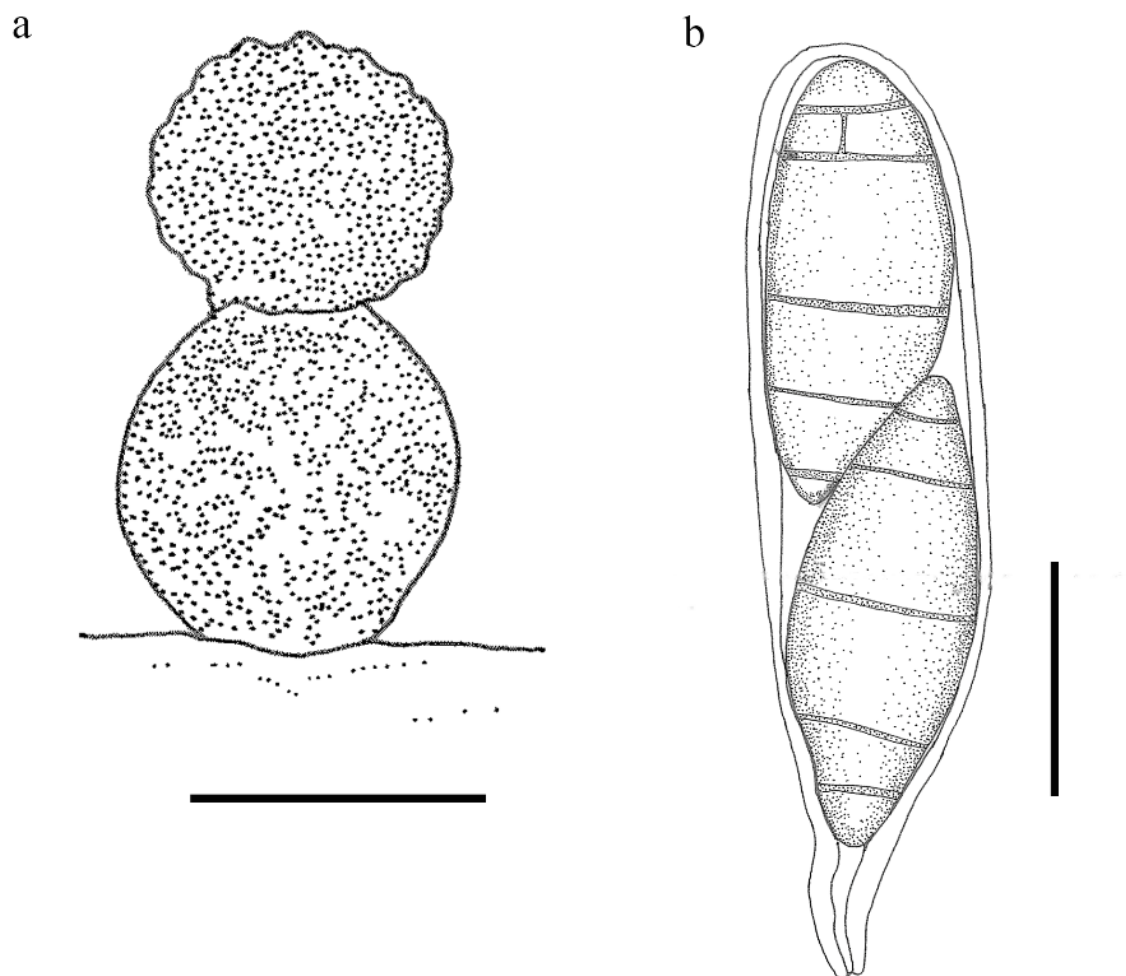


Figure 32 – *Bimuria novae-zelandiae* (CBS 107.79). a Ascoma. b Asci with ascospores. Scale bars a = 200 µm, b = 25 µm. Redrawn from Hawksworth et al. (1979).

Didymocrea Kowalski, Mycologia 57(3): 405 (1965).

Index Fungorum number: IF 1552; Facesoffungi number: FoF08238

Kowalski (1965) introduced *Didymocrea* by accommodating *D. sadasivanii* as the type species, which was previously known as *Didymosphaeria sadasivanii*. There are two species listed in the Species Fungorum (2025), and they have molecular data. Based on SSU and LSU and *TEF1-α* gene regions and morphology, Ariyawansa et al. (2014b) placed this genus in *Didymosphaeriaceae*, which was previously placed in *Zopfiaceae* (Aptroot 1995). Jayasiri et al. (2019) introduced the asexual morphology of this genus, which is hyphomycetous. The sexual morph is characterized by perithecia that are deep brown or black with a brown or black wall of parenchymatous cells. Pseudoparaphyses are septate, and asci are unitunicate, short-pedicellate,

with no apical pore. Ascospores are two-celled, rounded and wide upper cell, a true spiked lower cell, hyaline, and becomes brownish-yellow. Species have been reported from soil and saprobes on dead plant parts in India and Thailand (Kowalski 1965, Jayasiri et al. 2019).

Table 33 *Didymocrea* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Didymosphaeria sadasavanii</i>	India	ND	Kowalski (1965)

Neptunomyces M. Gonçalves, T. Vicente & A. Alves, MycoKeys 60: 37 (2019)

Index Fungorum number: IF 831436; Facesoffungi number: FoF 08239

Neptunomyces was introduced by Gonçalves et al. (2019) based on ITS and *TEFI-α* and *TUB2* single and multigene phylogeny analyses and morphological evidence, while accommodating *Neptunomyces aureus* as the type species. The genus comprises four species (Species Fungorum 2025), all of which have molecular data. The type species has an asexual morph with the solitary or aggregated, globose to subglobose, dark brown, immersed or rarely superficial conidiomata with a pseudoparenchymatous wall. Conidiophores are reduced to ampulliform to subcylindrical, hyaline, smooth conidiogenous cells that produce aseptate, golden yellow, smooth, subcylindrical conidia with rounded apices. The sexual morph remains undetermined (Gonçalves et al. 2019b). Species have been isolated from algae, dead plants, and two of them were from soil substrates distributed in Australia, Portugal and Thailand (Gonçalves et al. 2019b, Yasanthika et al. 2024).

Table 34 *Neptunomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Neptunomyces litoralis</i>	Australia	Sand	Austin et al. (2004)
<i>N. soli</i>	Thailand	Forest soil	Yasanthika et al. (2024)

Paraconiothyrium Verkley, Stud. Mycol. 50(2): 327 (2004).

Index Fungorum number: IF 500080; Facesoffungi number: FoF 00053

Verkley et al. (2004) erected *Paraconiothyrium* and typified by *P. estuarinum*. Currently, 28 species are listed under *Paraconiothyrium* (Species Fungorum 2025), and all of them have molecular data. Ariyawansa et al. (2014) provided a comprehensive phylogeny for this genus and new species have been identified by subsequent studies using morpho-molecular evidences (Wang et al. 2021). The asexual morph is characterized by the eustromatic to pycnidial conidiomata with phialidic or annellidic conidiogenous cells. Conidia are smooth-walled or minutely warted and hyaline, becoming brown at the latter stages. The sexual morph is unknown. They have several trophic modes as opportunistic human pathogens, phytopathogens, plant endophytes or saprobes (Ibrahim et al. 2024). The species have been isolated from fungicolous fungi, human samples, leaf spots, leaves, saline water, sediment from estuarine habitats, skin, soil, woods and wounds in Australia, Brazil, China, Papua New Guinea, South Africa, Thailand and the USA (Verkley et al. 2004, Gonçalves et al. 2020). Around 147 secondary metabolites have been investigated from *Paraconiothyrium* species and 95 of them are new (Wang et al. 2021).

Table 35 *Paraconiothyrium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Paraconiothyrium brasiliense</i>	Malaysia	Virgin peatland	Noman et al. (2023)
<i>P. cyclothyrioides</i>	Papua New Guinea	A national park	Gonçalves et al. (2020)
<i>P. kelleni</i>	Korea	ND	Yadav et al. (2023)

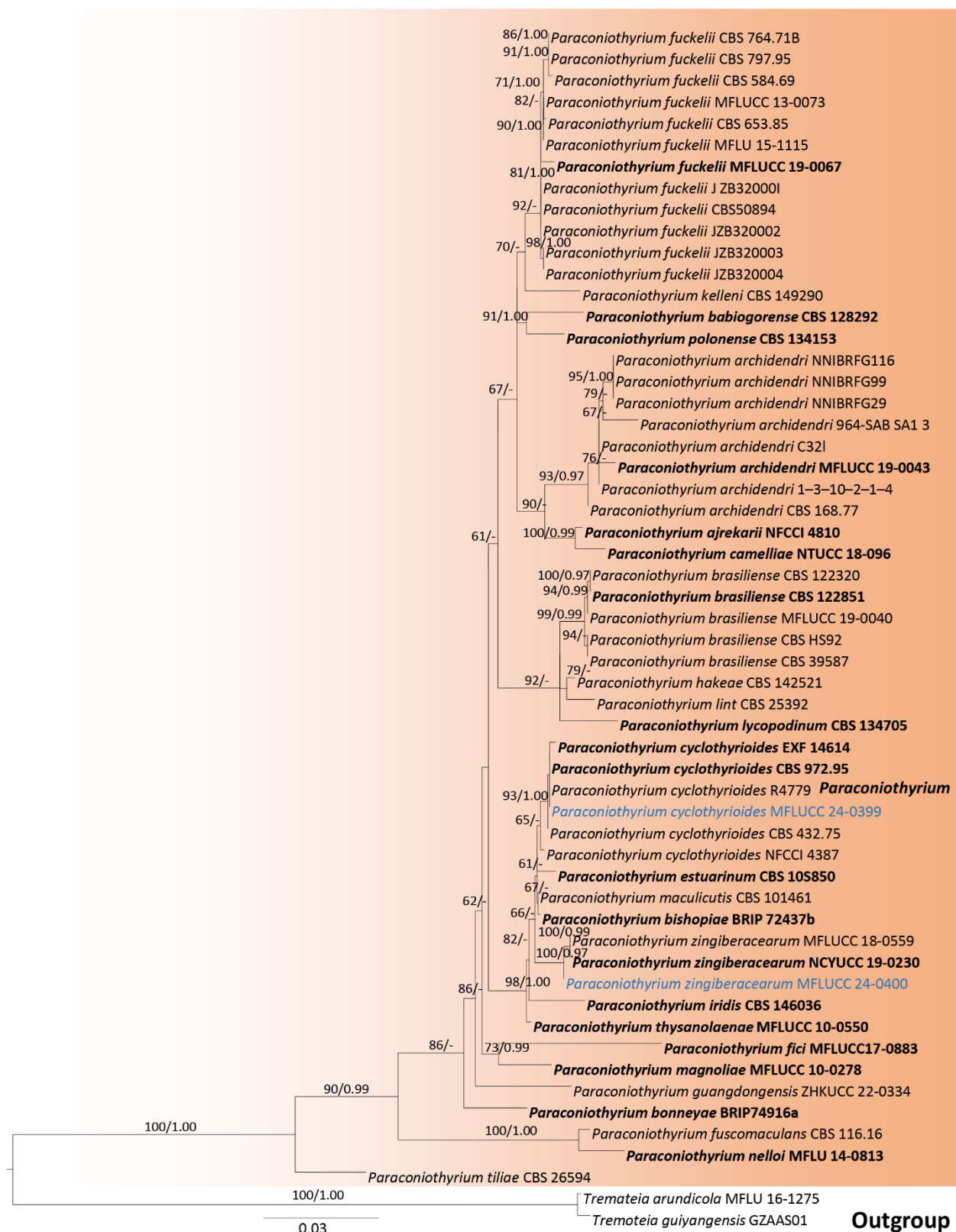


Figure 33 – The best-scoring maximum likelihood tree generated from the combined ITS and LSU sequence data for *Paraconiothyrium*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.95 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Trematea arundicola* (MFLU 16-1275) and *T. guiyangensis* (GZAAS01). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 1658 bp, and single gene alignments are ITS: 750 bp, and LSU: 908 bp. The

matrix had 1371 distinct alignment patterns with 26.34% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.250, C = 0.250, G = 0.250, T = 0.250; substitution rates AC = 1.00000, AG = 1.70814, AT = 1.00000, CG = 1.00000, CT = 6.85743, GT = 1.00000; gamma distribution shape parameter α = 0.690.

Paraconiothyrium cyclothyrioides Verkley Stud. Mycol. 50(2): 330 (2004)

Fig. 34

Index Fungorum number: IF 500083; Facesoffungi number: FoF 00432

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 300–350 × 225–250 μm ($\bar{x}$ = 315 × 242 μm , n=10), pycnidial, superficial to semi-immersed on PDA, brown to reddish brown, solitary or confluent. *Conidiomata wall* composed of cells of *textura angularis*, pale brown to brown, 8–15 μm ($\bar{x}$ = 11 μm , n=10) thick. *Conidiogenous cells* 7.5–3 × 7–2.5 μm ($\bar{x}$ = 5 × 4.5 μm , n=10), phialidic, subhyaline to pale-brown, ampulliform to subcylindrical, indeterminate. *Conidia* 3.5–5.5 × 1.5–2.5 μm ($\bar{x}$ = 3.5 × 2 μm , n = 25), hyaline, aseptate, cylindrical to globose, straight, rounded at both ends, smooth-walled.

Culture characteristics – *Colonies* on PDA at 25 °C, become 4–5 cm diam., after seven days, white becoming olive-brown to white when mature, reddish-brown at the center, brownish orange middle ring, yellow preiphery, raised, undulate margin. *Mycelium* superficial aseptate, hyaline, smooth when immature, becoming subhyaline to brown, thick-walled 1.5–3 μm ($\bar{x}$ = 2, n = 30), sporulated after 4 weeks.

Material examined – Thailand, Chiang Mai, Omkoi District, Sop Khong, forest, on soil, 17.7145N, 98.2619E, 1388m, 16 October 2019, W. A. Erandi Yasanthika (MFLU 25-0160), living culture 24-pin4= MFLUCC 24-0399.

GenBank numbers – MFLUCC 24-0399: LSU: PQ565569, ITS: PQ565453.

Notes – Based on the phylogenetic analyses of *Paraconiothyrium* shown in Figure 33, our strain (MFLUCC 24-0399) clusters with *P. cyclothyrioides* 93% ML, 1.00 BYPP statistical support. Our isolate has a similar morphology with *P. cyclothyrioides* by having irregularly globose or flattened, reddish brown to black conidiomata and phialidic, subhyaline to pale-brown, ampulliform to subcylindrical, conidiogenous cells and 1-celled, hyaline, both ends rounded conidia. However, the type species has short-cylindrical, straight, or slightly curved conidia, whereas our isolate has cylindrical to globose, straight conidia. Further, the type species has one or two very small, polar guttules in conidia and becomes yellow when mature, which is absent in our isolate. Morphology and phylogeny analyses confirm that our strain is *P. cyclothyrioides*. This species was introduced by Verkley et al. (2004) from soil in Papua New Guinea and has later been found in human specimens in the USA (Gonçalves et al. 2020). We document the first record of *P. cyclothyrioides* from soil collected in Thailand.

Paraconiothyrium zingiberacearum Tennakoon & S. Lumyong, Frontiers in Microbiology 13(101628): 16 (2023)

Fig. 35

Index Fungorum Number: IF559600; Facesoffungi number: FoF 10802

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 200–250 μm ($\bar{x}$ = 230 μm , n = 10) diam., pycnidial, superficial to semi-immersed on PDA, brown to dark brown, sub-globose, ostiole indistinct, *pycnidial wall* composed of cells of *textura angularis*. *Conidiogenous cells* 2–3 × 1.5–3 μm ($\bar{x}$ = 2.5 × 2 μm , n=10), subhyaline, ampulliform, thick-walled. *Conidia* 3.5–4.5 × 1–2 μm ($\bar{x}$ = 4 × 1.5 μm , n = 25), hyaline, aseptate, fusiform, rarely ellipsoidal to oval, thick-walled.

Culture characteristics – *Colonies* on PDA at 25 °C, become 3–4 cm diam., after 7 days, whitish-yellow becomes Ivory at the center and brown-beige outer rind when mature, reverse brown at the center, middle rind brownish-orange, brown-beige outer rind, raised, undulate filiform-margined. *Mycelium* superficial to semi-immersed, hyaline, become subhyaline to pale brown when mature, septate, smooth to verrucose 1.5–4 μm ($\bar{x}$ = 3), sporulated after 8 weeks.

Material examined – Thailand, Chiang Rai, Bandu, Market place, on soil, 19.967000 N, 99.855912E, 393m, 17 October 2022, W.A. Erandi Yasanthika, (MFLU 25-0161), living culture 91-u4-2 = MFLUCC 24-0400.

GenBank numbers – MFLUCC 24-0400: LSU: PQ565570, ITS: PQ565454.

Notes – Based on the multi-gene phylogenetic analyses in Figure 33, our strain (91-u4-2 = MFLUCC 24-0400) clusters with *Paraconiothyrium zingiberacearum* with 100% ML, 0.97 BYPP statistical support. When compared, each gene region between our strain and the type species (NCYUCC 19-0230) showed 100% similarity. *Paraconiothyrium zingiberacearum* was introduced by Tennakoon et al. (2022) from a dead stem of *Hedychium coronarium* in China. Only the sexual morph has previously been reported in this species (Tennakoon et al. 2022), however we observed the asexual morph in our isolate. By considering morphology and phylogeny, we suggest that our collection is the asexual morph of *P. zingiberacearum* isolated from an urban area in Thailand. It is the first soil record of this species, and it appears to adapt to a variety of habitats.

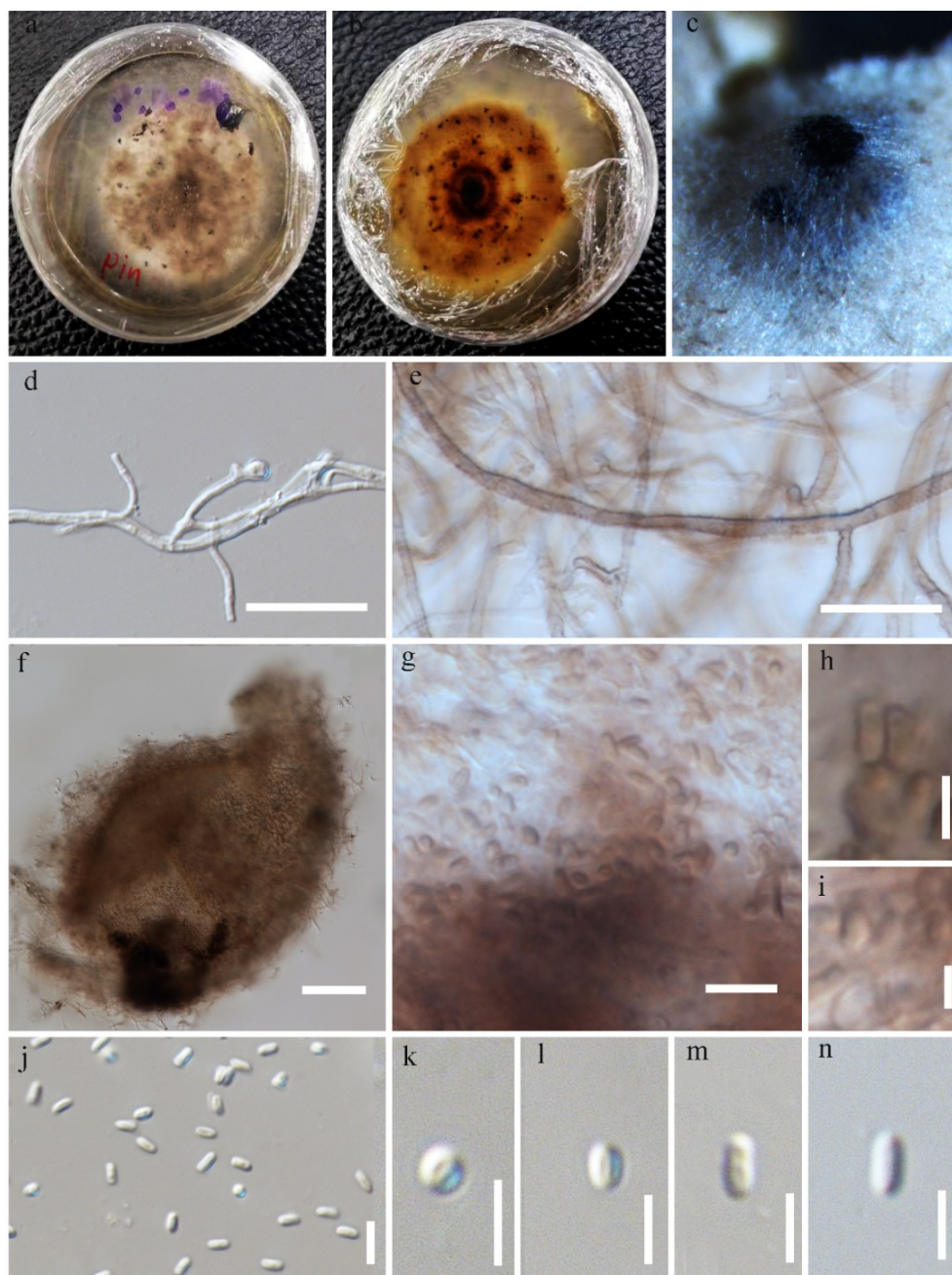


Figure 34 – *Paraconiothyrium cyclothyrioides* (MFLU 25-0160). a, b Culture characters on PDA (b = reverse). c Pycnidia forming on culture. d Immature hypha e. Mature hyphae. f Pycnidia. g Pycnidia matrix h, i Conidiogenous cells. j–n Conidia. Scale bars: f = 75 μ m, d, e = 10 μ m, f, g, j = 10 μ m, h, i, k–n = 5 μ m.

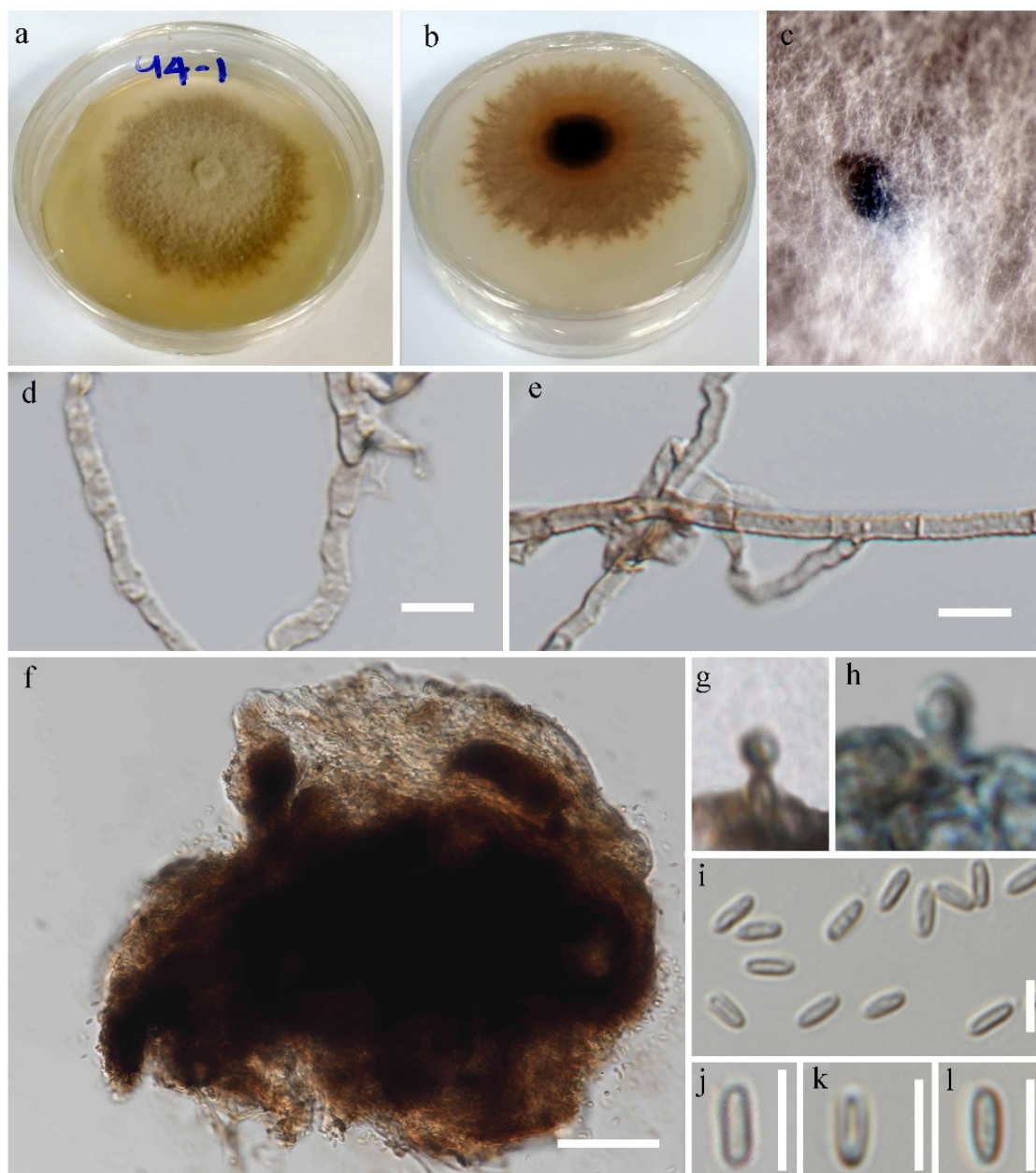


Figure 35 – *Paraconiothyrium zingiberacearum* (MFLU 25-0161). a, b Culture characters on PDA (b = reverse). c Pycnidia forming on culture. d Immature hyphae e Mature hyphae. f Pycnidia. g, h Conidiogenous cells. i–l Conidia. Scale bars: f = 50 μ m, d, e = 10 μ m, g–l = 5 μ m.

Phaeodothis Syd. & P. Syd., Annls mycol. 2(2): 166 (1904).

Index Fungorum number: IF 3914; Facesoffungi number: FoF 00059

Phaeodothis was established by Sydow & Sydow (1904); the type species is accepted as *Phaeodothis tricuspidis*. There are 22 species listed in the Species Fungorum (2025), however, only three have molecular data. Von Niessl (1875) transferred *Phaeodothis* to *Didymosphaeriaceae*, and subsequently, Aptroot (1995) placed *Phaeodothis* in *Phaeosphaeriaceae*. However, based on morphology and the multigene phylogeny, this genus is currently placed in *Didymosphaeriaceae* (Ariyawansa et al. 2014b, Tennakoon et al. 2020). The asexual morph is unreported and the sexual morph is characterized by the subglobose to hemispherical, immersed, scattered to gregarious, dark brown to black ascostromata. Hamathecium has pseudoparaphyses often in a gelatinous matrix. *Asci* are 8-spored, bitunicate, fissitunicate, cylindrical, short pedicellate with olivaceous brown ascospores that are fusiform with rounded ends (Ariyawansa et al. 2014b). The species are present

in saprobic or parasitic mode on dead wood, grasses and soil in terrestrial environments in Australia, Austria, Congo, India, Japan, Germany, Nigeria, Pakistan, Philippines, Sri Lanka, Thailand, Sweden and Uganda (Kamolmanit et al. 2013, Ariyawansa et al. 2014b, Tennakoon et al. 2020).

Table 36 *Phaeodothis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Phaeodothis ribesiella</i>	Congo	ND	Aptroot (1995)
<i>P. winteri</i>	Thailand	Agricultural field	Kamolmanit et al. (2013)

Pseudopithomyces Ariyaw. & K.D. Hyde, Fungal Divers. 75: 64 (2015).

Index Fungorum number: IF 551392; Facesoffungi number: FoF 00937

Pseudopithomyces was established by Ariyawansa et al. (2015a) by providing multigene phylogenetic analyses (ITS and LSU) and morphological descriptions. The type species is *Pseudopithomyces chartarum*, which was previously known as *Sporidesmium chartarum*. There are 13 species in the Species Fungorum (2025), and all of them have molecular data. The asexual morph has micronematous or semi-macronematous, thin-walled, hyaline to subhyaline, aseptate, smooth conidiophores, monoblastic or blastic, closely aggregated, globose or subglobose, integrated, terminal conidiogenous cells and dark, fuliginous, septate to multi-septate, fusiform or subglobose, verruculose to echinulate, and acrogenous conidia with ornamented walls (Ariyawansa et al. 2015a). *Pseudopithomyces* is morphologically similar to *Pithomyces* species, but can be distinguished by chinulate or fusiform, verruculose, and dark conidia. The sexual morph of the genus is still unknown. The genus is recorded as saprobes or plant and human pathogens that are found in animal specimens, dead leaves and stems, freshwater and marine environments, leaf spots, humans and soil in Africa, China, Korea and Thailand (Ariyawansa et al. 2015a, Wahdan et al. 2022, Mitra et al. 2024).

Table 37 *Pseudopithomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudopithomyces chartarum</i>	Brazil	ND	Oliveira et al. (2013)
<i>P. karoo</i>	China	Warm temperate area	Liu & Zhang (2007)

Pseudopithomyces chartarum (Berk. & M.A. Curtis) Jun F. Li, Ariyaw. & K.D. Hyde, in Ariyawansa et al., Fungal Diversity: 10.1007/s13225-015-0346-5, [40] (2015) Fig. 37

Index Fungorum number: IF551393; Facesoffungi number: FoF00938

Sexual morph: Undetermined. Asexual morph: *Conidiophores* macronematous, mononematous, branched, anastomosing, subhyaline to pale brown, smooth to verruculose $11.5\text{--}20.5 \times 3.5\text{--}7.5 \mu\text{m}$ ($\bar{x} = 14.5 \times 5 \mu\text{m}$, $n=10$). *Conidiogenous cells* $5\text{--}11 \times 6.5\text{--}10 \mu\text{m}$ ($\bar{x} = 8 \times 7.5 \mu\text{m}$), globose to subglobose, integrated, holoblastic, terminal, smooth. *Conidia* $12.5\text{--}22.8 \times 8.8\text{--}13 \mu\text{m}$ ($\bar{x} = 18.2 \times 16.2 \mu\text{m}$, $n = 25$), pleurogenous, broadly ellipsoid, 3–4 transverse septa and usually middle septum (septa) divided by longitudinal septum, middle brown to dark brown, apical and basal septa pale brown, often constricted at the septa, smooth to verruculose and rhexolytic. *Chlamydospores* hyaline to sub-hyaline, verruculose.

Culture characteristics – *Colonies* on CMA at 25 °C become 2–3 cm diam., in 7 days. Initially white became pale yellow to yellowish brown, flat surface, entire margin, reverse dark brown at the center with pale brown rind at the edge. *Hyphae* hyaline to pale brown, superficial, smooth to verruculose and septate, $1.5\text{--}4 \mu\text{m}$ ($\bar{x} = 3 \mu\text{m}$).

Material examined – Thailand, Chiang Rai Province, Chiang Rai, forest, 20°4'35"N, 100°5'43"E, on soil, 7 January 2020, W.A. Erandi Yasanthika, (MFLU 25-0129), living culture 7-gl01a = MFLUCC 24-0476.

GenBank numbers – MFLUCC 24-0476: LSU: PQ568014, ITS: PQ567559

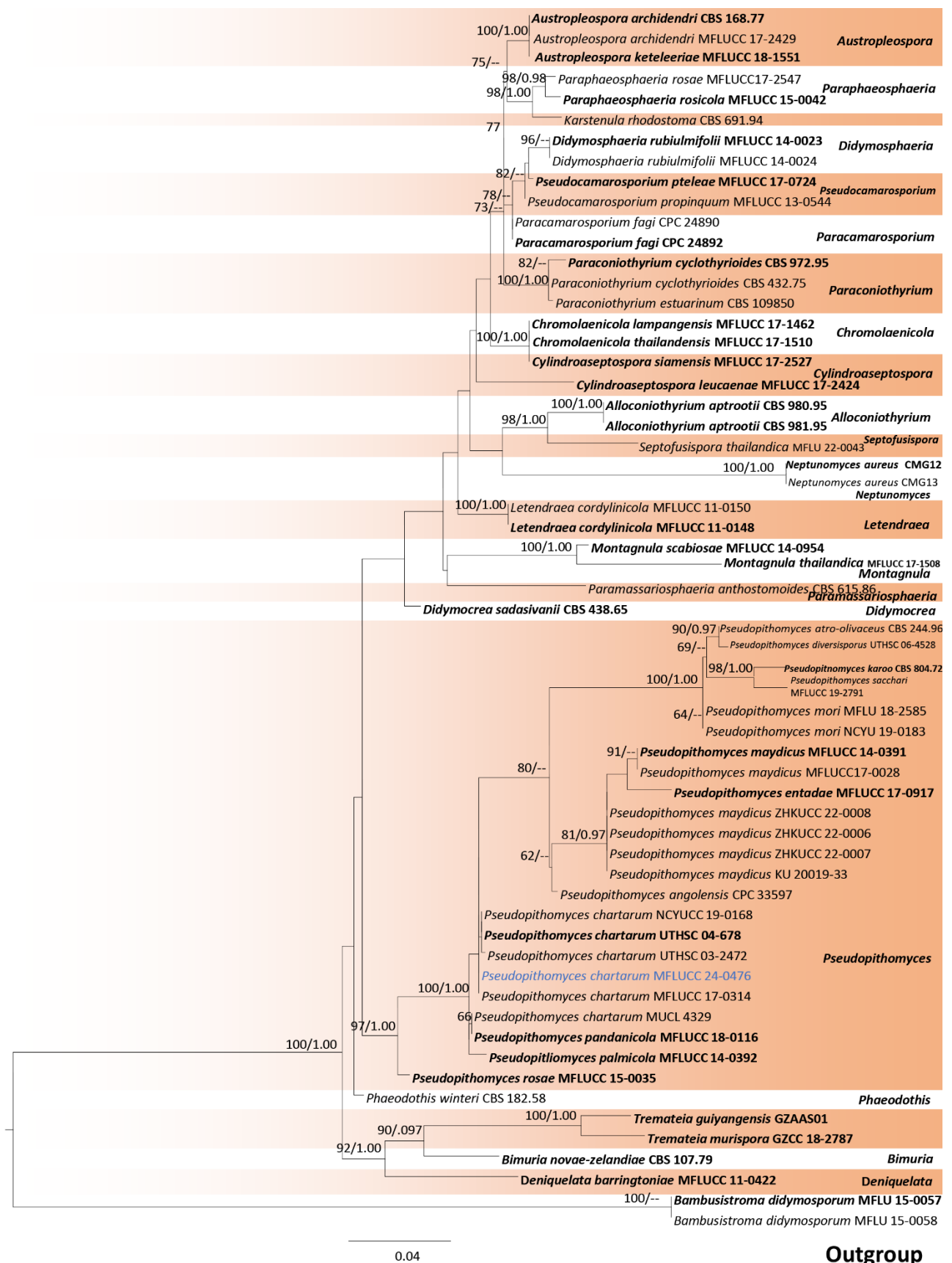


Figure 36 – The best-scoring maximum likelihood tree generated of the combined LSU, ITS and *TEF1-α* sequence data for *Didymosphaeriaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue, and ex-type strains are in bold. The tree is rooted to *Bambusistroma didymosporum* (MFLU 15-0057 and MFLU 15-0058). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 1333 bp, and single gene alignments are ITS: 632 bp, and LSU: 701 bp. The matrix had 1740 distinct alignment patterns with 23.54% % undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.225334, C = 0.250694, G = 0.286607, T = 0.237365; substitution rates AC = 1.166020, AG = 2.057124, AT = 1.892820, CG = 1.203646, CT = 5.719619, GT = 1.000000; gamma distribution shape parameter α = 0.505971.

Notes – As shown in Figure 36, our isolate (MFLUCC 24-0476) clusters with *Pseudopithomyces chartarum* strains with 100% ML, 1.00 BYPP statistical support. Comparing the LSU, ITS and *TEF1-α* regions of our strain with the type species (UTHSC04-678) showed that they have 100% similarity. Our isolate (MFLUCC 24-0476) shares a similar morphology with the type species by having mononematous, branched, and anastomosing conidiophores, integrated conidiogenous cells, and conidia with 3–4 transverse septa and usually with a middle septum (septa) divided by a longitudinal septum. According to the phylogeny and morphological analyses, we suggest that our species is *P. chartarum* (Ariyawansa et al. 2015a). The species have previously been isolated as saprobes on decaying pods, leaves, twigs, leaf spots and soil in Brazil, China and Thailand, and found pathogenic on human or sheep skin (Oliveira et al. 2013, Ariyawansa et al. 2015, de Silva et al. 2022). Herein, we provide the first report of *P. chartarum* from Thai soils, that was collected from forest habitats.

Spegazzinia Sacc., *Michelia* 2 (6): 37 (1880).

Index Fungorum number: IF 9963; Facesoffungi number: FoF 08241

Saccardo (1880) introduced *Spegazzinia*, accommodating *Spegazzinia ornata* as the type species. The genus comprises 19 species (Index Fungorum 2025), but only 11 species have molecular data. Previously, *Spegazzinia* was classified in *Apiosporaceae* (*Sordariomycetes*) by Hyde et al. (1998). However, based on SSU, LSU, ITS and *TEF1-α* sequence data of *S. deightonii* and *S. tessarthra*, Tanaka et al. (2015) placed the genus in *Didymosphaeriaceae*. Hughes (1953) mentioned this as a hyphomycetous genus, with a unique basauxic conidiophore ontogeny (conidiophores that arise and elongate from a cup-shaped basal cell called a conidiophore mother cell). It shows pleomorphism, where species produce two types of conidia in the same mycelium: α conidia are composed of 4–8 subglobose, very dark cells with very long spines, and have a very similar morphology and size in almost every species; while β conidia is characterized by subspherical or broadly ellipsoid, in general, flattened in one plane, cruciately septate or muriform, frequently pale brown and smooth, with short spines or lobed (Mena-Portales et al. 2017). Species are found as endophytes and saprobes in tropical, subtropical and temperate regions. Their hosts can be dead and living stems and leaves, fruits, lichens, marine and brackish estuary sediments and soils (Borut & Johnson 1962, Ellis 1971, Leão-Ferreira & Gusmão 2010).

Table 38 *Spegazzinia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Spegazzinia parkeri</i>	Australia	Wheat rhizosphere	Sivasithamparam (1974)
<i>S. tessarthra</i>	Thailand	ND	Manoch (1998)

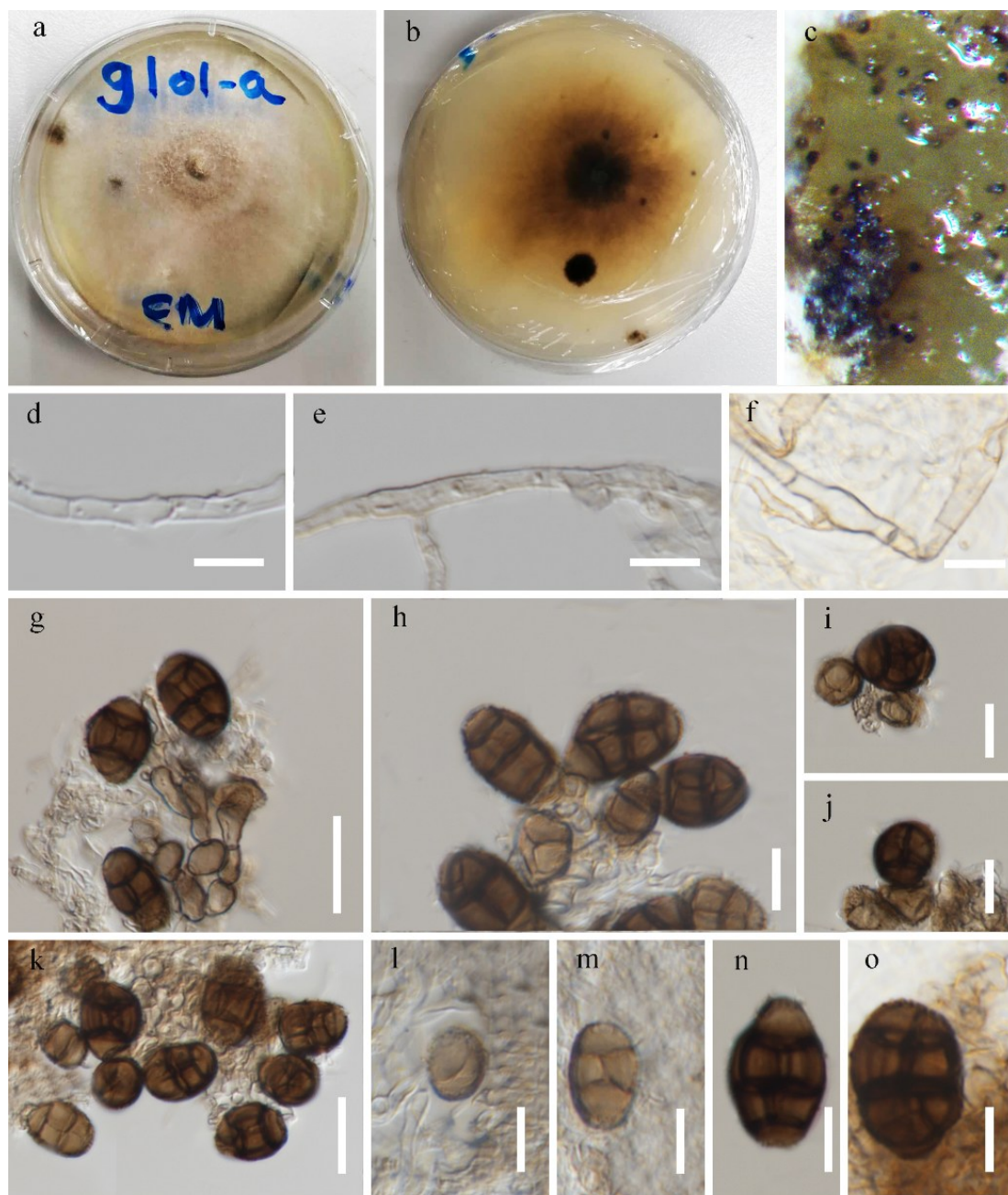


Figure 37. – *Pseudopithomyces chartarum* (MFLU 25-0129). a, b Culture characters on PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d Immature hyphae. e Mature hyphae. f Chlamydospore. g–j Conidiogenous cells attached with conidia. k–o Conidia. Scale bars: g, k = 20 μ m, d–f, h–j, l–o = 10 μ m.

Latoruaceae Crous

Latorua Crous, IMA Fungus 6(1): 175 (2015).

Fig. 38

Index Fungorum number: IF 812791; Facesoffungi number: FoF 07743

Crous et al. (2015) introduced *Latorua*, based on morpho-molecular (ITS and LSU) analyses with two species accepted, and *L. caligans* is designated as the type. However, Crane & Miller (2016) synonymized *Latorua* with *Bahusandhika* based on the development of conidiogenous cells and conidia and the conidial morphology. But *Latorua* was reinstated subsequently, and it currently remains as a monotypic genus with molecular data (Liu et al. 2018). The asexual morph is hyphomycetous, that is solitary, erect, clavate, pale brown and polyblastic.

conidiogenous cells that produce acrogenous, brown, fusoid-ellipsoidal, septate conidia that are constricted at the septa. Conidia appear in conidial chains, where secondary conidia are produced via the apical cells of conidia. The sexual morph is unknown (Crous et al. 2015, Crane & Miller 2016).

Table 39 *Latorua* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Latorua caligans</i>	Brazil	Soil sample taken in A soil horizon	Crane & Miller (2016)
<i>Latorua caligans</i>	India	ND	

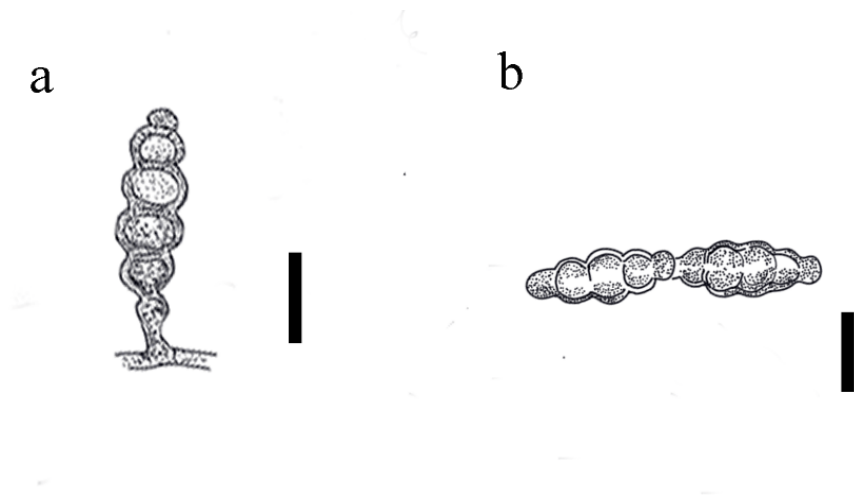


Figure 38 – *Latorua caligans* (CBS 576.65). a Conidiogenesis. b. Conidia. Scale bars a, b = 10 μm. Redrawn from Crous et al. (2015b).

Matsushimamyces Rah. Sharma & Roh. Sharma, IMA Fungus 6(2): 338 (2015)
Index Fungorum number: IF 810895; Facesoffungi number: FoF 07744
Sharma et al. (2015) erected *Matsushimamyces* and *M. bohaniensis* is designated as the type species. Currently, two species are listed in *Matsushimamyces* (Species Fungorum 2025), and both of them have molecular data. The asexual morph is hyphomycetous and bears solitary, erect, rarely branched macronematous, mononematous conidiophores that produce pale brown, coarsely verruculose, monoblastic, terminal conidiogenous cells and solitary, sub-hyaline to brown, fusoid to broadly ellipsoid, straight or curved, multi-septate conidia (Sharma et al. 2015). The genus was reported from soil and decaying leaves of unidentified trees in India and Cuba (Sharma et al. 2015).

Fig. 39

Table 40 *Matsushimamyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Matsushimamyces bohaniensis</i>	India	Soil in a village	Sharma et al. (2015)

Multiverruca H.Y. Wang, Y.F. Han & Z.Q. Liang, Int. J. Syst. Evol. Microbiol. 73(no. 005734): 6 (2023)
Index Fungorum number: IF 843849; Facesoffungi number: FoF 16007

Fig. 40

Wang et al. (2023a) introduced *Multiverruca* based on morpho-molecular analyses using ITS and LSU gene regions. Currently, the genus is comprised of one species (Species Fungorum 2025).

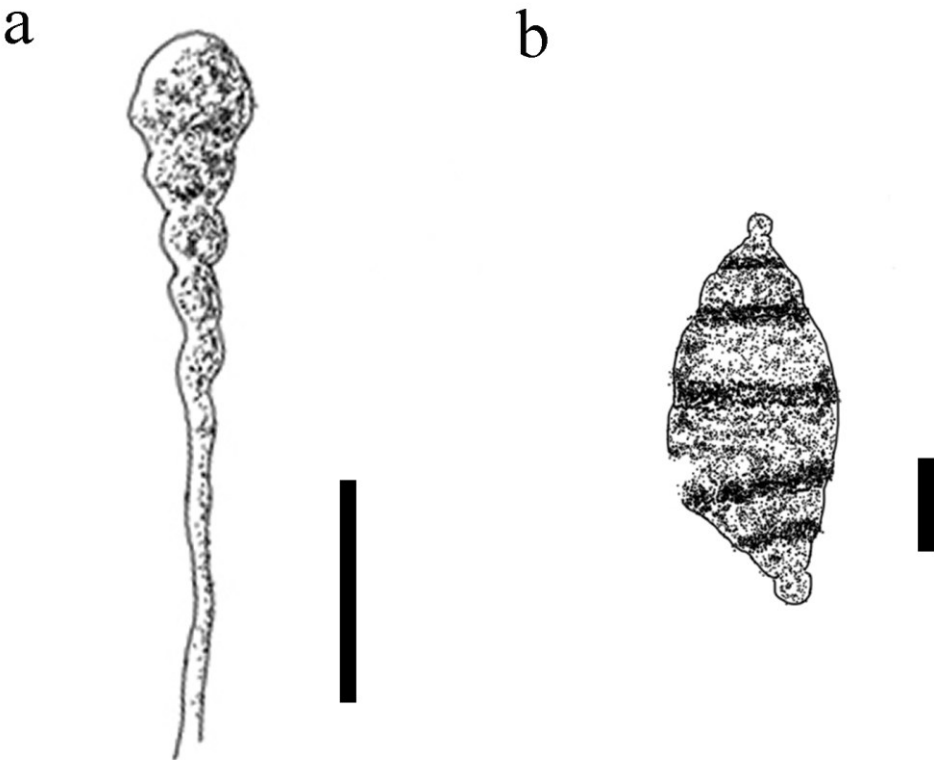


Figure 39 – *Matsushimamyces bohaniensis* (CBEC 001). a Conidiophore with conidium. b Conidium. Scale bar: a, b = 20 µm. Redrawn from Sharma et al. (2015).

Multiverruca sinensis, the type species, has been isolated from soil under vegetation in China. The asexual morph is hyphomycetous with conidiophores that are reduced to conidiogenous cells. Conidiogenous cells are solitary, erect, mostly globose, smooth and produce conidial chains. Conidia are characterized by acrogenous, mostly solitary or in short, branched chains, brown, verruculose, mostly cymbiform, septate, very thick-walled at the septa, and obtusely rounded basal and apical cells produced directly on the mycelium or on conidiogenous cells. Secondary conidia arise from the apical cells, and further, they form additional conidia. The sexual morph is still undetermined. (Wang et al. 2023a). The species have only been reported from soil habitats (Wang et al. 2023a).

Table 41 *Multiverruca* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Multiverruca sinensis</i>	China	Land with vegetation near a hospital	Wang et al. (2023a)

Polyschema H.P. Upadhyay, Mycopath. in Mycol. Appl. 30(3-4): 278 (1966). Fig.41
Index Fungorum number: IF 9506; Facesoffungi number: FoF 07745
Polyschema was introduced by Upadhyay (1966) and erected *P. terricola* as the type species. Currently, 20 species are available under the genus (Hyde et al. 2024c), but only four species have

molecular data. The asexual morph is hyphomycetous with lateral, short, or long, erect, simple, torulose, 0–3 septate conidiophores. Conidiogenous cells are mono- or polytretic and globose to clavate.

a



Figure 40 – *Multiverruca sinensis* (HMAS 351940). a Conidiogenous cells and conidia. Scale bar: a = 10 µm. Redrawn from Wang et al. (2023a).

Conidia are borne singly at hyphal tips, directly along sides, or on short pedicels, septate, smooth-walled, verrucose or tuberculate and pigmented (Hongsanan et al. 2020a). Species inhabiting in decaying woods and leaves, human clinical specimens and soil habitats have been found from Brazil, Cuba, India and the USA (Upadhyay 1966, Hongsanan et al. 2020a).

Table 42 *Polyschema* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Polyschema chambalensis</i>	India	ND	Joshi et al. (1983)
<i>P. congolense</i>	Congo	Forest	Reisinger & Kiffer (1974)
<i>P. queenslandicum</i>	Australia	Forest	Mota et al. (2008)
<i>P. sagari</i>	India	Forest	Pandeya & Saksena (1978)
<i>P. terricola</i>	Brazil	ND	Upadhyay (1966)
<i>P. variabile</i>	India	ND	Tiwari et al. (1977)
<i>P. yakuense</i>	Japan	Forest soil	Matsushima (1975)

Lentimurisporaceae N.G. Liu, J.K Liu & K.D. Hyde

Bahusandhika Subram., Journal of the Indian Botanical Society 35(4): 469 (1956)

Fig. 42

Index Fungorum number: IF 7319; Facesoffungi number: FoF 07231

Subramanian (1956) introduced *Bahusandhika* by accommodating *B. indica* as the type species. Currently, seven species are accepted in this genus, and only one has molecular data (Hyde et al. 2024c). Pratibha et al. (2014) suggested this genus in *Pleosporales* with ITS and LSU phylogeny.

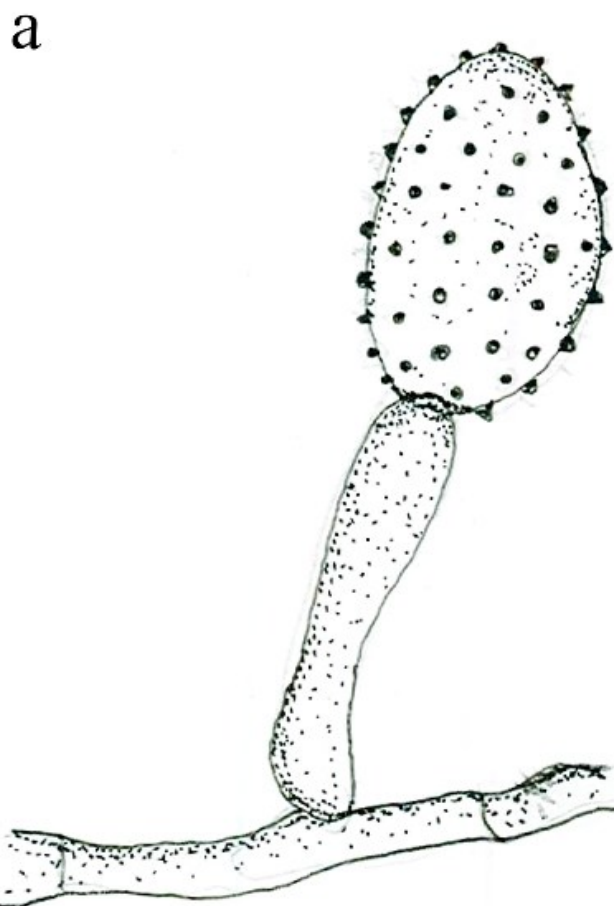


Figure 41 – *Polyschema terricola*. a. Conidiophore. Redrawn from Upadhyay (1966)

Crane & Miller (2016) synonymized several *Latorua* species under *Bahusandhika* based on morphological characteristics. The hyphomycetous asexual morph possesses conidiophores that are brown, borne terminally or laterally, septate, sometimes with constrictions at the septa, occasionally reduced to a stalk cell, and sometimes lacking conidiophores. Monoblastic or polyblastic, spherical and ovoid conidiogenous cells produce light or dark brown, fusiform, cylindrical, or rhomboidal, smooth or verrucose conidia present in simple or branched chains. The sexual morph is unknown (Pratibha et al. 2014). Most of the species are saprobes occupying woods or soil from India, Mexico, New Zealand, Panama and Venezuela (Crane & Miller 2016).

Table 43 *Bahusandhika* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Bahusandhika grootfonteinensis</i>	Namibia	Brown sandy soil	Crous et al. (2015a)
<i>B. terrestris</i>	India	<i>Shorea robusta</i> forest	Crane & Miller (2016)

***Leptosphaeriaceae* M.E. Barr**

***Leptosphaeria* Ces. & De Not. (1863).**

Index Fungorum number: IF 550958; Facesoffungi number: FoF 00454

Fig. 43

Leptosphaeria was introduced by Cesati & De Notaris (1863), and the type species is *L. doliolum*, which was previously known as *Sphaeria doliolum* (Barr 1987, Shearer et al. 1990). Based on the ITS, LSU and *Actin* gene regions, Ariyawansa et al. (2015) have provided an in-depth phylogenetic revision for this genus, including the *L. doliolum* species complex.

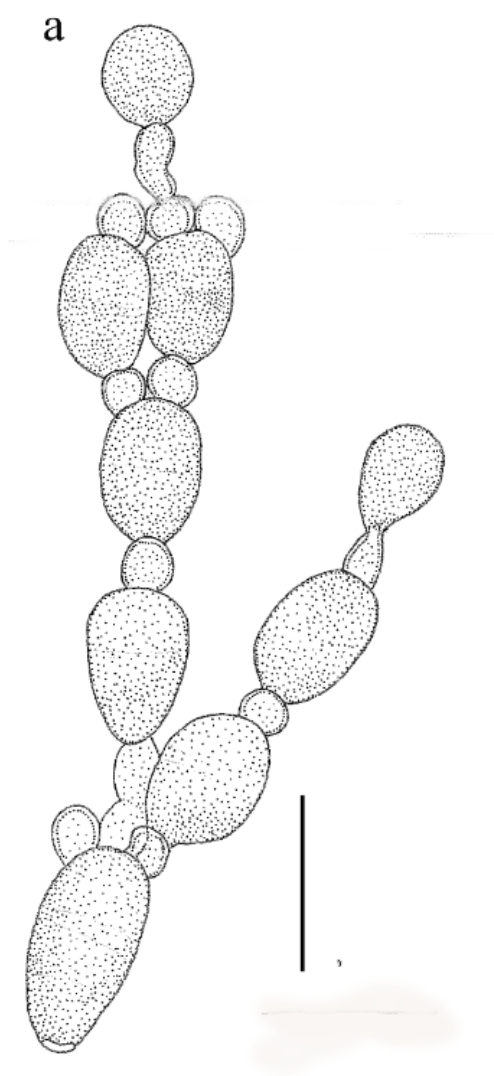


Figure 42 – *Bahusandhika indica* (HCIO 51509). a. Conidiogenous cells with conidial chains. Scale bar: a = 20. Redrawn from Pratibha et al. (2014).

The asexual morph is coelomycetous with depressed globose conidiomata, and ellipsoidal to subcylindrical conidia. The sexual morph has solitary, scattered ascomata in small groups, erumpent to superficial, globose to subglobose, broadly conical, black, coriaceous, and ostiolate. Asci are 8-spored, bitunicate, fissitunicate, cylindrical, pedicel furcate, rounded at the apex, with an ocular chamber, and having ascospores that are uni- or bi-seriate, partially overlapping, reddish to yellowish brown, 3-septate and constricted at each septum (Ariyawansa et al. 2015b). The species are saprobic or pathogenic and mostly found on herbaceous or woody plants in terrestrial habitats, while a few species are associated with soil. Species show a wide geographical distribution, including American, Asian and European regions (Ariyawansa et al. 2015b).

Table 44 *Leptosphaeria* species isolated from soil

Species	Country	Habitat or soil type	References
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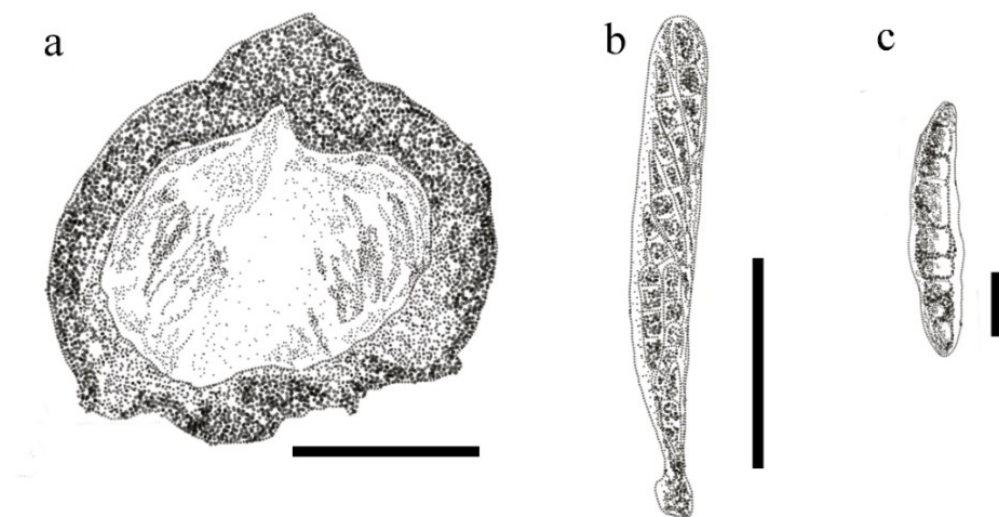


Figure 43 – *Leptosphaeria doliolum* (MFLU 15-1875). a Section of ascoma. b Ascus. c Ascospore. Scale bars a= 200 µm, b = 60 µm, c = 10 µm. Redrawn from Ariyawansa et al. (2015b).

Neocamarosporiaceae Wanas., Wijayaw., Crous & K.D. Hyde

Neocamarosporium Crous & M.J. Wingf., Persoonia 32: 273 (2014).

Fig. 44

Index Fungorum number: IF 808949; Facesoffungi number: IF 808949

Neocamarosporium was introduced by Crous et al. (2014a), with *N. goegapense* as the type species. There are 24 species in the Index Fungorum (2025) and all of which are supported with molecular data. Initially, the genus was treated under *Pleosporaceae* (Crous et al. 2014a, b), and then Wanasinghe et al. (2017b) established *Neocamarosporiaceae* based on the combined ITS, LSU, SSU, and *TEF1-α* phylogeny and designated *Neocamarosporium* as the type genus (Gonçalves et al. 2019a). The asexual morph is characterized by pycnidial conidiomata, hyaline conidiogenous cells that produce brown, smooth, muriform conidia, similar to *Camarosporium*. However, these two genera are phylogenetically distinguishable (Crous et al. 2014a, Gonçalves et al. 2019a). The sexual morph is characterized by superficial to semi-immersed, confluent, gregarious, globose, ostiolate ascomata with peridium comprised of loosely packed cells of *textura angularis*. Asci are 8-spored, bitunicate, fissitunicate, cylindrical-clavate to cylindrical, with muriform, mostly ellipsoidal, 5–7-transversely septate, 1–2-longitudinal septate ascospores that are constricted at the septum (Wanasinghe et al. 2017b). *Neocamarosporium* species have been discovered from deserts, hypersaline soils, salt marshes, seawater habitats and some are associated with leaf spots, plant debris, living leaves, roots, seedlings and stems. They can be potentially useful in agriculture in drought and salinity-affected soils (Crous et al. 2014b, Wanasinghe et al. 2017b, Gonçalves et al. 2019a). Species are distributed in Africa, Asi, Europe and the USA (Crous et al. 2021b).

Table 45 *Neocamarosporium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Neocamarosporium chichastianum</i>	Iran	ND	Crous et al. (2014b)
<i>N. jorjanensis</i>	Iran	Saline soil	Papizadeh et al. (2018)
<i>N. persepolisi</i>			
<i>N. solicola</i>			

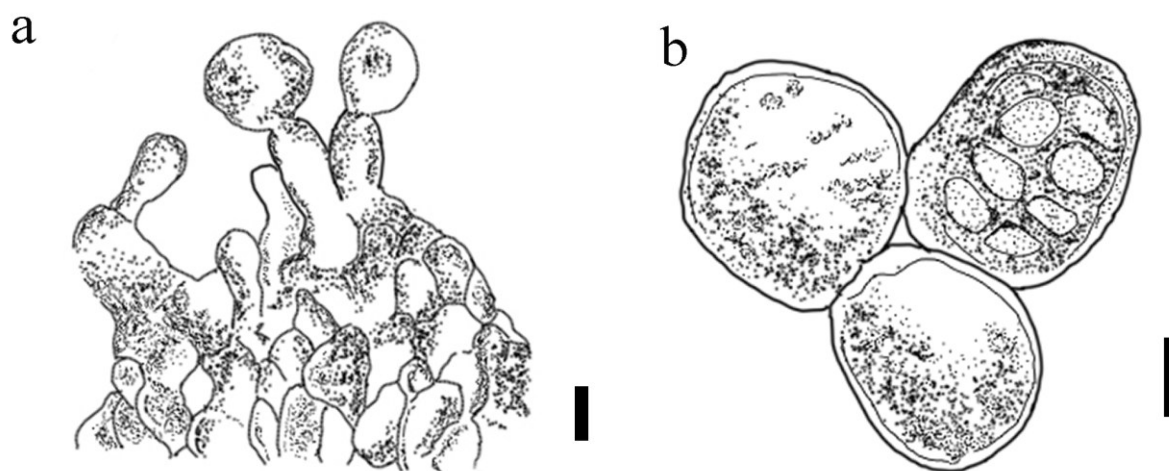


Figure 44 – *Neocamarosporium goegapense* (CBS 138008). a Conidiogenesis. b Conidia). Scale bars a, b = 10 µm. Redrawn from Crous et al. (2014a).

Nigrogranaceae Jaklitsch & Voglmayr

Nigrograna Gruyter, Verkley & Crous, Stud. Mycol. 75: 31 (2012) [2013]

Index Fungorum number: IF 564794; Facesoffungi number: FoF 09092

Nigrograna was introduced by de Gruyter et al. (2013) by using LSU phylogeny and morphology, accommodating *Nigrograna mackinnonii* ($\equiv$ *Pyrenochaeta mackinnonii*) as the type species. Currently, Species Fungorum (2025) has listed 43 species under the genus. The asexual morph of the type species is characterized by pycnidial conidiomata that are solitary or rarely confluent, superficial to immersed, globose to subglobose or pyriform, with dark brown, septate mycelial outgrowths, having papillate ostioles, olivaceous to olivaceous-black and with pseudoparenchymatous cells wall. Conidiogenous cells are hyaline, phialidic and discrete and produce subhyaline, aseptate, ellipsoidal conidia that appear brown in mass (de Gruyter et al. 2013). Subsequent studies have reported that the sexual morph is characterized by black ascomata, clavate, short pedicellate asci, and pale to chocolate brown, asymmetric, fusoid to narrowly ellipsoid, septate ascospores (Wanasinghe et al. 2020, Zhang et al. 2020). The sexual morph is reported from *N. chromolaenae*, *N. impatitensis* and *N. hydei* (Mapook et al. 2020, Zhang et al. 2020). Species have a wide distribution as endophytes, saprobes, or human pathogens and are associated with dead wood, hive-stored pollen, marine environments and soil in Austria, China, Italy, Norway, Thailand and Venezuela (Kolařík et al. 2017, Tibpromma et al. 2017, Kolařík 2018, Dayarathne 2020, Zhang et al. 2020, Yu et al. 2024).

Table 46 *Nigrograna* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Nigrograna carollii</i>	Kenya	Sediments and soils of a lake	Orwa et al. (2020)

Nigrograna spelunca Yasanthika & K.D. Hyde, sp. nov.

Fig. 46

Index Fungorum number: IF903041; Facesoffungi number: FoF 16707

Etymology – The specific epithet "*spelunca*", from Latin, refers to the cave, the location of which the holotype was collected.

Holotype – MFLU 25-0130

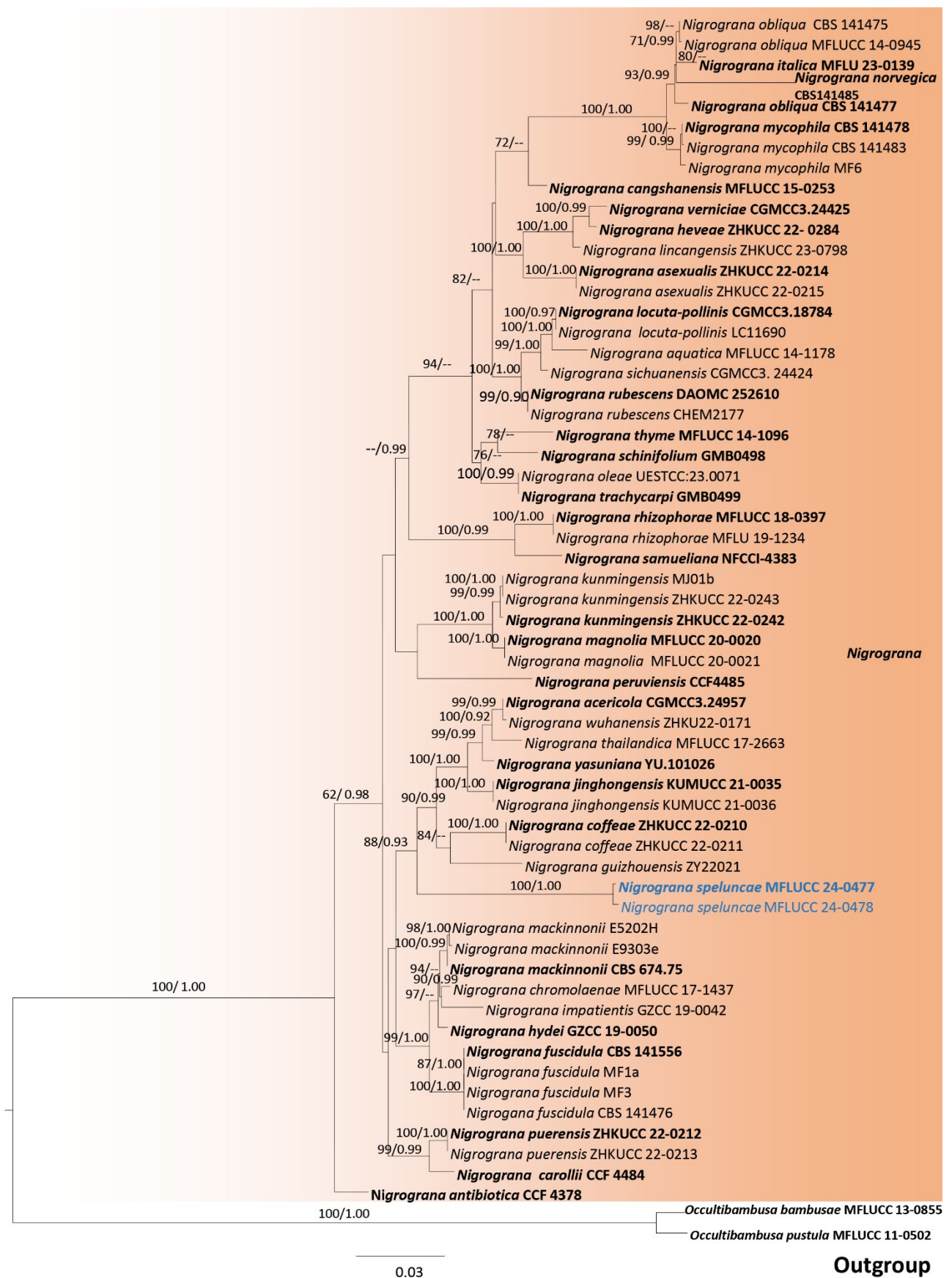


Figure 45 – The best-scoring maximum likelihood tree generated of the combined LSU, ITS and *TEF1-α* sequence data for *Nigrograna*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to

Occultibambusa bambusae (MFLUCC 13-0855) and *O. pustula* (MFLUCC 11-0502). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 3974 bp, and single gene alignments are ITS: 1745 bp, LSU: 786 bp and *TEF1-α*: 1443. The matrix had 1026 distinct alignment patterns with 19.98% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.250, C = 0.250, G = 0.250, T = 0.250; substitution rates AC = 1.00000, AG = 2.62417, AT = 1.00000, CG = 1.00000, CT = 6.47412, GT = 1.00000; gamma distribution shape parameter α = 0.700.

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 190–350 × 230–290 μm ($\bar{x}$ = 248 × 254 μm , n=10), pycnidial, mostly confluent, superficial on PDA, brown to dark brown or black, globose, unilocular, pycnidial wall pseudoparenchymatous. *Conidiophores* 2.5–6 × 1–2 μm ($\bar{x}$ = 4.5 × 1.7 μm), formed from the pycnidial wall, cylindrical to filiform, erect or flexuous, septate, hyaline to subhyaline or pale brown, simple to sparsely branched, with pegs, terminally phallic. *Phialides* 2.5–3.5 × 2.5–5 μm , ($\bar{x}$ = 3 × 3.5 μm), discrete, ampulliform to lageniform. *Conidia* 2.5–3.5 μm × 1.5–2.5 μm ($\bar{x}$ = 3 × 2 μm , n = 25), yellowish in groups, singly hyaline, aseptate, oval to ellipsoidal, thick-walled.

Culture characteristics – *Colonies* on PDA at 25 °C, become 3–4 cm diam. after seven days, whitish-brown when immature, become brown to pale brown when mature, reverse brown, dark brown, raised, entire-margined. *Mycelium* superficial, hyaline, becomes subhyaline to pale brown when mature, septate, smooth-walled, 1.5–3 μm ($\bar{x}$ = 2, n=30), sporulated after 8.5 weeks.

Material examined – Thailand, Chiang Rai, from What Tham Pha Tong cave, on soil 99.9038925N, 20.0918488E, 430m, 28 August 2022, W.A. Erandi Yasanthika (MFLU 25-0130, holotype); ex-type 90-cv23-1=MFLUCC 24-0477. *ibid.* (MFLU 25-0131); living culture 77-cv23-19=MFLUCC 24-0478.

GenBank numbers – MFLUCC 24-0477: LSU: PQ587532, ITS: PP994670, *TEF1-α*: PV618402; MFLUCC 24-0478: ITS: PQ577713, *TEF1-α*: PV618403

Notes – According to the Figure 45, our collection (MFLUCC 24-0477 and MFLUCC 24-0478) clusters within *Nigrograna* producing an independent clade adjacent to *Nigrograna acericola* (CGMCC3.24957), *N. coffeae* (ZHKUCC 22-0210, ZHKUCC 22-0211), *N. jinghongensis* (KUMUCC 21-0035, KUMUCC 21-0036), *N. thailandica* (MFLUCC 17-2663), *N. wuhanensis* (ZHKU 22-0171) and *N. yasuniana* (YU.101026), with 88 % ML and 0.93 BYPP statistical support. We compared the nucleotides across the ITS (+5.8S) gene region of our species (MFLUCC 24-0477) with each sister species, given that 71/ 451(15 %) (including gaps) difference with *Nigrograna acericola* CGMCC3.24957, while having 66/ 486 (13.5 %) (including gaps) *N. coffeae* (ZHKUCC 22-0210), 73/ 479 (15 %) (including gaps) *N. jinghongensis* (KUMUCC 21-0035), 82/ 476 (17 %) (including gaps) *N. thailandica* (MFLUCC 17-2663), 75/ 487 (15 %) (including gaps) *N. wuhanensis* (ZHKU 22-0171) and 59/417 (14 %) (including gaps) and *N. yasuniana* (YU.101026). Only sexual morph has been observed in *N. acericola*, *N. thailandica*, *N. jinghongensis*, *N. coffeae* and *N. wuhanensis* and no sexual or asexual morph reported for *N. yasuniana* YU.101026 (Kolařík et al. 2017, Boonmee et al. 2021, Lu et al. 2022, Li et al. 2023, Senanayake et al. 2023). Therefore, comparing the morphology of our species with the sister species was difficult. *Nigrograna thailandica* has been isolated from Thailand (Senanayake et al. 2023) and *N. acericola*, *N. coffeae*, *N. jinghongensis*, and *N. wuhanensis*, reported as plant saprobes in China (Boonmee et al. 2021, Lu et al. 2022, Li et al. 2023) while *N. yasuniana* was reported as an endophyte in Ecuador (Kolařík et al. 2017). Based on phylogenetic and morphological analyses, we introduce our species (MFLUCC 24-0477 and MFLUCC 24-0478) as *N. speluncae* isolated from undisturbed cave soils in Thailand.

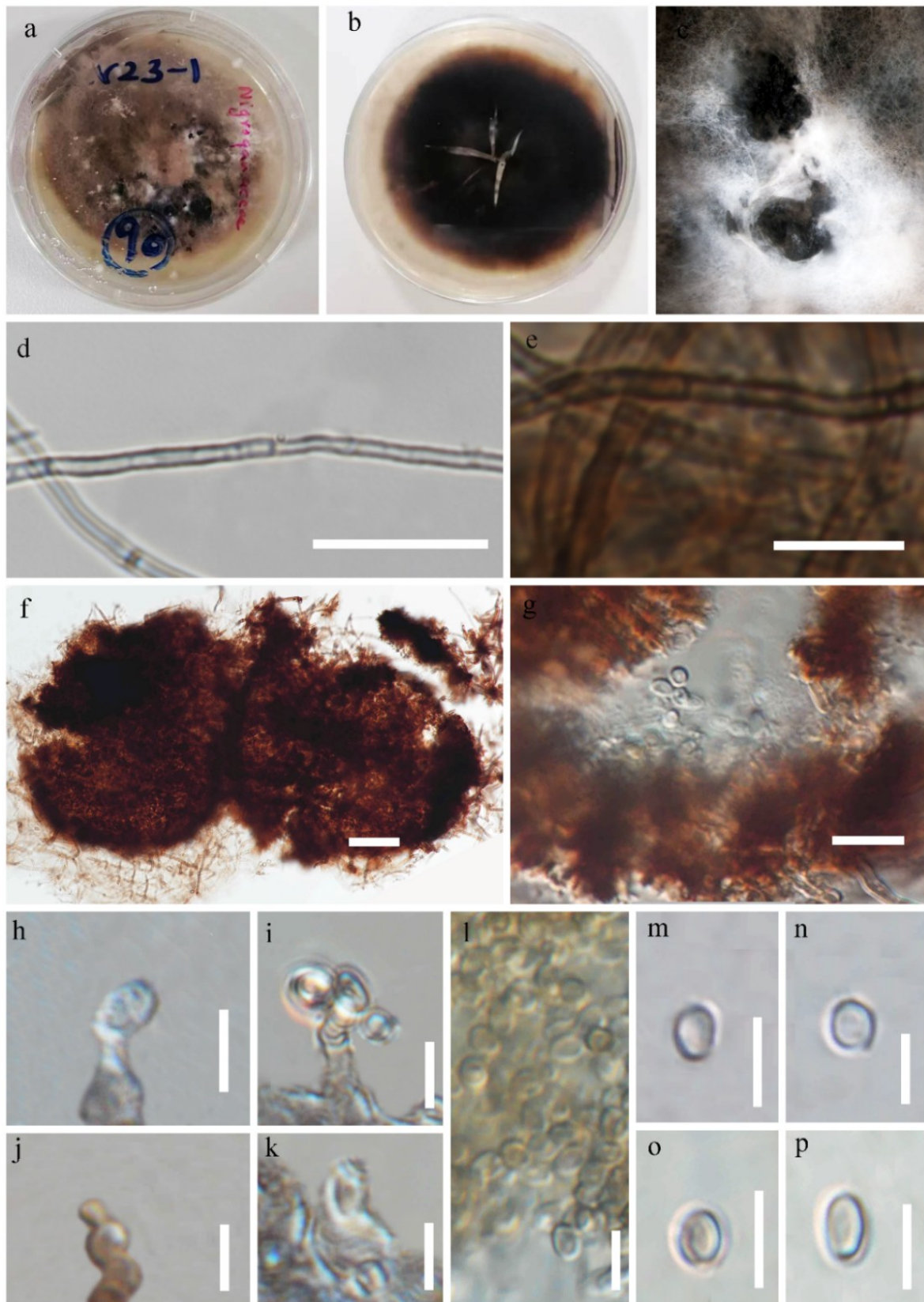


Figure 46 – *Nigrograna speluncae* (MFLU 25-0130, Holotype) a, b Culture characters on PDA (b = reverse). c Pycnidia forming on culture. d Immature hyphae. e Mature hyphae. f. Pycnidia. g pycnidia wall and matrix. h–k Conidiophores with phialidic conidiogenous cells. l–p Conidia. Scale bars: f = 50 μm , d = 20 μm , e, g = 10 μm , h–p = 5 μm .

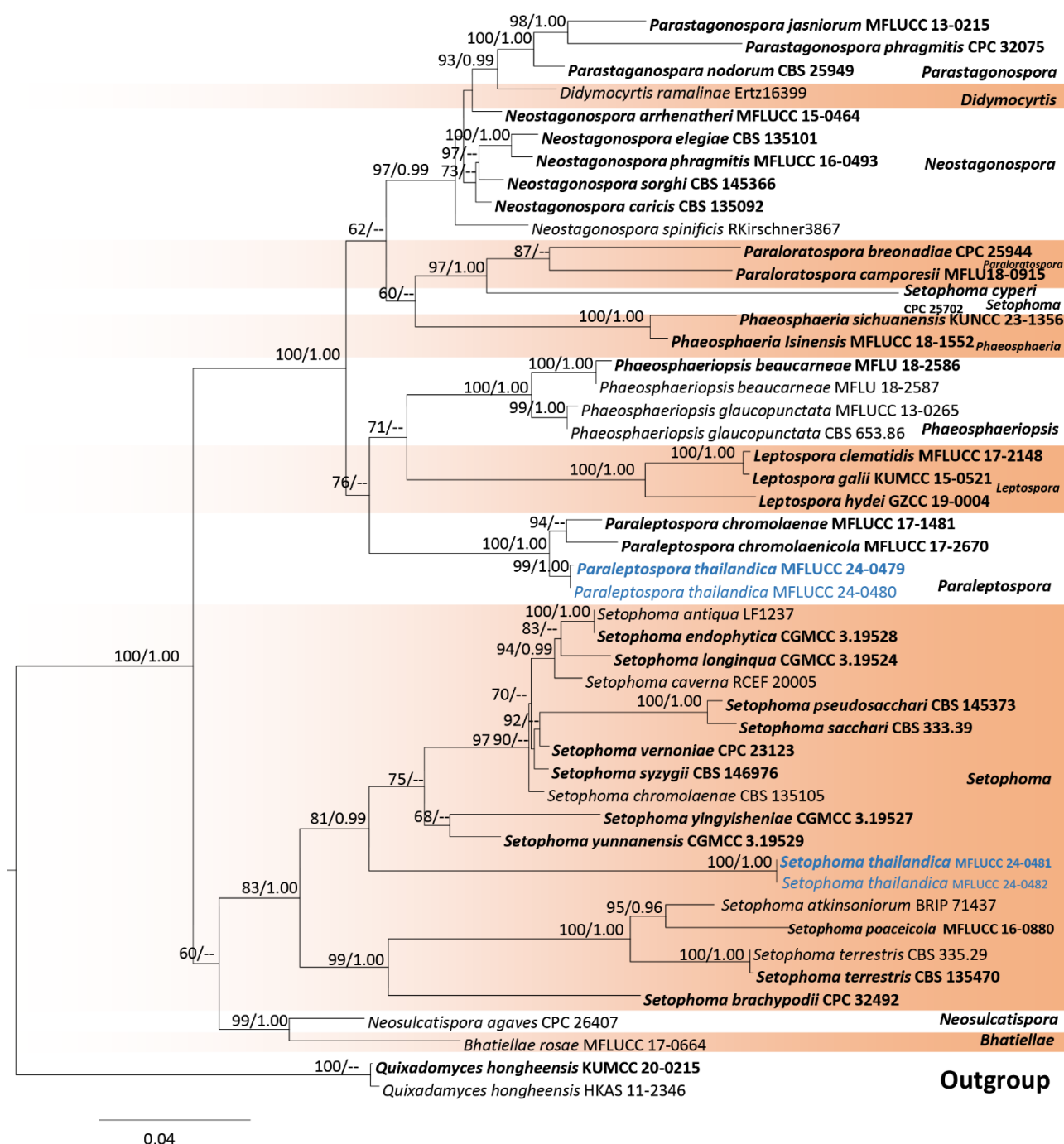


Figure 47 – The best-scoring maximum likelihood tree generated of the combined LSU and ITS sequence data for *Phaeosphaeriaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Quixadomyces hongheensis* (KUMCC 20-0215 and HKAS 11-2346). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 1312 bp, and single gene alignments are ITS: 540 bp, and LSU: 772 bp. The matrix had 341 distinct alignment patterns with 3.56% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.242, C = 0.215, G = 0.273, T = 0.269; substitution rates AC = 1.27505, AG = 3.36886, AT = 3.09631, CG = 0.30167, CT = 7.23013, GT = 1.00000; gamma distribution shape parameter α = 0.391.

Paraleptospora Mapook & K.D. Hyde, Fungal Diversity 101: 75 (2020)

Index Fungorum number: IF 557347; Facesoffungi number: FoF 07810

Mapook et al. (2020) introduced *Paraleptospora* based on phylogeny and morphology, accommodating *P. chromolaenae* as the type species. Currently, two species are accepted in the genus, both of which were introduced with molecular data (Mapook et al. 2020). The sexual morph consists of immersed to semi-immersed, solitary or scattered, globose or subglobose to ampulliform, brown to dark brown ascomata with short papillate ostiole, and the peridium is composed of several layers of thick-walled, pseudoparenchymatous, cells of *textura angularis*. Asci are 8-spored, bitunicate, fissitunicate, cylindrical to cylindric-subclavate, straight or slightly curved, pedicellate, apically rounded, with an ocular chamber, containing overlapping 1–3-seriate, hyaline or pale yellow to yellowish brown, cylindric-fusiform ascospores, (5–)6–7(–8)-septate, broader at the center and slightly constricted at septa, straight to slightly curved, guttulate, with or without polar appendages. Species have been reported as saprobes of dead stems of *Chromolaena odorata* in Thailand (Mapook et al. 2020). The genus has not been previously reported from soil.

Paraleptospora thailandica Yasanthika & K.D. Hyde, sp. nov.

Fig. 48

Index Fungorum number: IF903042; Facesoffungi number: FoF 16708.

Etymology – The specific epithet "*thailandica*", from Latin, refers to Thailand, the country of which the holotype was collected.

Holotype – MFLU 25-0169

Sexual morph: not observed. Asexual morph: Chlamydosporous. *Chlamydospores* $4.5\text{--}12 \times 3.5\text{--}6 \mu\text{m}$ ($\bar{x} = 7 \times 5 \mu\text{m}$, $n = 20$), produced from mature hyphae, mostly intercalary, sometimes terminal, solitary, or in simple or branched chains, globose to ellipsoidal or subcylindrical, subhyaline to pale brown, thick-walled.

Culture characteristics – *Colonies* on PDA reach to 4–5 cm diam. after 14 days at 25 °C, yellowish brown to greyish brown with brown periphery, raised cottony surface, reverse black brown center, yellowish middle rind and black to brown outer rind. *Mycelium* hyaline to subhyaline smooth-walled to thick-walled, septate, $1\text{--}3.5 \mu\text{m}$ ($\bar{x} = 2.1 \mu\text{m}$, $n=30$) wide.

Material examined – Thailand, Chiang Mai, Mae Taeng District, Mushroom Research Centre, from forest, on soil, 19.2145N, 98.5953E, 1440m, 17 February 2019, W.A. Erandi Yasanthika, (MFLU 25-0169, holotype); ex-type 69-fo5 = MFLUCC 24-0479. *ibid.* (MFLU 25-0170); living culture 69b-fo5b = MFLUCC 24-0480.

GenBank numbers – MFLUCC 24-0479: LSU: PQ590753, ITS: PQ012928; MFLUCC 24-0480: LSU: PQ590755, ITS: PQ590754.

Notes – Our isolates (MFLUCC 24-0479 and MFLUCC 24-0480) cluster in *Paraleptospora* clade (Figure 47), however made a distinct clade from *P. chromolaenae* (MFLUCC 17-1481) and *P. chromolaenicola* (MFLUCC 17-2670) with 99 % ML and 1.00 BYPP statistical support. The base pair difference of ITS (+5.8S) gene region in *P. thailandica* and *P. chromolaenicola* (MFLUCC 17-2670) is 20/473 (4.2%) (including gaps) and for *P. chromolaenae* (MFLUCC 17-1481), it is 17/473 (3.5%). Only sexual morph has been discovered previously (Mapook et al. 2020). Because there were no reproductive structures produced in MFLUCC 24-0479, we were unable to compare its morphology with sister species. However, chlamydospore production was observed in MFLUCC 24-0479. Based on our results, *Paraleptospora thailandica* is introduced, which is isolated from forest soil in Thailand. However, more specimens are needed for identifying its sexual and asexual characteristics. Both *P. chromolaenae* MFLUCC 17-1481 and *P. chromolaenicola* have been isolated from the dead stem of *Chromolaena odorata* from Thailand (Mapook et al. 2020). This is the first species in *Paraleptospora* associated with soil habitats.

Setophoma Gruyter, Aveskamp & Verkley, Mycologia 102(5): 1077 (2010)

Index Fungorum number: IF 514658; Facesoffungi number: FoF 00425

de Gruyter et al. (2010) introduced *Setophoma* accommodating *Setophoma terrestris* as the type species.

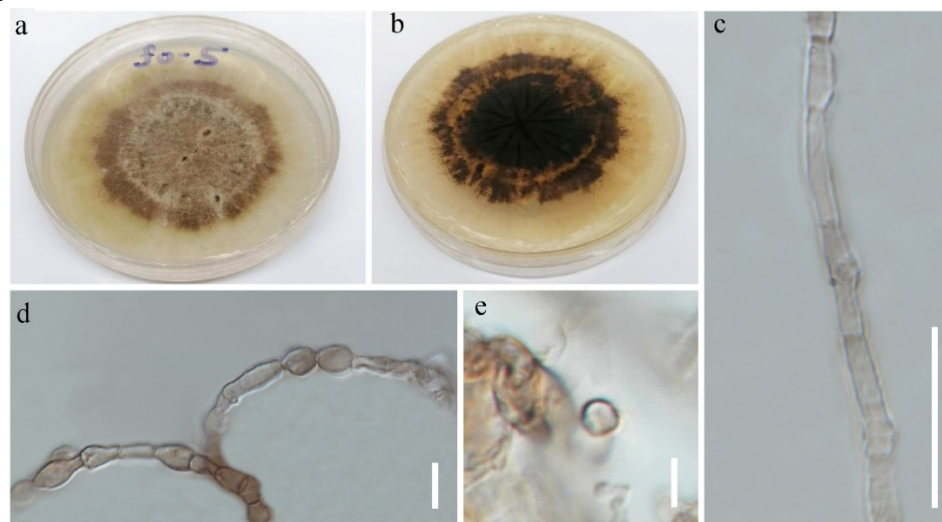


Figure 48 – *Paraleptospora thailandica* (MFLU 25-0169, Holotype) a, b Culture characters on PDA (b = reverse). c Hyphae. d, e Chlamydospores. Scale bars: c = 20 μ m, d = 10 μ m, e = 5 μ m.

The genus comprises 17 species (Species Fungorum 2025), and all of them are supported with molecular data. The asexual morph is characterized by pycnidia covered by setae, phialidic conidiogenous cells, and hyaline, ellipsoidal to subcylindrical, aseptate and guttulate conidia (de Gruyter et al. 2010). Most of the species can be found on living and dead leaves and associate with leaf spots. *Setophoma terrestris* a cosmopolitanspecies that are found in roots and soils, and also a root pathogen causing pink root rot (Boerema et al. 2004, de Gruyter et al. 2010, López-López et al. 2020). Species are distributed in Australia, Belgium, Brazil, China, France, Japan and Thailand (Liu et al. 2019b, Crous et al. 2021c).

Table 47 *Setophoma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Nigrograna carollii</i>	Argentina	Onion rhizosphere soil	Albarracín et al. (2016)

Setophoma thailandica Yasanthika & K.D. Hyde, sp. nov.

Fig. 49

Index Fungorum number: IF903044; Facesoffungi number: FoF 16709

Etymology – The specific epithet "*thailandica*", from Latin, refers to Thailand, the country of which the holotype was collected.

Holotype – MFLU 25-0135

Sexual morph: not observed. Asexual morph: Chlamydosporous. *Chlamydospores* 5–10 $\times$ 4–9 μ m ($\bar{x}$ = 7 $\times$ 6 μ m, n = 20), produced from mature hyphae, terminal or intercalary, solitary, or in simple chains, globose to sub-globose or cylindrical, pale yellow to pale brown, thick-walled, guttulate or eguttulate.

Culture characteristics – *Colonies* on PDA reach 4–5 cm diam. after 14 days at 25 °C, yellowish brown to brown, becoming brownish grey with brown periphery when mature, raised cottony surface, reverse black brown center, yellowish brown outer ring. *Mycelium* hyaline smooth becomes subhyaline to thick-walled, septate, 1–4 μ m ($\bar{x}$ = 3 μ m) wide.

Material examined – Thailand, Chiang Rai city, public area, on soil, Chiang Rai, 19.983438N, 99.892159E, 384m, 17 October 2022, W.A. Erandi Yasanthika, (MFLU 25-0135, holotype); ex-type living culture 94-u3-4= MFLUCC 24-0481. *ibid.* 19.82714926N, 99.7574546E, 407m, 28 October 2022, W.A. Erandi Yasanthika (MFLU 25-0136), living culture u4-2-110= MFLUCC 24-0482.

GenBank numbers – MFLUCC 24-0481: LSU: PQ577781, ITS: PP993943; MFLUCC 24-0482: ITS: PQ577782.

Notes – Based on the multi-gene phylogeny in Figure 47, our isolates (MFLUCC 24-0481 and MFLUCC 24-0482) cluster within *Setophoma*, producing an independent branch with 81% ML, 0.99 BYPP statistical support. Chlamydospores were produced in our culture, however, we have not observed the sexual or other asexual morphology in our species. This genus has members that produce chlamydospores: *Setophoma terrestris*, which is a common soil inhabitant, is characterized by producing globose to subglobose, terminal or intercalary, solitary or aggregated chlamydospores with guttules which are similar to our species (Ikeda et al. 2012, Yoshida 2022). Whereas, in our species, they can occasionally be in simple chains, cylindrical in shape and eguttulated. However, it is necessary to collect more specimens to identify its sexual and asexual morphology. Based on morphology and multigene phylogeny, we introduce *Setophoma thailandica* that is isolated from urban soil in Thailand.

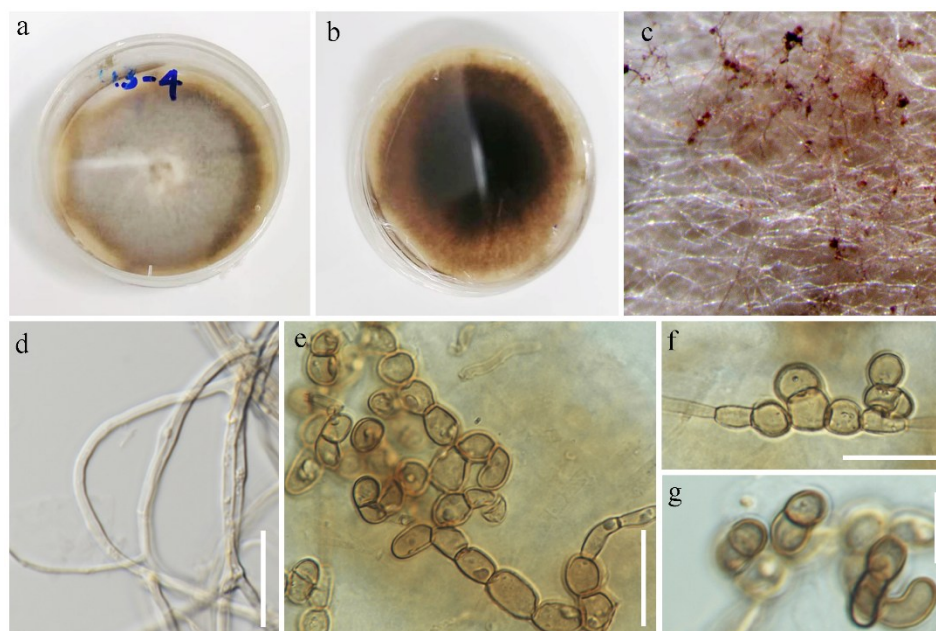


Figure 49 – *Setophoma thailandica* (MFLU 25-0135) a, b Culture characters on PDA (b = reverse). c Chlamydospore formations on culture. d Hyphae. e–g Chlamydospores. Scale bars: d–g = 20 μ m.

Pleosporaceae Nitschke

Alternaria Nees, Syst. Pilze (Würzburg): 72 (1817).

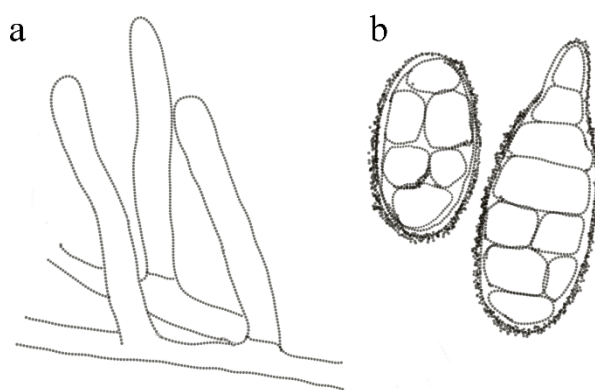
Fig. 50

Index Fungorum number: IF 7106; Facesoffungi number: FoF 00501

Alternaria was originally described by Nees von Esenbeck (1816), accommodating *A. tenuis* as the only species. Based on phylogeny *Alternaria* is currently considered a complex comprised of non-monophyletic genera within the *Alternaria* complex. Phylogenetic revision for the *Alternaria* complex is provided by recent studies, and currently it is comprised of 27 sections (Woudenberg et al. 2013, Lawrence et al. 2016). The type species is accommodated as *Alternaria alternata* (Woudenberg et al. 2013). The asexual morph in the species has dark-coloured multi-celled conidia with longitudinal and transverse septa (phaeodictyospores), and a beak of tapering apical cells (Hongsanant et al. 2020a). This is a ubiquitous genus, having saprobic, endophytic and pathogenic modes that are associated with agricultural products, air, animals, plants, seeds and soil. Some of them are serious plant pathogens leading to major crop and postharvest losses (Woudenberg et al. 2013, Lawrence et al. 2016, Jayawardena et al. 2024, Zhang et al. 2025).

Table 48 *Alternaria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Alternaria alternata</i>	Mexico	Spinach cultivation	Heredia et al. (1988)
<i>A. angustiovoidea</i>	Egypt	A Botanical garden	Ismail et al. (2020)
<i>A. arborescens</i>			
<i>A. chlamydospora</i>			
<i>A. tenuissima</i>			
<i>A. arborescens</i>	Switzerland	Peat soil	Norphanphoun et al. (2021)
<i>A. indefessa</i>	USA	ND	
<i>A. phragmospora</i>		ND	
<i>A. soliaridae</i>		ND	
<i>A. carotiincultae</i>	USA	ND	Park et al. (2008)
<i>A. limaciformis</i>	UK	ND	Woudenberg et al. (2013)
<i>A. kulundii</i>	Russia	Soda soil in steppe and a lake	Grum-Grzhimaylo et al. (2016)
<i>A. petuchovskii</i>		Soda/chloride soil in a lake	
<i>A. shukurtuzii</i>		Soda/chloride/sulfate soil in a lake	
<i>A. radicina</i>	USA	Carrot fields	Pryor et al. (1998)
<i>Alternaria</i> sp.	Thailand	ND	Manoch (2004)

**Figure 50** – *Alternaria alternata* (CBS 326.65). a Conidiophores. b. Conidia. Redrawn from Domsch et al. (1993).

Bipolaris Shoemaker, Can. J. Bot. 37(5): 882 (1959).

Index Fungorum number: IF 7375; Facesoffungi number: FoF 00503

Shoemaker (1959) introduced *Bipolaris*, and the type species is *Bipolaris maydis*. Currently, 76 species are listed in the Species Fungorum (2025). During the taxonomic refinements in *Helminthosporium*, the species were segregated into several genera including *Bipolaris*, *Curvularia*, *Drechslera*, *Exserohilum*, *Johnalcornia* and *Porocercospora* (Sivanesan 1987). Manamgoda et al. (2014) provided a phylogenetic revision for this genus, and the recent phylogenetic revision was provided by Bhunjun et al. (2020), while addressing various taxonomic misidentifications of the *Bipolaris* species and suggesting *GAPDH* as the best single marker for the genus. The asexual morph is hyphomycetous, having conidiophores that are pale to dark brown, single, branched, sometimes arranged in small groups, straight to flexuous or geniculate. Conidiogenous nodes are smooth to slightly verruculose and they produce conidia mostly curved, canoe-shaped, fusoid or obclavate, rarely straight, hyaline, pale to dark brown, reddish brown or pale to deep olivaceous and with 3–14-distoseptate (Manamgoda et al. 2014). The sexual morph is not common in nature; however, it can be produced in laboratory conditions. The sexual morph is characterized by the brown or black, immersed, erumpent ascomata and the peridium is comprised of pseudoparenchymatous cells. Asci are 2–8-spored, clavate, cylindrical-clavate or broadly fusoid,

bitunicate, fissitunicate and short pedicellate, and with fasciculate, filiform or flagelliform, hyaline to pale yellow or pale brown and septate ascospores (Manamgoda et al. 2014). The genus is globally reported as pathogens, saprobes and endophytes inhabiting various hosts, including plants and soil. Some species are important plant pathogens that manifest diseases over 60 host genera, and associate with leaf spots, foliar blights and root rots (Manamgoda et al. 2014, Bhunjun et al. 2020). *B. sorokiniana* is widely distributed in soil, which is known as a root pathogen (Manamgoda et al. 2014).

Table 49 *Alternaria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Bipolaris oryzae</i>	Thailand	Rice field	Reanprayoon & Pathomsiriwong (2012)
<i>B. australiensis</i> <i>B. hawaiiensis</i> <i>B. spicifera</i> <i>B. sorokiniana</i>	China Japan	Yellow River Delta Rice field	(Huimei & Tianyu (2004) Manamgoda et al. (2014)

Curvularia Boedijn, Bulletin du Jardin Botanique de Buitenzorg 13 (1): 123 (1933)

Index Fungorum: IF 7847; Facesoffungi Number: FoF 12887

Curvularia was introduced by Boedijn (1933) with its type species *C. lunata*. There are 196 species listed in the Species Fungorum (2025), and around 129 of them are supported with molecular data. Recent studies (Manamgoda et al. 2015, Marin-Felix et al. 2017a, b, Tan et al. 2018) provided multi-gene phylogenetic analyses for *Curvularia* and introduced new species. Both asexual and sexual morphs have been observed; however, mainly the asexual morph is used to distinguish this genus. Due to the morphological overlapping with other genera, multi-gene phylogenetic analyses are essential in species delineation in *Curvularia*. The asexual morph is characterized by brown, curved, disto- or eu-septate conidia with inordinately enlarged intermediate cells (Shoemaker 1959, Marin-Felix et al. 2017a, 2020a). The sexual morph is characterized by black, globose ascomata, bitunicate, cylindrical asci and filiform, hyaline ascospores (Manamgoda et al. 2015). Nelson (1964) mentioned it is difficult to observe the sexual morph in the natural environment, but they can be produced in cultures. The genus has worldwide distribution recorded from air, clinical samples, household environments, plants, soil and water habitats in various life modes such as saprobes, endophytes and pathogens. They can be pathogenic on animals, humans and plants (Manamgoda et al. 2015, Marin-Felix et al. 2017a, Tan et al. 2018). *Curvularia* infections have been observed in rice, maize, wheat and sorghum crops.

Table 50 *Curvularia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Curvularia affinis</i> <i>C. intermedia</i> <i>C. lunata</i>	China	Yellow River Delta	Huimei & Tianyu (2004)
<i>C. brachyspora</i> <i>C. inaequalis</i> <i>C. neergaardii</i> <i>C. spicifer</i>	Java France Chile Spain	ND Sand dune soil Desert soil ND	Manamgoda et al. (2014)
<i>C. Chiangmaiensis</i> <i>C. deserticola</i> <i>C. maraisii</i> <i>C. moringae</i> <i>C. namibe</i> <i>C. prasadii</i> <i>C. rouhanii</i> <i>C. stipagrostidicola</i>	Thailand Namibia	Forest soil Desert soil	Yasanthika et al. (2023) van Vuuren et al. (2024)

Species	Country	Habitat or soil type	References
<i>C. tribuli</i>	Thailand	Forests and cultivated lands	Seephueak et al. (2019)
<i>C. eragrostidis</i>			
<i>C. lunata</i>			
<i>C. pallescens</i>			

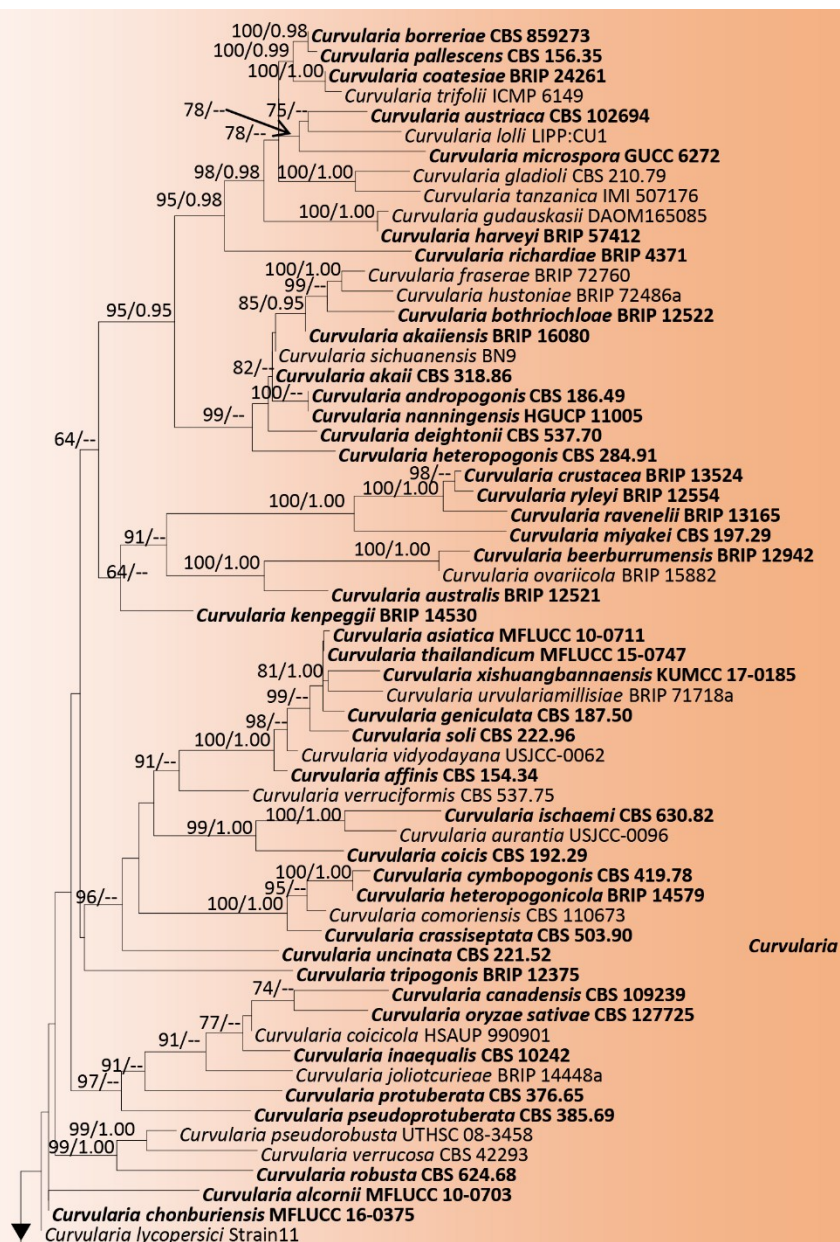


Figure 51 – The best-scoring maximum likelihood tree generated of the combined ITS, *GAPDH* and *TEF1-α* sequence data for *Pleosporaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted in *Bipolaris maydis* (CBS 13629) and *B. panici-miliacei* (CBS 19929LT). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 1820 bp, and single gene alignments are ITS: 377 bp, and *TEF1-α*: 906bp, *GAPDH*: 537bp. The matrix had 674 distinct alignment patterns with 16.84% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.230, C = 0.308, G = 0.243, T = 0.219; substitution rates AC = 1.00000, AG = 4.00737, AT = 1.00000, CG = 1.00000, CT = 6.66178, GT = 1.00000; gamma distribution shape parameter α = 0.674.

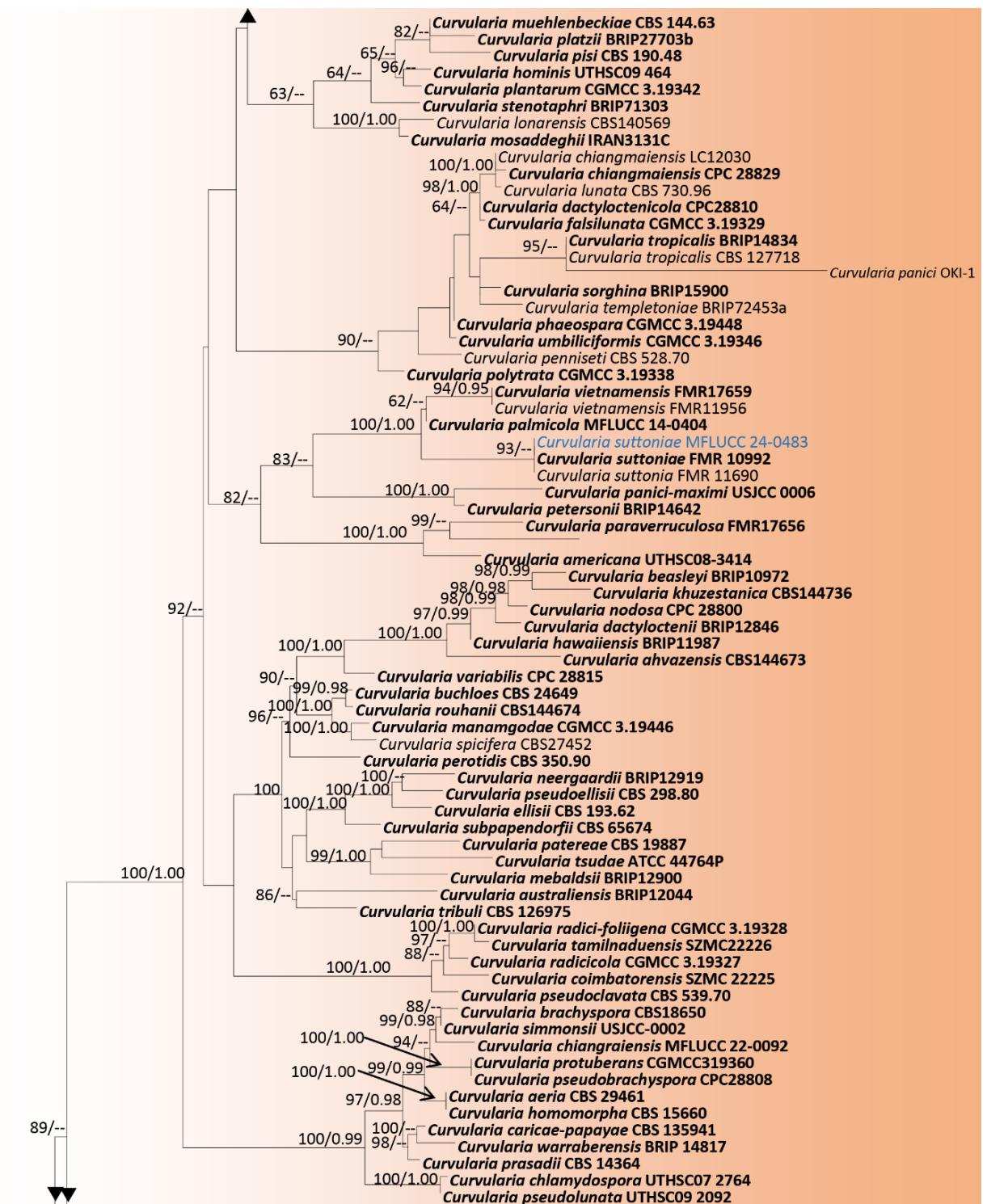


Figure 51 – Continued

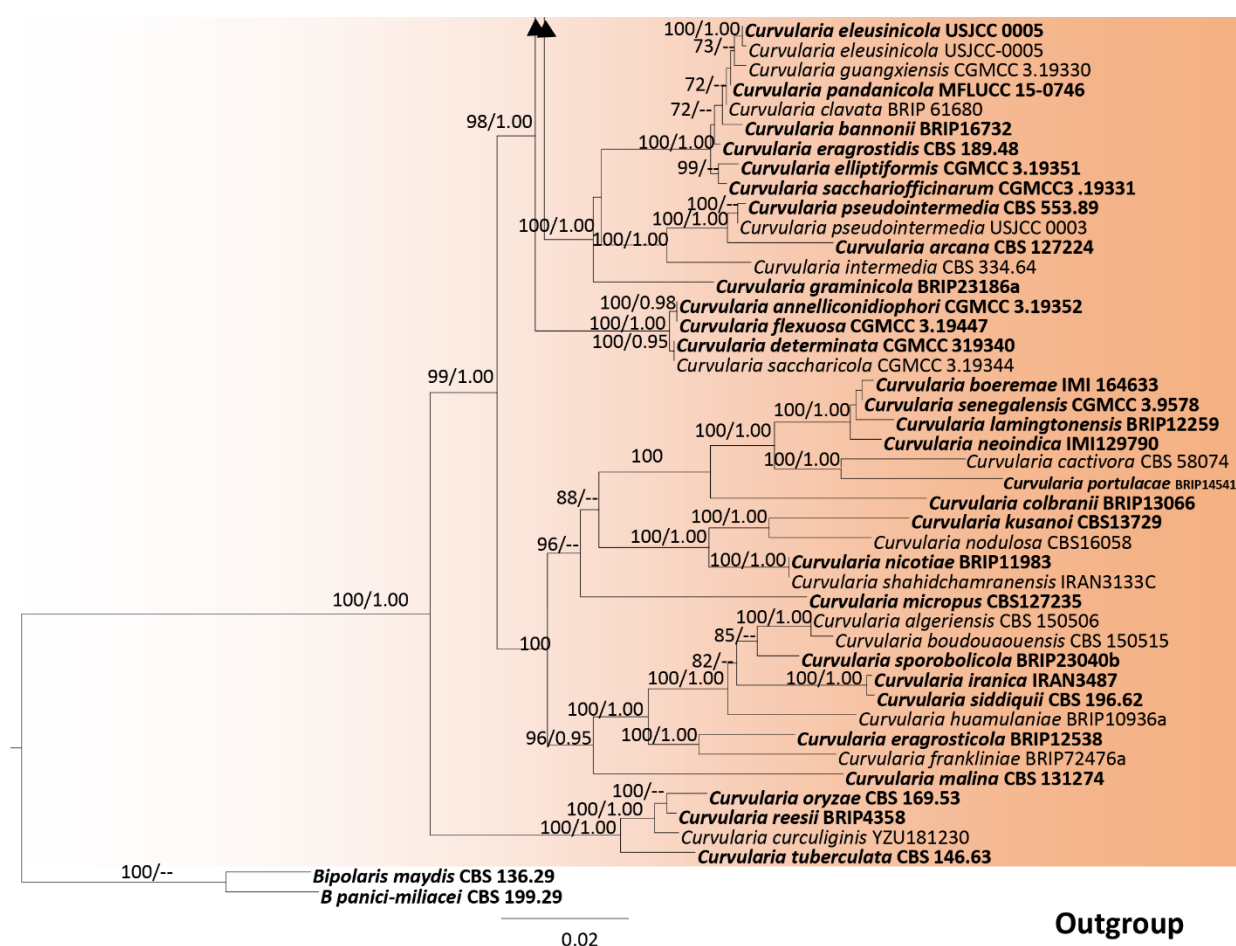


Figure 51 – Continued.

Curvularia suttoniae Iturrieta-González, Wiederhold, Gené & Dania García, MycoKeys 68: 13 (2020) Fig. 52

Index Fungorum number: IF 833025; Facesoffungi number: FoF 16710

Sexual morph: not observed. Asexual morph: *Conidiophores* 2–5.5 × 1.5–3 µm ($\bar{x}$ = 3.5 × 2.5 µm), mononematous, micronematous, mostly intercalary, smooth-walled, pale brown to brown. *Conidiogenous cells* arise from hyphae or mostly intercalary, polytretic, pale brown, subcylindrical. *Conidia* 11.5–20 × 6–9 µm ($\bar{x}$ = 15.5 × 7.5 µm, n = 25), pale brown, straight or slightly curved, smooth-walled, 2–3 septate, the third cell from the base often swollen, apical and basal cells paler than the middle cells, protuberant and thickened at hila. *Chlamydospores* subhyaline to brown, globose to subglobose intercalary, simple or branched chains, smooth to slightly verrucose-walled.

Culture characteristics – *Colonies* become 3–4 cm diam. at 25 °C on PDA, black-brown velvety, flat, irregularly-margined, reverse black. *Mycelium* sub-hyaline to brown, branched, smooth-walled to verrucose, septate, 2.5–6 µm ($\bar{x}$ = 4.5 µm) µm wide.

Material examined – Thailand, Chiang Rai, Public area in the city, 19.82714N, 99.7574546E, 407m, 28 October 2022, W.A. Erandi Yasanthika, (MFLU 25-0134), living culture 101-U2-3= MFLUCC 24-0483.

GenBank numbers – MFLUCC 24-0483: ITS: PQ567560, *GAPDH*: PV523927, *TEF1-α*: PV523926

Notes – Our strain (MFLUCC 24-0483) clustered with *Curvularia suttoniae* with 93% ML statistical support and in the phylogenetic tree (Figure 51), however, with BYPP value less than 0.90. Each gene region was compared between our strain and the type species (FMR 10992) and they showed 100% similarity. Our isolate has a similar morphology to *C. suttoniae* (FMR 10992) by having straight or slightly curved, 2–3 septate conidia with the third cell from the base often

swollen and protuberant and thickened hila (Iturrieta-González et al. 2020). However, the type species (FMR 10992) has semi- to macronematous, erect to slightly flexuous conidiophores with geniculated apices, while in our isolate, most of them are intercalary and smooth-walled. In addition, our isolate has produced chlamydospores. Based on morphology and phylogeny, we confirm our strain as *C. suttoniae*. The species has previously been isolated from human clinical samples in the USA (Iturrieta-González et al. 2020). Herein, we report its first record from soil that was isolated from a public place in Chiang Rai City, Thailand.



Figure 52 – *Curvularia suttoniae* (MFLU 25-0134) a, b Culture characters on PDA (b = reverse). c. Sporulated colony with conidial attachments on the mycelium. d. Immature hyphae. e Mature hyphae. f Chlamydospores g–j Conidiogenesis. k–n Conidia. Scale bars: d–f, k = 20 μ m, g–j, l–n = 10 μ m.

Pyrenophora Fr., Summa veg. Scand., Sectio Post. (Stockholm): 397 (1849)

Index Fungorum number: IF 4596; Facesoffungi number: FoF 000009

Pyrenophora was introduced by Fries (1849) while accommodating the type species, *P. phaeocomes* which was previously described as *Sphaeria phaeocomes* in *Xylariaceae* (Rebentisch 1804). However, Fries (1849) placed *Pyrenophora* in *Pleosporales* and currently, the genus consists of more than 100 species (Hyde et al. 2024c). *Pyrenophora* is linked to asexual morphs in *Drechslera* and the sexual morph is characterized by having ascomata that are immersed to semi immersed, neck covered with brown to reddish-brown setae, lack of pseudoparaphyses, clavate to saccate asci, usually with a large apical ring, and muriform terete (cylindrical, frequently circular in

section but narrowing to one end) ascospores (Ariyawansa et al. 2014a). Species can be saprobes or pathogens that have been found in living and dead leaves and stems, seeds and soil in Australia, Europe, Hungary, India, New Zealand, North America and Thailand. Further, they are pathogens on many graminicolous hosts that cause serious diseases such as barley stripe and tan spot of wheat (Zhang & Berbee 2001, Ariyawansa et al. 2014a).

Table 51 *Pyrenophora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pyrenophora</i> sp.	Thailand	ND	Manoch et al. (2004)
<i>Pyrenophora</i> sp.	India	Arsenic contaminated soil	Naseem et al. (2024)
<i>P. tritici-repentis</i>	China	North China Plain	Liu et al. (2024)

Pseudopyrenochaetaceae Valenz.-López, Crous, Stchigel, Guarro & J.F. Cano

Pseudopyrenochaeta Valenz.-Lopez, Crous, Stchigel, Guarro & Cano, Stud. Mycol. 90: 53 (2017). Fig. 53

Index Fungorum number: IF 820427; Facesoffungi number: FoF 08353

Pseudopyrenochaeta was erected by Valenzuela-Lopez et al. (2018), based on a multi-gene phylogenetic analysis (LSU, ITS, *TUB2* and *RPB2*) and the morphological support. It was designated as the type genus of *Pseudopyrenochaetaceae*, with *P. lycopersici* recognized as the type species (Valenzuela-Lopez et al. 2018). *Pseudopyrenochaeta* consists of two species (Species Fungorum 2025), and both of them have molecular data. The asexual morph possesses pycnidial, brown to dark brown, solitary, globose to subglobose, setose conidiomata. Conidiophores are hyaline, simple, filiform and have phialidic, hyaline and intercalary conidiogenous cells. Conidia are hyaline, cylindrical to allantoid, aseptate, smooth- and thin-walled. The sexual morph remains undetermined. Members are soil-borne fungal pathogens that can cause corky disease in tomatoes, leading to significant yield losses in tomato crops, and infect cucumber, eggplant, melon, pepper, safflower, spinach and tobacco, found in Korea, Russia and the Netherlands (Aragona et al. 2022).

Table 52 *Pseudopyrenochaeta* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudopyrenochaeta lycopersici</i>	Italy, Korea and Russia	Soil in tomato cultivations	Bubici (2018)
<i>P. terrestris</i>	The Netherlands	Greenhouse soil	Valenzuela-Lopez et al. (2018)

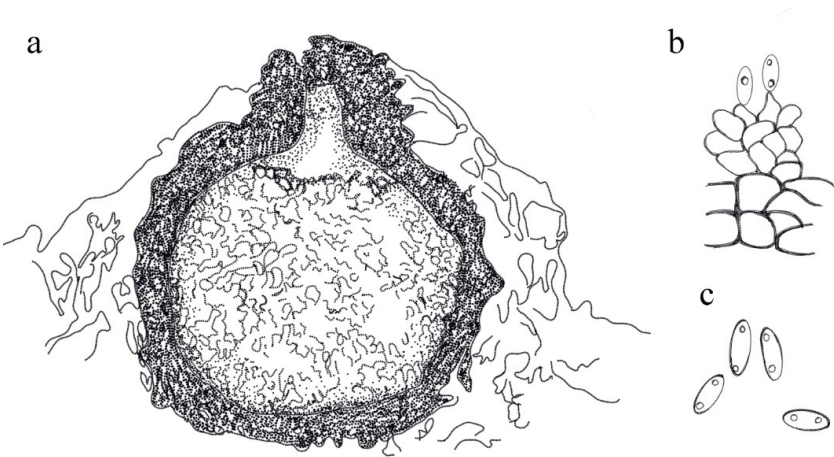


Figure 53 – *Pseudopyrenochaeta lycopersici*. a Conidiomata. b Conidiogenesis c Conidia. Redrawn from Schneider & Gerlach (1973).

Pyrenochaetopsidaceae Valenz.-López, Crous, Cano, Guarro & Stchigel

Neopyrenochaeta Valenz.-Lopez, Crous, Stchigel, Guarro & Cano, Stud. Mycol. 90: 54 (2017)

Index Fungorum number: IF 820313; Facesoffungi number: FoF 07389

Valenzuela-Lopez et al. (2018) introduced *Neopyrenochaetaceae* based on LSU, ITS, *TUB2* and *RPB2* gene regions and accommodated *Neopyrenochaeta* as a new genus with its type species, *N. acicula*. The genus comprises 16 species (Species Fungorum 2025), and all are supported with molecular data. The asexual morph is characterized by the pale brown to brown, solitary ovoid to globose pycnidia and setose, ostiolate and with pycnidial wall cells of *textura angularis*. Conidiogenous cells are phialidic, ampulliform or lageniform and produce aseptate, hyaline, smooth- and thin-walled, ovoid to subcylindrical conidia (Valenzuela-Lopez et al. 2018). Species are reported from dead plant materials, freshwater habitats, mobile phones and soil in China, Russia, South Africa, Thailand and the Netherlands (Li et al. 2020a, Magaña-Dueñas et al. 2021, Mapook et al. 2020, Valenzuela-Lopez et al. 2018).

Table 53 *Neopyrenochaeta* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Neopyrenochaeta acicula</i>	The Netherlands	ND	de Gruyter et al. (2010)

Neopyrenochaeta telephoni (Roh. Sharma, Kurli, Sonawane, Shouche & Rahi) Valenz.-Lopez, Crous, Stchigel, Guarro & Cano, Stud. Mycol. 90: 56 (2017) Fig. 55

Index Fungorum number: IF 833025, Facesoffungi number: FoF 07390

Sexual morph: not observed. Asexual morph: Chlamydosporous. *Chlamydospores* $3.5\text{--}4.5 \times 3\text{--}4 \mu\text{m}$ ($\bar{x} = 4 \times 3 \mu\text{m}$, $n = 20$), produced from mature hyphae, mostly intercalary, solitary, globose to subglobose, hyaline, thick-walled.

Culture characteristics – *Colonies* on PDA reach 3–4 cm diam. after 14 days at 25 °C, yellowish brown, becomes ivory-brown center and greyish periphery, flat, irregularly-margined, reverse black brown. *Mycelium* hyaline, becomes subhyaline to pale brown when mature, smooth-walled to thick-walled, septate, $1.5\text{--}3 \mu\text{m}$ ($\bar{x} = 2 \mu\text{m}$, $n=30$) wide.

Material examined – Thailand, Tham Tu Pu Cave (Buddha image cave), Chiang Rai, 99.802962N, 19.925411E, 424m, 21 June 2021, W.A. Erandi Yasanthika (MFLU 25-0171); living culture 44-cv10-98=MFLUCC 24-0484.

GenBank numbers – MFLUCC 24-0484: ITS: PQ567561, *RPB2*: PV611065

Notes – According to the phylogenetic analyses (Figure 54), our strain (MFLUCC 24-0484) clusters with *Neopyrenochaeta telephoni* CBS 139022 with 97% ML, 0.99 BYPP statistical support. Comparing the LSU, ITS and *RPB2* gene regions of our strain with those type species (UTHSC04-678), showed 100% similarity. We have observed only chlamydospores in our isolate and no other asexual or sexual morphs were observed. Thus, we were not able to compare the morphology with the type species (CBS 139022). The type species (CBS 139022) has been isolated from a mobile phone screen in India (Crous et al. 2015b). Herein, we report the first *N. telephoni* strain from soil in a disturbed cave in Thailand.

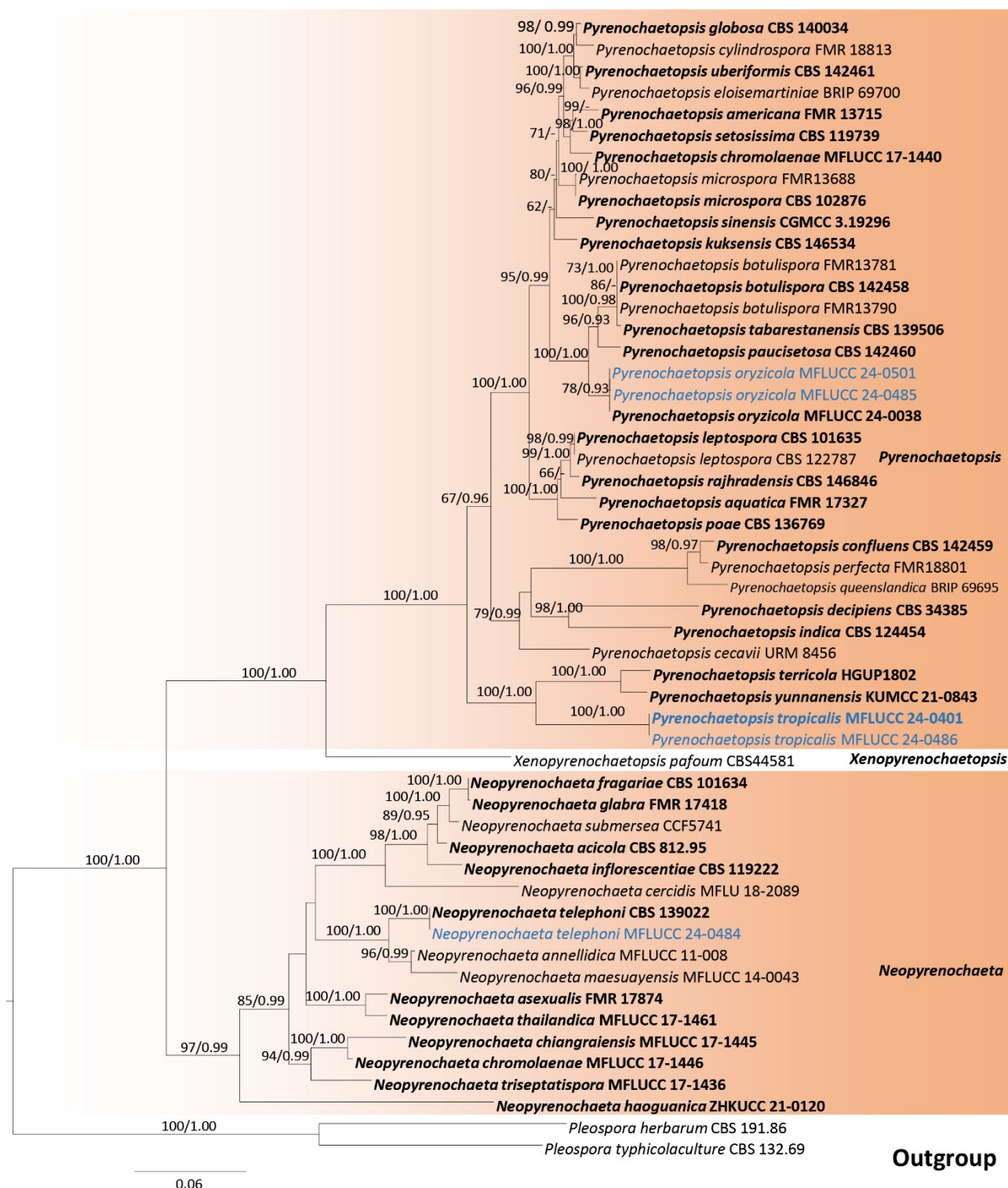


Figure 54 – The best-scoring maximum likelihood tree generated of the combined ITS, LSU and *RPB2* sequence data for *Pyrenochaetopsidaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Pleospora herbarum* (CBS 19186) and *Pleospora typhicolaculture* (CBS 13269). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 2827 bp, and single gene alignments are ITS: 535 bp, LSU: 1340 bp and *RPB2*: 952 bp. The matrix had 993 distinct alignment patterns with 21.21% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.250, C =

0.250, G = 0.250, T = 0.250; substitution rates AC = 1.76273, AG = 5.14987, AT = 1.76273, CG = 1.00000, CT = 8.82768, GT = 1.00000; gamma distribution shape parameter α = 0.488.

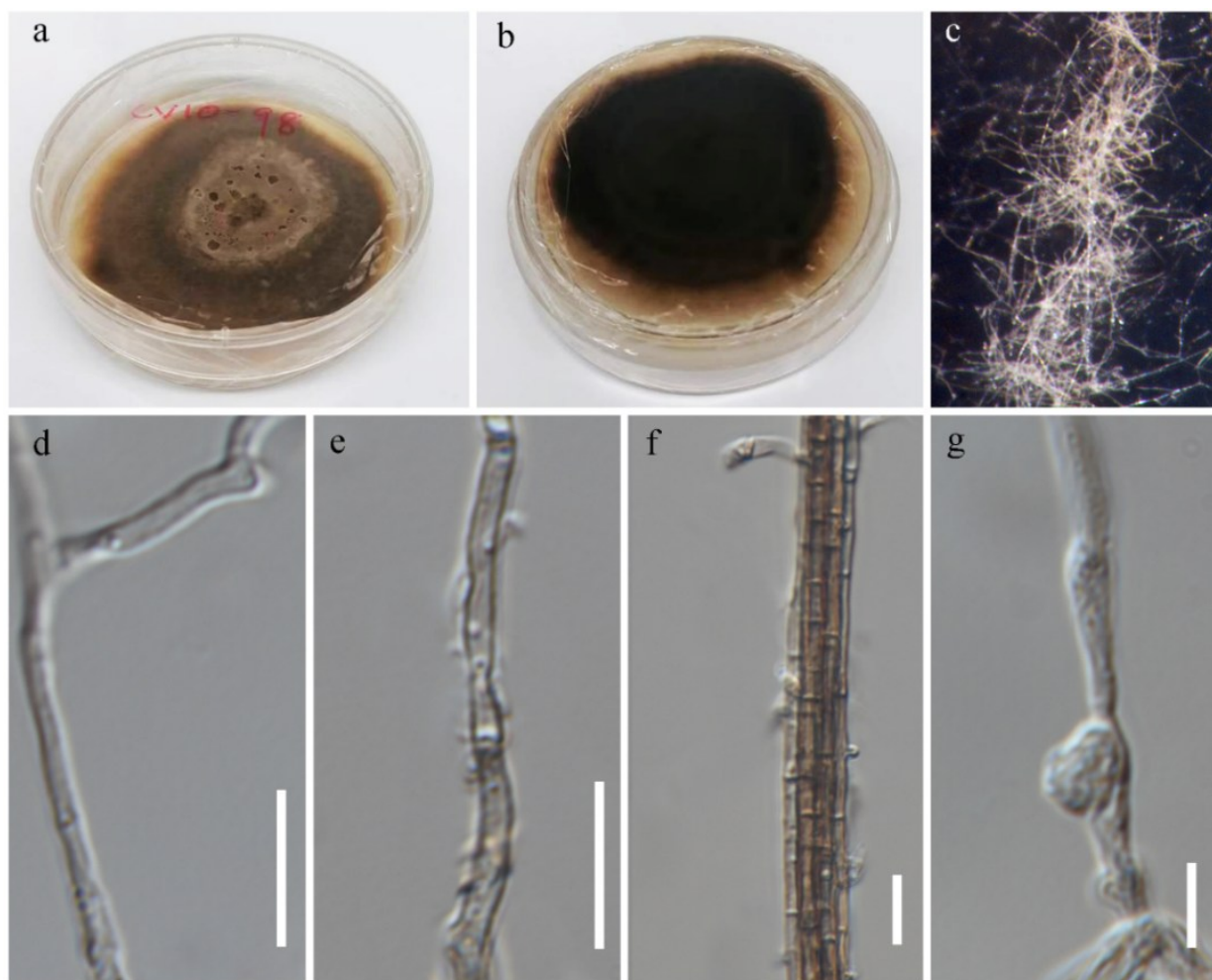


Figure 55 – *Neopyrenochaeta telephoni* (MFLU 25-0171) a, b Culture characters on PDA (b = reverse). c Mycelium. d,e Immature hypha. f.Mature hyphae. g Chlamydospores. Scale bars: d, e, f = 10 μ m. g = 5 μ m.

Pyrenochaetopsis Gruyter, Aveskamp & Verkley, Mycologia 102(5): 1076 (2010).

Index Fungorum number: IF 514653; Facesoffungi number: FoF 08356

Pyrenochaetopsis was introduced by de Gruyter et al. (2010) based on the LSU and SSU gene regions while revising the *Phoma* section. *Pyrenochaetopsis leptospora* ($\equiv$ *Pyrenochaeta leptospora*) is designated as the type species. Currently, the genus comprises 27 species (Species Fungorum 2025) and all of them have molecular data. The asexual morph is characterized by the solitary to confluent, superficial or immersed, globose to subglobose, honey/citrine to olivaceous/olivaceous-black pycnidia that are setose, with non-papillate or papillate ostiole and the wall with pseudoparenchymatal cells. Conidiogenous cells are hyaline, phialidic, discrete, or integrated in septate, acropleurogenous conidiophores and aseptate, cylindrical/ellipsoidal to allantoid, guttulate conidia (de Gruyter et al. 2010). Species have been found as plant pathogens, saprobes, and endophytes from human clinical samples, leaves, marine environments, stems and soil in China, India, New Zealand, North America, Thailand and the Netherlands. These species have been studied for their ability to produce bioactive compounds (da Silva et al. 2019, Špetík et al. 2021).

Table 54 *Pyrenochaetopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pyrenochaetopsis decipiens</i>	Europe	Rhizosphere soil	Boerema et al. (2004)
<i>P. leptospora</i>		ND	
<i>P. microspora</i>		ND	
<i>P. tabarestanensis</i>	Iran	Rice field	Papizadeh et al. (2017)
<i>P. terricola</i>	China	Mountain soil	Wang et al. (2019a)

Pyrenochaetopsis oryzicola S. Absalan, S. Lumyong & K. D. Hyde, J. Fungi 10 (no. 763): 22 (2024) Fig. 56

Index Fungorum number: IF 902535; Faces of Fungi number: FoF 16749

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 21–35 × 23–40 µm ($\bar{x}$ = 21 × 31 µm), pycnidial, mostly confluent, sometimes solitary, superficial on OA, translucent to pale brown, globose to ovoid, unilocular, *pycnidial wall* composed cells of *textura angularis*. *Conidiogenous cells* 2–3 µm × 1–2 µm ($\bar{x}$ = 2.5 × 1.5 µm), phialidic, hyaline to pale brown, subglobose, thick-walled, difficult to distinguish from the pycnidial wall. *Conidia* 4–3 µm × 1–2 µm ($\bar{x}$ = 3.5 × 1.5 µm, n = 25), aseptate, hyaline, obovoid to ellipsoidal or cylindrical, slightly guttulate, smooth-walled.

Culture characteristics – *Colonies* on the PDA at 25 °C, become 4–5 cm diam. after seven days, pale brown to greyish becomes brownish grey at the center, greyish to whitish grey middle ring with pale brown periphery when mature, reverse brown to black at the center, greyish brown outer ring, flat, circular, filiform-margined. *Mycelium* semi-immersed to superficial, hyaline, aseptate become subhyaline to pale brown, septate when mature, 1.5–3 µm ($\bar{x}$ = 2).

Material examined – Thailand, Chiang Rai, Bandu, outdoor market, on soil, 19.967000N, 99.855912E, 393m, 17 October 2022, W.A. Erandi Yasanthika (MFLU 25-0119, holotype); ex-type 108-u3-4=MFLUCC 24-501. *ibid.* (MFLU 25-0120), living culture 108b-u3-4b=MFLUCC 24-485

GenBank numbers – MFLUCC 24-501: LSU: PQ577865, ITS: PP998348, *RPB2*: PV618261; MFLUCC 24-485: ITS: PQ577885, *RPB2*: PV618262

Notes – The multigene phylogenetic tree (Figure 54) shows that our isolates (MFLUCC 24-501 and MFLUCC 24-485) grouped with the type species of *Pyrenochaetopsis oryzicola* (MFLUCC 24-0038) with 78% ML, 0.93 BYPP statistical support. *Pyrenochaetopsis oryzicola* was originally isolated from the dead panicle of *Oryza sativa* in Chiang Rai, Thailand (Absalan et al. 2024). Comparing the LSU, ITS and *RPB2* gene regions of our strain with those type species (MFLUCC 24-0038) resulted in 100% similarity. Our isolate is morphologically comparable to the type species by having globose to ovoid conidiomata, hyaline, guttulate, aseptate and cylindrical to ellipsoid conidia, and phialidic conidiogenous cells that are difficult to distinguish from the pycnidial wall. However, our isolate has hyaline to pale brown conidiogenous cells and relatively smaller conidia ($\bar{x}$ = 3.5 × 1.5 µm), which are distinct from the type species that has hyaline conidiogenous cells and larger conidia ($\bar{x}$ = 3.5 × 1.5 µm) (Absalan et al. 2024). Based on the morphology and molecular results, we confirm our strain is *P. oryzicola* from urban soil in Chiang Rai, Thailand. Thus, it confirms the occurrence of this species in the Chiang Rai region. Further, this is the first record of the species reported in soil habitats. The morphological variances of our isolate from the type species can be influenced by the hosts' differences (Yasanthika et al. 2022a).

Pyrenochaetopsis tropicalis Yasanthika & K.D. Hyde, sp. nov.

Fig. 57

Index Fungorum number: IF903047; Facesoffungi number: FoF 16711

Etymology – The specific epithet "*tropicalis*", from Latin, refers to the tropical, the ecological condition from which the holotype was collected.

Holotype – MFLU 25-0162

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 73–130 µm × 91–160 µm ($\bar{x}$ = 106 × 127 µm, n=10), pycnidial, mostly confluent, rarely solitary, semi-immersed on OA, brown to black, pyriform to subglobose, unilocular. *Conidiomatal wall* composed cells of *textura angularis*,

7–18 μm ($\bar{x}$ = 11) thick. *Conidiogenous cells* 2.5–5 μm $\times$ 1–2 μm ($\bar{x}$ = 4 $\times$ 1.5 μm , n=5), annellidic, hyaline, smooth-walled, determinate, ampulliform to cylindrical, *Conidia* 3–4 μm $\times$ 1–2 μm ($\bar{x}$ = 3.5 $\times$ 1.5 μm , n = 25), aseptate, hyaline, cylindrical or subglobose to reniform, sometimes with small guttules, thick-walled.

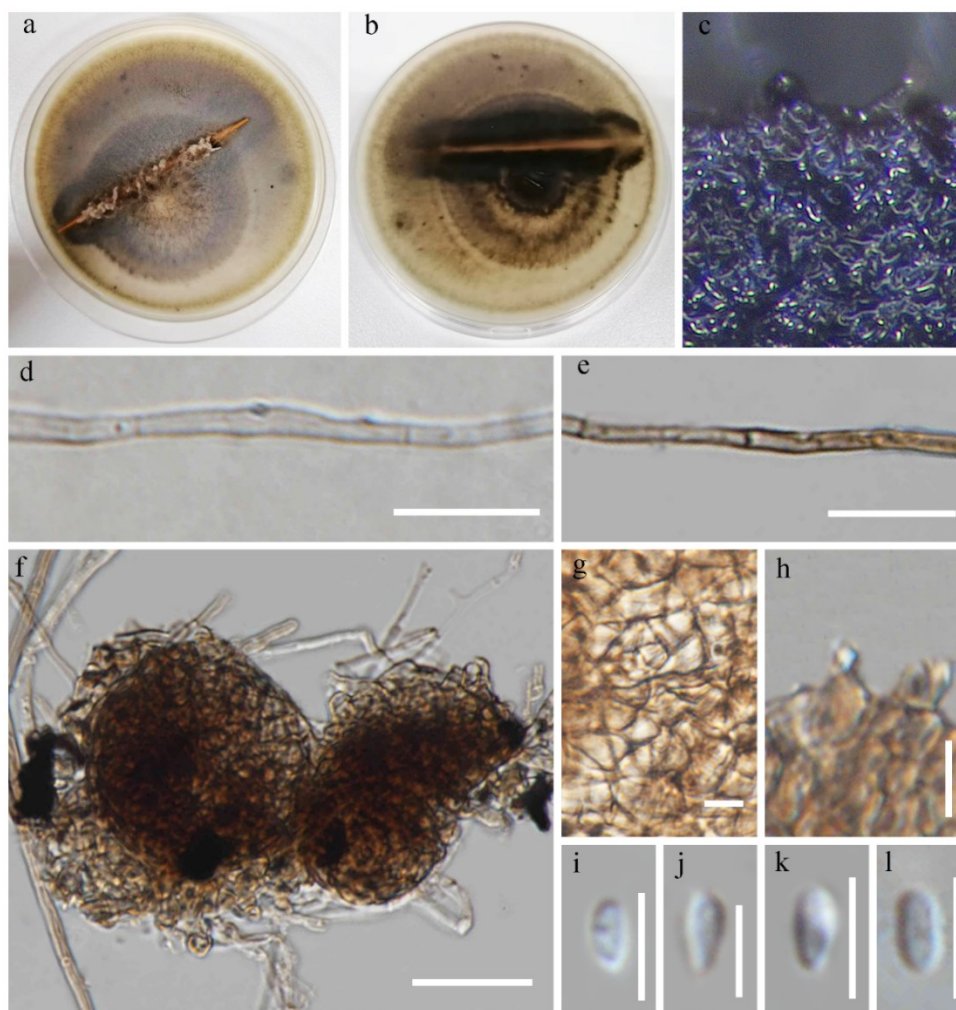


Figure 56 – *Pyrenochaetopsis oryzicola* (MFLU 25-0119, Holotype). a, b culture characters on PDA (b = reverse). c Pycnidia forming on culture. d Immature hypha e Mature hyphae. f Pycnidia. g Pycnidia wall. h Conidiogenous cells. i–l Conidia. Scale bars: f = 25 μm , d, e = 10 μm , g–l = 5 μm .

Culture characteristics – *Colonies* on PDA at 25 °C, become 3–4 cm diam. after seven days, whitish to ivory becoming brown at the center, ivory to white middle ring and brown to pale brown outer ring when mature, reverse brown to dark brown, flat, entire-margined. *Mycelium* superficial, hyaline, aseptate, becoming subhyaline to pale brown, septate when mature, 1–2 μm ($\bar{x}$ = 1.5 μm , n=30). *Chlamydospores* present, subhyaline to brown.

Material examined – Thailand, Chiang Mai, Omkoi District, Sop Khong, from forest, on soil, 17.7145N, 98.2619E, 1388m, 16 October 2019, W.A. Erandi Yasanthika (MFLU 25-0162, holotype), ex-type 19-pin3=MFLUCC 24-401. *ibid.* (MFLU 25-0163), living culture 19b-pin3b=MFLUCC 24-486.

GenBank numbers – MFLUCC 24-401: LSU: PQ568244, ITS: PP998344, *RPB2*: PV579158; MFLUCC 24-486: LSU: PQ577866, ITS: PQ577864, *RPB2*: PV579159

Notes – Based on morpho-molecular analyses, *Pyrenochaetopsis tropicalis* (MFLUCC 24-401 and MFLUCC 24-486) is introduced as a new species here. The multi-gene phylogeny of *Pyrenochaetopsidaceae* (Figure 54) shows that our isolates (MFLUCC 24-401) formed an

independent clade sister to *P. terricola* (HGUP1802) and *P. yunnanensis* (KUMCC 21-0843) with 100% ML and 1.00 BYPP statistical support. We compared the base pair difference in the ITS (+5.8S) gene region, comparison of *P. tropicalis* (MFLUCC 24-401) with *P. yunnanensis* showed 10/490 (2%) (including gaps) differences and with *P. terricola*, it was 19/478 (3.9%) (including gaps). Our collection (MFLUCC 24-401) and *P. yunnanensis* share similar conidial size ranges ($3\text{--}4\text{ }\mu\text{m} \times 1\text{--}2\text{ }\mu\text{m}$), while *P. terricola* having relatively smaller conidia ($2\text{--}3 \times 1\text{--}2\text{ }\mu\text{m}$). However, our isolate has cylindrical or subglobose to reniform conidia whereas *P. yunnanensis* having subglobose to oblong and *P. terricola* have ovoid to cylindrical conidial shapes (Wang et al. 2019a, Phookamsak et al. 2022). *Pyrenochaetopsis terricola* has been isolated from soil and *P. yunnanensis* from a dead bamboo stem in China (Wang et al. 2019a, Phookamsak et al. 2022). Our data confirms, this collection (MFLUCC 24-401 and MFLUCC 24-486), as a new species from forest soil in Thailand.

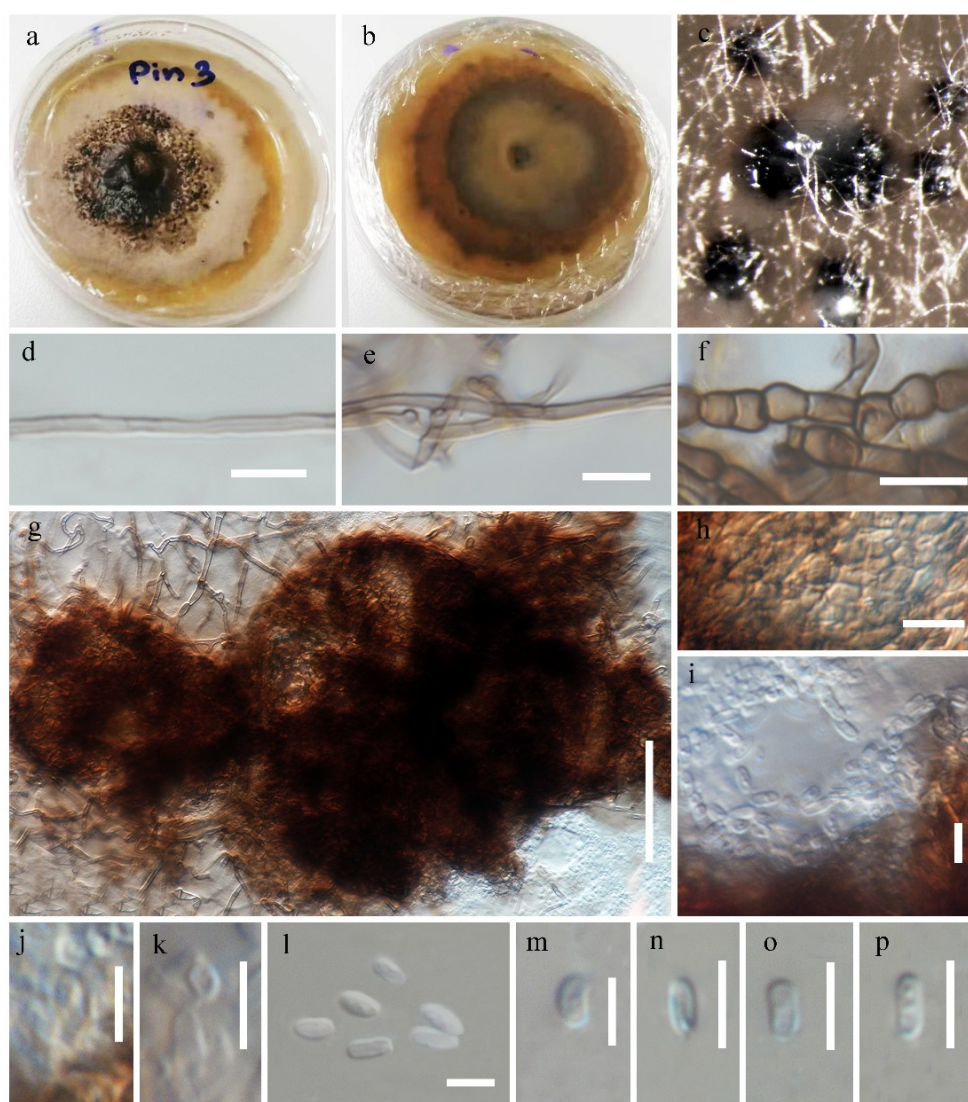


Figure 57 – *Pyrenochaetopsis tropicalis* (MFLU 25-0162, Holotype). a, b Culture characters on PDA (b = reverse). c Pycnidia forming on culture. d immature hypha e Mature hyphae. f Chlamydospores g Pycnidia. h Pycnidia wall. i Pycnidia matrix. j, k Conidiogenous cells. l–p Conidia. Scale bars: g = 50 μm , e, f, h = 10 μm . g = 50 μm , d, i–p = 5 μm .

Roussoellaceae Jian K. Liu, Phook., D.Q. Dai & K.D. Hyde.

Neoroussoella Jian K. Liu, Phookamsak & K.D. Hyde, Phytotaxa 181(1): 21 (2014).

Index Fungorum number: IF 550668; Facesoffungi number: FoF 08363

Liu et al. (2014) introduced *Neoroussoella* with its type species *N. bambusae* in *Roussoellaceae* based on the combined ITS, LSU, *TEFI-α* and *RPB2* phylogeny. Currently, 15 species are listed in the Species Fungorum (2025), and all of them are introduced with molecular data. The asexual morph is characterized by superficial to immersed, pycnidia, uni to multi-loculate, globose to subglobose or irregular shape, scattered or clustered, solitary or gregarious, indistinctly ostiolate conidiomata with the cell wall having several layers of cells of *textura angularis*. Conidiophores are unbranched, aseptate and have annellidic, unbranched, ampulliform or lageniform or cylindrical or cylindric-clavate conidiogenous cells. Conidia are oblong to ellipsoidal, hyaline, smooth-walled, aseptate with two guttules. The sexual morph is characterized by ascostromata that are coriaceous, solitary to gregarious, black, central ostiolate and peridium is composed of 2–3 layers of thin-walled cells of *textura angularis*, and the hamathecium comprises numerous, anastomosing, cellular pseudoparaphyses, which are branching at the apex, often constricted at the septum, embedded in a gelatinous matrix. Asci are 8-spored, bitunicate, cylindrical, short to long pedicellate, apically rounded with an ocular chamber containing ellipsoidal to fusiform, 2-celled, pale brown to brown or yellowish brown, rough-walled, longitudinally ribbed ascospores that are constricted at the septum and surrounded by a mucilaginous sheath. (Liu et al. 2014). Species have been isolated from brown algae in the sea and dead wood in terrestrial habitats in China, the Mediterranean Sea and Thailand (Liu et al. 2014, Karunarathna et al. 2019, Poli et al. 2020).

Table 55 *Neoroussoella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Neoroussoella solani</i>	China	ND	Shi et al. (2021)

Neoroussoella entadae Jayasiri, E.B.G. Jones & K.D. Hyde, Mycosphere 10(1): 105 (2019) Fig. 59.

Index Fungorum number: IF 555568; Facesoffungi number: FoF 05275

Sexual morph: not observed. Asexual morph: not observed.

Culture characteristics – *Colonies* on PDA reach 3–4 cm diam. after 14 days at 25 °C, ivory to whitish brown, becoming greyish brown, raised, irregularly-margined, reverse whitish yellow, becoming brownish yellow when mature. *Mycelium* hyaline, becoming sub-hyaline when mature, septate, thick-walled, verruculose, 1.5–4 µm ($\bar{x}$ = 3 µm, n = 10) wide.

Material examined – Thailand, Yang Piang, Chiang Mai, Omkoi District, from the forest, on soil 17.7145N, 98.4286E, 935m, 16 October 2019, W.A. Erandi Yasanthika (MFLU 25-0139); living culture 37-s9-20= MFLUCC 24-487.

GenBank numbers – MFLUCC 24-487: ITS: PQ570519, *RPB2*: PV611064

Notes – According to the multi-gene phylogeny (Figure 58), our strain (MFLUCC 24-487) clusters with *Neoroussoella entadae* strains (MFLUCC 18-0243, NI213, MFLUCC 17-0920) with a 98% ML and 0.99 BYPP support. The ITS (+5.8S) gene region of our isolate was compared with the type species of *Neoroussoella entadae*, which showed 100% similarity. We have not observed the sexual or asexual sporulation in our culture. The type species (MFLU 18–2106) is characterized by pycnidia that are solitary to gregarious, occasionally confluent, immersed, formed in uni- or multi-loculate stromata. Pycnidia are papillate, central, circular ostioles and have dark brown cells of *textura angularis* with a thin, hyaline inner layer. Conidiophores are reduced to conidiogenous cells with phialidic, ampulliform to cylindrical, hyaline, smooth-walled conidiogenous cells that produce initially hyaline, becoming pale brown when mature, oblong to ovoid, straight, both ends broadly rounded, aseptate conidia (Jayasiri et al. 2019). Species have been isolated as saprobes from *Entada phaseoloides*, *Leucaena* sp. and *Magnolia candolli* hosts in Thailand (Jayasiri et al. 2019, de Silva et al. 2022). We report the first record of *N. entadae* from Thai forest. This is also the first record of this genus associated with soil habitats.

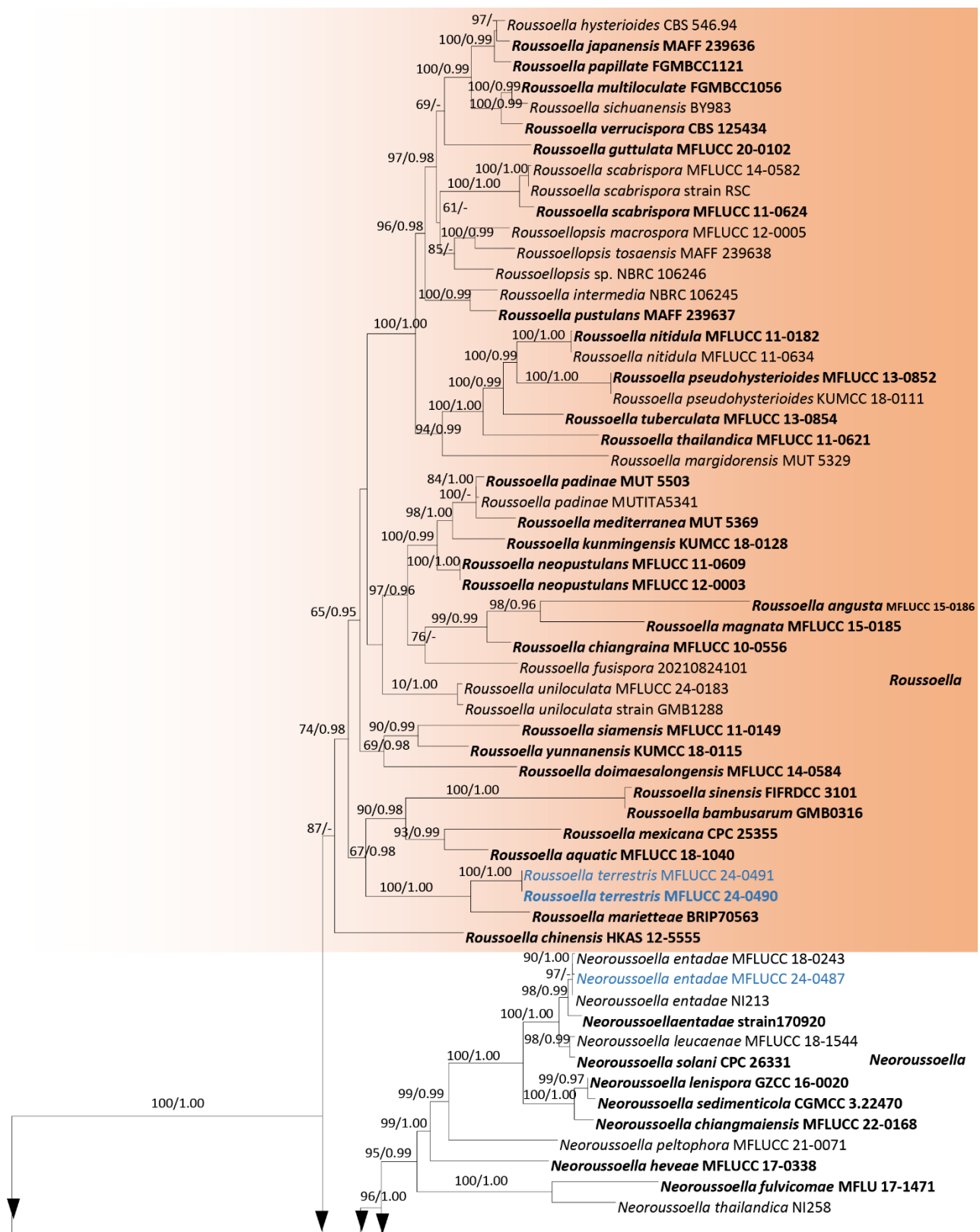


Figure 58 – The best-scoring maximum likelihood tree generated of the combined ITS, LSU, *TEF1- α* and *RPB2* sequence data for *Roussoellaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Torula herbarum* (CBS 111855) and *T. hollandica* (CBS 22069). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 3216 bp, and single gene alignments are ITS: 518

bp, LSU: 886 bp *TEF1- α* : 939 pb and *RPB2*: 873bp. The matrix had 1353 distinct alignment patterns with 30.25% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.239, C = 0.267, G = 0.272, T = 0.222; substitution rates AC = 1.62721, AG = 4.01951, AT = 1.62721, CG = 1.00000, CT = 8.33564, GT = 1.00000; gamma distribution shape parameter α = 0.569.

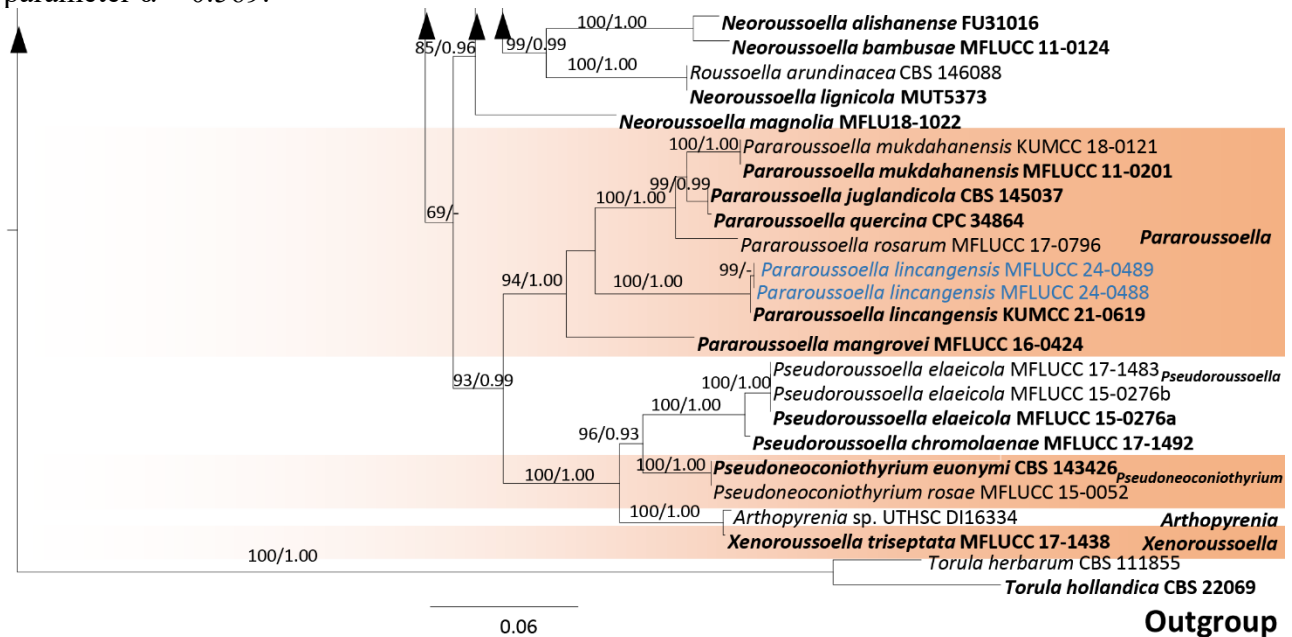


Figure 58 – Continued.

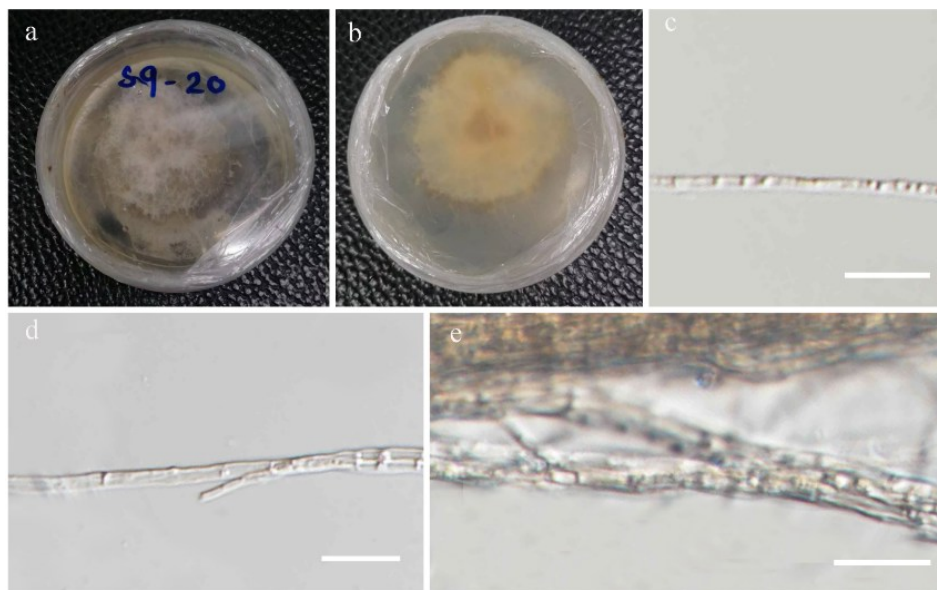


Figure 59 – *Neorousoella entadae* (MFLU 25-0139). a, b Culture characters on PDA (b = reverse). c–e. Hypha. Scale bars: d, e=20 μ m, c=10 μ m.

Pararousoella Wanas., E.B.G. Jones & K.D. Hyde, Fungal Divers. 89: 169 (2018).

Index Fungorum number: IF 554218; Facesoffungi number: FoF 04056

Wanasinghe et al. (2018) introduced *Pararousoella* using multi-gene phylogenetic analyses based on the combined LSU, ITS, *TEF1- α* and *RPB2* sequences, with *P. rosarum* as the type species. Currently, Species Fungorum (2025) has listed six species under this genus and all of them have molecular data. The sexual morph is characterized by scattered or aggregated ascomata,

arranged in groups. These ascomata are immersed, globose with a papillate ostiole. Ascomatal walls are comprised of small and thin-walled cells that tend to thicken towards the ostiole, and a pigmented outer layer with cells of *textura angularis*. Hamathecium is comprised of numerous filamentous, branched pseudoparaphyses. Asci are 8-spored, bitunicate, fissitunicate, and cylindrical, with a stipe and containing uniseriate to overlapping uniseriate ascospores that are narrowly ellipsoid, straight to slightly curved, and 1-septate. The ascospores are hyaline to pale brown at first, turning dark brown when mature, guttulate, rough, and exhibit irregular longitudinal striations, with or without a sheath (Wanasinghe et al. 2018b). Species have been reported from dead and living leaves and stems in China, England, Germany, and Thailand (Wanasinghe et al. 2018b, Crous et al. 2020). It has not been previously reported from soil.

Pararoussoella lincangensis G.C. Ren & K.D. Hyde, Mycosphere 15(1): 1044 (2024) Fig. 60

Index Fungorum number: IF 901359; Facesoffungi number: IF901359

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 55–85 × 102–124 µm (x̄ = 74 × 115 µm, n=5), superficial on PDA, brown to black, subglobose solitary, unilocular, pycnidial wall composed cells of *textura angularis*, 5.5–13.5 µm (x̄ = 11, n=10) wide. *Conidiogenous cells* 1.5–4.5 × 1–3 µm (x̄ = 3 × 12 µm, n=10), hyaline to subhyaline to pale brown, phialidic, smooth, ampulliform to doliiform. *Conidia* 3–4.5 × 2–3 µm (x̄ = 3 × 2.5 µm, n = 20), hyaline to pale brown, aseptate, ellipsoidal or to sub-cylindrical, rounded at both ends, thick-walled.

Culture characteristics – *Colonies* on PDA at 25 °C, become 3–4 cm diam. after seven days, white becoming reddish white to whitish grey when mature, reverse reddish yellow to reddish brown at the center with white periphery, raised, irregular, filiform-margined. *Mycelium* superficial hyaline, thick-walled, septate, verrucose, 1.5–5 µm (x̄ = 3.2 µm, n = 30), sporulated after eight weeks on the PDA.

Material examined – Thailand, Chiang Mai, Omkoi District, Yang Piang, from forest, soil, 17.7145N, 98.4286E, 935m, 16 October 2019, W.A. Erandi Yasanthika (MFLU 25-0140), living culture 73-s9-32=MFLUCC 24-089. *ibid.* (MFLU 25-0167), living culture 33-s9-321=MFLUCC 24-088.

GenBank numbers – MFLUCC 24-089: LSU: PQ572134, ITS: PQ570520; MFLUCC 24-088: LSU: PQ572135, ITS: PQ570521, *RPB2*: PV631715

Notes – *Pararoussoella lincangensis* was introduced by Ren et al. (2024) from dead twigs of *Heliciopsis terminalis* in China. In the phylogenetic analyses (Figure 58), our strains (MFLUCC 24-089 and MFLUCC 24-088) group with *P. lincangensis* with 100% ML and 1.00 BYPP statistical support. When comparing the ITS (+5.8S) gene region of our strain with the type species of *Pararoussoella lincangensis* (KUMCC 21-0619), it showed 100% similarity. Our isolate has similar morphology to the type species (KUMCC 21-0619) by having phialidic, smooth, ampulliform to doliiform conidiogenous cells and aseptate conidia (Ren et al. 2024). It has hyaline to pale brown, aseptate, ellipsoidal or sub-cylindrical conidia, whereas the type species has hyaline conidia, yellowing at maturity (Ren et al. 2024). Morpho-molecular evidence confirms that the strain in this study is *P. lincangensis* isolated from forest soil in Thailand. This genus has mostly been reported as plant-associated fungi (Wanasinghe et al. 2018b, Phukhamsakda et al. 2020, Ren et al. 2024,). Herein, we report the first *Pararoussoella* member present in soil which confirms its survival in alternative substrates.

Roussoella Sacc., Sér. 6 6: 410 (1888)

Index Fungorum number: IF 4799; Facesoffungi number: FoF 01689

Saccardo & Paoletti (1885) introduced *Roussoella* with its type species *R. nitidula*. Currently, the genus accommodates 42 species (Species Fungorum 2025). *Roussoella* is considered polyphyletic however, *Neoroussoella*, *Pararoussoella* and *Pseudoroussoella* are established to accommodate some species in *Roussoella sensu lato* (Jaklitsch & Voglmayr 2016, Jayasiri et al. 2019).

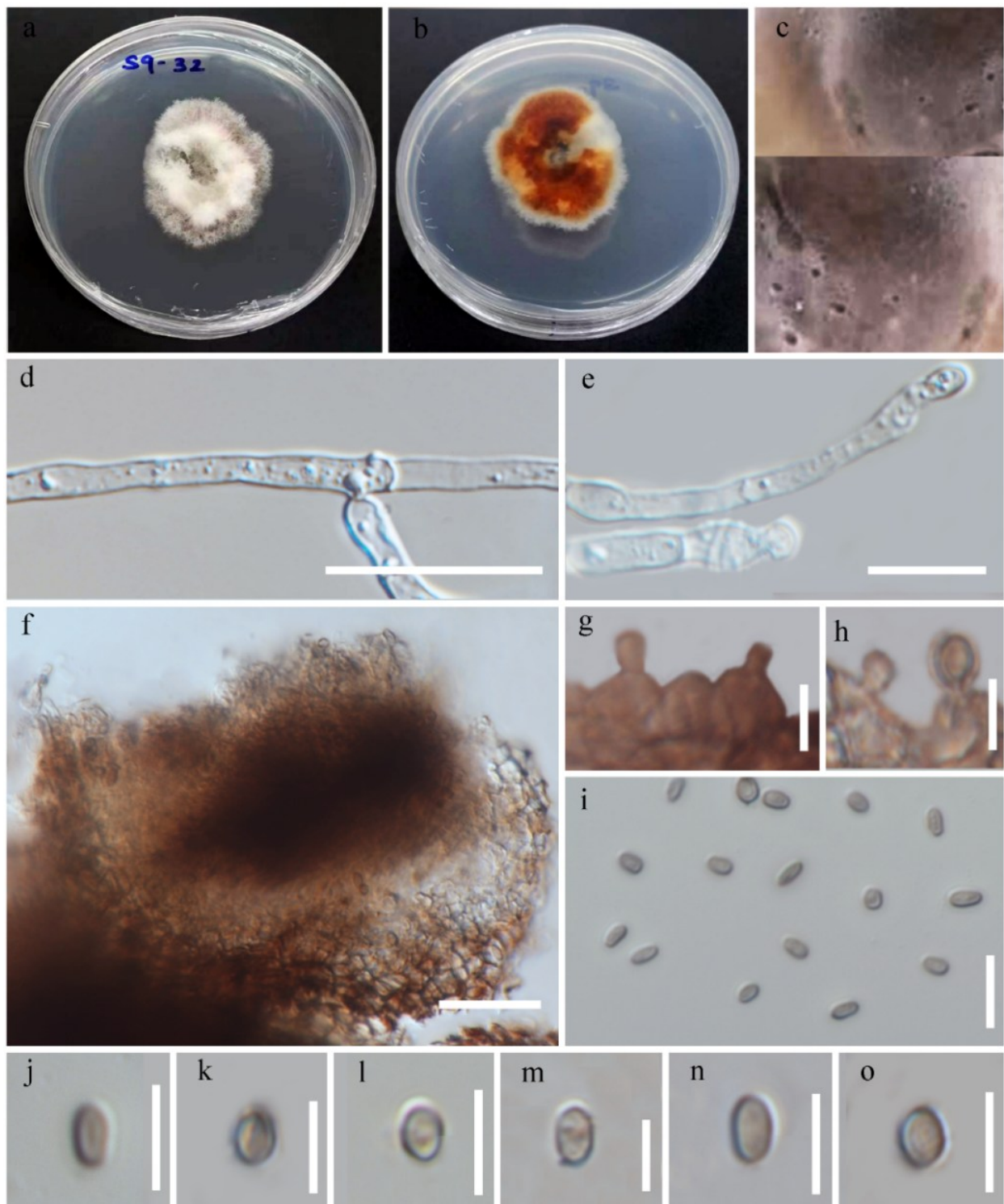


Figure 60 – *Pararoussoella lincangensis* (MFLU 25-0167). a, b Culture characters on PDA (b = reverse). c Pycnidia forming on culture. d, e Hyphae. f Pycnidia and pycnidia wall. g, h Conidiogenous cells. i–o Conidia. Scale bars: f = 25µm, d = 20 µm, e = 10 µm, g–o = 5 µm.

Roussoella sensu stricto is characterized by cytoplea-like asexual morphs and uni- to multi-loculate ascostromata, immersed in a clypeus, visible as raised, black dome-shaped or elongate linear on the host surface, and bitunicate, cylindrical to subcylindrical asci, with brown, 2-celled ornamented ascospores (Hongsanant et al. 2020a). Species are inhabiting on living and dead leaves and branches (mostly gramineous plants), human clinical samples from Africa, Mexico, China, Malaysia, Ecuador and Thailand (Dai et al. 2022).

Table 56 *Roussoella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Roussoella</i> sp.	Trinidad	Oil contaminated soil	Ramdass & Rampersad (2021)

Roussoella terrestris Yasanthika & K.D. Hyde, sp. nov.

Fig. 61

Index Fungorum number: IF903045; Facesoffungi number: FoF 16715

Etymology – The specific epithet "*terrestris*", refers to the terrestrial environment from Latin, of which the holotype was collected.

Holotype – MFLU 25-0141

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 175–300 × 220–337 µm ($\bar{x}$ = 220 × 337 µm, n=10), pycnidial, unilocular to multilocular, mostly confluent, superficial on MEA, dark brown to black, subglobose, *Conidiomatal wall* composed cells of *textura angularis*. *Conidiogenous cells* 2–4 × 2–3 µm ($\bar{x}$ = 3 × 2.5 µm, n = 20), phialidic, determinate, discrete, globose to subglobose, hyaline, thick-walled. *Conidia* 2–5 × 1–3 µm ($\bar{x}$ = 3 × 2 µm, n = 20), hyaline, broadly obovoid to globose or filiform, aseptate, sometimes granular, thick-walled. *Chlamydospores* hyaline to sub-hyaline, globose and thick-walled.

Culture characteristics – *Colonies* on PDA at 25 °C, becoming 3–4 cm diam. after seven days, initially white, becoming yellowish white when mature, reverse yellowish white at the center, white ring, flat, entire-margined. *Mycelium*, immersed to semi-immersed, hyaline, 1–4 µm ($\bar{x}$ = 2 µm, n=30), aseptate, thick-walled, sporulated after nine weeks on the MEA.

Material examined – Thailand, Krabi, from forest, soil, 2, 8°4'11 "N, 98°53'25" E, 181m, 28 October 2019, W.A. Erandi Yasanthika (MFLU 25-0141, holotype), ex-type 68-kr003=MFLUCC 24-0490. *ibid.* (MFLU 25-0168), living culture 68b-kr003b=MFLUCC 24-0491.

GenBank numbers – MFLUCC 24-0490: LSU: PQ577819, ITS: PP993960, *RPB2*: PV624713, *TEF1-α*: PV624715; MFLUCC 24-0491: LSU: PQ577821, ITS: PQ577820, *RPB2*: PV624712, *TEF1-α*: PV624714.

Notes – Our collection (MFLUCC 24-0490 and MFLUCC 24-0491) clusters within *Roussoella* (Figure 58), producing a distinct branch sister to *R. marietteae* with 100% ML and 1.00 BYPP statistical support. When compared the base pair difference of ITS (+5.8S) gene region of our species with *R. marietteae*, it resulted in having 11/468 (2.3%) (including gaps) differences. *Roussoella marietteae* has been isolated from *Sporobolus elongates* stem in Australia and introduced only based on molecular evidence LSU, ITS, *TEF1-α* and *RPB2* (Steinrucken et al. 2022, Tan & Steinrucken 2024). Thus, morphological comparison was not possible. Our culture (MFLUCC 24-0490) only produced an asexual morph, and sexual morph has not been observed. Based on our molecular and morphological data we introduced *R. terrestris* as a new species which is isolated from forest soils from Thailand. It is the first species of the genus that has been isolated in Thai soils.

Sporormiaceae Munk***Preussia*** Fuckel, Hedwigia 6: 175 (1867).

Fig. 62

Index Fungorum number: IF 4363; Facesoffungi number: FoF 06568.

Preussia was introduced by Fuckel (1866) with the type species, *P. funiculata*. There are 64 species present under *Preussia* (Species Fungorum 2025), while 40 species have molecular data. The sexual morph is associated with dark brown to black, immersed to semi-immersed, scattered or aggregated, ostiolate or non-ostiolate ascomata, fasciculate, clavate to cylindrical, short or elongated-stalked, inconspicuously bitunicate, 8- spored asci and dark brown, 3 to many septate ascospores. Species are isolated as endophytes from plant leaves, saprobes or coprophilous on dung, decaying wood, seeds, submerged plant debris and soil habitats found in Argentina, Germany, Japan, Iran, Nepal, Spain, the Netherlands and the USA (Hongsan et al. 2020a).

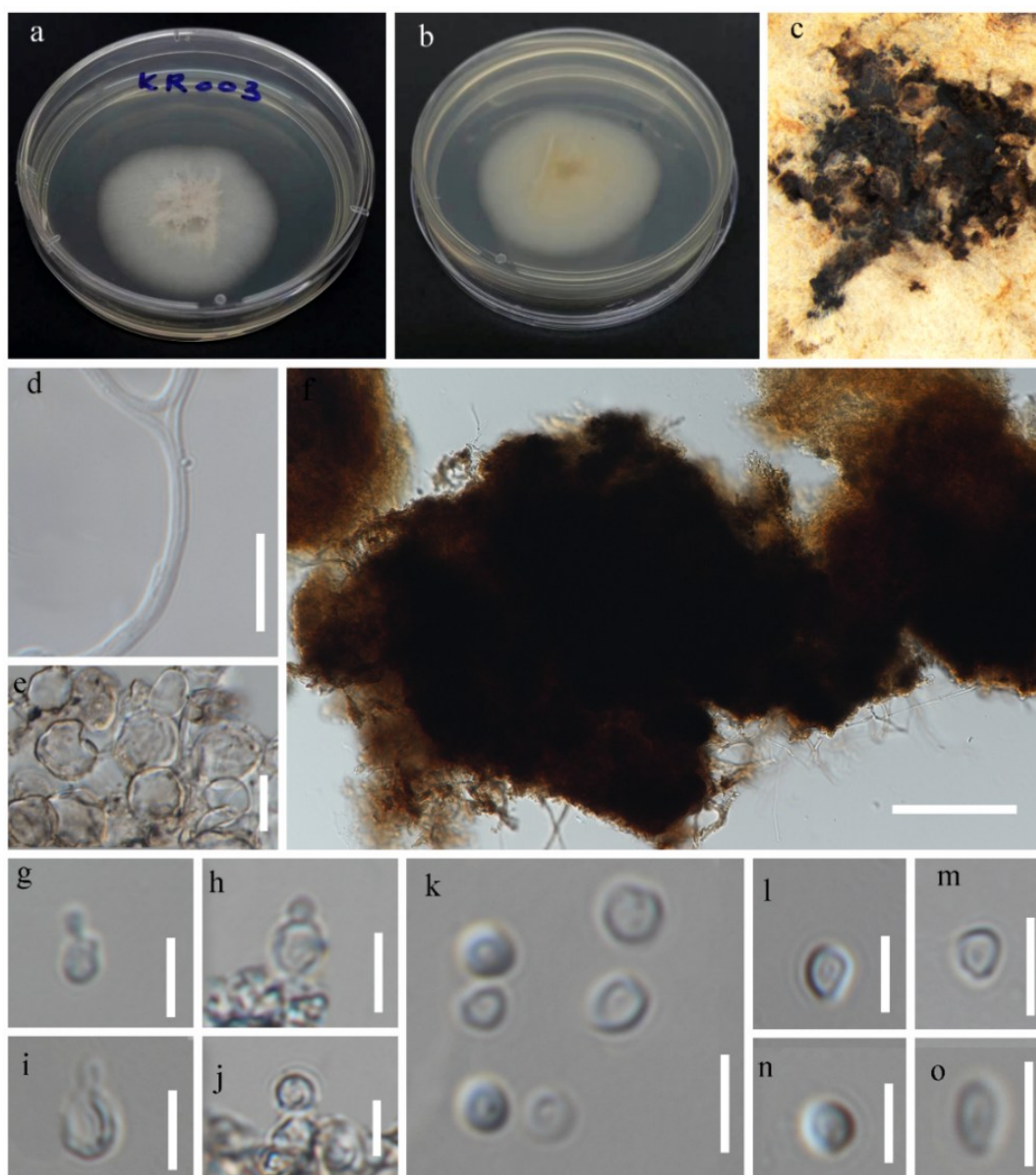


Figure 61 – *Rousoella terrestris* (MFLU 25-0141, Holotype) a, b Colony on PDA (front and reverse). c Pycnidia forming on culture. d Hypha. e Chlamydospores. f Pycnidia. g–j Conidiogenous cells. k–o Conidia. Scale bars: f = 100µm, d, e = 10 µm, g–o = 5 µm.

Table 57 *Preussia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Preussia fleischhakii</i>	Belgium	ND	Domsch et al. (1993)
<i>P. fleischhakii</i>	Poland	ND	
<i>P. flanaganii</i>	Mexico	Sandy soil	Gonzalez-Menendez et al. (2017)
<i>P. isomera</i>	Nepal	ND	
<i>Preussia</i> sp.	Spain	ND	
<i>Preussia</i> sp.	India	Frozen soil in Himalaya Mountain	Youn et al. (2018)
<i>P. aemulans</i>	Netherlands	Greenhouse soil	Asgari & Zare (2010)
<i>P. fleischhakii</i>	Germany	Wheat field soil	
<i>Preussia</i> sp.	Czech Republic	ND	
<i>P. globose</i>	Japan	Paddy field	Ito & Nakagiri (1995)

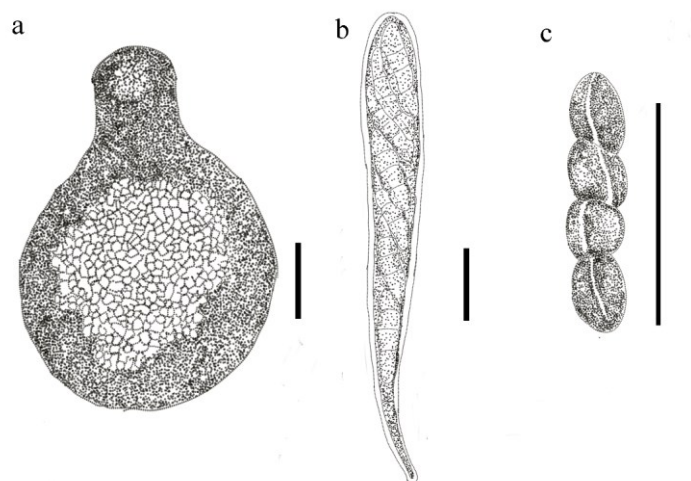


Figure 62 – *Preussia* sp. a Ascomata b. Ascus. *P. funiculata* c. Ascospore. Scale bars a = 50 μ m, b, c = 25 μ m. Redrawn from Guarro et al. (2012).

Westerdykella Stolk, Trans. Br. Mycol. Soc. 38 (4): 422 (1955).

Fig. 63

Index Fungorum number: IF 5772; Facesoffungi number: FoF 06570

Stolk (1955) introduced *Westerdykella* to accommodate *W. ornata* as the type species. Currently, 17 *Westerdykella* species are available in the Species Fungorum (2025) and 12 species have molecular data. The asexual morph produces subcylindrical, aseptate and hyaline conidia (Sue et al. 2014, Crous et al. 2017b). The sexual morph has cleistothecoid ascomata and short pedicellate asci. Ascospores are one celled and verruculose but without germ slits (Kruys & Wedin 2009). Most of the species are coprophilous fungi and have also been found in mud, plant material and soil distributed in France, India, Japan, the USA and Ukraine (Ito & Nakagiri 1955, Crous et al. 2017b, Pem et al. 2024).

Table 58 *Westerdykella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Westerdykella angulata</i>	India	Soil in <i>Oryza sativa</i> field	Das (1962)
<i>W. capitulum</i>	India	Saline soil	de Gruyter et al. (2013)
<i>W. minutispora</i>	India	Saline soil	
<i>W. centenaria</i>	Kuwait	Saline soil	Crous et al. (2017b)
<i>W. ornate</i>	Mozambique	ND	Stolk (1955)
<i>W. reniformis</i>	Korea	Agricultural fields	Adhikari et al. (2019)
<i>W. dispersa</i>	Armenia	Salt-marsh soil	Asgari & Zare (2010)
<i>W. dispersa</i>	The Netherland	Greenhouse soil	

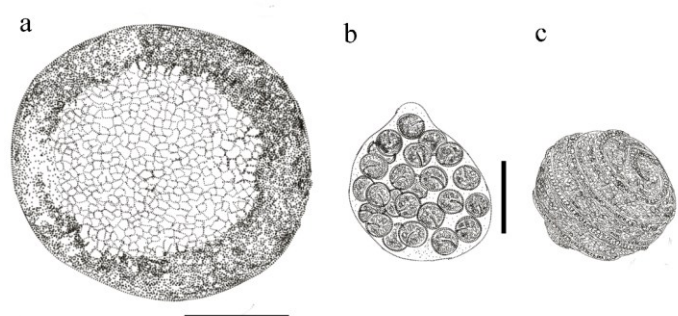


Figure 63 – *Westerdykella* sp. a. Ascomata. b. Ascus. *W. ornate*. c. Ascospore. Scale bars a = 100 µm, b = 10 µm, c = 2.5 µm. Redrawn from Guarro et al. (2012).

Tetraplosphaeriaceae Kaz. Tanaka & K. Hiray

Tetraploa Berk. & Broome, Ann. Mag. nat. Hist., Ser. 2 5: 459 (1850) Fig. 64

Index Fungorum number: IF 10199; Facesoffungi number: FoF 06666

Berkeley & Broome (1850) introduced *Tetraploa* and typified it with *T. aristata*. Species Fungorum (2025) lists 38 species under *Tetraploa*, while 27 of them have molecular data. The asexual morph is hyphomycetous and has micronematous conidiophores, monoblastic conidiogenous cells and brown, short-cylindrical conidia with four setose appendages at the apex (Ellis 1971, Tanaka et al. 2009). The sexual morph has globose to subglobose, glabrous ascomata, fissitunicate, cylindrical to clavate, short-stalked, 8-spored asci, and ascospores that are fusiform, hyaline, 1-septate with a mucilaginous appendage-like sheath (Tanaka et al. 2009). These species are found from the saprobic or endophytic mode in herbaceous plants or wood, while several have been found from freshwater habitats, raindrops and soil, and some species can rarely be human pathogens (Karpinska-Kolaczek et al. 2010). Species are reported in China, Germany, India, Java, Thailand, the Netherlands and the USA (Ellis 1949, Révay 1993, Karpinska-Kolaczek et al. 2010, Dong et al. 2020, Zhao et al. 2024a, Wang et al. 2024e).

Table 59 *Tetraploa* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Tetraploa setifera</i>	ND	ND	Markovskaja (2007)

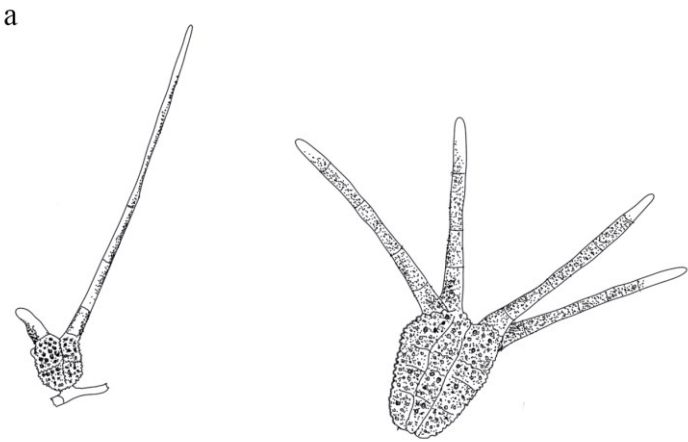


Figure 64 – *Tetraploa aristata* a Young and mature conidia. Redrawn from Ellis (1949).
Torulaceae Corda

Torula Pers., Ann. Bot. (Usteri) 15: 25 (1795). Fig. 65

Index Fungorum number: IF 10248; Facesoffungi number: FoF 01740

Persoon (1795) introduced *Torula*, accommodating the type species, *Torula herbarum*. Crane & Miller (2016) provided the generic key to differentiate *Torula* species from its seven allied hyphomycete genera but without DNA sequences. Crous et al. (2015a) provided DNA sequences for *Torula* species and discussed the phylogenetic relationships of *Torulaceae* based on ITS and LSU phylogeny. There are 60 *Torula* species (Species Fungorum 2025), but 24 species have molecular data. The asexual morph is characterized by the conidiophores, which are reduced to conidiogenous cells or with one brown supporting cell. Conidiogenous cells are solitary on

mycelium, erect, doliiform to ellipsoid or clavate, brown, mono- to polyblastic, and producing conidia that are phragmosporous, in branched chains, acrogenous, brown, pale brown apex, dry, constricted at septa. In conidial chains, the conidiogenous cell and the fertile cell (where branching occurs) are darker brown than other cells (Crous et al. 2015a). Some species can be plant pathogens while several are associated with dead wood and soil habitats in China, Cuba, India, Italy, Thailand, the Netherlands, and the UK (Crous et al. 2015a, Crane & Miller 2016, Li et al. 2017, Pem et al. 2024).

Table 60 *Torula* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Torula brunnea</i>	China	ND	Jiang YuLan & Zhang TianYu (2008)
<i>T. herbarum</i>	Canada	Forests	Domsch et al. (1993)
<i>T. herbarum</i>	The Neterlands	Arable soil	

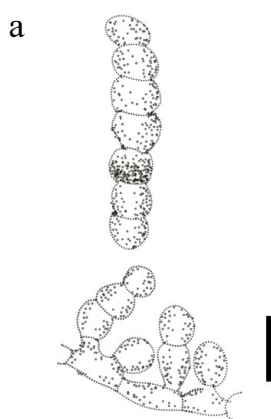


Figure 65 – *Torula herbarum* (CBS 220.59). a Conidiogenous cells and Conidia. Scale bars: a = X500. Redrawn from Domsch et al. (1993).

Pleosporales genera *incertae sedis*

Setophaeosphaeria Crous & Y. Zhang ter, Persoonia 32: 271 (2014)

Fig. 66

Index Fungorum number: IF 808945; Facesoffungi number: FoF 00305

Setophaeosphaeria was established by Crous et al. (2014a) with morpho-molecular (ITS and LSU) evidence, and the type is *S. hemerocallidis* (Crous et al. 2014a). There are seven species in the genus (Species Fungorum 2025), and all of which are supported with molecular data. The asexual morph has pycnidial, brown, globose, and ostiolate conidiomata. Conidiophores are reduced to ampulliform, hyaline, smooth conidiogenous cells that produce hyaline, smooth, subcylindrical, guttulate, and aseptate conidia. The sexual morph has pseudothecial, immersed, globose ascomata. Asci are narrowly ellipsoid, bitunicate, 8-spored, 2–3-seriate, rostrate, short-stipitate, with inconspicuous apical chambers and ascospores that are pale brown, fusoid to ellipsoid, guttulate, 5-septate, with mucoid caps at each end (Crous et al. 2014a). Species have been recorded from leaves, stems and soil in China, Italy and New South Wales (Crous et al. 2014a, Zhang et al. 2021c).

Table 61 *Setophaeosphaeria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Setophaeosphaeria</i>	China	Cave soil	Zhang et al. (2021c)

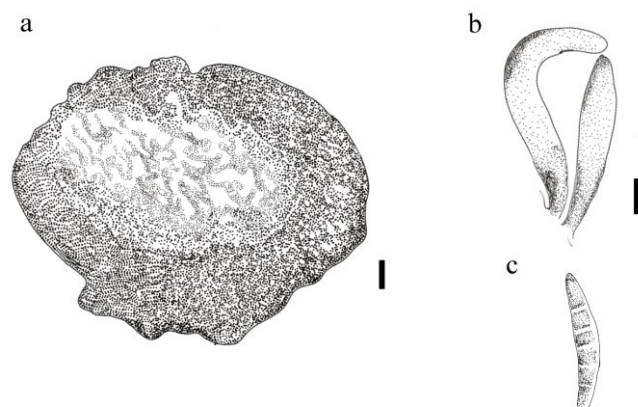


Figure 66 – *Setophaeosphaeria hemerocallidis* (CBS 138006). a Section of ascomata. b Asci. c Ascospore. Scale bars a–c = 10 µm. Redrawn from Crous et al. (2014a).

Dothideomycetes orders *incertae sedis*

Order: Botryosphaeriales C.L. Schoch, Crous & Shoemaker

Botryosphaeriaceae Theiss. & H. Syd.

Lasiodiplodia Ellis & Everh., Bot. Gaz. 21: 92 (1896).

Index Fungorum number: IF 843626; Facesoffungi number: FoF 12936

Ellis & Everhart (1894) introduced *Lasiodiplodia* with its type species *L. tubericola*; however, the generic description was provided by Clendenin (1896). Subsequently, Grifon & Maublanc (1909) suggested to synonymize *Botryodiplodia theobromae*, and the epithet *theobromae* (1892) is older than *tubericola* (1896); thus *L. theobromae* is considered the type species afterward. Currently, 85 species are listed in the Species Fungorum (2025), while 57 of them have molecular data. Due to overlapping morphological characteristics, multi-locus sequence data is more suitable for identifying the *Lasiodiplodia* species, particularly in the *L. theobromae* species complex, where the morphology is inadequate for species delineation (El-Ganainy et al. 2022). The genus has pathogens and endophytes from various plants, including *Fabaceae*, *Magnolia*, *Mangifera*, *Moraceae* and *Pandanaceae* found worldwide (Salvatore et al. 2020, El-Ganainy et al. 2022, Pem et al. 2024), while some have been reported from clinical samples and soil habitats as well (Salvatore et al. 2020, Zhang et al. 2021a). *Lasiodiplodia pseudotheobromae* is identified as soil-born root pathogen (Özkaya et al. 2024). Species have been isolated from China, Ecuador, Georgia, Indonesia, Java, Laos and Thailand (El-Ganainy et al. 2022). Several species are tested for bioactive compounds that have antifungal, anti-inflammatory and antibacterial activities (Salvatore et al. 2020).

Table 62 *Lasiodiplodia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Lasiodiplodia parva</i>	USA	Cassava field	El-Ganainy et al. (2022)
<i>L. pseudotheobromae</i>	Turkey	Peanut fields	Özkaya et al. (2024)

Eremomycetales Crous, Spatafora, Haridas & I.V. Grig.

Eremomycetaceae Malloch & Cain

Arthrographis G. Cochet ex Sigler & J.W. Carmich., Mycotaxon 4(2): 359 (1976)

Fig. 67

Index Fungorum number: IF 7222; Facesoffungi number: FoF 16646

Arthrographis was initially proposed by Cochet (1939), but it was not accepted due to an incompatibility with the International Code of Botanical Nomenclature (ICBN). Subsequently, Sigler & Carmichael (1976) validated *Arthrographis* and transferred *Oidiodendron kalrae* as the type species, while naming it as *Arthrographis kalrae*. Giraldo et al. (2014a) provided LSU based phylogeny for *Eremomycetaceae* and confirmed the phylogenetic placement of *Arthrographis*. Currently, ten species are available in Species Fungorum (2025) and nine species have molecular data. The asexual morph is hyphomycetous, and has dendritic conidiophores with 1-celled, hyaline, smooth-walled, cylindrical arthroconidia. In addition, it has trichosporiella-like synasexual morph that has solitary, globose to subglobose conidia which are produced laterally and sessile on undifferentiated vegetative hyphae (Sigler & Carmichael 1976, Giraldo et al. 2014a). Species have been identified in air, bark, dead wood, human clinical specimens, marine sediments and soil in Australia, Canada, China, Spain, the Netherlands, and the USA (Sigler & Carmichael 1976, Giraldo et al. 2014a, Li et al. 2022, Pem et al. 2024).

Table 63 *Arthrographis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Arthrographis grakistii</i>	the Netherlands	A garden	Hernández-Restrepo et al. (2020)
<i>A. kalrae</i>			
<i>A. longispora</i>			
<i>A. multiformispora</i>	China	Soil beside a road in a city area	Li et al. (2022c)

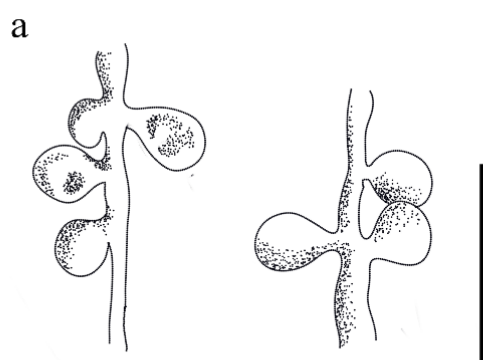


Figure 67 – *Arthrographis kalrae* (UTHSC 05-17). a Conidia. Scale bars a = 10 μm. Redrawn from Giraldo et al. (2014a).

Rhexothecium Samson & Mouch., Can. J. Bot. 53(16): 1637 (1975).

Fig. 68

Index Fungorum number: IF 4699; Facesoffungi number: FoF 06699

Rhexothecium was introduced by Samson & Mouchacca (1975), with the type species, *Rhexothecium globosum*. Currently, it remains a monotypic genus (Species Fungorum 2025). This genus was accepted in *Eremomycetaceae* by Lumbsch & Huhndorf (2010). Asexual morph is hyphomycetous, and it is trichosporiella-like and has solitary lateral conidia. The sexual morph has dark, globose or ellipsoidal, non-ostiolate ascomata with pseudoparenchymatous walls. Asci are eight-spored, obovoidal to clavate, thin-walled, evanescent in clusters with one-celled, globose to subglobose, pale yellow ascospores (Samson & Mouchacca 1975, Hongsanan et al. 2020b).

Table 64 *Rhexothecium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Rhexothecium globosum</i>	Egypt	Western Desert	Samson & Mouchacca (1975)

a

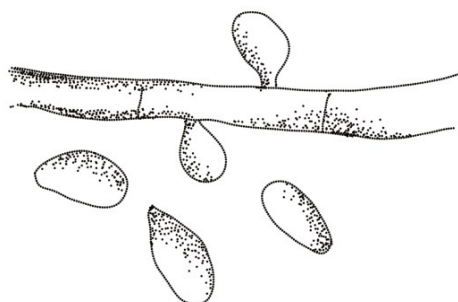
**Figure 68** – *Rhexothecium globosum*. a Conidiogenesis and conidia. Redrawn from Samson & Mouchacca (1975).***Muyocoprionales*** Mapook, Boonmee & K.D. Hyde***Muyocoprionaceae*** K.D. Hyde***Arxiella*** Papendorf, Trans. Br. mycol. Soc. 50(1): 73 (1967).

Fig. 69

Index Fungorum number: IF 7233; Facesoffungi number: FoF 08091

Arxiella was established by Papendorf (1967), and *A. terrestris* is accepted as the type species. Previously, the genus was treated as *incertae sedis* (Crous et al. 2014b) and Crous et al. (2018b) placed *Arxiella* within *Muyocoprionaceae* based on the LSU phylogeny. Subsequently, Hernández-Restrepo et al. (2019) confirmed its placement in *Muyocoprionaceae* using the combined ITS, LSU, *RPB2*, and *TEF1-α* phylogenetic analyses. Currently, four species are listed under *Arxiella* (Species Fungorum 2025), all of which are supported by the molecular data. Both coelomycetes and hyphomycetes asexual morphs have been recorded in the genus (Hongsan et al. 2020b). The asexual morph is characterized by septate, branched hyphae that are hyaline to slightly olivaceous. Conidiophores are 1- to multi-celled, with all cells being conidiogenous. Conidia are hyaline to slightly coloured, 1-septate, and reniform, with obliquely cornute ends. They are borne on short or elongate, sterigma-like projections, and occur singly, in short chains, or in small irregular groups (Papendorf 1967). The coelomycetous asexual morph has sporodochial, brown conidiomata with globose to somewhat elongated, phialidic, brown conidiogenous cells that produce reniform, medianly 1-septate conidia with guttules and horn-like appendages at the ends (Hongsan et al. 2020b, Tennakoon et al. 2021). Species have been recorded in leaves and soil from India, the Netherlands and South Africa (Tiwari 1976, Crous et al. 2014b, Tennakoon et al. 2021).

Table 65 *Arxiella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Arxiella terrestris</i>	India and South Africa	ND	Papendorf (1967), Tiwari (1976)

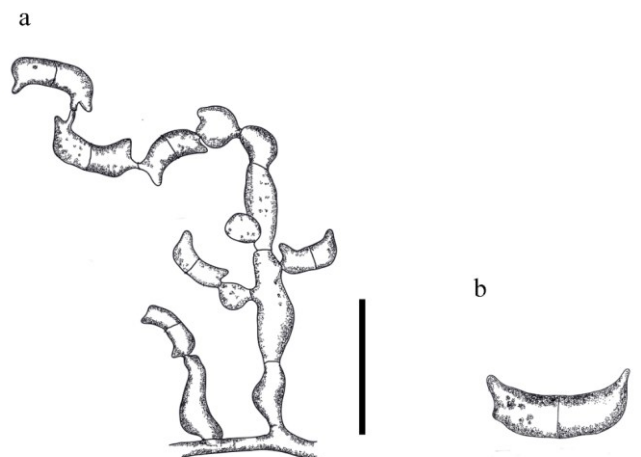


Figure 69 – *Arxiella terrestris*. a Conidiophores. b Conidia. Scale bars a = 20 µm, b = 15 µm. Redrawn from Papendorf (1967).

Leptodiscella Papendorf, Trans. Br. mycol. Soc. 53(1): 146 (1969).

Fig. 70

Index Fungorum number: IF 8743; Facesoffungi number: FoF 08092

Papendorf (1969a) introduced *Leptodiscella* and *L. africana* is designated as the type species. The genus comprises six species (Species Fungorum 2025), and all of which are supported by molecular data. The asexual morph has solitary or aggregated, mono- or polyblastic, sympodial conidiogenous cells, with solitary, hyaline, cylindrical to oblong, 1-septate conidia with a subpolar, filiform appendage at each cell. Three *Leptodiscella* species have been found in soil and some are associated with house dust, leaves and plant litter in Africa, China, Japan and the Netherlands (Barbosa et al. 2015, Crous et al. 2018c).

Table 66 *Leptodiscella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Leptodiscella brevicatenata</i>	Spain	Forest soil	Madrid et al. (2012)
<i>L. japonica</i>	Japan	Forest soil	Matsushima (1975)
<i>L. rintellii</i>	The Netherlands	ND	Crous et al. (2018c)

Phaeotrichales Ariyaw., Jian K. Liu & K.D. Hyde

Phaeotrichaceae Cain

Phaeotrichum Cain & M.E. Barr, Can. J. Bot. 34: 676 (1956).

Fig. 71

Index Fungorum number: IF 3967; Facesoffungi number: FoF 08132

Phaeotrichum was introduced by Cain (1956), to accommodate *P. hystricinum* as the type species (Cain 1956). The genus was previously placed in *Sporormiaceae* (Munk 1957); however, subsequently Barr (2000) placed it in *Phaeotrichaceae*. Currently, the genus accommodates five species (Species Fungorum 2025), but only two have molecular data. The sexual morph is characterized by superficial, cleistothecial, globose ascomata, covered by long, hairy appendages and eight-spored, broadly clavate, stipitate asci. Ascospores are dark-brown and opaque, thick-walled and deeply constricted at the single median transverse septum (Cain 1956). Species are coprophilous, isolated from dung and one species have been isolated from soil in Canada, Japan, Québec and the USA (Cain 1956, Hongsanan et al. 2020b).

Table 67 *Phaeotrichum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Phaeotrichum setosum</i>	Japan	ND	Hongsanan et al. (2020b)

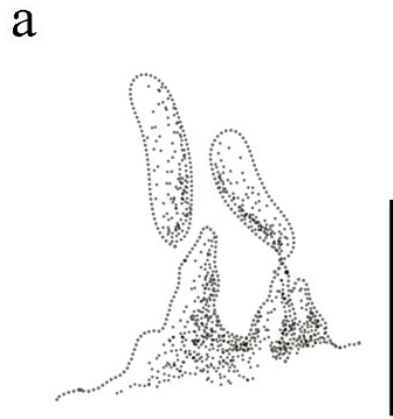


Figure 70 – *Leptodiscella africana* (URM 86557). a Conidiogenous cells and conidia. Scale bar a =10 µm. Redrawn from Barbosa et al. (2015).

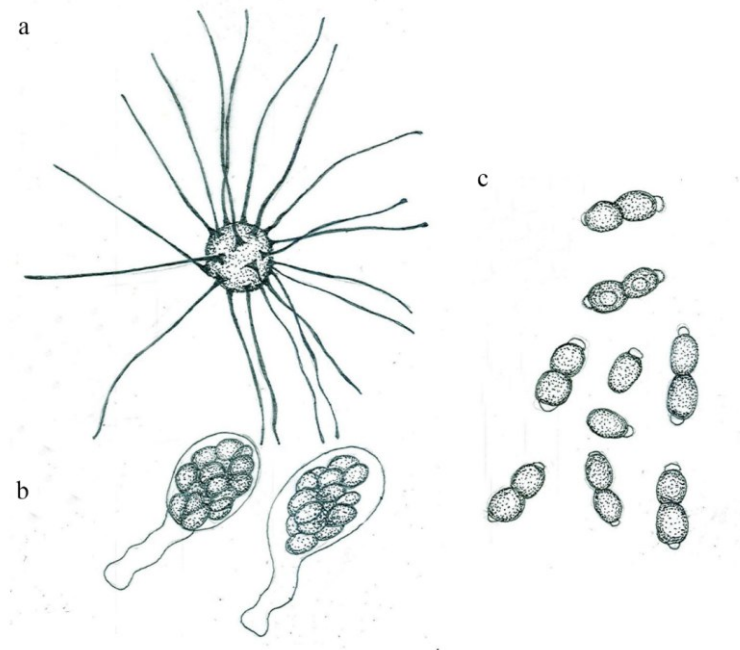


Figure 71 – *Phaeotrichum hystrix*. a Ascoma with appendages. b Asci. c Ascospores. Redrawn from Cain (1956)

Trypetheliales Lücking Aptroot & Sipman

Trypetheliaceae Zenker

Aptrootia Lücking & Sipman, Lichenologist 39: 188 (2007).

Fig. 72

Index Fungorum number: IF 29134; Facesoffungi number: FoF 08786

Aptrootia was introduced by Lücking et al. (2007); based on morphology and SSU phylogeny, while *A. terricola* is designated as the type species. *Aptrootia* has four species listed in the Species Fungorum (2025), and all are introduced with molecular data. Thallus appear distinctly

corticate, yellow-brown to mostly green, or ecorticate and greyish (Hongsanan et al. 2020b). The asexual morph is unknown. The sexual morph is characterized by solitary, brown-black, globose to pear-shaped or ovoid, coriaceous to carbonaceous, ostiolate ascomata that is usually covered by a thick thallus layer except for the ostiolar area. Asci are 1(–2)-spored, bitunicate, fissitunicate, oblongellipsoid, short pedicellate. Ascospores are oblong-ellipsoid, initially hyaline, becoming dark brown, muriform, weakly distoseptate, with a gelatinous sheath, initially hyaline and I+ amyloid, becoming dark brown (Lücking et al. 2007, Hongsanan et al. 2020b). These species have been found lichenized on bark, on bryophytes in terrestrial tropical forest habitats and two species have been found from soil substrates in Costa Rica, New Zealand and Thailand (Hongsanan et al. 2020b).

Table 68 *Aptrootia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Aptrootia terricola</i>	Seychelles	Soil on a granitic rock	Diederich et al. (2017)
<i>A. robusta</i>	Tasmania	Soil in rock crevices in alpine heathland	McCarthy & Kantvilas (1993)

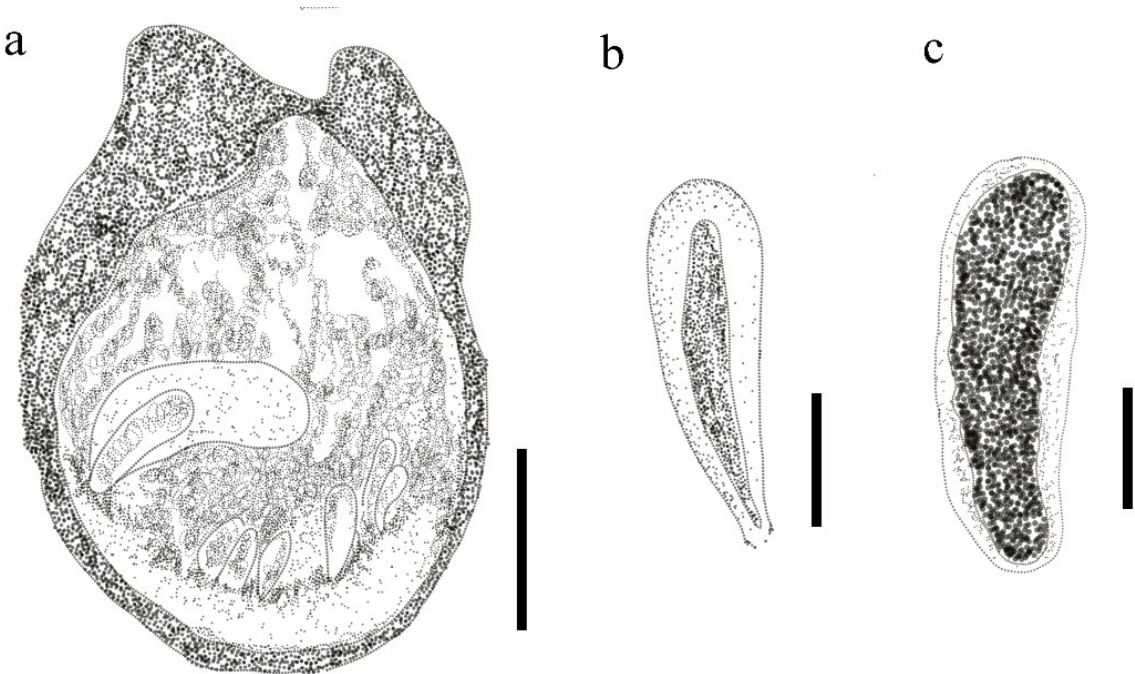


Figure 72 – *Aptrootia terricola*. (Lücking 17211) a Ascomata. b Immature ascus. c Mature ascospores. Scale bars: a = 200 µm, b, c = 50 µm. Redrawn from Lücking et al. (2007).

Venturiales Y. Zhang ter, C.L. Schoch & K.D. Hyde

Sympoventuriaceae Y. Zhang ter, C.L. Schoch & K.D. Hyde

Guizhoumyces T.P. Wei & Y.L. Jiang, Persoonia 48: 230 (2022)

Fig. 73

Index Fungorum number: IF 840922; Facesoffungi number: FoF 16647

Guizhoumyces is a monotypic genus that was established by Wei et al. (2022) based on morpho-molecular (SSU, ITS, LSU, *Actin*, *TEF1-α*) analyses and typified with *G. aciculaea*. The asexual morph is characterized by subcylindrical, simple, branched, straight or slightly geniculate, pale brown, septate conidiophores and sometimes reduced to conidiogenous cells and polyphialidic, sympodially proliferating conidiogenous cells with rhexolytic conidial secession. Conidia are enteroblastic, subhyaline to pale brown, solitary, acicular to obclavate or cylindrical, septate, with

thick and dark hilum; anastomosis between mature conidia. The sexual morph is still undetermined (Wei et al. 2022).

Table 69 *Guizhoumyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Guizhoumyces aciculaea</i>	China	Fodingshan National Nature Reserve	Wei et al. (2022a)

a

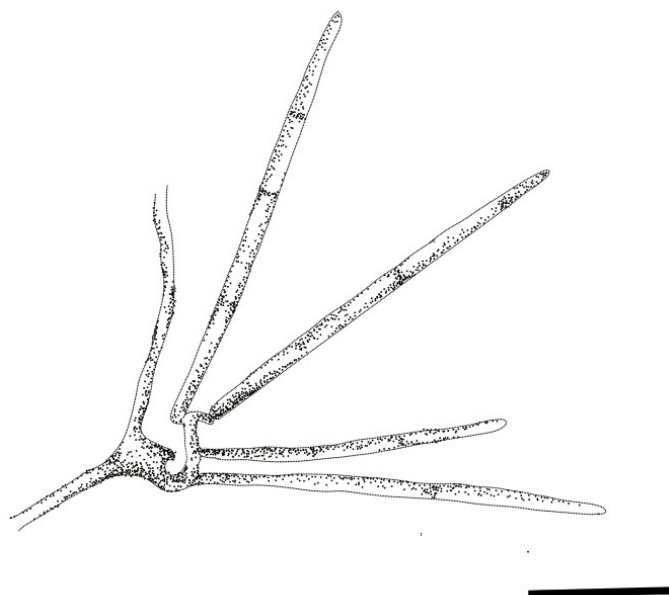


Figure 73 – *Guizhoumyces aciculaea* (GUCC 18195). a Conidiophores and conidia. Scale bars a = 10 µm. Redrawn from Wei et al. (2022).

Matsushimaea Subramanian, Kavaka 5: 96 (1978) [1977]

Index Fungorum number: IF8865; Facesoffungi number: FoF 08831

Matsushimaea was erected by Subramanian (1977) with the type, *M. fasciculate*. Currently, it accommodates four species (Species Fungorum 2025), while three of them have molecular data. Crous et al. (2018a) and Wei et al. (2022) provided phylogeny for this genus based on the combined ITS, LSU, *TEF1-α*, *RPB2* and *TUB2* data while introducing new species in the genus. The asexual morph is characterized by sessile, branched conidia, producing directly from vegetative hyphae, with polyblastic sympodial conidiogenous cells (Subramanian 1977). *Matsushimaea* has been isolated from forest litter and two species from the soil in China, Cuba, Japan and Spain (Crous et al. 2018b, Wei et al. 2022).

Table 70 *Matsushimaea* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Matsushimaea monilioides</i>	Spain	Garden soil	Crous et al. (2018b)
<i>M. fasciculate</i>	China	Land in a resort	Wei et al. (2022a)

Scolecobasidium E.V. Abbott, Mycologia 19: 30 (1927)

Index Fungorum number: IF9840; Facesoffungi number: FoF 09214

Fig.74

Scolecobasidium was described by Abbott (1927) with the type species, *S. terreum*. Shen et al. (2020) placed this genus in *Sympoventuriaceae* as it has slow-growing olivaceous colonies. Wei et al. (2022) used the combined SSU, ITS, LSU, *Actin*, *TUB2* and *TEF1-α* molecular data to infer its phylogenetic placement and suggested that *Ochroconis* can be synonymized under *Scolecobasidium*. *Scolecobasidium* currently comprises 77 species (Species Fungorum 2025) and 51 of them have molecular data. The asexual morph is hyphomycetous, and conidiophores possess one to three conidium-bearing denticles at the apex, ampulliform conidiogenous cells and T- or Y-shaped or bilobed, two- to multi-celled conidia (Hongsan et al. 2020b, Wei et al. 2022). The genus exhibits thermophilic properties and it has human and animal pathogens while some of the species are found in litter and soil substrates. They are geographically distributed in Australia, China, Georgia, India, Malaysia, Spain and the USA (Samerpitak et al. 2014, 2019, Wei et al. 2022a).

Table 71 *Scolecobasidium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Scolecobasidium constrictum</i>	USA	ND	Abbott (1927)
<i>S. terreum</i>		ND	
<i>S. globale</i>	China	Lawn soil	Wei et al. (2022)
<i>S. tshawytschae</i>		Lawn soil	
<i>S. spiralihyphum</i>		ND	
<i>S. tuberculatum</i>		ND	
<i>S. crassihumicola</i>	Papua New Guinea	ND	
<i>S. icarus</i>	Canada	Forests soil	
<i>S. verrucosa</i>	India	ND	
<i>S. coiledmyces</i>	China	Lawn soil	
<i>S. echinulatum</i>		ND	
<i>S. ellipsoideum</i>		ND	
<i>S. guangxiensis</i>		ND	
<i>S. humicola</i>	Canada	Peat soil	
<i>S. icarus</i>	Canada	Forest soil	
<i>S. leishanicola</i>	China	ND	
<i>S. minimum</i>	India	ND	
<i>S. ramosum</i>	China	ND	
<i>S. terreum</i>	USA	ND	
<i>S. tshawytschae</i>	Ireland	peat bog soil	
<i>S. variabile</i>	Canada	ND	
<i>S. verrucaria</i>	China	ND	
<i>S. verrucosum</i>	India	ND	
<i>V. terricola</i>	China	ND	

Verruconis Samerp. & de Hoog, Fungal Diversity 65: 117 (2013)

Fig. 75

Index Fungorum number: IF519169; Facesoffungi number: FoF 06351

Samerpitak et al. (2014) established *Verruconis* and designated *V. gallopava* as the type species. Currently, 15 species are listed in the Species Fungorum (2025), and all of which have molecular data. Initially, this genus was established to accommodate thermophilic species that have unbranched conidia. Later, mesophilic species have been discovered within the genus (Samerpitak et al. 2014, Zhang et al. 2018). Samerpitak et al. (2016) used the concatenated dataset of SSU, ITS, LSU, *Actin*, *TUB2* and *TEF1-α* for species delineation in *Sympoventuriaceae*. Subsequently, species delineation is mainly based on molecular analyses coupled with morphological characterization (Wei et al. 2022). *Verruconis* species are characterized by melanized hyphomycetes, brown to olivaceous colonies, and clavate to cylindrical, two-celled conidia (Zhang et al. 2018, Huanraluek et al. 2019). Later, Y- or T-shaped conidia were also described from this genus (Wei et al. 2022). The first sexual morph of this genus was recorded from *V. mangrovei*, which has superficial to semi-immersed, globose to sub-globose, pale brown to dark brown

ascomata, and dictyosporous, ellipsoidal to oblong, 4–5 transverse septate ascospores (Hyde et al. 2020a). Species can be endophytes, saprobes in plants and opportunistic pathogens in animals and humans (Giraldo et al. 2014b). *Verruconis* have been found in hot springs, humans, industrial effluents, plants and soil in India, Thailand and the USA (Yasanthika et al. 2023a).

Table 72 *Verruconis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Verruconis guizhouensis</i>	China	Rhizosphere soil	Shao et al. (2022b)
<i>V. soli</i>	Thailand	Forest soil	Yasanthika et al. (2023a)
<i>V. thailandica</i>			
<i>V. terricola</i>	China	ND	Ren et al. (2013)
<i>V. verruculosa</i>	India	ND	Samerpitak et al. (2014)

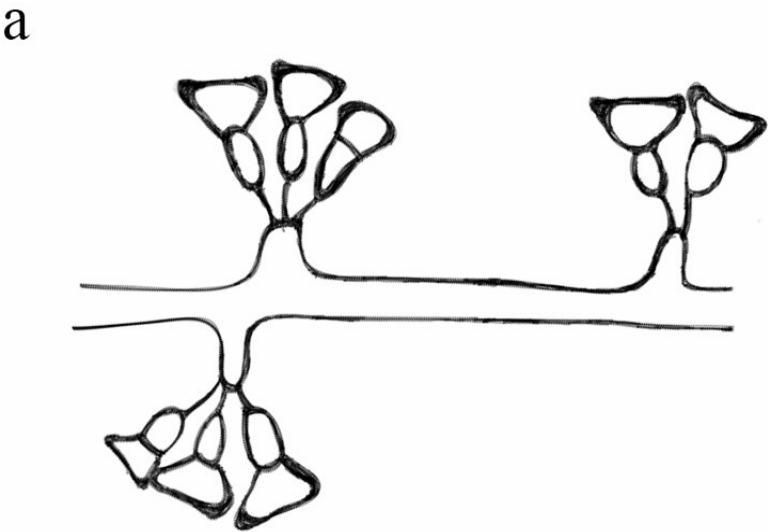


Figure 74 – *Scolecobasidium terreum*. a. Conidiogenesis on the conidiophores and conidia. Redrawn from Abbott (1927).

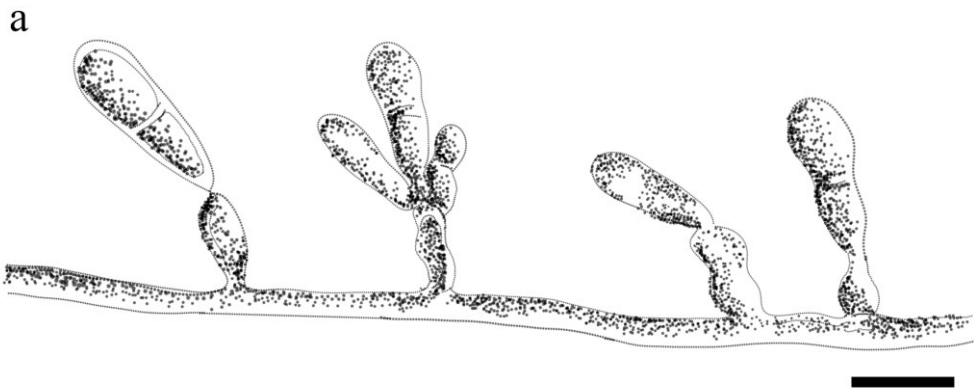


Figure 75 – *Verruconis gallopava* (CBS 437.64). a. Conidial apparatus and conidia. Scale bar: a = 10 µm. Redrawn from Samerpitak et al. (2014).

Dothideomycetes* families *incertae sedis

Pseudorobillarda M. Morelet, Bull. Soc. Sci. nat. Arch. Toulon et du Var 175: 5 (1968). Fig. 76
Index Fungorum number: IF 9607; Facesoffungi number: FoF 07559

Pseudorobillarda was erected by Morelet (1968) with the type species *P. phragmitis*. It has 20 species listed in the Species Fungorum (2025), while 10 have been supported with molecular data. The asexual morph has pycnidial conidiomata, phialidic or annellidic conidiogenous cells and subcylindrical to fusiform, 0–4-septate conidia with appendages at one end (Hongsanan et al. (2020b)). There is no sexual morph linked to *Pseudorobillarda* (Hongsanan et al. (2020b)). Many endophytes and saprobic species are found on both living and dead leaves and stems, respectively, and can also be found on soil in Belgium, Canada, China, Germany, India, Russia, Nigeria, Thailand and the USA. *Pseudorobillarda* species are known as one of the ten most abundant soil fungi and have a significant impact on nutrient cycling in the saprobic state (Tangthirasunun et al. 2014, Hongsanan et al. 2020b, Song et al. 2022).

Table 73 *Pseudorobillarda* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudorobillarda asparagis</i>	Canada	Asparagus field	Kadowaki et al. (2014)
<i>Pseudorobillarda texana</i>	ND	ND	

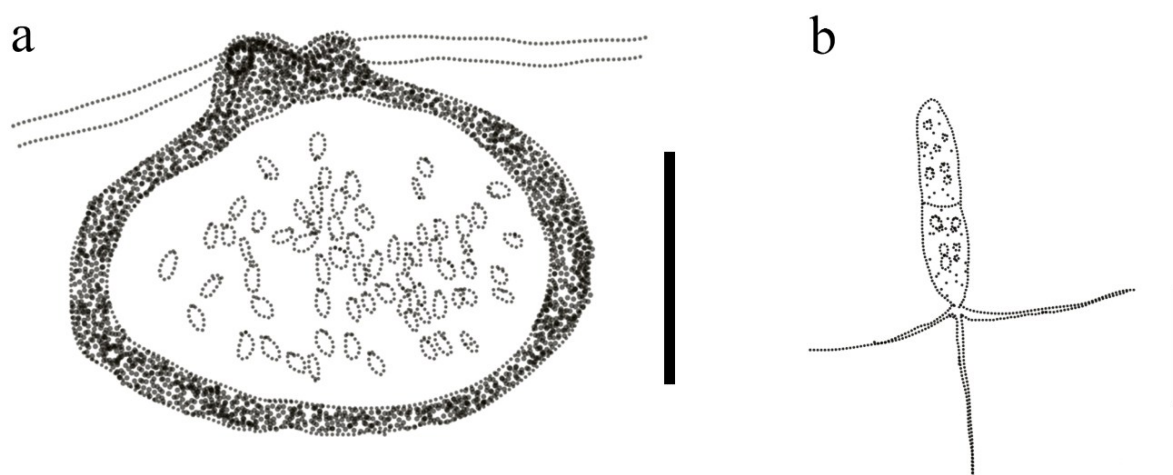


Figure 76 – *Pseudorobillarda phragmitis*. a Conidiogenesis in pycnidium. b Conidium. Scale bars a = 200 µm, b = 10 µm. Redrawn from Raj et al. (1972).

Dothideomycetes genera *incertae sedis*

Bahusakala Subram., J. Indian bot. Soc. 37: 63 (1958)

Index Fungorum number: IF 7318; Facesoffungi number: FoF09031

Subramanian (1958) introduced *Bahusakala* and its type species, *B. olivaceonigra*. Currently, there are four species listed in the Species Fungorum (2025) and two of them have molecular data. Its asexual morph is characterized by conidiophores that branch at irregular intervals to produce brown conidiogenous hyphae at the terminal and intercalary positions and brown to dark brown conidia that originate from random disarticulation of the main conidiophore axes and conidiogenous hyphae (Pem et al. 2019, Bundhun et al. 2021). Based on the phylogenetic analyses of Bundhun et al. (2021), suggested that *Parasymphodiella* and *Bahusakala* are congeneric and to accommodate *Bahusakala* taxa in *Parasymphodiella*, however, due to the lack of molecular data in the type species the exact phylogenetic placement of *Bahusakala* remains undetermined (Bundhun et al. 2021). The species are recorded from dead plants and soil, while several members are reported as human and plant pathogens in Cuba, India, Japan, Sri Lanka and Thailand (Pem et al. 2019, 2024).

Table 74 *Bahusakala* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Bahusakala australiensis</i>	Australia	ND	Domsch et al. (1993)
<i>Bahusakala</i> sp.	USA	Desert soil	Bhatnagar & Bhatnagar (2005)

Monodictys S. Hughes, Canad. J. Bot. 36: 785 (1958)

Index Fungorum number: IF 8979; Facesoffungi number: FoF12305

Hughes (1958) introduced *Monodictys* and the type species is designated as *M. putredinis*. There are more than 60 species listed in Species Fungorum (2025); however, most of them including the type species lack the sequence data. Thus, their phylogenetic placement is currently unresolved. Based on the previous studies, Tanaka et al. (2015) mentioned that some *Monodictys* species are segregated in *Dothideomycetes*, *Leotiomycetes* and *Sordariomycetes*. Thus, collecting fresh specimens to generate more sequences and conducting a phylogenetic reassessment are timely requirements to infer their true placement (Tanaka et al. 2015, Yeh & Kirschner 2019). The species are distributed in China, India, Hungary, Germany, Pennsylvania and Sri Lanka that are associated with plant debris and soil habitats (Tanaka et al. 2015).

Table 75 *Monodictys* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Monodictys fluctuata</i>	Thailand	ND	Manoch (1987)
<i>M. tuberculata</i>	China	Grassland soil	Wu & Zhang et al. (2009)
<i>M. clavata</i>			
<i>M. shigatsensis</i>			

Eurotiomycetes O.E. Erikss. & Winka

Chaetothyriomycetidae Doweld

Chaetothyriales M.E. Barr

Herpotrichiellaceae Munk

Cladophialophora Borelli, Proc. 5th International Conference on Mycoses: 355 (1980)

Index Fungorum number: IF 7677; Facesoffungi number: FoF 10373

Cladophialophora was initially introduced by de Hoog & de Hoog (1974), and *Cladophialophora carrionii* is designated as the type species (de Hoog 1974). Subsequently, the genus was revised by Borelli (1980) with significant changes and it was initially erected to accommodate a species exhibiting both *Cladosporium*- and *Phialophora*-like conidiogenesis. There are 67 *Cladophialophora* species in the Species Fungorum (2025), however, Chang et al. (2023) have provided the phylogenetic analyses using 46 species based on ITS, SSU, LSU, *TUB2*, and *TEF1-α* gene regions. The asexual morph is characterized by blastic, acropetal conidiogenesis, with branched or unbranched conidial chains, and one-celled, ellipsoidal to fusiform conidia (Sutton et al. 2009, Das et al. 2019, Chang et al. 2023). Around eleven species are found pathogenic to humans, with *C. emmonsii* causing human subcutaneous phaeohyphomycosis and skin infections in mammals. Species have been isolated from humans, lichens, plants, processed food and soil in Australia, China, Cuba, Denmark, Germany, Korea, New Zealand, South Africa and Spain (Tang et al. 2017, Torres-Garcia et al. 2023).

Table 76 *Cladophialophora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cladophialophora</i>	Germany	Wheat field	Crous et al. (2007)

<i>chaetospora</i>			
<i>C. humicola</i>	Germany	Arable soil	
<i>C. inabaensis</i>	Japan	Forest soil	Chang et al. (2023)
<i>C. lanosa</i>	Korea	Yellowish brown and fine gravelly clay loam soil	
<i>C. multiseptata</i>	Spain	ND	
<i>C. psammophila</i>	the Netherlands	Soil polluted with petroleum	
<i>C. pseudocarrionii</i>	Spain	ND	

Exophiala J.W. Carmich., Sabouraudia 5: 122 (1966)

Index Fungorum: IF 8233; Facesoffungi number: FoF 10374

Exophiala was introduced by Carmichael (1966), accommodating its type species as *E. salmonis*. The genus comprises 81 species (Hyde et al. 2024c), and most of them have molecular data. Molecular analyses are essential for species identification in *Exophiala* (Madrid et al. 2023) and exhibit extensive pleomorphism, producing phialophora-like, cladophialaphora-like or meristematic synanamorphs in cultures (de Hoog & Hermanides-Nijhof 1977, Crous et al. 2018a). Moreover, both sexual and asexual morphs have been reported in *Exophiala*; and characterized by the yeast-like budding cells. The asexual morph has annellidic conidiogenous cells and aseptate or transversely septate conidia in slimy masses (Madrid et al. 2023). *Exophiala* species are commonly found on dead or living plant material, indoor spaces, river sediments, rocks, humid surfaces, soil and water in China, Germany, Italy, Japan, Norway, Russia, Spain, Sri Lanka and Thailand (Matos et al. 2002, Dög'en et al. 2013, Madrid et al. 2023). Several species are pathogenic to animals and humans, causing skin and subcutaneous infections (Woo et al. 2013).

Table 77 *Exophiala* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Exophiala alcalophila</i>	Japan	ND	Ide-Pérez et al. (2024)
<i>E. atacamensi</i>	Chile	Desert soil	
<i>E. attenuate</i>	Colombia	ND	
<i>E. chapopotensis</i>	Mexico	Oil polluted soil	
<i>E. crusticola</i>	Chile and USA	ND	
<i>Exophiala viscosa</i>	Canada	Biological soil crust	

Phialophora Medlar, Mycologia 7(4): 202 (1915)

Fig. 77

Index Fungorum: IF 9342; Facesoffungi number: FoF 10380

Medlar (1915) erected *Phialophora* with its type species, *P. verrucosa*. There are 37 species listed in Species Fungorum (2025), but only eight of them are supported with molecular data. *Phialophora* is treated with LSU, *TUB2* and *TEFI-α* phylogeny by Torres-Garcia et al. (2023) while accommodating new species in the genus. Both sexual and asexual morphs are produced, however, the asexual morph is commonly found in nature. The asexual morph is characterized by pigmented conidiophores, solitary or aggregated, flask-shaped phialides with flaring collarettes and one-celled, ellipsoidal or cylindrical conidia (Gams 2000). Species are inhabiting fresh and polluted water, human skin, plants, paper, straw, soil, wood and wood pulp isolated from Brazil, China, Japan, North America, Peru, the Netherlands and the USA (McKemy 1997, Song et al. 2021). These species can have pathogenic or mutualistic relationships with plant roots (Yuan et al. 2010), while several members like *P. verrucosa* and *P. richardsiae* can cause skin infections, subcutaneous infections, or more systemic diseases in immunocompromised patients (Song et al. 2021).

Table 78 *Phialophora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Phialophora americana</i>	China	ND	Song et al. (2021)

<i>P. chinensis</i>		ND	
<i>P. macrospora</i>		ND	
<i>P. biformis</i>	Japan	Forest soil	Domsch et al. (1993)
<i>P. cinerescens</i>	Sardinia	Soil under oaks	
<i>P. cyclaminis</i>	Germany and the Netherlands	Agricultural soil	



Figure 77 – *Phialophora verrucosa* (CDC B1757). Redrawn from Zweibel & Wang (1977).

Rhinoctadiella Nannf., Svensk Skogsvårdsförening Tidskr. 3–4: 461 (1934) Fig. 78
Index Fungorum number: IF 9720, Facesoffungi number: FoF 10382

Rhinoctadiella was established by Melin & Nannfeldt (1934), designating *R. atrovirens* as the type species. *Rhinoctadiella* contains 20 species (Hyde et al. 2024c), while 13 have been provided with molecular data. Based on the combined ITS and LSU sequence data, Arzanlou et al. (2007) placed *Rhinoctadiella* in *Herpotrichiellaceae*. The asexual morph is characterized by the conidial apparatus, usually branched, olivaceous-brown, consisting of either slightly differentiated tips of ascending hyphae or septa, markedly differentiated conidiophores and intercalary or terminal, polyblastic, cylindrical to acicular, conidiogenous cells. Conidia are sympodially proliferating, solitary, hyaline to subhyaline, aseptate, thin-walled, smooth, subglobose and with subdenticulate rachis (Melin & Nannfeldt 1934, Arzanlou et al. 2007). *Rhinoctadiella* has been found in various hosts including herbaceous and decaying plant parts, human clinical samples, soil and submerged wood. Some members are known as human and plant pathogens. They are distributed in China, Costa Rica, Japan, Madagascar, Russia, Saudi Arabia, Spain, South Africa and Sweden, associated with herbaceous and decaying plant parts, human clinical samples, soil and submerged wood (Arzanlou et al. 2007, Roeun et al. 2022).

Table 79 *Rhinoctadiella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Rhinoctadiella anceps</i>	Canada	soil under <i>Thuja plicata</i>	Arzanlou et al. (2007)
<i>R. phaeophora</i>	Colombia	ND	

<i>R. terrigenum</i>	Korea	rhizosphere soil of <i>Robinia pseudoacacia</i>	Roeun et al. (2022)
<i>R. tibetensis</i>	China	Everglade soil	Domsch et al. (2007)
<i>R. vesiculosa</i>	Russia	ND	

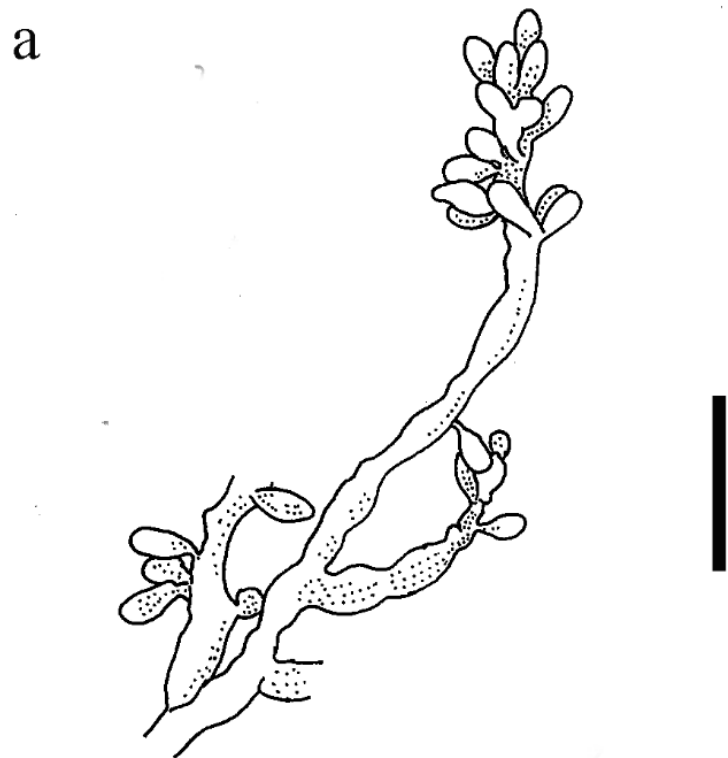


Figure 78 – *Rhinocladiella atrovirens* a. Conidia and conidiogenous rachids. Scale bars: a = 10 µm. Redrawn from Tsuneda et al. (1986).

Veronaea Cif. & Montemart., Atti Ist. bot. Univ. Lab. crittog. Pavia, sér. 5 15: 68 (1957) Fig. 79
Index Fungorum number: IF 10387; Facesoffungi number: FoF 10386

Veronaea was established by R. Ciferri and A. Montemartini in 1958, and *V. botryose* is designated as the type species (Ellis 1971, Arzanlou et al. 2007). Currently, 21 species are listed in the genus (Species Fungorum 2025), however, only five species have molecular data. Arzanlou et al. (2007) resolved the phylogenetic misconception that remained among *Cladosporium*, *Ramichloridium*, *Rhinocladiella* and *Veronaea* by providing a stable phylogeny with the combined LSU and ITS data. *Veronaea* produces hyphomycetous asexual morphs, with erect, straight or flexuose, unbranched or occasionally loosely branched, sometimes geniculate, smooth-walled, pale to medium- or olivaceous-brown conidiophores. Conidiogenesis cells are terminally integrated, polyblastic, occasionally intercalary, cylindrical, pale brown, often becoming septate and fertile part subhyaline, and solitary, smooth, pale brown, cylindrical to pyriform, 1(–2)-septate conidia, that are rounded at the apex and truncate at the base. Species have been isolated from India, Japan, and South Africa from dead bamboo clumps and wood materials, leaves, dung soil and submerged wood (Arzanlou et al. 2007).

Table 80 *Veronaea* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Veronaea botryose</i>	Egypt	Sandy loam soil	Su et al. (2023)
<i>V. compacta</i>	South Africa	ND	Arzanlou et al. (2007)

<i>V. gobica</i>	China	Yellow River source area	Pan et al. (2008)
<i>V. simplex</i>	South Africa	mixed <i>Acacia karroo</i> field	Papendorf (1969b)

a

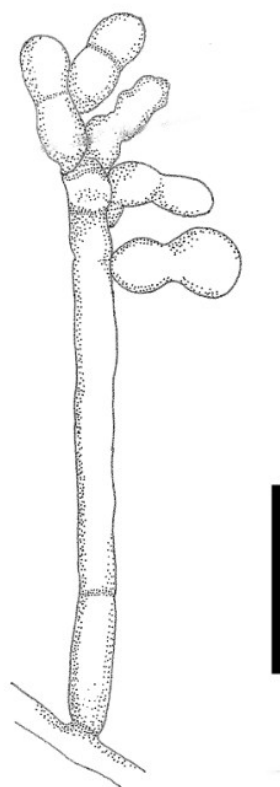


Figure 79 – *Veronaea botryose* (CBS 254.57). a Conidiogenesis on the conidiophores. Scale bar: a = 10 µm. Redrawn from Arzanlou et al. (2007).

Eurotiomycetidae Geiser & Lutzoni

Eurotiales G.W. Martin ex Benny & Kimbr.

Aspergillaceae Link (= Monascaceae J. Schröt.)

Aspergillus P. Micheli, Nov. pl. gen. (Florentiae): 212, tab. 92 (1729)

Fig. 80

Index Fungorum number: IF39019; Facesoffungi number: FoF16659

Aspergillus was named by Micheli in 1729. Subsequently, the first major monograph of *Aspergillus* was published by Tom and Church in 1926 (Bennett 2007). The type species is *Aspergillus flavus* (Raper 1965), and Visagie et al. (2024b) have accepted 453 species within the genus, including 6 subgenera, 28 sections and 88 series, while providing a phylogenetic revision of *Eurotiales* based on ITS, *RPB2*, *TUB2*, *BenA*, *cmdA* and LSU sequence data. Further, Visagie et al. (2024b) suggested that morphology, extrolite (secondary metabolite) profiling, and whole-genome sequencing can be effectively used in resolving this order. Steenwyk et al. (2024) have used phylogenomics to study *Aspergillus* while suggesting to use this method for species identification in the future. Their study also revealed extensive strain misidentification within *Aspergillus*. The asexual morph of the genus is characterized by erect conidiophores that terminate in a palisade-like layer of phialides or subtending cells with whorls of phialides. Subsequently, metulae and phialides are blown out, and bisepetal chains of conidia are produced (Domsch et al. 1980). *Aspergillus* species are globally reported across various hosts and substrates, including air, aquatic environments, dung, human tissues, plants and soil, functioning mostly as pathogens and saprobes

(Bennett 2007). These fungi can produce useful extracellular enzymes, organic acids and secondary metabolites that are important in medical, agricultural, and biotechnological industries (Bennett 2007). For example, *Aspergillus fumigatus* and *A. flavus* are pathogenic and produce mycotoxins, while *A. niger* is utilized in industrial applications, and *A. oryzae* is useful in producing fermented foods (Nierman et al. 2005, Steenwyk et al. 2024).

Table 81 *Aspergillus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Aspergillus agricola</i>	USA	ND	Visagie et al. (2024b)
<i>A. alboluteus</i>	Botswana		
<i>A. banksianus</i>	Australia		
<i>A. barbosae</i>	Brazil		

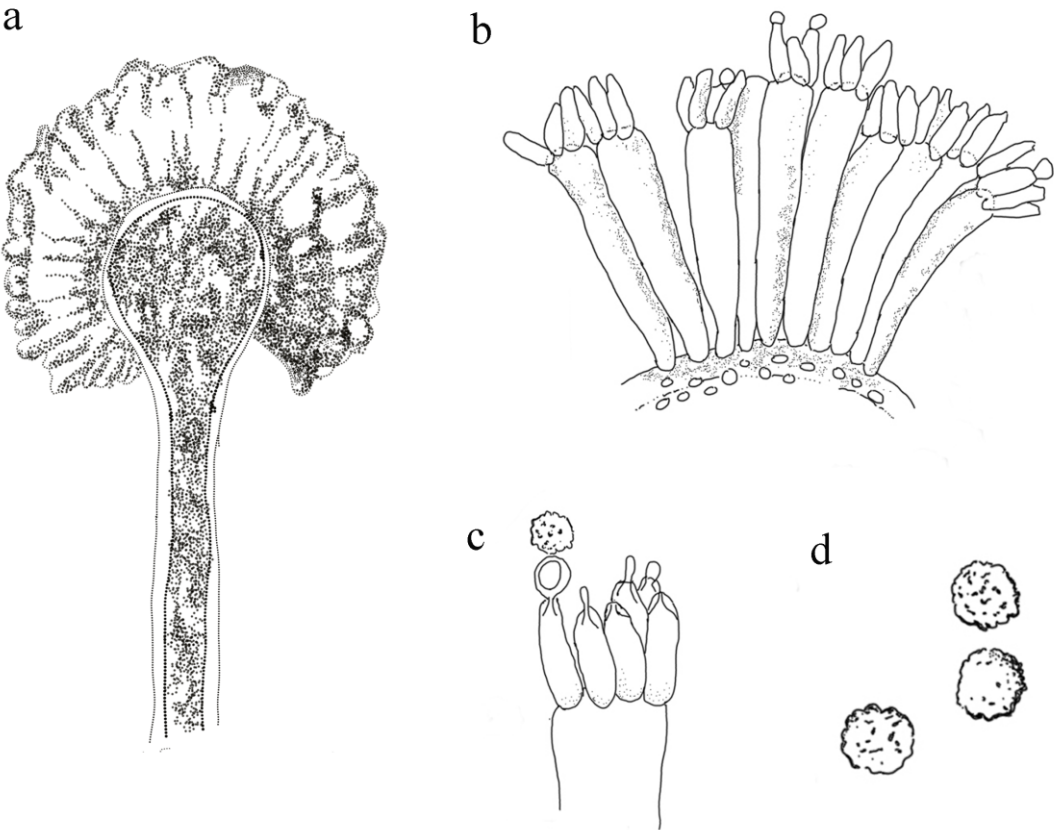


Figure 80 – *Aspergillus flavus*. a Conidiophore with a conidial head. *Aspergillus* sp. (CBS 117.48) b, c Parts of conidial head with long metulae and short phialidesd. d. Conidia. Redrawn from Domsch et al. (1993).

Hamigera Stolk & Samson, Persoonia 6(3): 342 (1971)

Index Fungorum number: IF 2215; Facesoffungi number: FoF16660

Stolk & Samson (1971) introduced *Hamigera* and designated *Hamigera avellanea* as the type species. Subsequently, Peterson et al. (2010) introduced six species using combined morphology and phylogeny. Currently, nine species are listed in the genus (Species Fungorum 2025) and all of them have molecular data. The asexual morph is *Penicillium*-like, and the sexual morph is soft, globose to subglobose, superficial, discrete and confluent ascomata, covered with interwoven hyphae. Asci are evanescent, 8-spored, subglobose to ellipsoid to clavate, stalked, and formed singly from croziers, and ascospores are yellowish, ellipsoid with different ornamentations (Stolk & Samson 1971). Species have been isolated from air, dung, insects, soil and textile materials in Australia, France, Poland and Togo (Peterson et al. 2010).

Table 82 *Hamigera* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Hamigera avellanea</i>	USA	ND	Peterson et al. (2010)
<i>H. fusca</i>	Australia and The Comoros	Phenol-treated soil	
<i>H. inflata</i>	Gran Canaria Island	ND	
<i>H. pallida</i>	Togo	Phenol-treated soil	
<i>H. paravellanea</i>	Poland	ND	
<i>H. terricola</i>	France and Equatorial Guinea	Phenol-treated soil	

Penicillium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1-2): 16 (1809)

Fig. 81

Index Fungorum number: IF 9257; Facesoffungi number: FoF 12565)

Penicillium was introduced by Link (1809), and the type species is designated as *P. expansum*. Based on the combined ITS, *RPB2*, *TUB2*, *BenA*, *cmdA* and LSU phylogeny for *Eurotiales* taxa, Visagie et al. (2024b) have accepted 553 species in the genus, classified into two subgenera, 32 sections, and 101 series. These species are widely distributed in air, indoors, soil and vegetation; and can be found as saprobes or pre-or post-harvest pathogens on food crops (Frisvad & Samson 2004, Visagie et al. 2014). Some of them can produce mycotoxins, whereas several species are exploited for producing cheese, fermented food and medical products (Frisvad & Samson 2004, Samson et al. 2010, Visagie et al. 2014).

Table 83 *Penicillium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Penicillium umkhoba</i>	South africa	ND	Visagie et al. (2024b)
<i>P. uttarakhandense</i>	India	ND	
<i>P. vaccaeorum</i>	Argentina	ND	Rodríguez-Andrade et al. (2021b)
<i>P. melanosporum</i>	Spain	ND	
<i>P. siccitolerans</i>		ND	
<i>P. sexuale</i>		ND	
<i>P. aurantioviolaceum</i>	Korea	Rhizosphere soil	Park et al. (2020)
<i>P. bissettii</i>			
<i>P. cairnsense</i>			Kirichuk et al. (2017).
<i>P. halotolerans</i>			
<i>P. kananaskense</i>			Kirichuk et al. (2017).
<i>P. ortum</i>			
<i>P. radiatolobatum</i>			Kirichuk et al. (2017).
<i>P. verhagenii</i>			
<i>P. anatolicum</i>	Turkey	ND	Kirichuk et al. (2017).
<i>P. argentinense</i>	Congo	Latosol soil	
<i>P. atrovenetum</i>	England	ND	Kirichuk et al. (2017).
<i>P. attenuatum</i>	Russia	Subaqueous soil	
<i>P. canescens</i>	England	ND	Kirichuk et al. (2017).
<i>P. cairnsense</i>	Australia	ND	
<i>P. christenseniae</i>	Costa Rica	Forest	Kirichuk et al. (2017).
<i>P. chrsaszczii</i>	Poland	Forest	
<i>P. daleae</i>	Poland	Soil under pine tree	Kirichuk et al. (2017).
<i>P. gorlenkoanum</i>	Syria	ND	
<i>P. hetheringtonii</i>	USA	ND	Kirichuk et al. (2017).
<i>P. janczewskii</i>	England	ND	
<i>P. melinii</i>	USA	Forest	Kirichuk et al. (2017).
<i>P. miczynskii</i>	Poland	Soil under conifer	
<i>P. murcianum</i>	Spain	Sandy soil	Kirichuk et al. (2017).
<i>P. neomiczynskii</i>	New Zealand	ND	
<i>P. nothofagi</i>	Chile	Soil under <i>Nothofagus</i>	Kirichuk et al. (2017).
<i>P. ochotense</i>	Russia	Subaqueous soil	
<i>P. pancosmium</i>	Tunisia	ND	

<i>P. piltunense</i>	Russia	Subaqueous soil
<i>P. raphiae</i>	Costa Rica	Primary forest
<i>P. sanguifluum</i>	Spain	Soil under pine tree
<i>P. sumatrense</i>	Syria	Soil under cornel
<i>P. tropicoides</i>	Thailand	Rainforest, soil
<i>P. tropicum</i>	India	Soil beneath <i>Coffea arabica</i>
<i>P. ubiquetum</i>	Costa Rica	A botanical garden
<i>P. waksmanii</i>	Poland	Forest
<i>P. wellingtonense</i>	New Zealand	ND
<i>P. westlingii</i>	Poland	Soil under conifer

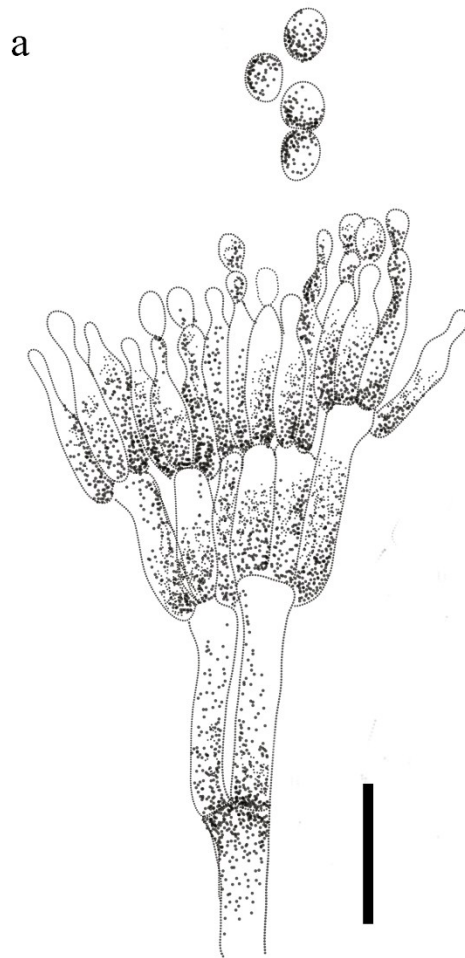


Figure 81 – *Penicillium expansum* (CBS 146.45). a Conidiophore and conidia. Scale bar: X200. Redrawn from Domsch et al. (1993).

***Thermoascaceae* Apinis**

***Paecilomyces* Bainier, Bull. Soc. mycol. Fr. 23(1): 26 (1907)**

Fig. 82

Index Fungorum number: IF 9196; Facesoffungi number: FoF16661

Bainier (1907a) introduced *Paecilomyces* while designating *P. variotii* as the type species. There are 16 species listed in the genus and all are supported with molecular data (Visagie et al. 2024a). The genus has hyphomycetous asexual morphs with verticillate conidiophores that have divergent whorls of phialides, with a cylindrical or inflated base tapering into a long and distinct neck. Conidia are hyaline, one-celled, smooth-walled, and produced in basipetal chains (He et al. 2011). *Paecilomyces* is ubiquitous and found in Australia, Brazil, China, France, Japan, South Africa and the Netherlands from the hosts including air, composts, food products, soil, and wood

(Visagie et al. 2024a). They can be pathogenic to plants, animals, insects, and humans or the saprobic mode can be found on plants and food (Dong et al. 2012, Li et al. 2020b, Monpierre et al. 2022, Urquhart & Idnurm 2023). Some species have industrial uses in agriculture and medical fields (Li et al. 2020b), while others are important as biological control agents (Dong et al. 2012).

Species	Country	Habitat or soil type	References
<i>Paecilomyces formosus</i>	Japan	ND	Visagie et al. (2024a)
<i>P. maximus</i>	Thailand	Pineapple field	
<i>Paecilomyces wawuensis</i>	China	ND	He et al. (2011)

Figure 82 – *Paecilomyces variotii*. a Conidiophore and conidia. Redrawn from Domsch et al. (1993).

Fig. 83

Miehe (1907) introduced *Thermoascus* with its type species *T. aurantiacus*. The genus comprises seven species (Species Fungorum 2025), all of which are supported with molecular data. The asexual morph is characterized by hyaline, clavate to somewhat spindle-shaped, aseptate or septate conidia that are terminal, on shorter or longer branches. The sexual morph has a superficial, cream, orange-yellow to brown, globose to irregular, relatively small, solitary or confluent ascocarp with peridium that has an outer layer of larger, hyaline to yellow-brown pseudoparenchymatous cells and an inner layer of smaller pseudoparenchymatous cells. Asci are formed in small clusters and are enclosed in an irregularly thick peridium, subglobose to oval, evanescent and 8-spored with ascospores that are hyaline or slightly yellow, non-septate and oval or elliptical (Apinis 1967, Miehe 1907). *Thermoascus* has been isolated from dead wood, mushroom-compost, sawdust, soil, stored grains and tobacco from Germany, Holland, India, Russia, the Netherlands and the USA (Salar & Aneja 2007).

Table 85 *Thermoascus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Thermoascus aurantiacus</i>	ND	ND	Salar & Aneja (2007)
<i>T. yaguchii</i>	China	ND	Yaguchi et al. (1995)

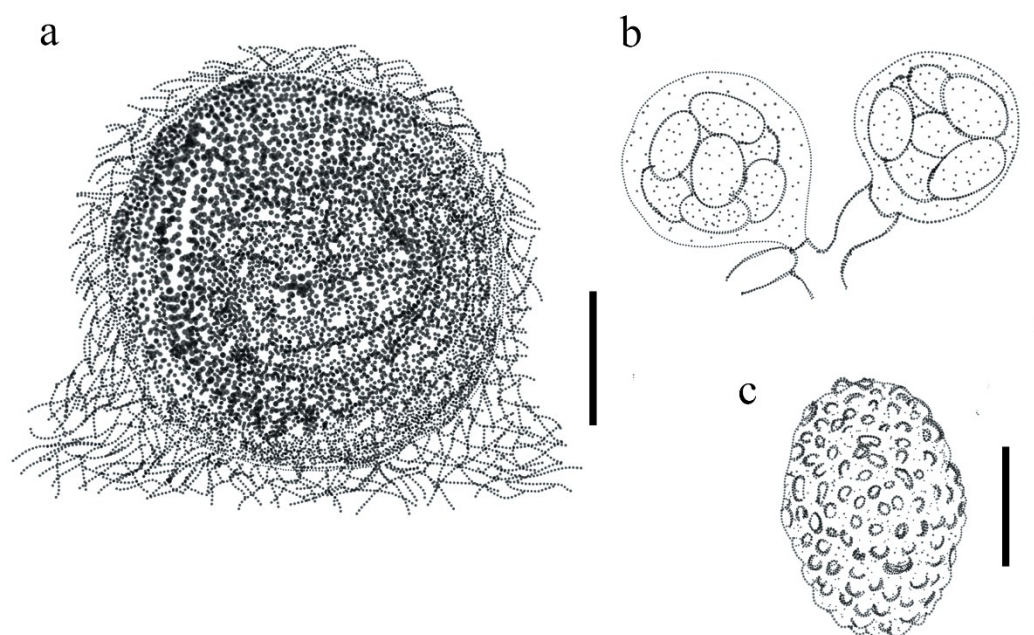
**Figure 83** – *Thermoascus* sp. a Ascoma. b Ascus. *T. aurantiacus* c Ascospore. Scale bars a = 100 μ m. b = 10 μ m. c = 2.5 μ m. Redrawn from Domsch et al. (1993).***Trichocomaceae*** E. Fisch.***Sagenomella*** W. Gams, Persoonia 10(1): 100 (1978)

Fig. 84

Index Fungorum number: IF 9773; Facesoffungi number: FoF16663

Gams (1978) introduced *Sagenomella* and placed *S. diversispora* as the type species. Currently, there are nine *Sagenomella* species included (Species Fungorum 2025), and all of them have been provided with molecular data. The asexual morph is characterized by the micronematous, erect conidiophores, terminal, simple phialides or rarely bearing several whorls of phialides. Phialides are aculeate, often centrally swollen, and in old cultures, they are often sympodially proliferating. Conidia are one-celled, hyaline, or with pigmented incrustations and ornamentations, with long or short chains, with connectives on both ends (Gams 1978). *Sagenomella* has been found in fodder, roots, and soil in Canada, Sweden, Spain, the Netherlands and the USA, while some species cause diseases in animals and humans (Gams 1978, Malewski et al. 2023).

Table 86 *Sagenomella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Sagenomella alba</i>	Sweden	Forest soil	Sigler et al. (2010)
<i>S. humicola</i>	Canada	ND	
<i>S. ocotl</i>	Mexico	Heat-treated soil	Gams (1978)
<i>S. griseoviridis</i>	Canada	ND	
<i>S. oligospora</i>	Sweden	Agricultural soil	
<i>S. verticillata</i>	Canada	ND	

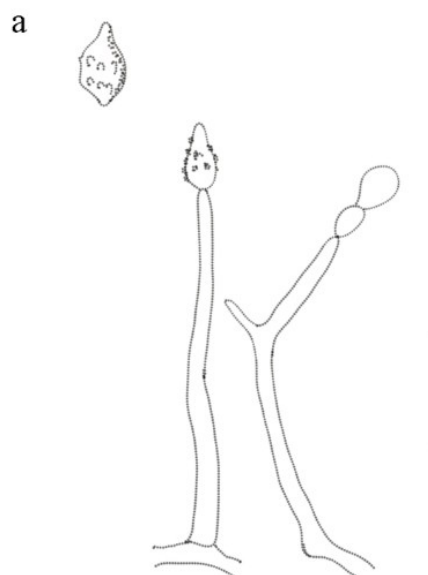


Figure 84 – *Sagenomella diversispora* (CBS 354.36). a Conidiophores with phialides and conidia. Scale bar: X3000. Redrawn from Domsch et al. (1993).

Talaromyces C.R. Benj., Mycologia 47(5): 681 (1955)

Index Fungorum number: IF 5347; Facesoffungi number: FoF16664

Benjamin (1955) introduced *Talaromyces* as the teleomorph of the *Penicillium* species and typified it with *T. vermiculatus*. Based on the phylogenetic analyses of Visagie et al. (2024b), 203 species are accepted in the genus. The asexual morph has smooth or rough-walled conidiophores, symmetrically bi-verticillate, with a minor proportion having subterminal branches, monoverticillate, or with solitary phialides. They are typically acerose, rarely flask-shaped, with conidiogenous cells that produce aseptate, green masses, in basipetal chains, usually ellipsoidal to fusiform, rarely globose to subglobose, or ovoidal conidia. The sexual morph is characterized by cleistothecial, usually with a distinctly hyphal exterior soft wall, often yellow, occasionally white, creamish, pinkish, orange, reddish or green ascomata. Asci are produced in chains, 8-spored or rarely two-spored, and ascospores are hyaline to yellow, occasionally red, one-celled, ellipsoidal to globose, often with spines and/or less common ridges and rarely smooth-walled (Benjamin 1955, Yilmaz et al. 2014). They are isolated from decaying wood, house dust, soil and weathering canvas (Yilmaz et al. 2014). Species are widely distributed including Australian, Asian, European and American regions. Some species are pathogenic to humans and cause mycosis in immunocompromised individuals, while several species produce mycotoxins in food products (Sigler et al. 1996, Richer et al. 1997, Yilmaz et al. 2014). Besides, *T. flavus* is used as a bio-control agent against soil-borne fungal pathogens, and some species are utilized in producing enzymes and soluble pigments (Gohel et al. 2006, Reyes et al. 1999).

Table 87 *Talaromyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Talaromyces gaditanus</i>	Denmark	ND	Visagie et al. (2024b)
<i>T. chongqingensis</i>	China	ND	
<i>T. pernambucoensis</i>	Brazil	ND	
<i>T. dimorphus</i>	China	ND	Jiang et al. (2018a)
<i>T. lentulus</i>		ND	
<i>T. mae</i>		ND	
<i>T. thailandensis</i>	Thailand	ND	Manoch et al. (2013)
<i>T. tratensis</i>		ND	

Species	Country	Habitat or soil type	References
<i>T. purpurogenus</i>	Korea	Soil in agricultural fields	Adhikari et al. (2015)
<i>T. trachyspermus</i>			

Onygenales Cif. ex Benny & Kimbr.

Ajellomycetaceae Unter., J.A. Scott & Sigler

Blastomyces Gilchrist & W.R. Stokes, J. Exp. Med. 3: 76 (1898) (= *Ajellomyces* McDonough & A.L Lewis; *Emmonsia* Cif. & Montemart.)

Index Fungorum number: IF7389; Facesoffungi number: FoF16665

Blastomyces was introduced by Gilchrist & Stokes (1898) with the type species, *B. dermatitidis*. The genus comprises nine species (Species Fungorum 2025), and six of them have molecular data. Jiang et al. (2018) revised the phylogenetic relationships of the family *Ajellomycetaceae* using the combined ITS, LSU *RPB2*, *TUB2* and *TEF3* phylogeny, while accommodating new species in the *Blastomyces*. The asexual morph of *Blastomyces* has conidiophores that arise at right angles from the vegetative hyphae, narrow and unbranched, and sometimes with secondary conidiophores, arising from a swollen tip. Conidia form at the tip or on the sides of conidiophores, or sessile on vegetative hyphae with rhexolytic dehiscence and they can be solitary aleurioconidia or irregular alternate arthroconidia. The sexual morph is characterized by spherical ascumata with coiled appendages and muricate spherical or oblate ascospores (Guarro et al. 2012, Jiang et al. 2018b, Kandemir et al. 2022). The sexual state of *B. dermatitidis* causes humans and canine blastomycosis and has also been recorded as pathogen in vertebrates. *Blastomyces* is mainly found in human clinical samples, including the brain, lungs and skin (Jiang et al. 2018b), while some of them have been isolated from the soil (Guarro et al. 2012). Species are distributed in Canada, Iraq, South Africa and the USA (Jiang et al. 2018b).

Table 88 *Blastomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Blastomyces dermatitidis</i>	USA	ND	Klein et al. (1986)
<i>B. parvus</i>	Canada	ND	Jiang et al. (2018b)
<i>B. silverae</i>	Canada	ND	

Emergomyces Dukik, Sigler & de Hoog, Mycoses 60: 304 (2017)

Index Fungorum number: IF818569; Facesoffungi number: FoF16666

Emergomyces was established by Dukik et al. (2017) and typified by *E. pasteurianus*. Kandemir et al. (2022) have accepted seven *Emergomyces* species and all of them are supported with molecular data. The combined ITS, LSU, *RPB2*, *TUB2* and *TEF3*, analyses of *Ajellomycetaceae* by Jiang et al. (2018b) have transferred four *Emmonsia* species to this genus. The asexual morph has short and unbranched conidiophores, slightly swollen at the top, arising at right angles from vegetative hyphae, and holothallic on short-stalked conidia. The sexual morph remains unknown (Jiang et al. 2018b). The genus has been recorded as human pathogens isolated from human blood samples, lungs and skin, and some species occur on air and soil (Jiang et al. 2018b). They have been found in Canada, China, Germany, Italy and South Africa (Jiang et al. 2020, Kandemir et al. 2022).

Table 89 *Emergomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Emergomyces soli</i>	USA	ND	Jiang et al. (2020)

Emmonsiiellopsis Y. Marín, Stchigel, Guarro & Cano, Mycoses 58(8): 455 (2015)

Fig. 85

Index Fungorum number: IF811334; Facesoffungi number: FoF16667

Emmonsiiellopsis was introduced by Marin-Felix et al. (2015) based on morpho-molecular (ITS and LSU) analyses, and is typified by *E. terrestris*. Currently, three *Emmonsiiellopsis* species are listed in the Species Fungorum (2025), and all the species have molecular data. The asexual morph is characterized by hyaline, globose to ovoid or clavate, smooth-walled and verrucose or spinulose, thick-walled, rarely 1-septate, sessile, blastic conidia borne laterally or terminally on the hyphae, or on pedicels, solitary or in chains of two conidia, rarely intercalary; and hyaline, short or long, smooth- and thin-walled pedicels inflated at the middle or at the apex. The sexual morph and yeast-like morph are not recorded within the genus. *Emmonsiiellopsis* is separable from other family members by the absence of thermal dimorphism (Marin-Felix et al. 2015). These species are found in Spain and USA and they are known for their geophilic nature that have been isolated from sediments and soil (Marin-Felix et al. 2015, Jiang et al. 2018b).

Table 90 *Emmonsiiellopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Emmonsiiellopsis coralliformis</i>	Spain	ND	Jiang et al. (2020)
<i>E. terrestris</i>	USA	ND	Marin-Felix et al. (2015)

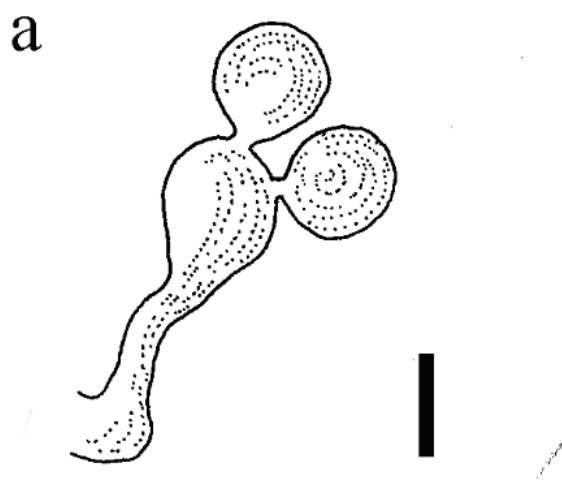


Figure 85 – *Emmonsiiellopsis terrestris* (CBS 273.77). a Conidia on inflated pedicels. Scale bar = 5 µm. Redrawn from Marin-Felix et al. (2015).

Arthrodermataceae Currah

Arthroderma Curr., Outl. Brit. Fung. (London): 357 (1860)

Fig. 86

Index Fungorum: IF335; Facesoffungi number: FoF16676

Arthroderma was introduced in Berkeley (1860) with the type species *A. curreyi*. It was later revised by Currah (1985), and currently, the genus comprises 45 taxa (Hyde et al. 2024c), among which 31 species have molecular data. The asexual morph is *Chrysosporium*-like and the sexual morphs have gymnothecia, typically with arched hyphal appendages, slightly curved at the apices. The genus has been discovered in Brazil, Canada, the Czech Republic, Germany, Japan, the Netherlands, the UK and the USA from various hosts including air, animal burrows, caves, fur, hair, clinical materials and soil. Some of the species are known as dermatophytes, causing human and animal superficial infections (Hainsworth et al. 2021).

Table 91 *Arthroderma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Arthroderma chinense</i>	China	Karst cave	Kandemir et al. (2022)
<i>A. curreyi</i>	UK	Dune soil	
<i>A. kuzurovia</i>	Russia	Black soil	
<i>A. ciferrii</i>	USA	ND	Moulíková et al. (2023)
<i>A. crocatum</i>	Japan and the Netherland	ND	
<i>A. cuniculi</i>	UK	Soil from rabbit burrows	
<i>A. gertleri</i>	Germany	ND	
<i>A. gloriae</i>	USA	ND	
<i>A. insingulare</i>	Canada	Farm soil	
<i>A. lenticulare</i>	USA	Soil from gopher hole	
<i>A. multifidum</i>	UK	Soil from rabbit burrow	
<i>A. simile</i>	USA	Soil from bat hibernaculum	
<i>A. terrestre</i>	Australia	ND	
<i>A. tuberculatum</i>	India	ND	
<i>A. uncinatum</i>	USA	ND	

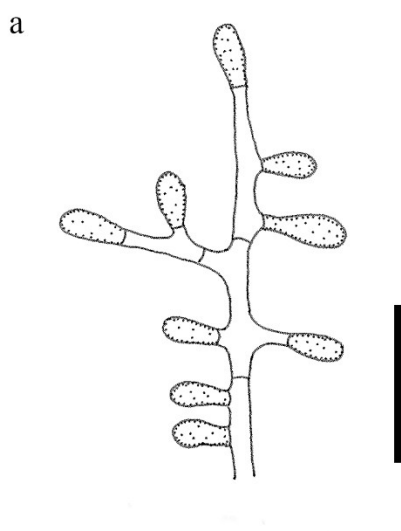
**Figure 86** – *Arthroderma curreyi*. a Conidia on inflated pedicels. Scale bar = 5 µm. Redrawn from Guarro et al. (2012).***Ctenomyces*** Eidam, Beitr. Biol. Pfl. 3: 274 (1880)

Fig. 87

Index Fungorum: IF1342; Facesoffungi number: FoF16677

Eidam (1880) introduced *Ctenomyces*, designating *C. serratus* as the type species. Based on the ITS phylogeny for *Arthrodermataceae*, Kandemir et al. (2022) revised the genus and currently, 11 species are included in the genus (Hyde et al. 2024c), while eight of them have molecular data. The asexual morph has verrucose, thick-walled, and lightly pigmented conidia, typically with ampulliform swelling that are borne terminally and laterally on hyphae (Zhang et al. 2019b). The sexual morph has orange-brown cleistothecia, a peridium formed from a thin layer of densely interwoven hyphae and ctenoid appendages consisting of thick-walled, asperulate cells. This ascomal appendage is considered to be helpful for the attachment to animal surfaces (Currah 1985). Most of the species are keratinophilic, however, the pathogenic state is not reported. *Ctenomyces* are associated with bird feathers, hair, human specimens and soil in China, Germany, and India. Some of the species have been isolated by the baiting techniques using chicken feathers and human hair (Currah 1985, Zhang et al. 2019b).

Table 92 *Ctenomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Ctenomyces serratus</i>	Australia	Soils associated with birds	Frey & Griffin (1961)
<i>C. vellereus</i>	Egypt	ND	Kandemir et al. (2022)
<i>C. albus</i>	China	ND	Zhang et al. (2019b)
<i>C. obovatus</i>	China	ND	
<i>C. peltricolor</i>	China	ND	

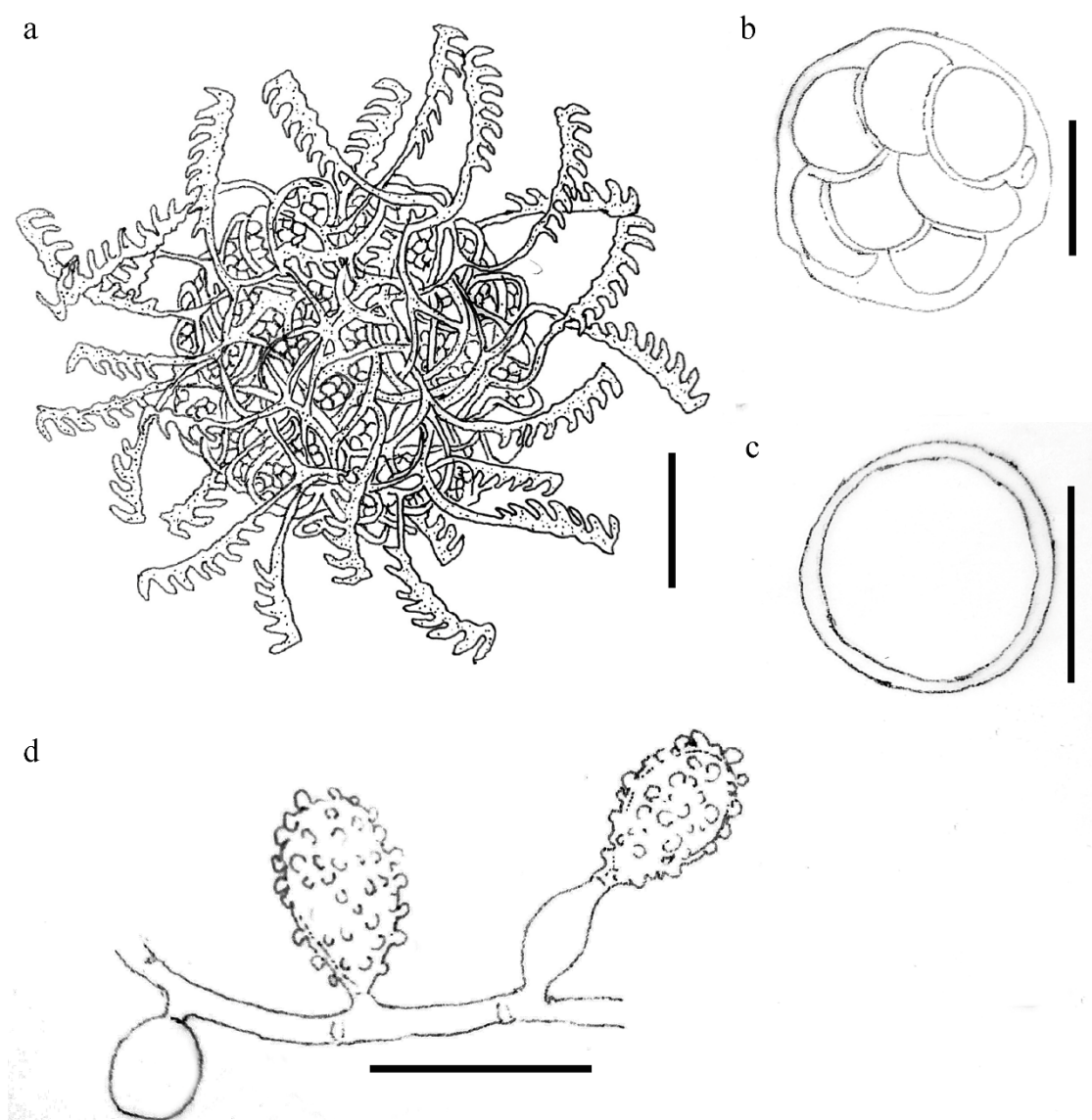


Figure 87 – *Ctenomyces serratus*. a. Ascoma. b. Ascus. c. Ascospore. d. Conidiogenesis. Scale bars a = 100 µm, d = 10 µm, b, c = 5 µm. Redrawn from Guarro et al. (2012).

Microsporium Gruby, C. r. hebd. Séanc. Acad. Sci., Paris 17: 302 (1843)

Index Fungorum number: IF8939; Facesoffungi number: FoF17774

Microsporium is introduced by Gruby (1843) with the type species *M. audouinii*. It accommodates 19 species (Species Fungorum 2025), and three have been provided with molecular data. Kandemir et al. (2022) have provided ITS-based phylogeny for *Arthrodermataceae* while transferring *Microsporium guizhouense* to *Nannizzia*. These species have been isolated from the

skin and scalp of humans and monkeys, while several species have been reported from dung, freshwater habitats, feathers, nests and soil (de Hoog et al. 2017, Kandemir et al. 2022). *Microsporum canis* has been reported to cause skin infections in cats (Newbury et al. 2015). Geographically, they can be found in Czechoslovakia, the Czech Republic, France and India (Newbury et al. 2015, Kandemir et al. 2022).

Table 93 *Microsporum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Microsporum gypseum</i>	ND	ND	Gordon (1953)
<i>M. canis</i>	Iran	Area with a semi-desert	Rezaei-Matehkolaei et al.
<i>M. gypseum</i>	Iran	climate	(2017)

Nannizzia Stockdale, Sabouraudia 1: 45 (1961)
Index Fungorum number: IF3420; Facesoffungi number: FoF16678

Fig. 88

The genus *Nannizzia* was erected by Stockdale & Phyllis (1961) and typified with *N. incurvata*. The ITS phylogeny of *Arthrodermataceae* provided by Kandemir et al. (2022) includes 14 *Nannizzia* species. Currently, there are 16 species listed in the Species Fungorum (2025), all of which are supported with molecular data. The asexual morph has multi-septate, thin- to relatively thick-walled, ornamented macroconidia. The sexual morph produces gymnothecia formed by spirally twisted, peridial hyphae, composed of ossiform cells with spherical, evanescent asci, and one-celled, lenticular ascospores. *Nannizzia* is keratinophilic, which can occur on human hair, nails, skin, soil and warm-blooded animals in China, Denmark, India, Somalia and Venezuela (Kandemir et al. 2022).

Table 94 *Nannizzia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Nannizzia sinensis</i>	China	Soil from a hospital	Zhang et al. (2023d)
<i>N. corniculata</i>	Somalia	ND	Dukik et al. (2020)
<i>N. graeserae</i>	India	ND	

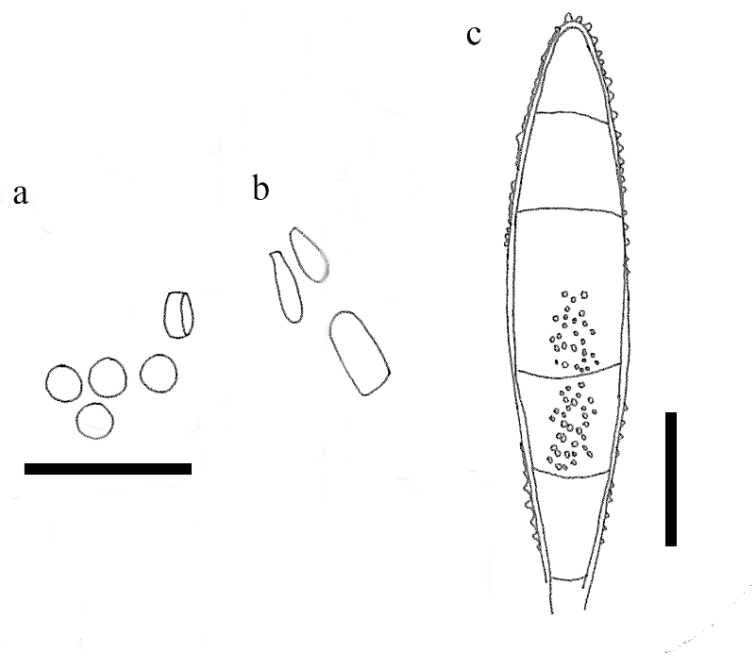


Figure 88 – *Nannizzia incurvata* (CBS 173.64). a. Ascospores. b. Micro-conidia. c. Macroconidium. Scale bar X1000. Redrawn from Domsch et al. (1980).

Trichophyton Malmsten, Arch. Anat. Physiol. Wiss. Med., 1848: 14 (1848)

Index Fungorum number: IF 10292; Facesoffungi number: FoF16679

Malmsten (1848) introduced *Trichophyton* with its type species, *T. tonsurans*. There are 143 species currently present in *Trichophyton* (Hyde et al. 2024c). It is a keratinophilic genus that has been isolated from human clinical samples and soil habitats (Durie & Frey 1957) in Australia, Brazil, Canada, Denmark, France, Iran, Japan, Sudan and Venezuela (Čmoková et al. 2021). Species cause superficial and systemic infections in humans and animals as well (Pchelin et al. 2016, Kumar et al. 2023).

Table 95 *Trichophyton* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Trichophyton indicum</i>	India	ND	Randhawa & Sandhu
<i>T. phaseoliforme</i>	Venezuela	ND	(1963)

Gymnoascaceae Baran.

Arachniotus J. Schröt., Krypt.-Fl. Schlesien (Breslau) 3.2: 210 (1893)

Fig. 89

Index Fungorum number: IF291; Facesoffungi number: FoF16668

Arachniotus was erected by Schroeter (1893), accommodating *A. ruber* as the type species. The genus comprises 15 species (Hyde et al. 2024c). Kandemir et al. (2022) analysed the phylogenetic relationships of *Onygenales* based on the LSU phylogeny while placing four species in the genus. The asexual morph of the genus is characterized by arthroaleuriospores (Orr et al. 1977). Kuehn & Orr (1959) described that this genus produces croziers and lacks conidia on phialides. The sexual morph possesses snow-white or yellowish gymnothecia; peridial elements are thin-walled, more or less uniform in diameter, similar to the vegetative hyphae, completely encasing the asci in a fragile membrane. Asci are ovoid to spherical, hyaline, evanescent, 8-spored, and ascospores are hyaline, ovoid to ellipsoid and smooth-walled (Orr et al. 1977). The genus is characterized by halotolerant members that are highly adapted to high salt contents. Thus, they have been isolated from cheese, marine water-sediment, saline soils, alkaline soils, dog and sheep dung recorded from the Soviet Union, the UK and the USA. Further, studies showed that some *Arachniotus* species are unable to grow at 37°C (Kandemir et al. 2022).

Table 96 *Arachniotus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Arachniotus ruber</i>	UK	Alkaline or neutral soils	Orr et al. (1977)
<i>A. aurantiacus</i>	Soviet Union	ND	Kandemir et al. (2022)
<i>A. confuens</i>	Kuwait	Halomorphic soil	

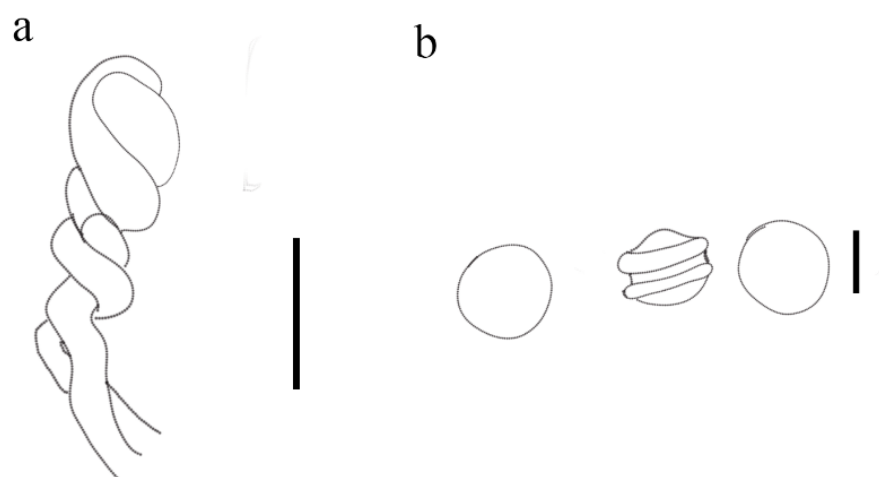


Figure 89 – *Arachniotus ruber* (CBS 12.69). a. Ascogonial coil. b. Ascospores. Scale bar 2000X. Redrawn from Domsch et al. (1993).

Gymnascella Peck, Ann. Rep. N.Y. St. Mus. nat. Hist. 35: 143 (1884)

Fig. 90

Index Fungorum number: IF 2164; Facesoffungi number: FoF16670

Peck (1884) accommodated *Gymnascella* with *G. aurantiaca* as the type species. Kandemir et al. (2022) have accepted 11 *Gymnascella* species based on the LSU phylogeny in *Gymnoascaceae*. All the species in the genus have molecular data. The asexual spores in *Gymnascella* are characterized by the arthroaleuriospore type that is produced on hyphae (Orr et al. 1977). As described by Currah (1985) and Orr & Kuehn (1971), the sexual morph of *Gymnascella* has discrete ascocarps; coarsely verrucose, loose peridial elements around the asci with subspherical to ovoid, evanescent, 8-spored asci; and smooth, thick-walled, ovoid to oblate ascospores. Most of the species are associated with dung, compost and soil in China, France, India, Japan, the UK and the USA (Kandemir et al. 2022).

Table 97 *Gymnascella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Gymnascella afilamentosa</i>	USA	Clay soil,	Currah (1985)
<i>G. dankaliensis</i>	India and USA	ND	
<i>G. devroeyi</i>	Belgium	ND	
<i>Gymnascella citrina</i>	USA	ND	Orr et al. (1977)
<i>G. thermotolerans</i>	China	Corn field soil	Kandemir et al. (2024)
<i>G. udagawae</i>	Japan	ND	Currah (1988)
<i>G. aurantiaca</i>	USA	Clay soil	Orr & Kuehn (1972)

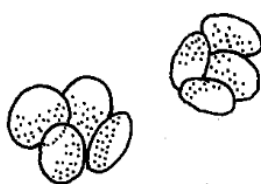


Figure 90 – *Gymnascella aurantiaca* ascospores. Redrawn from Orr et al. (1977).

Gymnoascoideus G.F. Orr, K. Roy & G.R. Ghosh, Mycotaxon 5(2): 460 (1977)

Index Fungorum number: IF 2166; Facesoffungi number: FoF16671

Gymnoascoideus was introduced by Orr et al. (1977) with *G. petalosporus* as the type species. Based on the LSU phylogeny treated to *Onygenales* by Kandemir et al. (2022), there are two species included in the genus. Both species have molecular data. *Gymnoascoideus* is distinct by its discrete gymnothecia that has typical elements with branching at right angles, blunt at the apices and covered by asexual spores in and around the ascal clusters. Ascospores are arranged in a petaloid pattern in the asci (von Arx 1971, Orr et al. 1977, Kandemir et al. 2022). These species prefer keratin substrates and are associated with feathers, horns, horse skin, human clinical samples and soil. Species have been isolated from Bolivia and India (Orr et al. 1977, Kandemir et al. 2022).

Table 98 *Gymnoascoideus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Gymnoascoideus petalosporus</i>	India	ND	Sur & Ghosh (1980)
<i>G. boliviensis</i>	Bolivia	Chicken yard	Kandemir et al. (2022)
<i>G. verrucosus</i>	India	Railway station,	Sharma & Singh (2013)

Gymnoascus Baran., Bot. Ztg. 30: 158 (1872)

Fig. 91

Index Fungorum number: IF 2168; Facesoffungi number: FoF16669

Baranetzky (1872) introduced *Gymnoascus*, accommodating *G. reesii* as the type species. Phylogenetic revision on *Onygenales* based on the LSU gene region by Kandemir et al. (2022) has placed 11 species in the genus, while some of the *Gymnoascus* species were synonymized to *Arachniotus*, *Gymnascella*, *Gymnoascoideus* and *Narasimhella*. There are 11 species with molecular data, and four species do not have molecular data. The asexual morph of *Gymnoascus* produces chrysosporium-like conidia. The sexual morph possesses spherical, yellowish to brownish ascomata, and peridium formed from a loose network of hyaline or pigmented hyphae, with or without appendages, and oblate and pigmented ascospores (von Arx 1971, Solé et al. 2002, Sharma & Singh 2013, Zhou et al. 2016). Species have been found in Guinea pigs and conch shells collected from India and Canada (Kandemir et al. 2022), while some have been isolated from soil habitats in Australia, Bangladesh, Germany, Italy, Japan, Pakistan, and the USA (Kandemir et al. 2022).

Table 99 *Gymnoascus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Gymnoascus flavus</i>	China	Karst cave	Zhang et al. (2021c)
<i>G. longitrichus</i>	USA	Composite soil	Kandemir et al. (2022)
<i>G. intermedius</i>	USA	ND	
<i>G. dugwayensis</i>	USA	Sandy soil	
<i>G. longitrichus</i>	Iran	Soil dune	Kandemir et al. (2024)

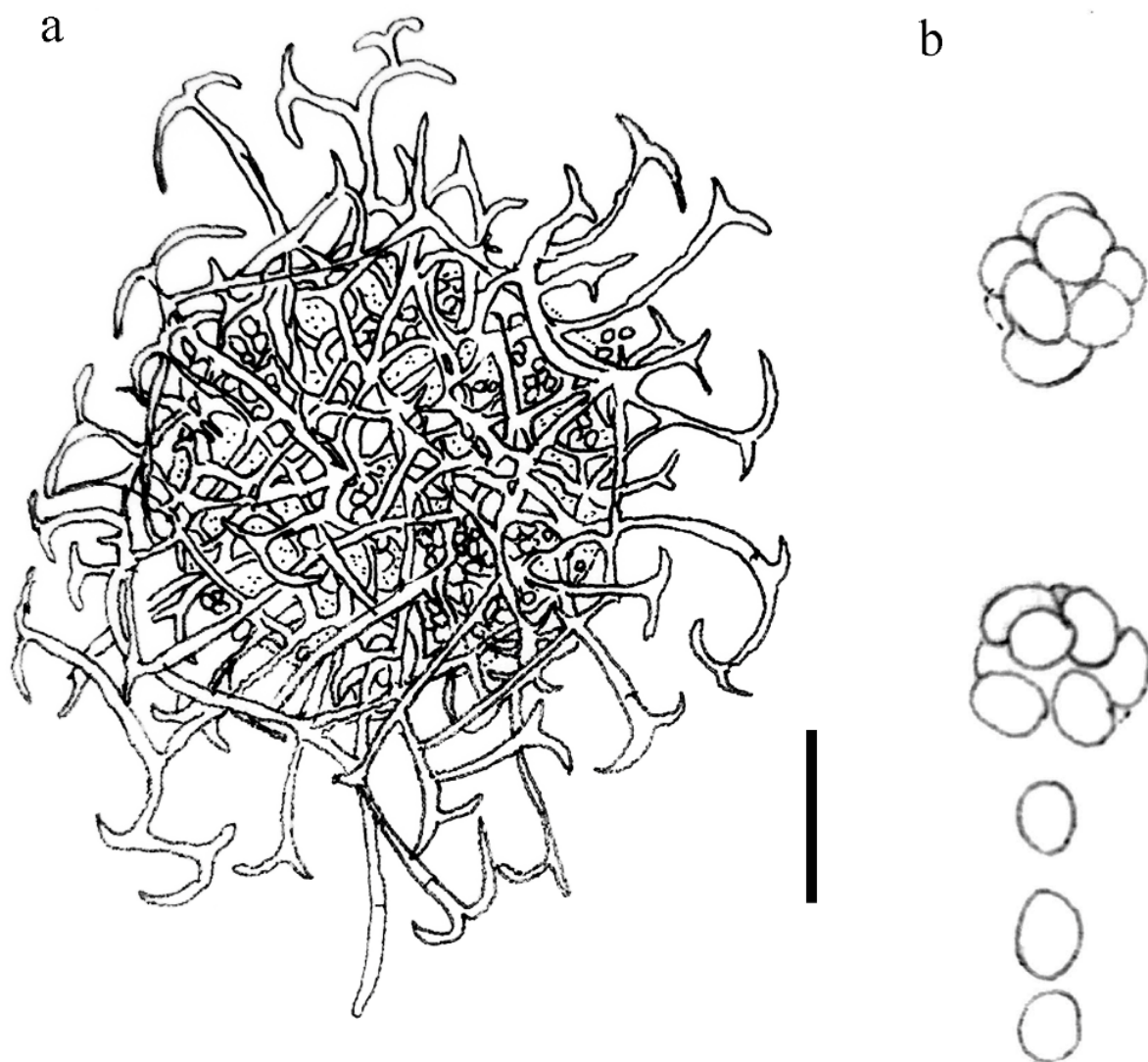


Figure 91 – *Gymnoascus* sp. a Ascomata. *G. reesii* (CBS 497.64) b Asci and ascospores. Scale bar: a = 100. Redrawn from Domsch et al. (1980).

Kraurogymnocarpa Udagawa & Uchiy., Mycoscience 40(3): 277 (1999)

Fig. 92

Index Fungorum number: IF28359; Facesoffungi number: FoF16672

Udagawa & Uchiyama (1999) introduced *Kraurogymnocarpa* by designating *K. lenticulospora* as the type species. Currently, only *K. trochleospora* has been accepted in this genus by Kandemir et al. (2022). This genus has been reported from sandy-clay and clay soils, which have higher water-holding capacities than most other soil types (Orr & Kuehn 1972).

Table 100 *Kraurogymnocarpa* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Kraurogymnocarpa trochleospora</i>	USA	ND	Udagawa & Uchiyama (2001)

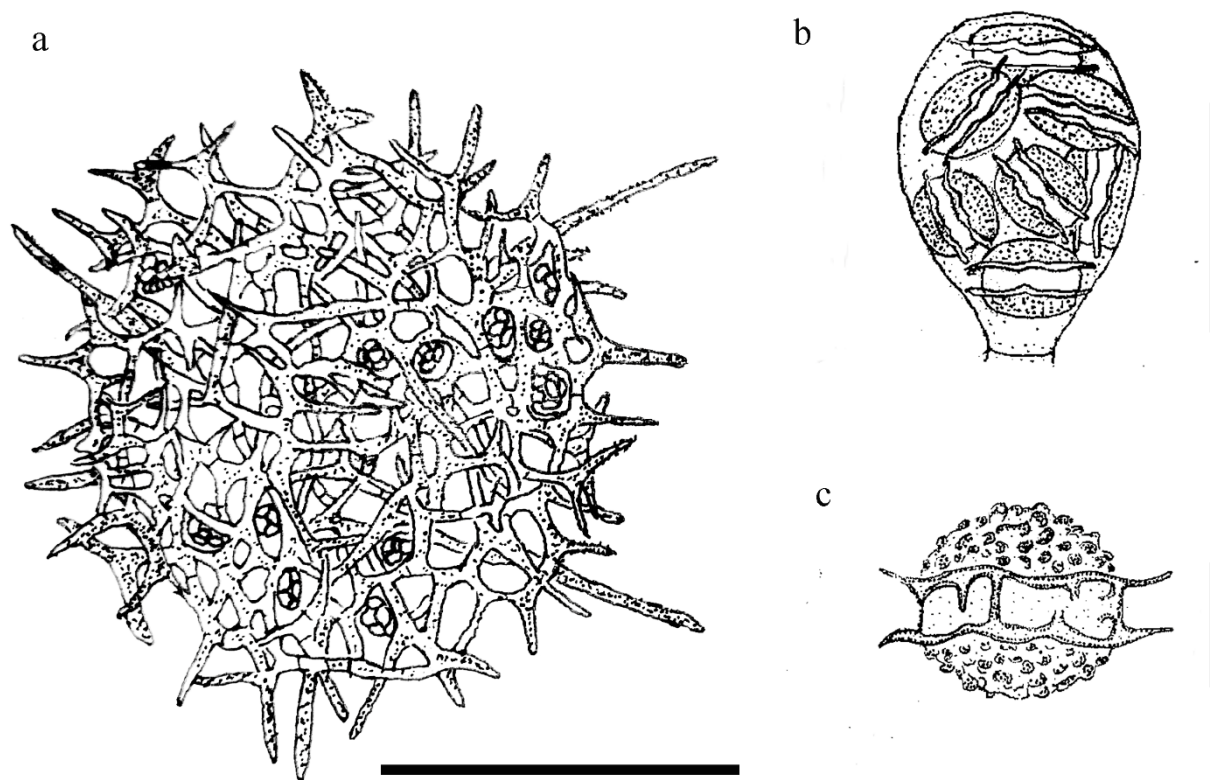


Figure 92 – *Kraurogymnocarpa lenticulospora* a. Ascomata. b. Ascus. c. Ascospores. Scale bar: a = 100 µm, b = 10 µm, c = 2.5 µm. Redrawn from Guarro et al. (2012).

Narasimhella Thirum. & P.N. Mathur, Sydowia 19(1–6): 184 (1966)

Index Fungorum number: IF3425; Facesoffungi number: FoF16674

Narasimhella was introduced by Thirumalachar & Mathur (1966), accommodating *N. poonensis* as the type species. Kandemir et al. (2022) have accepted five species in this genus, and all of them have molecular data (LSU and ITS). The sexual morph of the genus has well-developed, stipitate fruiting bodies, with a sterile stipe, composed of upwards-growing hyphae and irregularly globular, fertile head-bearing groups of asci (Thirumalachar & Mathur 1966). It lacks a peridium and shows a crozier formation, similar to the *Pseudoarachniotus* species. von Arx (1971) reported that *Narasimhella* colonies produce synnema- or sporodochium-like structures with yellow, cinnamon, or greenish colours. Unlike the other *Gymnoascaceae* members, this genus has been obtained from buried substrates, such as cables and fabrics in dung-enriched soil and rhizosphere soil in India and the USA. Thus, they have the potential to grow on hard-buried substrates in nutrient-rich soils (Kandemir et al. 2022).

Table 101 *Narasimhella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Narasimhella poonensis</i>	India	ND	Kandemir et al. (2022)
<i>N. echinulata</i>	India	Rice-feld	
<i>N. punctata</i>	India	Rice-feld	

Pseudoarachniotus Kuehn, Mycologia 49(5): 694 (1957)

Index Fungorum number: IF4411; Facesoffungi number: FoF16673

Pseudoarachniotus was introduced by Kuehn (1957). Based on the LSU and ITS phylogeny of *Onygenales* by Kandemir et al. (2022), it was suggested that previously classified *Pseudoarachniotus* species, including the type species (*P. roseus*), were not related to this genus. As a result, they have been transferred to *Gymnascella*, and only *Pseudoarachniotus reticulata* was

accepted within *Pseudoarachniotus*, which is phylogenetically close to *Mallochia reticulata* (Kandemir et al. 2022). As suggested by Kandemir et al. (2022), further molecular analyses are required to resolve the remaining taxonomic ambiguities in *Pseudoarachniotus*. The asexual morph is unreported, and the sexual morph of *P. reticulata* is characterized by absent ascocarps, red-capped hyphae among the tufts of asci, and globose to reticulate ascospores (von Arx 1971, Kandemir et al. 2022). Studies recorded this species as non-oligotrophic and prefer higher nutritious soils (von Arx 1971, Orr et al. 1971, Kandemir et al. 2022).

Table 102 *Pseudoarachniotus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudoarachniotus reticulatus</i>	USA	Rhizosphere soil of <i>Musa sapientum</i>	von Arx (1971), Kandemir et al. (2022)

Sporendonema Desm., Annls Sci. Nat., sér. 1 11: 246 (1827)

Index Fungorum number: IF 10021; Facesoffungi number: FoF16675

Desmazières (1827) introduced *Sporendonema*, accommodating *S. casei* as the type species. The genus was previously subjected to controversies regarding its taxonomic position and nomenclature. However, Kandemir et al. (2022) suggested its placement in the *Gymnoascaceae* based on the phylogeny. Subsequently, Kandemir et al. (2024) revised the genus using ITS and LSU gene regions while accepting six species in the genus. Species have been found in cheese, soil and dung in China, France, Kuwait and Russia (Kandemir et al. 2024).

Table 103 *Sporendonema* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Sporendonema aurantiacum</i>	Russia	Semi-desert (slightly loam) soil	Kandemir et al. (2024)
<i>S. rubrum</i>	The Netherlands	Agricultural soil	Kuehn & Orr (1964)
<i>S. rubrum</i>	UK	Alluvial pasture soil	
<i>S. confluens</i>	Kuwait	ND	
<i>Sporendonema rubrum</i>	UK	ND	

Malbrancheaceae Kandemir & de Hoog

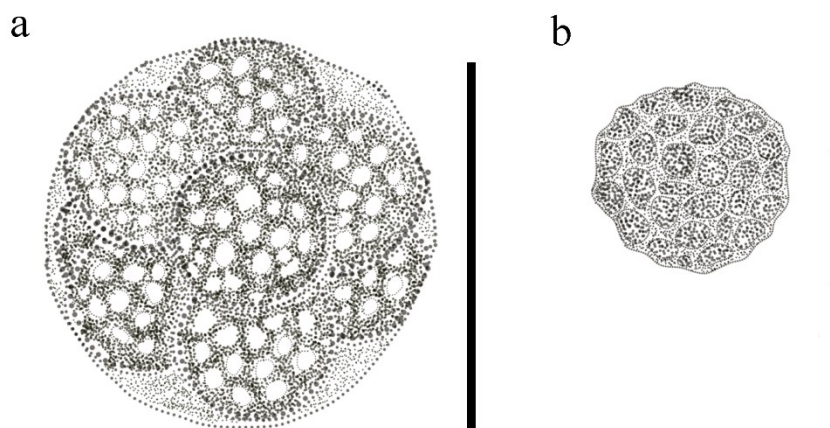
Malbranchea Sacc., Michelia 2(no. 8): 639 (1882)

Fig. 93

Saccardo (1882) introduced *Malbranchea* with its type species *M. pulchella*. Rodríguez-Andrade et al. (2021a) revised the genus using combined ITS and LSU phylogeny, and synonymized *Auxarthron* with *Malbranchea*. Later, based on ITS, LSU, *TUB2*, *TEF1-α*, *TEF3*, *RPB1*, *RPB2* gene regions and ribosomal protein 60S L10 (L1) (RP60S) sequences phylogeny, Kandemir et al. (2022) established *Malbrancheaceae* to accommodate *Malbranchea*. It currently comprises 37 species, and 28 are supported with molecular data. The asexual morph is characterized by the alternate, hyaline arthroconidia produced in the curved branches from the vegetative hyphae. The sexual morph is originally described under *Auxarthron* (Hyde et al. 2024c, Kandemir et al. 2022) which has globose to less globose ascomata of yellow, orange or brown with thick-walled peridial hyphae, inverted Y-shaped arches produced from peripheral peridium that arise as short or elongate appendages, hyaline, subglobose, globose, or obovate, 8-spored, evanescent asci, and globose or ovoidal and asperulate to echinulate-reticulate ascospores (Orr et al. 1963). Some species can degrade keratin substrates and are found in eutrophic environments associated with animal dung and cave soil in Austria, China, France, India, Spain, the UK and the USA (Orr et al. 1963, Sarrocco et al. 2015, Zhang et al. 2021).

Table 104 *Malbranchea* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Malbranchea albolutea</i>	USA	ND	Sigler & Carmichael (1976)
<i>M. arcuata</i>		ND	
<i>M. chrysosporioidea</i>		ND	
<i>M. flavorosea</i>		ND	
<i>M. flocciformis</i>	France	Briny soil	

**Figure 93** – *Malbranchea* sp. a Ascus. *M. californiense* b Ascospore. Scale bars: a = 10 µm, b = 2.5 µm. Redrawn from Guarro et al. (2012).***Neogymnomycetaceae*** Kandemir & de Hoog***Auxarthronopsis*** Rah. Sharma, Y. Gräser & S.K. Singh, IMA Fungus 4(1): 93 (2013)

Index Fungorum number: IF563744; Facesoffungi number: FoF16690

Sharma et al. (2013) established *Auxarthronopsis* with its type species *A. bandhavgarhensis*. Previously, it was placed in *Onygenaceae* (Sharma et al. 2013), and later, based on the ITS phylogeny, Kandemir et al. (2022) transferred the genus to *Neogymnomycetaceae* with six accepted species. All the species have molecular data (ITS, LSU and *TUB2*). The asexual morph has terminal and intercalary, hyaline arthroconidia and aleurioconidia. The sexual morph is characterized by solitary, globose to subglobose, white to pale cream ascomata, peridium made of a mesh of interwoven hyphae with swollen septa, and straight, sometimes branched appendages tapering at the apex, with multiple (≥ 10) swollen septa. The asci are globose to subglobose, hyaline, evanescent and 8-spored, and unicellular, hyaline, oblate ascospores with finely and regularly punctate walls (Sharma et al. 2013). Most of the species have saprobic life modes, and are distributed in animal dung, rocks, plant debris and soil in China and Thailand (Sharma et al. 2013, Labuda et al. 2021, Zhang et al. 2021c).

Table 105 *Auxarthronopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Auxarthronopsis bandhavgarhensis</i>	India	ND	Sharma et al. (2013)
<i>A. globiasca</i>	China	Luotian Cave	Zhang et al. (2021c)

Canomyces Rahul Sharma & Shouche, Mycopathologia 185(1): 76 (2020)

Index Fungorum number: IF829249; Facesoffungi number: FoF13278

Fig. 94

Canomyces was introduced by Sharma & Shouche (2020) and typified by *C. reticulatus*. Kandemir et al. (2022) performed molecular analyses for *Onygenales*, describing this as a monotypic genus and transferring it from *Onygenaceae* to *Neogymnomycetaceae*. The species have ITS and LSU molecular data. The asexual morph has narrow, elongated arthroconidia produced from hyphae. The sexual morph is characterized by solitary, globose, cream-coloured ascomata, the peridium formed with loosely arranged hyphae, pale brown, globose, evanescent, 8-spored asci, and unicellular, pale cream to yellowish, regularly punctate-reticulate ascospores (Sharma & Shouche 2020, Kandemir et al. 2022).

Table 106 *Canomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Canomyces reticulatus</i>	India	ND	Sharma & Shouche (2020).

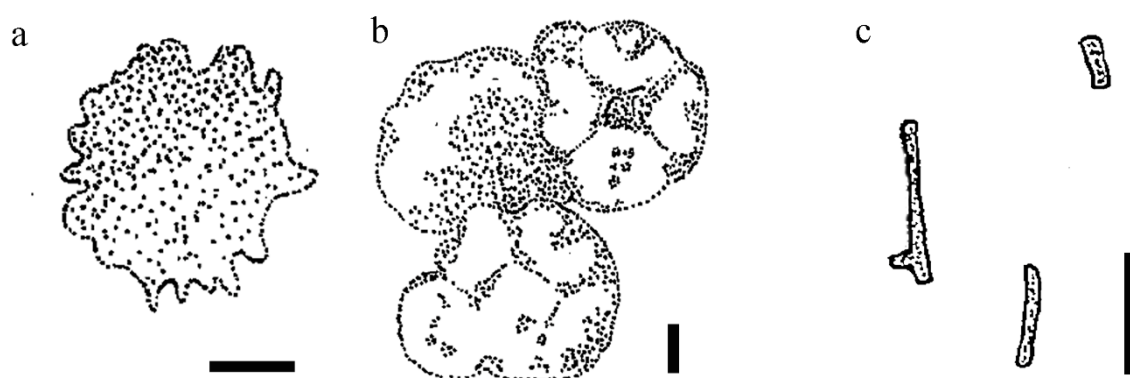


Figure 94 – *Canomyces reticulatus* (MCC 1486). a Ascomata. b Asci with ascospores. c Narrow, elongated arthroconidia. Scale bars: a =100 µm, b = 2 µm, c = 10 µm. Redrawn from Sharma & Shouche (2020).

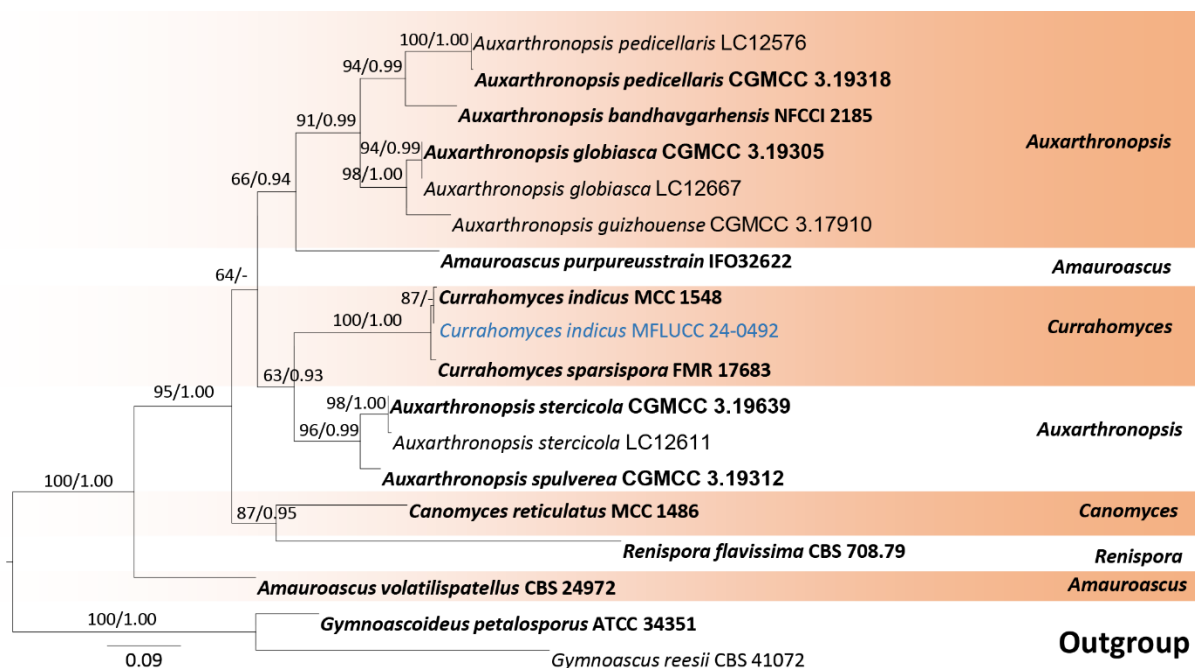


Figure 95 – The best-scoring maximum likelihood tree of the combined ITS sequence data for *Neogymnomycetaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Gymnoascoideus petalosporus* ATCC 34351 and *Gymnoascus reesii* CBS 41072. The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of ITS alignment is 683 bp. The matrix had 354 distinct alignment patterns with 13.99% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.250, C = 0.250, G = 0.250, T = 0.250; substitution rates AC = 1.00000, AG = 2.64528, AT = 2.05543, CG = 2.05543, CT = 5.62234, GT = 1.00000; gamma distribution shape parameter α = 1.131.

Currahomyces Rahul Sharma & Shouche [as '*Currahmyces*'], Mycopathologia 185(1): 73 (2019)

Index Fungorum number: IF829247; Facesoffungi number: FoF16689

Currahomyces was introduced by Sharma & Shouche (2020) based on the ITS and LSU sequences and morphological evidence, the type species is *C. indicus*. The phylogenetic revision using the ITS region conducted by Kandemir et al. (2022) has placed *Currahmyces* in *Neogymnomycetaceae* with two species (Kandemir et al. 2022). Currently, two species are listed in this genus (Species Fungorum 2025), and both have molecular data. The asexual morph has terminal and intercalary slender arthroconidia (Sharma & Shouche 2020). The sexual morph is characterized by the solitary, globose to subglobose, white on the outer periphery and brown in the centre ascomata with a peridium wall having loosely arranged thin- to thick-walled asperulate, septate hyphae that are densely asperulate, towards the margin covered with spine-like crystal structures. Asci are globose, brown, evanescent, 8-spored, that contain ascospores characterized by unicellular, pale brown globose, with broadly punctate-reticulate walls (Sharma & Shouche 2020).

Table 107 *Currahomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>C. indicus</i>	India	ND	Sharma & Shouche (2020).

Currahomyces indicus Rahul Sharma & Shouche [as '*Currahmyces*'], Mycopathologia 185(1): 76 (2019) [2020] Fig. 96

Index Fungorum number: IF 835304; Facesoffungi number: FoF 16722

Sexual morph: Undetermined. Asexual Morph: *Arthroconidia* 3–8 × 1–2 μm ($\bar{x}$ = 5 × 1.5 μm , n = 25), terminal and intercalary.

Culture characteristics – *Colonies* on PDA become 2–3 cm diam. after 7 days at 25 °C, white, undulate-margined, flat, reverse yellow to yellowish orange. *Hyphae* 0.6–1.5 μm ($\bar{x}$ = 1 μm), superficial to semi-immersed, hyaline, thick-walled, verrucose and aseptate.

Material examined – Thailand, Chiang Mai, Chai Prakan District, What Tham Tap Tao, cave, on soil, 99.117570N, 19.662672E, 598m, 9 May 2022, W.A. Erandi Yasanthika (MFLU 25-0172), living culture 71-cv-21-21=MFLUCC 24-0492.

GenBank numbers – MFLUCC 24-0492.: ITS: PQ570522

Notes – Multigene phylogeny in Figure 95 indicates that our strain (MFLUCC 24-0492) clusters with the type species of *Currahomyces indicus* with 100% statistical support. Morphologically, our isolate has similar characteristics to *C. indicus* by having terminal and intercalary arthroconidia (Sharma & Shouche 2020). Based on multigene phylogeny and morphology, we confirm our strain as *C. indicus*. *Currahomyces indicus* was introduced by Sharma & Shouche (2020) from soil in India. We report the first record of *C. indicus* from soil in Thailand, which was isolated from a disturbed cave environment.



Figure 96 – *Currahomyces indicus* (MFLU 25-0172). a, b Culture characters on PDA (b = reverse). c Sporulation. d, e Hyphae. f–i Terminal and intercalary arthroconidia. Scale bars: d–i = 10 µm.

Renispora Sigler & J.W. Carmich., Mycotaxon 10 (1): 133 (1979)

Fig. 97

Index Fungorum number: IF 4675; Facesoffungi number: FoF16691

Sigler et al. (1979) introduced *Renispora* by accommodating *R. flavissima* as the type species. Previously, the genus was placed in *Onygenaceae*; however, it has been placed in *Neogymnomycetaceae* by Kandemir et al. (2022) as a monotypic genus. The asexual morph is characterized by one-celled, solitary, terminal or lateral conidia arising from hyphal structures. The sexual morph has heterothallic, gymnothecial ascomata that appear in yellow and peridial hyphae are poorly differentiated from vegetative hyphae. There are unitunicate, 8-spored, clavate asci with one-celled, reinform bacillus ascospores (Guarro et al. 2012). Species have been isolated from dung and soil in the USA (Sigler et al. 1979).

Table 108 *Renispora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Renispora flavissima</i>	USA	Barn housing	Sigler et al. (1979)

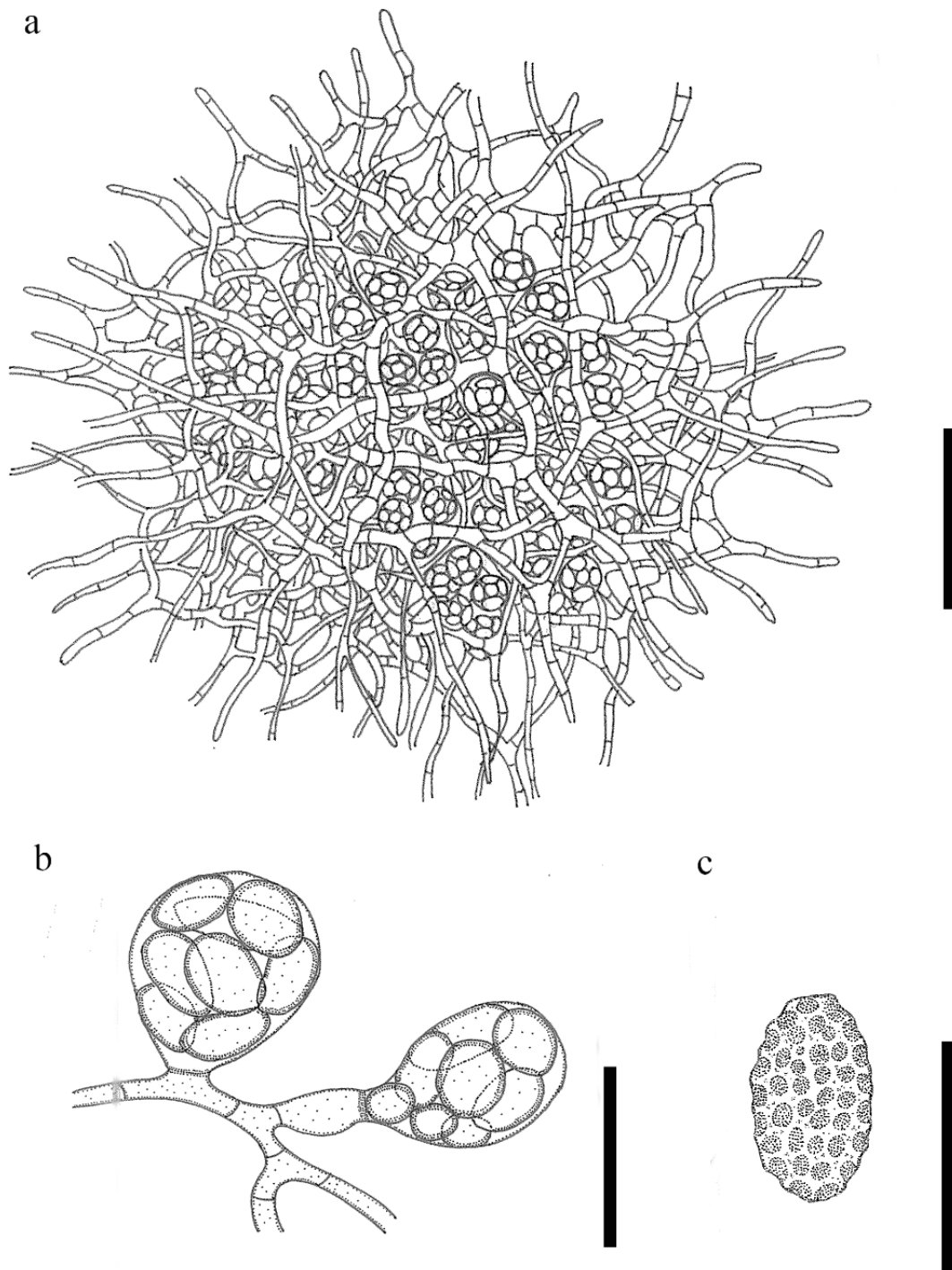


Figure 97 – *Renispora flavissima*. a Ascoma. b Ascus. c Ascospore. Scale bars a = 100 μm , b = 10 μm , c = 5 μm . Redrawn from Guarro et al. (2012).

Onygenaceae Berk.

Amauroascus J. Schröt., Krypt.-Fl. Schlesien (Breslau) 3.2(1–2): 210, 211 (1893)

Fig. 98

Index Fungorum number: IF152; Facesoffungi number: FoF16680

Schroeter (1893) introduced *Amauroascus*, which was typified by *A. niger*. The ITS phylogeny of *Onygenaceae* conducted by Kandemir et al. (2022) accepted four species in the

genus. Species Fungorum (2025) has listed 14 species while seven have molecular data (ITS and LSU). Guarro et al. (2012) provided a key to the species in *Amauroascus* and further described *Chrysosporium* and *Malbranchea* as the anamorphic genera of *Amauroascus* (Guarro et al. 2012). The sexual morph has gymnothecial ascomata, solitary or in clusters with dense, peridial hyphae that can be undifferentiated and slightly differentiated from vegetative hyphae, and unitunicate, 8-spored, ovoid to pyriform or spherical to subspherical asci (Guarro et al. 2012). Based on the ascospore morphology, *Amauroascus* species can be differentiated as punctate-reticulate ascospores and irregularly verruculose-punctate ascospores. They have been found in dung, insects and soil collected in Germany, Japan, Poland, Spain and the USA (Sharma & Shouche 2020).

Table 109 *Amauroascus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Amauroascus javanicus</i>	Jawa	Paddy field soil	Kandemir et al. (2022)
<i>A. malaysianus</i>	Malaysia	Garden soil	
<i>A. niger</i>	USA	ND	
<i>A. purpureus</i>	Japan	Cultivated soil	
<i>A. tropicalis</i>	Cuba	Forest soil	
<i>A. verrucosus</i>	USA	ND	
<i>A. volatilispatellus</i>	USA	Clay soil	

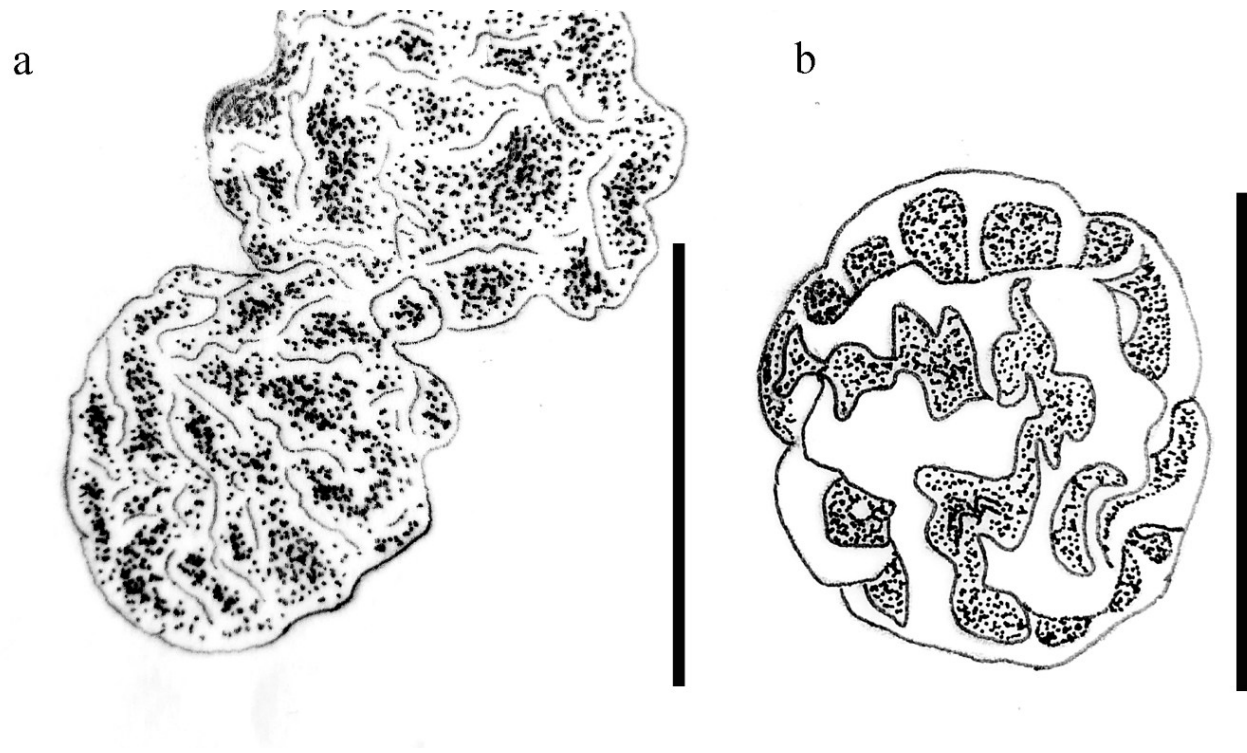


Figure 98 – *Amauroascus niger* a Ascomata. b Ascospores. Scale bars: a, b = 5 µm. Redrawn from Guarro et al. (2012).

Aphanoascus Zukal, Ber. Dt. Bot. Ges. 8: 295 (1890)

Index Fungorum number: IF245; Facesoffungi number: FoF16688

Aphanoascus was introduced by Zukal (1890), accommodating *A. cinnabarinus* in the genus. However, Apinis (1968) suggested a new combination, naming *A. fulvescens*, while proposing it as the type species in *Aphanoascus*. Subsequently, Labuda et al. (2021) have deposited the neotype and stabilized the current concept of this genus. Based on the phylogeny, Kandemir et al. (2022) confirmed the placement of this genus in *Onygenaceae* and updated the *A. fulvescens* (UAMH 4114) as the neotype, including 13 species in the phylogenetic analyses (Kandemir et al.

Fig. 99

2022). There are 19 species in the genus (Hyde et al. 2024c), while 14 of them have molecular data (ITS and LSU). The sexual morph is cleistothecial, superficial or in clusters, pale to dark brown, ascomata with a thick peridium wall of *textura angularis* or *intricata* cells, unitunicate, 8-spored, subspherical to ellipsoidal asci, and one-celled, subspherical, discoid or obovate or irregular, pale or dark brown ascospores with pitted or verruculose walls. *Aphanoascus* species are distributed in keratinous substrates, including dung, sediments, and soil in Australia, China, India and Spain (Cano & Guarro 1990, Kandemir et al. 2022).

Table 110 *Aphanoascus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Aphanoascus fulvescens</i>	Australia	ND	Kandemir et al. (2022)
<i>A. jingzhouensis</i>	China	Farmland soil	
<i>A. pinarensis</i>	Cuba	Forest soil	
<i>A. verrucosus</i>	Spain	Arable soil	

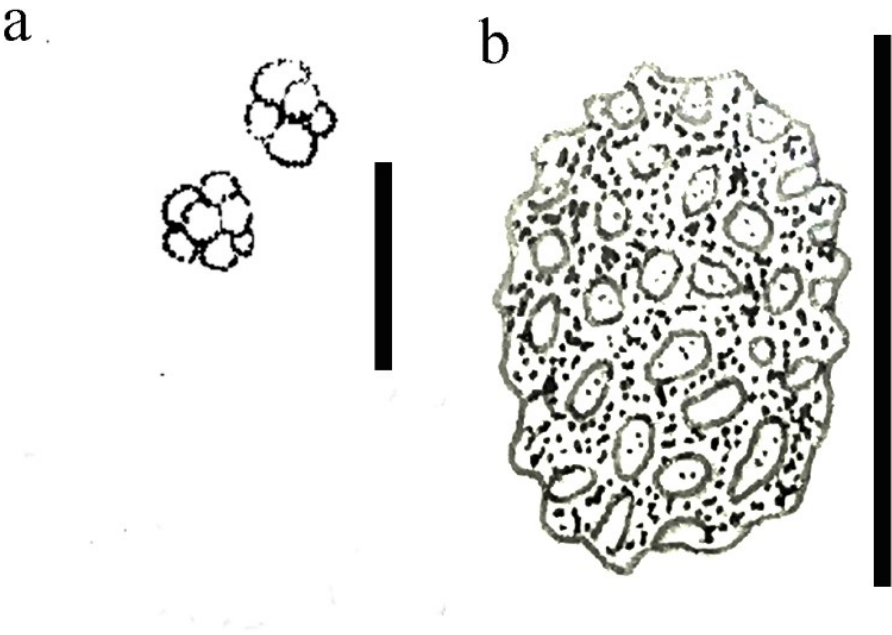


Figure 99 – *Aphanoascus fulvescens* a Asci. b Ascospore. Scale bars: a = 10 µm, b = 5 µm. Redrawn from Guarro et al. (2012).

Brunneospora Guarro & Punsola, Persoonia 13(3): 387 (1987)

Index Fungorum number: IF25158; Facesoffungi number: FoF16685

Guarro et al. (1987) introduced *Brunneospora* with *B. reticulata* as the type species. Currently, two species are accepted (Kandemir et al. 2022), and both of them have molecular data (ITS, LSU, SSU and *TUB2*). The genus has chrysosporium-like asexual morphs, and the sexual morph has gymnothecia with helical, peridial appendages and pigmented ellipsoidal ascospores. These species are keratinophilic, have been isolated from bird feathers and soil in Australia and Spain, and can infect mammals by inhaling environmental propagules. It has also been reported to have thermal dimorphic characteristics (Kandemir et al. 2022).

Fig. 100

Table 111 *Brunneospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Brunneospora reticulata</i>	Spain	Arable soil	Kandemir et al. (2022)

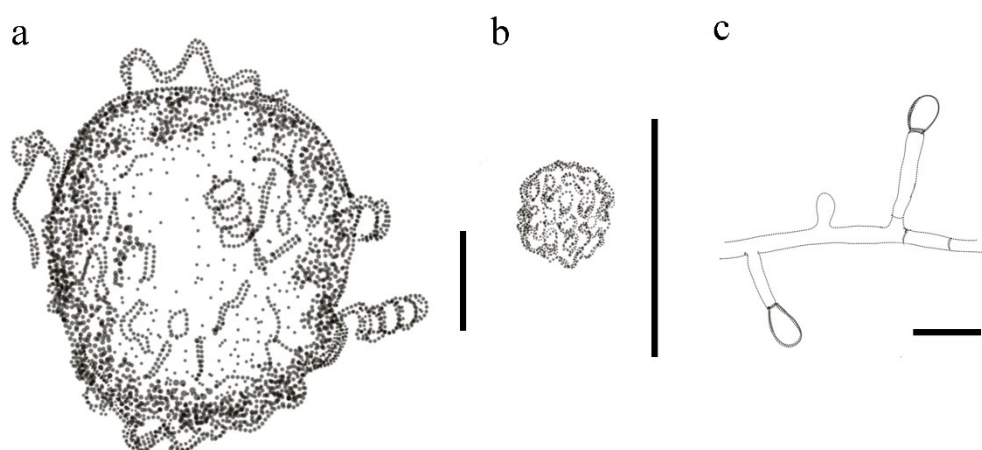


Figure 100 – *Brunneospora reticulata* (FMR 784). a Ascomata. b Ascospore. c Chrysosporium-like asexual morph. Scale bars: a = 100 μ m, b, c = 10 μ m. Redrawn from Guarro et al. (1987).

Coccidioides C.W. Stiles, Rep. Johns Hopkins Hosp. 1: 243 (1896)

Fig. 101

Index Fungorum number: IF7712; Facesoffungi number: FoF16683

Rixford & Gilchrist (1896) introduced *Coccidioides*, designating *C. immitis* as the type species. The phylogenetic study of *Onygenaceae* by Kandemir et al. (2022) revised this genus and accepted two species. Both species have molecular data (ITS). The asexual morph is prominent and can be seen in saprobic and pathogenic life modes. It is hyphomycetous and produces arthroconidia, and the asexual life cycle in the pathogenic phase produces endospores in mammalian hosts (Lewis et al. 2015). Species cause systemic mycosis in mammals (Van Dyke et al. 2019) while some of them are inhabiting in air and soil. This genus is distinct within *Onygenaceae* because of its keratinophilic properties and thermal dimorphism, where they can thrive in soils with low pH levels and temperatures ranging between -6.5°C and 60.6°C and also tolerate up to 8% NaCl (del Rocio Reyes-Montes et al. 2016).

Table 112 *Coccidioides* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Coccidioides immitis</i>	Argentina, Italy and the USA	ND	Domsch et al. (1993)

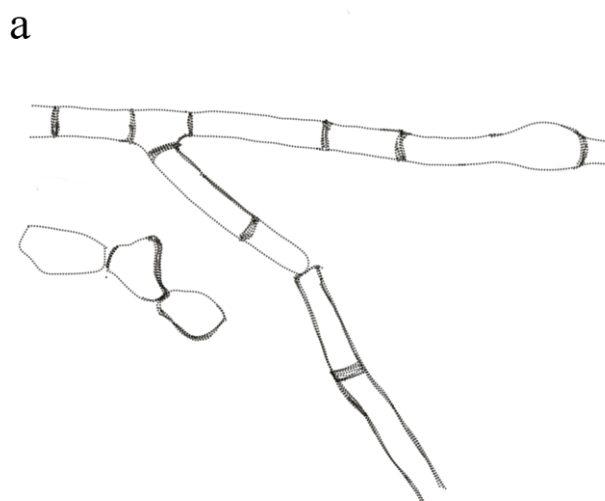


Figure 101 – *Coccidioides immitis* (CBS 711.73). a. Fragmentig hyphae and arthroconidia. Redrawn from Domsch et al. (1980).

Keratinophyton H.S. Randhawa & R.S. Sandhu, Sabouraudia 3: 252 (1964)

Index Fungorum number: IF2559; Facesoffungi number: FoF16687

Randhawa & Sandhu (1964) erected *Keratinophyton*, accommodating *K. terreum* as the type species. Kandemir et al. (2022) revised this genus, suggesting new combinations, and currently, there are 26 species accepted in the genus (Labuda et al. 2024). All the species have molecular data (ITS and LSU). The genus has chrysosporium asexual morphs and the sexual morph has cleistothecia with a pseudoparenchymatic peridium (Labuda et al. 2021, Kandemir et al. 2022). They live on keratinous substrates, dung, pollen, and nutrient-rich soil in China, India, Italy and Spain (Sutton et al. 2013, Labuda et al. 2021, Kandemir et al. 2022).

Table 113 *Keratinophyton* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Keratinophyton indicum</i>	India	ND	Kandemir et al. (2022)
<i>K. terreum</i>	India	Lawn soil	
<i>K. evolceanui</i>	India	ND	
<i>K. linfenense</i>	China	ND	Labuda et al. (2021)
<i>K. chongqingense</i>	China	ND	
<i>K. straussii</i>	Italy	ND	
<i>K. siglerae</i>	Spain	ND	
<i>K. gollerae</i>	Slovakia	Forest soil	
<i>K. hispanicum</i>	Spain	Beach soil	
<i>K. hubeiense</i>	China	Soil under the chicken feather	
<i>K. lemmensii</i>	Austria	Compost soil	
<i>K. linfenense</i>	China	Rhizosphere soil	
<i>K. pannicola</i>	India	ND	
<i>K. straussii</i>	Italy	Garden soil	
<i>K. wagner</i>	Slovakia	Forest soil	
<i>K. turgidum</i>	India	Soil near barber shop	
<i>K. sichuanense</i>	China	ND	

Pectinotrichum Varsavsky & G.F. Orr, Mycopath. Mycol. appl. 43(2): 229 (1971)

Fig. 102

Index Fungorum number: IF3784; Facesoffungi number: FoF16686

Varsavsky & Orr (1971) introduced *Pectinotrichum*, accommodating *P. llanense* as the type species. Currently, one species is accepted in the genus and it is supported with molecular data (ITS). The asexual morph has thallic, terminal or lateral, one-celled conidia and the sexual morph is characterized by gymnothecial ascomata, peridium composed of anastomosed hyphae and appendages, unitunicate, 8-spored, spherical asci, and one-celled hyaline, or pale yellow, smooth ascospores (Guarro et al. 2012, Kandemir et al. 2022).

Table 114 *Pectinotrichum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pectinotrichum llanense</i>	Venezuela	Savannah soil	Kandemir et al. (2022)

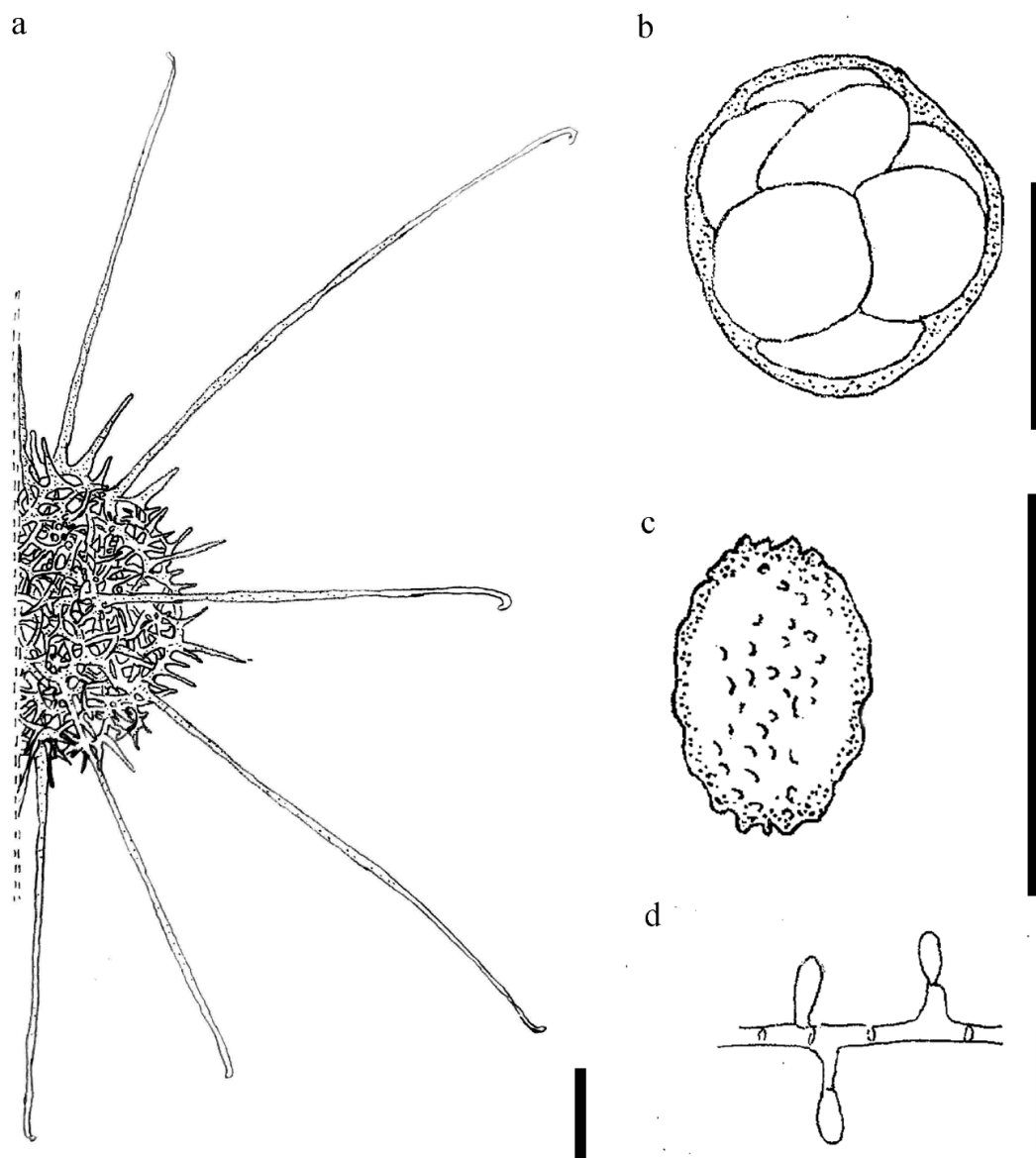


Figure 102 – *Pectinotrichum llanense* a Ascomata. b Ascus. c Ascospore. d Asexual morph. Scale bars: a = 100µm, b, c = 5µm. d = 4 µm. Redrawn from Guarro et al. (2012).

Pseudoamauroascus Cano, M. Solé & Guarro, Stud. Mycol. 47: 175 (2002)

Fig. 103

Index Fungorum number: IF28669; Facesoffungi number: FoF16684

Cano et al. (2002) introduced *Pseudoamauroascus* with its type species, *P. australiensis*. It remains as a monotypic genus (Kandemir et al. 2022), supported by molecular data (ITS). The asexual morph has arthroconidia produced on the main hyphae and straight or slightly flexuose lateral branches. Sexual morph is gymnothecial, white, peridium possesses an anastomosed network, unitunicate, 8-spored asci and one-celled, sub hyaline hyaline to oblate ascospores (Cano et al. 2002).

Table 115 *Pseudoamauroascus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudoamauroascus australiensis</i>	Australia	ND	Guarro et al. (2012)

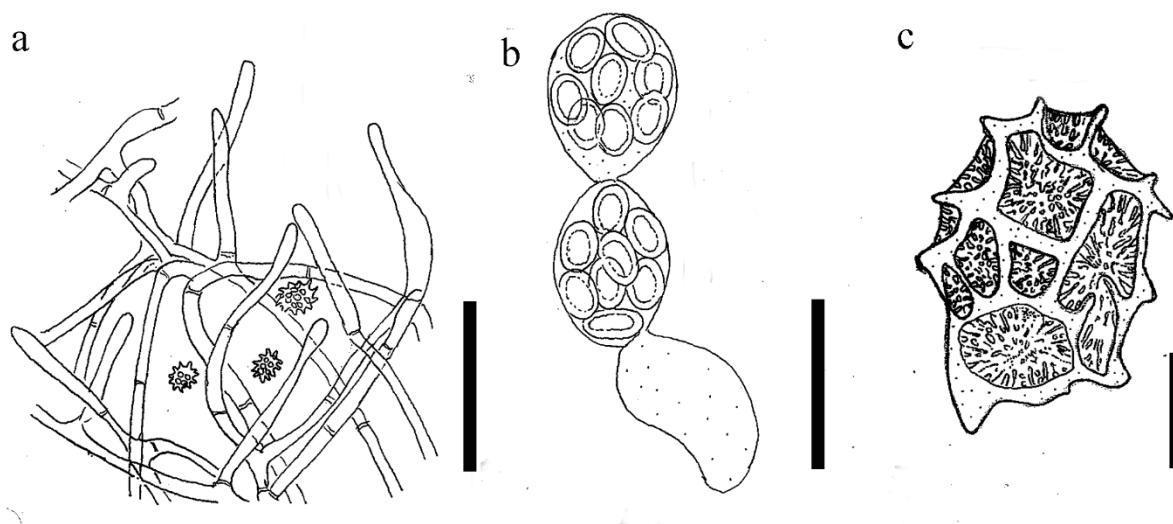


Figure 103 – *Pseudoamauroascus australiensis* a Part of ascomata b Ascus c Ascospore. Scale bars: a = 20 μ m, b = 10 μ m, c = 2.5 μ m. Redrawn from Guarro et al. (2012).

Spiromastigoidaceae Guarro, Cano & Stchigel (= *Spiromastigaceae* Guarro, Cano & Stchigel)

Pseudospiromastix Guarro, Stchigel & Cano, *Mycoses* 57(7): 425 (2014)

Index Fungorum number: IF805790; Facesoffungi number: FoF16692

Pseudospiromastix was validated by Hirooka et al. (2016) based on the morphology and ITS phylogeny, while designating *P. tentaculata* as the type species. It is currently a monotypic genus, supported by molecular data (Hirooka et al. 2016, Kandemir et al. 2022). The asexual morph forms conidiophores on aerial hyphae and sparingly or laterally branched conidiogenous hyphae, producing arthroconidia. Arthroconidia can be septate, cylindrical, cuboid or doliiform. Terminal and single lateral conidia are unicellular, subglobose to clavate or broadly ellipsoidal (Hirooka et al. 2016). In sexual morphs, ascomata can be present or absent based on the species and the asci are globose to ovoid or pyriform, short-stipitate, evanescent, 8-spored, with hyaline, yellowish or pale brown ascospores (Guarro et al. 1993, Hirooka et al. 2016).

Table 116 *Pseudospiromastix* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudospiromastix tentaculata</i>	Somalia	ND	Hirooka et al. (2016)

Spiromastigoides Doweld, *Index Fungorum* 30: 1 (2013)

Index Fungorum number: IF550257; Facesoffungi number: FoF16693

Spiromastigoides was introduced by Doweld (2013) with *S. warcupii* as the type species. Based on the ITS and LSU analyses for *Onygenales*, Kandemir et al. (2022) accepted 15 species in this genus, with all the species having molecular support (SSU, LSU and ITS). The asexual morph shows malbranchea- or chrysosporium-like characteristics (Hirooka et al. 2016, Kandemir et al. 2022), where conidiophores have predominantly unilateral branching patterns. The sexual morph is characterized by discrete or confluent, brown ascomata, curved or twisted appendages, eight-spored, subglobose, ovoid to ellipsoidal in shape asci and smooth-walled, yellowish to pale brown ascospores (Rizzo et al. 2014). The sexual morph in *Spiromastigoides* is found to be unique due to its curved but incompletely coiled peridial appendages (Kuehn & Orr 1962). Most of the species are cellulolytic and non-keratinolytic, and some are known as pathogens in mammals (Kandemir et al. 2022). They have been isolated from dung, household dust, human clinical samples and soil in Australia, Indonesia, Japan and the USA (Stchigel et al. 2017).

Table 117 *Spiromastigoides* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Spiromastigoides gypsea</i>	USA	ND	Stchigel et al. (2017)
<i>S. warcupii</i>	Australia, Indonesia, Japan and the USA	ND	
<i>S. sugiyamae</i>	USA	ND	
<i>S. sphaerospora</i>	Japan	Athletics ground	
<i>S. princeps</i>	Kenya	ND	

Lecanoromycetes O.E. Erikss. & Winka

Ostropomycetidae V. Reeb, Lutzoni & Cl. Roux

Graphidales Bessey

Diploschistaceae Zahlbr.

Diploschistes Norman, Conat. Praem. Gen. Lich.: 20 (1852)

Index Fungorum number: IF 1621; Facesoffungi number: FoF16694

Acharius (1852) introduced *Diploschistes*, and the type species is *Diploschistes muscorum*. Currently, the genus comprises 48 species (Mamut et al. 2022). It is known as lichen-forming genus having crustose lichens (Lumbsch & Mangold 2007). The sexual morph is characterized by three different forms of ascomata, which are perithecioid (ascoma enclosed by a wall and opened only by a small ostiole, disc not visible from above, similar to a perithecium with a well-developed carbonized excipulum), urceolate (ascoma with an exposed, deeply concave disc and well-developed carbonized excipulum), and lecanoroid (ascoma with an exposed flat to moderately concave disc, and reduced hyaline excipulum) (Fernández-Brime et al. 2013). The species can be found in barks, rocks, mosses, other lichens, soil and wood substrates (Ababaikeli et al. 2016, Fernández-Brime et al. 2013) and are distributed in Africa, Australia, Europe and the USA (Fernández-Brime et al. 2013).

Table 118 *Diploschistes* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Diploschistes diacapsis</i>	Spain	ND	Rubio & Lázaro (2023)

Leotiomyces O.E. Erikss. & Winka

Helotiales Nannf. ex Korf & Lizoň (= *Cyttariales* Luttr. ex Gamundí)

Amorphothecaceae Parbery

Amorphotheca Parbery, Aust. J. Bot. 17: 340 (1969)

Index Fungorum number: IF161; Facesoffungi number: FoF05857

Amorphotheca was introduced by Parbery (1969), accommodating *A. resinae* as the type species. The genus has only one species, and it is supported by molecular data. The sexual morph is characterized by the submerged or superficial ascocarps that are more or less spherical but often irregular in shape. Asci are pyriform or globose, 8-spored, hyaline. The ascospores are unicellular, often biguttulate, inner membrane constricted, hyaline, brownish and thick (Parbery 1969). Some species are utilized for producing industrially important melanin (Oh et al. 2021), and *Amorphotheca resinae* has been identified having potential for biodegradation (Ran et al. 2014).

Table 119 *Amorphotheca* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Amorphotheca resiniae</i>	Germany	ND	Furst et al. (1998)

Discinellaceae Ekanayaka & K.D. Hyde

Acidea Hujšlová & M. Kolařík, Mycol. Progr. 13(3): 826 (2014)

Index Fungorum number: IF805195; Facesoffungi number: FoF16650

Acidea is a monotypic genus typified by *A. extrema* and was introduced by Hujšlová et al. (2014) based on LSU and SSU multi-gene phylogeny. The genus is comprised of a hyphomycetous asexual morph that is sparsely branched, sterile mycelium that is often fragmenting. The sexual morph is still undetermined (Hujšlová et al. 2014).

Table 120 *Acidea* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Acidea extrema</i>	Czech Republic	Highly acidic soil	Hujšlová et al. (2014)

Hyphodiscaceae Ekanayaka & K.D. Hyde

Soosiella Hujšlová & M. Kolařík, Mycol. Progr. 13(3): 827 (2014)

Index Fungorum number: IF805196; Facesoffungi number: FoF16651

Soosiella is a monotypic genus which was introduced by Hujšlová et al. (2014) based on morphology and LSU and SSU phylogeny, and *S. minima* is designated as the type species. The asexual morph is hyphomycetes and the sexual morph remains unknown (Hujšlová et al. 2014).

Table 121 *Soosiella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Soosiella minima</i>	Czech Republic	Highly acidic soil	Hujšlová et al. (2014)

Myxotrichaceae Currah

Byssoascus Arx, Persoonia 6(3): 377 (1971)

Fig. 104

Index Fungorum number: IF 699; Facesoffungi number: FoF16698

Von Arx (1971) introduced *Byssoascus* by transferring *Arachniotus striatisporus* as a new combination. Currently, it is a monotypic genus with its type, *B. striatisporus* (Species Fungorum 2025) and supported by molecular data (ITS, LSU and *RPB2*). The asexual morph has cylindrical conidia that are born in chains by fragmentation of branching conidiophores. The sexual morph is characterized by spherical or irregular, small ascomata with an inconspicuous peridium, composed of the loosely arranged hyphal network. Asci are produced from *ascogenous* hyphae with croziers, in clusters, broadly clavate or obovate, thin-walled, and 8-spored. Ascospores are fusiform, striate by longitudinal flutes, and straw-coloured when mature (Von Arx 1971).

Table 122 *Byssoascus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Byssoascus striatisporus</i>	Canada	ND	Peng et al. (2014)

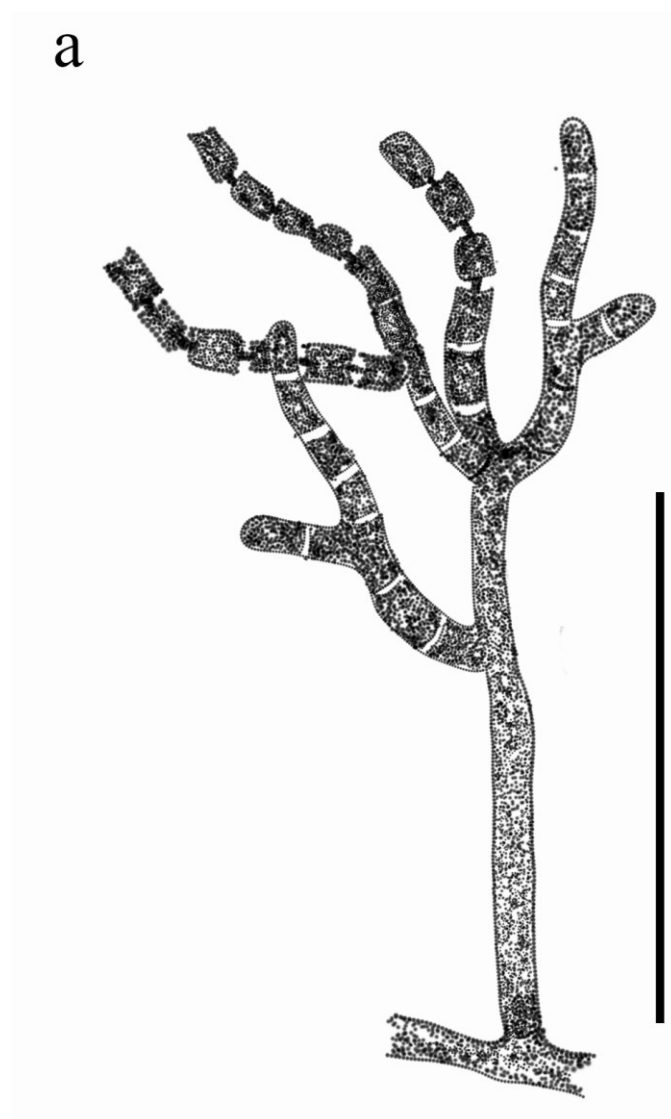


Figure 104 – *Byssosascus striatosporus* a. Conidiophore. Scale bars: a = 50 μ m. Redrawn from Guarro et al. (2012).

Myxotrichum Kunze, Mykologische Hefte (Leipzig) 2: 108 (1823)

Fig. 105

Index Fungorum number: IF 3405; Facesoffungi number: FoF17775

Myxotrichum was introduced by Kunze & Schmidt (1823), with the type species accommodated as *M. chatarum*. The genus comprises of 17 species (Hyde et al. 2024c), and eight of them have molecular data. They have been isolated from lichen, litter and soil in Alaska, China, France, Germany, Japan and the USA (Uchiyama et al. 1995, Yuan et al. 2013, Liang et al. 2019).

Table 123 *Myxotrichum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Myxotrichum arcticum</i> .	Alaska	Forest soil	Uchiyama et al. (1995)
<i>M. dendromorphum</i>	Pakistan	Coniferous forest soil	
<i>My. ochraceum</i>	Japan	ND	
<i>M. stellatum</i>	Japan	Forest soil	Udagawa & Uchiyama (2000)
<i>M. retardatum</i>	Canada	Forest soil	Udagawa & Uchiyama (1999)
<i>M. dendromorphum</i>	Pakistan	Coniferous forest soil	
<i>M. deflexum</i>	Canada	ND	Peng et al. (2014)

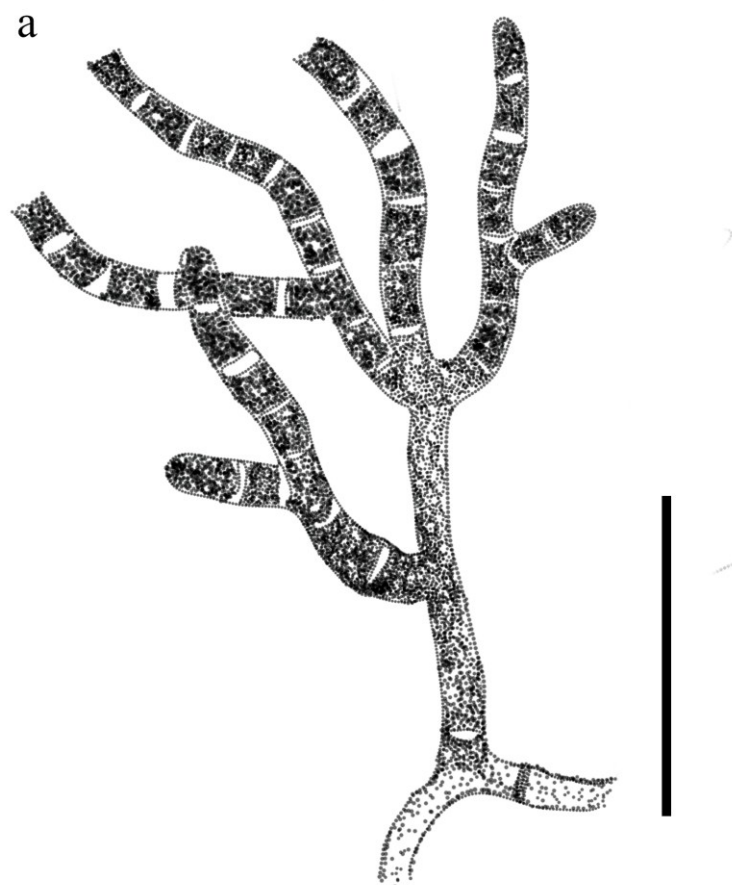


Figure 105 – *Myxotrichum* sp. a Conidiophore. Scale bars: a = 25 μ m. Redrawn from Guarro et al. (2012).

Oidiodendron Robak, Nytt Mag. Natur. 71: 245 (1932)

Index Fungorum number: IF9141; Facesoffungi number: FoF16697

Robak (1932) introduced *Oidiodendron* accommodating *O. fuscum* as the type species. The genus is comprised of 26 species (Hyde et al. 2024c), while 15 of them have molecular data (ITS, LSU and SSU). It is morphologically distinct by having the arborescent conidiogenous apparatus, that has erect conidiophores terminating in a complex branching head of fertile hyphae where they produce arthrospores basipetally. Species can be found in air, bark, decaying wood, humus, insects, lichens, marine sediments, mosses, papers, soil and wood pulp, while some have been reported as mycorrhizal fungi (Hambleton et al. 1998, Lee et al. 2022). The genus is distributed in Austria, Canada, Denmark, Korea, Italy, the Netherlands and the USA (Lee et al. 2022).

Table 124 *Oidiodendron* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Oidiodendron chlamydosporicum</i>	USA	ND	Hambleton et al. (1998)
<i>O. citrinum</i>	Canada	Peat soil	
<i>O. echinulatum</i>	Canada	Peat soil	
<i>O. pilicola</i>	Alaska	Soil on human hair	

Sclerotiniaceae Whetzel ex Whetzel

Botrytis P. Micheli ex Pers., Neues Mag. Bot. 1: 120 (1794)

Index Fungorum number: IF 7435; Facesoffungi number: FoF00142

Fig. 106

Micheli (1794) introduced *Botrytis* with the type species, *B cinera*, and the genus was later formally revised by Persoon (1801). As mentioned by Hyde et al. (2024), the genus comprises more than 70 species; however, Garfinkel (2021) mentioned that only 38 species are formally described. For the species delineation in the genus, *GAPDH*, *RPB2*, heat shock protein 60 (HSP60), *NEP1*, and *NEP2* gene regions have been used (Garfinkel 2021). Some species of this genus produce highly melanized sclerotia for long-term survival, and subsequently, they produce hyphae with conidiophores or apothecia (Richards et al. 2021). The genus has important plant pathogens that affect a broad range of hosts such as tomatoes, paper, grapes, strawberries, legumes and cut flowers worldwide (Richards et al. 2021, Brauna-Morževska et al. 2023).

Table 125 *Botrytis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Botrytis allii</i>	Israel	Onion field	Kritzman & Netzer (1978)
<i>B. cinerea</i>	Jamaica, Nepal and India	Grassland, Garden, arable, peat land soil, saline, sandy, salt marsh, mangrove, cave and Uranium mine	Domsch et al. (1993)



Figure 106 – *Botrytis cinera*. a. Conidiophore and conidia. Scale bar: a=800X. Redrawn from Domsch et al. (1980).

Sclerotinia Fuckel, Jb. nassau. Ver. Naturk. 23-24: 330 (1870) [1869–70]
Index Fungorum number: IF 4942; Facesoffungi number: FoF16696

Fuckel (1870) introduced *Sclerotinia* and typified with *Sclerotinia libertiana*. It is comprised of around 103 species (Hyde et al. 2024c, Species Fungorum 2025), and the genus is supported by ITS, *GAPDH*, *RPB2* and *HSP60* gene regions (Yin et al. 2024). These species are plant pathogens that infect more than 600 plant species in 75 families, including bean, carrot, pea, lettuce, mustard, canola, lentil and sunflower (Smolińska & Kowalska 2018). The genus forms sclerotia in soil, plant residues, or seeds during the winter and summer. Around 90% of the life cycle of *Sclerotinia* is spent in the soil as sclerotia (Adams & Ayers 1979, Yin et al. 2024). Species are geographically distributed in China, Germany, Poland, the Netherlands, Venezuela and the USA (Yin et al. 2024).

Table 126 *Sclerotinia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Sclerotinia sclerotiorum</i>	ND	Rhizosphere soil	Domsch et al. (1993)

Helotiales genera *incertae sedis*

Cadophora Lagerb. & Melin, Svensk Skogsvårdsförening Tidskr. 25: 263 (1927)

Index Fungorum number: IF7462; Facesoffungi number: FoF 16649

Lagerberg et al. (1927) established *Cadophora* based on morphological characterization and *C. fastigiata* is designated as the type species. Currently, 44 *Cadophora* species are listed in the Species Fungorum (2025), while 37 of them have molecular data. The asexual morph is hyphomycetous and produces solitary phialides with distinct hyaline collarettes. *Cadophora* has different trophic modes, such as saprobes, plant pathogens, and mutual associations. It is described as one of the most ubiquitous fungal taxa inherent with a higher number of stress-tolerance genes, thus have been isolated from cold, glacial water, marine sediments, soils and submerged woods in Arctic and Antarctic sites, Canada, China, Finland, Germany, Italy, North America and Norway (Zhang et al. 2022a).

Table 127 *Cadophora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cadophora antarctica</i>	Antarctica	Diesel-contaminated soil	Zhang et al. (2022a)
<i>C. caespitosa</i>	China	Snow mountain	
<i>C. indistincta</i>	China	Glacier soil	
<i>C. inflata</i>	China	Glacier soil	
<i>C. magna</i>	China	Glacier soil	
<i>C. malorum</i>	China	Snow mountain	
<i>C. novi-eboraci</i>	China	Glacier soil	
<i>C. psychrophila</i>	China	Glacier soil	
<i>C. qinghai- tibetana</i>	China	Snow mountain	
<i>C. yulongensis</i>	China	Snow mountain	

Scytalidium Pesante, Annali Sper. agr., N.S. 11(2, Suppl.): cclxiv (1957)

Index Fungorum number: IF 9862; Facesoffungi number: FoF16699

Pesante (1957) introduced *Scytalidium* with its type species *Scytalidium lignicola*. The genus comprises 32 species (Species Fungorum 2025), of which 24 species have molecular data (ITS, LSU and SSU). It is a hyphomycetous genus characterized by small, hyaline fission arthroconidia together with larger, brown conidia (Moore 1992). Species have a wide geographical distribution, including Brazil, China, India, Italy, Malaysia, South Korea and Sweden, associated with air, fruit trees, leaves, soil, timber, and wood (Machouart et al. 2013, Peng et al. 2014). They

have been reported as plant and human pathogens (Machouart et al. 2013), while some of them are fungicolous fungi (Peng et al. 2014, Goh et al. 2015).

Table 128 *Scytalidium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Scytalidium chinense</i>	China	Sandy soil	Wu & Zhang (2010)
<i>S. nielamuense</i>	China	Grassland soil	
<i>S. verruculosum</i>	China	Mountain soil	
<i>S. xigazense</i>	China	Mountain soil	
<i>S. flavobrunneum</i>	Georgia	Forest soil	Domsch et al. (1993)

Lichinomycetes V. Reeb, Lutzoni & Cl. Roux

Geoglossales Zheng Wang, C.L. Schoch & Spatafora

Geoglossaceae Corda

Hemileucoglossum Arauzo, Errotari 11: 176 (2014)

Fig. 107

Index Fungorum number: IF 809532; Facesoffungi number: FoF 16648

Arauzo & Iglesias (2014) introduced *Hemileucoglossum* and designated *H. littorale* as the type species, which was isolated from *Littorela uniflora* plants (Kers & Carlsson 1996). This genus comprises six species (Species Fungorum 2025), and all of them have molecular data (ITS and LSU). The sexual morph is characterized by the setose hairs on the stipe, paraphyses agglutinated by a dense brown amorphous material and hyaline mature ascospores. Most of the species have been isolated from soil in Denmark, Slovakia and the USA (Fadnes et al. 2021).

Table 129 *Hemileucoglossum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Hemileucoglossum pusillum</i>	Slovakia	Gravel soil in fen	Crous et al. (2017a)
<i>H. pusillum</i>	Slovakia	Gravel soil in fen	
<i>H. littorale</i>	Denmark	Sand	
<i>H. intermedium</i>	USA	Swampy soil	



Figure 107 – *Hemileucoglossum littorale*. a. Ascus. b. Ascospores. Scale bar: b = 10 µm. Redrawn from Kučera & Fedosova (2017).

***Orbiliomycetes* O.E. Erikss. & Baral**

Orbiliales Baral, O.E. Erikss., G. Marson & E. Weber

***Orbiliaceae* Nannf.**

***Arthrobotrys* Corda, Pracht-Fl. Eur. Schimmelbild.: 43 (1839)**

Index Fungorum number: IF 7217; Facesoffungi number: FoF 14384

Corda (1839b) introduced *Arthrobotrys*, designating *A. superba* as the type species. There are 59 species accepted in the genus (Zhang et al. 2022b). Zhang et al. (2022b) provided phylogenetic analyses for 54 species using the ITS, *TEF*, and *RPB2* gene regions. *Arthrobotrys* is considered as the largest genus in *Orbiliaceae*. The genus is characterized by having an asexual morph with the branched or simple conidiophores that asynchronously produce conidia on the nodes or on short denticles, which are obovoid, elliptic, pyriform and 0–3-septate (Subramanian 1977, Chen et al. 2007, Kim et al. 2001). Species can be found in animal waste, freshwater, hot springs, sediments, soil and tree trunks. *Arthrobotrys* are saprobes and are also recorded as nematode-trapping fungi (Kim et al. 2001, Zhang et al. 2022b). These species are distributed in Canada, China, Kazakhstan, Poland and the USA (Zhang et al. 2022b).

Table 130 *Arthrobotrys* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Arthrobotrys constringens</i>	Canada	ND	Dowsett et al. (1984)
<i>A. jinpingensis</i>	China	ND	Zhang et al. (2022b)
<i>A. luquanensis</i>	China	ND	
<i>A. microscaphoides</i>	China	ND	
<i>A. shuifuensis</i>	China	ND	
<i>A. zhaoyangensis</i>	China	ND	

***Pezizomycetes* O.E. Erikss. & Winka**

***Pezizales* J. Schröt.**

***Ascodesmidaceae* J. Schröt.**

***Cephaliophora* Thaxt., Bot. Gaz. 35: 157 (1903)**

Fig. 108

Index Fungorum number: IF 7518; Facesoffungi number: FoF16695

Thaxter (1903) introduced *Cephaliophora*, and the type species is accommodated as *Cephaliophora tropica*. The genus is comprised of three species (Species Fungorum 2025) and two of them have molecular data. The asexual morph is characterized by having conidia that are produced synchronously from a swollen ampulla, arising directly from vegetative hyphae and from a short lateral branch. The sexual morph is unknown (Goos 1964, Pfister & Healy 2021). The species have been found as saprobes from dung and soil, and they can cause keratitis in humans and are distributed in China, Jamaica, Java, Liberia, India and Puerto Rico (Nguyen et al. 2017, Pfister & Healy 2021).

Table 131 *Cephaliophora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cephaliophora</i> sp.	India	ND	Pandey et al. (1990)
<i>C. tropica</i>	Iran	<i>Cucurbitaceae</i> farms	Pordel et al. (2015)

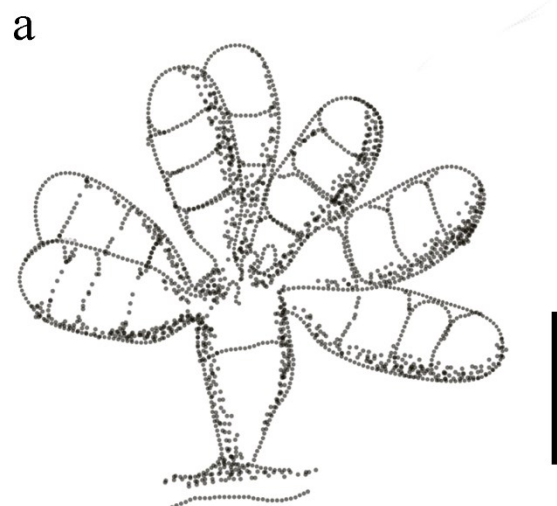


Figure 108 – *Cephaliophora tropica*. a Conidiogenous cells with synchronously forming conidia. Scale bars: a=500X μm . Redrawn from Domsch et al. (1980).

Pezizaceae Dumort. (= *Carbomycetaceae* Trappe)

Peziza Dill. ex Fr., Syst. mycol. (Lundae) 2(1): 40 (1822)

Index Fungorum number: IF 3859; Facesoffungi number: FoF16337

Fries (1822) introduced *Peziza*, and it is considered the largest genus in the *Pezizales*, having more than 100 species (Barseghyan & Solomon 2011). The sexual morph is characterized by epigeous, sessile or stipitate, cup-shaped, cupulate, turbinate, pulvinate or sparassoid apothecia. Species can be found in different types of soil, dung and wood collected in Austria, Denmark and the USA (Petersen 1967, 1985).

Table 132 *Peziza* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Peziza ammophila</i>	Morocco	ND	Barseghyan & Solomon (2011)
<i>P. ampelina</i>	Denmark	Clayey soil	Hansen et al. (2002)
<i>Peziza aurata</i>	Denmark	ND	
<i>P. arvernensis</i>	Denmark	Disturbed soil	
<i>P. domiciliana</i>	Denmark	Forest	
<i>P. fimeti</i>	Denmark	ND	
<i>P. fimeti</i>	Russia	Clay soil	
<i>P. nivalis</i>	USA	ND	
<i>Peziza varia</i>	Denmark	ND	
<i>Peziza varia</i>	USA	Soil with wood debris	
<i>Peziza</i> sp.	Denmark	Calcareous soil	
<i>Peziza</i> sp.	Denmark	Clayey soil	
<i>Peziza</i> sp.	Austria	ND	
<i>Peziza</i> sp.	USA	Soil at the campfire site	
<i>Peziza</i> sp.	USA	Disturbed mineral soil	

Pyronemataceae Corda (= *Otideaceae* Eckblad)

Lotinia Pérez-Butrón, Fern.-Vic. & P. Alvarado

Fig. 109

Index Fungorum number: IF 814887; Facesoffungi number: FoF16652

Lotinia is a monotypic genus, introduced by Crous et al. (2015b) and typified with *L. verna*. The species is supported with molecular data (ITS, LSU and *TEF1- α*). The asexual morph is unknown. The sexual morph is identified as having brownish, discoidal ascomata, an external

surface covered with flexuose hairs from the base to the top. The peridium wall arranged of cells of *textura prismatica*. Asci are 8-spored, operculate, and non-amyloid, comprising smooth, eguttulate, globose to ellipsoid ascospores (Crous et al. 2015b).

Table 133 *Lotinia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Lotinia verna</i>	Spain	Muddy soil	Crous et al. (2015b)

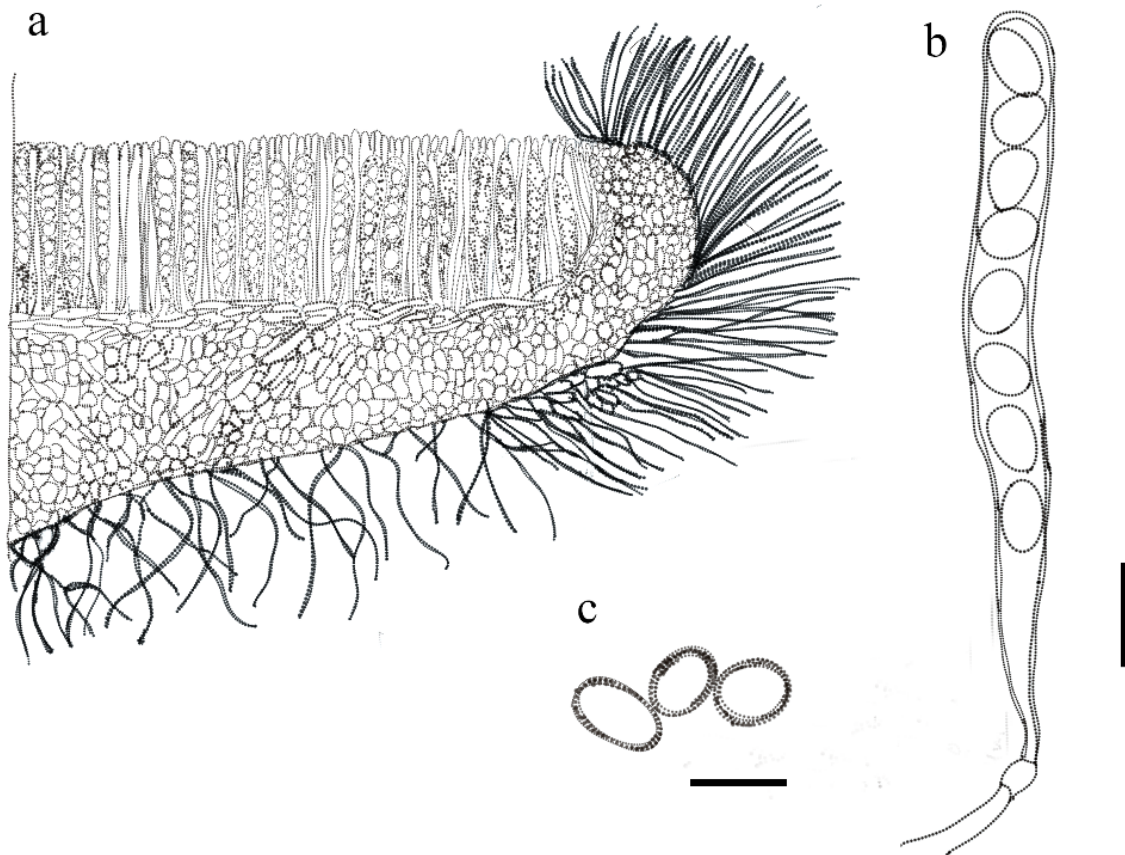


Figure 109 – *Lotinia verna* a Ascoma. b Ascus. c Ascospores. Scale bars: b = 60 μ m, c = 30 μ m. Redrawn from Crous et al. (2015b).

Sordariomycetes O.E. Erikss. & Winka

Diaporthomycetidae Senan., Maharachch. & K.D. Hyde

Calosphaeriales M.E. Barr

Calosphaeriaceae Munk

Jattaea Berl., Icon. fung. (Abellini) 3(1-2): 6 (1900)

Fig. 110

Index Fungorum number: IF 2528; Facesoffungi number: FoF07774

Jattaea was introduced by Berlese (1900) without designating the type species, and subsequently, *J. algeriensis* was designated as the lectotype (Clements & Shear 1931). Currently, the genus has 26 species listed in the Species Fungorum (2025), and 12 of them have molecular data. The phylogenetic revisions for *Jattaea* were provided by Réblová et al. (2015) and Zhang et

al. (2021) based on ITS, SSU, LSU, *TUB2*, and *RPB2*. *Jattaea* has phialophora-like asexual morphs with short to elongate, ampulliform phialides or adelo-phialides with funnel-shaped collarettes (Réblová et al. 2015, Zhang et al. 2021c). The sexual morph has astromatic perithecial ascomata, clavate and stipitate asci, and allantoid, 1-septate and hyaline ascospores. Species can be saprobic on decaying wood and soil-based substrates in Algeria, Canada, France, Germany, Italy, Sweden, Thailand and the USA (Réblová et al. 2015, Zhang et al. 2021c).

Table 134 *Jattaea* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Jattaea reniformis</i>	China	Cave	Zhang et al. (2021c)

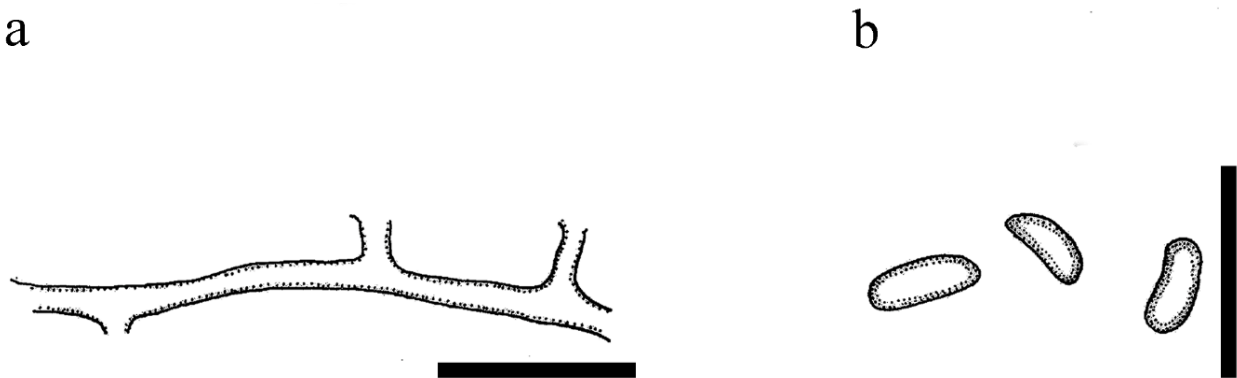


Figure 110 – *Jattaea algeriensis*. a Adelophialides. b Conidia. Scale bars: a, b = 10 μm. Redrawn from Kazemzadeh-Chakusary et al. (2021).

Pleurostomataceae Réblová, L. Mostert, W. Gams & Crous

Pleurostoma Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 247 (1863) Fig. 111
Index Fungorum number: IF4247; Facesoffungi number: FoF01137

Pleurostoma was erected by Tulasne & Tulasne (1863), and *P. candollei* is designated as the type species. The genus comprises eight species (Species Fungorum 2025), and only six of them have molecular data (ITS, SSU, LSU and *TUB2*). The asexual morph is hyphomycetous, monophialidic, and heavily sporulating, and the collarettes are frequently cupped or slightly rounded. The conidiophore and conidial characteristics among *Pleurostoma* species are highly variable. The sexual morph has globose, black ascomata, reniform to oblong asci, and allantoid, aseptate ascospores (Tulasne & Tulasne 1863, Réblová et al. 2015, Maharachchikumbura et al. 2016, Tsang et al. 2021). Species are found in contaminated ground wood pulp, dead wood, human clinical samples, sewage and soil. Further, they can be human and plant pathogens. Species are distributed in China, France, Sweden, Sudan and the USA (Tulasne & Tulasne 1863, Tsang et al. 2021).

Table 135 – *Pleurostoma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pleurostoma richardsiae</i>	India	Hexachlorocyclohexane dump site	Kaur et al. (2023)

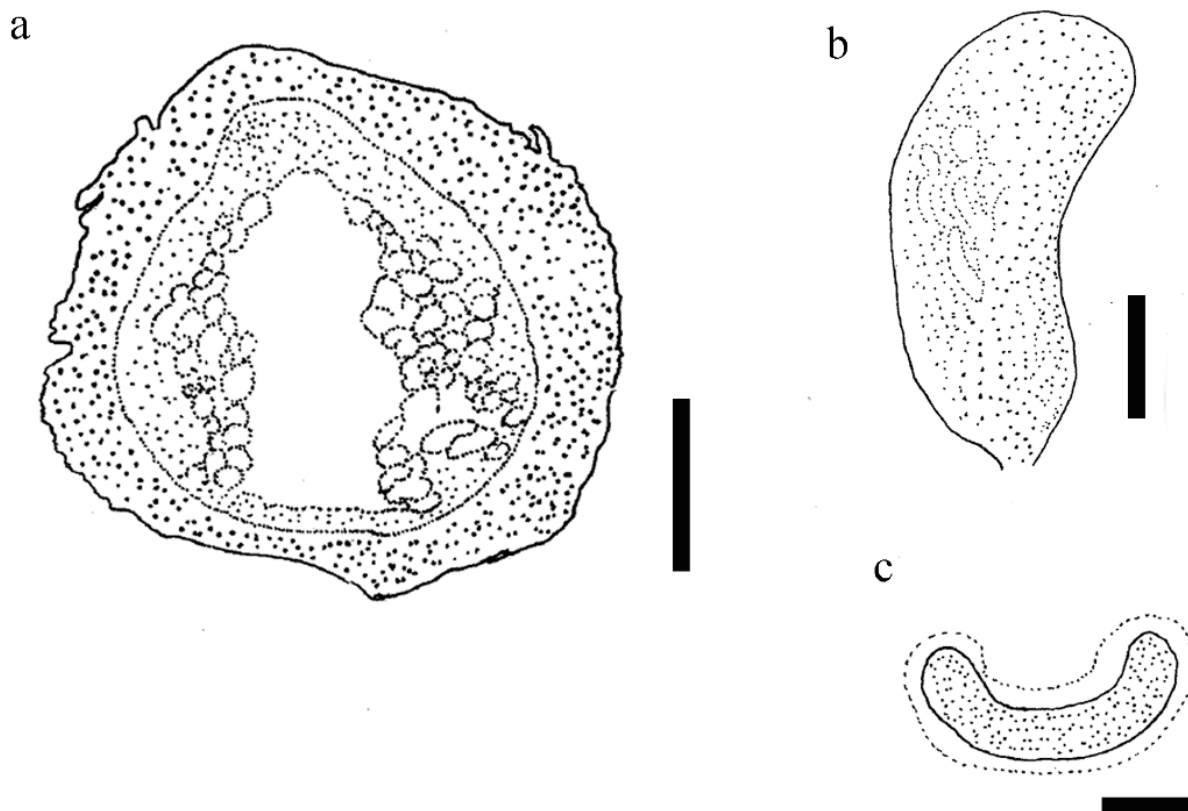


Figure 111 – *Pleurostoma candollei* (PC 0167640). a Ascoma b Asci. c Ascospore. Scale bars: a = 100 μ m, b = 5 μ m, c = 1 μ m. Redrawn from Hyde et al. (2020c).

Diaporthales Nannf.

Diaporthosporellaceae C.M. Tian & Q. Yang

Diaporthosporella C.M. Tian & Q. Yang; Mycoscience 59: 229–235 (2017)

Index Fungorum number: IF822664, Facesoffungi number: FoF 08398

Diaporthosporella was introduced by Yang et al. (2018b) based on combined phylogeny (ITS and LSU) and morphological evidence and *D. cercidicola* is accommodated as the type species. There are two species listed in Species Fungorum (2025), with both having molecular data. The asexual morph is phomopsis-like, which is characterized by pycnidial conidiomata, erumpent at maturity with acropleurogenous, branched or sympodial branched, cylindrical, aseptate conidiophores. Conidiogenous cells are enteroblastic, phialidic, cylindrical, terminal, slightly tapering towards the apex, that produce ellipsoidal, aseptate, hyaline, smooth conidia that are bi-guttulate at each end. The sexual morph has perithecial ascomata that are inconspicuous at bark level, surrounding ectostromatic discs, usually irregularly scattered, globose to subglobose, and dark brown to black. Asci are 8-spored, unitunicate, clavate to oblong-clavate, sessile, thin-walled, that contain irregularly uniseriate, allantoid or subreniform, hyaline, aseptate somewhat acute at one end and obtuse at other, 3-4- guttulate ascospores with larger guttules at the center and smaller ones at the ends (Yang et al. 2018b). Species have been isolated as saprobic and pathogenic stages from China (Yang et al. 2018b, Tennakoon et al. 2021). The genus has not previously been reported from soil.

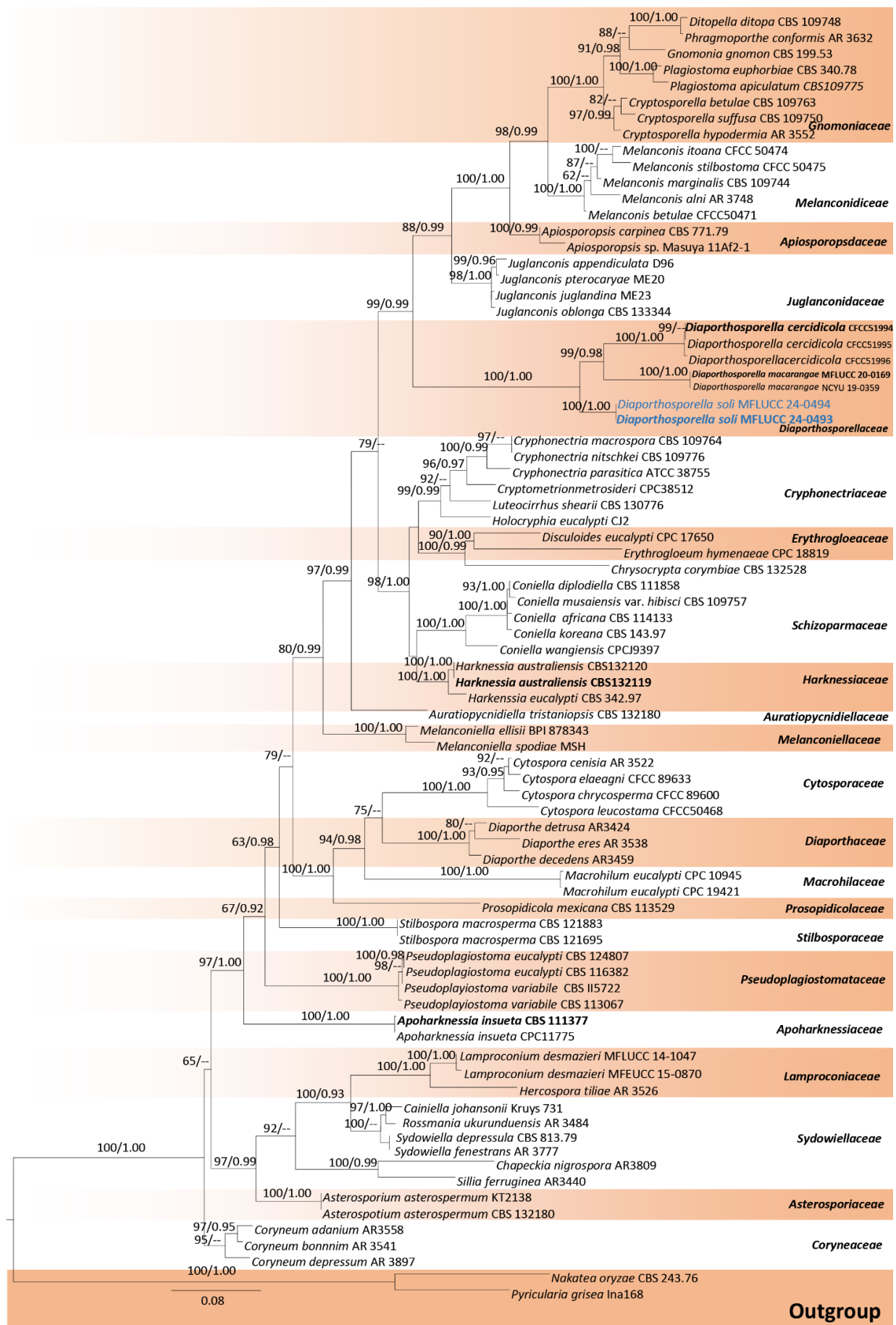


Figure 112 – The best-scoring maximum likelihood tree generated of the combined ITS and LSU sequence data for selected families in *Diapothales*. Bootstrap support values of maximum

likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted in *Nakatea oryzae* (CBS243.76) and *Pyricularia grisea* (Ina168). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 1589 bp, and single gene alignments are ITS: 750 bp, and LSU: 839 bp. The matrix had 755 distinct alignment patterns with 25.24% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.250, C = 0.250, G = 0.250, T = 0.250; substitution rates AC = 1.54849, AG = 2.62794, AT = 2.47465, CG = 1.49097, CT = 6.45856, GT = 1.00000; gamma distribution shape parameter α = 0.654.

Diaporthosporella soli Yasanthika & K.D. Hyde, sp. nov.

Fig. 113

Index Fungorum number: IF903046; Facesoffungi number: FoF 16716

Etymology – The specific epithet "*soli*", refers to the soil in Latin, the location of which the substrate holotype was collected.

Holotype – MFLU 25-0137

Sexual morph: Undetermined. Asexual morph: *Conidiomata* 90–120 × 100–135 μm ($\bar{x}$ = 110 × 119 μm , n=10), pycnidial, solitary or confluent, superficial on MEA, reddish brown to black, globose to sub-globose, unilocular, pycnidial wall cells of *textura angularis*. *Conidiophores* 2–5 × 2–4 μm ($\bar{x}$ = 3 × 2.5 μm , n=10), formed from the pycnidial wall, acropleurogenous, cylindrical to subcylindrical, erect or flexuous, aseptate, hyaline to subhyaline, mostly simple, unbranched, terminally phialidic. *Conidiogenous cells* 3.5–5.5 × 2.5–4 μm ($\bar{x}$ = 4.5 × 3 μm , n=10), phialidic, discrete, ampulliform. *Conidia* 3.5–5.5 × 1–2 μm ($\bar{x}$ = 4.5 × 1.5 μm , n = 20), hyaline, obovoid to cylindrical to reniform or ellipsoidal, aseptate or sometimes 1 septate, rough granular surface, thick-walled, verruculose. *Chlamydospores* present, intercalary, hyaline to pale reddish-brown, globose to subglobose, in simple or branched chains, thick-walled.

Culture characteristics – *Colonies* on PDA at 25 °C, become 4–5 cm diam. after seven days of incubation, white becoming brownish red when mature, reverse yellowish white at the center and white at the periphery, becomes dark brown when mature, flat, irregularly-margined. *Mycelium* immersed to semi-immersed or superficial, hyaline, becoming pale brown to reddish brown when mature, thick-walled, septate 1.5–4 μm ($\bar{x}$ = 3), sporulated after 1.5 weeks on PDA and MEA.

Material examined – Thailand, Chiang Mai, Mae On District, Tham Muang On cave, on soil, 99.238054N, 18.7862964E, 496m 9 May 2022, W.A. Erandi Yasanthika (MFLU 25-0137, holotype). ex-type 66-cv20-15=MFLUCC 24-0493. *ibid.* (MFLU 25-0177), living culture 59-cv20-12=MFLUCC 24-0494

GenBank numbers – MFLUCC 24-0493: LSU: PQ577822, ITS: PQ012929; MFLUCC 24-0494: LSU: PQ577823, ITS: PQ577824.

Notes – Based on multi-gene phylogeny and the morphological studies, *Diaporthosporella soli* has been introduced as a new species. The phylogenetic analyses in *Diportales* (Figure 112) showed that our species (MFLUCC 24-0493 and MFLUCC 24-0494) clusters within *Diaporthosporella*, producing a distinct clade sister to *D. cercidicola* and *D. macarangae* with 100% ML and 1.0 BYPP statistical support. The base pair difference in the ITS (+5.8S) gene region between *Diaporthosporella soli* and *D. cercidicola* is 108/559 (19%) (including gaps), and with *D. macarangae* is 101/520 (19%) (including gaps). Our collection produced asexual morphs with ampulliform conidiogenous cells and obovoid to cylindrical to reniform or ellipsoidal, aseptate or 1 septate, rough granular surface, thick-walled conidia, which are different from *D. cercidicola* and *D. macarangae* that have cylindrical conidiogenous cells and ellipsoidal, aseptate, hyaline, smooth, biguttulate at each end of the conidia (Yang et al. 2018, Tennakoon et al. 2021). *Diaporthosporella cercidicola* has been found in twigs and branches of *Cercis chinensis* and *D. macarangae* on dead leaves of *Macaranga tanarius* (Yang et al. 2018b, Tennakoon et al. 2021). Based on multi-gene phylogeny and morphology, we introduce our species as *Diaporthosporella soli* from disturbed cave soil in Thailand. This is the first *Diaporthosporella* species found in the soil, denoting its preferences for various habitats.

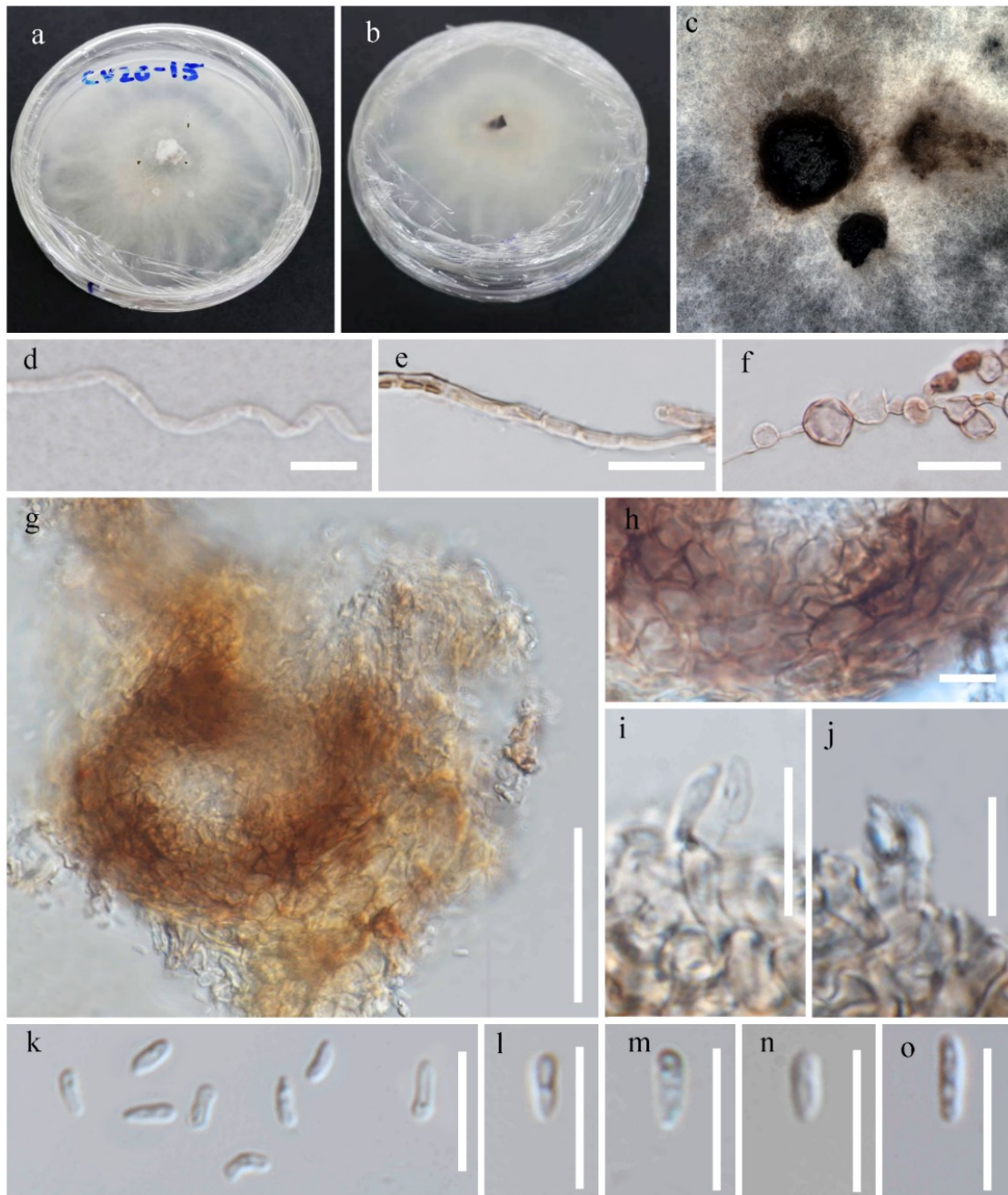


Figure 113 – *Diaporthosporella soli*. (MFLU 25-0137, Holotype). a, b Culture characters on the PDA (b = reverse). c Pycnidia forming on the culture. d Immature hypha. e Mature hyphae. f Chlamydospores. g Pycnidia. h Pycnidia wall. i, j Conidiogenous cells. k–o Conidia. Scale bars: g = 50 µm, e, f = 20 µm, d, h–o = 10 µm.

Magnaporthales Thongk., Vijaykr. & K.D. Hyde

Magnaporthaceae P.F. Cannon

Falciphoriella Hern.-Restr. & Crous, Stud. Mycol. 83: 9 (2016)

Fig. 114

Index Fungorum number: IF816902; Facesoffungi number: FoF10236

Falciphoriella was introduced by Hernández-Restrepo et al. (2016b) based on multi-gene phylogeny (LSU, ITS, *rpb1* and *TEF1-α*), with the type species, *F. solaniterrestris*. The genus is comprised of two species (Species Fungorum 2025), and both of them have molecular data. The

hyphomycetous asexual morph is characterized by hyaline to pale brown, differentiated, indeterminate, and branched conidiophores and phalidic, hyaline to pale brown, terminal or intercalary conidiogenous cells, with hyaline, fusiform, sometimes obovoid, conidia. Species are associated with soil and submerged wood in fresh water and terrestrial habitats located in China and the Netherlands (Hernández-Restrepo et al. 2016b, Wang et al. 2024e).

Table 136 *Falciphoriella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Falciphoriella solaniterrestris</i>	the Netherlands	Potato field	Hernández-Restrepo et al. (2016b)

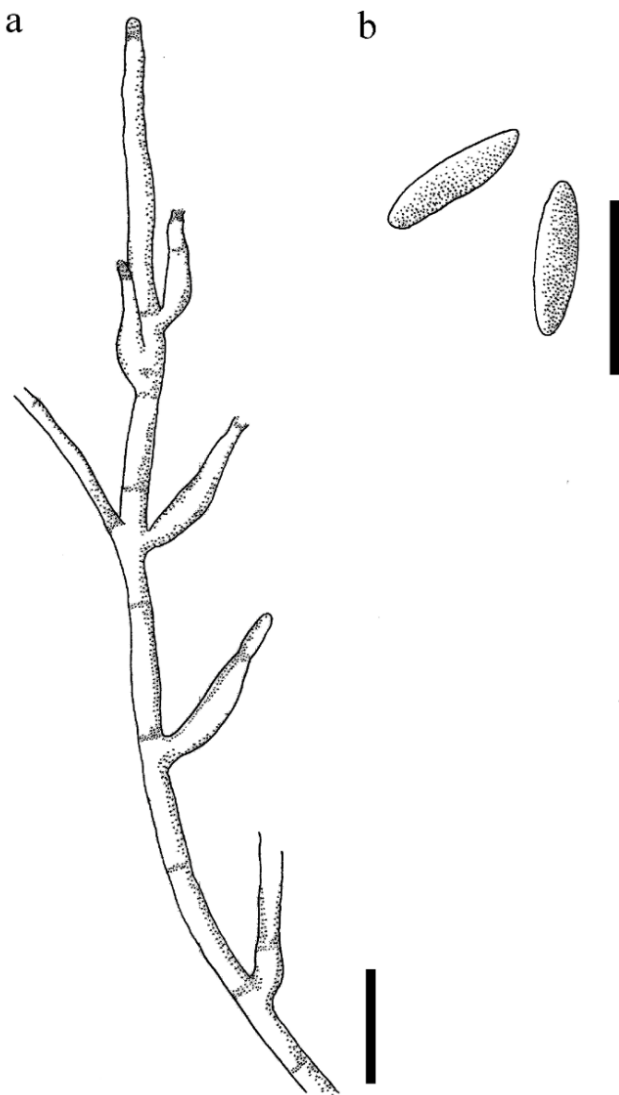


Figure 114 – *Falciphoriella solaniterrestris* (CBS H-22572). a Conidiophores b Conidia. Scale bars: a, b = 10 μm. Redrawn from Hernández-Restrepo et al. (2016b).

Myrmecridiales Crous

Myrmecridiaceae Crous

Myrmecridium Arzanlou, W. Gams & Crous, Stud. Mycol.58: 84 (2007)
 Index Fungorum number: IF504559; Facesoffungi number: FoF07925

Fig. 115

Arzanlou et al. (2007) established *Myrmecridium*, typified by *M. schulzeri* based on LSU and ITS phylogeny. Currently, 23 *Myrmecridium* species are listed in the Species Fungorum (2025) and all of them have molecular data. The genus has a ramichloridium-like asexual morph that is characterized by unbranched, straight or flexuose, brown conidiophores, and terminally integrated, polyblastic, cylindrical, conidiogenous cells. Conidia are solitary, subhyaline, smooth or finely verrucous, obovoidal or fusiform, with a wing-like gelatinous sheath and they are produced from schizolytic conidial secession (Arzanlou et al. 2007). The only known sexual morph is reported from *M. montseguinum* (Hyde et al. 2020c). *Myrmecridium* species are distributed in both terrestrial and aquatic environments, including leaves, marine sediments, reed litter, soil, stems and submerged wood, while some species are eurypsychrophilic, meaning that they can grow at lower temperatures (Peintner et al. 2016). Species have been found in Australia, China, Indonesia, Thailand and the Netherlands (Jiea et al. 2013, Peintner et al. 2016).

Table 137 *Myrmecridium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Myrmecridium flexuosum</i>	Suriname	ND	Arzanlou et al. (2007)
<i>M. obovoideum</i>	China	ND	Jiea et al. (2013)
<i>M. hiemale</i>	Austria	Snow-covered alpine soil	Peintner et al. (2016)
<i>M. schulzi</i>	Germany	Wheat-field soil	

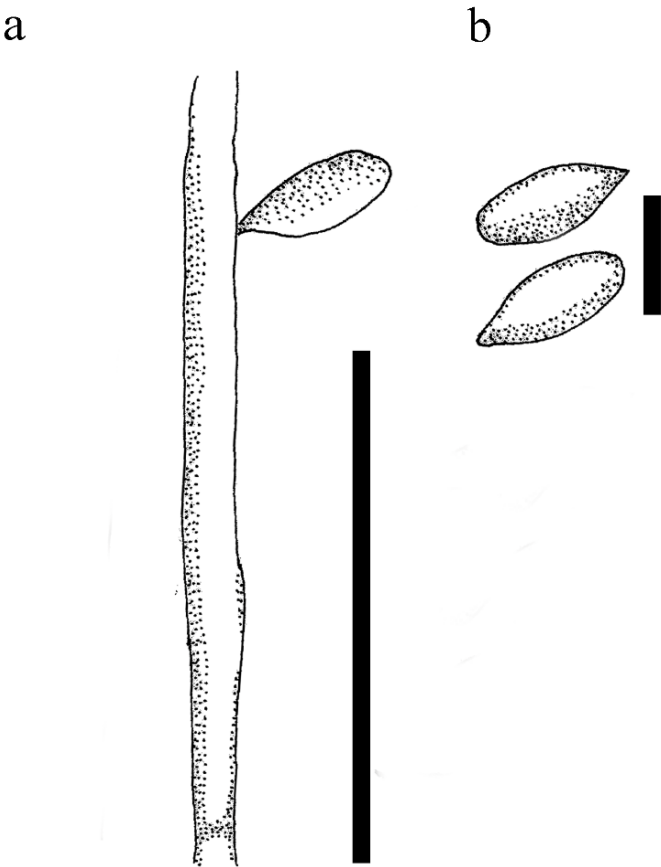


Figure 115 – *Myrmecridium schulzeri* (CBS 325.74). a Conidiogenesis b Conidiogenesis. Scale bars: a, b = 10 µm. Redrawn from Arzanlou et al. (2007).

Ophiostomatales Benny & Kimbr.

Ophiostomataceae Nannf.

Leptographium Lagerb. & Melin, Svensk SkogsvårdsföreningTidskr. 25: 257 (1927) Fig. 116
Index Fungorum number: IF8749; Facesoffungi number: FoF11030

Leptographium was introduced by Lagerberg et al. (1927), and the type species is designated as *L. lundbergii*. The phylogenetic revision of De Beer & Wingfield (2013) described 10 species complexes in *Leptographium sensu lato*. Previously, generic boundaries between *Grosmannia* and *Leptographium* had a controversy; however, currently, they have been recognized as two distinct genera (Wang et al. 2024d). There are 93 species available in the Species Fungorum (2025), and Wang et al. (2024b) have provided LSU and ITS phylogeny using 63 *Leptographium* species. According to De Beer & Wingfield (2013), *Leptographium sensu lato* was predominantly characterized by leptographium-like asexual morphs, while some smaller lineages had synnematosus or raffaelea-like asexual morphs, and they have dark mononematous conidiophores and conidiogenous apparatus that are comprised of a series of apical branches (metulae) with ameroconidia produced in slimy masses (Lagerberg et al. 1927, Weber et al. 1996). The sexual morph has ascomata with long necks and ascospores in slimy masses (Lagerberg et al. 1927). These species are tolerant to high concentrations of cycloheximide in culture, and their cell walls are composed of rhamnose and cellulose (Harrington 1981). *Leptographium* is associated with dung, insects (bark beetles), decaying plant materials, sediments and soil and some species are root pathogens of conifers (Weber et al. 1996, Hyde et al. 2020c). The genus has been found in Canada, Finland, , Mexico, Spain, The UK and the USA (Wang et al. 2024d).

Table 138 *Leptographium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Leptographium reconditum</i>	South Africa	Rhizosphere of <i>Triticum</i>	Jooste (1978)
<i>L. costaricense</i>	Costa Rica	Rhizosphere of <i>Talauma sambuensis</i>	Weber et al. (1996)

a

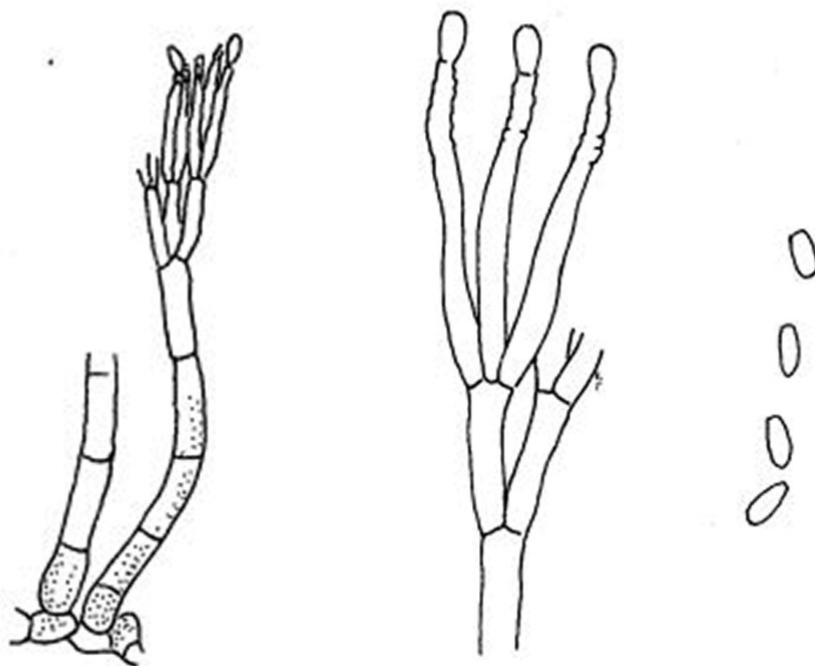


Figure 116 – *Leptographium lundbergii*. a Conidiogenesis on the conidiophores and conidia Redrawn from Seifert et al. (2011).

Sporothrix Hektoen & C.F. Perkins, J. Exp. Med. 5: 80 (1901)

Index Fungorum number: IF10046; Facesoffungi number: FoF10509

Sporothrix was introduced by Hektoen & Perkins (1900), and *S. schenckii* is designated as the type species. Species Fungorum (2025) has listed 98 species in the genus, while 66 of them have molecular data (de Beer et al. 2022). Previously, *S. schenckii* and *Ophiostoma stenoceras* were considered a species complex in *Ophiostoma sensu lato* (Berbee & Taylor 1992). Subsequently, *Sporothrix* was confirmed as a distinct clade from *Ophiostoma sensu stricto* based on multi-gene phylogenetic analyses (LSU, ITS, *TUB2* and *cmdA*) (de Beer et al. 2016). Ostafińska et al. (2021) mentioned that the ITS is the least informative gene region while emphasizing the use of protein genes for the species delineation in the genus. The hyphomycetous asexual morph of *Sporothrix* has sympodially proliferating conidiophores with denticulate conidiogenous cells that produce hyaline or occasionally pigmented conidia. The sexual morph is characterized by dark brown to black, globose, ostiolate ascomata with elongated necks and evanescent, globose to broadly clavate asci, with curved, lunate to reniform, hyaline, aseptate ascospores (De Beer & Wingfield 2013, Hyde et al. 2020c). Some *Sporothrix* species cause disease in humans and animals. Further, they are mostly found in *Protea* sp. and other forest wood substrates, while several species are associated with ambrosia beetles, basidiocarps, human clinical samples, mites, and soil. The genus is distributed in African, American, and Asian regions (Hyde et al. 2020c, Ostafińska et al. 2021).

Table 139 *Sporothrix* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Sporothrix pallida</i>	the Netherlands	A garden	de Meyer et al. (2008)
<i>S. dimorphospora</i>	Canada	ND	de Beer et al. (2022)
<i>S. guttuliformis</i>	Malaysia	ND	
<i>S. inflata</i>	Canada	Wheat field soil	
<i>S. albicans</i>	UK	ND	
<i>S. chilensis</i>	Chile	ND	
<i>S. humicola</i>	South Africa	ND	
<i>S. mexicana</i>	Mexico	ND	
<i>S. bragantina</i>	Brazil	Forest	
<i>S. brunneoviolacea</i>	Spain	Forest	

Diaporthomycetidae families *incertae sedis*

Trichosphaeriaceae G. Winter

Brunneochlamydosporium Giraldo López & Crous, Stud. Mycol. 92: 260 (2018)

Fig. 117

Index Fungorum number: IF 828053; Facesoffungi number: FoF13528

Brunneochlamydosporium was established by Giraldo & Crous (2019) based on morphology and the LSU, ITS, *TEF1-α* and *RPB2* multigene phylogeny, while accommodating the type species, *B. nepalense*, which was previously known as *Acremonium nepalense*. Giraldo & Crous (2019). Currently, the genus accommodates four species (Species Fungorum 2025), and all of them have molecular data. The asexual morph of the genus is hyphomycetous which is characterized by erect, lateral, simple or poorly branched conidiophores. Conidiogenous cells are enteroblastic, monophialidic, and sometimes polyphialidic and produce hyaline, ellipsoidal, cylindrical, 1-celled, smooth-walled conidia arranged in slimy heads. The sexual morph remains unreported. The species have been discovered from dead wood, leaves, river sediments, sputum and soil in Brazil, France, Nepal, Spain, Switzerland and the Netherlands (Giraldo & Crous 2019).

Table 140 *Brunneochlamydosporium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Brunneochlamydosporium nepalense</i>	Nepal	Soil under <i>Pinus</i> sp.	Giraldo & Crous (2019)
<i>B. nepalense</i>	the Netherlands	Scrub sandy soil	
<i>B. nepalense</i>	the Netherlands	Garden soil	
<i>B. terrestre</i>	France	Soil associated with <i>Manihot</i>	

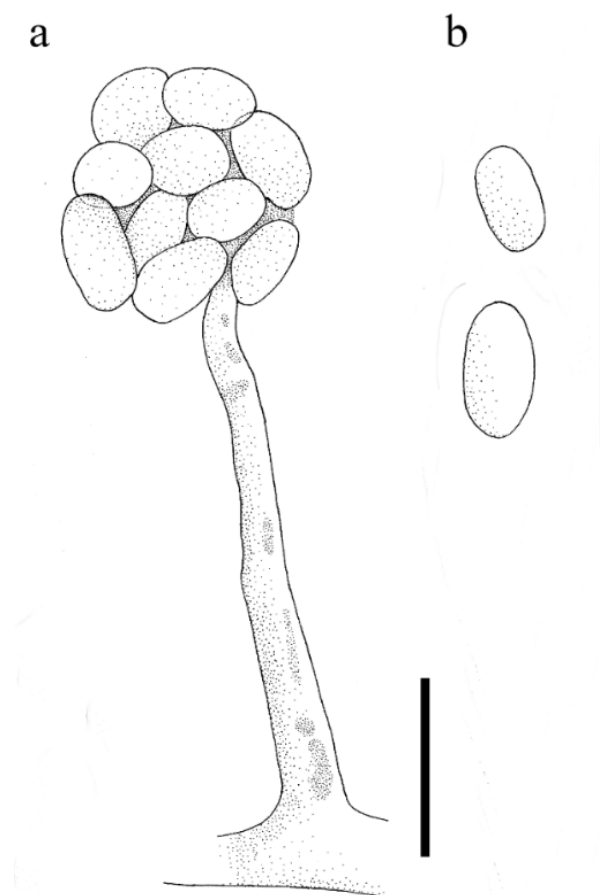


Figure 117 – *Brunneochlamydosporium nepalense* (CBS 971.72). a Conidiogenesis b Conidia. Scale bar: b = 10 μ m, a = 5 μ m,. Redrawn from Giraldo & Crous (2019).

Chordomyces Bilanenko, Georgieva & Grum-Grzhim., Fungal Divers. 71(1): 29 (2015) Fig. 118
Index Fungorum number: IF811265; Facesoffungi number: FoF13530

Grum-Grzhimaylo et al. (2016) erected *Chordomyces* based on morphology and combined LSU and ITS phylogeny, and *Chordomyces antarcticus* is designated as the type species. There are two species recognized in the genus Species Fungorum (2025), and both of them have molecular data. The hyphomycetous asexual morph is characterized by conidiophores that are solitary or form in synnemata, having enteroblastic, mono- or polyphialidic sympodially proliferating conidiogenous cells, and hyaline, subglobose, limoniform, ellipsoidal to cylindrical conidia. The sexual morph is unknown (Grum-Grzhimaylo et al. 2016, Giraldo & Crous 2019). Species are isolated from dead stems, leaf litter and soil habitats (including agricultural fields, gardens, rhizosphere and soda soils) collected from Belgium, Germany, Mongolia and Russia (Giraldo & Crous 2019).

Table 141 *Chordomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Chordomyces albus</i>	the Netherlands	Garden	Giraldo et al. (2019)
<i>C. antarcticus</i>	Russia	Soda soil	
<i>C. antarcticus</i>	the Netherlands	Garden	

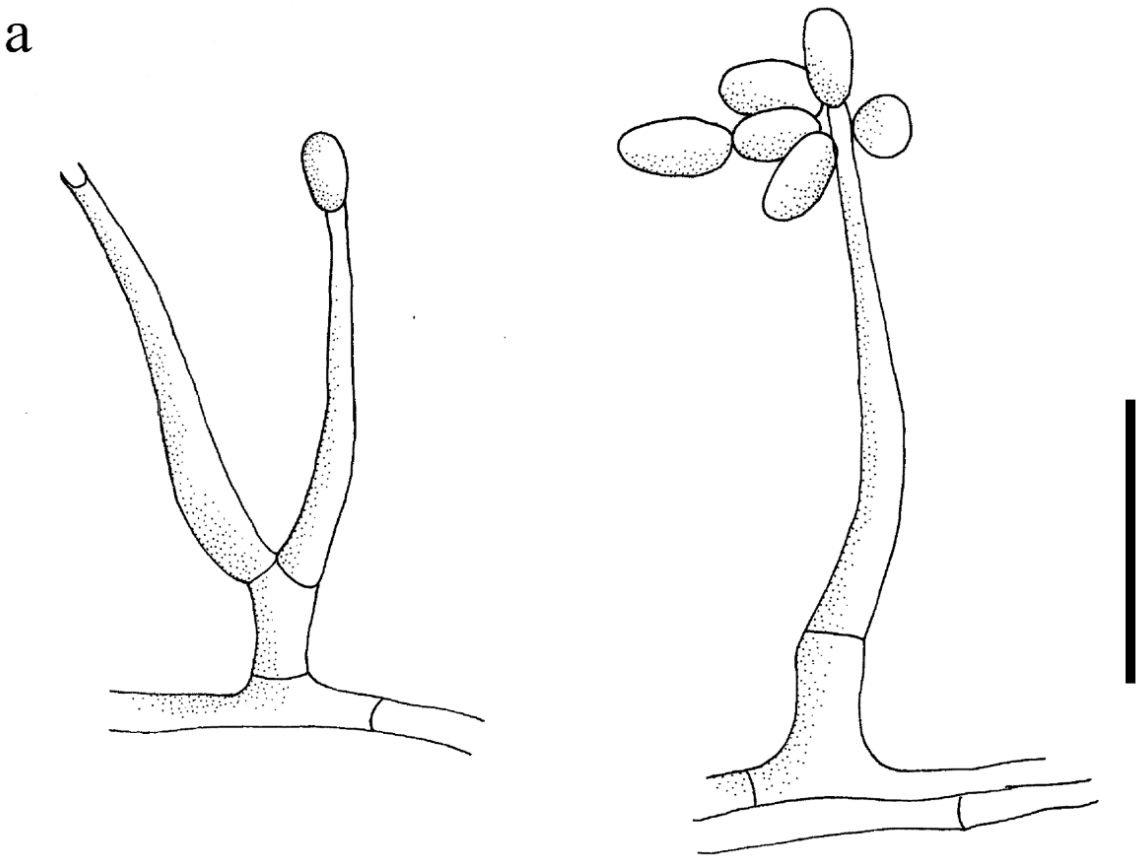


Figure 118 – *Chordomyces antarcticus* (CBS 120045). a Conidiogenesis on conidiophores. Scale bar: a = 10 μ m. Redrawn from Grum-Grzhimaylo et al. (2016).

Furcasterigmium Giraldo López & Crous, Stud. Mycol. 92: 251 (2019) Fig. 119
Index Fungorum number: IF 828041; Facesoffungi number: FoF13531

Giraldo & Crous (2019) introduced *Furcasterigmium* based on morphology and LSU, ITS, *TEF1*- α and *RPB2* combined gene analyses; the type species is designated as *F. furcatum* and only one species is accepted (Species Fungorum 2025). The asexual morph is hyphomycetous, characterized by erect conidiophores with sympodially proliferating, enteroblastic, mono- and polyphialidic conidiogenous cells and ellipsoidal, 1-celled, hyaline, smooth-walled conidia. Sexual morph is unknown. *Furcasterigmium* species has been found in plants and soil in France, Germany, Iran and Italy (Giraldo & Crous 2019).

Table 142 *Furcasterigmium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Furcasterigmium furcatum</i>	France	Dune sand under <i>Calystegia soldanella</i>	Giraldo & Crous (2019)
<i>F. furcatum</i>	Italy	Agricultural soil	
<i>F. furcatum</i>	The Netherlands	Garden	

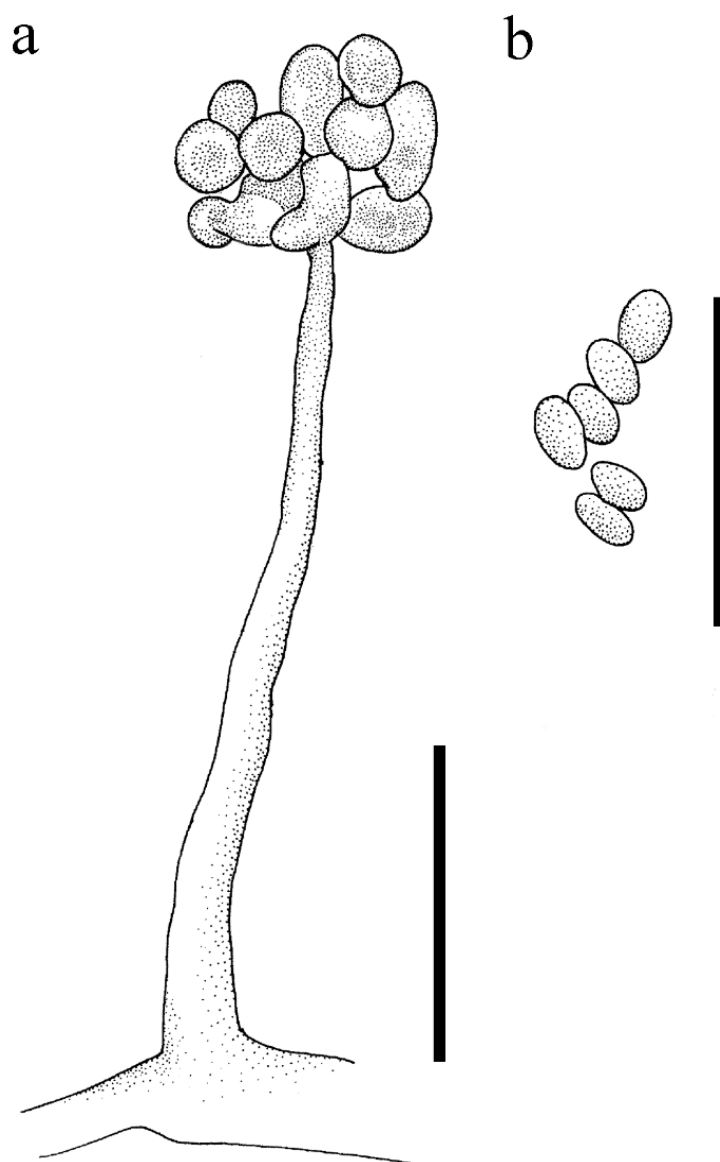


Figure 119 – *Furcaterigmium furcatum* (CBS 122.42). a Conidiophores and slimy heads b Conidia Scale bar: a, b = 10 µm. Redrawn from Giraldo & Crous (2019).

Fuscohypha Giraldo López & Crous, Stud. Mycol. 92: 264 (2019)

Fig. 120

Index Fungorum number: IF828058; Facesoffungi number: FoF13532

Fuscohypha was introduced by Giraldo & Crous (2019) based on morpho-molecular (LSU, ITS, *TEF1-α* and *RPB2*) analyses and *F. expansa* is placed as the type species. Currently, it remains as a monotypic genus. The genus has a hyphomycetous asexual morph characterized by simple or verticillate conidiophores with enteroblastic, monophialidic conidiogenous cells, and sub-globose or ellipsoidal, 1-celled, hyaline conidia that are arranged in slimy heads. The sexual morph is unknown (Giraldo & Crous 2019, Hyde et al. 2020c). The genus has been found in soil and the tuber of *Dioscorea* sp. in Brazil and Martinique (Giraldo & Crous 2019).

Table 143 *Fuscohypha* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Fuscohypha expansa</i>	Brazil	ND	Giraldo & Crous (2019)

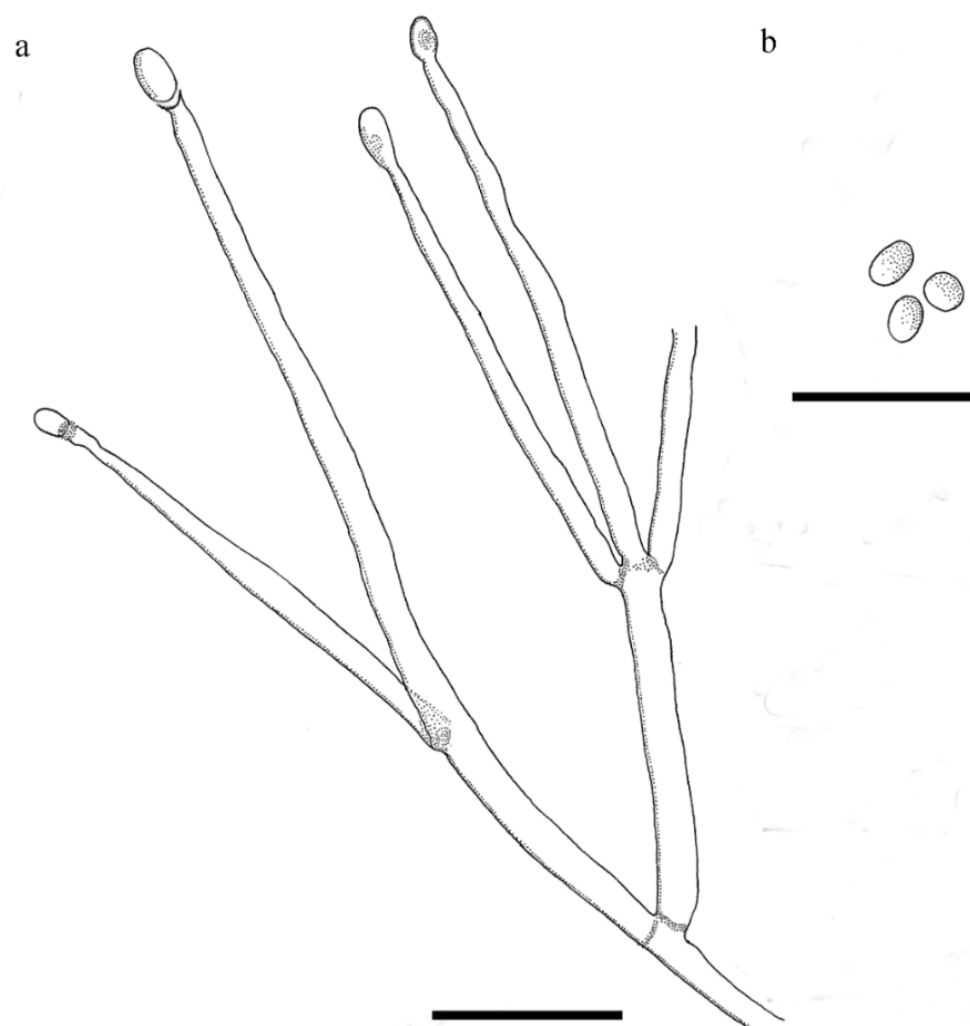


Figure 120. – *Fuscohypha expansa* (CBS 419.89). a Conidiophores b Conidia Scale bar: a, b = 10 μm. Redrawn from Giraldo & Crous (2019).

Gibellulopsis Bat. & H. Maia, Anais Soc. Biol. Pernambuco 16(1): 153 (1959)

Fig. 121

Index Fungorum number: IF8331; Facesoffungi number: FoF13533

Gibellulopsis was introduced by Batista & Maia (1959) and typified by *G. piscis*. However, based on LSU, ITS, *TEF1-α* and *RPB2* phylogeny and the morphology, Giraldo & Crous (2019) designated *G. serrae* as the type species as a result of a new combination derived from *G. piscis* in their study. In Species Fungorum (2025), there are seven species listed under the genus. The asexual morph is hyphomycetous, which comprises erect, mostly terminal conidiophores and conidiogenous cells with collarettes and distinct periclinal thickenings. The conidia are hyaline, elongate, ellipsoidal to cylindrical, 1- or 2-celled, and produced in slimy heads. The species have been isolated from clinical specimens, seeds, soil, wrapping material and wool in Argentina, Canada, Denmark, Finland, France, Germany, Israel, Sweden and the Netherlands (Giraldo & Crous 2019, Hyde et al. 2020c).

Table 144 *Gibellulopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Gibellulopsis fusca</i>	India	ND	Giraldo & Crous (2019)
<i>G. fusca</i>	The Netherlands	Garden	
<i>G. nigrescens</i>	Israel	ND	
<i>G. nigrescens</i>	The Netherlands	Sandy soil	

<i>G. nigrescens</i>	The Netherlands	Soil under lawn
<i>G. serrae</i>	Israel	ND
<i>G. serrae</i>	New Zealand	ND
<i>G. serrae</i>	Argentina	Soil of <i>Glycine max</i>
<i>G. serrae</i>	Israel	Soil in cotton field

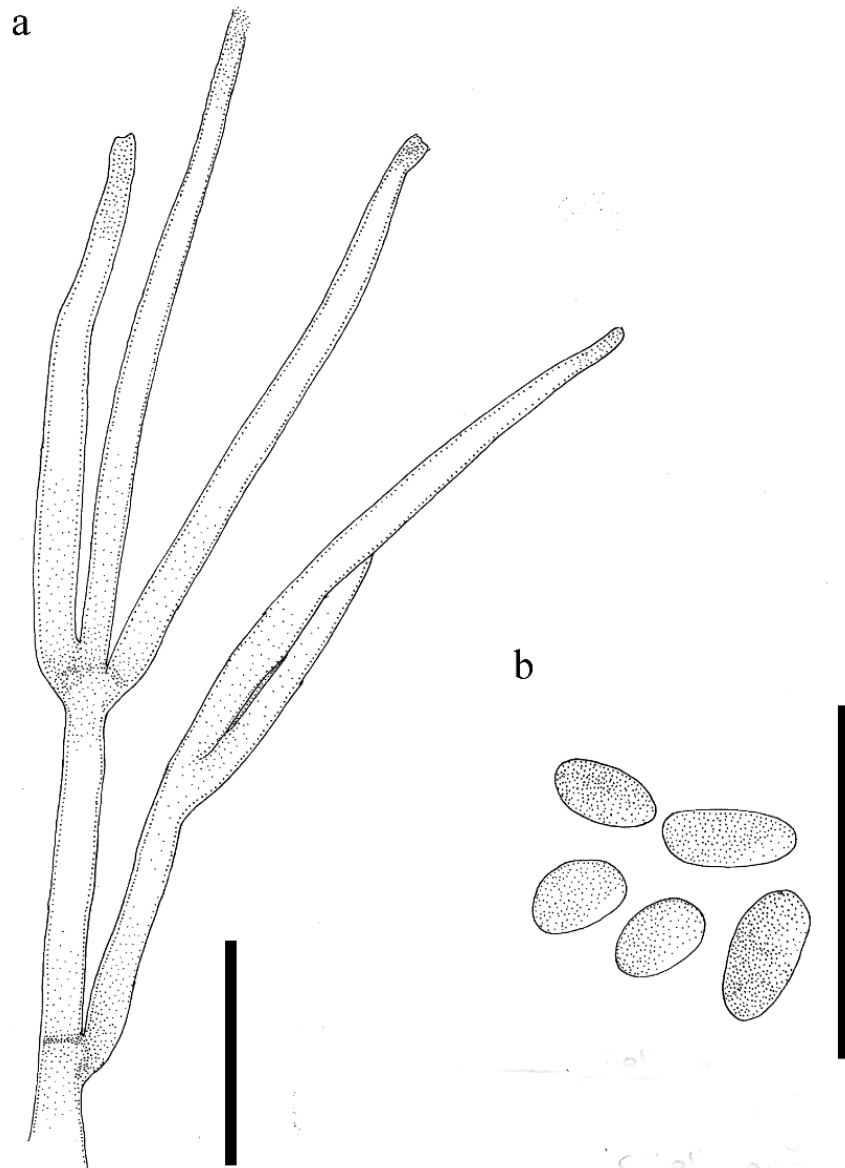


Figure 121 – *Gibellulopsis serrae* (CBS 101221). a. Conidiophores. (CBS 892.70) b. Conidia. Scale bar: a = 10µm. Redrawn from Giraldo & Crous (2019).

Lectera P.F. Cannon, MycoKeys 3: 28 (2012) Fig. 122
Index Fungorum number: IF550041; Facesoffungi number: FoF13534
Lectera was established by Cannon et al. (2012), assigning *L. colletotrichoides* as the type species. Six species are currently accepted in the genus (Cannon et al. 2012a, Species Fungorum 2025), and all the species are supported by molecular data. *Lectera* was delineated based on the conidial size, and the ITS and *GAPDH* genes (Crous et al. 2017b, Hyde et al. 2020c). The asexual morph is characterized by sporodochial or acervular, pink or flesh-coloured, globose to subglobose conidiomata that do not possess a clear upper wall, and conidiophores are often reduced to conidiogenous cells that produce navicular or fusiform conidia. The sexual morph is unknown (Cannon et al. 2012a, Giraldo & Crous 2019). Species have been identified as pathogens or

saprobies inhabiting plants and soils from Australia, Brazil, Egypt and Malaysia (Cannon et al. 2012a, Giraldo & Crous 2019).

Table 145 *Lectera* species isolated from soil

Species	Country	Habitat or soil type	References
<i>L. colletotrichoides</i>	Brazil	ND	Cannon et al. (2012a)
<i>L. humicola</i>	Brazil	ND	
<i>L. nordwiniana</i>	Garden	The Netherlands	

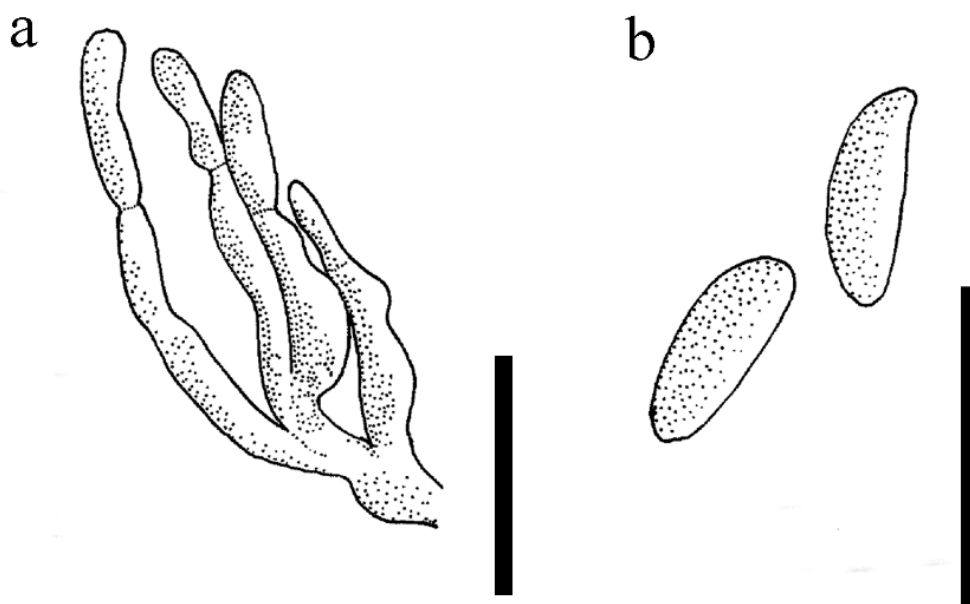


Figure 122 – *Lectera colletotrichoides* ((IMI 332702). a Conidiogenous cells. b Conidia. Scale bar: a = 10µm. Redrawn from Giraldo & Crous (2019).

Paramusicillium Giraldo López & Crous, Stud. Mycol. 92: 269 (2019)

Fig. 123

Index Fungorum number: IF828067; Facesoffungi number: FoF16638

Paramusicillium is a monotypic genus introduced by Giraldo & Crous (2019) based on morphology and the multi-gene phylogeny (LSU, ITS, *TEF1-α* and *RPB2*), *Paramusicillium asperulatum* (= *Musicillium theobromae*) as the type species. Due to the distant phylogeny and conidiophore morphology, *M. theobromae* was separated from *Musicillium* and established *Paramusicillium* (Giraldo & Crous 2019, Hyde et al. 2020c). The hyphomycetous asexual morph is characterized by septate, repeatedly verticillate towards the apex, distinctly brown pigmented conidiophores, enteroblastic, monophialidic conidiogenous cells, and ellipsoidal or cylindrical, 1-celled, smooth-walled conidia that are in slimy heads and appear in pale brown when in mass. The sexual morph remains undetermined. *Paramusicillium asperulatum* is identified as a postharvest pathogen in fruits and also inhabits soil substrates in Argentina, China, Egypt, Sao Tome and Principe (Youssef et al. 2020).

Table 146 *Paramusicillium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Paramusicillium asperulatum</i>	Sao Tome and Principe	ND	Giraldo & Crous (2019).

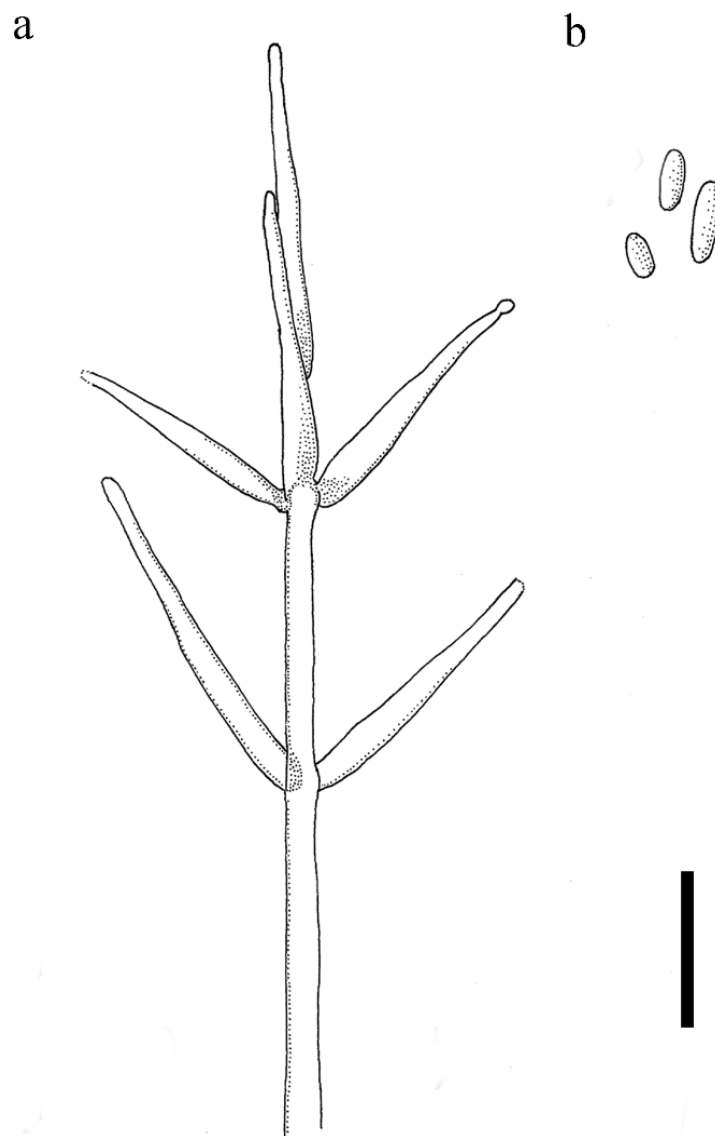


Figure 123 – *Paramusicillium asperulatum* a. Conidiophores. b. Conidia. Scale bar: a, b = 10µm. Redrawn from Giraldo & Crous (2019).

Phialoparvum Giraldo López & Crous, Stud. Mycol. 92: 265 (2019)

Fig. 124

Index Fungorum number: IF828063; Facesoffungi number: FoF13539

Giraldo & Crous (2019) introduced *Phialoparvum* with its type species *P. bifurcatum*, based on morpho-molecular (LSU, ITS, *TEF1-α* and *RPB2*) studies. Currently, three *Phialoparvum* species are listed in Species Fungorum (2025) and all of them are supported by molecular data. The asexual morph is hyphomycetous; having erect, unbranched or poorly branched conidiophores and enteroblastic, mono- and polyphialidic conidiogenous cells. Conidia are hyaline, 1-celled, smooth-walled and are arranged in slimy heads. The sexual morph is undetermined (Giraldo & Crous 2019). The species have been discovered from plant roots and soil in Belgium, China and the Netherlands (Giraldo et al. 2019).

Table 147 *Phialoparvum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Phialoparvum rietveldiae</i>	the Netherlands	Garden	Giraldo & Crous (2019)
<i>P. maaspleinense</i>	the Netherlands	Garden	
<i>P. bifurcatum</i>	Belgium	ND	

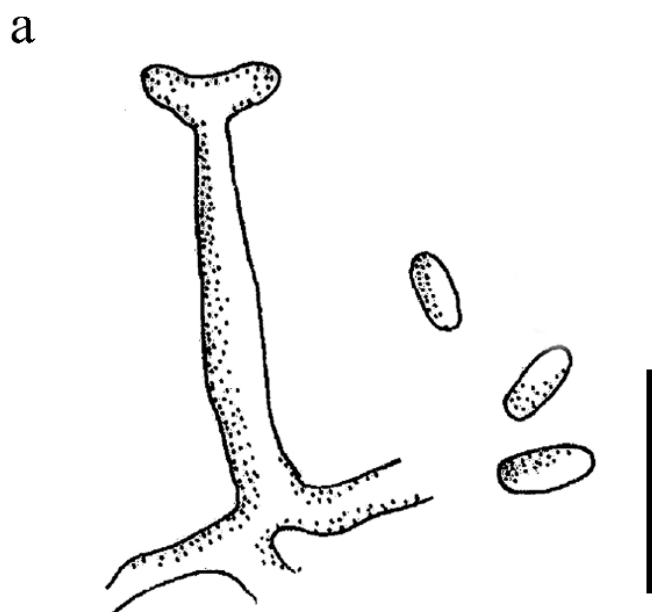


Figure 124 – *Phialoparvum bifurcatum* (CBS 299.70B). a Conidiogenesis on conidiophores. b Conidia Scale bar: a, b = 10 μm. Redrawn from Giraldo & Crous (2019).

Plectosphaerella Kleb., Phytopath. Z. 1: 43 (1929)

Fig. 125

Index Fungorum number: IF4197; Facesoffungi number: FoF01335

Plectosphaerella was introduced by Klebahn (1929), with *P. cucumerina* as the type species. The genus accommodates 25 species (Species Fungorum 2025), while 23 species are supported by molecular data (LSU, ITS, *TEF1-α* and *RPB2*). Previously, the genus was placed in *Hypocreaceae* and subsequently in *Sordariaceae* Domsch et al. (1973); however, it is currently placed in *Plectosphaerellaceae* (Zare et al. 2007, Yang et al. 2021b). The asexual morph is hyphomycetous, and has hyaline, simple and poorly branched conidiophores with enteroblastic, mono- and polyphialidic conidiogenous cells. Conidia are hyaline, cylindrical 1- or 2-celled, smooth-walled, and arranged in slimy heads (Giraldo et al. 2019, Klebahn 1929). The sexual morph is characterized by perithecial, solitary or gregarious, superficial, sub-globose to pyriform ascomata with dark brown basal part and paler at the neck. Asci are unitunicate, cylindrical, clavate, thin-walled, 8-spored, and containing 2- celled, hyaline, smooth to slightly warted ascospores. Species are present on leaves, papers, plant roots and soil in Brazil, Canada, Italy, Spain, the Netherlands and the USA (Giraldo et al. 2019, Giraldo & Crous 2019).

Table 148 *Plectosphaerella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Plectosphaerella cucumerina</i>	The Netherlands	Garden	Giraldo & Crous (2019)
<i>P. hanneae</i>	The Netherlands	Garden	
<i>P. humicola</i>	Congo	ND	
<i>P. oligotrophica</i>	Brazil	ND	
<i>P. pauciseptata</i>	The Netherlands	Garden	
<i>P. plurivora</i>	Germany,	ND	
<i>P. plurivora</i>	The Netherlands	Garden	
<i>P. verschoorii</i>	The Netherlands	Garden	

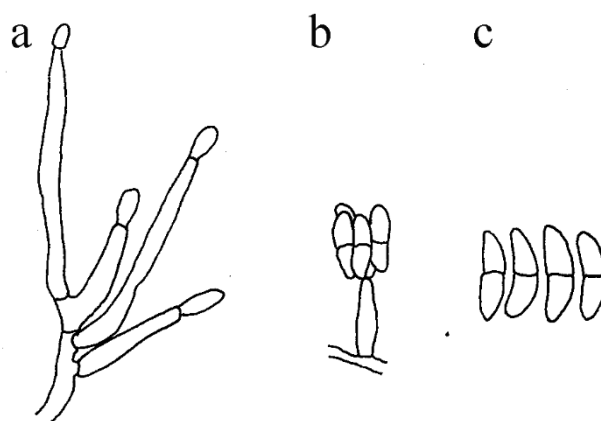


Figure 125 – *Plectosphaerella cucumerina*. a, b Conidophores. c Conidia. Redrawn from Domsch et al. (1993).

Sayamraella Giraldo López & Crous, Stud. Mycol. 92: 255 (2019)

Fig. 126

Index Fungorum number: IF828047; Facesoffungi number: FoF13540

Sayamraella is a monotypic genus, which was introduced by Giraldo & Crous (2019) based on morpho-molecular analyses (LSU, ITS, *TEF1-α* and *RPB2*) along with *S. subulata*, isolated from soil, as the type species (Giraldo & Crous 2019). The asexual morph is hyphomycetous and characterized by sympodially proliferating conidiophores with conidiogenous cells, having minute, cylindrical collarettes and an inconspicuous periclinal thickening at the conidiogenous locus; and hyaline, ellipsoidal, and 1-celled conidia, arranged in slimy heads (Giraldo & Crous 2019). The sexual morph is undetermined.

Table 149 *Sayamraella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Sayamraella subulata</i>	Thailand	Soil associated with <i>Hopea odorata</i>	Giraldo & Crous (2019)

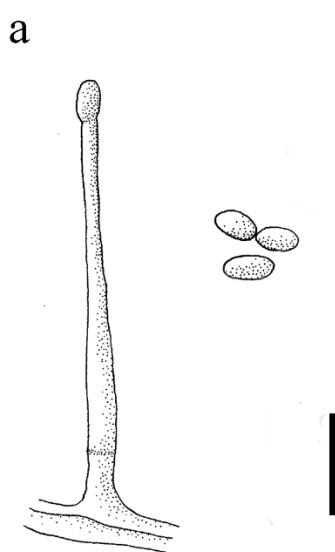


Figure 126 – *Sayamraella subulata* (BCC 78964). a Simple conidiophore and conidia Scale bar: a = 10 μm. Redrawn from Giraldo & Crous (2019).

Sodiomyces Grum-Grzhim., Debets & Bilanenko ex S.A. Bondarenko, Grum-Grzhim., Debets & Bilanenko, Fungal Diversity 76(1): 52 (2015) [2016] Fig. 127

Index Fungorum number: IF92131; Facesoffungi number: FoF13541

Sodiomyces was introduced by Grum-Grzhimaylo et al. (2016) with the type species *S. alkalinus*. The genus was established based on ITS, LSU, SSU, *RPB2* and *TEF1-α* phylogeny and morphological support (Grum-Grzhimaylo et al. 2016), and currently, the genus comprises four species (Species Fungorum 2025), and all of them have molecular data. The asexual morph has weakly branched or penicillate, hyaline conidiophores and enteroblastic, monophialidic conidiogenous cells. Conidia are hyaline, subglobose, cylindrical to oval or allantoid and 1-celled. The sexual morph of the genus has cleistothecial, superficial, globose, dark-brown ascomata and unitunicate, saccate, thin-walled asci without an apical apparatus, and pale brown, ovoid, 2-celled ascospores. *Sodiomyces alkalinus* is known as a holomorphic, alkaliphilic species (Grum-Grzhimaylo et al. 2016). Most *Sodiomyces* species are discovered from animal feces, sludge and soil collected from Japan, Kenya, Mongolia and Thailand (Giraldo & Crous 2019).

Table 150 *Sodiomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Sodiomyces alkalinus</i>	Mongolia	Soda soil	(Grum-Grzhimaylo et al.
<i>S. magadii</i>	Kenya	Soda soil	(2016)
<i>S. tronii</i>	Kenya	Soda soil	

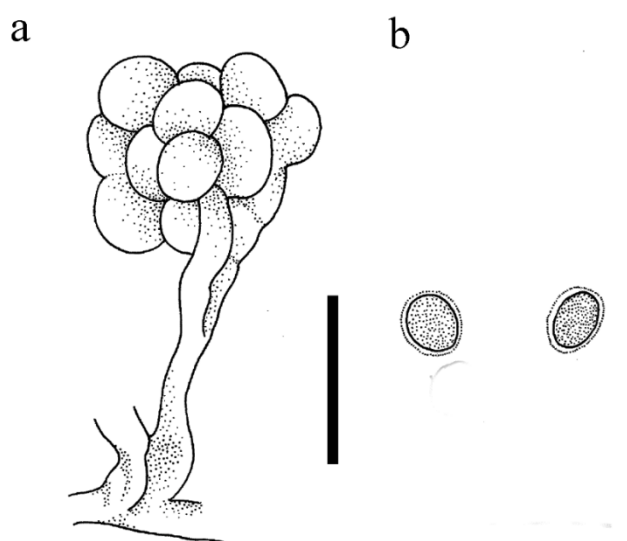


Figure 127 – *Sodiomyces alkalinus*. a. Conidiophore. b. Conidia Scale bar: a, b = 10µm. Redrawn from Grum-Grzhimaylo et al. (2016).

Stachylidium Link, Mag. Gesell. Naturf. Freunde, Berlin 3(1–2): 15 (1809) Fig. 128

Index Fungorum number: IF10053; Facesoffungi number: FoF13542

Stachylidium was introduced by Link (1809) without designating a type species (Hughes 1951b). Gams (2017) designated *S. bicolor* (L2923) as the type species of the genus. Subsequently, Giraldo & Crous (2019) have studied the specimens deposited by Link and proposed B700016303 (*S. bicolor*) as the most suitable lectotype. Currently, seven species are listed in the genus (Species Fungorum 2025), and only two of them have molecular data. The hyphomycetous asexual morph is characterized by septate, verticillate conidiophores arranged singly or in groups, and enteroblastic, hyaline or pale brown, monophialidic conidiogenous cells in whorls, with pale brown to brown, ellipsoidal or cylindrical, 1-celled conidia. The sexual morph is unknown. The species are

distributed in India, Nepal, Spain, Thailand, and Turkey, occurring in decaying plants and soil (Giraldo & Crous 2019).

Table 151 *Stachylidium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Stachylidium pallidum</i>	Nepal	Soil under <i>Abies</i> sp.	Giraldo & Crous (2019)
<i>S. pallidum</i>	Thailand	ND	

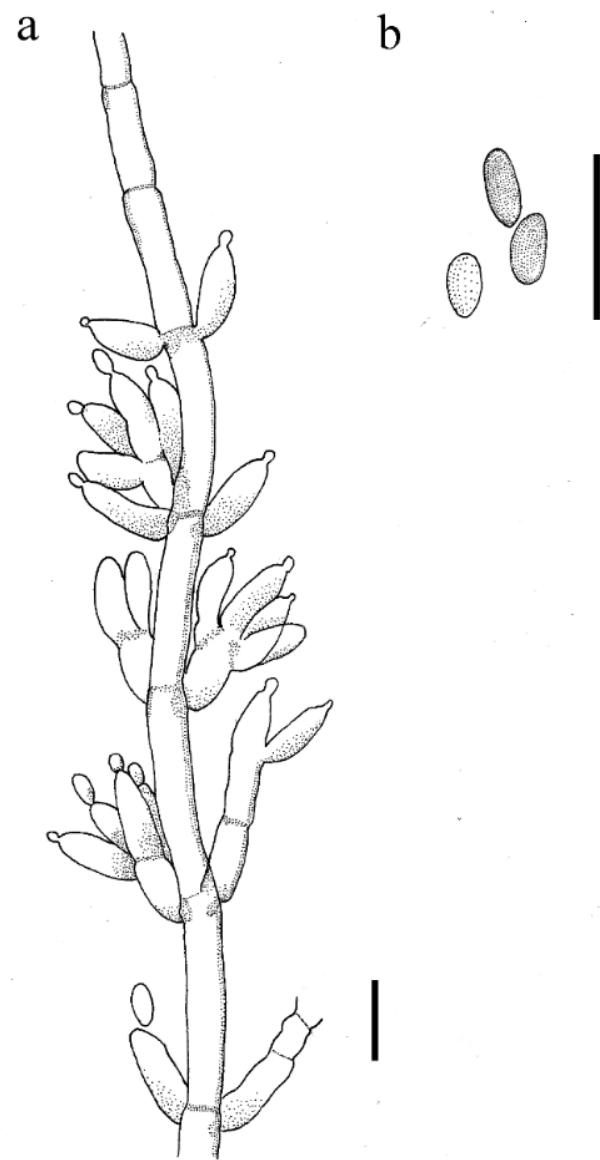


Figure 128 – *Stachylidium bicolor* (CBS 121802). a Conidiophore and conidiogenous cells b Conidia. Scale bar: a, b = 10µm. Redrawn from Giraldo & Crous (2019).

Summerbellia Giraldo López & Crous, Stud. Mycol. 92: 252 (2019)

Fig. 129

Index Fungorum number: IF828043; Facesoffungi number: FoF13543

Summerbellia is a monospecific genus that was introduced by Giraldo & Crous (2019) based on ITS, LSU, SSU, and *TEF1-α* gene regions, accommodating *S. oligotrophica* as the type species. The asexual morph is characterized by erect or (sub-)erect, unbranched or poorly branched conidiophores and enteroblastic, monophialidic, hyaline conidiogenous cells that produce ellipsoidal or cylindrical, 1-celled, hyaline, smooth-walled conidia arranged in slimy heads. The

sexual morph remains undetermined. The species has been isolated from a bath towel, grapefruit juice cans and soil found in Australia, Indonesia, and the USA (Giraldo & Crous 2019).

Table 152 *Summerbellia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Summerbellia oligotrophica</i>	Indonesia	Alkaline soil	Giraldo & Crous (2019)

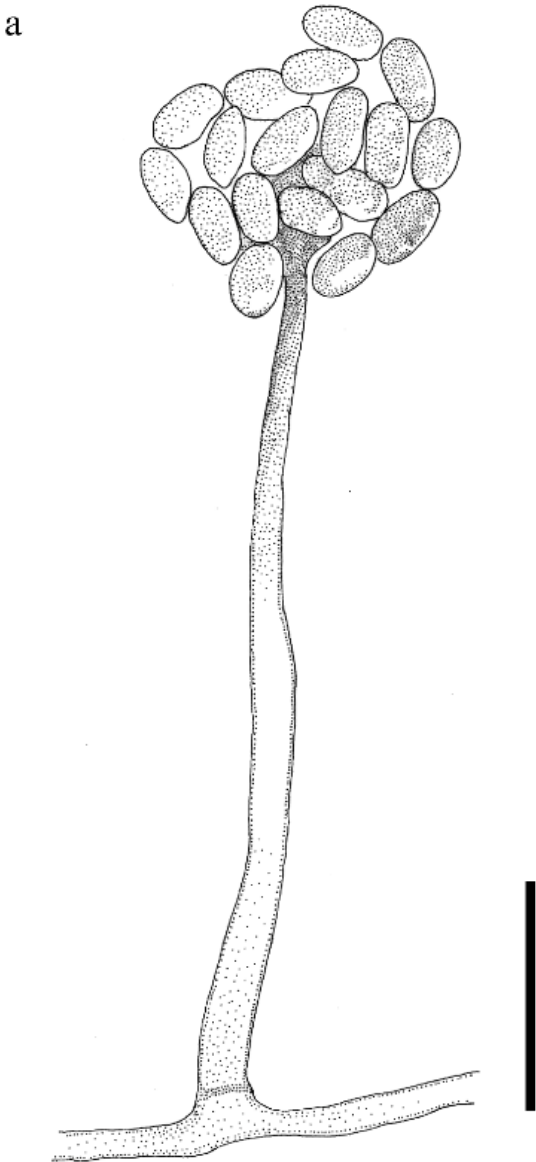


Figure 129 – *Summerbellia oligotrophica* (CBS 657.94). a Conidiophore and conidia. Scale bar: a =10 µm. Redrawn from Giraldo & Crous (2019).

Verticillium Nees, Syst. Pilze (Würzburg): 57 (1816)

Fig. 130

Index Fungorum number: IF10400; Facesoffungi number: FoF00162

Initially, *Verticillium* was introduced with the type species *V. tenerum*; however, that was later synonymized to *V. luteoalbum* (Subramanian 1971); but this species was subsequently transferred to *Acrostalagmus* by Zare et al. (2004). As a result, Gams et al. (2005) proposed *V. dahlia* as the type species in *Verticillium* to conserve the *Verticillium* name. The genus is comprised of 80 species (Species Fungorum 2025), and they are supported by ITS, LSU, SSU, *RPB2* and

TEF1-α molecular data (Giraldo & Crous 2019). The asexual morph is characterized by mostly verticillate, septate, hyaline to sub-hyaline conidiophores, and enteroblastic, monophialidic, flask-shaped or aculeate conidiogenous cells, with hyaline, ellipsoidal or cylindrical and 1-celled or rarely 2-celled conidia. The sexual morph is unknown. Species are associated with dead and living plant materials, dung, and soils, while some of them are plant pathogenic fungi. *Verticillium* is a globally reported genus, including Canada, Japan, New Zealand, the Netherlands, the UK and the USA (Domsch et al. 1993, Giraldo & Crous 2019).

Table 153 *Verticillium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Verticillium albo-atru</i>	Canada	Soil from potato field	Giraldo & Crous (2019)
<i>V. dahlia</i>	the Netherlands	ND	
<i>V. isaacii</i>	Israel	Soil from potato field	
<i>V. nubilum</i>	the UK	ND	
<i>V. tricorpus</i>	New Zealand	ND	
<i>V. tricorpus</i>	Israel	Soil from potato field	

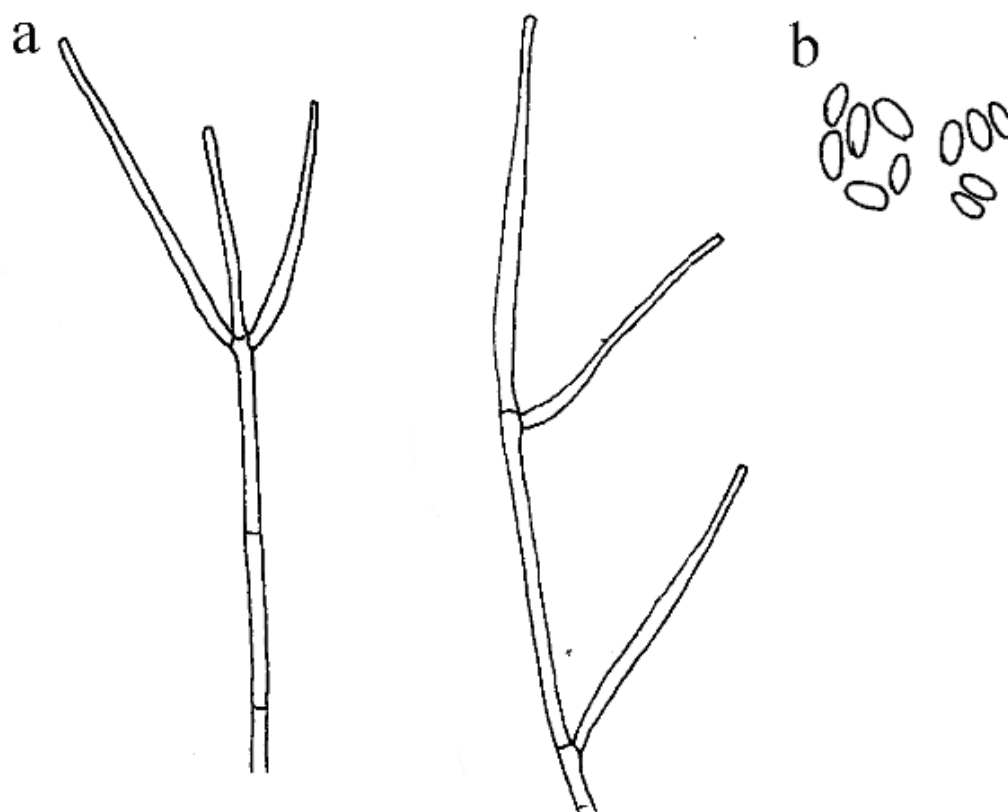


Figure 130 – *Verticillium dahliae* (CBS 205.26). a Conidiophore. b Conidia. Redrawn from Domsch et al. (1993).

Trichosphaeriaceae genera *incertae sedis*

Acrostalagmus Corda, Icon. fung. (Prague) 2: 15 (1838)

Fig. 131

Index Fungorum number: IF7044; Facesoffungi number: FoF13527

Corda (1838) introduced *Acrostalagmus* with its type species, *A. cinnabarinus*. However, *Sporotrichum luteoalbum*, which was later considered *Verticillium luteoalbum* (Subramanian 1971), was found to have an identical morphology with *A. cinnabarinus* (Zare et al. 2004). Thus, a new combination, *A. luteoalbus*, and was designated as the type species (Zare et al. 2004). Giraldo & Crous (2019) provided a recent phylogeny for this genus based on LSU, ITS, *TEF1-α* and *RPB2*

gene regions. There are 13 species available in *Acrostalagmus* (Species Fungorum 2025). The hyphomycetous asexual morph consists of mononematous or synnematous, distinctly bright orange to reddish, branched conidiophores and enteroblastic, sub-hyaline to pale orange, monopialidic, flask-shaped, conidiogenous cells. Conidia are bright orange to reddish, oval, ellipsoidal to oblong-ellipsoidal and 1-celled. The sexual morph is unknown (Zare et al. 2004, Giraldo & Crous 2019). Some species have cosmopolitan distribution and have been found from birds' feathers and nests, cotton fibres, dung, decaying wood, different types of soil, litter, plant roots, and seeds in Canada, Germany, the Netherlands and the UK (Mohammadi 2015, Giraldo & Crous 2019). Species are known for producing bioactive compounds, which are utilized for drug development (Shi et al. 2023).

Table 154 *Acrostalagmus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Acrostalagmus luteoalbus</i>	The Netherlands	A Garden	Giraldo & Crous (2019)
<i>A. luteoalbus</i>	Russia	Soda soil	
<i>A. annulatus</i>	Brazil	ND	

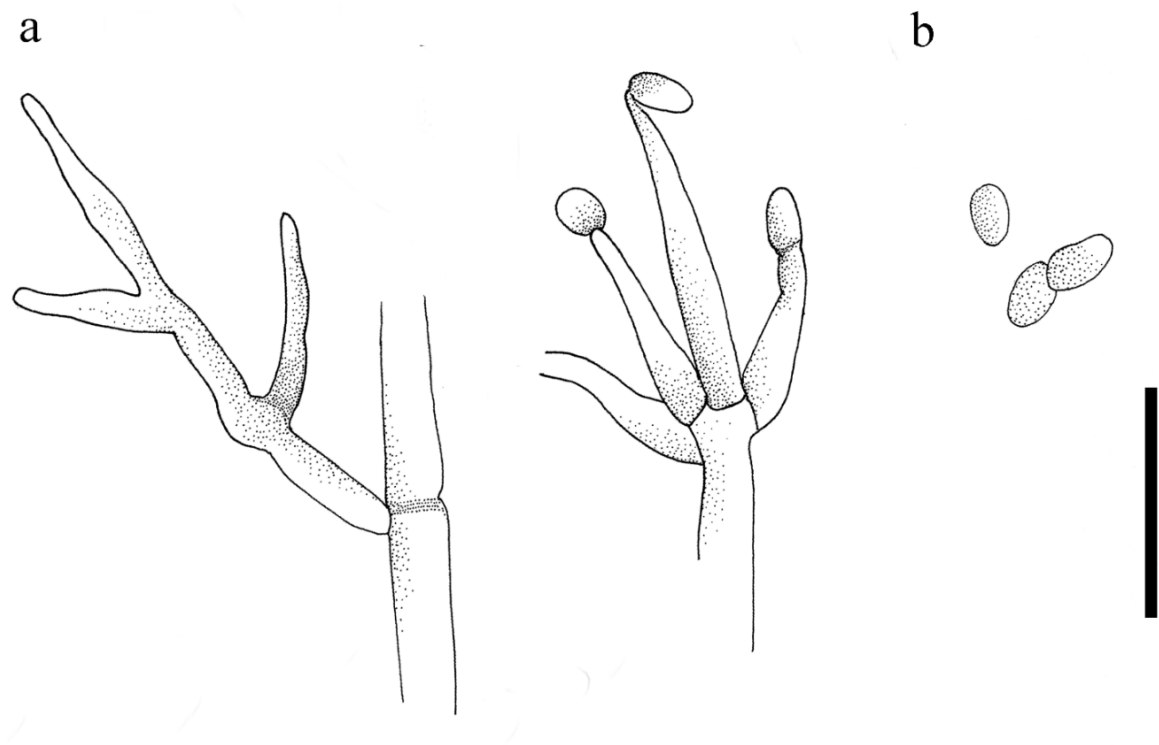


Figure 131 – *Acrostalagmus luteoalbus* (CBS 121214). a Conidiophore with phialides b Conidia. Scale bar: a, b = 10µm. Redrawn from Giraldo & Crous (2019).

Hypocreomycetidae O.E. Erikss. & Winka

Coronophorales Nannf. (= *Melanosporales* N. Zhang & M. Blackw.)

Ceratostomataceae G. Winter

Dactylidispora Y. Marín, Stchigel, Guarro & Cano, MycoKeys 44: 89 (2018)

Index Fungorum number: IF812079; Facesoffungi number: FoF10514

Marin-Felix et al. (2018) introduced *Dactylidispora* using multi-gene phylogeny (ITS, LSU, *Actin*, and *TEF1-α*) and morphology while transferring several *Microthecium* and *Melanospora* species, and the type species is designated as *D. ellipsospora*. Currently, three species are listed in

Dactylidispora (Species Fungorum 2025), and all of them have molecular data. The sexual morph is characterized by globose to pyriform, yellowish-brown to dark brown, glabrous, or setose, short, conical ascomata with or without ostiole, and membranaceous, cells of *textura angularis* in ascomatal wall, and lacking paraphyses. Asci are characterized by 8-spored, broadly clavate, short-stipitate and evanescent, and containing ascospores that are 1-celled, fusiform or citriform, umbonate initially hyaline, becoming brown to dark brown when mature. All the species are isolated from soil substrates (Marin-Felix et al. 2018, Hyde et al. 2020c).

Table 155 *Dactylidispora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Dactylidispora collipora</i>	India	ND	Stchigel et al. (1997)
<i>D. ellipsospora</i>	Papua New Guinea	Forest	Marin-Felix et al. (2018)
<i>D. singaporensis</i>	Singapore	ND	

Echinusithec Y. Marín, Stchigel, Dania García, Guarro, A.N. Mill. & Cano, MycoKeys 44: 91 (2018)

Index Fungorum number: IF812084; Facesoffungi number: FoF10515

Marin-Felix et al. (2018) introduced *Echinusithec* based on ITS, LSU, *Actin* and *TEF1-α*, and the morphological support, while designating *E. citrispora* as the type species. It is a monotypic genus (Species Fungorum 2025), supported by molecular data (ITS, LSU, SSU and *TEF1-α*). The asexual morph remains undetermined. The sexual morph is characterized by superficial or immersed, solitary to gregarious, globose, non-ostiolate ascomata, 8-spored, globose to subglobose, non-stipitate asci, and hyaline, ellipsoidal, one-celled, smooth-walled ascospores with a depressed germ pore at each end and becoming brown to dark brown when mature (Marin-Felix et al. 2018).

Table 156 *Echinusithec* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Echinusithec citrispora</i>	USA	Forest	Marin-Felix et al. (2018)

Vittatispora P. Chaudhary, J. Campb., D. Hawksw. & K.N. Sastry, Mycologia 98(3): 461 (2006) Fig. 132

Index Fungorum number: IF500705; Facesoffungi number: FoF10525

Vittatispora was introduced by Chaudhary et al. (2006) and typified by *V. coorgii*. Marin-Felix et al. (2018) has suggested the phylogenetic placement of *Vittatispora* within *Coronophorales* using the ITS, LSU, *Actin* and *TEF1-α* multi-gene phylogeny. Subsequently, Huang et al. (2021a) described its placement within *Hypocreomycetidae* while providing the ITS, LSU, SSU, *TEF1-α*, *RPB2* and *TUB2* phylogeny. Currently, it remains as a monotypic genus. The asexual morph is unreported (Chaudhary et al. 2006, Hyde et al. 2020c) and the sexual morph is characterized by perithecial, solitary or gregarious, globose ascomata with a long cylindrical neck, a membranaceous wall with brown cells of *textura angularis*, 8-spored, clavate, ellipsoidal to citriform asci, and brown to dark brown ascospores with two apical germ pores surrounded by a raised rim and a thick vertical hyaline ridge running connecting the germ pores (Chaudhary et al. 2006).

Table 157 *Vittatispora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Vittatispora coorgii</i>	India	Plateau of the western Ghats	Chaudhary et al. (2006)

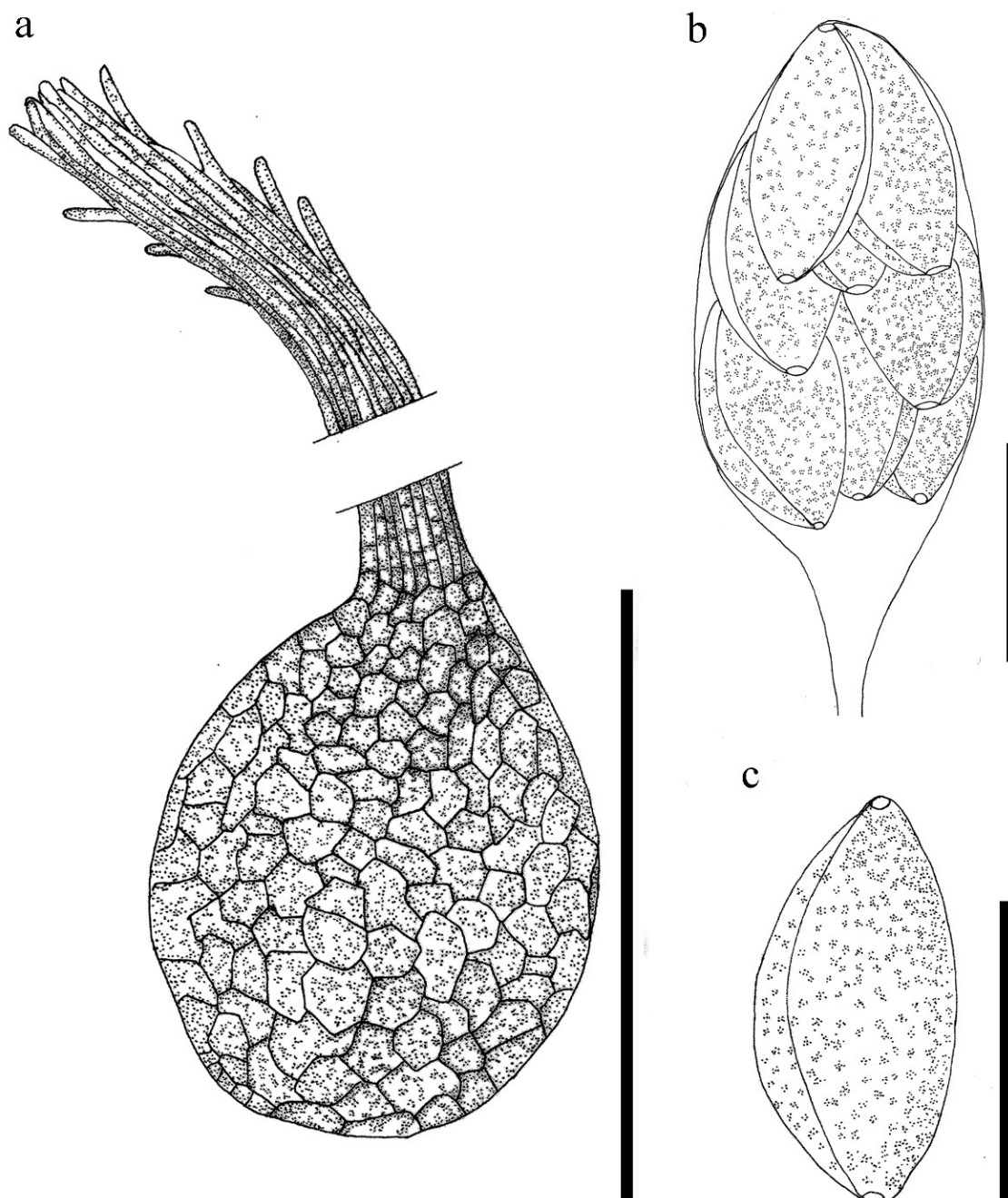


Figure 132 – *Vittatispora coorgii* (BICC 7817). a Immature ascoma with cell walls b Ascus. c Ascospore. Scale bars: a=200µm, b,c= 5µm. Redrawn from Huang et al. (2021a).

Glomerellales Chadeff. ex Réblová, W. Gams & Seifert

Glomerellaceae Locq. ex Seifert & W. Gams

Colletotrichum Corda, in Sturm, Deutschl. Fl., 3 Abt. (Pilze Deutschl.) (12): 41 (1831)

Index Fungorum number: IF 7737; Facesoffungi number: FoF00144

Colletotrichum was introduced by Corda (1831), and the type species is designated as *C. lineola*. Based on the combined phylogeny (ITS, *TUB2*, *Actin*, *CHS-1*, *GAPDH*, *cmdA*, GS, and SOD2), Cannon et al. (2012b) revised the genus with 113 accepted species and nine species complexes. A study of Liu et al. (2022) has accepted 80 species, 16 species complexes, and 15 singleton species in *Colletotrichum*, while Jayawardena et al. (2021) write detailed notes on the

genus. This is a globally reported genus, as important plant pathogens (Jayawardena et al. 2021, Zhang et al. 2025), while some of them are saprobes, endophytes, and human pathogens. They have been isolated from air, clinical samples, plant materials and soil (Jayawardena et al. 2020, Liu et al. 2022).

Table 158 *Colletotrichum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Colletotrichum coccodes</i>	ND	ND	Farley (1972)

Hypocreales Lindau

Acremoniopsidaceae M. Li, M. Raza & L. Cai

Acremoniopsis A. Giraldo, Gené & Guarro, Persoonia 33: 265 (2014) Fig. 133
Index Fungorum number: IF809883; Facesoffungi number: FoF13623

Acremoniopsis was established by Crous et al. (2014b) based on the combined morphology and LSU and ITS phylogeny, with *A. suttonii* as the type species. Currently, it has two species (Species Fungorum 2025) and both of them are supported by molecular data (ITS, LSU, *RPB2*, *TEF1-α*). The asexual morph is characterized by erect, simple or poorly branched conidiophores and enteroblastic, monophialidic, sub-hyaline, cylindrical to subulate conidiogenous cells, and hyaline, unicellular, globose or subglobose conidia that are arranged in slimy heads. The sexual morph has not been determined (Crous et al. 2014b). The species have been reported from soil and *Sternorrhyncha* species (Crous et al. 2014b, Tan & Steinrucken 2024).

Table 159 *Acremoniopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Acremoniopsis suttonii</i>	Spain	ND	Crous et al.(2014b)

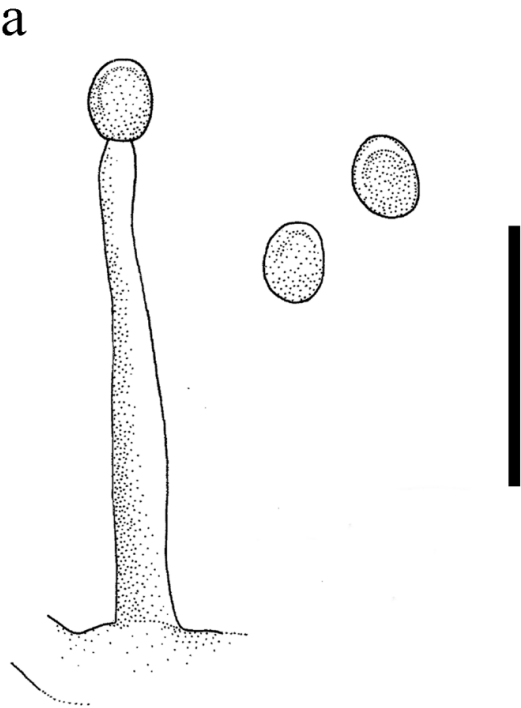


Figure 133 – *Acremoniopsis suttonii* (CBS 138708). a Conidiophore and conidia. Scale bar: a = 10µm. Redrawn from Crous et al. (2014b).

Bionectriaceae Samuels & Rossman

Acremonium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 15 (1809)

Index Fungorum number: IF7028; Facesoffungi number: FoF12995

Acremonium was established by Link (1929), and typified by *A. alternatum*. Currently, around 200 species are available in the Index Fungorum (2025) and is one of the largest genera in *Sordariomycetes* (Yang et al. 2019). Studies have analyzed *Acremonium* based on multigene phylogeny (LSU, SSU, ITS and *TEF1-α*) and numerous species were synonymized into other genera (Yang et al. 2019, Li et al. 2022). *Acremonium* has a polyphyletic nature and are distributed in two classes: *Leotiomyces* and *Sordariomycetes*; however, most of the species including the type species belong to *Hypocreales* (Summerbell et al. 2011, Giraldo et al. 2012, 2017, Yang et al. 2019). The genus has simplified and plastic morphologies; thus, morphology is not that informative for the species delimitation (Yang et al. 2019). However, mostly ITS and LSU loci are used in species delineation in *Acremonium*, and the lack of protein sequence data in GenBank is a major constraint (Yang et al. 2019, Li et al. 2022). Currently, the genus comprises more than 100 species (Hyde et al. 2024c). The asexual morph of the genus is characterized by simple or verticillate conidiophores with narrow phialides, solitary and cylindrical, and unicellular, hyaline to light-pigmented, spherical to cylindrical conidia that are arranged in slimy heads or unconnected chains or both. Species occur on various substrates such as air, dung, seawater or deep-sea sediments and soil. They can also be saprobes on dead plant materials, pathogens on humans and animals, parasites on fungi, lichens, insects or arthropods and endophytes on plants, seaweeds or animals (Li et al. 2022, Yang et al. 2019). They have a wide geographical distribution and can be found in Antarctica, China, the Czech Republic, India, Italy, Germany, Korea, Morocco, Ivory Coast, Papua New Guinea, Peru, Sri Lanka and the USA (Yang et al. 2019, Li et al. 2022).

Table 160 *Acremonium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Acremonium varicolor</i>	Korea	A river bank	Park et al. (2017)
<i>A. globosporum</i>	China	ND	Li et al. (2022b)
<i>A. curvum</i>	China	ND	
<i>A. sclerotinarum</i>	Worldwide	ND	Wang et al. (2015a)
<i>A. cavarraeanum</i>	Italy	ND	Domsch et al. (1993)
<i>A. borodinense</i>	Japan	Rhizosphere soil of sugarcane	Ito et al. (2000)

Amphichorda Fr., Syst. orb. veg. (Lundae) 1: 170 (1825)

Fig. 134

Index Fungorum number: IF7134; Facesoffungi number: FoF13119

Amphichorda was introduced by Fries (1825) and typified by *A. felina*. Based on the ITS, *RPB1*, *RPB2* and *TEF1-α* gene regions, Zhang et al. (2021) and Liu et al. (2023) provided phylogeny for this genus within *Cordycipitaceae* while introducing new species. However, Guerra-Mateo et al. (2023) and Wang et al. (2024c) have suggested this genus in *Bionectriaceae* based on ITS, SSU, LSU, *TEF1-α*, *RPB1* and *RPB2* phylogeny, with nine accepted species. The genus is characterized by the hyphomycetous asexual morphs with indeterminate synnemata, branched conidiophores, and sympodial conidiogenous cells that produce amero sporous and single conidia. The sexual morph remains undetermined (Hyde et al. 2020c). Species discovered from the air, animal and bird faeces, living bats, insects, marine sediments, plant debris and soil collected in Brazil, China, Spain and the UK (Hyde et al. 2020c).

Table 161 *Amphichorda* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Amphichorda cavernicola</i>	China	Cave soil	Zhang et al. (2021c)

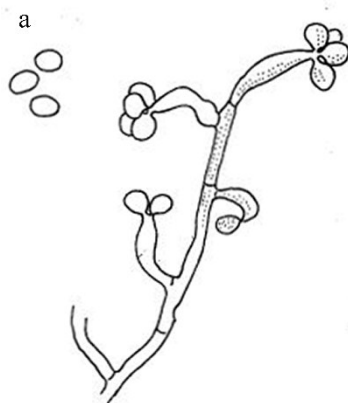


Figure 134 – *Amphichorda felina*. (CBS 250.34) a Branched conidiophores and conidia. Redrawn from Seifert et al. (2011).

Clonostachys Corda, Pracht-Fl. Eur. Schimmelbild.: 31 (1839)

Index Fungorum number: IF7701; Facesoffungi number: FoF14271

Corda (1839a) introduced *Clonostachys*, designating the type species as *C. araucaria* which is currently known as *C. rosea* (Schroers et al. 1999). Based on ITS, LSU, *TUB2* and *TEF1-α* gene regions, Wang et al. (2023b) revised the phylogenetic placement of the genus in *Bionectriaceae* including 56 species. There are 81 *Clonostachys* species listed in the Species Fungorum (2025). The asexual morph is characterized by the conidiophores that are penicillate, sporodochial, or dimorphic with phialidic conidiogenous cells and hyaline conidia. The sexual morph is previously linked to *Bionectria*, but subsequently, this genus was accepted as *Clonostachys* which has white, pale yellow, or orange to dark brownish-orange, warted or smooth ascomata formed in pseudoparenchymatous stroma or directly on the substrate. Ascospores are smooth, spinulose, striate or warted (Spegazzini 1919, Schroers et al. 1999, Schroers 2001). These species have a cosmopolitan distribution which can be found in bark, dead wood, leaves, roots, and soils. *Clonostachys* species are recorded as saprotrophs, endophytes, epiphytes of living plants and mycoparasites found from France, India, Japan, Sri Lanka, Switzerland, the Netherlands and the USA (Kapeua-Ndacnou et al. 2023, Wang et al. 2023b, Manawasinghe et al. 2025). Species also used as biocontrol agents against various ascomycetes, soil-borne hyphomycetes, and basidiomycetes (Wang et al. 2023b).

Table 162 *Clonostachys* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Clonostachys candelabrum</i>	The Netherlands	ND	Abreu et al. (2014)
<i>C. candelabrum</i>	Brazil	ND	
<i>C. chloroleuca</i>	Brazil	Savanna soil	
<i>C. pseudochroleuca</i>	Brazil	ND	
<i>C. chlorina</i>	Brazil	ND	Wang et al. (2023b)
<i>C. chuyangsinensis</i>	China	ND	
<i>C. compactiuscula</i>	China	ND	
<i>C. intermedia</i>	South Korea	ND	
<i>C. kunmingensis</i>	China	ND	
<i>C. rhizophaga</i>	China	ND	
<i>C. rogersoniana</i>	China	ND	
<i>C. divergens</i>	Germany	ND	Schroers (2001)
<i>C. intermedia</i>	The Netherlands	Agricultural soil	
<i>C. parva</i>	The Netherlands	Agricultural soil	
<i>C. rogersoniana</i>	Brazil	Rain forest soil	

Species	Country	Habitat or soil type	References
<i>C. rosea</i>	USA	ND	
<i>C. solani</i>	Germany	Wheat field soil	

Emericellopsis J.F.H. Beyma, *Antonie van Leeuwenhoek* 6: 264 (1940) Fig. 135

Index Fungorum number: IF1773; Facesoffungi number: FoF13424

Beyma (1940) erected *Emericellopsis* and typified it by *E. terricola*. Species Fungorum (2025) lists 24 species in *Emericellopsis*, and 22 of them are supported by molecular data. Based on the LSU phylogeny, Crous et al. (2018b) accommodated this genus in *Myrotheciomycetaceae*. However, based on LSU, SSU, ITS, *TEF1-α* and *RPB2* phylogeny, Bao et al. (2023) transferred this genus to the *Hypocreales* genera *incertae sedis* and suggested that further revisions are needed to confirm its phylogenetic placement. The asexual morph of the genus is characterized by the aerial hyphae and hyaline, 1–2-guttulate, elongate-ellipsoidal conidia (Hyde et al. 2020c). The species have been isolated from freshwater-, estuarine- and marine-mud sediments, rhizomes, peat, prairies and soils that are located in China, Germany, Ireland, Italy, South Korea, Soviet Union and the Netherlands (Domsch et al. 1980, Bao et al. 2023).

Table 163 *Emericellopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Emericellopsis alkalina</i>	Russia	Soda soil	Kuvarina et al. (2022)
<i>E. stolckiae</i>	USA	Saline soil	Davidson & Christensen (1971)
<i>E. terricola</i>	The Netherlands	ND	Domsch et al. (1993)

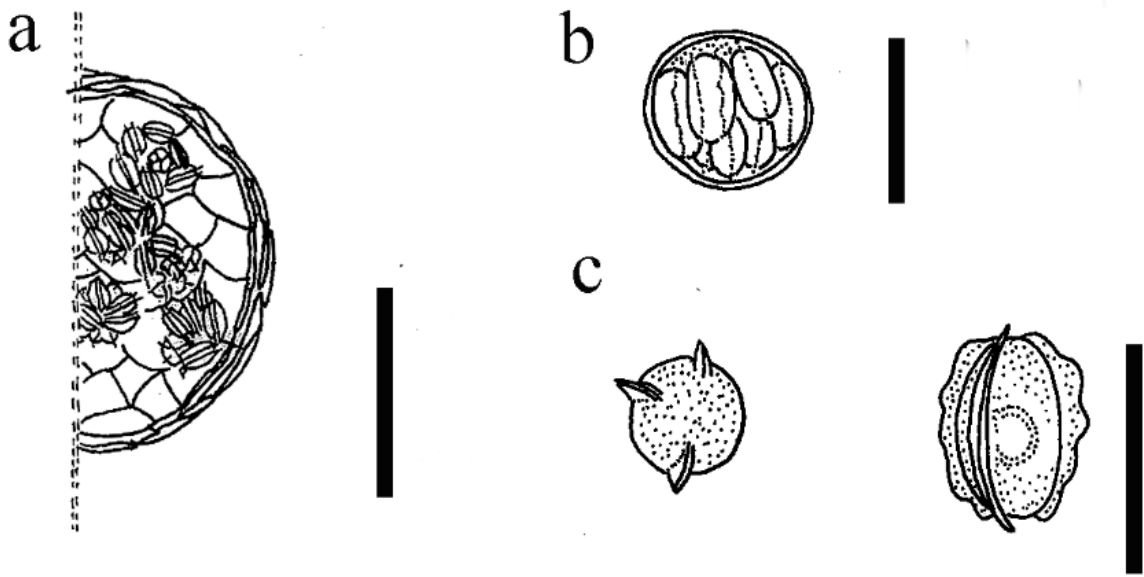


Figure 135 – *Emericellopsis terricola*. a. Section of ascoma b. Asci. c. Ascospore. Scale bars: a = 50µm, b = 20µm, c = 10 µm. Redrawn from Guarro et al. (2012).

Clavicipitaceae (Lindau) Earle ex Rogerson

Keithomyces Samson, Luangsa-ard & Houbraken, *Stud. Mycol.* 95: 186 (2020) Fig.136

Index Fungorum number: IF834876; Facesoffungi number: FoF4489

Keithomyces was introduced by Mongkolsamrit et al. (2020) and typified by *K. carneus* based on multi-gene phylogeny (SSU, LSU, *TEF1-α*, *RPB1* and *RPB2*) and morphological characterization. Mongkolsamrit et al. (2020) transferred several *Paecilomyces* and *Metarhizium* species to establish *Keithomyces*. There are five species listed in the Index Fungorum (2025), and

all of them have molecular data. The asexual morph is characterized by paecilomyces-like asexual morphs with divergent whorls of 2–4 phialides bearing conidiophores and echinulate or aciculate conidial chains. The sexual morph remains undetermined. Species have been isolated from China, France, India and Japan from *Lepidoptera* larvae and soil habitats (Mongkolsamrit et al. 2020, Crous et al. 2022).

Table 164 *Keithomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Keithomyces carneus</i>	France	Sandy soil	Mongkolsamrit et al. (2020)
<i>K. acicularis</i>	Japan	Soil under <i>Angelica keiskei</i>	Crous et al. (2022)
<i>K. indicus</i>	India	ND	Zhang et al. (2024b)
<i>K. echinosporus</i>	China	Wild life park	

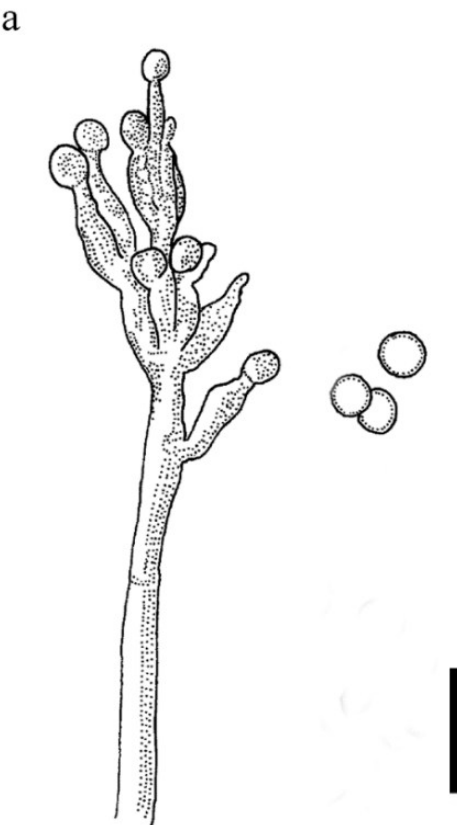


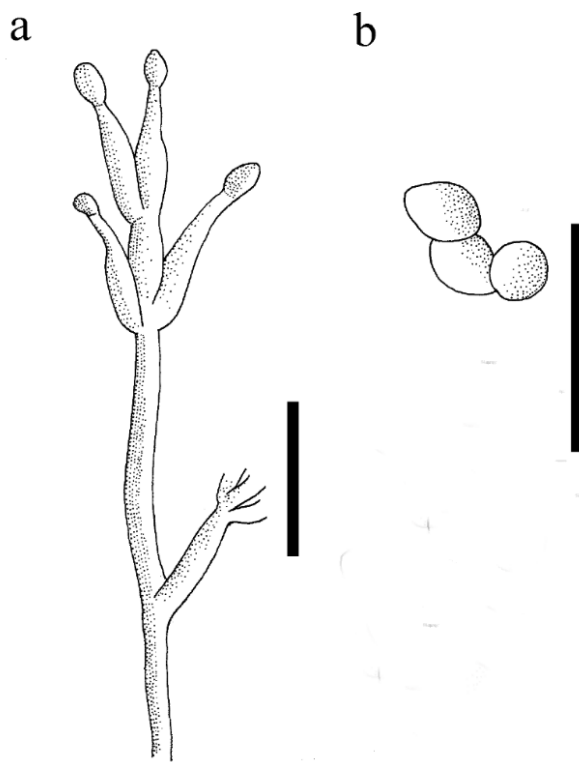
Figure 136 – *Keithomyces carneus* (CBS 339.59). a Conidiophore and conidia. Scale bar: a = 10µm. Redrawn from Mongkolsamrit et al. (2020).

Marquandomyces Samson, Houbraken & Luangsa-ard, Stud. Mycol. 95: 194 (2020) Fig. 137
 Index Fungorum number: IF834879; Facesoffungi number: FoF4490

Marquandomyces was established by Mongkolsamrit et al. (2020); the type species is designated as *M. marquandii* (= *Paecilomyces marquandii*). It is a monospecific genus introduced with morphology and the multi-gene (SSU, LSU, *TEF1-α*, *RPB1* and *RPB2*) phylogeny (Mongkolsamrit et al. 2020). The asexual morph is characterized by having hyaline, smooth-walled conidiophores bearing whorls of 2–4 phialides and ellipsoidal to fusiform, hyaline conidia in dry divergent chains. Cultures produce chlamydospore-like structures that are solitary, thin-walled, and globose to ellipsoidal cells (Mongkolsamrit et al. 2020). *Marquandomyces marquandii* has been isolated from mushrooms and soil in Russia, the Netherlands, the UK, and the USA (Mongkolsamrit et al. 2020).

Table 165 *Marquandomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Marquandomyces marquandii</i>	USA	ND	Mongkolsamrit et al. (2020)

**Figure 137** – *Marquandomyces marquandii* (CBS 282.53). a Conidiophore b Conidia. Scale bars: a, b = 10 µm. Redrawn from Mongkolsamrit et al. (2020).

Metapochonia Kepler, Rehner & Humber, Mycologia 106(4): 820 (2014)

Index Fungorum number: IF806070; Facesoffungi number: FoF13083

Kepler et al. (2014) erected *Metapochonia* while accommodating *M. suchlasporia* as the type species, based on morphology and *TUB2*, *RPB1*, *RPB2* and *TEF1-α* multi-gene phylogeny. The genus is currently comprised of nine species (Hyde et al. 2024c), and all of them are supported by molecular data. *Metapochonia* and *Pochonia* are similar in morphology, such as producing dictyochlamydospores, and are parasitic on nematode eggs or cysts (Kondo et al. 2020). Based on morphology and multi-gene phylogenetic (ITS and *TEF1-α*) analysis, Kepler et al. (2014) and Labuda et al. (2018) transferred *Pochonia* species to *Metapochonia*. Mongkolsamrit et al. (2020) mentioned that this genus requires further revision. The asexual morph has conidia on slender, awl-shaped phialides, and the sexual morph has not been reported (Kepler et al. 2014). These species infect nematodes and rotifers and have also been isolated from insects, such as Coleoptera, Hemiptera and Lepidoptera larvae, plant roots and soil distributed in Canada, China, Denmark and Sweden (Hyde et al. 2020c).

Table 166 *Metapochonia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Metapochonia hahajimaensis</i>	Japan	ND	Kondo et al. (2020)
<i>M. variabilis</i>	China	Karst cave	Zhang et al. (2017b)

Metarhizium Sorokīn, Veg. Parasitenk. Mensch Tieren 2: 268 (1879)

Fig. 138

Index Fungorum number: IF8912; Facesoffungi: FoF13085

Rombach et al. (1987) amended *Metarhizium* and the type species is designated as *M. anisopliae*. Study of Kepler et al. (2014) prioritized the taxonomic stability of *Metarhizium* while removing *Metacordyceps*, and retaining *Pochonia* and a new genus, *Metapochonia*, however, mentioning that several placements have phylogenetic ambiguities. Currently, 78 species have been accepted in this genus (Mongkolsamrit et al. 2020). The asexual morph of the genus is characterized by the variously branched conidiophores without synnemata and hyaline to brown or green conidia (Kepler et al. 2014). The sexual morph is characterized by the predominantly cylindrical or clavate, pale yellow, green to greenish brown or dark purple stromata with immersed to semi-immersed perithecia, and the ascospores are filiform and whole with septation or they can be dissociated into part-spores (Hyde et al. 2020c, Mongkolsamrit et al. 2020). Species have been reported from arthropods, nematodes, plant roots and soil (Kepler et al. 2014, Mongkolsamrit et al. 2020).

Table 167 *Metarhizium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Metarhizium aciculare</i>	Japan	ND	Mongkolsamrit et al. (2020)
<i>M. alvesii</i>	Brazil	Soil, associated with <i>Musa</i>	
<i>M. anisopliae</i>	Brazil	ND	
<i>M. baoshanense</i>	China	Soil, associated with <i>Angiospermae</i>	
<i>M. acridum</i>	West Africa	ND	
<i>M. brunneum</i>	Australia	ND	
<i>M. guizhouense</i>	Australia	ND	
<i>M. humberi</i>	Brazil	ND	
<i>M. lepidiotae</i>	Australia	ND	
<i>M. novozealandicum</i>	Australia	ND	
<i>M. robertsii</i>	Australia	ND	

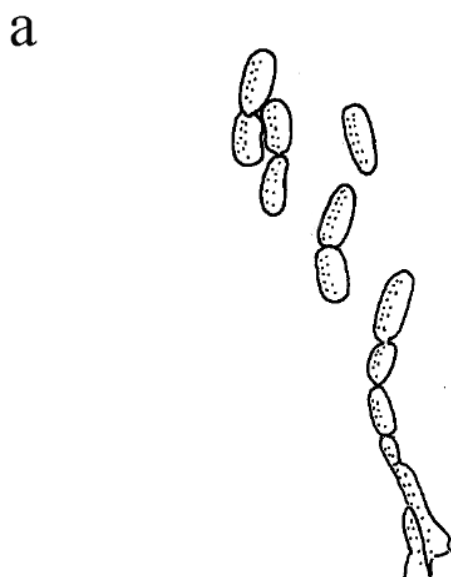


Figure 138 – *Metarhizium anisopliae*. a Conidiophore and conidia. Redrawn from Domsch et al. (1993).

Pochonia Bat. & O.M. Fonseca, Publicações Instituto de Micologia, Recife 462, 4 (1965) Fig. 139

Index Fungorum number: Facesoffungi number: FoF 13104

Batista & Fonseca (1965) introduced *Pochonia*, designating *P. humicola*, as the type species. There are five species accepted in the genus however, only four species have molecular data (SSU, ITS, LSU, *RPB2* and *TEFI-α*) (Zhang et al. 2023c). Initial phylogeny was provided by Zare et al. (2001), and several subsequent studies revisited this genus; however, taxonomic ambiguities remained (Sung et al. 2007, Kepler et al. 2014). Sung et al. (2007) introduced *Metacordyceps*, transferring several *Metarhizium* and *Pochonia* species. However, Kepler et al. (2014) proposed the suppression of *Metacordyceps* and retained *Pochonia*. A recent taxonomic explanation of *Pochonia* was provided by Mongkolsamrit et al. (2020). *Pochonia* species produce sexual and asexual morphs, while some of them produce dictyochlamydospores or irregularly swollen hyphae (Zare et al. 2001, Mongkolsamrit et al. 2020). Most of the *Pochonia* are nematode parasites, and some have been isolated from soil-based substrates in Brazil, Canada, China, Japan, the Netherlands and Thailand (Hyde et al. 2020c, Mongkolsamrit et al. 2020, Chethana et al. 2023)

Table 168 *Pochonia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pochonia chlamydosporia</i>	Canada	ND	Mongkolsamrit et al. (2020)
<i>P. chlamydosporia</i>	Thailand	Forest	Chethana et al. (2023)
<i>P. humicola</i>	Brazil	ND	Batista & Fonseca (1965)
<i>P. boninensis</i>	Japan	Cultivated soil under <i>Livistona chinensis</i>	Nonaka et al. (2013)
<i>P. sinensis</i>	China	Green belt soil	Zhang et al. (2023a)

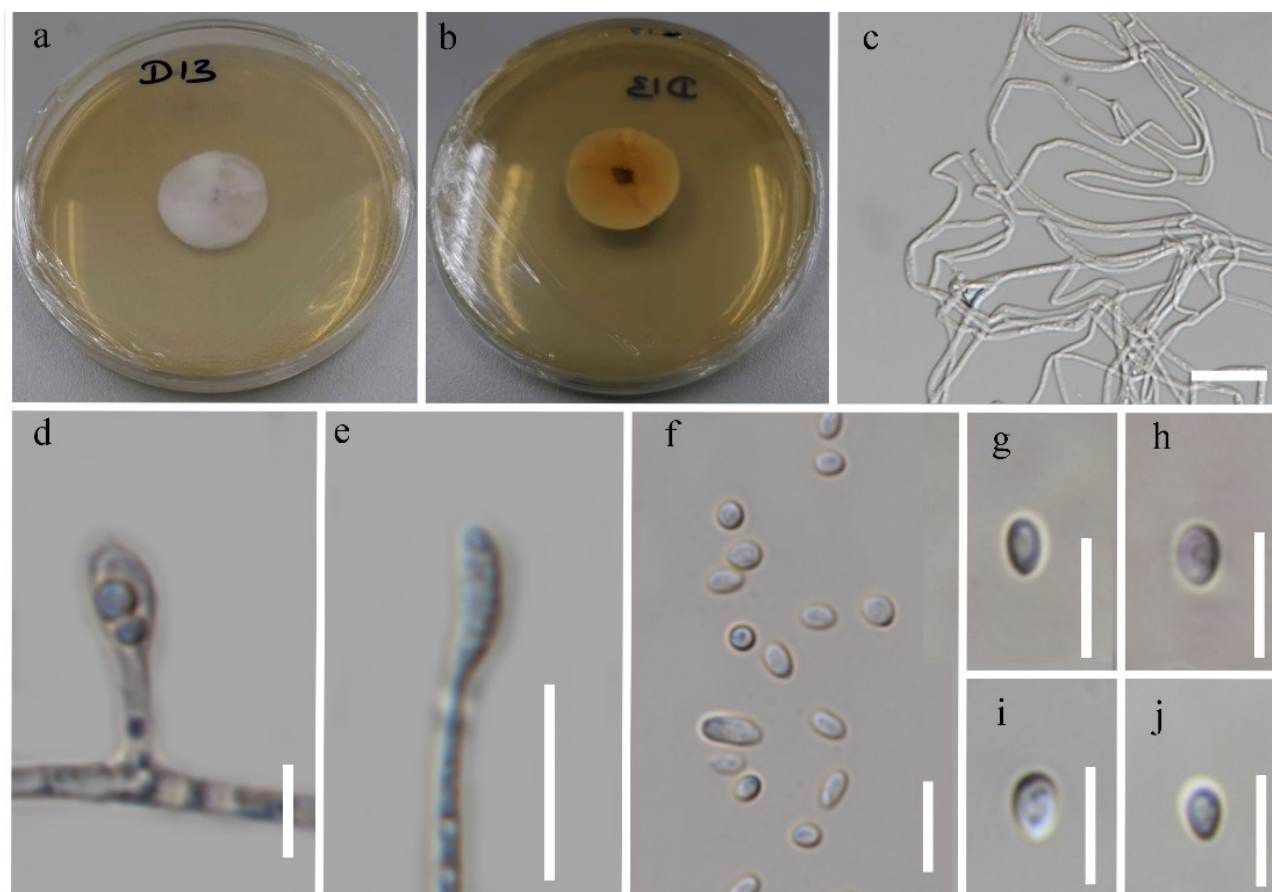


Figure 139 – *Pochonia chlamydosporia* (MFLUCC 23-0021). a, b culture characters on PDA (b = reverse). c Hyphae. d, e Conidiophores and conidiogenous cells. f–j Conidia. Scale bars: c = 20 μm, e–j = 10 μm, d = 5 μm. The photoplate is rearranged from Chethana et al. (2023).

Romanoa Thirum., R.C. Ist. Sup. Sanità, (Rome) 17: 1326 (1954)

Index Fungorum number: IF4779; Facesoffungi number: FoF13107

Thirumalachar (1954) erected *Romanoa* with its type species, *R. terricola*. Currently, it is a monotypic genus (Hyde et al. 2024c), and does not have molecular data. Species have been recorded from soil (Hyde et al. 2020c).

Table 169 *Romanoa* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Romanoa terricola</i>	Italy	ND	Thirumalachar (1954)

Cordycipitaceae Kreisel ex G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora

Beauveria Vuill., Bull. Soc. bot. Fr. 59: 40 (1912)

Index Fungorum number: IF7346; Facesoffungi number: FoF13121

Beauveria was introduced by Vuillemin (1912), designating *B. bassiana* as the type species. There are around 50 species recognized in the genus (Species Fungorum 2025), and 37 of them are supported with molecular data (SSU, LSU, *TEF1-α*, *RPB1*, *RPB2* and Bloc). The asexual morph is characterized by the globose to flask-shaped conidiogenous cells with one-celled, terminal, holoblastic conidia that are produced in sympodial succession on an indeterminate, denticulate rachis and possess cordyceps-like sexual morph (Vuillemin 1912, Rehner et al. 2011). The genus has saprobes and endophytes residing on plant substrates and soil habitats and some species are pathogens on arthropods. They are cosmopolitan species with a wide geographical distribution (Keller et al. 2003, Hyde et al. 2020c).

Table 170 *Beauveria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Beauveria australis</i>	Chile	ND	Rehner et al. (2011)
<i>B. bassiana</i>	Thailand	ND	Manoch (1998)
<i>B. bassiana</i>	China	ND	Wang et al. (2022b)
<i>B. brongniartii</i>	Switzerland	ND	Keller et al. (2003)
<i>B. caledonica</i>	Australia and Scotland	ND	Rehner et al. (2011)
<i>B. medogensis</i>	China	ND	Imoulan et al. (2016)
<i>B. vermiconia</i>	Chile	ND	Wang et al. (2022b)

Cordyceps Fr., Observ. mycol., Cancellans Edn (Havniae) 2: 316 (1818)

Index Fungorum number: IF1240; Facesoffungi number: FoF01317

Fries (1818) introduced *Cordyceps*, with *C. militaris* as the type species. Being one of the largest genera in *Hypocreales*, it comprises of around 564 species (Sung et al. 2007, Zhang et al. 2021b). Previously, it was placed in *Clavicipitaceae* (Shrestha et al. 2017), but phylogenetic studies revealed that *Cordyceps sensu lato* is not monophyletic (Sung et al. 2007); thus, the genus was circumscribed to *Cordyceps sensu stricto* and new genera were suggested for the species outside this clade. Based on the phylogenetic analyses of Sung et al. (2007) and Kepler et al. (2014), around 180 *Cordyceps* species were transferred to new genera and *Cordyceps sensu stricto* was placed in *Cordycipitaceae*. However, there are still *Cordyceps* species that remain unresolved within *Hypocreales* (Shrestha et al. 2017). The asexual morph is characterized by evlachovaea-like, isaria-like, lecanicillium-like, mariannaea-like and simplicillium-like phialides or conidia. The sexual morph has bright, stipitate, fleshy stromata, superficial to embedded perithecia, and ascospores that do not break or produce part spores (Hyde et al. 2020c). The genus is considered to have a cosmopolitan distribution, including Brazil, China, India, Indonesia, Japan, Madagascar, Papua New Guinea and Ukraine. Most of the species are entomopathogenic, and some are

associated with decaying wood, food and soil as well (Sung et al. 2007, Zhang et al. 2021b, Dong et al. 2022).

Table 171 *Cordyceps* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cordyceps chaetoclavata</i>	China	Lepidoptera buried in soil	Wang et al. (2020)
<i>C. cocoonihabita</i>	China	Limacodidae in cocoons buried in soil	
<i>C. shuifuensis</i>	China	Lepidoptera buried in soil	
<i>C. subtenuipes</i>	China	Lepidoptera buried in soil	

Gamszarea Z.F. Zhang & L. Cai, Fungal Diversity 106: 97 (2020)

Index Fungorum number: IF556420, Facesoffungi number: FoF08439

Zhang et al. (2021) introduced *Gamszarea* based on the combined ITS, LSU, SSU, *TEF1-α*, *RPB1* and *RPB2* phylogeny and morphology, and typified with *Gamszarea wallacei* (= *Simplicillium wallacei*). Currently, eight species are listed in this genus (Index Fungorum 2025) and all the species have molecular data. The asexual morph is characterized by erect, hyaline conidiophores and discrete aculeate phialides, solitary or verticillate conidiogenous cells, producing less globose, septate macro- or aseptate microconidia with slimy heads. The sexual morph has hyaline, obclavate to naviculate perithecia, 8-spored, narrowly cylindrical asci, and hyaline, filiform ascospores. *Gamszarea* species have been isolated from lepidopteran larvae, spiders, on rocks and soil collected from China, the Czech Republic and Sulawesi (Zhang et al. 2021c).

Table 172 *Gamszarea* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Gamszarea humicola</i>	China	Cave soil	Zhang et al. (2021c)

Lecanicillium W. Gams & Zare, Nova Hedwigia 72(3-4): 332 (2001)

Fig. 140

Index Fungorum number: IF28528; Facesoffungi number: FoF16639

Zare & Gams (2001) introduced *Lecanicillium* to accommodate the taxa with aculeate phialides within *Cordycipitaceae* and typified by *L. lecanii*. This genus is polyphyletic in *Cordycipitaceae* (Sanjuan et al. 2014, Chiriví-Salomón et al. 2015, Zhang et al. 2021c). Based on the phylogeny of Kepler et al. (2017), three *Lecanicillium* species were synonymized to *Akanthomyces*, including the type species (*L. lecanii*). Zhang et al. (2021) followed the polyphyletic nature of this genus and four *Lecanicillium* were identified as distinct clade in the combined phylogeny of ITS, LSU, SSU, *TEF1-α*, *RPB1* and *RPB2* sequences, thus accommodating as the new genus, *Gamszarea*. Currently, 16 species are accepted in the *Lecanicillium* (Hyde et al. 2024c) and all of them have molecular data. However, further phylogeny and updated descriptions are required to resolve the phylogenetic placement of this genus. Both sexual and asexual morphs are present, and the asexual morph is hyphomycetous. The species have been observed from animal dung, soil and wood materials as saprobes, endophytes or fungicolous fungi (Yasanthika et al. 2021). They are distributed in Australia, China, Ghana, India, Iran and Sri Lanka (Zhou et al. 2022).

Table 173 *Lecanicillium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Lecanicillium dimorphum</i>	China	Contaminate soil	Yasanthika et al. ((2021)
<i>L. magnisporum</i>	China	Cave	Zhang et al. (2021c)
<i>L. saksenae</i>	India	ND	Sreeja et al. (2023)

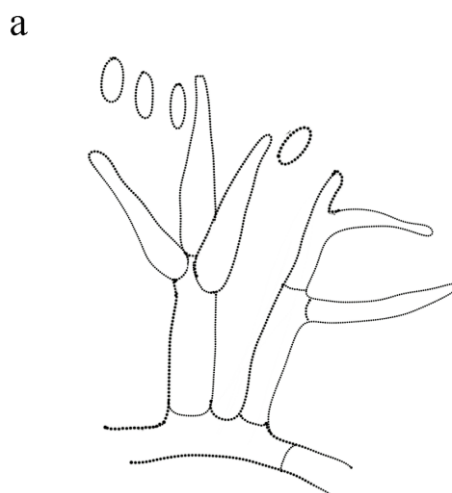


Figure 140 – *Lecanicillium lecanii* (IMI 327441). a Conidiophore and conidia..Redrawn from redrawn from Zare & Gams (2001).

Simplicillium W. Gams & Zare, Nova Hedwigia 73(1-2): 38 (2001)

Index Fungorum number: IF28570; Facesoffungi number: FoF13133

Simplicillium was introduced by Zare & Gams (2001) and typified by *S. lanosoniveum*. Previously, *Simplicillium* species were placed in *Verticillium* sect. *prostrata* *Clavicipitaceae* (Zare & Gams 2001). Based on SSU, LSU and ITS sequences, this was subsequently considered as a separate genus in *Clavicipitaceae* (Zare & Gams 2001). However, the placement of *Simplicillium* was revised again to *Cordycipitaceae* based on phylogeny (Maharachchikumbura et al. 2016, Wijayawardene et al. 2018, Wei et al. 2019). *Simplicillium* presently accommodates 33 species and all of them are supported by molecular data (Yan et al. 2023a) The genus is considered to have a cordycep-like asexual morph with predominantly solitary phialides, conidial masses either in globose slimy heads, short chains, or in sympodial succession (Zare & Gams 2001, Zhang et al. 2021c). These species can be found in a variety of environments, including freshwater and marine habitats, human nails and skin, insects, nematodes, plants, mushrooms, cyanobacteria (*Chroococcus* sp.) and distributed soil in China, Germany, Japan and Thailand (Wei et al. 2019, Hyde et al. 2020c, Zhang et al. 2021c). They have various trophic modes, such as mammal- and plant-parasitic, symbiotic, entomopathogenic, fungicolous and nematophagous fungi. Bioactive compounds such as anti-fungal and anti-bacterial profiles have been investigated from some *Simplicillium* species (Wei et al. 2019).

Table 174 *Simplicillium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Simplicillium album</i>	China	Cave	Zhang et al. (2021c)
<i>S. humicola</i>	China	Cave	

Hypocreaceae De Not.

Kiflimonium Summerb., J.A. Scott, Guarro & Crous, Microorganisms 6(3, 88): 17 (2018)

Index Fungorum number: IF826819; Facesoffungi number: FoF13218

Kiflimonium was introduced by Summerbell et al. (2018) and designated *K. curvulum* ($\equiv$ *Acremonium curvulum*) as the type species based on the ITS phylogeny. Currently, three species are listed in the Index Fungorum (2025), and all of them have molecular data. The asexual morph is characterized by conidiophores arising laterally from somatic hyphae, hyaline, subcylindrical,

mostly with 1–4 conidiogenous cells that are phialidic, form singly, laterally on hyphae or on conidiophores. Conidia are 0–1 septate, smooth-walled, lunate to falcate, produced on slimy heads (Summerbell et al. 2018). The sexual morph is not reported. Species are identified as saprobes on plants, in rust-infected *Lolium* ryegrass and soil substrates in China, Germany and the Netherlands (Summerbell et al. 2018, Crous et al. 2021c).

Table 175 *Kiflimonium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Kiflimonium curvulum</i>	Germany	ND	Summerbell et al. (2018)

Trichoderma Pers., Neues Mag. Bot. 1: 92 (1794)

Index Fungorum number: IF 10282; Facesoffungi number: FoF 02075

Persoon (1974) introduced *Trichoderma* with its type species, *T. viride*. The genus comprises more than 500 species (Hyde et al. 2024c), and nearly 300 species are supported by molecular data. The *RPB2* and *TEF1-α* gene regions are important for species identification in *Trichoderma* (Zhao et al. 2024b). The genus is globally reported and most of the species are associated with soil habitats (Zhao et al. 2024b). *Trichoderma* have saprobic or endophytic relationships with dead and living plants (Jaklitsch & Voglmayr 2015, Matar et al. 2022, Perera et al. 2023, Zhao et al. 2024b). Some can be opportunistic pathogens in humans and also cause diseases in cultivated mushrooms (Sandoval-Denis et al. 2014, Perera et al. 2023). This genus has been widely utilized in commercial enzymes and antibiotic production (Zhao et al. 2024b). Members have also been recognized as biocontrol agents, plant growth promoters and bioremediatory against some heavy metal ions (Zhang et al. 2023b, Zhao et al. 2024b).

Table 176 *Trichoderma* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Trichoderma gongcheniae</i>	China	Rice field	Zhao et al. (2024b)
<i>T. hongkuii</i>		Corn field	
<i>T. hongkuii</i>		Corn field	
<i>T. parapeberdyi</i>		Peach orchard	
<i>T. neoguizhouense</i>		Eggplant field.	
<i>T. parahamatum</i>		Rice field	
<i>T. shaanxiensis</i>		Wheat field	
<i>T. harzianum</i>	Turkey	ND	Ülker et al. (2011)
<i>T. guizhouense</i>	China	Soil polluted by heavy metal	Li et al. (2024a)

Myrothecium Crous

Trichothecium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1-2): 18 (1809)

Fig. 141

Index Fungorum number: IF10303; Facesoffungi number: FoF13427

Link (1809) erected *Trichothecium* with the type species *T. roseum*. Currently, 27 *Trichothecium* species are listed in the Species Fungorum (2024), but only four species have molecular data. Summerbell et al. (2011) suggested that extensive phylogenetic investigations are essential in resolving this genus as some species remain without sequence data, and the recent phylogeny is provided by Hou et al. (2023) with ITS, LSU and *RPB2* gene regions. The hyphomycetous asexual morph is characterized by simple, unbranched, conidiophores and 1-septate, clavate conidia, with the apical cell being larger than the curved basal cell (Subramanian 1962, Summerbell et al. 2011, Hyde et al. 2020). The sexual morph is produced on the aerial mycelium, irregularly coiled with spherical or slightly spherical, non-ostiolate, hyaline or slightly pink ascomata, clavate to spherical, evanescent, 8-spored asci, and ellipsoidal or reniform, smooth or finely striate, hyaline to yellow to pink ascospores (Summerbell et al. 2011). *Trichothecium* has

been isolated from decaying plants, grains, seeds, soil and various fruits and vegetables in Algeria, China, Denmark, Egypt, France, Israel, Japan, Poland, Russia, Tanzania, Turkey, and the USA (Hyde et al. 2020c, Perera et al. 2020).

Table 177 *Trichothecium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Trichothecium roseum</i>	China, Denmark, Egypt, France, Israel, Japan, Poland	Forest nurseries, forest soils under beech trees, teak, cultivated soils	Domsch et al. (1993)

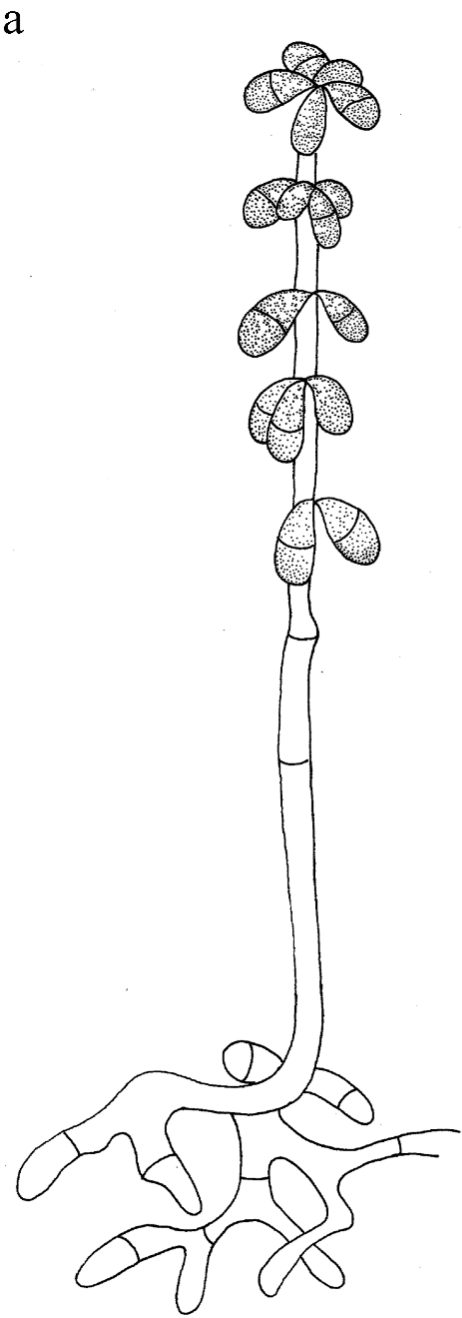


Figure 141 – *Trichothecium roseum* a. Conidiogenesis on conidiophore. Scale bar: a = 10µm. Redrawn from Hyde et al. (2020c).

Nectriaceae Tul. & C. Tul.

Calonectria De Not., Comm. Soc. crittog. Ital. 2(3): 477 (1867)

Index Fungorum number: IF746; Facesoffungi number: FoF16640

Calonectria was introduced by De Notaris in 1867, with *C. pyrochroa* as the type species (Rossman 1979). The genus is currently comprised of 127 species, which belong to 13 species complexes with two major groups: the Prolate group, which has clavate to pyriform to ellipsoidal terminal vesicles and the Sphaero-naviculate group characterized by sphaeropedunculate and naviculate terminal vesicles (Lombard et al. 2010, Pham et al. 2019). Liu & Chen (2023) have identified *Calonectria* species from soils in southern China based on *TEF1-α*, *TUB2*, *cmdA*, *His3*, *RPB2* and *Actin* phylogeny. The asexual morph possesses three types of conidia: mega-, micro- and macroconidia. Mega- and microconidia are not common and are not considered informative characters to distinguish between species (Lombard et al. 2010). The sexual morph has yellow to dark red perithecia, with scaly to warty ascocarp walls and long-stalked, clavate asci, and 1-septate to multi-septate ascospores. In the genus, both homothallic and heterothallic mating systems can be found. Some species are recognized as pathogens, affecting 335 hosts across 100 plant families and several have been recorded from soil in South America, South China and Southeast Asia (Lombard et al. 2010).

Table 178 *Calonectria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Calonectria monticola</i>	Thailand	ND	Crous et al. (2015c)
<i>C. densa</i>	Ecuador	ND	Lombard et al. (2010)
<i>C. humicola</i>	Ecuador	ND	
<i>C. orientalis</i>	Indonesia	ND	
<i>C. hongkongensis</i>	China	<i>Eucalyptus</i> plantation	Wu & Chen (2021)
<i>C. auriculiformis</i>	Vietnam	<i>Acacia auriculiformis</i> plantation	Zhang et al. (2022d)
<i>C. pauciramosa</i>	South Africa	ND	Pham et al. (2018)

Cylindrocladiella Boesew., Can. J. Bot. 60(11): 2289 (1982)

Index Fungorum number: IF7869; Facesoffungi number: FoF13442

Boesewinkel (1982) introduced *Cylindrocladiella* and typified by *C. parva*. The genus comprises 45 species (Liu & Chen 2024), and 44 of them are supported by molecular data (*his3*, ITS, *TEF1-α*, and *TUB2*). The asexual morph is hyphomycetous and characterized by the symmetrically branched, penicillate and/or subverticillate conidiophores, producing asymmetrical bundles of small, cylindrical, 1-septate conidia (Lombard et al. 2012). The genus includes soil-born species and can also be found in decayed leaves and wood litter. Some are pathogens, causing leaf spots, and rots of roots, stems and cuttings of agricultural, forestry and horticultural crops in Australia, Brazil, Malaysia, Peru, India, Thailand, the Netherlands and Vietnam (Scattolin & Montecchio 2007).

Table 179 *Cylindrocladiella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cylindrocladiella cymbiformis</i>	Australia	ND	Lombard et al. (2012)
<i>C. lanceolata</i>	Australia	ND	
<i>C. longiphialidica</i>	Thailand	ND	
<i>Cy. natalensis</i>	South Africa	ND	
<i>Cy. variabilis</i>	Australia	ND	
<i>C. clavata</i>	Australia	ND	
<i>C. arbusta</i>	Vietnam	<i>Acacia mangium</i> plantation	Pham et al. (2018)

<i>C. lageniformis</i>	Vietnam	<i>Eucalyptus camaldulensis</i> plantation
<i>C. malesiana</i>	Malaysia	Soil in <i>A. mangium</i> plantation
<i>C. obpyriformis</i>	Vietnam	Soil in <i>Acacia</i> hybrid plantation
<i>C. solicola</i>	Vietnam	Soil in <i>Acacia</i> hybrid plantation

Fusarium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1-2): 10 (1809)

Index Fungorum number: IF8284; Facesoffungi: FoF00149

Fusarium was introduced by Link (1809) and typified by *F. roseum*. Currently, around 400 species are listed in this genus, however, most of them lack a proper description (Nikitin et al. 2023). The genus has a cosmopolitan distribution, which can be found in air, insects, plants, water and soil (Nikitin et al. 2023, Hyde et al. 2023). The members of this genus are recorded as pathogens on a wide range of crops, causing rots, blights, wilts, and cankers (Samiksha & Sanjeev 2021, Crous et al. 2021a). This is known as soil-borne genus and has pathogenic, parasitic and saprobic life modes recorded from various substrates. Further, they produce mycotoxins adverse to humans and animals (Watanabe et al. 2011, Samiksha & Sanjeev 2021). Species are useful in industrial applications such as biofuels, cosmetics, food, and pharmacy (Samiksha & Sanjeev 2021).

Table 180 *Fusarium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Fusarium solani</i>	Bahrain	Saline soil	Mandeel (2006)
<i>F. oxysporum</i>			
<i>F. chlamydosporum</i>			
<i>F. equiseti</i>			
<i>F. compactum</i>			
<i>F. oxysporum</i>	South Africa	Agricultural soil	Marasas et al. (1988)
<i>F. equiseti</i>			
<i>F. solani</i>			
<i>F. lateritium</i>	Malaysia	Loamy sand	Mohamed Zubi et al. (2021)
<i>F. proliferatum</i>			
<i>F. incarnatum</i>	Malaysia	Sandy loam	
<i>F. rigidiuscula</i>	Malaysia	Silt loam	

Mariannaea G. Arnaud ex Samson, Stud. Mycol. 6: 74 (1974)

Fig. 142

Index Fungorum number: IF 8846; Facesoffungi number: FoF13445

Mariannaea was established by Samson (1974) and typified by *M. elegans*. There are 23 species listed in the Species Fungorum (2025) and all of them have molecular data. An in-depth revision of *Mariannaea* was provided by Hu et al. (2017) based on ITS and *TUB2* phylogeny. The asexual morph is characterized by the branched, septate conidiophores with hyaline and flask-shaped phialides, and hyaline, 1–2-celled conidia mostly forming imbricate chains or in slimy heads, and the sexual morph has solitary, globose, perithecial ascomata with a flat apex and inconspicuous or absent stroma, and cylindrical to narrowly clavate, 8-spored asci, containing 1-septate, hyaline, smooth to spinulose ascospores. Chlamydospores can be present or absent (Nonaka et al. 2015, Hu et al. 2017, Bao et al. 2023). Species are reported from leaves, soil, terrestrial and submerged wood found in Brazil, China, the Czech Republic, Thailand, the Netherlands, Venezuela and the USA (Hu et al. 2017, Bao et al. 2023).

Table 181 *Mariannaea* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Mariannaea atlantica</i>	Brazil	Forest	Hyde et al. (2020a)

<i>M. camptospora</i>	The Netherlands	Forest	Samson (1974)
<i>M. elegans</i>	Japan	ND	Arnaud (1952)
<i>M. humicola</i>	Brazil	ND	Lombard et al. (2015)
<i>M. punicea</i>	Zaire	ND	

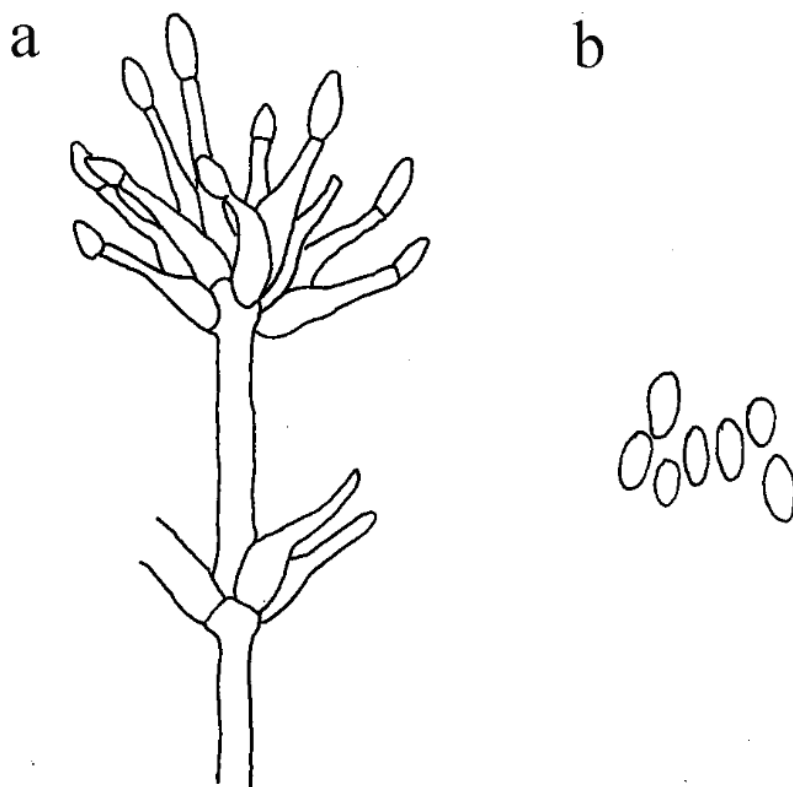


Figure 142 – *Mariannaea elegans* a Conidiophore. b Conidia. Redrawn from Domsch et al. (1993).

Nectria (Fr.) Fr., Summa veg. Scand., Sectio Post. (Stockholm): 387 (1849)

Index Fungorum number: IF3431; Facesoffungi number: FoF02122

Fries (1849) introduced *Nectria* while designating *N. cinnabarina* as the type species. There were around 800 species accommodated in *Nectria sensu lato*. Subsequently, based on LSU data and morphology, studies have excluded many *Nectria sensu lato* species and placed them in other genera while listing *Nectria* species that are congeneric with the type species as *sensu stricto* (Rossman et al. 1999, Yang et al. 2018a). The asexual morphs are coelomycetous (Rossman et al. 1999, Maharachchikumbura et al. 2016, Yang et al. 2018a), and the sexual morph of *Nectria* has well-developed stromata, subglobose to globose, red to dark red, fleshy, soft-textured, uniloculate, warted perithecia that become cupulate when dry. It has unitunicate, clavate to cylindrical asci, producing hyaline to yellow-brown, broadly ellipsoid to long-fusiform, and non- to multi-septate or muriform ascospores (Fries 1849). The species are plant pathogens and occur on hardwood trees, leaves, fruits and organic matter, and have also been reported from the soil worldwide (Domsch et al. 1993, Yang et al. 2018a).

Table 182 *Nectria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Nectria rubicola</i>	Sudan	ND	Lombard et al. (2015)
<i>N. vasinfecta</i>	South Africa	ND	
<i>N. inventa</i>	ND	ND	Domsch et al. (1993)

Neocosmospora E.F. Sm., Bull. U.S. Department of Agriculture 17: 45 (1899)

Fig. 143

Index Fungorum number: IF 3447; Facesoffungi number: FoF10977

Smith (1899) introduced *Neocosmospora* while designating *N. vasinfecta* as the type species. In the recent revision, Sandoval-Denis et al. (2019) provided the phylogeny (ITS, LSU, *TEF1-α* and *RPB2*) and morphology for the genus while introducing new species. According to O'Donnell et al. (2020), some medically important *Fusarium* species had been misplaced in *Neocosmospora*, thus, they have been provided phylogenetic corrections for controversial species, however Crous et al. (2021) do not agree with this. Presently, the genus accommodates 66 species (Species Fungorum 2025), and all of them are supported by the molecular data. The asexual morphs possess distinctive, very long, narrow, acremonium-like, aerial monophialides. The sexual morph is characterized by the orange to red-brown, smooth-walled to coarsely warted perithecia, containing yellow-golden brown, globose to ellipsoidal, 0–1-septate, distinctly ornamented (striate, cerebriform to spinulose) ascospores (Sandoval-Denis et al. 2019). Species are present in the air, dead and living plants, human clinical samples, soil and water. Some of them have plant pathogenic nature and several can cause mycotoxicosis in humans and animals (Sandoval-Denis et al. 2019, Perera et al. 2023). They can be found in Austria, Belgium, Brazil, India, Italy, Ivory Coast, Japan, South Africa, Spain, Sri Lanka, Thailand, the Netherlands and the USA (Sandoval-Denis et al. 2019).

Table 183 *Neocosmospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>N. bostrycoides</i>	Honduras	ND	Sandoval-Denis et al. (2019)
<i>N. brevis</i>	Belgium	Polluted soil water	
<i>N. keratoplastica</i>	Belgium	Greenhouse humic soil	
<i>N. lichenicola</i>	Brazil and Tahiti	ND	
<i>N. martii</i>	USA	ND	
<i>N. parceramosa</i>	South Africa	Silty loam soil	
<i>N. pisi</i>	The Netherlands and USA	ND	
<i>N. pisi</i>	Belgium	Greenhouse soil	
<i>N. solani</i>	USA	Soil under <i>Castanea</i> sp.	
<i>N. solani</i>	Japan	Soil on wheat field	
<i>N. stercicola</i>	Belgium	Greenhouse humic soil	
<i>N. striata</i>	Japan	ND	
<i>N. vasinfecta</i>	South Africa	ND	
<i>N. vasinfecta</i>	Ivory Coast	Soil on coffee plantation	

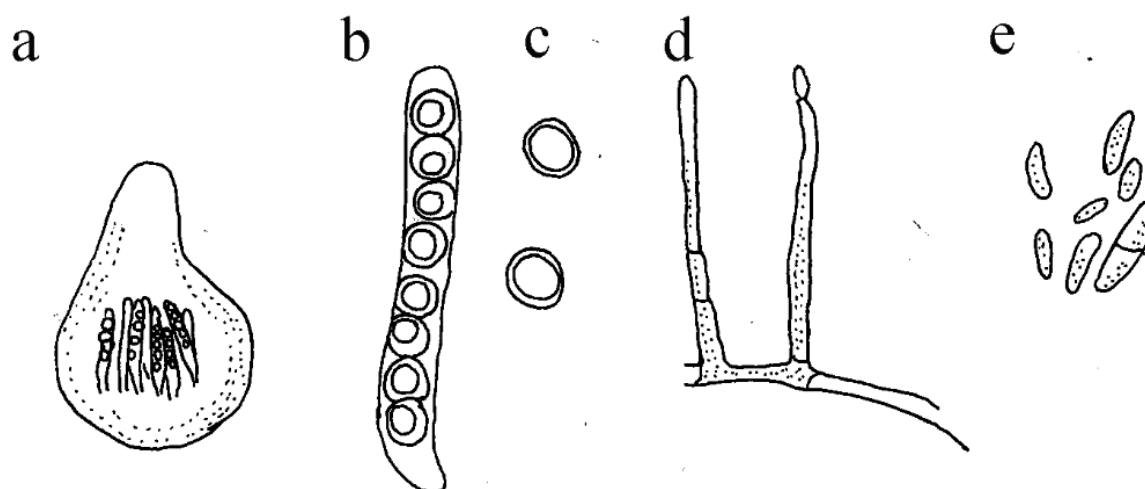


Figure 143 – *Neocosmospora vasinfecta* (CBS 237.55). a. Ascoma. b. Ascus c. Ascospores. d. Conidiophore. e. Conidia. Redrawn from Domsch et al. (1993).

Paracremonium L. Lombard & Crous, in Lombard, van der Merwe, Groenewald & Crous, Stud. Mycol. 80: 233 (2015) Fig. 144

Index Fungorum number: IF810267; Facesoffungi number: FoF06584

While revising *Nectriaceae*, Lombard et al. (2015) introduced *Paracremonium* based on phylogeny using ITS, LSU, *TEF1-α*, ATP citrate lyase (*acl1*), *RPB1*, *RPB2*, *TUB2*, *cmdA* and *His3* and morphology, accommodating *P. inflatum* as the type species. It presently comprises eleven species (Species Fungorum 2025). The asexual morph is characterized by erect, cylindrical to subcylindrical, hyaline conidiophores, and monophialidic, hyaline, ampulliform or subcylindrical conidiogenous cells, with aseptate, fusiform to ellipsoidal to cylindrical conidia, forming in slimy heads (Lombard et al. 2015). Sometimes mycelium produces sterile coils with conidiophores radiating outwards with inconspicuously swollen septa, which is a significant character for this genus; however, some species do not have this character. The sexual morph is not observed (Lombard et al. 2015, Ming et al. 2021). This genus is recorded as human pathogens and entomopathogenic fungi. They are distributed in air, aquatic habitats, human clinical samples and terrestrial habitats such as alkaline mud samples, cave sewage, soil, stream embankments, submerged wood and water located in Canada, China, Egypt, India, Thailand, the Netherlands and the USA (Ming et al. 2021).

Table 184 *Paracremonium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Paracremonium apiculatum</i>	China	Cave	Ming et al. (2021)
<i>P. bendijkiorum</i>	The Netherlands	ND	Crous et al. (2021a)
<i>P. binnewijzendii</i>	The Netherlands	Soil from stream embankment	
<i>P. moubasheri</i>	Egypt	Alkaline mud	Al-Bedak (2019)

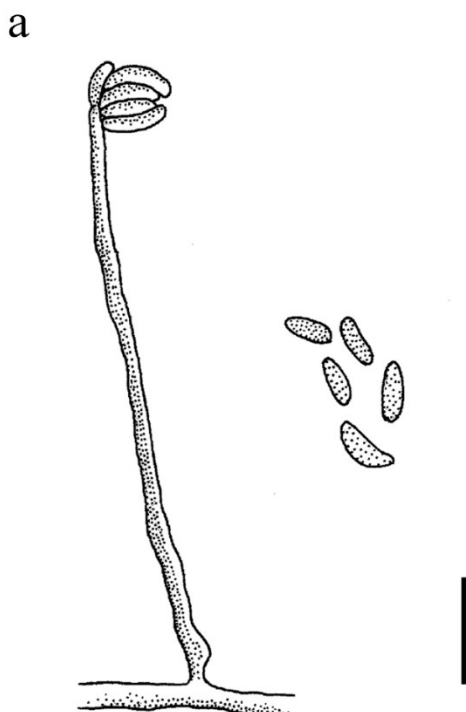


Figure 144 – *Paracremonium inflatum* (CBS 485.77). a Conidiophores and conidia. Scale bar: a, b = 10 µm. Redrawn from Lombard et al. (2015).

Ophiocordycipitaceae G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora

Purpureocillium (Thom) Luangsa-ard, Houbraken, Hywel-Jones & Samson, FEMS Microbiol. Lett. 321(2): 144 (2011)

Index Fungorum number: IF519529; Facesoffungi: FoF14520

Luangsa-ard et al. (2011) introduced *Purpureocillium* with the type species *P. lilacinum*. The genus comprises nine species and all of them have molecular data (Chen et al. 2024). The asexual morph is characterized by the mononematous, stiff, verticillate conidiophores and ovate to cylindrical phialides. Conidia are in dry divergent chains, purple in mass, straight to slightly curved or ellipsoidal to fusiform and slightly roughened. Species are recorded as saprobes and opportunistic pathogens in humans (Calvillo-Medina et al. 2021, Corrêa-Moreira et al. 2022). *Purpureocillium* has a cosmopolitan distribution and is found in animals, indoor air, humans, insect larvae, nematodes, plant debris and soil in China, Iran, Mexico and Venezuela (Luangsa-ard et al. 2011). Some have been used for biological control of plant-parasitic nematodes and insects in agricultural practices (Corrêa-Moreira et al. 2022).

Table 185 *Purpureocillium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Purpureocillium lavendulum</i>	Venezuela	ND	Perdomo et al. (2013)
<i>P. lilacinum</i>	ND	ND	Luangsa-ard et al. (2011)
<i>P. sodanum</i>	Iran	ND	
<i>P. jiangxiense</i>	China	ND	Chen et al. (2024)
<i>P. zongqii</i>	China	Sinkhole	

Ophiocordyceps Petch, Trans. Br. mycol. Soc. 16(1): 73 (1931)

Index Fungorum number: IF3598; Facesoffungi: FoF01318

Petch (1931) introduced *Ophiocordyceps* with the type species *O. blattae*. Being the largest genus in *Ophiocordycipitaceae*, it comprises 323 species (Fei et al. 2024). The genus has hirsutella-like asexual morphs with columnar, wart-like, or filamentous, solitary or branched, hyaline to light or dark brown conidiophores, and unicellular, occasionally multicellular, conidia vary in shape; some species have a hyaline or colored mucus layer on the surface of one or more conidia, and several species produce secondary conidia (Liang 1990, Fei et al. 2024). The sexual morph has hard or flexible, dark-colored, and fibrous stromata with superficial or partially embedded perithecia arranged vertically or obliquely. Ascospores are cylindrical, septate or break into secondary spores (Luangsa-ard et al. 2018, Fei et al. 2024). The genus is pathogenic to a wide range of insects such as *Coleoptera*, *Diptera*, *Hemiptera* and *Lepidoptera*. Species can also be associated with decaying wood, forest plants, leaf litter, mosses, buried host insects, and soils in Brazil, China, Japan, Thailand and Ukraine (Fei et al. 2024).

Table 186 *Ophiocordyceps* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Ophiocordyceps sinensis</i>	China	ND	Peng et al. (2013), Xia et al. (2015)
<i>O. highlandensis</i>	China	<i>Pinus armandi</i> forest	

Tolypocladium W. Gams, Persoonia 6(2): 185 (1971)

Fig. 145

Index Fungorum number: IF10242; Facesoffungi number: FoF10425

Tolypocladium was established by Gams (1971), accommodating *T. inflatum* as the type species. Currently, 52 species are listed in the Species Fungorum (2025), but only around 34 are supported by the molecular data. Previously, the genus was placed in *Clavicipitaceae* (Sung et al. 2007), subsequently, *Tolypocladium* was placed in *Ophiocordycipitaceae* using SSU, LSU, *TEF*-

1α, *RPB1* and *RPB2* phylogeny (Sung et al. 2007). Based on combined SSU, LSU, *TEF-1α* and *RPB1* combined phylogeny, Wang et al. (2022) revised the genus, introducing soil inhabiting new species and providing a key to the 48 *Tolypocladium* species. The asexual morph is characterized by solitary or branched conidiophores, cylindrical to conical phialides, and one-celled, cylindrical to globose conidia. The sexual morph has darkly pigmented, stipitate stromata, with semi-immersed to immersed perithecia and cylindrical asci with cylindrical, multi-septate ascospores that disarticulate into part spores, though occasionally they remain articulating (Gams 1971, Hyde et al. 2020c, Wang et al. 2022c). These species produce metabolites such as cyclosporin A, tolypoalbin, tolypin, and tolyprolinol that can be used in pharmacology and biocontrol products. *Tolypocladium* species have been reported from insects, rotifers, on other fungi or as soil-inhabitants with parasitic, saprobic or plant endophytic life modes in Brazil, Canada, China, Finland, Japan, Mexico, New Zealand, Sri Lanka and the USA (Hyde et al. 2020c, Wang et al. 2022c).

Table 187 *Tolypocladium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Tolypocladium album</i>	Colombia, France, Scotland	ND	Gams (1980)
<i>T. geodes</i>	Austria, Canada, China	ND	Bissett (1983)
<i>T. microsporum</i>	Canada, Germany, the Netherlands	ND	
<i>T. nubicola</i>	Canada and China	ND	
<i>T. tundrense</i>	Canada	ND	
<i>T. inflatum</i>	Japan and the USA	ND	Hodge et al. (1996)
<i>T. terricola</i>	Finland	ND	Weiser et al. (1991)
<i>T. pseudoalbum</i>	China	ND	Wang et al. (2022c)
<i>T. yunnanense</i>	China	ND	

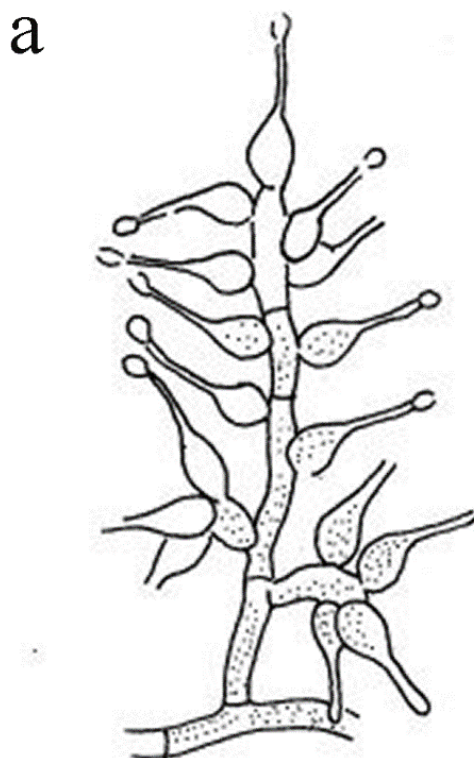


Figure 145 – *Tolypocladium inflatum*. a Branched conidiophore with conidia. Redrawn from Seifert et al. (2011).

Polycephalomycetaceae Y.P. Xiao, Y.B. Wang, T.C. Wen, H. Yu & K.D. Hyde

Polycephalomyces Kobayasi, Sci. Rep. Tokyo Bunrika Daig., Sect. B 5: 245 (1941)

Index Fungorum number: IF9494; Facesoffungi number: FoF03811

Polycephalomyces was introduced by Kobayasi (1941) and typified by *P. formosus*. It was previously accommodated in *Ophiocordycipitaceae*. Later, in Xiao et al. (2023), *Polycephalomycetaceae* was introduced to accommodate this genus by using the combined SSU, ITS, *TEF-1α*, *RPB1* and *RPB2* phylogeny. Presently, it comprises 13 species (Species Fungorum 2025), however only six have molecular data. The asexual morph has branched or unbranched, divergent conidiophores, 1–4 phialides arising from conidiophores and phialidic conidiogenous cells that are intercalary or terminal, giving rise to monomorphic, oblong to cylindrical, hyaline and one-celled conidia. The sexual morph remains undetermined. Species have been identified as insect parasites and also associate with plant leaves and soil in China, Ecuador, France, Japan and Thailand (Xiao et al. 2023).

Table 188 *Polycephalomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Polycephalomyces aurantiacus</i>	Thailand	<i>Ophiocordyceps barnesii</i> buried in the soil	Xiao et al. (2018)
<i>P. marginaliradians</i>	Thailand	<i>Cossidae</i> larva (Lepidoptera), buried in the soil.	

Stachybotryaceae L. Lombard & Crous

Brevistachys L. Lombard & Crous, Persoonia 36: 182 (2016)

Fig. 146

Index Fungorum number: IF815934; Facesoffungi number: FoF05536

Brevistachys was introduced by Lombard et al. (2016) based on *B. variabilis*. The genus comprises five species, and all of them are supported by the molecular data (*cmdA*, ITS, *RPB2* and *TUB2*) (Lombard et al. 2016). The genus accommodates stachybotrys-like species having distinctly short conidiophores and conidiogenous cells that are born either on conidiophores or directly from vegetative hyphae, features not observed in *Stachybotrys sensu stricto* (Lombard et al. 2016). They are saprobic fungi and are found on plants (*Musa* sp. and *Zingiber* sp.) and soil in Australia, Georgia, Mexico and Sri Lanka (Lombard et al. 2016).

Table 189 *Brevistachys* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Brevistachys globosa</i>	Indonesia	Botanical Garden	Rizki & Ilmi (2021)

Didymostilbe Henn., Hedwigia 41: 148. 1902 (non *Didymostilbe* Bres. & Sacc. 1902)

Index Fungorum number: IF8021; Facesoffungi number: FoF05542

Didymostilbe was introduced by Hennings (1902) with the type *D. coffeae*. Twelve species are accommodated in Species Fungorum (2025) and only three species are supported by molecular data. *Didymostilbe* was previously classified in *Bionectriaceae* (*Hypocreales*, *Hypocreomycetidae*), however, phylogenetic analyses (*cmdA*, ITS, *RPB2*, and *TUB2*) by Lombard et al. (2016) showed that this genus belongs to *Stachybotryaceae*. The asexual morph is characterized by thick-walled, large conidia with prominent apical and/or basal mammiform protuberances (Seifert 1985). Species are distributed in Australia, Cuba, Ecuador, Japan, Poland, Thailand and Trinidad that are associated with terrestrial and submerged wood, pods and soil (Lombard et al. 2016).

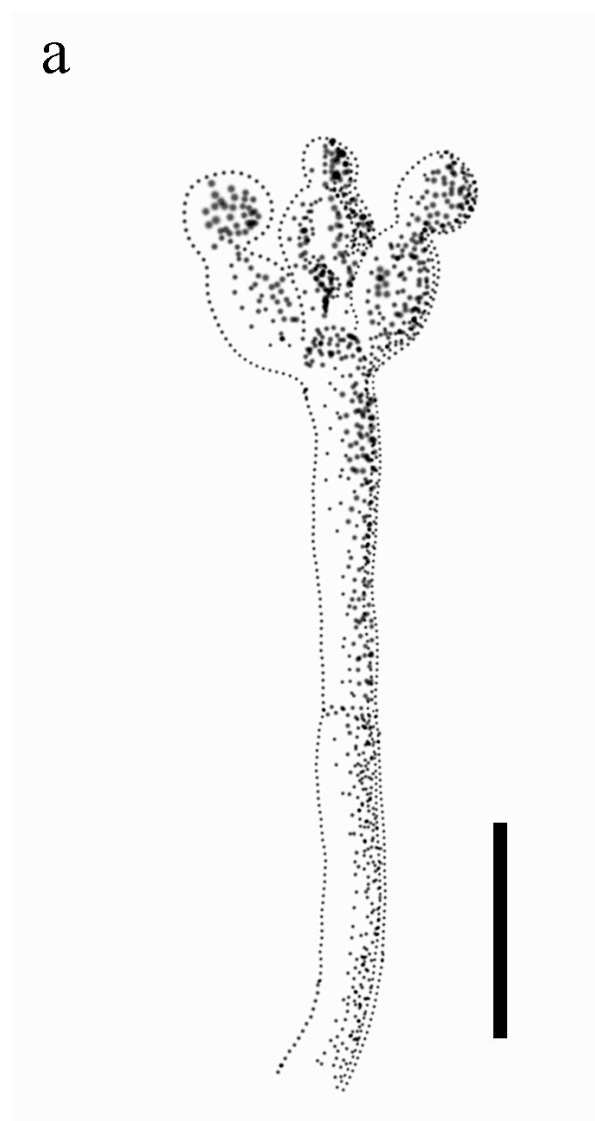


Figure 146 – *Brevistachys variabilis* (CBS 141057). Conidiogenesis on conidiophore. Scale bar a= 10 μ m. Redrawn from redrawn from Lombard et al. (2016).

Table 190 *Didymostilbe* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Didymostilbe</i> sp.	Thailand	ND	Manoch (1987)

Memnoniella Höhn., Centbl. Bakt. ParasitKde, Abt. II 60: 16 (1923) [1924]

Index Fungorum number: IF8900; Facesoffungi number: FoF05558

Memnoniella was introduced by Von Höhnel (1924) with the type species, *M. aterrima*. Seventeen *Memnoniella* species are listed in Species Fungorum (2025), and all of them have molecular data. The species show a close relationship with *Stachybotrys* and both genera have conidiophores composed of a stipe and a whorl of phialides giving rise to one-celled conidia. Additionally, at least part of the conidiophore or the conidia are pigmented. The confusing taxonomic history of these two genera was deeply discussed by Wang et al. (2015), and they concluded that *Memnoniella* is a synonym of *Stachybotrys*. However, Lombard et al. (2016) resurrected the genus *Memnoniella* and epitypified the type species of the genus, *M. echinata*, based on multi-locus phylogenetic analysis of *cmdA*, ITS, *RPB2* and *TUB2* sequence data. The asexual morph is characterized by mononematous, unbranched, septate conidiophores, phialidic conidiogenous cells and ellipsoidal to globose to reniform, aseptate conidia (Ellis 1971, Lombard et

al. 2016). *Memnoniella* can be distinguished from *Stachybotrys* by the formation of mostly smooth, unbranched, thick-walled conidiophores, giving rise to conidia, which are sometimes carried in dry chains (Lombard et al. 2016). They are mostly saprobic species associated with dead plant materials, and soil collected in Austria, China, Nepal, Thailand and Venezuela (Lombard et al. 2016, Tennakoon et al. 2021, Yeh et al. 2023).

Table 191 *Memnoniella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Memnoniella humicola</i>	Suriname	Soil under <i>Elaeis guineensis</i>	Lombard et al. (2016)
<i>M. sinensis</i>	China	ND	

Myrothecium Tode, Fung. mecklenb. sel. (Lüneburg) 1: 25 (1790)

Index Fungorum number: IF9049; Facesoffungi number: FoF05560

Myrothecium was introduced by Tode (1790) with type *M. inundatum*. There are 64 records in the Species Fungorum (2025). Previously, this genus was placed in *Hypocreales* order *incertae sedis* and later, it was accepted in *Stachybotryaceae* (Maharachchikumbura et al. 2015). *Myrothecium* species produce secondary metabolites with strong antifungal and antibiotic activities (Ruma et al. 2015, Lombard et al. 2016). Phylogenetic analyses of *Myrothecium* species (*Stachybotryaceae*) were constructed based on the combined SSU, LSU, ATP6, *TEF1-α* and *RPB2* regions (Chen et al. 2016), *cmdA*, ITS, *RPB2* and *TUB2* regions (Lombard et al. 2016), and ITS region (Dai et al. 2017). The asexual morph is characterized by sporodochial (to occasionally synnematus) conidiomata, phialidic conidiogenesis and variably-shaped conidia accumulating in a green mucoid drop (Tulloch 1972). *Myrothecium* species are mostly saprobes in decaying leaves and soil, and some are weak plant pathogens found in India, the Philippines, Thailand and Venezuela (Liang 1990, Chen et al. 2016, Dai et al. 2017). Some *Myrothecium* species produce macrocyclic trichothecenes, biochemical compounds being exploited for their strong cytotoxicity towards human and murine lymphocytic leukaemia and solid tumours (Lombard et al. 2016).

Table 192 *Myrothecium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Myrothecium curvisporum</i>	China	Farmland soil	Jiang et al. (2017a)
<i>M. australiense</i>	Australia	Forest soil	

Stachybotrys Corda, Icon. fung. (Prague) 1: 21 (1837)

Index Fungorum number: IF10052; Facesoffungi number: FoF 01246

Stachybotrys was introduced by Corda (1837) with *Stachybotrys atrus* (= *S. chartarum*) as the type species. There are 89 species accommodated in the Species Fungorum (2025), and only 13 have sequence data. Previously, *Memnoniella* and *Stachybotrys* were treated as distinct genera in *Stachybotryaceae* (Bisby 1945, Jong & Davis 1976). This idea was further supported by Lombard et al. (2016) using *cmdA*, ITS, *RPB2*, *TEF1-α* and *TUB2* multi-gene phylogenetic analyses. Conversely, Wang et al. (2015b) suggested *Stachybotrys* as a synonym of *Memnoniella* by indicating morphological and phylogenetic similarities. The asexual morph is characterized by macronematous, mononematous, erect, unbranched or branched, hyaline to olivaceous brown conidiophores, bearing 3–12 conidiogenous cells at the apex with aseptate, initially hyaline, becoming olivaceous brown to dark brown, smooth to verrucose, thick-walled, ellipsoidal to globose to fusiform to limoniform conidia that are rounded at both ends or with an apical hilum. The sexual morph is characterized by ascomata that are perithecial, stromatic, solitary or occasionally in pairs, subglobose to obpyriform, black, surface glabrous, papillate ostiolar region without periphyses, with setae irregularly arranged over the surface and with a single layer of cells of *textura angularis* in the ascomatal wall. Setae are erect, irregularly flexuous and sometimes

develop into fertile conidiophores. Asci are clavate, 8-spored, rounded apex to nearly truncate with refractive apical ring and containing cylindrical, 1-septate, subhyaline, verrucose ascospores that are slightly tapering towards apices and surrounded by a thick mucoid sheath (Lombard et al. 2016). Species are widely distributed as saprobes or pathogens and also can be found on cotton, damp papers, indoor environments, dead and living plant substrates, linen, and soil in Austria, Cuba, Indonesia, Italy, Japan, Thailand, Uganda and the USA (Wang et al. 2015b). *Stachybotrys chartarum* is a soil- born fungus that cause mycotoxicosis in humans and animals and human respiratory diseases (Wang et al. 2015b).

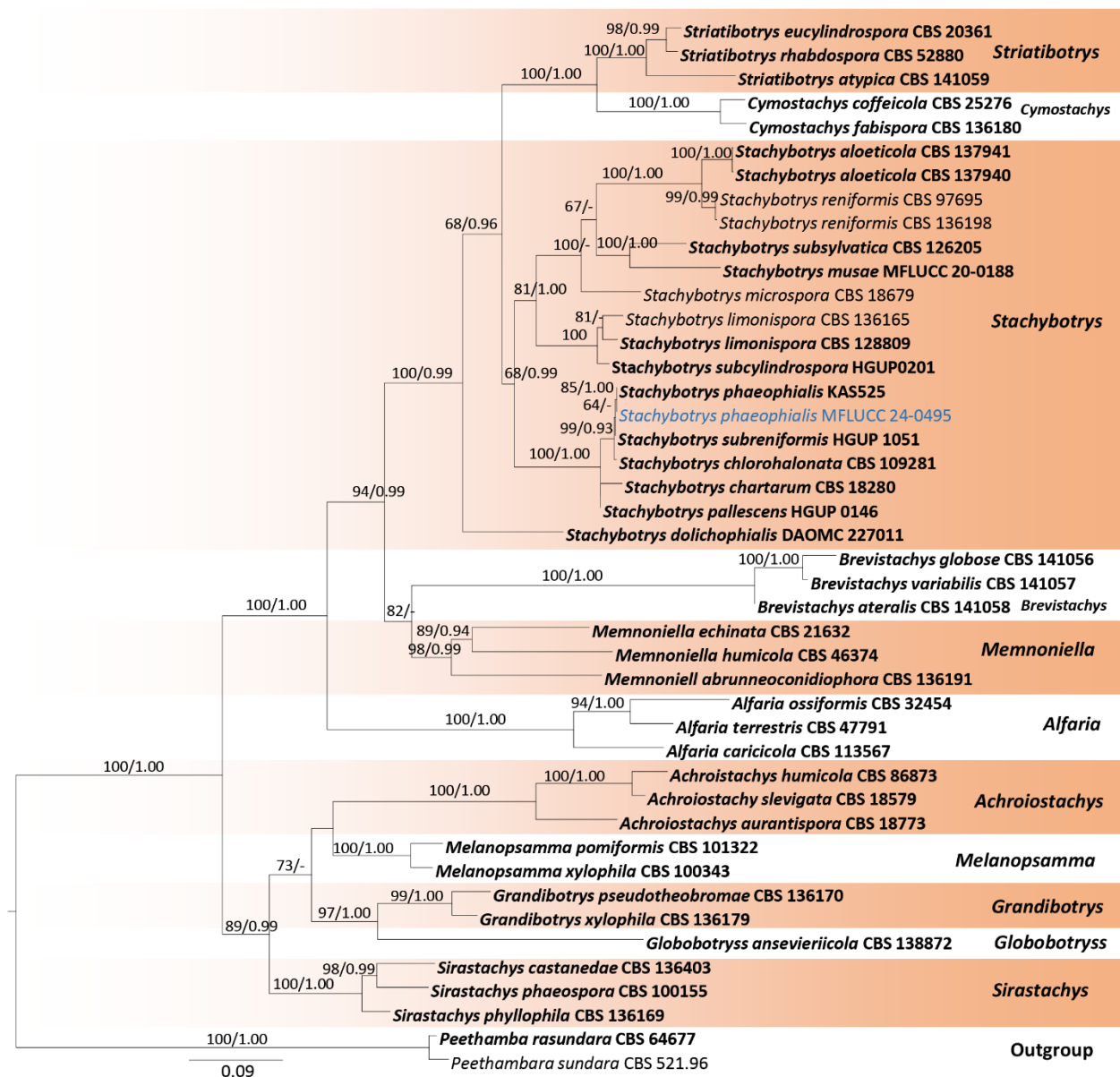


Figure 147 – The best-scoring IQ tree generated from the combined ITS, *TUB2*, *TEF1-α* and *RPB2* sequence data for *Stachybotryaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Peethambara sundara* (CBS64677 and CBS52196). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 1843 bp, and single gene alignments are ITS: 686 bp, *RPB2*: 773 and *TUB2*: 384 bp. The matrix had 1318 distinct alignment patterns with 23.66% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.230, C = 0.294, G = 0.256, T = 0.220; substitution rates

AC = 1.37637 AG = 3.24931, AT = 1.37637, CG = 1.00000, CT = 6.14096, GT = 1.00000; gamma distribution shape parameter $\alpha = 0.955$.

Table 193 *Stachybotrys* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Stachybotrys xigazenensis</i>	China	ND	Wu & Zhang (2010)
<i>S. jiangziensis</i>	China	ND	
<i>S. subcylindrospora</i>	China	Tropical primordial rain fores	Jie et al. (2013)
<i>S. terrestris</i>	China	Soil in arable plain (Hexi Corridor)	Kong et al. (2007)
<i>S. subreniformis</i>	China	Forest	
<i>S. chartarum</i>	Belgium, Canada, France and Switzerland	ND	Lombard et al. (2016)
<i>S. chlorohalonata</i>	France	ND	
<i>S. limonispora</i>	USA	ND	
<i>S. microspora</i>	Sudan	ND	
<i>S. pallescens</i>	China	ND	
<i>S. subsylvaticus</i>	Namibia	Woodland of <i>Colophospermum mopane</i>	

Stachybotrys phaeophialis L. Lombard & Crous, Persoonia 36: 223 (2016)

Fig. 148

Index Fungorum number: IF 816033; Facesoffungi number: FoF 16719

Sexual morph: Undetermined. Asexual morph: *Conidiophores* 35–63 × 2–4 µm ($\bar{x}$ = 45 × 3 µm, n=10), single or in groups, mononematous, macronematous, hyaline to sub-hyaline, 1–2 septate, straight to slightly flexuous, smooth to verrucose walled with 3–6 conidiogenous cells. *Conidiogenous cells* 6–10 × 2.5–5.5 µm ($\bar{x}$ = 8 × 4 µm, n=10), phialidic, hyaline to subhyaline, terminal, clavate to subclavate, smooth, with collarette present. *Conidia* 6–10 × 4.5–7.5 µm ($\bar{x}$ = 7.5 × 5.8 µm, n=25), hyaline, ellipsoidal to fusiform or oval, truncate base, thick-walled. *Chlamydospores* subglobose to globose, intercalary, hyaline.

Culture characteristics – *Colonies* on the PDA become 2–3 cm after 7 days at 25 °C, whitish brown, become greyish brown at the center, brown to brownish orange at the edge, undulate-margined, flat, reverse brown. *Hyphae* 3.5–2.5 µm ($\bar{x}$ = 3 µm, n = 20), superficial to semi-immersed, hyaline to pale brown, smooth to verrucose and aseptate, become septate at maturity.

Material examined – Thailand, Chiang Rai, Construction site, 20.031269N, 99.880183E, 398m, 17 October 2022, W.A. Erandi Yasanthika, (MFLU 25-0138), living culture 96 -u1-6=MFLUCC 24-0495.

GenBank numbers – MFLUCC 24-0495: ITS: PQ570523, *TUB2*: PV611463, *RPB2*: PV611460

Notes – According to multi-gene phylogeny (Figure 147), our strain clusters with *Stachybotrys phaeophialis* with 85% ML and 1.00 BYPP support. *Stachybotrys phaeophialis* was introduced by Lombard et al. (2016) from seeds of an unidentified herb imported into Canada from China. Each gene region of our strain was compared with the type species, resulting in 100% similarity. Our strain resembled the type species of *S. phaeophialis* by having macronematous, mononematous conidiophores that are single or in groups, smooth to slightly verrucose, phialidic conidiogenous cells, and ellipsoidal to fusiform conidia (Lombard et al. 2016). However, we have observed oval conidia as well. Our phylogeny and morphological results confirm that our strain is *S. phaeophialis*. Herein, we report *S. phaeophialis* from an urban area in Thailand and this is the first record of this species associated with soil.

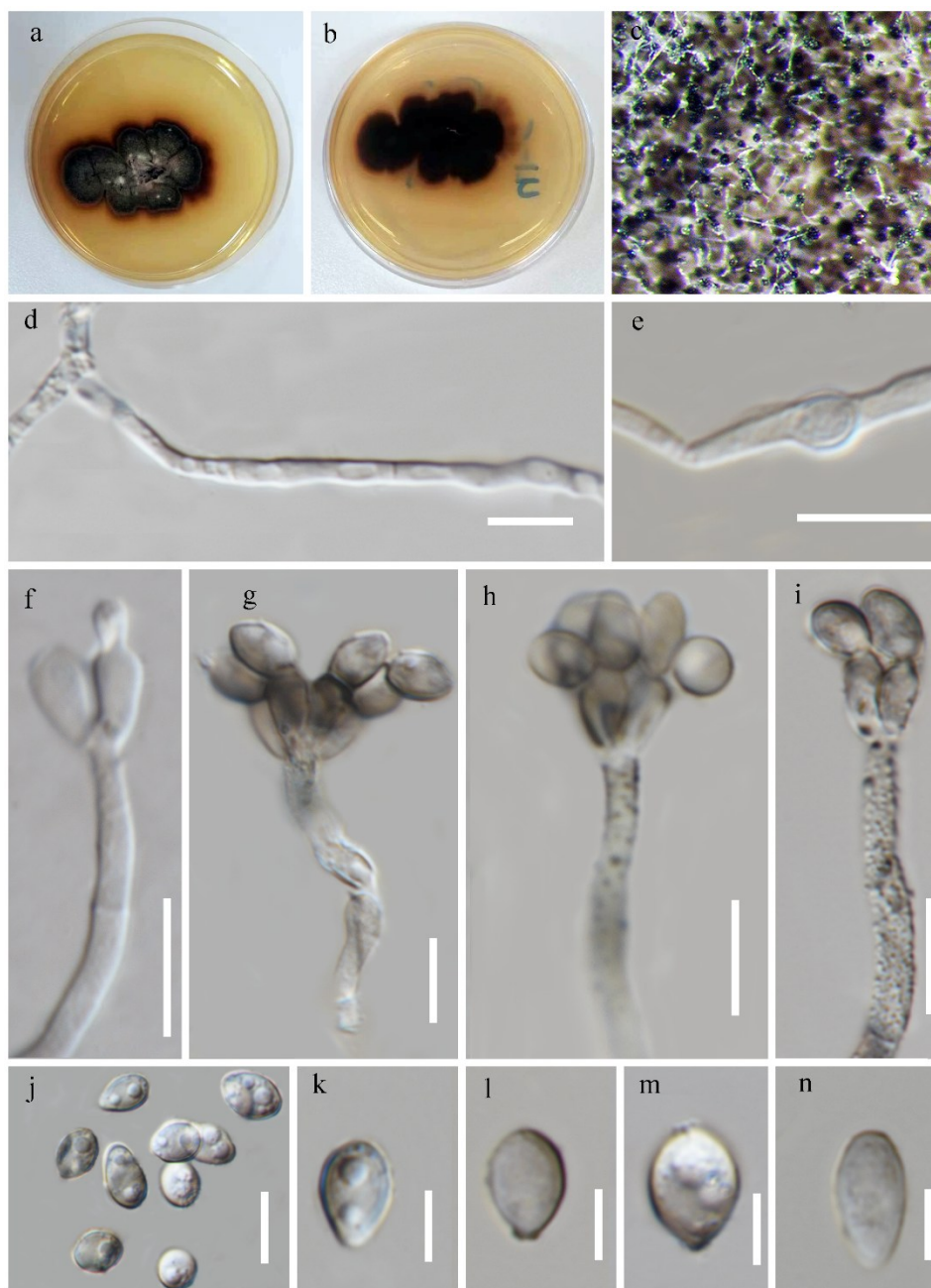


Figure 148 – *Stachybotrys phaeophialis* (MFLU 25-0138) a, b Culture characters on the PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d Mature pigmented hyphae. e Chlamydospore. f–i Conidiophores with phialides. j–n Conidia. Scale bars: d–j = 10 µm, k–n = 5 µm.

Microascales Luttr. ex Benny & Kimbr.

Ceratocystidaceae Locq. ex Réblová, W. Gams & Seifert

Ceratocystis Ellis & Halst., New Jersey Agric. Coll. Exp. Sta. Bull. 76: 14 (1890)

Fig. 149

Index Fungorum number: IF888; Facesoffungi number: FoF01249

Ceratocystis was erected by Halsted (1890), and the taxonomic description was provided by Halsted & Fairchild (1891), confirming the type species as *Ceratocystis fimbriata*. Currently, 106 species are listed in the genus Species Fungorum (2025), and around 45 have molecular data. Marin-Felix et al. (2017) provided a combined ITS, *TUB2*, *TEF1-α*, *RPB2* and ms204 phylogeny for *Ceratocystis*, mentioning that morphology is largely insignificant for distinguishing species

within the genus. Instead, the *RPB2* and *ms204* gene regions, in combination with ITS, have a high impact on species delineation in this genus. The asexual morph is chalara-like or thielaviopsis-like, and has straight or flexuous, hyaline to pale brown conidiophores, and endophialidic conidiogenous cells, which can be flask-shaped producing various shapes of cylindrical conidia or tubular form producing doliiform conidia (Marin-Felix et al. 2017a, Hyde et al. 2020c). Sometimes secondary, dark, barrel-shaped, thick-walled aleurioconidia are produced that facilitate survival in wood or soil during the dry seasons (Hyde et al. 2020c). The sexual morph of *Ceratocystis* is characterized by brown to black, subglobose to globose or obpyriform, ostiolate, perithecial ascomata, covered with undifferentiated hyphae and having ostiolar necks. The asci are evanescent, and the ascospores are hyaline, 1-celled, ellipsoidal, surrounded by a gelatinous sheath (de Beer et al. 2014, Marin-Felix et al. 2017, Hyde et al. 2020). These species are known as destructive plant pathogens that damage cash crops such as cacao, coffee, eucalyptus and giant taro. Species are distributed in Australia, Colombia, Ecuador, Japan, Russia, Sweden and Venezuela associated with stumps, soils, twigs and wood (Maharachchikumbura et al. 2016, Marin-Felix et al. 2017, Hyde et al. 2020).

Table 194 *Ceratocystis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Ceratocystis fimbriata</i>	Brazil	ND	Harrington (2013)

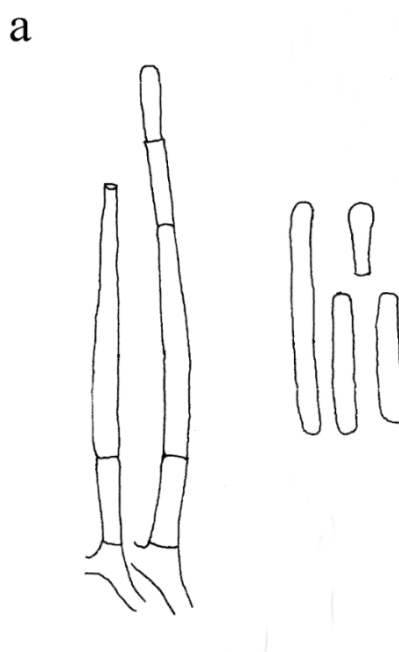


Figure 149 – *Ceratocystis* sp. a Conidiophores and conidia. The drawings are redrawn from Siefert et al. (2011)).

Graphiaceae De Beer

Graphium Corda, Icon. fung. (Prague) 1: 18 (1837)

Fig. 150

Index Fungorum number: IF8398; Facesoffungi number: FoF02143

Corda (1837) introduced *Graphium*, with *G. penicillioides* as the type species. There are 76 species currently listed in Species Fungorum (2025), and 16 are supported by molecular data. de Beer et al. (2013) established *Graphiaceae* (*Microascales*) based on the combined LSU and SSU phylogeny, and species belonging to *Graphium sensu stricto* were classified as *Graphium* with a genus description. Asexual morphology of the genus has synnematus conidiophores and monoblastic, percurrent, subulate or cylindrical conidiogenous cells, producing 1-celled, hyaline, cuneiform or ellipsoidal conidia (Wu et al. 2015, Hyde et al. 2020). These species are reported as

plant pathogens and harbor on living leaves, manure, plant debris, polluted water, soil and woody substrates collected from China, Costa Rica, Germany, India, Poland and Romania and the UK (de Beer et al. 2013, Hyde et al. 2020).

Table 195 *Graphium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Graphium variabile</i>	China	Forest	Wu et al. (2015b)
<i>G. wuweense</i>	China	Desert oasis soil	
<i>G. terricola</i>	India	Seashore soil	

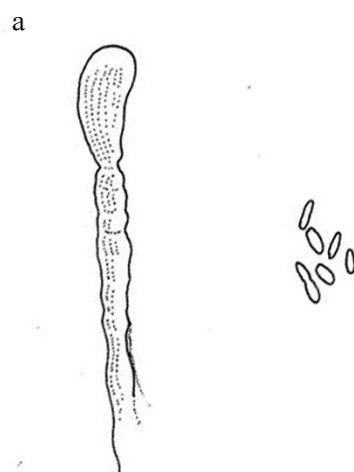


Figure 150. – *Graphium penicillioides*. a Conidiogenesis on synnematus conidiophores and conidia. Redrawn from Crane & Schoknecht (1973).

Microascaceae Luttr. ex Malloch

Acaulium Sopp, Skr. VidenskSelsk. Christiania, Kl. I, Math.- Natur. 11: 42. 1912. Fig. 151
Index Fungorum number: IF7011; Facesoffungi number: FoF06823

Acaulium was introduced by Sopp (1912), and the type species is *A. albonigrescens*. Subsequently, the genus was considered a synonym of *Scopulariopsis* but was reinstated by Sandoval-Denis et al. (2016a; b), based on LSU, ITS, *TEF1-α* and *TUB2* phylogeny. Later, the placement of *Acaulium* was confirmed by Woudenberg et al. (2017) and Hyde et al. (2020). Currently, 8 species are listed in the genus (SpeciesFungorum 2025), and all of them are supported by molecular data (Su et al. 2020). However, morphology is not informative for species delineation in this genus (Sandoval-Denis et al. 2016b, Hyde et al. 2020c). The asexual morph of this genus is characterized by mononematous, rarely synnematus conidiophores and annellidic conidiogenesis with hyaline or subhyaline, smooth- and thick-walled guttulate conidia with a truncate base (Sandoval-Denis et al. 2016a, b). The sexual morph produces superficial or immersed scattered ascomata; evanescent, 8-spored, subglobose to globose asci, and pale orange to red-brown, 1-celled, lunate ascospores. Cultures can be grown at low temperatures and abundant sporulation can be observed at 15 °C. Hyphae have dense fascicles and are abundant with oil drops, which is significant in the genus. Species are distributed in terrestrial habitats worldwide, such as buildings, hair, litter, skin of a horse and soil (Sandoval-Denis et al. 2016b).

Table 196 *Acaulium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Acaulium acremonium</i>	Germany	Wheat field soil	Sandoval-Denis et al.

<i>A. pannemaniae</i>	the Netheralnds	ND	(2016a)
<i>A. peruvianum</i>	Peru	ND	Su et al. (2020)

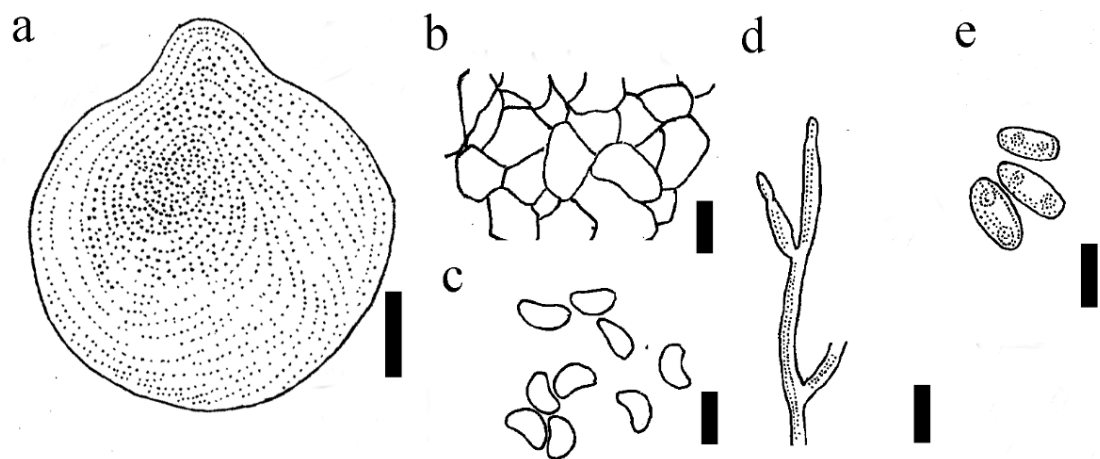


Figure 151 – *Acaulium albonigrescens* (IHEM 18560). a Ascoma. b Ascomatal peridium. c Ascospores. d Conidiophores and conidiogenous cells. e. Conidia. Scale bars: a = 100µm, b–e = 5 µm. Redrawn from Sandoval-Denis et al. (2016b).

Cephalotrichum Link, Mag. Gesell. naturf. Freunde, Berlin 3(1–2): 20 (1809) Fig. 152
Index Fungorum number: IF7527; Facesoffungi number: FoF06826

Cephalotrichum was introduced by Link (1809) and typified by *C. stemonitis*. The genus comprises 42 species (Species Fungorum 2025), and 22 are supported by molecular data. The updated phylogeny of *Cephalotrichum* was provided with new species by Woudenberg et al. (2017) based on LSU, ITS, *TUB2* and *TEF1-α* multi-gene phylogeny, while studying cultures and herbarium specimens in China. The asexual morph is hyphomycetous, and has branched or unbranched, septate conidiophores that are aggregated in synnemata, penicillately arranged, annellidic conidiogenous cells, producing basipetal, catenate, dry, 1-celled, obovoid, ellipsoidal, globose to subglobose conidia. The echinobotryum-like synasexual morphs produced oval to fusiform, dark brown, verrucose and thick-walled conidia often with a pointed apex (Link 1809). Sexual morph is unknown. These species are saprobic on dung, indoors, soil and wood with a worldwide distribution including Argentina, China, England, Italy, Japan, the Netherlands and the USA (Sandoval-Denis et al. 2016b, Hyde et al. 2020).

Table 197 *Cephalotrichum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cephalotrichum asperulum</i>	Argentina	ND	Wei et al. (2024)
<i>C. asperulum</i>	China	Farmland soil	
<i>C. brunneisporum</i>	China	Forest soil	
<i>C. cylindricum</i>	France	ND	
<i>C. dendrocephalum</i>	Iraq	Cultivated soil	
<i>C. domesticum</i>	China	Bamboo forest soil	
<i>C. gorgonifer</i>	China	Forest soil	
<i>C. hinnuleum</i>	South Korea	ND	
<i>C. lageniforme</i>	China	Forest soil	
<i>C. microsporum</i>	Germany	Wheat field soil	
<i>C. nanum</i>	China	Meadow soil	
<i>C. stemonitis</i>	USA	ND	
<i>C. tenuissimum</i>	USA	ND	Woudenberg et al. (2017b)
<i>C. telluricum</i>	Canada	ND	
<i>C. verrucisporum</i>	the Netehrland	Sand dune	



Figure 152 – *Cephalotrichum stemonitis*. Conidiophores, conidiogenous cells and conidia. Redrawn from Seifert et al. (2011).

Gamsia M. Morelet, Ann. Soc. Sci. Nat. Arch. Toulon et du Var 21: 105 (1969)

Index Fungorum number: IF8306; Facesoffungi number: FoF06831

Gamsia was initially erected by Morelet (1969) with the type species *Gamsia dimera*. The genus accommodates six species (Species Fungorum 2025), and all of them have molecular data. Sandoval-Denis et al. (2016b) accepted the current placement of *Gamsia* based on the LSU, ITS, *TEF1-α* and *TUB2* phylogeny and the morphology, particularly the lack of well-differentiated conidiophores and the conidial arrangement with large apical clusters. The asexual morph has unbranched or sometimes branched, septate, hyaline conidiophores, with two types of conidia and conidiogenesis. Polyblastic conidiogenous cells form 1-celled, ovoid to broadly ellipsoidal, brown to black, smooth- and thick-walled conidia, flat at the base and annellidic conidiogenous cells sometimes grouped in sporodochia, producing catenate, 1–2-celled, oval to ellipsoidal, hyaline, smooth- and thin-walled conidia, truncate at the base. Species have been isolated from dung, milled rice, sediments and soil in Austria, China, Germany, Japan and the Netherlands and the USA (Sandoval-Denis et al. 2016b).

Table 198 *Gamsia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Gamsia columbina</i>	the Netherlands	Sandy soil	Sandoval-Denis et al. (2016b)
<i>G. dimera</i>	Germany	<i>Triticum aestivum</i> field	Morelet (1969)
<i>Gamsia kooimaniorum</i>	the Netherlands	Garden soil	Crous et al. (2017a)

Lomentospora Hennebert & B.G. Desai, Mycotaxon 1(1): 45 (1974)

Index Fungorum number: IF 8790; Facesoffungi number: FoF13422

Lomentospora was introduced by Hennebert & Desai (1974) and typified with *L. prolificans*, which was isolated from soil. Currently, two species are accepted in the genus, and both have molecular data (Hennebert & Desai 1974, Crous et al. 2018, Hyde et al. 2020c). Previously, *Lomentospora* was considered invalid, and the species were transferred to *Beauveria*. Subsequently, the species was synonymized to *Scedosporium inflatum* and later was renamed as *S. prolificans* (Guého & de Hoog 1991, Malloch & Salkin 1984). Based on phylogeny (ITS and *TUB2*) and morphology, Lackner et al. (2014) re-established *Lomentospora*. Species are distributed in Australia, Europe and the southern USA (Ramirez-Garcia et al. 2018). The species prefer nutrient-rich environments and have the ability to inhabit in low-aerated and high-osmotic substrates, including polluted waters, pond bottoms, sewage, sludge and soil (from agricultural

lands, gardens, crude oil contaminated areas, manure of livestock, poultry, or cattle). *Lomentospora prolificans* is known as pathogenic to humans, causing respiratory tract and cutaneous infections and allergic conditions (Ramirez-Garcia et al. 2018, Huang et al. 2023).

Table 199 *Lomentospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Lomentospora valparaisensis</i>	Chillie	ND	Crous et al. (2018b)
<i>L. prolificans</i>	Belgium	greenhouse	Hennebert & Desai (1974)

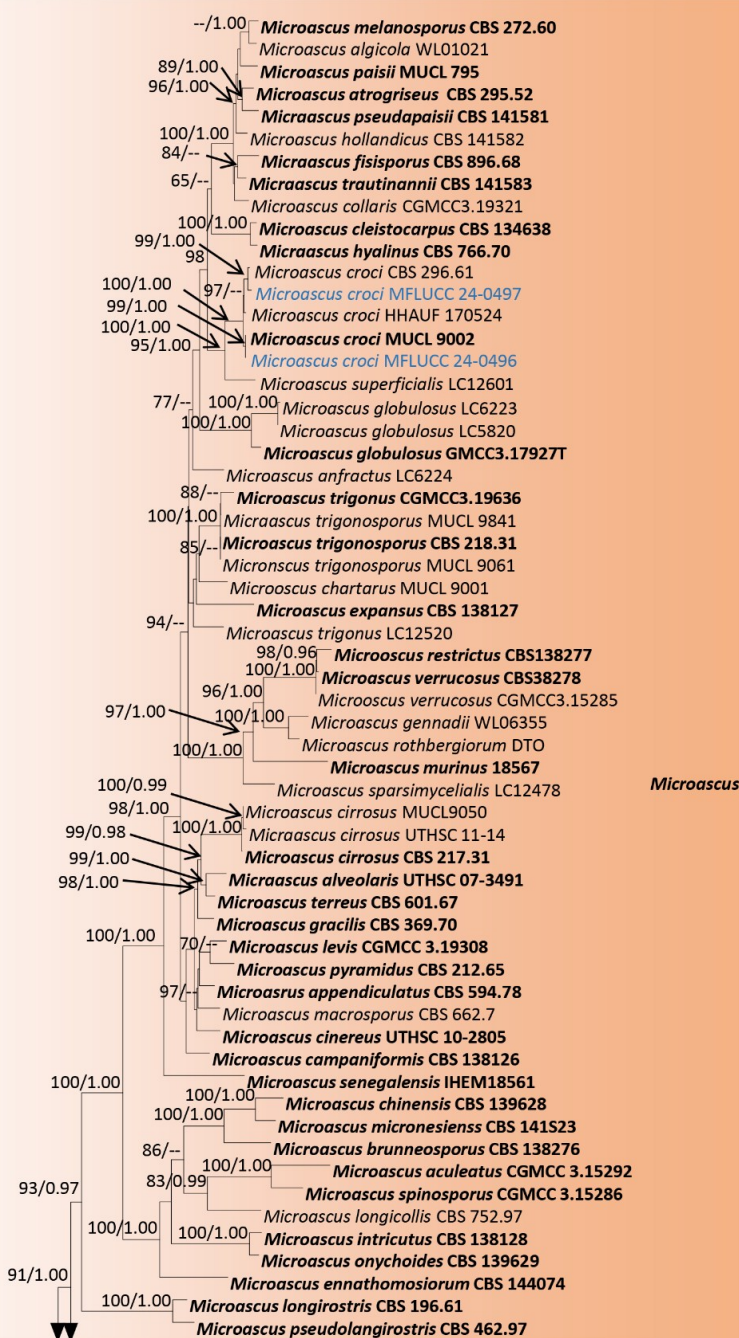


Figure 153 – The best-scoring maximum likelihood tree generated of the combined ITS, LSU, *TEF1-α*, *TUB2* sequence data for selected genera in *Microascaceae*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold.

The tree is rooted to *Graphium longistipitatum* (KFL42216RJPV) and *Graphium penicillioides* (CBS 102632). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 3012 bp, and single gene alignments are ITS: 641 bp, and LSU: 880 bp, *TEF1- α* : 962 bp, *TUB2*: 529 bp. The matrix had 1399 distinct alignment patterns with 24.03% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.216, C = 0.301, G = 0.279, T = 0.203; substitution rates AC = 0.69108, AG = 1.96958, AT = 1.47683, CG = 1.01176, CT = 4.66246, GT = 1.00000; gamma distribution shape parameter α = 0.714.

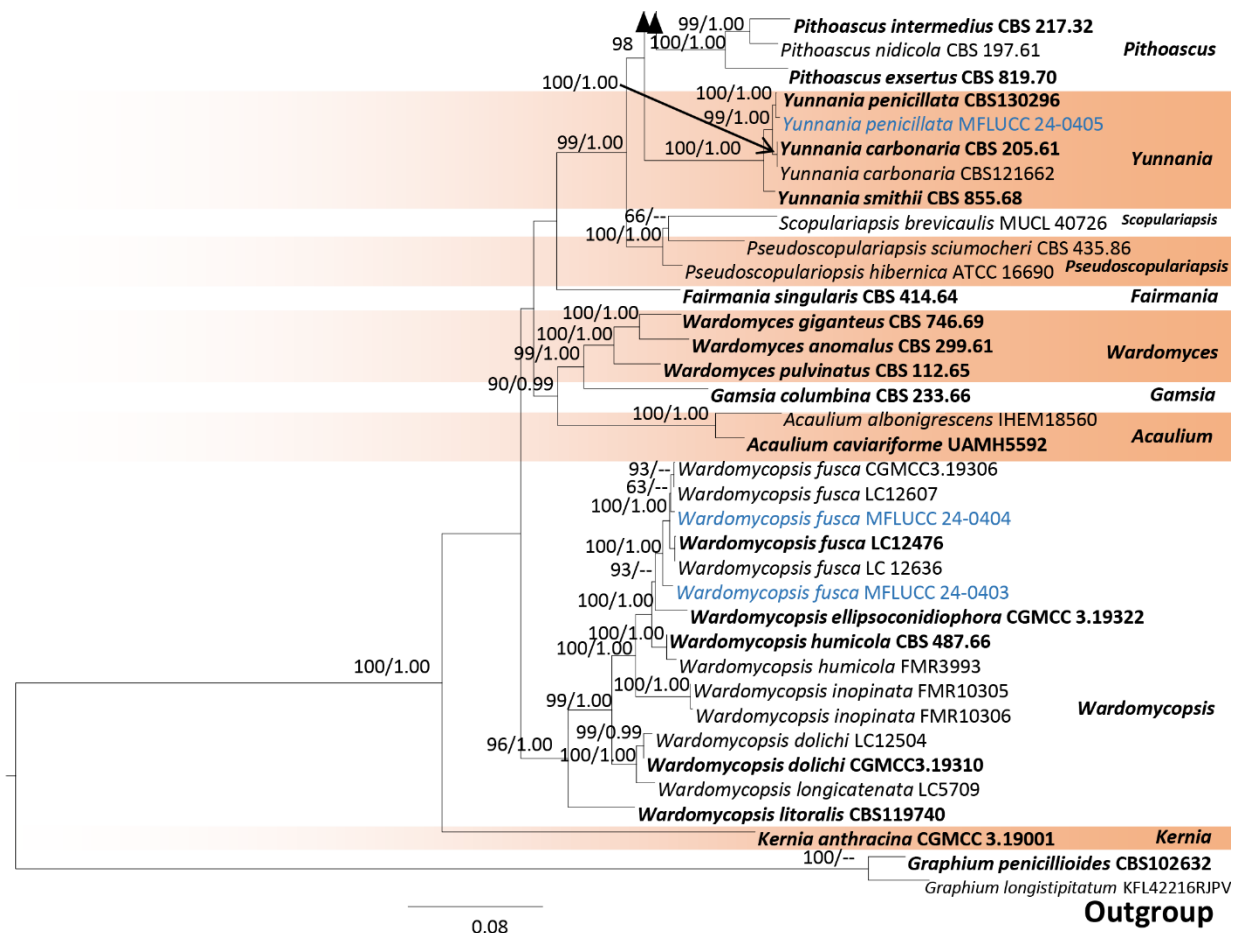


Figure 153 – Continued.

Microascus Zukal, Verh. Zool.-Bot. Ges. Wien 35: 339 (1885)

Index Fungorum number: IF3153; Facesoffungi number: FoF 12120

Microascus was erected by Zukal (1885), which was previously known as *Masoniella* (Sandoval-Denis et al. 2016a, Zhang et al. 2021c), and is typified by *Microascus longirostris*. This genus comprises 67 species (Species Fungorum 2025), while 48 have molecular data. The genus shows a polyphyletic nature in *Microascaceae* (Zhang et al. 2021c). Sandoval-Denis et al. (2016a, b) suggested that combined ITS, LSU, *TEF1- α* and *TUB2* regions are required to distinguish species between *Microascus*, *Scopulariopsis* and other closely related genera. Species are characterized by brown to green-brown mycelia and hyphomycetous asexual state. Conidiogenous cells (annellides) have a long, and narrow annellate zone. Conidia are globose to sub-globose, smooth to roughened, pale yellow to dark brown and produced singly or in basipetal dry chains. Sexual morph has perithecial, immersed or superficial, ostiolate ascomata with papillate or long cylindrical necks, unitunicate and 8-spored asci. Ascospores are 1-celled, asymmetrical and reniform (Sandoval-Denis et al. 2016a, Sun et al. 2020, Zhang et al. 2021c). *Microascus* species

have been recorded from air, animal dung, plant debris, indoor environments and soils (Sandoval-Denis et al. 2016a, b; Zhang et al. 2021c). Several species have been recorded as human, plant and insect pathogens (Sandoval-Denis et al. 2016a, b, Sun et al. 2020, Zhang et al. 2021c).

Table 200 *Microascus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Microascus levis</i>	China	Cave	Zhang et al. (2021c)
<i>M. trigonus</i>	China	Cave	
<i>M. aculeatus</i>	China	pig farm	Sun et al. (2020)
<i>M. spinosporus</i>	China	pig farm	
<i>M. cinereus</i>	India	ND	Sandoval-Denis et al. (2016a)
<i>M. gracilis</i>	UK	ND	
<i>M. intricatus</i>	Argentina	ND	
<i>M. longirostris</i>	Japan	ND	
<i>M. macrosporus</i>	the USA	ND	

Microascus croci (J.F.H. Beyma) Sand.-Den., Gené & Guarro, Persoonia 36: 17 (2015) Fig. 154

Index Fungorum number: IF809207; Facesoffungi number: FoF 16717

Sexual morph: Undetermined. Asexual morph: *Conidiogenous cells* (annellophores) pleurogenous on hyphae, hyaline, solitary or clustered, sometimes branched, ampuliform or obpyriform, inflated base, 2–3 μm ($\bar{x}$ = 2.5 μm , n=10) wide and abruptly tapering. *Conidia* 3.5–4.5 $\times$ 2.5–4.5 μm ($\bar{x}$ = 4 $\times$ 3.5 μm , n = 25), catenate, globose to sub-globose, rounded at apex, pale brown to hyaline, rough when gelatinous membrane becomes dry.

Culture characteristics – *Colonies* on the PDA at 25 °C, attaining 3–4 cm diam. in seven days, with dark brown to brownish black, powdery surface, raised, filiform margin, reverse dark brown at the center, with a pale brown ring at the edge. *Mycelium* mostly superficial. *Hyphae* 2–4.5 μm ($\bar{x}$ = 2.5 μm), hyaline to pale brown, smooth and septate when mature.

Material examined – Thailand, Chiang Rai Province, Chiang Rai, What Tham Pha Tong cave, 99.9038925N, 20.0918488E, on soil, 28 August 2022, W. A. Erandi Yasanthika, (MFLU 25-0175), living culture 86-cv23-24 = MFLUCC 24-0496. *ibid.*, Thailand, Chiang Mai, Chiang Dao District, Chiang Dao cave, on soil, 98.929366N, 19.400409E, 451m, 9 May 2022, W. A. Erandi Yasanthika, (MFLU 25-0176) living culture 113-cv22-3 = MFLUCC 24-0497.

GenBank numbers – MFLUCC 24-0496: LSU: PQ572136, ITS: PQ570524, *TUB2*: PV611066; MFLUCC 24-0497: LSU: PQ572137, ITS: PQ570525, *TUB2*: PV611067.

Notes – The multigene phylogeny of *Microascaceae* in Figure 153 shows that our strains (MFLUCC 24-0496 and MFLUCC 24-0497) cluster with *Microascus croci* with 100% ML and 1.00 BYPP statistical support. Our isolate is morphologically similar to *Microascus croci* in having catenate, globose to sub-globose mature conidia, rounded at apex (van Beyma thoe Kingma 1944). When compared to each ITS, LSU, *TEF1- α* and *TUB2* gene region of our strain with those of the type species of *Microascus croci*, they all are identical with 100% similarity. Based on ITS, LSU, *TEF1- α* and *TUB2* phylogeny (Sandoval-Denis et al. 2016a) suggested *Microascus croci* ($\equiv$ *Scopulariopsis croci*) as a new combination. The species has been isolated from air, aquatic sediments, soil and plants (Sandoval-Denis et al. 2016a). It has previously been reported from air samples from Nerja cave in Spain (Jurado et al. 2021). According to the phylogenetic and morphological evidence, we confirm our strains as *M. croci*. Furthermore, our study reports the first record of this species from Thai soil, isolated from both undisturbed and disturbed caves in Thailand.

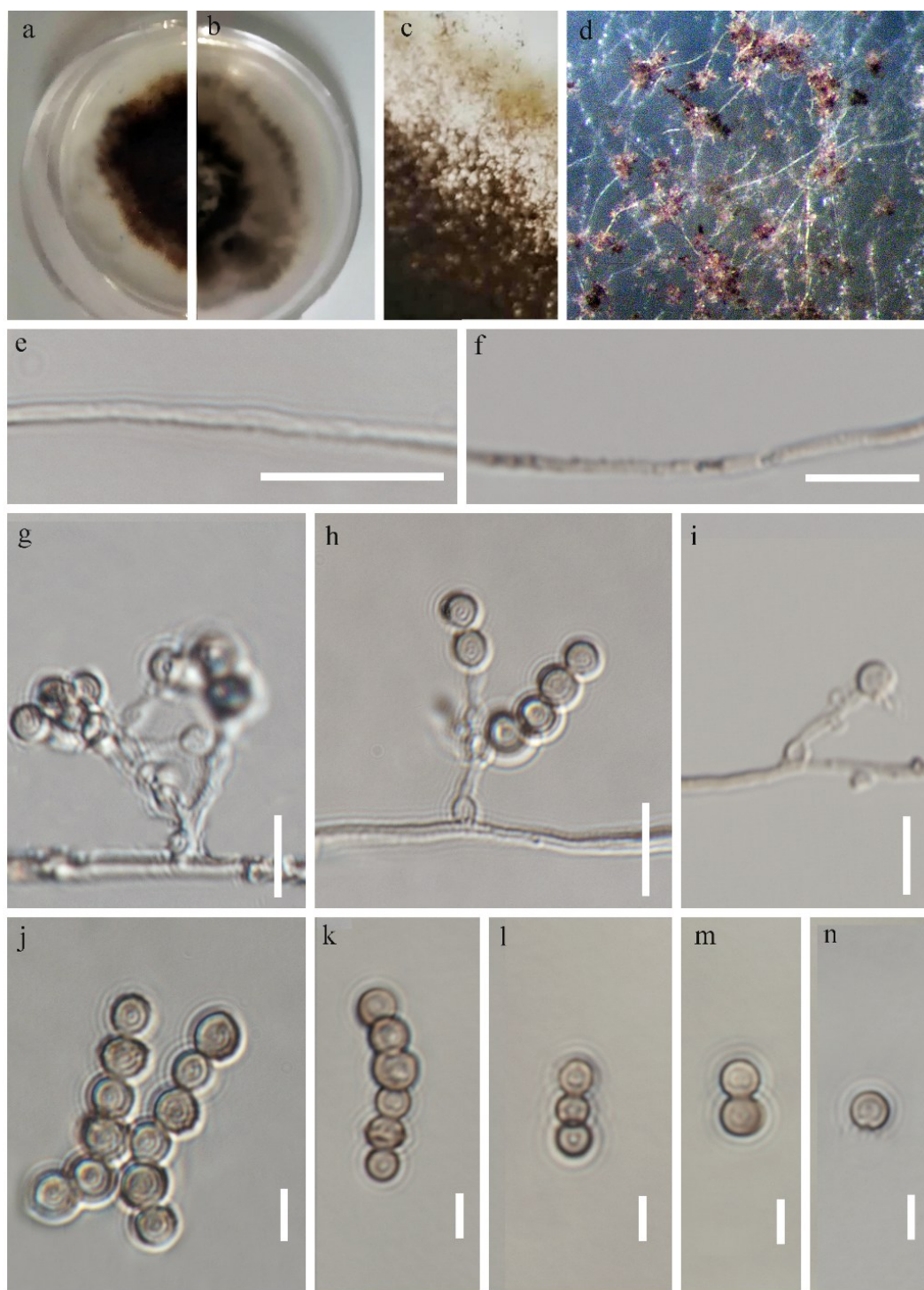


Figure 154. – *Microascus croci* (MFLU 25-0175) a, b Culture characters on the PDA (b = reverse). c, d Sporulated colony with conidial attachments on the mycelium. e Immature hyphae. f Mature hyphae. g–i Conidiogenesis on annellophores. j–n Conidia. Scale bars: f–i = 10 μ m, j–n = 5 μ m.

Petriella Curzi, Boll. R. Staz. Patalog. Veget. Roma 10: 384 (1930)

Index Fungorum number: IF3852; Facesoffungi number: FoF06834

Petriella was introduced by Curzi (1930), and the type species is designated as *P. asymmetrica*. The genus comprises nine species (Species Fungorum 2025), and five have molecular data (ITS and LSU). Morphologically, *Petriella* is closely resembles to *Microascus*, however, different in having larger ascospores (Barron et al. 1961). These species have been isolated from bathroom jars, compost, submerged decaying wood, dung, nails and soil in Iran and Thailand (Lackner & de Hoog 2011).

Table 201 *Petriella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Petriella setifera</i>	Singapore	ND	Lackner & de Hoog (2011)
<i>P. sordida</i>	Germany	ND	

Pseudallescheria Negr. & I. Fisch., Revista Inst. Bacteriol. Dr. Carlos G. Malbrán' 12 (201): 5–9 (1944) I

Index Fungorum number: IF4403; Facesoffungi number: FoF06835

Negróni & Fischer (1944) introduced *Pseudallescheria*, typified by *P. shearii*. The genus comprises eight species (Species Fungorum 2025). Based on the ITS phylogeny, Lackner et al. (2014) prioritized *Scedosporium* over *Pseudallescheria* and proposed several *Pseudallescheria* species in *Scedosporium*. However, up to now, several studies have accepted *Pseudallescheria* in *Microascaceae* (Kirk et al. 2013, Hyde et al. 2020, Wijayawardene et al. 2022). Hyde et al. (2020) suggested that scedosporium-like and graphium-like taxa are probably linked to the asexual morph of this genus. The sexual morph has cleistothecial ascomata and fusiform or ellipsoidal ascospores (Babu et al. 2014). *Pseudallescheria* species can act as saprobes, and they can grow in very low oxygen substrates and eutrophic environments (Rainer & De Hoog 2006), where they have been found in the manure of farm animals, polluted water, sewage and soil. In addition to being saprobes, they have also been reported as human and animal pathogens (Kaltseis et al. 2009, Wijayawardene et al. 2017, Hyde et al. 2020c). Species are distributed in Brazil, Korea, Kuwait, Namibia, Panama, Spain, Tajikistan and the USA (Rainer & De Hoog 2006, Babu et al. 2014).

Table 202 *Pseudallescheria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudallescheria africana</i>	Namibia	ND	Rainer & De Hoog (2006)
<i>P. desertorum</i>	Kwait	Salt marsh	
<i>P. boydi</i>	Brazil, Korea, Panama and Tadjikistan	ND	Rainer & De Hoog (2006), Babu et al. (2014)

Scopulariopsis Bainier, Bull. Soc. Mycol. Fr. 23: 98 (1907)

Fig. 155

Index Fungorum number: IF9854; Facesoffungi number: FoF06838

Bainier (1907) established *Scopulariopsis*, typifying with *S. brevicaulis*. This genus comprises 75 species (Species Fungorum 2025), but only 21 have molecular data. Sandoval-Denis et al. (2016a) accepted this genus in *Microascaceae* based on morpho-molecular (ITS, LSU, *TUB2* and *TEF1-α*) analyses. Still, there are phylogenetic ambiguities remaining in *Scopulariopsis*. The asexual morph is hyphomycetous and consists of branched, penicillate conidiophores and annellidic conidiogenous cells that produce 1-celled, hyaline, avellaneous or brown, globose to ovate conidia. The sexual morph has perithecial, immersed or superficial, globose to subglobose or pyriform, glabrous, ostiolate ascomata with unitunicate, 8-spored, subglobose, irregularly ovoidal or ellipsoidal, evanescent asci. Ascospores are 1-celled, asymmetrical, short, broadly reniform or lunate, with or without an inconspicuous germ pore (Hyde et al. 2020c, Sandoval-Denis et al. 2016a). *Scopulariopsis* species have a wide distribution, including Austria, Canada, China, France, Italy, and the Netherlands, associated with air, food, human clinical samples, moldy indoor environments, and soil (Hyde et al. 2020c).

Table 203 *Scopulariopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Scopulariopsis brevicaulis</i>	China	ND	Yasanthika et al. (2021)
<i>S. asperula</i>	Germany	ND	Sandoval-Denis et al. (2016a)

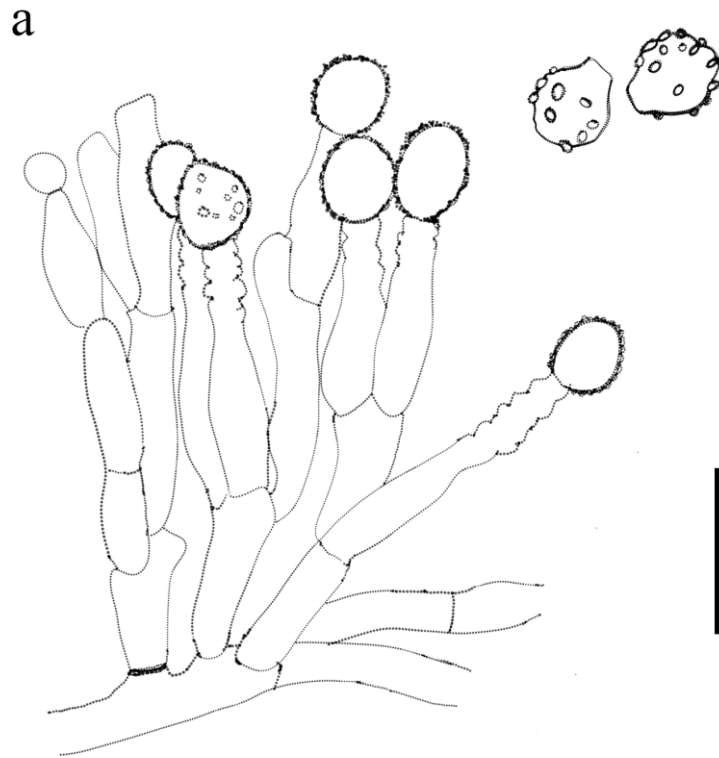


Figure 155 – *Scopulariopsis brevicaulis* (CBS273.30). a. Conidiophores and annelidic conidiogenous cells and conidia. Scale bar=500X. The drawings are redrawn from Domsch et al. (1980).

Scedosporium Sacc. ex Castell. & Chalm., Manual of tropical medicine (London): 1122 (1919) Fig. 156

Index Fungorum number: IF9794; Facesoffungi number: FoF05201

Saccardo (1911) suggested *Scedosporium* with the type species *S. apiospermum*, and this generic name was validated by Castellani & Chalmers (1919). Using the ITS phylogeny, Lackner et al. (2014) accepted *Scedosporium* over *Pseudallescheria*, and Abrantes et al. (2021) used *TUB2* and ITS to provide a phylogenetic revision for this genus while introducing a new species. Currently, 21 species are listed under *Scedosporium* (Species Fungorum 2025), while 17 are supported by molecular data. *Scedosporium*-like asexual morph produces annelidic conidiogenous cells with solitary conidia; graphium-like synnematosus synanamorph has unicellular sessile conidia; and polycytella-like synanamorph is only produced by *S. apiospermum* that has a sort of “macroconidia”. The sexual morph has dark, globose, non-ostiolate ascomata, with a thin peridial wall of *textura epidermoidea*, 8-spored, evanescent asci, and yellowish or reddish brown, broadly fusiform to ellipsoidal ascospores (Abrantes et al. 2021). This is a ubiquitous filamentous genus that occurs in air, aquatic, human clinical samples, indoor environments and soils found in China, Kuwait, Tajikistan, Thailand and the USA. Some species are pathogenic to humans causing respiratory disease (Abrantes et al. 2021, Wang et al. 2024a).

Table 204 *Scedosporium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Scedosporium apiospermum</i>	China	ND	Huang et al. (2023)
<i>S. boydii</i>		ND	
<i>S. aurantiacum</i>		ND	

<i>S. dehogii</i>		ND	
<i>S. haikouense</i>		ND	
<i>S. desertorum</i>	Kwait	Salt marsh soil	Abrantes et al. (2021)
<i>S. ellipsoideum</i>	Tayikistán	ND	
<i>S. satunense</i>	Thailand	Cave	Preedanon et al. (2023)

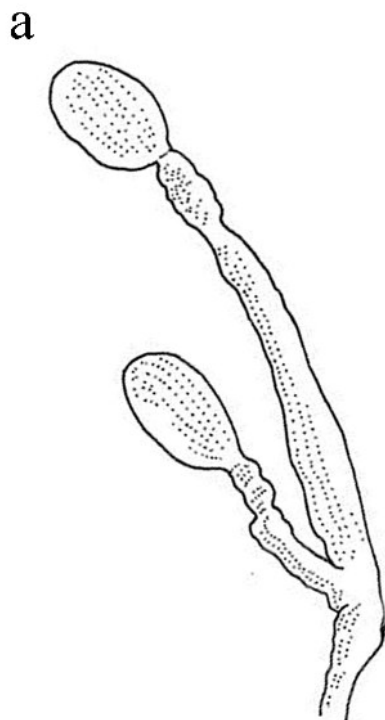


Figure 156 – *Scedosporium apiospermum*. a. Conidiogenous cells and conidia. Redrawn from Guarro et al. (2006).

Wardomyces F.T. Brooks & Hansf., Trans. Br. mycol. Soc. 8(3): 137 (1923) Fig. 157
Index Fungorum number: IF10433; Facesoffungi number: FoF06839

Brooks & Hansford (1923) introduced *Wardomyces*, with *W. anomalus* as the type species. There are eight species in the genus (Species Fungorum 2025), and seven have sequence data. Sandoval-Denis et al. (2016b) provided the phylogeny (ITS, LSU, *TUB2* and *TEF1-α*) for *Microascaceae* and showed that this genus does not form a monophyletic clade but and scattered in three closely related lineages. However, there are no significant morphological differences between *sensu lato* and *sensu stricto*. The asexual morph is hyphomycetous, characterized by branched conidiophores and polyblastic conidiogenous cells. Conidia are solitary, dark 1–2-celled, with a longitudinal germ slit. Some species have secondary annellidic, hyaline, 1-celled conidia, arranged in chains. Sexual morph possesses larger ascomata and dark ascospores with two germ pores (Sandoval-Denis et al. 2016b). Many species are saprobes that live in dung, mud and soil collected from China, the UK and the USA (Hyde et al. 2020c, Sandoval-Denis et al. 2016b).

Table 205 *Wardomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Wardomyces humicola</i>	Canada	ND	Sandoval-Denis et al. (2016b)
<i>W. ovalis</i>	Germany	ND	
<i>W. inflatus</i>	Belgium	ND	
<i>W. anomalus</i>	China	ND	HaoQin et al. (2012)
<i>W. humicola</i>	China	ND	

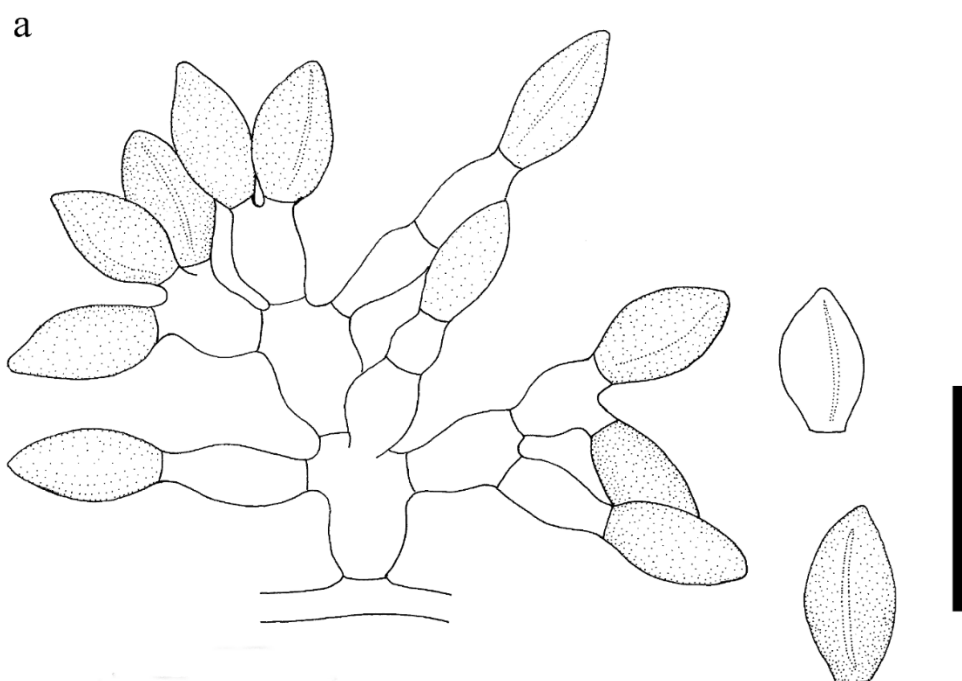


Figure 157 – *Wardomyces anomalus*. a. conidiophores and conidia. Scale bar: a = 10 μ m. Redrawn from Hennebert (1962).

Wardomycopsis Udagawa & Furuya, Mycotaxon 7(1): 92 (1978)

Index Fungorum number: IF 10434; Facesoffungi number: FoF 06840

Udagawa & Furuya (1978) introduced *Wardomycopsis*, and typified by *Wardomycopsis inopinata*. Currently, the genus has eight species (Species Fungorum 2025), and all with molecular data. The genus is characterized by conidiogenous cells that are annellidic, producing conidial chains that are similar to *Scopulariopsis* and *Fairmani*, featuring globose, darkly pigmented conidia with a single longitudinal germ slit. Sexual morph of the genus has not yet been recorded (Silvera-Simón et al. 2008, Sandoval-Denis et al. 2016b, Zhang et al. 2021c). Based on the combined ITS, LSU, *tef1- α* and *tub2* phylogeny of Sandoval-Denis et al. (2016a) and Zhang et al. (2017b), they revealed *Wardomycopsis* as a monophyletic genus. *Wardomycopsis* has coprophilous and saprobic species that are recorded from air, dung and soil, around the world in saprobic and cor (Sandoval-Denis et al. 2016a, Zhang et al. 2021c).

Table 206 *Wardomycopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Wardomycopsis dolichi</i>	China	Cave	Zhang et al. (2021c)
<i>W. fusca</i>	China	Cave	
<i>W. humicola</i>	Canada	ND	Sandoval-Denis et al.
<i>W. inopinata</i>	Myanmar	ND	(2016a)
<i>W. litoralis</i>	Spain	ND	Silvera-Simón et al. (2008)

Wardomycopsis fusca Z.F. Zhang, F. Liu & L. Cai, Fungal Diversity 10.1007/s13225-020-00453-7, (2020) Fig. 158

Index Fungorum number: 557752; Facesoffungi number: FoF 08461

Sexual morph: Undetermined. Asexual morph: *Conidiophores* 3.5–6.5 $\times$ 1.5–4.5 μ m ($\bar{x}$ = 3.5 $\times$ 2.5 μ m, n=15) arising from hyphae, ellipsoidal to globose, often branched, smooth, thick-walled and pale olive-brown to hyaline. *Conidiogenous cells* 3.5–6.5 $\times$ 1.5–4 μ m ($\bar{x}$ = 4 $\times$ 3 μ m,

n=10), ellipsoidal, clustered on conidiophores, smooth, thick-walled, hyaline to pale olive-brown. *Conidia* $3.5\text{--}4.5 \times 1.5\text{--}3 \mu\text{m}$ ($\bar{x} = 3.8 \times 2 \mu\text{m}$, $n = 25$), ellipsoidal, thick-walled, hyaline to pale brown with a truncated base.

Culture characteristics – *Colonies* on PDA at 25 °C, become 2–3 cm diam. after seven days, white becoming olive-green to dark green at the center, yellowish at the edge when mature, reverse dark brown at the center, with yellowish-white at the edge, and have a slimy to cottony, raised surface with an irregular margin. *Mycelium* immersed, producing immature aseptate, smooth-surfaced hyphae, becoming septate, branched, coarse-surfaced hyphae, sporulated after three weeks.

Material examined – Thailand, Chiang Mai, Chiang Dao District, Chiang Dao cave, Chiang Dao District, Chiang Mai Province, 98.929366N, 19.400409E, on soil, 9 May 2022, E. Yasanthika (MFLU 25-0123), living culture 118-cv22-6= MFLUCC 24-0404. *ibid.*, Thailand, Chiang Rai, Wat Tham Pha Tong cave, on soil, 99.9038925N, 20.0918488E, 430m, 28 August 2022, W.A. Erandi Yasanthika (MFLU 25-0124); living culture 87-cv23-15= MFLUCC 24-0403.

GenBank numbers – MFLUCC 24-0404: LSU: PQ565572, ITS: PQ565590, *TEF1-α*: PV611461; MFLUCC 24-0403: LSU: PQ565571, ITS: PQ565589, *TUB2*: PV615282, *TEF1-α*: PV615283

Note – Based on the multigene phylogeny study (Figure 153), our strains (MFLUCC 24-0404 and MFLUCC 24-0403) cluster with *Wardomyces fusca* (CGMCC3.19306, LC12526, LC12607, LC12636) with 100% ML statistical support. Comparison of each ITS, LSU, *TEF1-α* and *TUB2* gene region of our strain with the type species of *Wardomyces fusca*, resulted in 100% similarity. Our isolates morphologically resemble to *W. fusca* (HMAS 247997), in having ellipsoidal to globose, often branched conidiophores, ellipsoidal conidiogenous cells, and ellipsoidal, thick-walled conidia. However, we observed relatively smaller conidia ($3.5\text{--}4.5 \times 1.5\text{--}3 \mu\text{m}$) than the type species ($4\text{--}6.5 \times 2.5\text{--}3.5 \mu\text{m}$) (Zhang et al. 2021c). Aligning to morpho-molecular results, we confirm our strains as *W. fusca* from disturbed and undisturbed caves in Thailand. As the type species has been isolated from soil collected in Guangxi Cave, China (Zhang et al. 2021c), our study has become the first record of this species from soil in Thailand.

Yunnania H.Z. Kong, Mycotaxon 69: 320 (1998)

Index Fungorum number: IF 27939; Facesoffungi number: FoF 06841

Kong (1998) established *Yunnania* and typified by *Y. penicillata*. Woudenberg et al. (2017) transferred *Fuscoannellis* species to *Yunnania* by providing comprehensive phylogenetic analyses (LSU, ITS, *TUB2* and *TEF1-α*) for *Microascaceae*. *Yunnania* species cannot be delineated based on their ITS sequences (Woudenberg et al. 2017a). Currently, three species are accepted in this genus (SpeciesFungorum 2025), and all the species have molecular data. The asexual morph is hyphomycetous. Conidia are truncate and produced by annellids and the sexual morph has not yet been discovered (Kong 1998, Houbraken & Samson 2011). Species of this genus have been isolated from dead hardwood, molded pork sample and soil (Woudenberg et al. 2017). In addition, some species have been tested for producing useful bioactive compounds, such as *Yunnania penicillata* (von Freiesleben et al. 2019). The species have been found in China, Germany and Panama Woudenberg et al. (2017).

Table 207 *Yunnania* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Yunnania carbonaria</i>	Panama	ND	Woudenberg et al. (2017)
<i>Y. smithi</i>	Germany	Garden soil	

Yunnania penicillata H.Z. Kong, Mycotaxon 69: 320 (1998)

Fig. 159

Index Fungorum number: IF 447022; Facesoffungi number: FoF 06841

Sexual morph: Undetermined. Asexual morph: *Conidiophores* septate, frequently branched, discrete, each branch forms terminal group of annellidic conidiogenous cells. *Annellides*

ampulliform, $6\text{--}10 \times 2.5\text{--}4 \mu\text{m}$ ($\bar{x} = 8 \times 3 \mu\text{m}$, $n=10$), hyaline to pale brown, smooth-walled. *Conidia* in long basipetally developing chains, ellipsoidal to ovoid, with truncate base, subhyaline to pale brown, smooth, thick-walled, $3.5\text{--}4.5 \times 2.5\text{--}4 \mu\text{m}$ ($\bar{x} = 4 \times 3.5 \mu\text{m}$, $n = 25$).

Culture characteristics – *Colonies* on PDA become 2–3 cm after 7 days at 25 °C, olivaceous to olivaceous grey at the center, yellow ring at the edge, undulate-margined, flat powdery surface, reverse olivaceous grey at the center with yellow at the edge. *Hyphae* 1–2 μm ($\bar{x} = 1.5 \mu\text{m}$, $n=10$), superficial, hyaline to pale brown, smooth and mostly aseptate.

Material examined – Thailand, Chiang Rai Province, Chiang Rai, Fish cave temple, Wat Tham Pla cave, 99.863679N, 20.328605E, on soil, 8 February 2021, W.A.E. Yasanthika, (MFLU 25-0164), living culture 21-cv2-1 = MFLUCC 24-0405.

GenBank numbers – 21-cv2-1 = MFLUCC 24-0405: LSU: PQ565573, ITS: PQ565591, *TEF1- α* : PV611062, *TUB2*: PV611063.

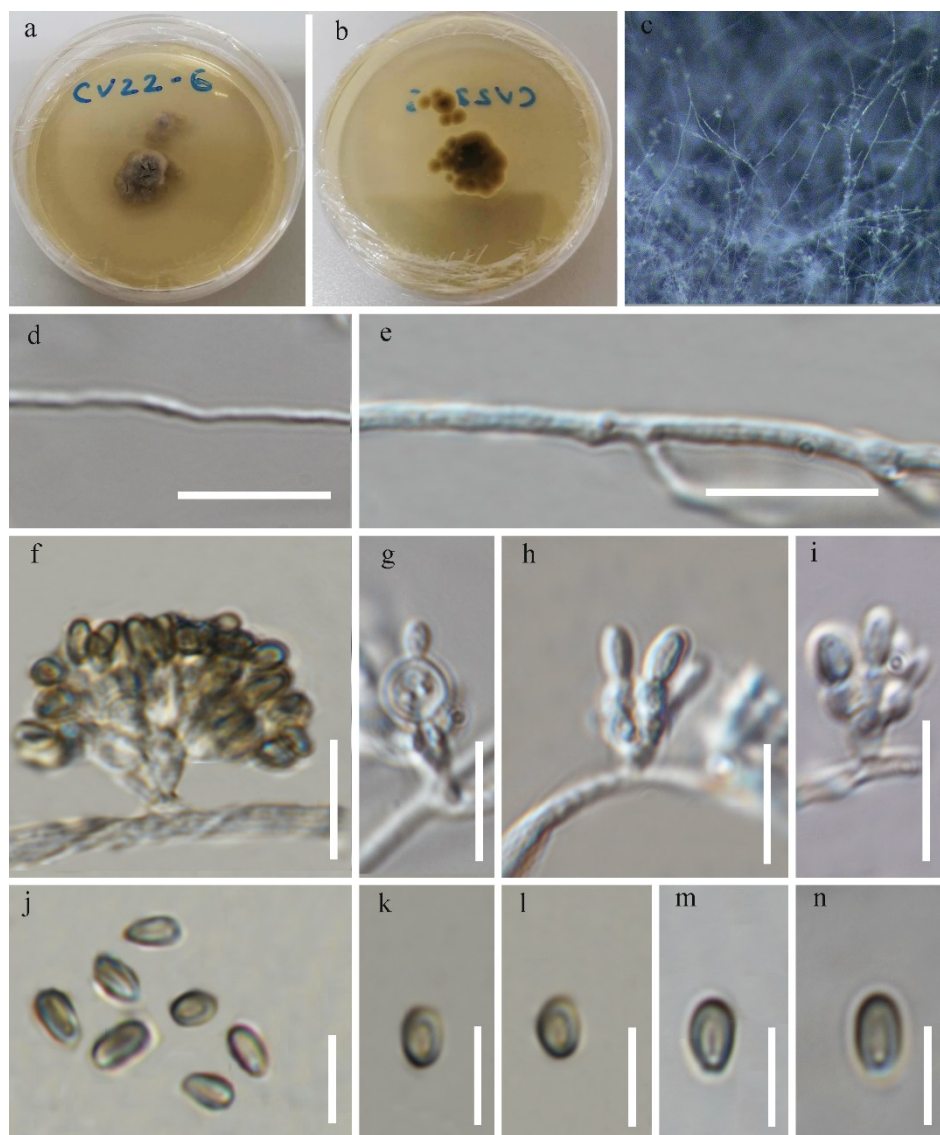


Figure 158 – *Wardomyopsis fusca* (MFLU 25-0123) a, b Culture characters on PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d Immature hyphae. e Mature course-surfaced hyphae. f–i Conidiogenesis on the conidiophores. j–n Conidia. Scale bars: d, e = 20 μm , f–i = 10 μm , j–n = 5 μm .

Notes – Figure 153 shows that our isolate (MFLUCC 24-0405) clusters with *Yunnania penicillata* with 99% ML, 1.00 BYPP statistical support. We compared each gene region (ITS,

LSU, *TEF1-α* and *TUB2*) of our strain with the *Y. penicillata* that showed 100% similarity. Morphologically, our isolate is similar to *Yunnania penicillata* in having frequently branching conidiophores with terminal, ampulliform annellides and ellipsoidal to ovoid conidia in long chains. The type species has been isolated from molded pork in Yunnan, China (Woudenberg et al. 2017a), and it has later been isolated from soil in India (Deshmukh et al. 2018). Herein, we confirm that our species as *Yunnania penicillata* from a disturbed cave; the first record of the species from Thai soil.

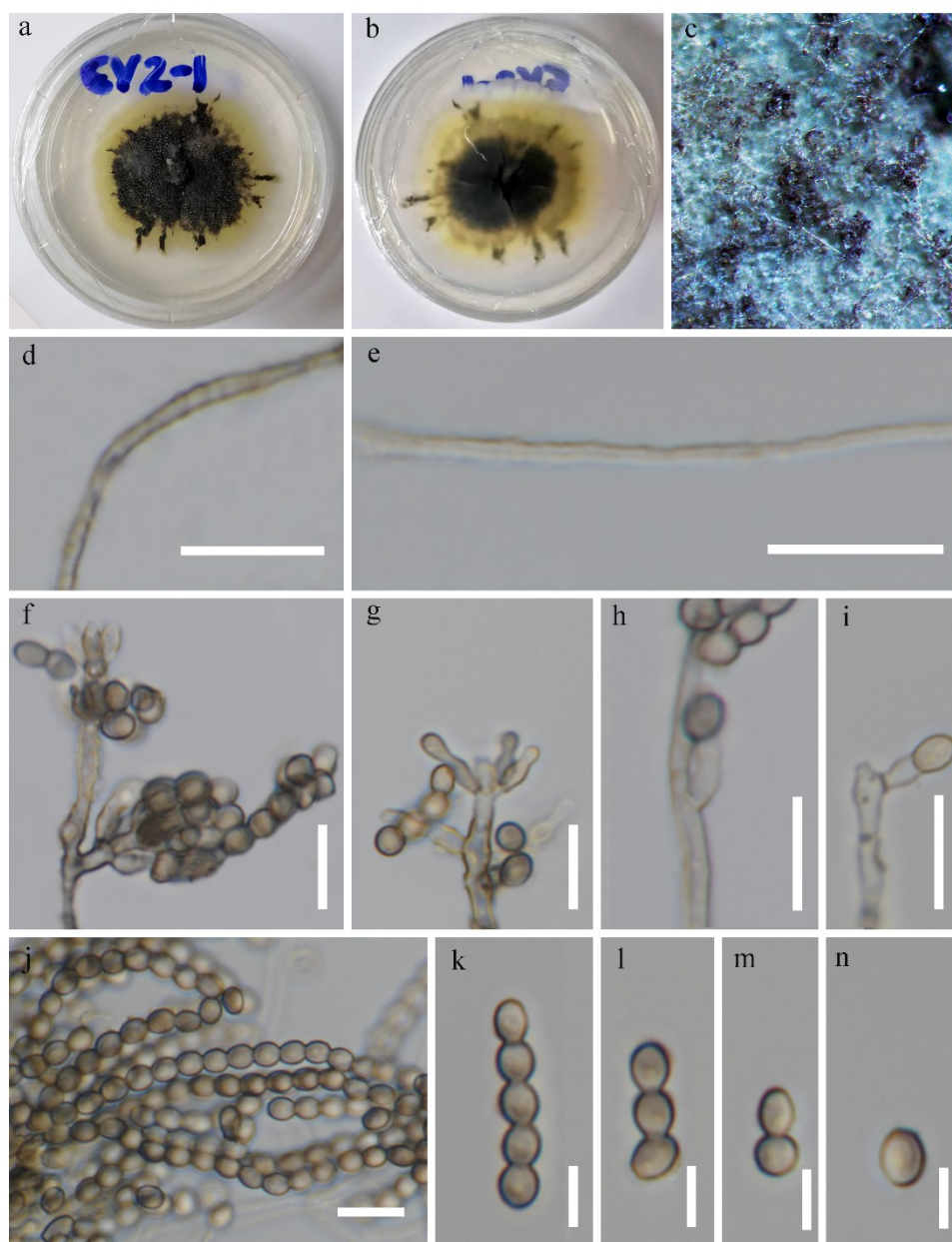


Figure 159 – *Yunnania penicillata* (MFLU 25-0164). a, b Culture characters on PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d Mature pigmented hyphae. e Immature hyphae. f–i Conidiogenesis. j–n Conidia. Scale bars: d–j = 10 μm, k–n = 5 μm.

Triadelphiaceae Y.Z. Lu, J.K. Liu, Z.L. Luo & K.D. Hyde

Triadelfia Shearer & J.L. Crane, Mycologia 63(2): 247 (1971)

Index Fungorum number: IF10270; Facesoffungi number: FoF13588

Fig. 160

Shearer & Crane (1971) erected *Triadelfhia*, and typified it with *T. heterospora*. Currently, the genus comprises 20 species (Species Fungorum 2025), and 10 of them have molecular data. The type species is characterized by sporodochial hyphomycete that was isolated from submerged wood blocks and have two different forms of conidia. This genus is characterized by holoblastic, unilocular conidiogenous cells and solitary, pigmented, and pleomorphic (2 to 5) synasexual morphs. However, sexual morph is currently unknown (Chuaseeharonnachai et al. 2020). Species are found in human clinical samples, soil, submerged wood and woody substrates in Australia, Egypt, Saudi Arabia, Thailand and the USA (Hyde et al. 2020c).

Table 208 *Triadelfhia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Triadelfhia pulvinata</i>	Saudi Arabia	Soil contaminated with bat guano	Bagga & Chattu (2018)

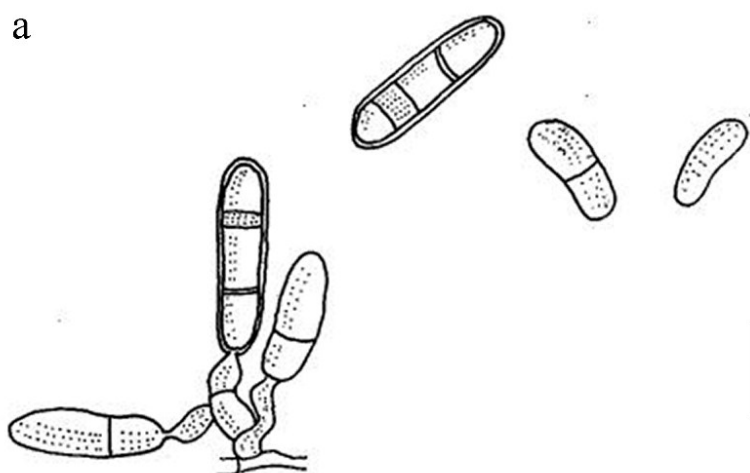


Figure 160 – *Triadelfhia heterospora*. a Conidiogenesis and conidia. Scale bar a = 10 µm. Redrawn from Shearer & Crane (1971).

Sordariomycetidae O.E. Erikss & Winka (= *Meliolomycetidae* P.M. Kirk & K.D. Hyde)

Cephalothecales Maharachch. & K.D. Hyde

Cephalothecaceae Höhn.

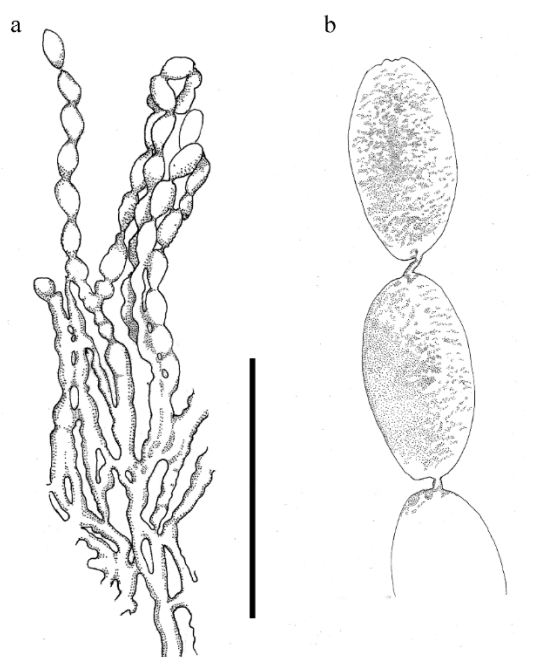
Victoriomyces D Davolos, B Pietrangeli, AM Persiani & O Maggi, Int. J. Syst. Evol. Microbiol. 69(4):1099-1110 (2019) Fig. 161

Index Fungorum number: IF823713; Facesoffungi number: FoF13021

Davolos et al. (2019) introduced *Victoriomyces* based on morphology and phylogeny (LSU, SSU and *RPB2*) within *Cephalothecaceae*, placing *V. antarcticus* as the type species. It remains as a monotypic genus supported by molecular data. The asexual morph has *Metarhizium*-like micromorphological characteristics that have conidiophores, develop a palisade layer, rarely simple, mostly branched, immediately below the septum profusely and closely in penicillate with a strongly tapering, thick-walled conidiogenous apex. Conidia are greyish yellow pigmented, ellipsoidal to ovoid and individual conidium appear dull yellow. The sexual morph remains unknown (Davolos et al. 2019).

Table 209 *Victoriomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Victoriomyces antarcticus</i>	Antarctica	Victoria Land	Davolos et al. (2019)

**Figure 161** – *Victoriomyces antarcticus*. a. Conidiophores in sporodochium; b. conidia. Scale bars: a = 50µm, b = 5 µm. Redrawn from Davolos et al. (2019).

Chaetosphaeriales Huhndorf, A.N. Mill. & F.A. Fernández

Chaetosphaeriaceae Réblová, M.E. Barr & Samuels

Caligospora Réblová, in Réblová & Nekvindová, Stud. Mycol. 106: 219 (2023)

Fig. 162

Index Fungorum number: IF848560; Facesoffungi number: FoF16641

Caligospora was introduced by Réblová & Nekvindová (2023) based on morphology and combined phylogeny (ITS, LSU and *TEF1*-α), with *Caligospora dilabens* (≡ *Chaetosphaeria dilabens*) as the type species. Currently, three species are accommodated in the genus (Réblová & Nekvindová 2023), and all of them have molecular data. The asexual morph is hyphomycetous and has macronematous, mononematous, solitary conidiophores and terminal, percurrently and sympodially proliferating conidiogenous cells. Conidia are pale brown, aseptate, smooth and adhering in slimy heads. The sexual morph is characterized by perithecial, superficial stroma, globose to subglobose, dark brown, glabrous, papillate ascomata with a two-layered, brittle, carbonaceous wall; persistent, branching, anastomosing paraphyses; and unitunicate, cylindrical-clavate, short-stipitate, 8-spored asci containing hyaline, fusiform, transversely septate ascospores with the cells separating into part-spores at an early stage within the ascus. The species have been recorded from Brazil and Japan from bamboo stems and culms and soil (Réblová & Nekvindová 2023).

Table 210 *Caligospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Caligospora pannosa</i>	Brazil	ND	Réblová & Nekvindová (2023)

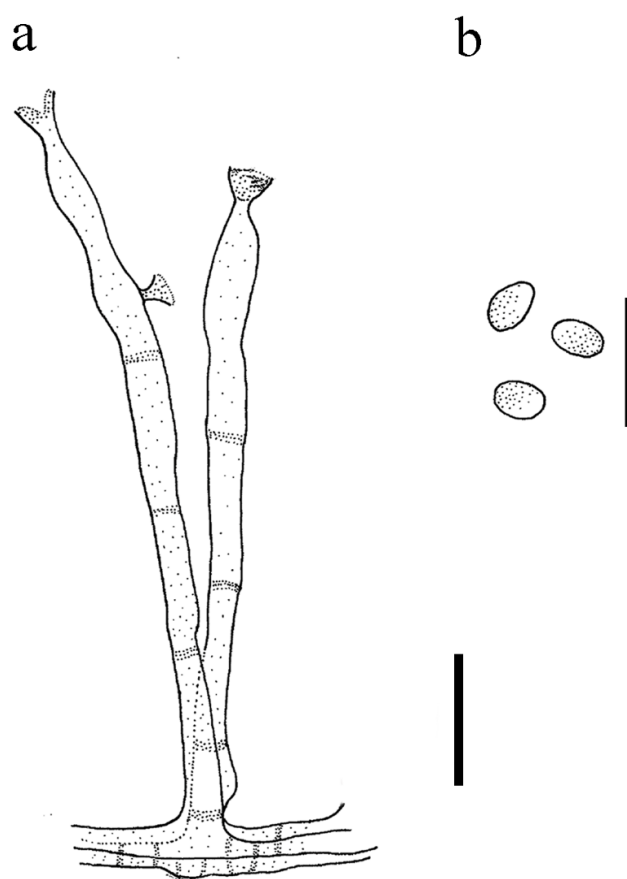


Figure 162 – *Caligospora dilabens* (CBS 734.83). a Conidiophores b. Conidia. Scale bars: a, b = 10 μ m. Redrawn from Réblová & Nekvindová (2023).

Chaetosphaeria Tul. & C. Tul., Select. fung. carpol. (Paris) 2: 252 (1863)

Index Fungorum number: IF970; Facesoffungi number: FoF01140

Chaetosphaeria was introduced by Tulasne & Tulasne (1863) and typified by *Chaetosphaeria innumera*. Locquin (1984) established *Chaetosphaeriaceae* and accommodated *Chaetosphaeria* as the type genus. Over the years, various phylogenetic and morphological studies have synonymized *Chaetosphaeria* species to other genera such as *Cacumisporium*, *Catenularia*, *Chloridium*, *Codinaea*, *Dictyochoeta*, *Exserohilum*, *Gonytrichum* and *Menispora* (Huhndorf & Fernández 2005, Réblová et al. 2021a, b, Zhang et al. 2022c). Currently, Species Fungorum (2025) has listed 89 species in the genus. The asexual morph is hyphomycetous, characterized by macronematous or mononematous conidiophores, monophialidic or polyphialidic conidiogenous cells, and aseptate to multi-septate, guttulate or eguttulate conidia with or without appendages. The sexual morph consists of black ascomata with surface smooth or covered by setae; 8-spored asci, with small, distinct, refractive, septate, hyaline ascospores (Hyde et al. 2020c). Species are mostly saprobes on plant parts in freshwater and terrestrial habitats located in Austria, China, France, Denmark, Germany, Japan, Malaysia and Mexico (Huhndorf & Fernández 2005, Hyde et al. 2020c).

Table 211 *Chaetosphaeria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Chaetosphaeria vermicularioides</i>	Worldwide	Beech forest, oak forests, Mediterranean brown soil and peat bog soil	Domsch et al. (1980)

Chloridium Link, Mag. Gesell. naturf. Freunde, Berlin 3(1-2): 13 (1809)

Fig. 163

Index Fungorum number: IF7624; Facesoffungi number: FoF13052

Chloridium was introduced by Link (1809) and typified by *C. virescens*. Currently, the genus comprises 30 species (Réblová et al. 2022, Species Fungorum 2025), and all of them are supported with molecular data. Previously, it was accepted as polyphyletic within *Chaetosphaeriaceae*. Based on ITS, LSU, and *TEFI-α* phylogeny, Réblová et al. (2022) suggested *Chloridium* as a monophyletic genus. Réblová & Nekvindová (2023) confirmed the placement of *Chloridium* within *Chaetosphaeriaceae* based on morphological and phylogenetic illustrations. The asexual morphology is illustrated in four sections: four types of conidiophores, conidial colour and the shape, presence or absence of chlamydospores and their location in vegetative hyphae (Réblová et al. 2022). Four types of conidiophores are gonytrichum-type, chloridium-type, phialocephala-type and pseudogliomastix-type, but they have common phialidic conidiogenesis on multiple loci, percurrently extending phialides with a flaring collarette and relatively small, aseptate conidia accumulating in slimy heads or cirrhi (Réblová et al. 2022). The sexual morph is characterized by perithecial, non-stromatic, ostiolate ascomata, and unitunicate, stipitate asci with hyaline, fusiform, 1-septate ascospores (Réblová et al. 2022). Most of the species are saprobes found in aquatic and terrestrial wood and some soil inhabitants prefer nutrient-rich habitats that have been found in China, France, Japan, Thailand and Venezuela (Réblová et al. 2022).

Table 212 *Chloridium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Chloridium chlamydosporum</i>	France	Forest	Réblová et al. (2022)
<i>C. chlamydosporum</i>	Chile	Volcanic ash soil	
<i>C. chloroconium</i>	Netherlands	ND	
<i>C. costaricense</i>	Costa Rica	Rhizosphere Soil	
<i>C. fuscum</i>	Germany	Wheat field soil	

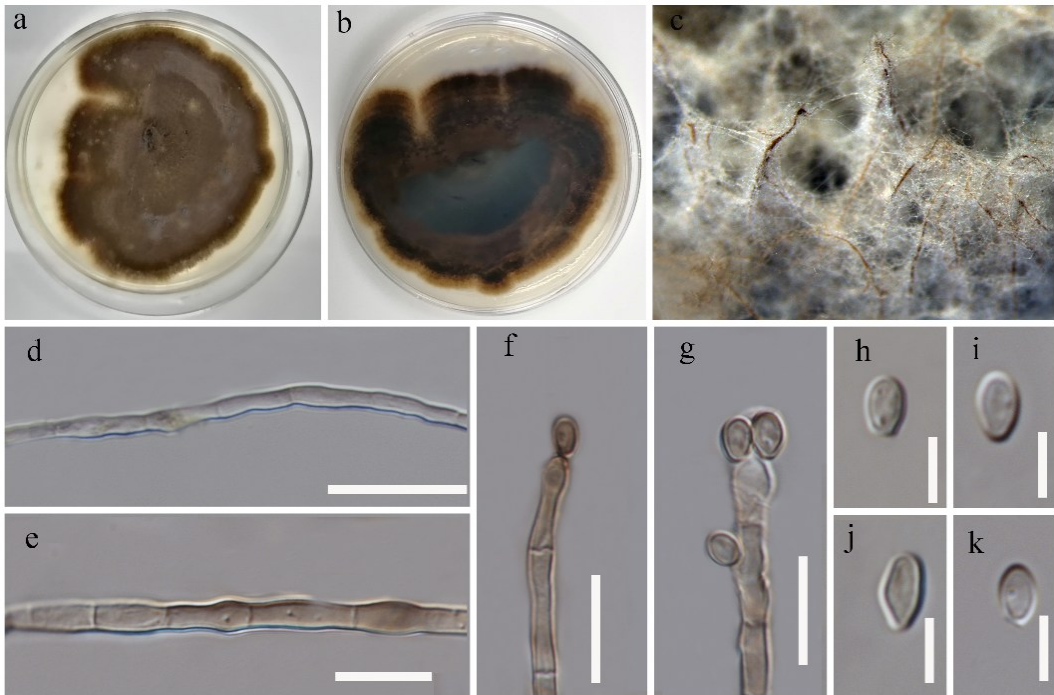


Figure 163 – *Chloridium gonytrichii* (MFLUCC 21-0110). a, b Culture characters on PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d, e Hyphae. f, g

Conidiophores, conidiogenous cells and conidia. h–k Conidia. Scale bars: c = 200 µm, d= 20 µm, e–g=10 µm, h–k = 5 µm. The photoplate is rearranged from Yasanthika et al. (2022a).

Dinemasporium Lév., Annls Sci. Nat., Bot., sér. 3 5: 274 (1846)

Index Fungorum number: IF8040; Facesoffungi number: FoF01763

Léveillé (1846) introduced *Dinemasporium* based on morphology and typified by *D. graminum*. Currently, 43 species are listed in the Species Fungorum (2025), and 27 of them are supported by the molecular data. Wu & Diao (2022) provided an updated phylogeny (LSU and ITS) and morphological characterization for this genus while introducing new species. The asexual morph is coelomycetous with black, stromatic, cupulate conidiomata that are initially closed, later become erumpent and mostly covered with conidia masses, and hyaline, cylindrical to subcylindrical conidiophores are produced in the lining of the conidiomata cavity. Conidiogenous cells are hyaline and phialidic, producing hyaline, ellipsoid, allantoid to naviculate or fusiform, unicellular conidia with bipolar or lateral appendages. The sexual morph is characterized by immersed to semi-immersed, globose to elongated ascomata with 4–8-spored, unitunicate, cylindrical to subcylindrical, pedicellate asci and hyaline uniseriate, rarely sub-biseriate and biguttulate ascospores. Species have been recorded in dead woods, human sputum, soil and various plants in Argentina, Canada, China, Cuba, Czech Republic, France, Ghana, India, Italy, Japan and the Netherland (Hashimoto et al. 2015, Hyde et al. 2020c, Li et al. 2020b, Wu & Diao 2022).

Table 213 *Dinemasporium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Dinemasporium graminum</i>	Australia	Wheat field	Warcup (1957)
<i>D. pseudoindicum</i>	USA	Tall grass soil	Réblová & Nekvindová (2023)

Kionochaeta P.M. Kirk & B. Sutton, Trans. Br. mycol. Soc. 85(4): 712 (1986) [1985] Fig. 164

Index Fungorum number: IF11111; Facesoffungi number: FoF13064

Kirk & Sutton (1985) introduced *Kionochaeta* and its type species, *K. ramifera*. Based on multi-gene phylogenetic analyses (LSU, SSU, *TEF1-α* and *RPB2*), Maharachchikumbura et al. (2015) accepted this genus in *Chaetosphaeriaceae*. The genus accommodates 15 species (Species Fungorum 2025), which have been supported by the molecular data. Lin et al. (2019) stated the polyphyletic nature of the *Kionochaeta* within *Chaetosphaeriaceae*, based on combined SSU, ITS and LSU gene regions and the synopsis for asexual morphology of *Kionochaeta* species are illustrated. This genus is characterized by hyphomycetous asexual morph that has macronematous, mononematous, solitary conidiophores and ampulliform, lageniform or cylindrical conidiogenous cells with hyaline to pale yellow, monophialidic, ampulliform conidia (Hyde et al. 2020c; Kirk & Sutton 1985). The species are discovered in freshwater and terrestrial habitats as saprobes living on decaying leaves, seeds, twigs and soils, that are collected from Australia, China, Ivory Coast, Kenya, Malaysia and Papua New Guinea (Lin et al. 2019, Hyde et al. 2020c, Yasanthika et al. 2022a). Pittayakhajonwut et al. (2002) investigated *K. pughii* for extracting ‘pughiinin A’ and ‘pyncnidione’, which perform anti-plasmodium activity against *Plasmodium falciparum* and anti-cancer activity.

Table 214 *Kionochaeta* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Kionochaeta microspora</i>	Thailand	Forest	Yasanthika et al. (2022a)

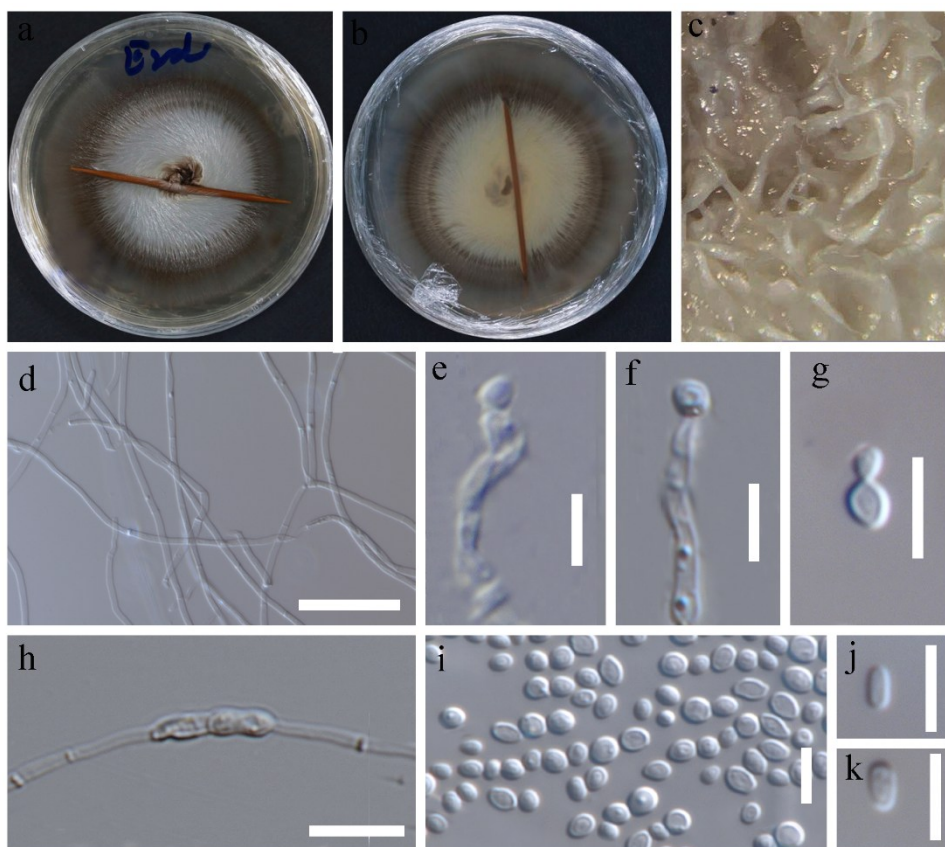


Figure 164 – *Kionochaeta microspora* (MFLUCC 21-0109). a, b culture characters on PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d hyphae. e–g Conidiophores and conidiogenous cells. h. Chlamydospore. i–k Conidia. Scale bars: d = 25 μ m, h = 10 μ m, e–g, i–k = 5 μ m. The photoplate is rearranged from Yasanthika et al. (2022a).

Menispora Pers., Mycol. eur. (Erlanga) 1: 32 (1822)

Index Fungorum number: IF8902; Facesoffungi number: FoF13066

Menispora was introduced by Persoon (1822), and the type species is designated as *M. glauca*. The Species Fungorum (2025) lists 19 species in the genus, while nine are supported by the molecular data. The asexual morph is hyphomycetous, having macronematous, brown conidiophores with phialides in a lateral or terminal position that are tapering, strongly recurved apex and conidia are hyaline with inconspicuous collarette and without or with polar setulae (Réblová & Seifert 2008). The species have been isolated from decayed wood, bark or on decayed leaves and soil in Australia, China, the Czech Republic, Germany and Ukraine (Hyde et al. 2020c).

Table 215 *Menispora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Menispora</i> sp.	Thailand	ND	Manoch (1998)

Thozetella Kuntze, Revis. gen. pl. (Leipzig) 2: 873 (1891)

Fig. 165

Index Fungorum number: IF10214; Facesoffungi number: FoF12974

Kuntze (1891) introduced *Thozetella* based on morphology and typified by *T. nivea*. Currently, 41 species are listed in the Species Fungorum (2025), and 29 of them have been supported with molecular data. Perera et al. (2016), Yan et al. (2023), and Réblová & Nekvindová (2023) illustrated the placement of *Thozetella* within *Chaetosphaeriaceae* based on different combinations of LSU, ITS, *TUB2*, *TEF1- α* and *RPB2* gene phylogeny. The asexual morph is hyphomycetous which is characterized by the sporodochial or synnematal conidiomata with

phialidic conidiogenous cells and aseptate conidia with unbranched setula at each end and sterile microawns (Sutton & Cole 1983, Jeewon et al. 2009). The genus has been reported in decaying plant parts and soil in freshwater and terrestrial habitats in Australia, China, France, India, Japan Panama and the USA (Hyde et al. 2020c, Perera et al. 2016).

Table 216 *Thozetella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Thozetella tocklaiensis</i>	India	Tea plantation soils	Agnihothrudu (1962)

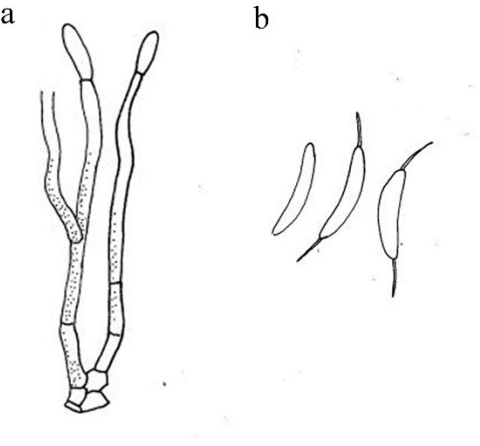


Figure 165 – *Thozetella nivea*. a. Conidiophores and conidiogenesis. b Conidia Redrawn from redrawn from Seifert et al. (2011).

Verhulstia Hern.-Restr., in Crous et al., Persoonia 39: 449 (2017)

Index Fungorum number: IF823032; Facesoffungi number: FoF12972

Verhulstia was introduced by Crous et al. (2017a) to accommodate its type, *V. trisororum*; based on combined ITS and LSU phylogeny. Currently, two *Verhulstia* species are accepted, and Réblová & Nekvindová (2023) provided a combined ITS, LSU, *TEF1-α* and *RPB2* phylogeny for this genus. The asexual morph has sporodochial, superficial conidiomata and unbranched, cylindrical, hyaline to brown, dense layers of conidiophores that arise from the stroma. Conidiogenous cells are hyaline to pale brown, phialidic with a collarette and having hyaline, cylindrical to ellipsoidal, or obovoid aseptate and smooth conidia (Crous et al. 2017a, Hyde et al. 2020c). These species are found in China and the Netherlands in dead leaves and soil (Réblová & Nekvindová 2023).

Table 217 *Verhulstia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Verhulstia trisororum</i>	Netherlands	ND	Crous et al. (2017a)

Coniochaetales Huhndorf, A.N. Mill. & F.A. Fernández

Coniochaetaceae Malloch & Cain

Coniochaeta (Sacc.) Cooke, Grevillea 16 (no. 77): 16 (1887)

Fig. 166

Index Fungorum number: IF1209; Facesoffungi number: FoF01333

Cooke (1887) introduced *Coniochaeta* and the type species is accepted as *C. ligniaria*. It currently comprises 114 species (Species Fungorum 2025). Based on morphology (polyblastic conidiogenesis) and LSU phylogeny, García et al. (2006) transferred some *Coniochaeta* species to *Coniolariaella* and *Coniocessia* (*Xylariales*) (Asgari & Zare 2011). Subsequent study of Kabtani et

al. (2022), provided a multigene phylogeny for *Coniochaeta* based on ITS, LSU, *TUB2* and *TEF1-α* gene regions. This genus is characterized by having pleomorphic yeasts. The asexual morph is characterized by the phialidic conidiogenous cells and the sexual morph has dark brown to black ascomata with setae (García et al. 2006, Si et al. 2021). Species are widely distributed and reported in butter, dung, plants, soil, uranium mines, wastewater and wood in saprobic or endophytic modes, while some have been found as human and animal pathogens in Argentina, Australia, China, Germany, Sweden and the UK (Harrington et al. 2019, Si et al. 2021).

Table 218 *Coniochaeta* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Coniochaeta extramundana</i>	USA	Arid chaparral soil	Romero et al. (1999)
<i>C. tetraspora</i>	Argentina	ND	García et al. (2006)
<i>C. emodensis</i>	Nepal	ND	
<i>C. cruciata</i>	Nigeria	ND	

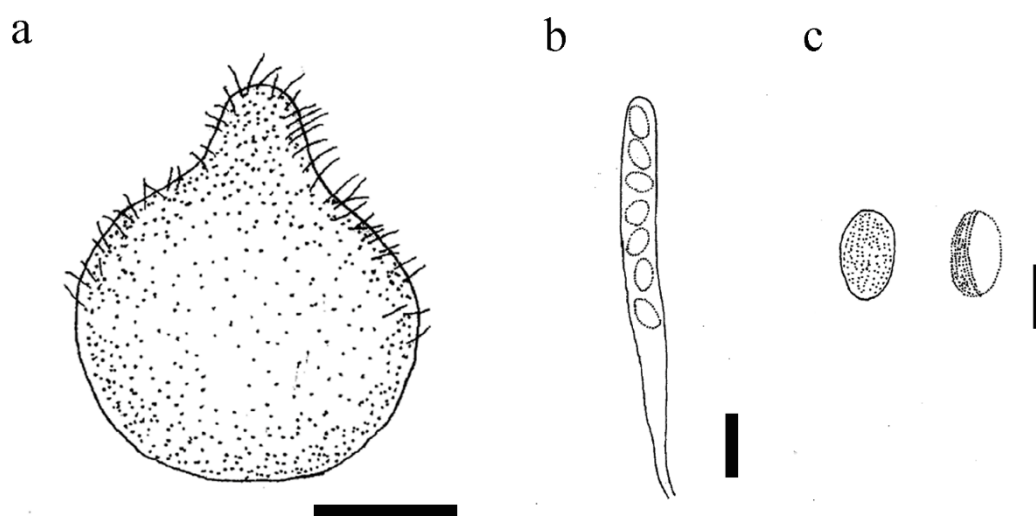


Figure 166 – *Coniochaeta ligniaria* (HAH2883). a Ascoma b Ascus. c Ascospore. Scale bars: a = 100 μm, b = 25 μm, c = 10 μm. Redrawn from Checa et al. (1988).

Cordanaceae Nann.

Cordana Preuss, Linnaea 24: 129 (1851)

Fig. 167

Index Fungorum number: IF7777; Facesoffungi number: FoF01674

Cordana was introduced by Preuss (1851) by accommodating *C. polyseptata*, *C. pauciseptata* and *C. pedunculata* in the genus, however, without a type species. Hernández-Restrepo et al. (2014) designated an epitype (*C. pauciseptata*) and provided ITS phylogeny and a dichotomous key to the species. Currently, the genus has 26 species (Species Fungorum 2025), while 14 are supported with the molecular data. This is a hyphomycetous genus and asexual morph is characterized by brown, septate conidiophores with swollen conidiogenous zones; terminal and intercalary conidiogenous cells and having pale brown to brown, 0–1-septate conidia (Hernandez Restrepo et al. 2015). Species are associated with living plants, plant debris and soil substrates as saprobes or pathogens. They are distributed in Africa, Central and South America, New Zealand, Southeast Asia and Spain (Hyde et al. 2020c).

Table 219 *Cordana* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cordana terrestris</i>	Thailand	Forest	Chethana et al. (2023)
<i>C. yunnanensis</i>	China	Rocky Soil	Yang et al. (2022)

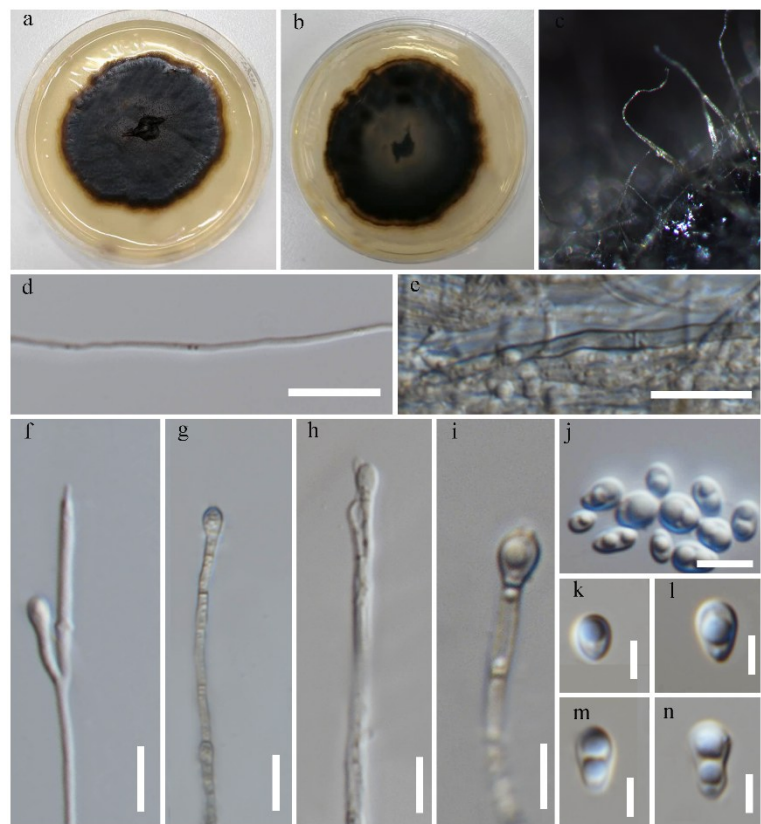


Figure 167 – *Cordana terrestris* (MFLUCC 23-0022). a, b culture characters on PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d Immature hyphae. e Mature pigmented hyphae. f–i Conidiophores j–n Conidia. Scale bars: d = 20 µm, e= 15 µm, f–h = 10 µm, i, j–n = 5 µm. The photoplate is rearranged from Chethana et al. (2023).

Sordariales Chad. ex D. Hawksw. & O.E. Erikss.

Chaetomiaceae G. Winter

Achaetomium J.N. Rai, J.P. Tewari & Mukerji, Can. J. Bot. 42(6): 693 (1964) Fig. 168
Index Fungorum number: IF38; Facesoffungi number: FoF06538

Achaetomium was established by Rai et al. (1964) and the type species is *A. globosum*. Subsequently, Mukerji (1978) and Cannon (1986) validated the genus. Based on LSU, SSU and *tefl-α* phylogeny, Maharachchikumbura et al. (2016) accommodated *Achaetomium* in *Chaetomiaceae*. The genus accommodates 16 species (Species Fungorum 2025), and seven of them having molecular data. The asexual morph is described as *Lecythophora*-like structure that is present in *A. strumarium* (Abbott et al. 1995, Rodríguez et al. 2004). In some species, chlamydospores can be present (von Arx 1985, Mehrabi et al. 2020). The sexual morph is characterized by globose to pyriform, ostiolate ascomata covered with yellowish hypha-like hairs, with a relatively thick peridium consisting of cells of *textura intricata*, cylindrical asci and dark brown ascospores that are opaque with an apical germ pore (Rodríguez et al. 2004). *Achaetomium* is mostly found in soil, while some are associated with plant debris and human infections (Abbott et

al. 1995, Rodríguez et al. 2004). They are distributed in Algeria, India, Israel, Pakistan, Spain and Thailand (Guarro et al. 2012).

Table 220 *Achaetomium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Achaetomium globosum</i>	India	Rhizosphere of <i>Tamarindus indica</i>	Rodríguez et al. (2004)
<i>A. luteum</i>	India	ND	
<i>A. strumarium</i>	India	Garden soil	
<i>A. umbonatum</i>	India	ND	
<i>A. cristalliferum</i>	Egypt	Arid soil	Locquin-Linard (1980)

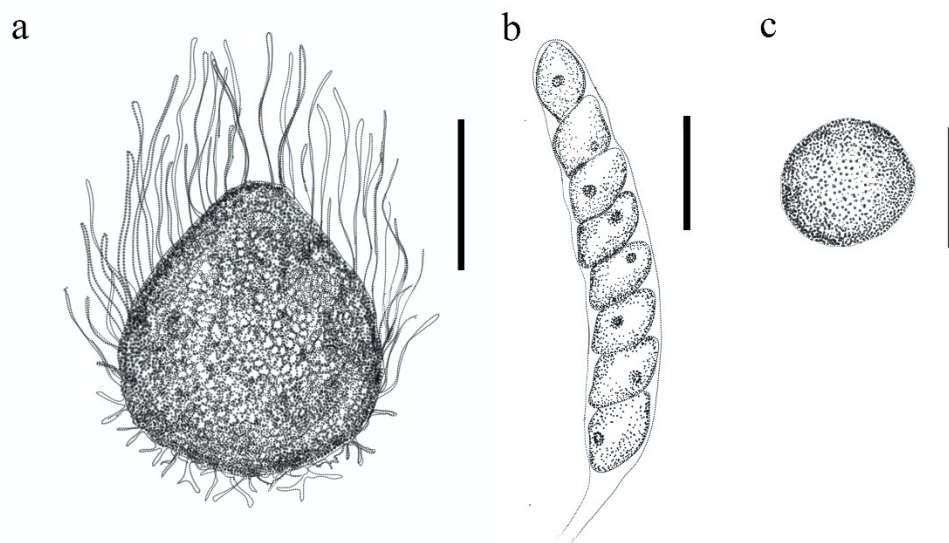


Figure 168 – *Achaetomium* sp. a Ascomata. b Ascus. *A. globosum* c Ascospore. Scale bars: a = 100 µm, b, c = 10 µm. Redrawn from redrawn from Guarro et al. (2012).

Arxotrichum A. Nováková & M. Kolařík, Persoonia 40: 259 (2018)

Fig. 169

Index Fungorum number: IF824080; Facesoffungi number: FoF13033

Crous et al. (2018a) introduced *Arxotrichum* based on morphology and LSU phylogeny, accommodating *A. wyomingense* as the type species. Wang et al. (2022a) provided *RPB2*, *TUB2*, ITS and LSU multi gene phylogeny for *Chaetomiaceae* with eight accepted species in the genus. The asexual morph is hyphomycetous, conidiophores septate, stipe with basal part yellowish brown, upper part colourless, and hyaline conidiogenous cells producing solitary, aseptate, subglobose, rough-walled to rugose conidia. In sexual morph, ascomata can be absent or present in pale ochraceous to olivaceous grey, superficial, sphaerical to ovate, and the wall angular or irregular. Asci are obovate-clavate, short stalked, 8-spored, evanescent and containing brown, ellipsoidal-fusoid, at both ends attenuated and rounded ascospores with distinct apical germ pores (Crous et al. 2018b). Species have been isolated from and Chile, China, Japan the USA from dung, soil and wood (Crous et al. 2018b, Hyde et al. 2020c).

Table 221 *Arxotrichum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Arxotrichum piluliferoides</i>	Japan	Grassland soil	Udagawa & Horie (1975)
<i>A. wyomingense</i>	USA	NA	Crous et al. (2018b)
<i>A. repens</i>	Spain	NA	von Arx (1985)



Figure 169 – *Arxotrichum wyomingense*. a Conidiogenous cells and conidia. Scale bar: a = 10 μ m. Redrawn from Crous et al. (2018a).

Chaetomium Kunze, Mykologische Hefte (Leipzig) 1: 15 (1817)

Fig. 170

Index Fungorum number: IF953; Facesoffungi number: FoF01843

Chaetomium was introduced by Kunze & Schmidt (1817) and typified by *C. globosum*. It is considered the largest genus in *Chaetomiaceae* (Wang et al. 2016a). The genus contains 211 morphological species, including 106 species with sequence data (Hyde et al. 2020c). Wang et al. (2022a), revised the genus and transferred some species in the other genera in *Chaetomiaceae* placing 42 species in the genus. The asexual morphs are acremonium-like (Wang et al. 2016a), and the sexual morph is characterized by globose, ellipsoid to ovate or obovate, sometimes ostiolate ascomata with hypha-like, flexuous ascomatal hairs, clavate or fusiform, evanescent asci, and limoniform to globose, bilaterally flattened ascospores. Species are widely distributed including, Austria, Brazil, China, Congo, Germany, India, Japan, the UK and the USA. Most of them are present on decaying twigs and soil, and in indoor environments (Hyde et al. 2020c).

Table 222 *Chaetomium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Chaetomium angulare</i>	China	ND	Zhang et al. (2017a)
<i>C. erectum</i>	China	ND	
<i>C. murorum</i>	Israel	Soil in Dead Sea	
<i>C. nozdrenkoae</i>	Russia	ND	

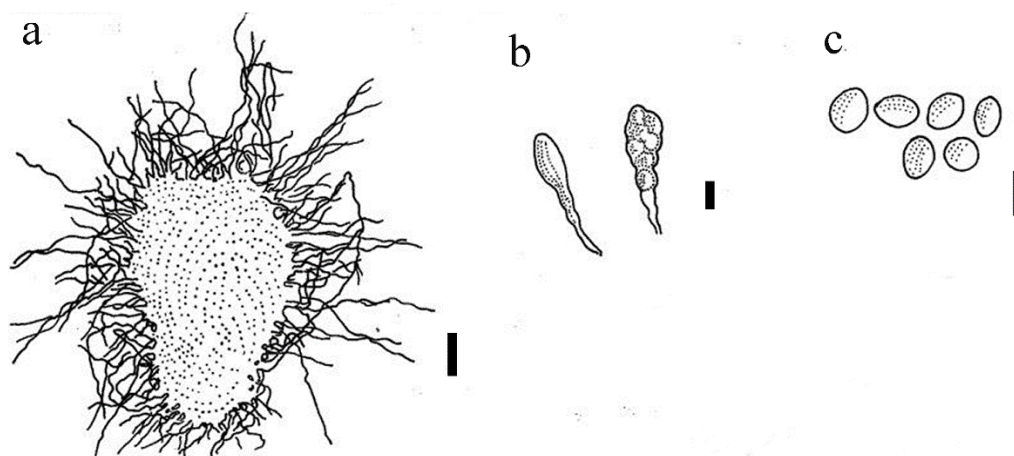


Figure 170 – *Chaetomium globosum*. a Ascomata. b. Asci. c. Ascospore. Scale bar: a = 100 μ m, b, c = 10 μ m. Redrawn from redrawn from Wang et al. (2016b).

Humicola Traaen, Nytt Mag. Natur. 52: 31 (1914)

Fig. 171

Index Fungorum number: IF8566; Facesoffungi number: FoF13038

Humicola was established by Traaen (1914) with *H. fuscoatra* (the type) and *H. grisea*. Presently, it comprises 66 species (Species Fungorum 2025). Phylogenetic relationships of *Humicola* species in *Chaetomiaceae* were evaluated based on LSU, ITS, *TUB2* and *RPB2* gene regions (Wang et al. 2019c, 2022a). While providing the phylogenetic revision for *Chaetomiaceae* Wang et al. (2022a), revised the genus placing 19 species. The asexual morph comprises aleurioconidia-like conidia, humicola-like, and acremonium-like characteristics. Humicola-like morph produces intercalary or lateral, monoblastic conidiogenous cells that are reduced to a hyphal cell without conidiophores. Aleurioconidia-like conidia are 1-celled, solitary or rarely in chains of a few spores of brown, globose, subglobose, or irregular in shape. Acremonium-like morph have lateral or terminal phialides with hyaline, aseptate, smooth, obovoid conidia in basipetal chains (Wang et al. 2022a). The sexual morph is characterized by superficial ascomata covered by aerial hyphae, ostiolate. Terminal hairs are flexuous and seta-like and ascospores are limoniform to quadrangular, bilaterally flattened, with an apical germ pore. Some *Humicola* species produce ascomata together with asexual morphs (Wang et al. 2019c). *Humicola* species produce thermostable enzymes such as cellulases, xylanases, feruloyl esterases, pectate lyases, and β -xylosidases with biotechnological and industrial importance (Ibrahim et al. 2021). Species are distributed in Brazil, China, Congo, Italy, Thailand and the USA, most of which are isolated from soil while some have been found on woody substrates (Bertoldi 1976, Mel'nik 2000, Wang et al. 2019c, 2022a).

Table 223 *Humicola* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Humicola lutea</i>	Sardinia, Italy	woodland of Quercus	Bertoldi (1976)
<i>H. repens</i>	Sardinia, Italy	<i>Triticum aestivum</i> field	
<i>H. rugose</i>	Sardinia, Italy	Woodland soil	
<i>H. sardiniae</i>	Sardinia, Italy	Vineyard soil	
<i>H. variabilis</i>	Sardinia, Italy	Woodland soil	
<i>H. interseminata</i>	China	Mountain soil	Jiang & Zhang (2010)
<i>H. macrospora</i>	China	Mountain soil	
<i>H. subminima</i>	China	Rice field	

a

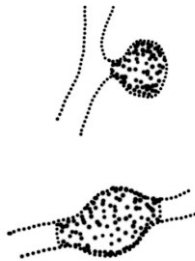


Figure 171 – *Humicola fuscoatra* (CBS 516.67). a Formation of aleurioconidia. Redrawn from Domsch et al. (1980).

Staphylotrichum J. Mey. & Nicot, Bull. trimest. Soc. mycol. Fr. 72: 322 (1957) [1956] Fig.172
Index Fungorum number: IF10065; Facesoffungi number: FoF13045

Staphylotrichum was established by Nicot & Meyer (1956) with the type *S. coccosporum*. There are 11 epithets listed in Species Fungorum (2025), while nine of them are supported with molecular data. Phylogenetic revisions for *Staphylotrichum* were inferred based on concatenated LSU, ITS, *TUB2*, and *RPB2* (Qiao et al. 2021, Wang et al. 2022a), while transferring *Humicola* species in the genus. The asexual morph consists of two types, macronematous and micronematous. The macronematous type has thick-walled, apically branched conidiophores and cylindrical or denticle-like, monoblastic or sympodial polyblastic conidiogenous cells. The micronematous type has cylindrical or denticle-like, monoblastic, rarely sympodial polyblastic conidiogenous cells and single-celled, smooth or slightly verrucose, hyaline to pale brown, globose, subglobose or obovoid conidia rhexolytic when seceding (Wang et al. 2022a). The sexual morph consists of two types: *Ascomata* of type I with conspicuous neck, superficial or covered by aerial hyphae, ostiolate, elongated obpyriform ascomata and *Ascomata* of type II, with superficial, ostiolate, ovate to subglobose ascomata with terminal hairs, clavate to fusiform asci and broad limoniform to globose, bilaterally flattened ascospores with an apical germ pore (Wang et al. 2022a). Species of this genus were reported from different substances, including air, hare dung, plant litter and soils in China, Poland, South Africa and the USA (Qiao et al. 2021).

Table 224 *Staphylotrichum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Staphylotrichum boninense</i>	Japan	Soil under <i>Elaeagnus</i>	Qiao et al. (2021)
<i>S. sinense</i>	China	<i>rotundata</i> ND	

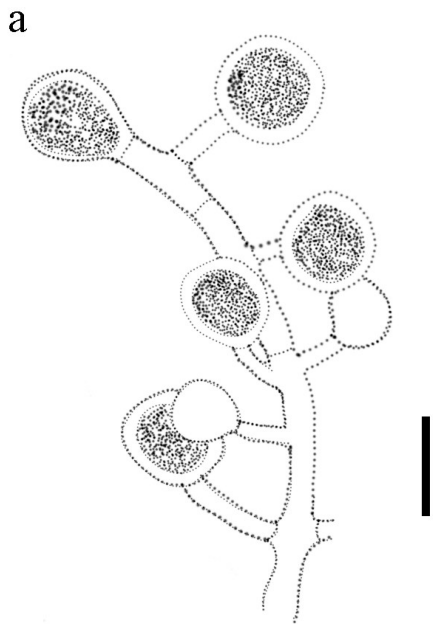


Figure 172 – *Staphylotrichum coccosporum*. a Conidiophores and conidia. Redrawn from Domsch et al. (1980).

Stellatospora Tad. Ito & Nakagiri, Mycoscience 35(4): 413 (1994) Fig. 173
Index Fungorum number: IF27456; Facesoffungi number: FoF13568

Stellatospora was introduced by Ito & Nakagiri (1994) and the type species is *S. terricola*. *Stellatospora* is monospecific, and previously, Wijayawardene et al. (2017) and Hyde et al. (2020) listed this genus in *Sordariaceae*. However, the combined phylogeny (LSU, SSU, *RPB2* and *TEF1*-

α) treated in *Sordariomycetes* by Huang et al. (2021) placed the genus in *Chaetomiaceae*. The asexual morph is not determined. The sexual morph is characterized by cleistothecial, solitary or gregarious, globose to subglobose, dark brown to black, ascomata, 3–8-spored, unitunicate, obpyriform to oval, evanescent, obpyriform asci, and multiseriate, pale greenish brown to brown stellate ascospores (Ito & Nakagiri 1994).

Table 225 *Stellatospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Stellatospora terricola</i>	Japan	Rice field	Ito & Nakagiri (1994)

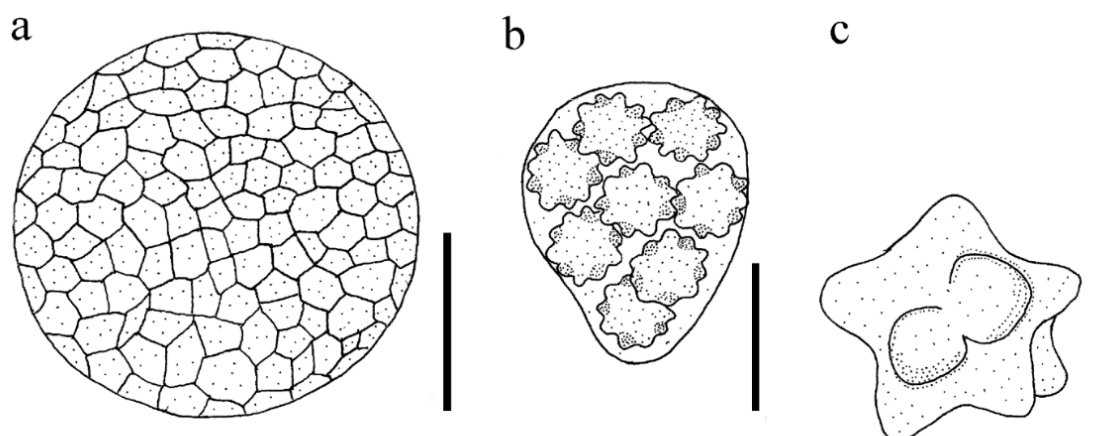


Figure 173 – *Stellatospora terricola* a Ascoma. b Ascus. c Ascospore. Scale bar: a = 50 µm, b = 25 µm, c = 5 µm. Redrawn from Guarro et al. (2012).

Thielavia Zopf, Verh. bot. Ver. Prov. Brandenb. 18: 105 (1876)

Index Fungorum number: IF5450; Facesoffungi number: FoF13048

Thielavia is typified with *T. basicola* Zopf (1876). There are 80 species listed in the Species Fungorum (2025). Phylogeny of *Thielavia* species was resolved based on combined *RPB2*, *TUB2*, ITS and LSU gene regions (Wang et al. 2019b). The sexual morph is characterized by non-ostiolate ascomata with a thin peridium and single-celled, smooth, ellipsoidal, with attenuated ends, or fusiform, pigmented ascospores with one germ pore. *Thielavia* species can be endophytes, lichenicolous, coprophilous, and even marine-derived (Ibrahim et al. 2022). The majority of species have been identified from desert, grassland, or alkaline soils and other hotsts including animals, dung and decaying plant materials (Wang et al. 2019b, Ibrahim et al. 2022). *Thielavia* species are important source of enzymes with industrial potential as laccases, cutinases, glucuronoyl esterases, feruloyl esterases, 1,4-b-endoglucanase, and lytic polysaccharide monooxygenases (Ibrahim et al. 2022). In addition, secondary metabolites such as depsides (e.g. thielocins and thielavins), azaphilones (spiro-, bis-spiro-, and nor-spiro-azaphilone), pyrazines, naphthodianthrone, and anthraquinone derivatives have been identified in phytochemical studies (Ibrahim et al. 2022) (Ibrahim et al. 2022).

Table 226 *Thielavia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Thielavia achromatica</i>	India	ND	Subrahmanyam (1981)
<i>T. ampullata</i>	India	Farm soil	Rai & Wadhwani (1977)
<i>T. aurantiaca</i>	Japan	Field soil	Ito et al. (1998)

Trichocladium Harz, Bull. Soc. Imp. nat. Moscou 44(1): 125 (1871)

Fig. 174

Index Fungorum number: IF10278; Facesoffungi number: FoF13049

Trichocladium was introduced by Harz (1871) with the type *T. asperum*. There are 60 species listed in Species Fungorum (2025), and 23 species are supported with molecular data. Phylogenetic relationships of *Trichocladium* were inferred based on combined ITS, *TUB2*, and *RPB2* (Belosokhov et al. 2022), and LSU, ITS, *TUB2*, and *RPB2* (Wang et al. 2022a) gene regions. The asexual morph is characterized by simple or branched conidiophores arising laterally or terminally from hyphae with monoblastic or polyblastic conidiogenous cells, and 1-celled, didymo-, phragmo- or muriform, globose, subglobose, oblate, ellipsoid, obovoid, pyriform, hyaline to brown conidia. Some species have acremonium-like phialides and hyaline, aseptate, obovoid, smooth Acromonium-like conidia that are produced in basipetal chains or in a false slimy head (Wang et al. 2022a). The sexual morph is characterized by superficial or immersed, ostiolate or non-ostiolate ascomata, cylindrical or clavate to fusiform 8-spored asci and broadly ovate, bilaterally flattened, or ellipsoidal ascospores with an apical germ pore (Wang et al. 2022a). *Trichocladium* species are commonly identified from dung, estuarine sediment, grass, leaf, and soil, from Brazil, China, Germany, India, Italy, Malaysia and the USA (Tagele et al. 2019), and a few members are known as thermophilic species (Belosokhov et al. 2022).

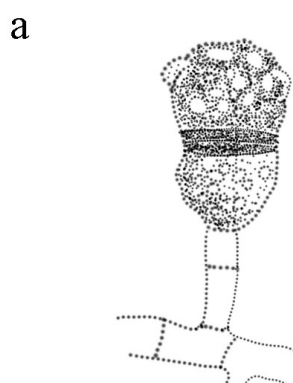


Figure 174 – *Trichocladium asperum*. a Conidiogenesis and conidium. Redrawn from Domsch et al. (1980).

Table 227 *Trichocladium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Trichocladium pyriforme</i>	Ireland	ND	Dixon (1968)
<i>Trichocladium griseum</i>	South Korea	Paddy field	Tagele et al. (2019)

Diplogelasinosporaceae Y. Marin & Stchigel

Diplogelasinospora Cain, Can. J. Bot. 39: 1669 (1961)

Fig. 175

Index Fungorum number: IF1609; Facesoffungi number: FoF14636

Diplogelasinospora was introduced by Cain (1961) and typified by *D. princeps*. This genus was previously considered a member of *Neurosporaceae*. Based on ITS, LSU *RPB2*, and *TUB2* phylogeny, Marin-Felix et al. (2020b) introduced *Diplogelasinosporaceae* and accommodated *Diplogelasinospora* as the type genus. Marin-Felix et al. (2020b) have accepted four species in this genus and all of them are supported by the molecular data. The asexual morph has conidiophores that are lacking or not distinctly differentiated from vegetative hyphae, and blastic, arthric, terminal or intercalary, hyaline, oblong to cylindrical conidia. Sexual morph of this genus has non-ostiolate, immersed or superficial ascomata with membranaceous to slightly coriaceous and *textura angularis* cells of the ascomatal wall. Asci are unitunicate, 8-spored, cylindrical to cylindrical-clavate that

contain initially hyaline, aseptate, ellipsoidal, becoming transversely septate and two-celled ascospores with one hyaline cell and a black and opaque cell. (Cain 1961, Marin-Felix et al. 2020b). Species have been isolated from seeds and soil collected from Brazil, China, India, Thailand and the USA (Marin-Felix et al. 2020b).

Table 228 *Diplogelasinospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Diplogelasinospora moalensis</i>	Spain	ND	Marin-Felix et al. (2020b)
<i>D. princeps</i>	USA	ND	

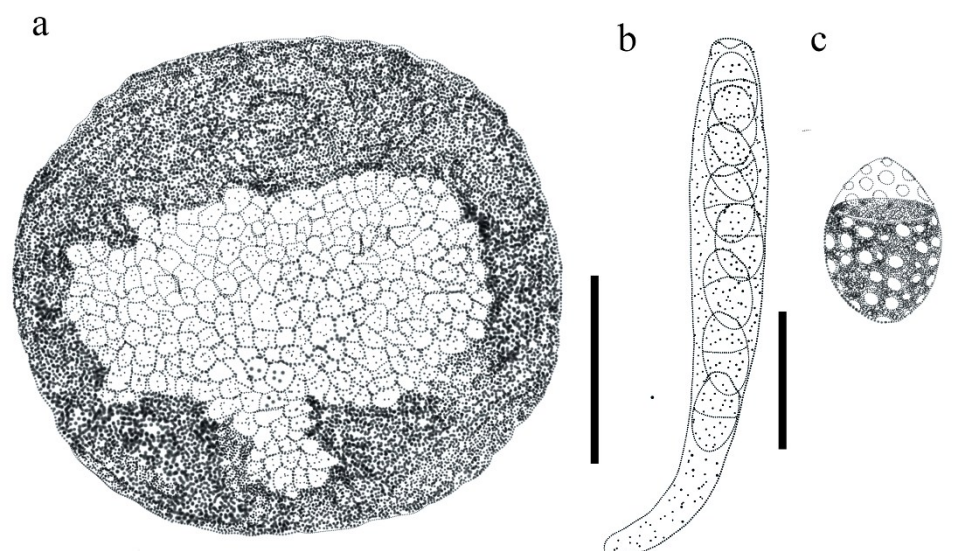


Figure 175 – *Diplogelasinospora* sp. a Ascomata. b Ascus. *D. princeps* c Ascospore Scale bars: a = 100 µm, b = 25 µm, c = 10 µm. Redrawn from Guarro et al. (2012).

Naviculisporaceae Y. Marin & Stchigel

Naviculispora Stchigel, Y. Marín, Cano & Guarro, Microorganisms 8(9, no. 1430): 14 (2020) Fig. 176

Index Fungorum number: IF812135; Facesoffungi number: FoF14640

Marin-Felix et al. (2020b) introduced *Naviculispora* with its type *N. terrestris*, while accommodating the genus in *Naviculisporaceae* based on LSU, ITS, *RPB2* and *TUB2* multigene phylogeny and the morphological characterization. It is a monospecific genus (Species Fungorum 2025). The asexual morph has conidiophores that are reduced to conidiogenous cells or sympodially proliferating. Conidiogenous cells are phialidic, producing holoblastic, sometimes sessile, hyaline to subhyaline, ellipsoidal to subspherical, obovoid or clavate conidia (Marin-Felix et al. 2020b). The sexual morph is characterized by scattered or aggregated, immersed or superficial, ostiolate or rarely non-ostiolate, brown to dark brown or black, globose to subglobose, pyriform or ovate, ascomata that are glabrous or with flexuose or stiff hairs and the ascomatal wall is composed of cells of *textura angularis* or irregularly-shaped cells. Asci are unitunicate, cylindrical or clavate, evanescent, long- or short-stipitate with two types of ascospores. Mostly, 2-celled ascospores are present; 1-celled ascospores are initially hyaline, becoming ochraceous to brown or blackish brown when mature and two-celled ascospores are initially one-celled and hyaline, clavate, cylindrical or spatuliform, becoming two-celled with transversely septate, olivaceous or brown to dark brown navicular (Marin-Felix et al. 2020b).

Table 229 *Naviculispora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Naviculispora terrestris</i>	Argentina	Valley	Marin-Felix et al. (2020b)

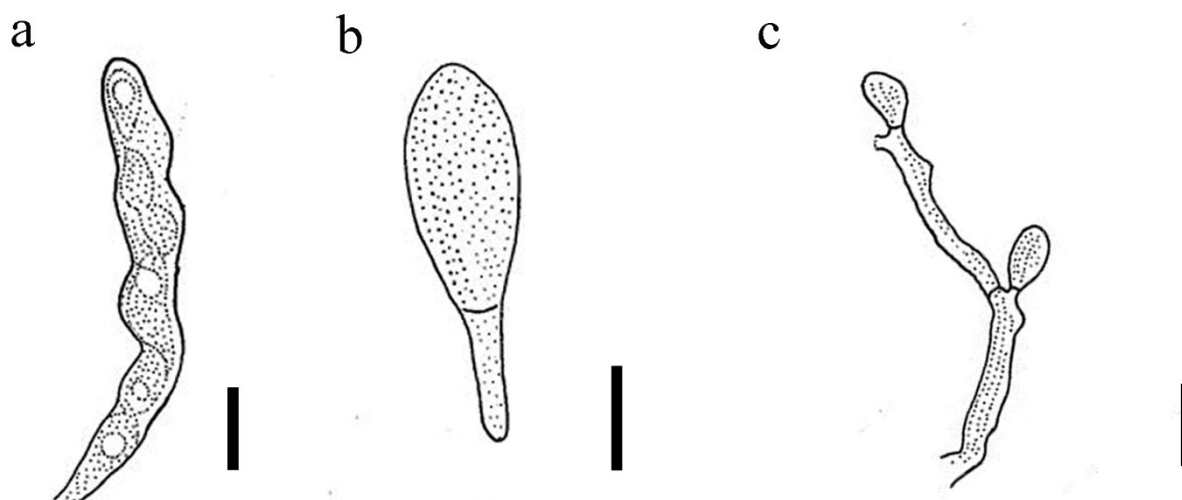
**Figure 176** – *Naviculispora terrestris*. a Ascus. b Ascospore. c Sessile conidia. Scale bars: a = 20 μ m, b = 15 μ m, c = 5 μ m. Redrawn from Marin-Felix et al. (2020).***Podosporaceae*** X. Wei Wang & Houbraken***Cladorrhinum*** Sacc. & Marchal, Bull. Soc. Roy. Bot. Belgique 24: 64. (1885)

Fig. 177

Index Fungorum number: IF7678; Facesoffungi number: FoF13545

Cladorrhinum was introduced by Saccardo and Marchal in 1885, accommodating the type species *C. foecundissimum* (Marchal 1885). The genus accommodates 16 species (Species Fungorum 2025), and 13 of them have molecular data. Carmaran et al. (2015) and Wang et al. (2019) described *Cladorrhinum* as polyphyletic genus, however Marin-Felix et al. (2020) treated this as a monophyletic group based on ITS, LSU, *RPB2* and *TUB2* phylogeny. Asexual morph is hyphomycetous, conidiophores can be absent or present as micronematous conidiophores and reduced to intercalary, occasionally terminal, conidiogenous cells with enteroblastic conidiogenesis producing one-celled, hyaline, broad obovoid, ellipsoidal or subglobose conidia. *Cladorrhinum tomentosum* and *C. coprophilum* were introduced as new combinations by Marin-Felix et al. (2020), and the genus description was amended with new sexual characteristics. The sexual morph is characterized by ostiolate or non-ostiolate, superficial to immersed, solitary or aggregated, globose to subglobose ascomata with membranaceous wall, and unitunicate, eight-spored, cylindrical, evanescent asci. There are two type of ascospores: 1-celled ochraceous or olivaceous brown to dark brown, ellipsoidal to broadly fusiform, ovoid or obovoid ascospores or two-celled, biseriate or triseriate, initially hyaline, upper cell brown, ellipsoidal and lower cell cylindrical ascospores (Marin-Felix et al. 2020b). Species are saprobes living in dung, plant parts and soil, while some of them can be root endophytes. Species have been discovered from China, France, India, Italy and the USA (Carmaran et al. 2015, Hyde et al. 2020c). *Cladorrhinum foecundissimum* found to be reducing the damping-off caused by *Rhizoctonia solani* and *Pythium ultimum* (Carmaran et al. 2015, Marin-Felix et al. 2020b).

Table 230 *Cladorrhinum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Cladorrhinum globisporum</i>	China	Acidic soil	Marin-Felix et al. (2020b)
<i>C. terricola</i>	Japan	River sediment	Ueda (1994)

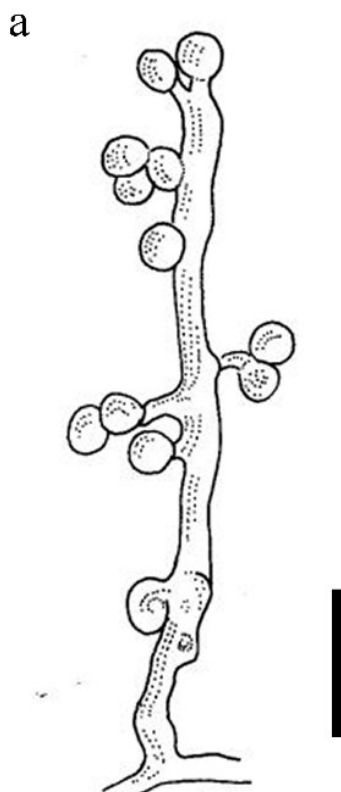


Figure 177 – *Cladorrhinum foecundissimum* (CBS180.66). a. Conidiogenous cells and conidia. Scale bars: a = 10µm. Redrawn from Wang et al. (2019).

Podospora Ces., Hedwigia 1(15): 103 (1856)

Index Fungorum number: IF4284; Facesoffungi number: FoF13546

Cesati (1856) introduced *Podospora*, which was considered one of the largest genera in *Lasiosphaeriaceae* (Wang et al. 2019b, Hyde et al. 2020c,). However, according to the phylogeny of Wang et al. (2019) *Podospora* was suggested as a monophyletic genus, placing it in *Podosporaceae*, while many species were synonymized to other genera. Based on the ITS, LSU *RPB2*, and *TUB2* phylogeny of Marin-Felix et al. (2020), five species have been accepted in the *Podospora* as *sensu stricto* and several *Podospora* species that do not correspond to the type species have been provided as an unsupported clade and suggested belong in *Lasiosphaeriaceae*. The asexual morph has conidiophores that are micronematous, reduced to conidiogenous cells and intercalary conidiogenous cells that originate from a lateral peg-like structure with a flaring collarette. Conidia are blastic, single-celled, hyaline, smooth-walled, globose or ellipsoidal to elongate. The sexual morph of *Podospora* is characterized by superficial, solitary, ostiolate and pyriform, or less frequently non-ostiolate and globose, covered by erect or flexuous ascomata with unitunicate, eight-spored, clavate or cylindrical asci and uniseriate or biseriate, two-celled, upper cell olivaceous brown to brown or dark brown, ellipsoidal to ovoid or obovoid ascospores (Marin-Felix et al. 2020b). The species have been recorded from dung, plant roots and soil (Wang et al. 2019b, Marin-Felix et al. 2020b).

Table 231 *Podospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Podospora australis</i>	Australia	Sand and loamy soils	Lundqvist (1972)
<i>P. striatispora</i>	Thailand	ND	Marin-Felix et al. (2020b)
<i>P. bulbillosa</i>	Egypt	Desert soil	Wang et al. (2019b)
<i>P. granulostrata</i>	Southeast Asia	Fire-affected soils	Richardson (1998)

Index Fungorum number: IF5534; Facesoffungi number: FoF13547

Triangularia was introduced by Boedijn (1934) and typified by *T. bambusae*. Currently, 29 species are listed in the Species Fungorum (2025), while nine species have molecular data. Marin-Felix et al. (2020b) provided a recent phylogeny (ITS, LSU, *RPB2* and *TUB2*) of *Triangularia*, accepting it as a monophyletic clade and the generic description has been rearranged. The asexual morph is a cladorrhinum-like and has micronematous conidiophores reduced to conidiogenous cells. Conidiogenous cells are intercalary or occasionally terminal, sometimes phialidic, and have 1-celled, hyaline, globose to subglobose or pyriform conidia. The sexual morph is characterized by ostiolate or non-ostiolate, often superficial, sometimes semi-immersed to immersed, globose to subglobose, ovoid, or obpyriform to ampulliform, glabrous ascomata. The asci are unitunicate, four to eight or multi-spored, cylindrical to elongated clavate or fusiform and short or long stipitate, containing 1-celled ascospores that are uniseriate and hyaline becoming yellowish, olivaceous to brown-black, ellipsoidal with an apical germ pore; and two-celled ascospores are uniseriate, biseriate, triseriate with an apical or subapical pore (Hyde et al. 2020c, Marin-Felix et al. 2020b). Species prefer warm environmental conditions and occur in aquatic sediments, plant debris and soil (Hyde et al. 2020c). They have been reported from Brazil, Canada, Central Africa, India, Japan, Panama, Spain, Ukraine and the USA (Marin-Felix et al. 2020b).

Table 232 *Triangularia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Triangularia angulispora</i>	Panama	Tropical forest soil	Domsch et al. (1993)
<i>T. verruculosa</i>	USA	Soil, associated with <i>Avena sativa</i>	Guarro & Cano (1988)
<i>T. matsushimae</i>	Japan	Forest soil	Huang (1976)
<i>T. backusii</i>	USA	Garden soil	
<i>T. batistae</i>	Brazil	ND	Marin-Felix et al. (2020b)
<i>T. longicaudata</i>	Spain	Sandy soil	Von Arx (1975)

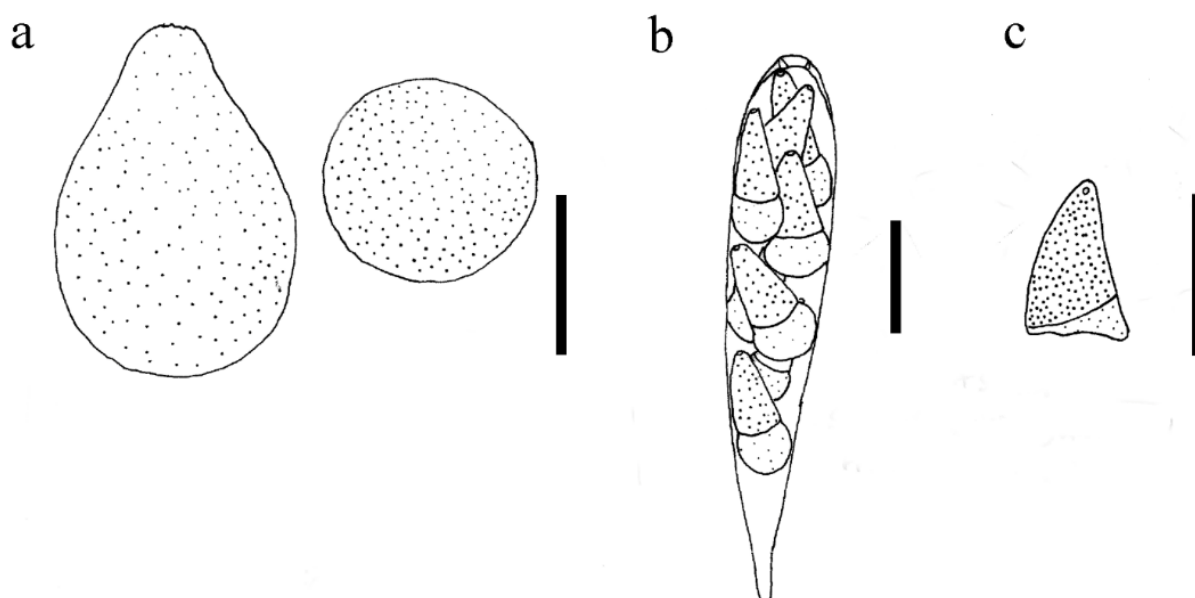


Figure 178 – *Triangularia* sp. a Ascomata b Ascus. *T. bambusae* c Ascospore. Scale bars: a = 100 µm, b, c = 25µm. Redrawn from Guarro et al. (2012).

Jugulospora N. Lundq., Symb. bot. upsal. 20(no. 1): 256 (1972)

Fig. 179

Index Fungorum number: IF2538; Facesoffungi number: FoF13304

Lundqvist (1972) introduced *Jugulospora* and accommodated *J. rotula* as the type species. The genus currently accommodates five species (Species Fungorum 2025), and all have molecular data. The asexual morph can be present or absent, and conidia are characterized by the hyaline to pale brown, smooth-walled, ovate to elongate, and are produced laterally or terminally on undifferentiated hyphae. The sexual morph is characterized by the ostiolate ascomata covered with pale brown, flexuous, septate, thick-walled hairs, and the ascomata wall is membranaceous and semi-transparent. The asci are unitunicate, 8-spored, cylindrical, with a thin apical ring, that produce initially 1-celled, hyaline, clavate ascospores latter become septate upper cell brown, navicular, globose, or obovoid, warted, finely granulated, or pitted with an apical germ pore and a hyaline, thin gelatinous sheath rarely present. The species are associated with soil substrates in Antarctica, Spain, the UK and the USA (Marin-Felix et al. 2020b).

Table 233 *Jugulospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Jugulospora antarctica</i>	Antarctica	Island	Stchigel et al. (2003)
<i>J. vestita</i>	Nepal	Fire-affected soils	Udagawa & Horie (1982)
<i>J. carbonaria</i>	the UK	Burnt soil	Marin-Felix et al. (2020b)
<i>J. minor</i>	Sweden		
<i>J. rotula</i>	the UK		

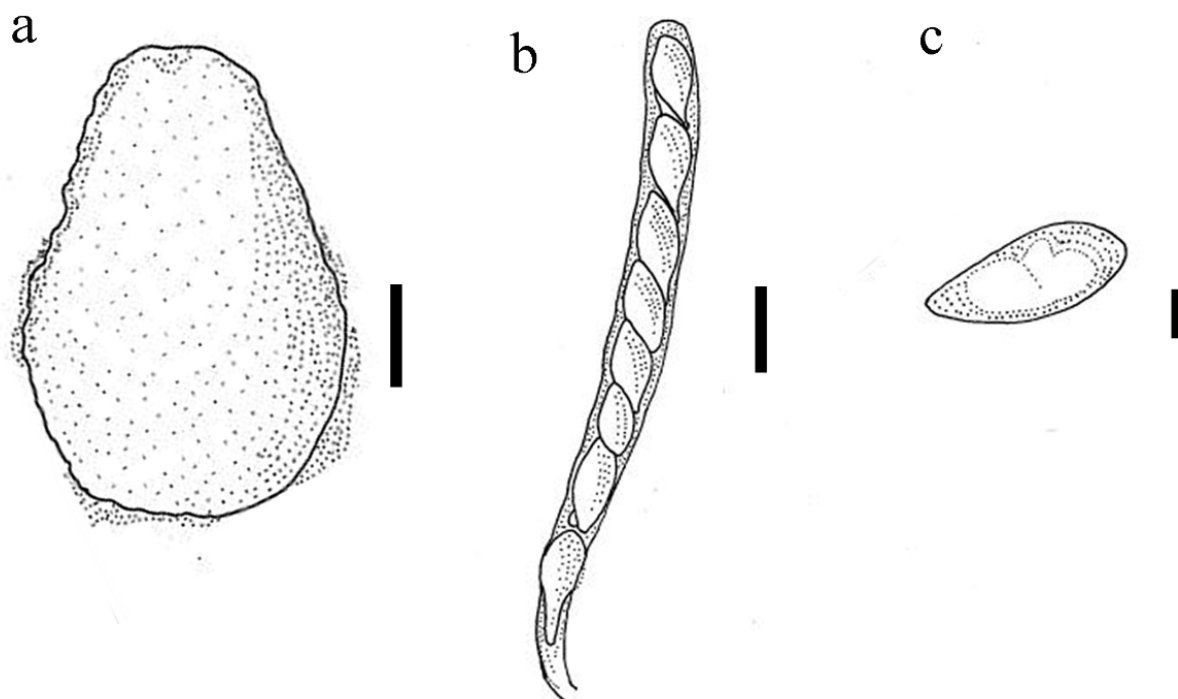


Figure 179 – *Jugulospora rotula* (FMR12428). a Ascoma. b Ascus. c Ascospore. Scale bars: a = 100 µm, b = 15 µm, c = 5µm. Redrawn from Marin-Felix et al. (2020b).

Lundqvistomyces Y. Marin & Stchigel, Microorganisms 8(9, no. 1430): 29 (2020)

Index Fungorum number: IF835508; Facesoffungi number: FoF14649

Marin-Felix et al.(2020) introduced *Lundqvistomyces* based on morphology and phylogeny (LSU, ITS, *RPB2* and *TUB2*), with its type species, *L. karachiensis*. There are two *Lundqvistomyces* species listed in the Species Fungorum (2025). The asexual morph can be absent or present with conidia delimited from peg-like non-proliferating structures on undifferentiated hyphae. The sexual morph is characterized by the ostiolate, immersed to almost superficial, scattered or aggregated, brown to nearly black, pyriform ascomata, and unitunicate, eight-spored, clavate or cylindrical-clavate, thin-walled, short stipitate asci with biseriate, at first one-celled, ellipsoidal, becoming transversely uniseptate and two-celled ascospores (Marin-Felix et al. 2020b). Species have been isolated from animal dung, plant material and soil that are reported from several countries, including Brazil, China, Egypt, Germany, India, Russia, Sweden and the USA (Marin-Felix et al. 2020b).

Table 234 *Lundqvistomyces* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Lundqvistomyces karachiensis</i>	Egypt	Arid soil in desert	Marin-Felix et al. (2020b)

Sordariaceae G. Winter

Boothiella Lodhi & Mirza, Mycologia 54(2): 217 (1962)

Fig. 180

Index Fungorum number: IF 627; Facesoffungi number: FoF4655

Boothiella was established by Lodhi & Mirza (1962). It includes only the type, *B. tetraspora*, that has been supported with the molecular data (Hyde et al. 2020c, 2024a). Kirk et al. (2009) transferred *Boothiella* to *Sordariaceae* and Maharachchikumbura et al. (2015) placed this genus in *Chaetomiaceae*. Phylogenetic analyses of LSU, ITS, *TUB2* and *RPB2* by Wang et al. (2019b) and Huang et al. (2021b) confirmed the placement of *Boothiella* in *Sordariaceae*. The sexual morph is characterized by superficial to immersed, solitary or gregarious, cleistothecial ascomata, membranaceous peridium composed of cells of *textura angularis*, unitunicate, clavate to cylindrical, 4-spored asci and oval to citriform, 1–2-apiculate, hyaline to brown ascospores with a germ pore at one or each end (Lodhi & Mirza 1962, Huang et al. 2021b, Wang et al. 2019c). Species has been reported from soil and frogs in China, India and Pakistan (Kirk et al. 2009, Yang et al. 2023).

Table 235 *Boothiella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Boothiella tetraspora</i>	India	ND	Wang et al. (2019b)
<i>B. tetraspora</i>	Pakistan	Barley field soil	

Neurospora Shear & B.O. Dodge, J. Agric. Res., Washington 34: 1025 (1927)

Index Fungorum number: IF3502; Facesoffungi number: FoF13566

Shear & Dodge (1927) introduced *Neurospora* to accommodate dark ascospores, with a grooved surface and longitudinal ribs, with four accepted species, including the type species, *N. sitophila*. There are 57 species listed in the Species Fungorum (2025), and 36 have molecular data. The phylogenetic relationships between *Neurospora* and *Gelasinospora* were investigated by Dettman et al. (2001), based on ITS, *GAPDH*, mating-type A-1, and mating-type a-1. *Gelasinospora* is another genus in *Sordariaceae* that has similar ascospore morphology to *Neurospora*. The main difference between *Neurospora* and *Gelasinospora* is the ornamentation of the surface of their ascospore wall (García et al. 2004). However, García et al. (2004) analyzed phylogenetic relationships between *Neurospora* and *Gelasinospora* based on the 28S rDNA gene

and showed that *Gelasinospora* did not form a distinct group from *Neurospora*. Therefore, they treated *Gelasinospora* as a synonym of *Neurospora*. *Neurospora* species were recorded from dung, root, stem, soil, and wood from various geographical regions including Brazil, China, Kenya, Thailand and the USA (García et al. 2004).

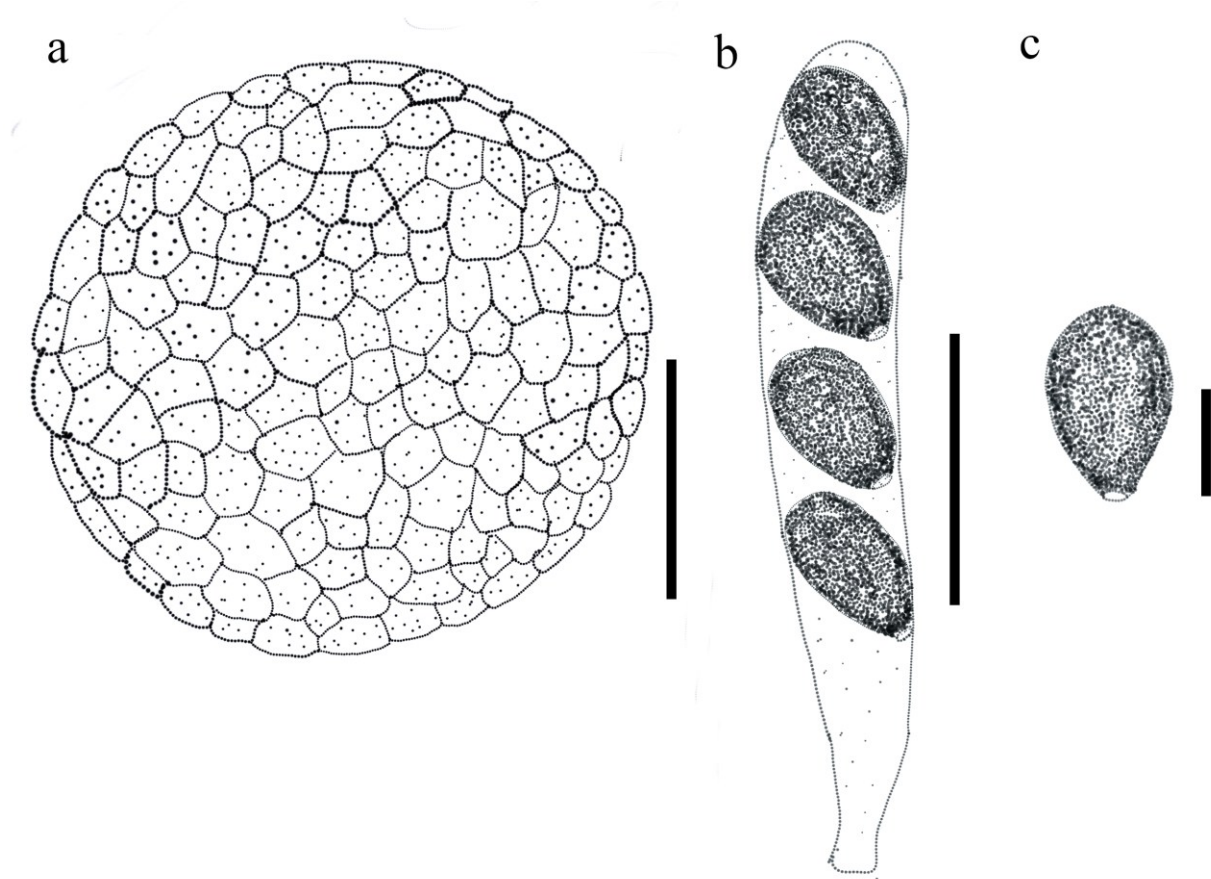


Figure 180 – *Boothiella tetraspora*. a Ascomata. b Ascus. c Ascospore. Scale bars: a = 100 μ m, b = 25 μ m, c = 10 μ m. Redrawn from Guarro et al. (2012)

Table 236 *Neurospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Neurospora crassa</i>	Brazil, India and the USA	Post-fire soils and grasslands	Perkins & Turner (1988)
<i>N. pseudocalospora</i>	Papua New Guinea	Rainforest	Udagawa et al. (1973)

Pseudoneurospora Dania García, Stchigel & Guarro, Mycol. Res. 108(10): 1139 (2004) Fig. 181
Index Fungorum number: IF28887; Facesoffungi number: FoF13567

Based on LSU phylogeny and morphology García et al. (2004) introduced *Pseudoneurospora* with the type species, *P. amorphoporcata*. Currently, the genus accommodates two species (Crous et al. 2014a), and both of which have molecular data. The asexual morph remains undetermined and the sexual morph is characterized by the pyriform, ostiolate, glabrous or gently hairy ascomata and the peridium of *textura angularis* cells. Asci are cylindrical, 8-spored apical structures non-amyloid and ascospores are unicellular, ellipsoidal, reticulate with irregularly rounded crests (García et al. 2004). *Pseudoneurospora* species have been reported from plant debris and soil in Brazil, Japan and Thailand (García et al. 2004, Crous et al. 2014a).

Table 237 *Pseudoneurospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pseudoneurospora amorphoporcata</i>	Thailand	ND	García et al. (2004)
<i>P. canariensis</i>	Spain	Forest soil	Crous et al. (2014a)

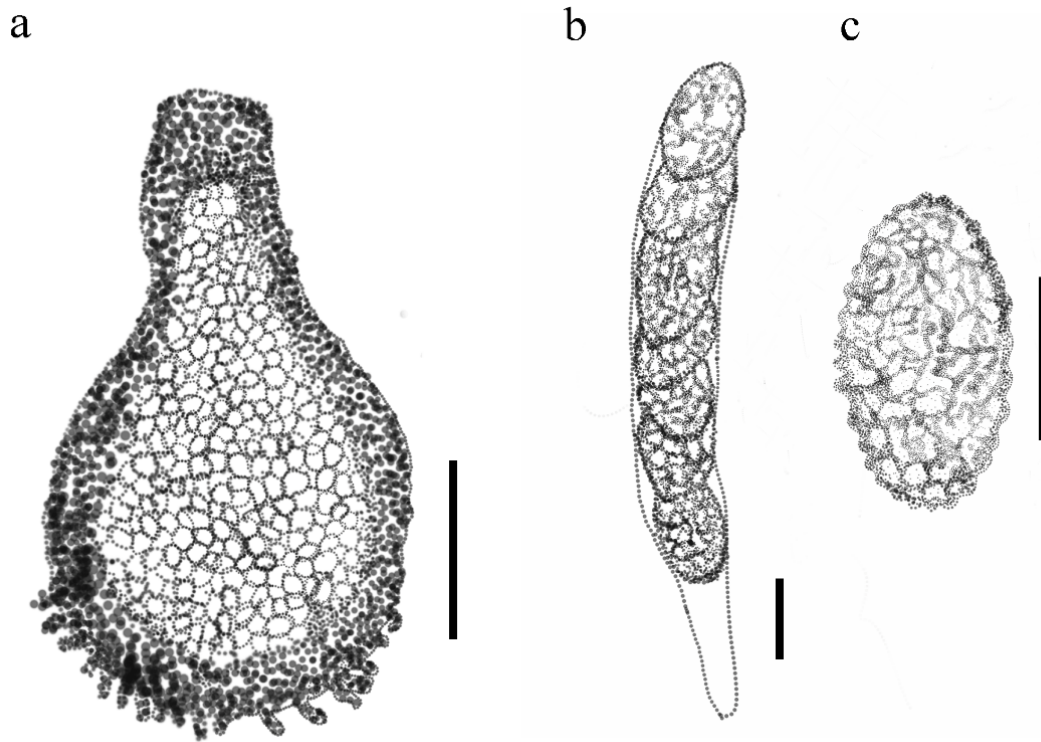


Figure 181 – *Pseudoneurospora amorphoporcata* a Ascomata. b Ascus. c Ascospore. Scale bars: a = 100 μ m, b = 25 μ m, c = 15 μ m. Redrawn from Guarro et al. (2012).

Sordaria Ces. & De Not., Comm. Soc. crittog. Ital. 1(4): 225 (1863) Fig. 182
Index Fungorum number: IF5061; Facesoffungi number: FoF01149

Cesati & De Notaris (1863) introduced *Sordaria* and the type species is accepted as *S. fimicola*. The genus comprises around 50 species, while 15 have molecular data (Hyde et al. 2020c, 2024a). The sexual morph consists of superficial, obovate, pyriform, or ampulliform, with a conical or cylindrical ascomata with cylindrical, short stalked, unitunicate, at the truncate apex often ring-like thickenings, 8-spored asci and uniseriate, ellipsoidal, cylindrical, or fusiform with rounded ends, aseptate, brown or opaque when mature ascospores (Guarro & Von Arx 1987). The species are occurring on decaying plant materials, dung, herbaceous plants, seeds and soil and are globally reported including in Australia, Brazil, India, Japan and South Africa (Hyde et al. 2020a, 2024a).

Table 238 *Sordaria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Sordaria fimicola</i>	Japan and USA	ND	Kwon-Chung & Bennett (1992)
<i>Sordaria macrospora</i>	Japan, India and USA	ND	Mayr (1982)

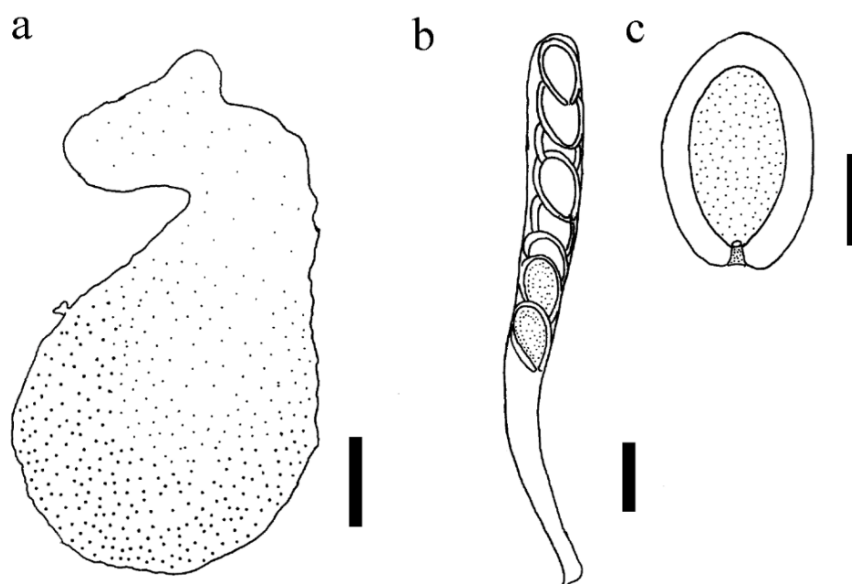


Figure 182 – *Sordaria fimicola*. a Ascoma. c Ascospore. *Sordaria* sp. b Ascus. Scale bars: a = 100 µm, b = 25 µm, c = 10 µm. Redrawn from Guarro et al. (2012).

Sordariales genera *incertae sedis*

Eosphaeria Höhn., Annls mycol. 15(5): 362 (1917)

Index Fungorum number: IF1843; Facesoffungi number: FoF13300

Eosphaeria was introduced by Höhnelt (1917) and was typified by *E. uliginosa*. It is a monospecific genus, and sequence data is currently unavailable (Huang et al. 2021b, Index Fungorum 2025). Previously, this was placed in *Lasiosphaeriaceae*; however, it is presently placed in *Sordariales* genera *incertae sedis* (Huang et al. 2021b, Wijayawardene et al. 2022). The asexual morph is hyphomycetous and phialophora-like and has small, oval to globose conidia. The sexual morph is characterized by the perithecial, globose to subglobose, brown to black, carbonaceous, ostiolate ascomata with carbonaceous to membranaceous peridium, composed of black to pale brown to hyaline cells of *textura angularis* to *textura prismatica*. Asci are 8-spored, unitunicate, cylindrical, pedicellate, subapical globule and ascospores are biseriate, slightly curved, aseptate, multi-guttulate, hyaline and ellipsoidal when young, becoming multi-septate, dark brown when mature, and bipolar short appendages are disappearing with age (Huang et al. 2021b). Species have been reported from plant debris and soil in Germany, India, the UK and the USA (Nash & Pippin 1981, Huang et al. 2021b).

Table 239 *Eosphaeria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Eosphaeria uliginosa</i>	USA	Road and clay soils	Huang et al. (2021b)
<i>E. uliginosa</i>	Germany	Marshy lands	

Xylariomycetidae O.E. Erikss & Winka

Amphisphaeriales D. Hawksw. & O.E. Erikss.

Apiosporaceae K.D. Hyde, J. Fröhl., Joanne E. Taylor & M.E. Barr

Arthrinium Kunze, Mykologische Hefte (Leipzig) 1: 9 (1817)

Index Fungorum number: IF7214; Facesoffungi number: FoF01781

Kunze & Schmidt (1817) initially introduced *Arthrinium* and the type species is designated as *A. caricicola*. Kwon et al. (2021) have used ITS, *TUB2* and *TEF-1a* combined phylogeny, including 54 species while introducing eight new species in the genus. *Arthrinium* is accepted as an anamorphic genus having basauxic conidiophores and the telemorph is linked to *apiospora-like taxa* (Hyde et al. 2020c). The genus has a wide host distribution where species associate with leaves, stems and roots of different plants in saprobic and endophytic modes, some have been reported as plant and human pathogens and have also been recorded from marine and soil habitats. It has a wide geographical distribution as well, including Brazil, China, India, Malaysia and the USA (Crous & Groenewald 2013, Wang et al. 2018).

Table 240 *Arthrinium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Arthrinium minutisporum</i>	Korea	Mountain soil	Das et al. (2020c)
<i>A. arundinis</i>	China	Karst cave	Wang et al. (2018)
<i>A. rasikravindrae</i>	China	Karst cave	
<i>A. xenocordella</i>	Zimbabwe	Roadway	Crous & Groenewald (2013)

Nigrospora Zimm. Abt. II 8: 220 (1902)

Index Fungorum number: IF9124; Facesoffungi number: FoF14273

Zimmerman (1902) introduced *Nigrospora* and was typified by *N. panici*. Currently, 35 species are present in the genus (Hyde et al. 2024c), and 33 of them are supported by the molecular data. The asexual morph is hyphomycetous with micronematous or semimacronematous conidiophores, monoblastic conidiogenous cells, and black, shiny, aseptate conidia. Sexual morph is characterized by perithecial ascomata, short-stalked asci with biseriate ascospores (Wang et al. 2017). *Nigrospora* has cosmopolitan distribution recorded from China, Germany, India, Indonesia, South Africa and the USA as endophytes, saprobes or pathogens (human/plant) that occur on decaying and fresh plants, forest litter, human clinical samples and soil (Wang et al. 2017, Raza et al. 2019).

Table 241 *Nigrospora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Nigrospora globose</i>	China	Cave	Zhang et al. (2021c)
<i>N. humicola</i>	China	Garden soil	Zhang et al. (2024a)

Beltraniaceae Nann.

Beltraniella Subram., Proc. Indian Acad. Sci., Sect. B 36: 227 (1952)

Index Fungorum number: IF7356; Facesoffungi number: FoF05499

Subramanian (1952) introduced *Beltraniella* with the type species *B. odinae*. There are 30 species belong to this genus (Hyde et al. 2024c), while 11 are supported by the molecular data (ITS and LSU). The asexual morph possesses branched conidiophores with having setiform apex and radially lobed basal cells. Conidiogenous cells are polyblastic and sympodial, producing acropleurogenous, turbinate or biconic conidia with a distinct hyaline transverse band (Subramanian 1952). Species have been isolated from fallen decomposing leaves, soil and submerged wood in freshwater and terrestrial habitats in tropical and subtropical regions of the world such as Australia, China, India, Peru, Puerto Rico, Thailand and the UK (Lin et al. 2017).

Table 242 *Beltraniella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Beltraniella fertilis</i>	Thailand	Forest soil	Yasanthika et al. (2020)

Sporocadaceae Corda

Bartalinia Tassi, Bulletin Labor. Orto Bot. de R. Univ. Siena 3: 4 (1900)

Index Fungorum number: IF7327; Facesoffungi number: FoF00659

Bartalinia was established by Tassi (1900) while designating *B. robillardoides* as the type species. Currently, 25 species are listed in the genus (Species Fungorum 2025), and only 10 have molecular data. The asexual morph is characterized by the 3–4-septate conidia (Nag Raj 1993). Species have a wide distribution around the world, where they have been found as saprobes and associated with leaf spots from various plants.

Table 243 *Bartalinia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Bartalinia</i> sp.	Thailand	ND	Manoch (1987)

Broomella Sacc., Syll. fung. (Abellini) 2: 557 (1883)

Index Fungorum number: IF658; Facesoffungi number: FoF00626

Saccardo (1883) introduced *Broomella* with its type species *B. vitalbae*. It currently comprises 15 species (Species Fungorum 2025), however only 3 have been supported with molecular data. The asexual morph of the genus is pestalotia-like (Hyde et al. 2020c, Wanasinghe et al. 2018b) while the sexual morph has cylindric-elongate, unitunicate asci and J-, discoid apical ring, bearing 2-3-septate, ellipsoid to fusiform ascospores with brown, median and hyaline, terminal cells bearing centric appendages at each end (Liu et al. 2019a). *Broomella* has been explored as saprobes occurring on dead leaves, stems, wood and soil found from Australia, Ecuador, France, Italy, Pakistan, the Philippines and the UK (Hyde et al. 2020c).

Table 244 *Broomella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Broomella</i> sp.	Australia	Wheat-field	Walker (1984)

Neopestalotiopsis Maharachch., K.D. Hyde & Crous, Stud. Mycol. 79: 135 (2014)

Index Fungorum number: IF 809759, Facesoffungi number: FoF 01545

Neopestalotiopsis was introduced by Maharachchikumbura et al. (2014) using ITS, *TUB2* and *TEF1-α* phylogeny and the morphology and *N. protearum* is designated as the type species. Razaghi et al. (2024) used LSU, ITS, *TEF-1α*, *TUB2*, and *RPB2* multigene phylogeny, including 117 *Neopestalotiopsis* species, while revising the genus and introducing 20 species. The asexual morph is characterized by acervular or pycnidial, subglobose, globose, clavate, solitary or aggregated, dark brown to black, immersed to erumpent, unilocular or irregularly plurilocular conidiomata; exuding dark brown to black conidia in a slimy, globose mass. Conidiophores are indistinct, often reduced to conidiogenous cells which are discrete, cylindrical, ampulliform to lageniform, hyaline, smooth, thin-walled with initially holoblastic conidiogenesis becoming percurrent. Conidia are fusoid, ellipsoid to subcylindrical, straight to slightly curved, 4-septate. Having conic to sub-cylindrical hyaline or pale brown to olivaceous, thin and rugose to smooth-walled basal cell that has truncate base, basal appendage single, tubular, unbranched, centric; three median cells doliiform, wall rugose to verruculose, versicoloured, septa darker than the rest of the cell; and hyaline, conic to cylindrical, thin- and smooth-walled apical cell with tubular apical appendages, one to many, filiform or attenuated, flexuous, branched or unbranched;

(Maharachchikumbura *et al.* 2014). The species can be endophytes, saprobes, human and animal pathogens that have been recorded from air, dead and living plant parts (leaves and wood), fabrics and soil (Senanayake *et al.* 2020). The genus is distributed in Australia, China, Iraq, Iran, India, Pakistan, Portugal, Thailand and the USA (Maharachchikumbura *et al.* 2014, Razaghi *et al.* 2024).

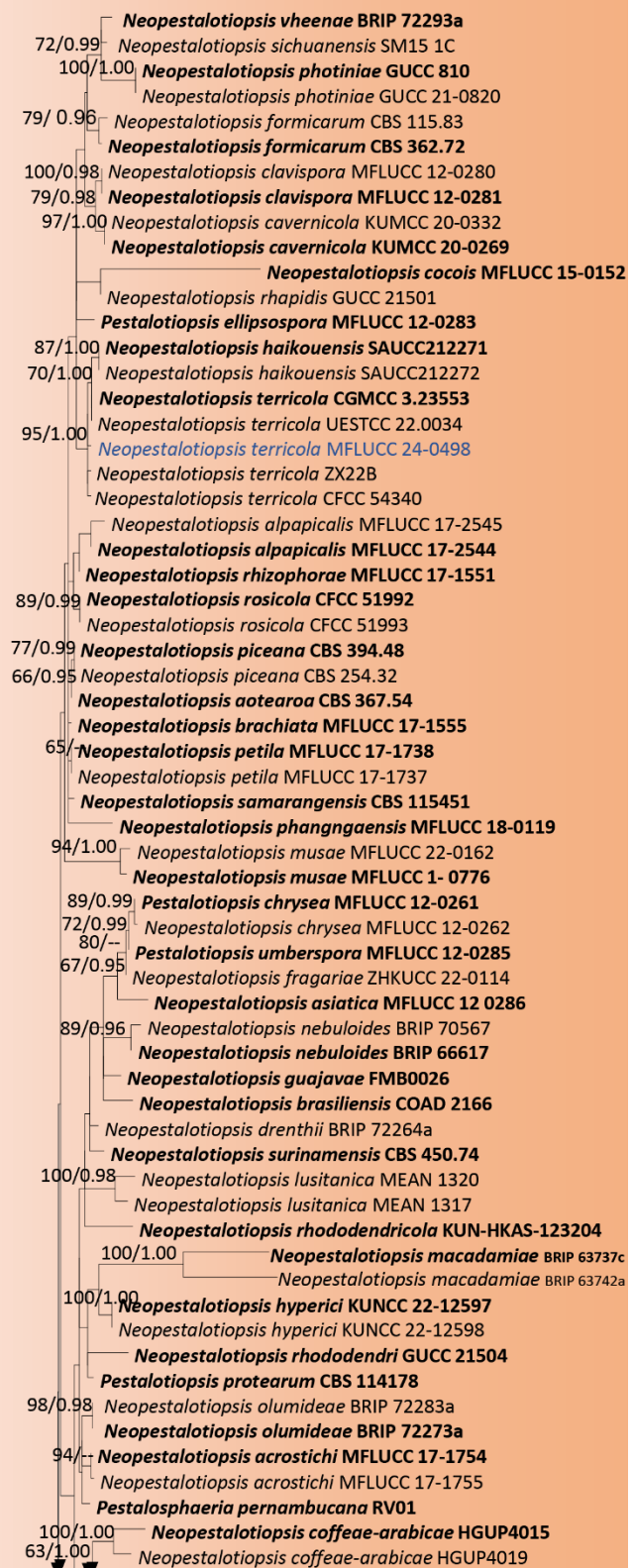


Figure 183 – The best-scoring maximum likelihood tree generated from the combined ITS, *TUB2* and *TEF1-α* sequence data for *Neopestalotiopsis*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above

the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *N. natalensis* (CBS138.41) and *P. trachicarpicola* (IFDRCC 2240). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the combined alignment is 1049 bp, and single gene alignments are ITS: 592 bp, *TEF1-α*: 565 bp and *TUB2*: 445 bp. The matrix had 738 distinct alignment patterns with 15.14% % undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.231, C = 0.267, G = 0.216, T = 0.287; substitution rates A-C = 1.51641 A-G = 4.45171 A-T = 1.51641 C-G = 1.00000 C-T = 4.45171 G-T = 1.00000; gamma distribution shape parameter $\alpha = 0.665$.

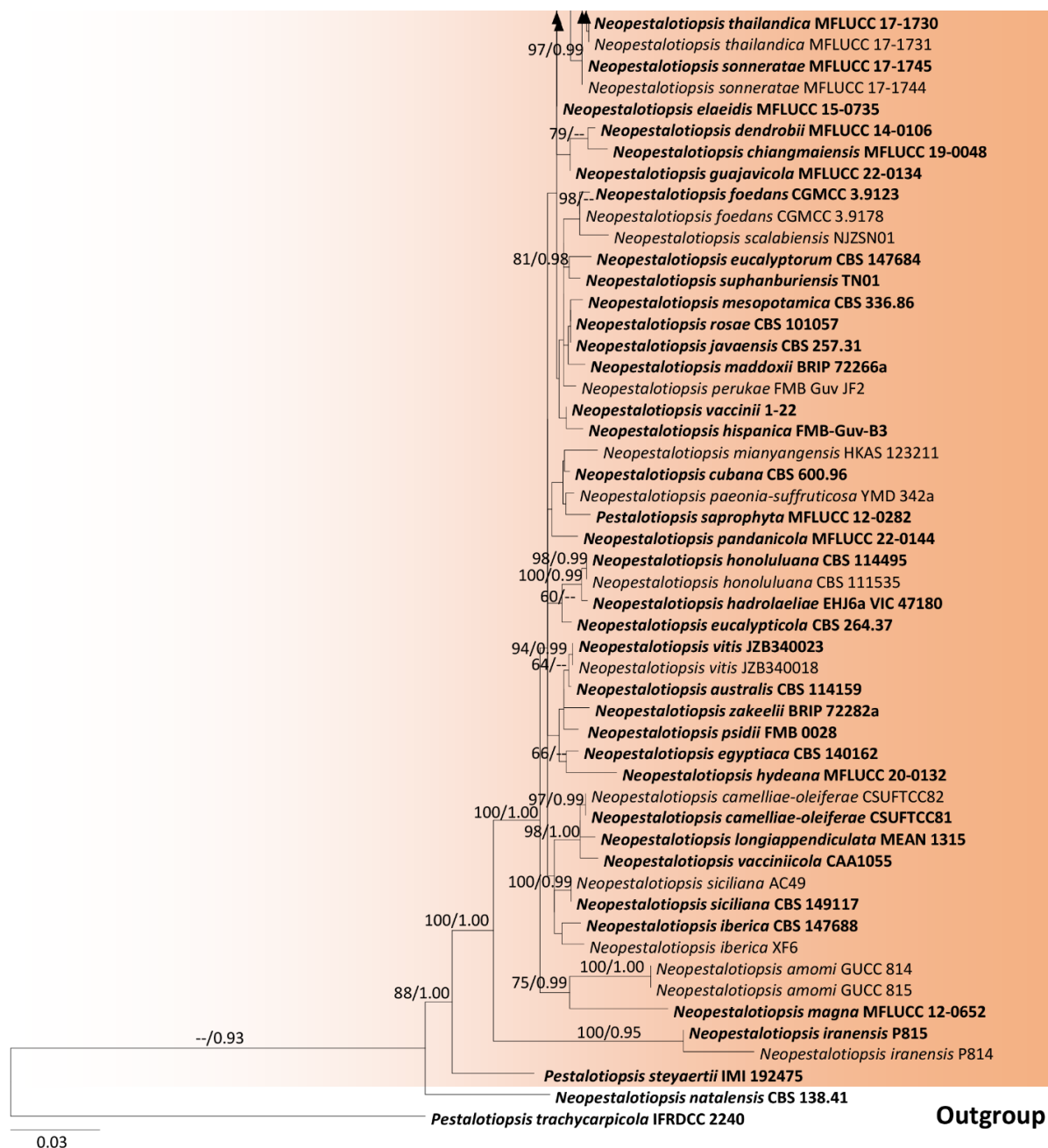


Figure 183 – continued.

Table 245 *Neopestalotiopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Neopestalotiopsis surinamensis</i>	Suriname	Soil under <i>Elaeis guineensis</i>	Maharachchikumbura et al. (2014)

Neopestalotiopsis terricola W.L. Li & Jian K. Liu, Journal of Fungi 8(11, no. 1175): 14 (2022) Fig.184

Index Fungorum number: IF 833025, Facesoffungi number: FoF 12748

Sexual morph: Undetermined. Asexual morph: *Conidiomata* solitary, globose, semi-immersed, black. *Conidiophores* $2.5\text{--}6 \times 1\text{--}4 \mu\text{m}$ ($\bar{x} = 4 \times 2 \mu\text{m}$, $n=10$) or sometimes reduced to conidiogenous cells. *Conidiogenous cells* $5.5\text{--}9 \times 4.5\text{--}8 \mu\text{m}$ ($\bar{x} = 7 \times 6 \mu\text{m}$, $n=10$), hyaline, mostly integrated, ampulliform to lageniform, single, truncated apex, smooth-walled. *Conidia* $15\text{--}21 \times 5\text{--}8 \mu\text{m}$ ($\bar{x} = 18 \times 6 \mu\text{m}$, $n = 30$), fusoid, ellipsoid, mostly straight, 4-septate; apical cell $2\text{--}3 \mu\text{m}$ ($\bar{x} = 2.5 \mu\text{m}$) long, hyaline, cylindrical to sub-cylindrical, thin and smooth-walled with three apical tubular appendages, arising from the upper half of the apical cell just below the crest with different locus, unbranched, filiform, $7\text{--}19 \mu\text{m}$ ($\bar{x} = 11 \mu\text{m}$) long; three medial cells hyaline to light brown to dark, thick walled, sometimes second cell from base paler than other medial cells; basal cell $2\text{--}4.5 \mu\text{m}$ ($\bar{x} = 3 \mu\text{m}$) long, hyaline, conical to obconical, truncated base, thin walled, with basal appendix; single basal appendix, tubular, unbranched, centric, $2\text{--}3 \mu\text{m}$ ($\bar{x} = 2.5 \mu\text{m}$).

Culture characteristics – *Colonies* on PDA at 25 °C, become 2–3 cm diam., after 7 days, white and sparse mycelium densely grow when mature, conidial masses and conidiomata black spots, reverse yellowish-white. raised, circular, filiform-margined. *Hyphae* superficial to semi-immersed hyaline septate, smooth-walled, $2.1\text{--}3.9 \mu\text{m}$ ($\bar{x} = 3 \mu\text{m}$).

Material examined – Thailand, Chiang Mai, Mae Taeng District, Mushroom Research Centre, Forest, 19.2145N, 98.5953E, 1440m, 17 February 2019 W.A. Erandi Yasanthika (MFLU 25-0125), living culture 122-CML4= MFLUCC 24-0498.

GenBank numbers – MFLUCC 24-0498: ITS: PQ570526, *TUB2*: PV611462.

Notes – The multigene phylogeny of *Neopestalotiopsis* (Figure 183) shows that our strain (MFLUCC 24-0498) clusters with *N. terricola* with 95% ML, 1.00 BYPP statistical support. Our isolate resembles to *N. terricola* by having solitary, globose, semi-immersed, black conidiomata and hyaline, mostly integrated, ampulliform to lageniform, single, truncated apex conidiogenous cells. Conidial morphology of our strain is similar to *N. terricola* by fusoid, ellipsoid, mostly straight, 4-septate conidia with three apical tubular appendages, and a basal appendix (Li et al. 2022a). We confirm our species as *N. terricola* based on the morpho-molecular results. *Neopestalotiopsis terricola* was introduced by Li et al. (2022a) from a dead-diseased branch of *Paeonia suffruticosa* in China. This is the first record of *N. terricola* inhabiting soil, which was collected in Thai forest.

***Robillarda* Sacc., Michelia 2(no. 6): 8 (1880)**

Index Fungorum number: IF22470; Facesoffungi number: FoF01688

Saccardo (1880) erected *Robillarda* with the type species *R. sessilis*. *Robillarda* comprises 20 species, while nine are supported by the molecular data. The asexual morph possesses solitary or gregarious, scattered, subglobose, unicellular, immersed, ostiolate, glabrous pycnidia and holoblastic conidiogenous cells that are sympodially or percurrently proliferating near the apex. Conidia are septate with flexuous, narrow and tubular polar appendages (Nattawut et al. 2012). Species occur on plant leaves, branches and stems from aquatic and terrestrial habitats and soils in China, France, Germany, India, Italy, Romania and Thailand (Nattawut et al. 2012, Dissanayake et al. 2024).

Table 246 *Robillarda* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Robillarda</i> sp.	Thailand	ND	Manoch (1998)

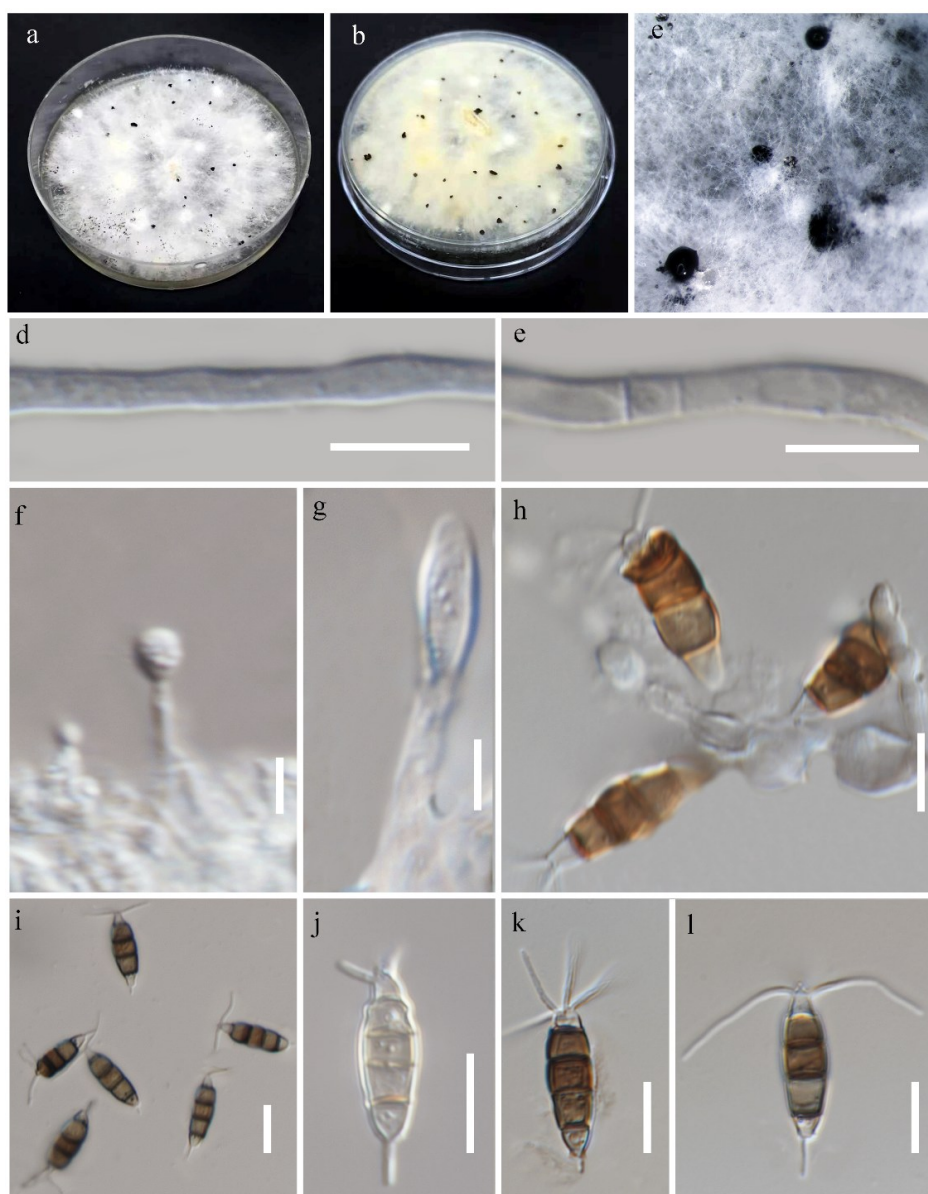


Figure 184 – *Neopestalotiopsis terricola* (MFLU 25-0125). a, b Culture characters on the PDA (b = reverse). c Sporulated colony. d, e hyphae. f–h Conidiogenesis i–l Conidia. Scale bars: d, e, h–l = 10 µm, f, g = 5 µm.

Xylariales Nannf.

Conioceksiaceae Asgari & Zare

Conioceksia Dania García, Stchigel, D. Hawksw. & Guarro, Mycol. Res. 110(11): 1284 (2006) Fig. 185

Index Fungorum number: IF29049; Facesoffungi number: FoF01297

Conioceksia was introduced by García et al. (2006) with the type species *C. nodulisporioides* by using morphology and LSU phylogeny. Based on ITS and LSU phylogeny, Asgari & Zare (2011) introduced *Conioceksiaceae* to accommodate *Conioceksia*. Currently, it comprises 5 species (Species Fungorum 2025), all of which have molecular data. The asexual morph is characterized by the hyaline, micronematous to macronematous, simple or branched, smooth-walled or verrucose conidiophores, and hyaline, sympodially elongating conidiogenous cells that produce hyaline, globose, subglobose to pyriform conidia. The sexual morph is characterized by the non-stromatic, superficial, globose, subglobose to pyriform glabrous, ostiolate

ascomata, and 4-spored, cylindrical to subcylindrical, non-amyloid asci with ellipsoidal or fusiform, dark brown to black ascospores (Asgari & Zare 2011). Species have been recorded from Iran, Jordan and Spain from dung, wheat seeds, straw and soil (García et al. 2006, Asgari & Zare 2011).

Table 247 *Coniocessia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Coniocessia nodulisporioides</i> .	Jordan	ND	Asgari & Zare (2011)

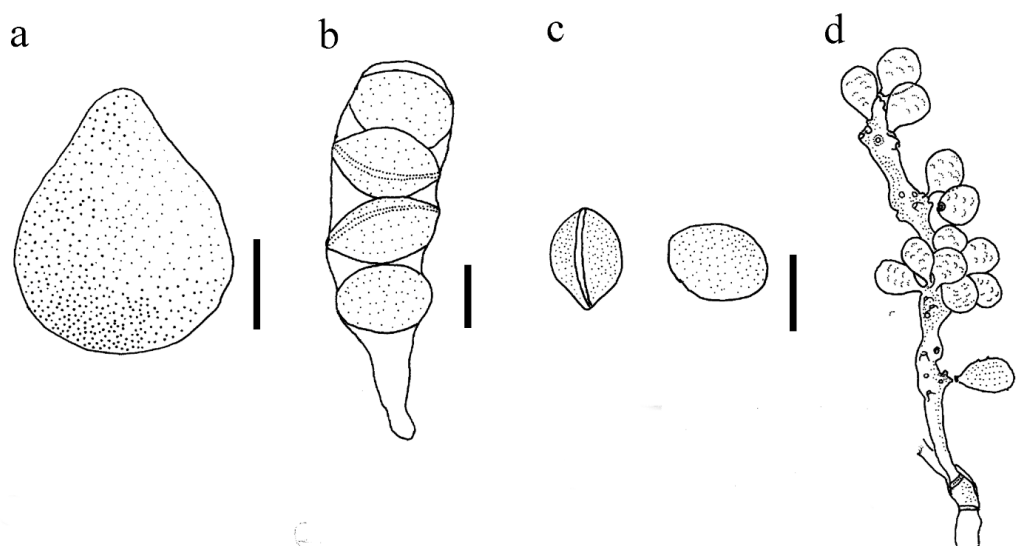


Figure 185 – *Coniocessia nodulosporioides*. a Ascoma. b Ascus. c Ascospores. d Conidiophore, conidiogenous cells, and conidia. Scale bars: a = 100 µm, b–d = 10 µm. Redrawn from Guarro et al. (2012).

Hansfordiaceae Crous

Hansfordia S. Hughes, Mycol. Pap. 43: 15 (1951)

Index Fungorum number: IF8423; Faces of Fungi number: FoF 06207

Hansfordia was introduced by Hughes (1951a), accommodating *H. ovalispora* as the type species. Crous et al. (2019) introduced *Hansfordiaceae* to accommodate *Hansfordia* by using the LSU and ITS combined phylogeny. The genus presently accommodates 13 species (Species Fungorum 2025), however, only two of them have molecular data. The asexual morph is characterized by the superficial or setiform, solitary, erect, multi-septate with lateral branches, surface smooth, straight to flexuous, light brown conidiophores and hyaline, cylindrical or clavate, with subdenticulate apical loci conidiogenous cells that produce solitary, dry, aseptate, hyaline to pale brown, globose, ellipsoid to fusoid, smooth-walled or finely roughened conidia and the sexual morph is undetermined (Hyde et al. 2020c). Species have been isolated as saprobes, endophytes and lichenized fungi from dead stems, leaves, litter and soils in Congo, China, Indonesia, Italy, the UK and the USA (Crous et al. 2019, Changtian et al. 2022). However, pathogenicity or toxicity has not been reported (Changtian et al. 2022).

Table 248 *Hansfordia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Hansfordia rosea</i>	China	Forest soil	Wu et al. (2015a)

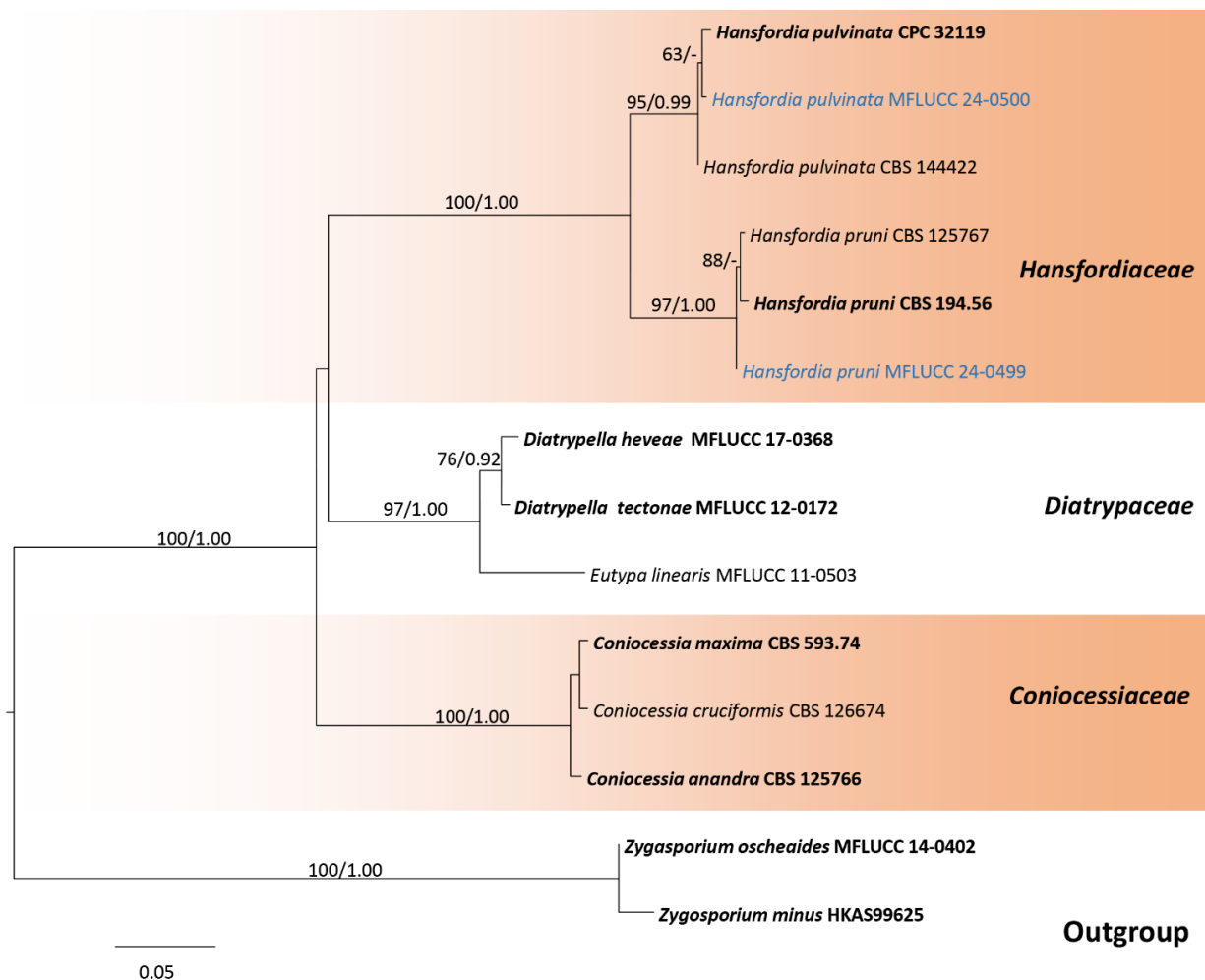


Figure 186 – The best-scoring maximum likelihood tree generated from the combined ITS sequence data for *Xylariales*. Bootstrap support values of maximum likelihood greater than 60% and Bayesian posterior probabilities (BYPP) greater than 0.90 are indicated above the nodes. Newly added strains are in blue and ex-type strains are in bold. The tree is rooted to *Zygasporium oscheaides* (MFLUCC 14-0402) and *Z. minus* (HKAS99625). The topology and clade stability of the combined gene tree are compared with the single gene analyses. The approximate length of the ITS alignment is 550 bp. The matrix had 209 distinct alignment patterns with 13.56% undetermined characters and gaps. Estimated base frequencies were as follows; A = 0.250, C = 0.250, G = 0.250, T = 0.250; substitution rates AC = 1.87336, AG = 2.59063, AT = 1.87336, CG = 1.00000, CT = 4.80167, GT = 1.00000; gamma distribution shape parameter $\alpha = 0.453$.

Hansfordia pruni Crous, Fungal Systematics and Evolution 3: 84 (2019)

Fig. 187

Index Fungorum number: IF 829306, Faces of Fungi number: FoF 16721

Sexual morph: Undetermined. Asexual morph: *Conidiophores* 36–44 × 1.5–2 µm ($\bar{x} = 39 \times 2$ µm, n=15), solitary, mostly erect, with lateral branches in the upper half, hyaline, smooth to verucose, sometimes multi-septate. *Conidiogenous cells* 0.7–1.5 × 0.9–2.5 µm, ($\bar{x} = 1 \times 1.5$ µm, n=10), holoblastic, hyaline, subcylindrical, tapering towards apices. *Conidia* 4.5–5.5 × 4.5–5.5 µm ($\bar{x} = 5 \times 5$ µm, n = 25), aseptate, solitary, dry, globose to subglobose, hyaline, smooth-walled.

Culture characteristics – *Colonies* on PDA at 25 °C, become 3–4 cm diam., after seven days, white becomes yellowish white when mature, reverse brownish yellow in the center, bright yellow at the middle ring and whitish yellow at the periphery, flat, cottony surface, undulate-margined. *Hyphae* superficial to semi-immersed, hyaline to pale brown, aseptate to septate, smooth-walled, 1.5–4 µm ($\bar{x} = 2$ µm, n=30).

Material examined – Thailand, Chiang Rai, Buddha Cave (What Tham Phra), 99.788928N, 101.9175247E, 425m, 21 June 2021, W.A. Erandi Yasanthika (MFLU25-0173); living culture 42-cv5-606 =MFLUCC 24-0499.

GenBank numbers – MFLUCC 24-0499: ITS: PQ570527

Notes – As shown in Figure 186, our strain (MFLUCC 24-0499) clusters with *Hansfordia pruni* (CBS 125767, CBS27651) with 100% ML, 1.00 BYPP statistical support. Each gene region of our strain was compared with the type species and resulted in having 100% similarity. *Hansfordia pruni* is morphologically comparable with our isolate in having solitary, mostly erect, smooth to verrucose, sometimes multi-septate conidiophores and conidiogenous cells that are subcylindrical and tapering towards apices. Our strain is similar in conidial morphology by aseptate, solitary, dry, globose to subglobose and smooth-walled conidia (Crous et al. 2019). Morphology and multi-gene phylogeny confirm that our strain is *H. pruni*. *Hansfordia pruni* was introduced from *Prunus persica* twigs in Italy (Crous et al. 2019). This study provides the first record of the species from soil which was isolated in a disturbed cave in Thailand.

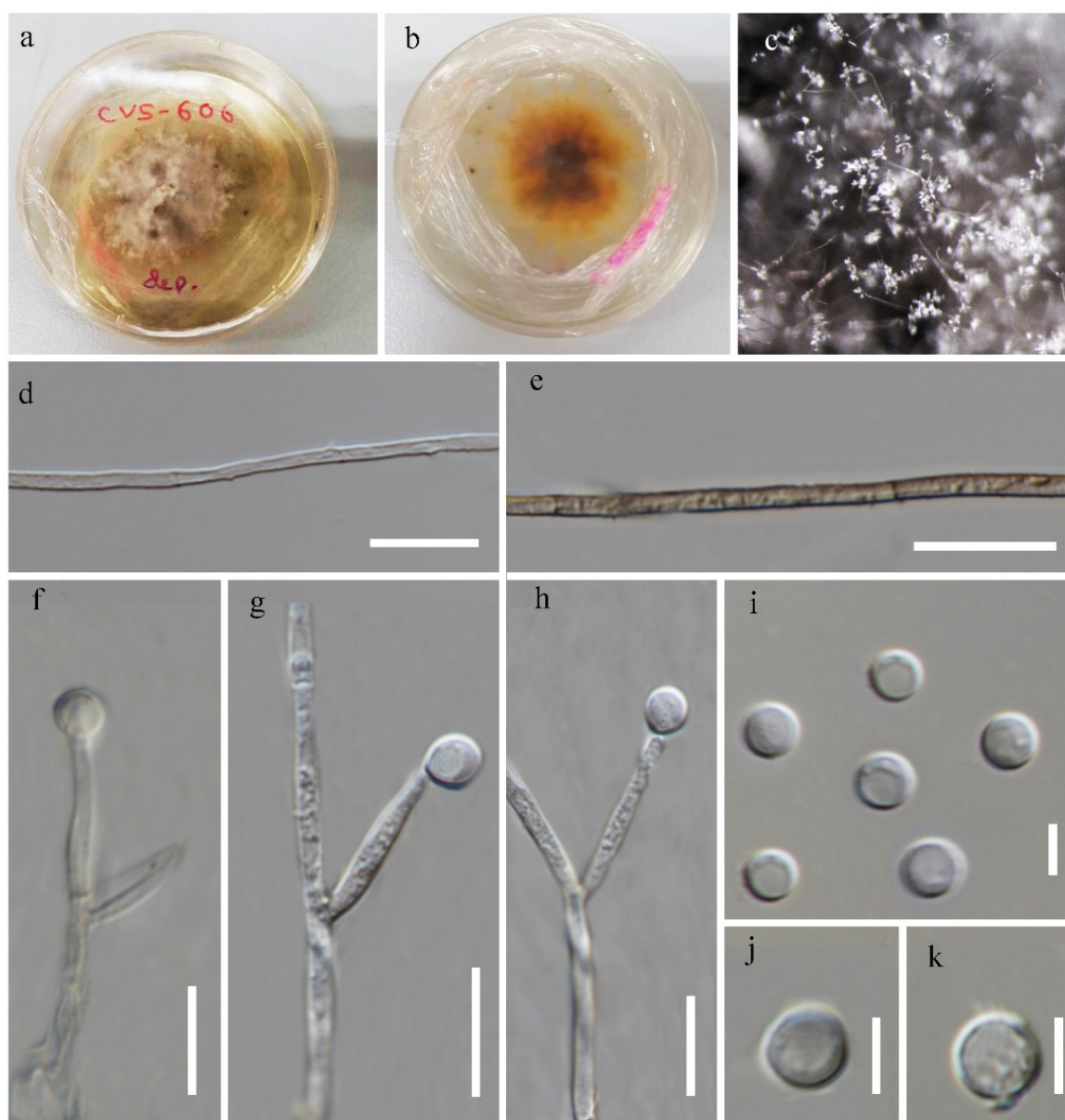


Figure 187 – *Hansfordia pruni* (MFLU 25-0174). a, b Culture characters on PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d, e hyphae. f–h Conidiophores i–k Conidia. Scale bars: d, e = 20µm, f–h = 10 µm, i–k = 5µm.

Hansfordia pulvinata (Berk. & M.A. Curtis) S. Hughes, Canad. J. Bot. 36: 771. 1958. Fig. 188

Index Fungorum number: IF 298125, Facesoffungi number: FoF 16720

Sexual morph: Undetermined. Asexual morph: *Conidiophores* 37.3–47 × 2–3.5 µm. ($\bar{x}$ = 41.6 × 2.4 µm, n=15), solitary, erect to flexuous, unbranched or branched, hyaline, multi-septate, macronematous, mononematous, smooth to verrucose, *Conidiogenous cells* 0.5–1.2 × 0.5–1.1 µm ($\bar{x}$ = 0.9 × 0.8 µm, n=10), subcylindrical, holoblastic, tapering towards the apices, hyaline. *Conidia* 5.3–4.6 µm × 51–4.1 µm ($\bar{x}$ = 4.8 × 4.6 µm, n = 25) hyaline, solitary, dry, globose, finely roughened, thick-walled.

Culture characteristics – *Colonies* on PDA at 25 °C, become 3–4 cm diam., after seven days, yellowish-white becomes brown when mature, reverse yellowish becomes dark brown to black when mature, flat, undulate, filiform-margined. *Hyphae* superficial to semi-immersed hyaline to pale brown, aseptate to septate, smooth-walled to verrucose, 1–2.2 µm ($\bar{x}$ = 1.6, n=20).

Material examined – Thailand, Chiang Rai, Buddha Cave (What Tham Phra), 99.788928N, 19.9175247E, 425m, 21 June 2021, W.A. Erandi Yasanthika (MFLU 25-0174), living culture 40-cv5-602= MFLUCC 24-0500.

GenBank numbers – MFLUCC 24-0500: ITS: PQ570528

Notes – Based on phylogeny of *Xylariales* (Figure 186), our strain (MFLUCC 24-0500) grouped with *H. pulvinata* with 98% ML, 0.97 BYPP support. Comparing each gene region of our strain with *H. pulvinata* resulted in 100% similarity. Morphologically, *H. pulvinata* and our isolate have similar characteristics, such as solitary, erect to flexuous, unbranched or branched conidiophores, subcylindrical conidiogenous cells tapering towards the apices and hyaline, solitary, dry, globose, finely roughened conidia (Hughes 1951). This species was introduced by Hughes (1951) as fungicolous (Deighton 1972), and has later been reported from *Macrozamia miquelii* in Australia (Crous et al. 2019). Based on morphology and multi-gene phylogeny, we confirm that our species is *H. pulvinata*, and it becomes the first strain to associate with soil habitats.

Microdochiaceae Hern.-Restr., Crous & J.Z. Groenew.

Idriella P.E. Nelson & S. Wilh., Mycologia 48: 550. (1956)

Fig. 189

Index Fungorum number: IF8625; Facesoffungi number: FoF06783

Nelson & Wilhelm (1956) introduced *Idriella* and *lunata* is accepted as the type species. Based on LSU, ITS, *TUB2* and *RPB2* gene regions, Hernández-Restrepo et al. (2016a) provided a phylogenetic re-evaluation for *Idriella*. Currently, there are 26 species listed in the Species Fungorum (2025), but only four have molecular data. The asexual morph is hyphomycetous and consists of brown, non-septate conidiophores with polyblastic, terminal, denticulate, lageniform to cylindrical conidiogenous cells, and dry, hyaline, unicellular, smooth, lunate, curved conidia. Sexual morph remains undetermined (Hernández-Restrepo et al. 2016a, Hyde et al. 2020c). The genus is reported from Australia, Canada, China, Cuba, India, Japan, South Korea, Mexico, the Netherlands and the USA, that are inhabiting in dead leaves, roots and soil (Hyde et al. 2020c, Zhang et al. 2024b).

Table 249 *Idriella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Idriella chlamydospora</i>	China	A university land	Zhang et al. (2023d)
<i>I. multiformispora</i>	USA	A university land	
<i>I. lunata</i>	The Netherland	ND	Hernández-Restrepo et al. (2016a)
<i>I. variabilis</i>	China	Wildlife park	Zhang et al. (2024b)

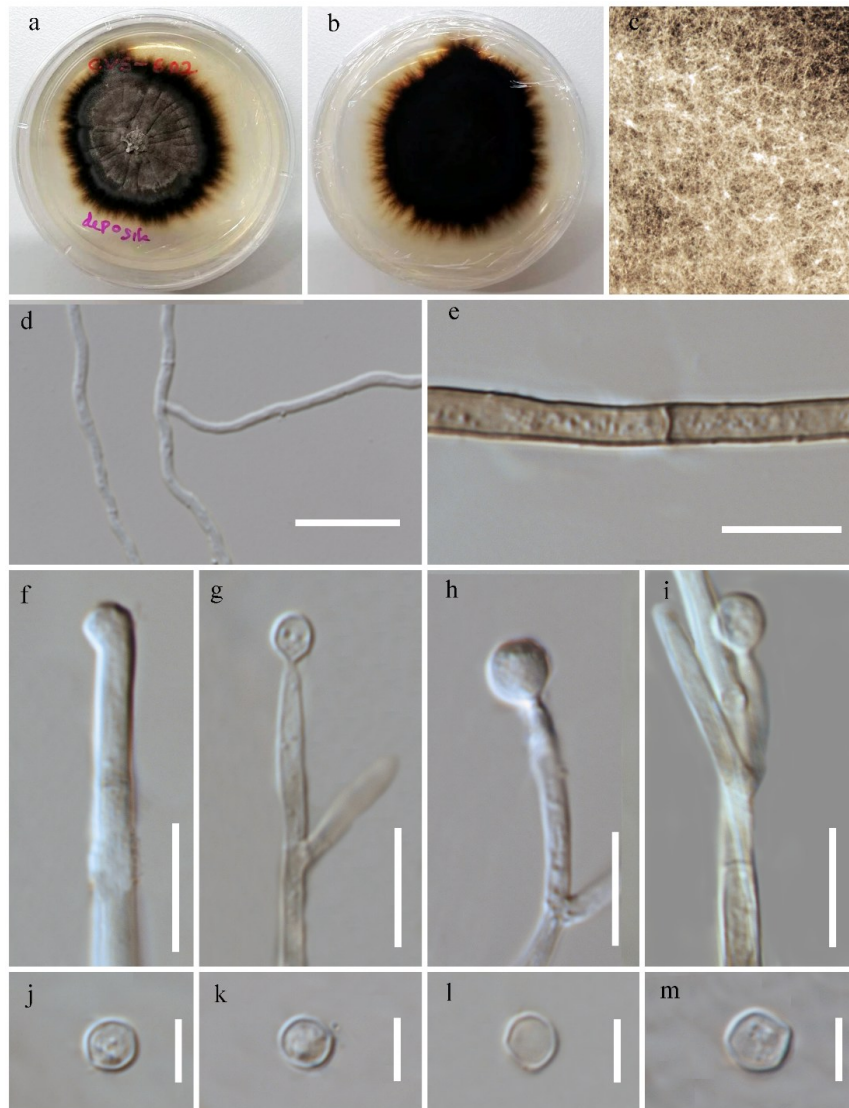


Figure 188 – *Hansfordia pulvinata* (MFLU 25-0174) a, b Culture characters on PDA (b = reverse). c Sporulated colony with conidial attachments on the mycelium. d, e hyphae. f–i Conidiophores j–m Conidia. Scale bars: d–i = 10 μ m, j–m = 5 μ m.

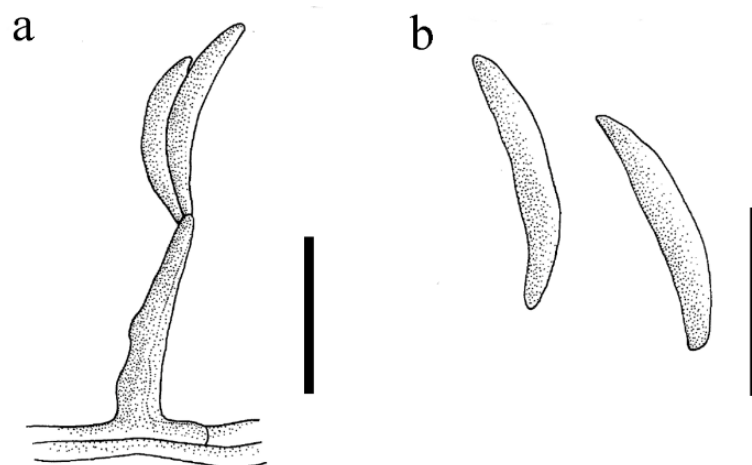


Figure 189 – *Idriella lunata*. a Conidiogenesis on the conidiophore. b Conidia. Scale bars: a, b = 10 μ m. Redrawn from Hernández-Restrepo et al. (2016a).

Microdochium Syd. & P. Syd., Annls mycol. 22(3/6): 267 (1924)

Index Fungorum number: 8926; Facesoffungi number: FoF02121

Microdochium was introduced by Sydow (1924), and it is typified by *M. phragmitis*. Based on LSU phylogeny, Hernández-Restrepo et al. (2016a) introduced *Microdochiaceae* and accommodated *Microdochium* as the type genus. Currently, 60 species are present in the genus (Species Fungorum 2025), and the molecular data are available for 38 species. The asexual morph of this genus is characterized by the hyphomycetes that are more or less verticillate, often slightly differentiated conidiophores reduced to conidiogenous cells that are hyaline, holoblastic, solitary or aggregated in small sporodochia, producing unicellular or multiseptate, hyaline, lunate, falcate, fusiform, filiform, obovoid or subpyriform conidia with dry or slimy mass. The sexual morph has perithecial, immersed, solitary or in groups, pale brown to black, globose, subglobose to oval, ostiolate ascomata. Asci are unitunicate, oblong to clavate, bi to multiseriate, and ascospores are hyaline to brown, clavate, fusoid or oblong and septate (Hernández-Restrepo et al. 2016a). They are economically important plant pathogens that cause microdochium patch, seedling blight, tar spot disease, scald disease, root and necrosis in cereals and grasses (Gao et al. 2022, Hyde et al. 2020c). They can be endophytes and saprobes from aquatic environments, cereals, leaves and soil, reported mostly in Europe and Asia. Bioactive compounds have been discovered from this genus that can be used against plant pathogenic fungi and human and animal diseases (Gao et al. 2022).

Table 250 *Microdochium* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Microdochium trichocladiopsis</i>	ND	Rhizosphere of <i>Triticum aestivum</i>	Hernández-Restrepo et al. (2016a)
<i>M. salmonicolor</i>	Korea	Forest soil	Das et al. (2020b)

Xylariaceae Tul. & C. Tul.

Ascotricha Berk., Ann. nat. Hist., Mag. Zool. Bot. Geol. 1: 257 (1838)

Index Fungorum number: IF384; Facesoffungi number: FoF03021

Ascotricha was erected by Berkeley (1838) and typified with *A. chartarum*. Genus has 27 species in the Species Fungorum (2025), while only nine have the sequence data. Hyde et al. (2020c) suggested that this genus needs revision to infer its correct phylogenetic placement. The sexual morph has ascomata bearing long hairs with shorter hyaline branches and brown ellipsoidal ascospores with an equatorial germ slit. Species are distributed in France, the Philippines and Portugal that are associated with soil, paper, lignum or other cellulosic substrates and marine habitats (Cheng et al. 2015).

Table 251 *Ascotricha* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Ascotricha distans</i>	Japan	Cultivated soil	Udagawa et al. (1994)
<i>A. hispanica</i>	Spain	Calcareous soil with the vegetation	Stchigel & Guarro (1998)
<i>A. xylina</i>	India	ND	Rai & Tewari (1961)

Coniolarrella Dania García, Stchigel & Guarro, in García, Stchigel, Cano, Caldach, Hawksworth & Guarro, Mycol. Res. 110(11): 1285 (2006)

Index Fungorum number: IF29050; Facesoffungi number: FoF03030

García et al. (2006) introduced *Coniolarrella* based on morphology and LSU phylogeny and accommodated *C. gamsii* as the type species. It has four species listed in the Species Fungorum (2025), and all of them are supported with molecular data. The asexual morph has branched, slightly pigmented conidiophores with sub-hyaline to pale olive–brown, sympodially elongating conidiogenous cells, and conidia are sub-hyaline to pale olivaceous, solitary or in small chains on

ramoconidia. The sexual morph consists of globose, ostiolate, glabrous ascomata surrounded at the base by brown, thick hyphae, pseudoparenchymatous to coriaceous, *textura intricata* to *textura angularis* peridium cells and paraphyses present. Asci are cylindrical, 8-spored, without apical structures, non-amyloid with one-celled, ellipsoidal, brown, dark brown to black ascospores with longitudinal germ-slit (García et al. 2006). The species have been isolated from leaves, soil and twigs collected from Iran, Spain and the USA (Zare et al. 2010).

Table 252 *Coniolaria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Coniolaria macrothecia</i>	USA	Monument valley area	Zare et al. (2010)

Xylaria Hill ex Schrank, Baier. Fl. (München) 1: 200 (1786)

Index Fungorum number: IF5832; Facesoffungi number: FoF000696

Xylaria was validated by Schrank (1786), and *X. hypoxylon* was designated as the type species. It is accepted as the type genus in *Xylariaceae*, with approximately 300 species included in the genus (Hyde et al. 2024c). Various combinations of ITS, *RPB2*, *TUB2* and *Actin* have been used for the phylogenetic analyses in *Xylaria* (Wangsawat et al. 2021, Ma et al. 2022). However, phylogenetic ambiguities remain in this genus, where some studies suggest that secondary metabolites can be a potential marker for species identification (Hyde et al. 2020c, Song et al. 2014). Around 188 secondary metabolites are found in *Xylaria* (Song et al. 2014). The asexual morph is a geniculosporium-like, and the sexual morph is characterized by cylindrical stromata, eight-spored asci with an amyloid apical apparatus and ascospores are brown unicellular with a germ slit (Wangsawat et al. 2021). The species have been globally reported from various habitats such as dung, fruits, leaves, seeds, soil, termite nests and wood (Li et al. 2024a, Wangsawat et al. 2021). Most of them are saprobes, mainly contributing as wood decomposes in forest ecosystems. Some produce beneficial compounds with antibacterial, antioxidative and anticarcinogenic properties (Li et al. 2024b).

Table 253 *Xylaria* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Xylaria chaiyaphumensis</i>	Thailand	Soil near termite nest	Wangsawat et al. (2021)
<i>X. escharoidea</i>	India	Inactive termite mounds in a forest	Karun & Sridhar (2015)
<i>X. symploci</i>	India	Soil under the standing dead tree in a forest	
<i>X. curta</i>	India	Mountain soil	Ramesh et al. (2012)
<i>X. hirsuta</i>	Congo	ND	Ju et al. (2023)
<i>X. guepini</i>	France	Humiferous sandy soil	Hsieh et al. (2022)

Sordariomycetes orders *incertae sedis*

Amplistromatales M.J. D'souza, Maharachch. & K.D. Hyde

Amplistromataceae Huhndorf, A.N. Mill., Greif & Samuels

Acidothrix Hujšlová & M. Kolařík, Mycol. Progr. 13(3): 824 (2014)

Fig. 190

Index Fungorum number: IF805194; Facesoffungi number: FoF02965

Acidothrix was erected by Hujšlová et al. (2014) based on LSU phylogeny and morphological analyses, treated to *Amplistromataceae*. It is a monospecific genus and typified by *A. acidophila*, which was isolated from soil (Hujšlová et al. 2014). Colonies are white to slightly salmon with abundant aerial mycelium. The asexual morph is hyphomycetous, having acrothecium-

like conidiophores, producing single, globose, or ellipsoidal to lacrimose conidia. This species is morphologically similar to acrodontium-like asexual morphs of *Amplistroma* and *Wallrothiella* in *Amplistromataceae*. The sexual morph is undetermined (Hujšlová et al. 2014).

Table 254 *Acidothrix* species isolated from soil

Species	Country	Habitat or soil type	References
<i>A. acidophila</i>	Czech Republic	Highly acidic soil	Hujšlová et al. (2014)

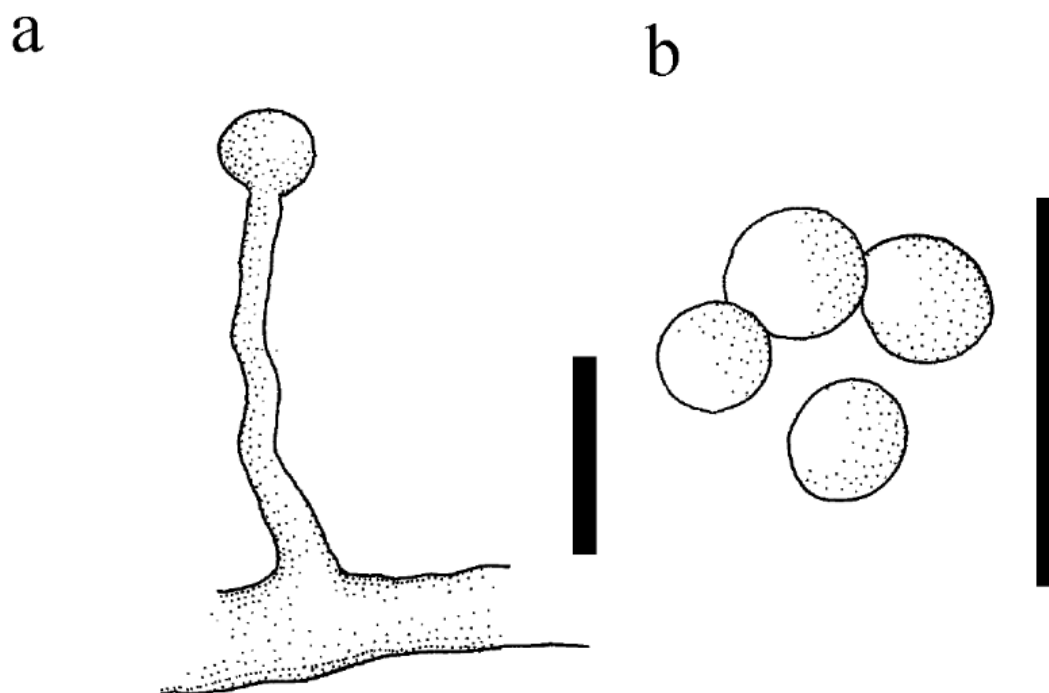


Figure 190 – *Acidothrix acidophila* a. Conidiophore b. Conidia. Scale bars: a, b = 10 µm. Redrawn from Hujšlová et al. (2014).

Saccharomycotina O.E. Erikss. & Winka

Dipodascomycetes M. Groenew., Hittinger, Opulente & A. Rokas

Dipodascales M. Groenew., Hittinger, Opulente & A. Rokas

Trichomonascaceae Kurtzman & Robnett

Trichomonascus H.S. Jacks., Mycologia 39(6): 712 (1948) [1947]

Index Fungorum number: IF 5562; Facesoffungi number: FoF16657

Trichomonascus was introduced by Jackson (1948), and the type species is designated as *T. mycophagus* (Smith et al. 2011). There are six species currently listed in the Species Fungorum (2025), and three of them have molecular data. In asexual reproduction, both pseudohyphae and true hyphae are formed, and multi-lateral budding occurs; these species produce blastoconidia in

short chains. Heterothallic or homothallic occurs in sexual reproduction. Gametangia may form on hyphal tips or hyphae after the fusion of two intercalary cells by lateral outgrowths. The asci are globose to ellipsoidal, with firm, thick walls, sometimes with a sterile apical cell and contain two to four ascospores. Ascospores are long-ellipsoidal to fusiform or hat- or helmet-shaped (Smith et al. 2011, Groenewald et al. 2018). Species are distributed in Canada, Hungary, South Africa and the Netherlands and are associated with fungicolous fungi, human clinical samples, marine aquatic environments and pollen stored in honeycomb and soil (Smith et al. 2011, Groenewald et al. 2018).

Table 255 *Trichomonascus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Trichomonascus vanleeneni</i>	the Netherlands	A garden	Groenewald et al. (2018)
<i>T. cijferrii</i>	South Africa	ND	Cosio et al. (2024)

Zygoascus M.T. Sm., Antonie van Leeuwenhoek 52: 27 (1986)

Index Fungorum number: IF 25781; Facesoffungi number: FoF16658

Zygoascus was established by Smith (1986), and *Z. hellenicus* is designated as the type species. There are nine species listed in the Species Fungorum (2025), and only six have molecular data (LSU, ITS and *RPB2*). Asexual reproduction is characterized by multi-lateral budding and pseudohyphae, and septate hyphae are present where blastoconidia are formed. Hyphal septa have micropores. Species can be homo- or heterothallic. Asci are obovate to spherical and contain one to four hemispherical to galeate ascospores (Smith 1986). Species have been isolated from fermenting grapes, decaying wood, emulsion of white oil and polysorbate, soil and tar in Canada, China, France, Japan, South Africa and the Netherlands (Chai et al. 2022).

Table 256 *Zygoascus* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Zygoascus flipseniorum</i>	the Netherlands	A garden	Groenewald et al. (2018)

Pichiomycetes M. Groenew., Hittinger, Opulente & A. Rokas

Pichiales M. Groenew., Hittinger, Opulente & A. Rokas

Pichiaceae Zender

Ogataea Y. Yamada, K. Maeda & Mikata, Biosc., Biotechn., Biochem. 58(7): 1253 (1994)

Index Fungorum number: IF 27299; Facesoffungi number: FoF16654

Ogataea was introduced by Yamada et al. (1994) and typified with *O. minuta* (Kurtzman 2011a). Currently, there are 38 species listed in the Species Fungorum (2025), and all of them have molecular data. Asexual reproduction is a process with multi-lateral budding on a narrow base, and cells are spherical to ellipsoidal. Pseudohyphae can occur with a few elongated cells. True hyphae are not formed. The sexual morph has asci that are deliquescent and may be unconjugated or show conjugation between a cell and its bud or between independent cells, one to four, or sometimes more asci are produced, with hat-shaped, allantoid, or spherical ascospores. Species are characterized by homothallic or infrequently heterothallic nature (Kurtzman 2011a). They have been found in Australia, Brazil, Canada, China, Colombia, Hungary, Italy, South Africa, Thailand and the USA in association with dung, grapefruits, leaves and soil (Garcia-Acero et al. 2024, Kurtzman 2011a).

Table 257 *Ogataea* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Ogataea Polymorpha</i>	Brazil, the USA	ND	Kurtzman (2011a)
<i>O. thermomethanolica</i>	Thailand	ND	Groenewald et al. (2018)
<i>O. degrootiae</i>	the Netherlands	A garden	
<i>Ogataea chonburiensis</i>	Thailand	ND	Limtong et al. (2008)

Pichia E.C. Hansen, Centbl. Bakt. ParasitKde, Abt. I 12(19): 538 (1904)

Index Fungorum number: IF 4095; Facesoffungi number: FoF16655

Pichia was introduced by Hansen (1904) (Kurtzman 2011b) and typified with *P. membranifacien*. The genus accommodates 61 species (Species Fungorum 2025), and most of them are supported by the molecular data (ITS and LSU). Species have spheroidal, ellipsoidal, or elongated, occasionally tapered cells. In the sexual morph, the asci are deliquescent but occasionally persistent, containing one to four ascospores that are hat-shaped (galeate), hemispheroidal, or spheroidal with a ledge. Hyphal or pseudo-hyphal cells may serve as asci (Kurtzman 1998). Species have been isolated from decaying plant tissues and soil in Mexico, India and Indonesia, while some species have been identified as opportunistic human pathogens (Groenewald et al. 2018).

Table 258 *Pichia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Pichia gijzeniarum</i>	the Netherlands	ND	Groenewald et al. (2018)
<i>P. chibodasensis</i>	Indonesia	ND	Kobayashi et al. (2017)

Saccharomycetes O.E. Erikss. & Winka

Ascoideales J.H. Schaffner

Saccharomycopsidaceae Arx & Van der Walt

Saccharomycopsis Schiønning, C. r. Trav. Laboratoire d. Carlsberg 6(2): 124 (1903)

Index Fungorum number: IF 4816; Facesoffungi number: FoF16656

Schiønning (1903) introduced *Saccharomycopsis* and designated *S. capsularis* as its type. The genus currently comprises 15 species (Species Fungorum 2025), and all of them have molecular data (LSU). The asexual morph has multipolar budding, and the sexual morph shows significant variations in the ascospore shapes (Hajihosseinali et al. 2020). Species have been isolated from alcoholic drinks, dairy products, fallen fruits and soil that are distributed in Australia, Chile, India, Japan, Iran and the Soviet Union (Hostinová et al. 2010, Kohlwein & Paltauf 1984, Groenewald et al. 2018).

Table 259 *Saccharomycopsis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Saccharomycopsis oosterbeekiorum</i>	the Netherlands	A garden	Groenewald et al. (2018)
<i>S. praedatoria</i>	Brazil	Amazonian rainforest	Santos et al. (2023)

Saccharomycodales M. Groenew., Hittinger, Opulente & A. Rokas

Saccharomycodaceae Kudryavtsev

Hanseniaspora Zikes, Centbl. Bakt. ParasitKde, Abt. II 30: 148 (1911)

Index Fungorum number: IF 2218; Facesoffungi number: FoF16653

Hanseniaspora was introduced by Zikes in 1911 (Cadez & Smith 2011), and *H. valbyensis* is accepted as the type species. Currently, the genus has 16 accepted species (Groenewald *et al.* 2018; Species Fungorum 2025), and all have molecular data. In the asexual morph, bipolar budding can be seen, and blastoconidia are produced in basipetal succession on a broad base. Cells appear in apiculate and ovoid to long-ovoid or elongate. Pseudohyphae can be present. The sexual morph possesses persistent or deliquescent asci and forms one to four ascospores that are smooth, hat- or helmet-shaped, spherical, and with an equatorial ledge or spherical and warty with an equatorial ledge (Cadez & Smith 2011). These species have been identified from various substrates such as insect frass, lichen, soil and wood that are distributed in China, France, Georgia, South Africa and the Netherlands (Jindamorakot *et al.* 2009).

Table 260 *Hanseniaspora* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Hanseniaspora vineae</i>	South Africa	vineyard soil	Cadez & Smith (2011)
<i>H. occidentalis</i>	West Indies and Java	ND	
<i>H. mollemarum</i>	The Netherlands	A garden	Groenewald <i>et al.</i> (2018)
<i>H. valbyensis</i>	Denmark	ND	Limongelli <i>et al.</i> (2023)
<i>H. terricola</i>	China	ND	Liu <i>et al.</i> (2019c)
<i>H. occidentalis</i>	France	ND	

Ascomycota genera *incertae sedis*

Effetia Bartoli, Maggi & Persiani, Mycotaxon 19: 517 (1984)

Fig. 191

Index Fungorum number: IF25588; Facesoffungi number: FoF13564

Effetia was introduced by Bartoli *et al.* (1984), accommodating *E. craspedoconidica* as the type species. The genus has one species in the Species Fungorum (2025), however, no molecular data are provided, and it needs to be further studied (Bartoli *et al.* 1984, Huang *et al.* 2021b). Previously, *Effetia* was placed in *Sordariaceae* based on its sexual morph, subsequently, Huang *et al.* (2021b) suggested transferring this genus to *Ascomycota* genera *incertae sedis*. The asexual morph is hyphomycetous with brown, unbranched, straight or flexuous, septate conidiophores and polyblastic, terminal conidiogenous cells, producing acropleurogenous, oval to ellipsoidal, aseptate, light brown to dark brown conidia. The sexual morph is characterized by the perithecial, solitary, brown to dark brown, globose to subglobose, ostiolate ascomata, 8-spored, unitunicate, cylindrical, apex rounded asci, and hyaline to brown, ellipsoidal, aseptate ascospores. Species have been isolated from litter and soil in Ivory Coast (Bartoli *et al.* 1984, Huang *et al.* 2021b).

Table 261 *Effetia* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Efetia craspedoconidica</i>	Ivory Coast	Woodland soil	Bartoli <i>et al.</i> (1984)

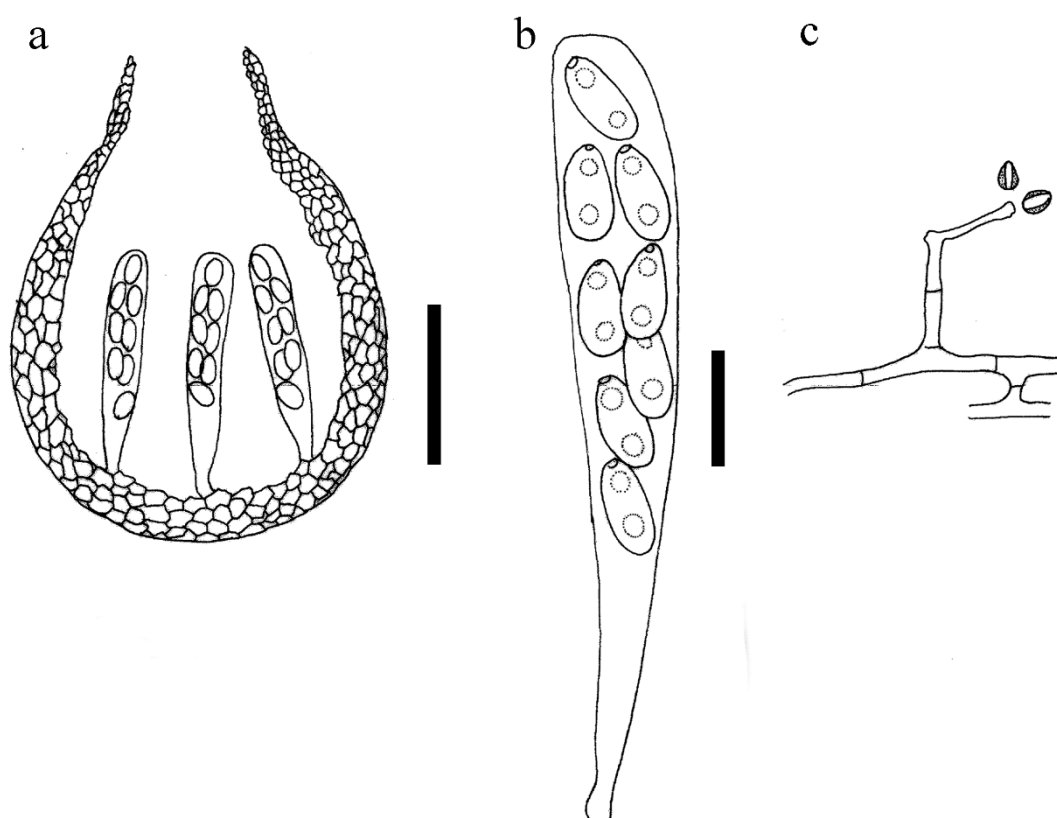


Figure 191 – *Effetia craspedoconidica*. a Ascoma with asci. b Ascus with ascospores. c. Conidiophores and conidia. Scale bars: a = 50 µm, c = 20 µm, b =10 µm. Redrawn from Huang et al. (2021b).

Heterocephalum Thaxt., Bot. Gaz. 35: 157 (1903)

Index Fungorum number: IF8521; Facesoffungi number: FoF16642

The type species is *Heterocephalum aurantiacum*, currently, the genus comprises two species (Hyde et al. 2024c), and only one species has molecular data. They have been isolated from dung, lesions on turtles and soil found in Jamaica, Ivory Coast and the Philippines (Yaguchi et al. 1996).

Table 262 *Heterocephalum* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Heterocephalum taiense</i>	Ivory Coast	Forest soil:	Persiani & Maggi (1986)
<i>H. taiense</i>	Japan	Volcanic island	Yaguchi et al. (1996)
<i>H. aurantiacum</i>	India	ND	Sharma et al. (2004)

Gilmaniella G.L. Barron, Mycologia 56(4): 514 (1964)

Index Fungorum number: IF8334; Facesoffungi number: FoF16643

Barron (1964) introduced *Gilmaniella* and the type species is accommodated as *G. humicola*. There are eight species present in the genus (Species Fungorum 2025), and only two have molecular data. The asexual morph is characterized by conidiophores that are single, short, septate, simple or branched and the branches and stalks are frequently inflated, while conidia are born singly or in clusters, appearing in dark brown with an apical germ pore (Barron 1964). The species are recorded from Australia, China, Egypt, India, Kuwait and Pakistan, which are associated with dung, leaves, stems and soil (Mouchacca 2007).

Table 263 *Gilmaniella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Gilmaniella humicola</i>	Canada	ND	Barron (1964)
<i>G. humicola</i>	Thailand	ND	Manoch (1987)
<i>G. macrospora</i>	Kuwait	Salt marsh soil	Moustafa (1975)
<i>G. subornata</i>	China	ND	Morinaga & Udagawa (1978)
<i>G. multiporosa</i>	Egypt	Salt marsh soil	Mouchacca (2007)

Phaeotrichoconis Subram., Proc. Indian Acad. Sci., Sect. B 44: 2 (1956)

Index Fungorum number: IF9325; Facesoffungi number: FoF16644

Subramanian (1956a) accommodated *Phaeotrichoconis* with the type species, *P. crotalariae*. The genus comprises seven species (Hyde et al. 2024c), and no molecular data is provided for any of them. The asexual morph has conidiophores that are micronematous, erect, septate, with a swollen apex and producing acrogenous, brown, elongate, fusiform conidia with a long appendage at the apex (Subramanian 1956a). Species are reported as animal pathogens, plant endophytes or saprobes. They have been isolated from both aquatic and terrestrial habitats, that are associated with branches, clinical samples, leaves, pods, and soil in Brazil, India, Ivory Coast and Puerto Rico (Lima et al. 2012, Shukla et al. 1989, Subramanian 1956a).

Table 264 *Phaeotrichoconis* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Phaeotrichoconis crotalariae</i>	Thailand	ND	Manoch (1998)
<i>Phaeotrichoconis crotalariae</i>	India	Rhizosphere of <i>Ocimum sanctum</i>	Lima et al. (2012)

Solosympodiella Matsush., Microfungi of the Solomon Islands and Papua-New Guinea (Osaka): 55 (1971)

Index Fungorum number: IF9954; Facesoffungi number: FoF16645

Solosympodiella was erected by Matsushima (1971) accommodating *S. clavata* as the type species. There are eight species in the genus (Hyde et al. 2024c), but molecular data is unavailable. The asexual morph is characterized by macronematous, mononematous hyaline or pigmented, erect, solitary conidiophores, sometimes branched, with polyblastic, integrated, terminal, sympodial, denticulate conidiogenous cells. Conidia are acropleurogenous, ellipsoidal to clavate, truncate at the base, sometimes septate and clear brown (Matsushima 1971). Species are discovered from dead leaves, stems and soil in Australia, China, Japan, Papua New Guinea and Peru (Rambelli 2011).

Table 265 *Solosympodiella* species isolated from soil

Species	Country	Habitat or soil type	References
<i>Solosympodiella</i> sp.	Thailand	ND	Manoch (1998)
<i>Solosympodiella clavata</i>	Papua New Guinea	Forest soil	Matsushima (1971)
<i>Solosympodiella queenslandic</i>	Australia	ND	Matsushima (1989)

DISCUSSION

Soil is one of the most diverse habitats on Earth (Thies & Grossman 2023). The soil-inhabiting fungal groups are documented in the Global Soil Mycobiome Consortium (Tedersoo et al. 2021), GlobalFungi (Větrovský et al. 2020), and UNITE (Nilsson et al. 2019). The Global Soil

Mycobiome Consortium (GSMc) reported that soil fungi represent 722,682 OTUs (Operational Taxonomic Units), and 62.4% of those OTUs were accommodated in *Ascomycota*. Although *Ascomycota* is considered the most abundant fungal group in many soils, the HTS data are often limited to higher taxonomic ranks (Egidi et al. 2019). Moreover, by incorporating morpho-molecular studies, species and genera of *Ascomycota* have been extensively studied and revised over the past two decades. However, information on soil-inhabiting taxa remains scattered across different sources. We have compiled the dispersed data by developing a comprehensive outline of the genera of soil *Ascomycota*. This provides an overview of the genera recorded from soils globally. Moreover, we have provided 270 *Ascomycota* genera notes that include information on updated phylogeny, morphology, and ecological status. The genera are mainly comprised of *Dothideomycetes*, *Eurotiomycetes* and *Sordariomycetes* classes (Figure 192), while several other *Ascomycota* classes have also been included. Previously, Domsch et al. (1993, 2007) have provided around 170 genera notes of *Ascomycota* and some lower fungal groups in soil. However, most of these taxa had been subjected to phylogenetic and morphological reappraisal over time, and our study provides the most recent updates on their generic information. These compiled data will be useful for the taxonomists, researchers or students who are working on soil-inhabiting *Ascomycota*.

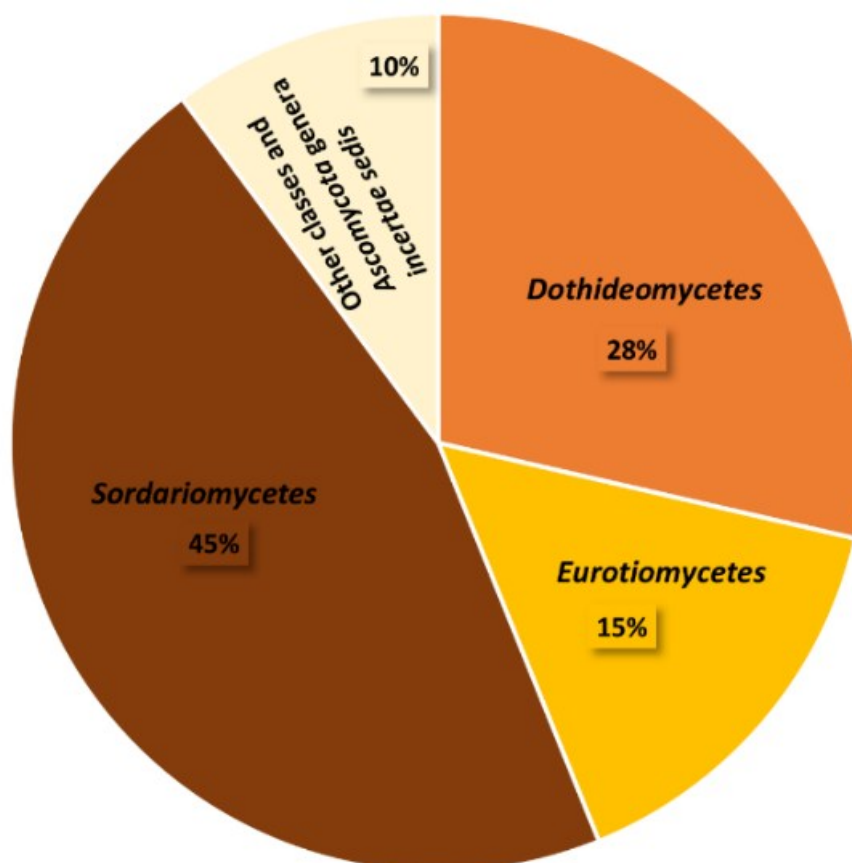


Figure 192 – The percentage of *Dothideomycetes*, *Eurotiomycetes* and *Sordariomycetes* genera that are compiled in this study.

Ascomycota groups are highly diverse and are variably distributed across the globe (Tedersoo et al. 2014, Wu et al. 2019, Baldrian et al. 2022b, Pem et al. 2024, Thiyagaraja et al. 2025). There are different soil types and soil-associated habitats present on the earth, and the fungal communities residing in each of them can be varied (Tedersoo et al. 2022). The habitats and soil types of the compiled generic data in our study are graphically illustrated in Figure 193, showing that the genera of *Dothideomycetes*, *Eurotiomycetes* and *Sordariomycetes* are mostly reported from

forests, cultivated lands, and urban areas. This suggests that the soils of these habitats have been relatively well-studied as compared to others.

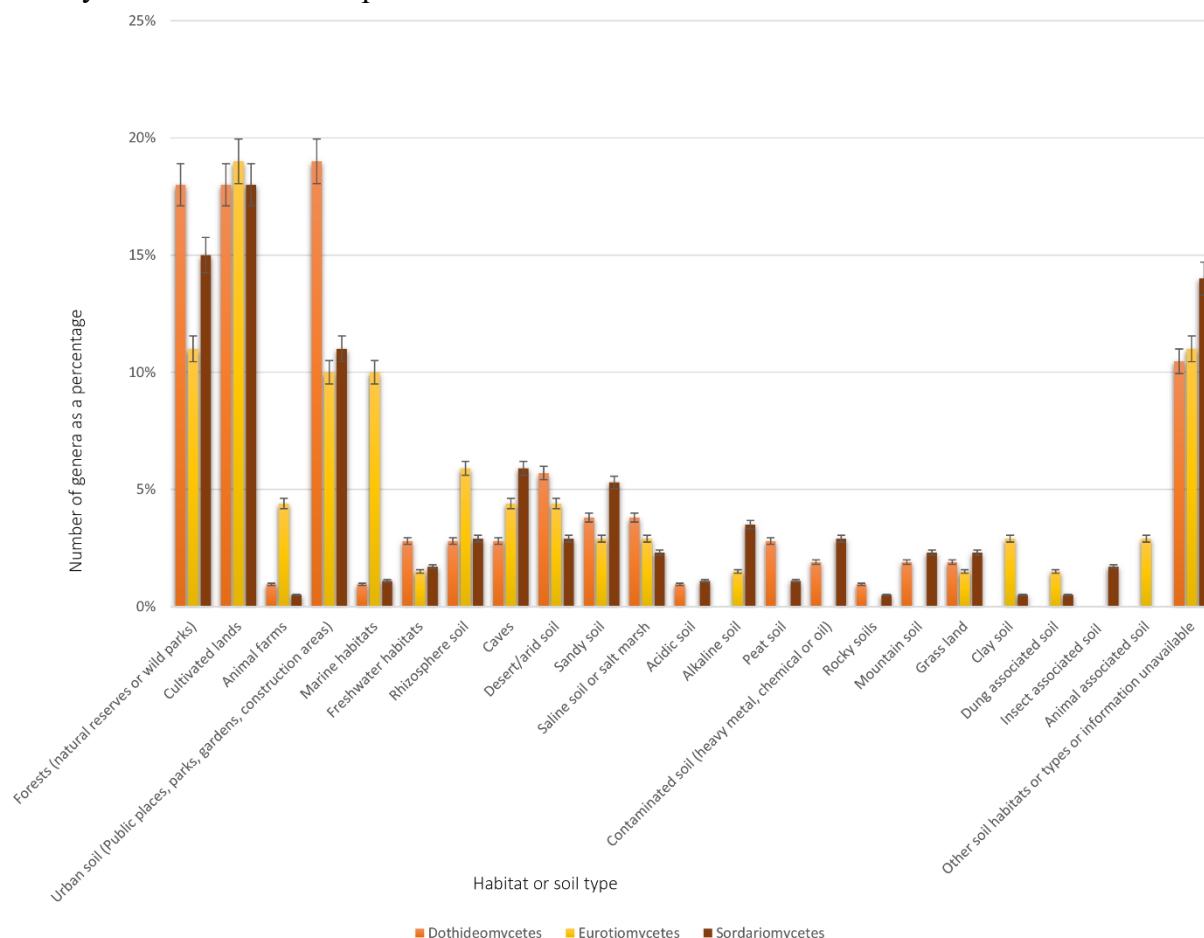


Figure 193 – The genera of *Dothideomycetes*, *Eurotiomycetes* and *Sordariomycetes* that have been compiled in this study are shown as a percentage. The total number of genera belonging to these three classes are 243, and they vary based on the habitat or soil type which they have been reported.

Ascomycota species are ubiquitous and abundant; others are rare in soil. Considering the *Ascomycota* classes, *Sordariomycetes* is the most dominant, and we compiled 123 genera, which is 45% of the total compiled genera (Figure 192). Reportedly, *Podospora*, *Chaetomium*, *Fusarium*, and *Trichoderma* are common soil inhabitants. Further, *Aspergillus*, *Exophiala*, *Knufia*, *Penicillium*, *Cadophora* and *Leohumicola* are some of the *Leotiomycetes* and *Eurotiomycetes* that are relatively common in edaphic habitats (Egidi et al. 2019, Do Nascimento Barbosa et al. 2016, Tedersoo et al. 2020). Of the total, 28% are *Dothideomycetes* genera (Figure 192), with *Alternaria*, *Aureobasidium*, *Cladosporium*, and *Curvularia* (Egidi et al. 2019) being the most common soil-inhabiting *Dothideomycetes*. The dominance of certain species over others can result from their dispersal abilities, lifestyles and functional attributes. Many of these genera, including *Alternaria*, *Aureobasidium*, *Cladosporium*, *Penicillium*, *Fusarium*, *Chaetomium*, *Acremonium*, and *Curvularia*, are wind-dispersed, which may partially explain their abundance in soil. Another common characteristic among these genera is their flexible trophic nature, which allows them to colonize in multiple niches. For example, some species can shift from a plant or human pathogenic state to a saprobic state (i.e., *Fusarium*, *Alternaria*, *Chaetomium*, *Cladophialophora*, *Knufia* and *Exophiala*) (Egidi et al. 2019, Janowski & Leski 2022). This adaptability enhances their ability to utilize resources, compete, and tolerate environmental stress. Additionally, their fast growth and high adaptability make them easier to isolate (Bridge & Spooner 2001, Mueller et al. 2004, Tedersoo et al. 2014, Taylor & Sinsabaugh 2015).

However, in most mycobiomes, including soils, fungal diversity is primarily represented by rare taxa. These rare sub-communities are more sensitive to host selection and play a crucial role in fungal co-occurrence networks and ecosystem functions, such as crop yield and soil enzyme activities (Xiong et al. 2021). Moreover, approximately 80% of fungal species are considered rare and may be prone to extinction (Banerjee et al. 2024). Anderson (2009) identified several factors contributing to the rarity of certain fauna species in soil, which could also be applied to rare fungal species. These include seasonal population occurrences, adaptations to above-ground environments, intrinsically rare nutritional or niche requirements, distribution limitations, and the lack of standardized sampling and detection methods. Even when rare taxa are detected through HTS, isolating them *in vitro* can still be a challenge. Many are slow-growing, lack necessary nutrients in growth media, lose mutual relationships, or are highly sensitive to micro-climatic changes in the soil. (Bridge & Spooner 2001, Tedersoo et al. 2014, 2020, Wu et al. 2019, Yasanthika et al. 2022b). Therefore, isolating uncommon soil ascomycetes could lead to the discovery of novel taxa, unveil hidden biodiversity, and open new approaches for biotechnological applications.

Due to its high biodiversity, we selected Thailand to uncover the soil-dwelling *Ascomycota* species. Finlay (2007) estimated that approximately 75,000 belowground fungal species had been globally reported at the time of their study. However, in Thailand, only 89 genera and 95 species had been discovered by 1998 (Manoch 2004). From 2000 to 2024, soil fungal research in the country has been conducted using both morpho-molecular methods. In Table 267, we have listed the soil-associated *Dothideomycetes*, *Eurotiomycetes* and *Sordariomycetes* genera published in Thailand over the past two decades. The data show that studies have mostly focused on agriculture sites, including cultivated lands (rice, rubber and palm, pineapple plantations), livestock farms, and forest ecosystems (Manoch, 1993, 1998, Kosol, 1999, Manoch et al. 2013, Dethoup et al. 2007, Puangsombat et al. 2010). Meanwhile, some have used the HTS methods. Amma et al. (2018) reported *Sordariomycetes* as the most abundant class, particularly from the *Hypocreales* and *Xylariales* orders, with *Fusarium* as the dominant genus. They also identified *Eurotiomycetes*, *Orbiliomycetes* and *Leotiomycetes* in Dipterocarpaceae-dominated forests. Another HTS study discovered *Aspergillus*, *Penicillium*, *Cladosporium*, *Talaromyces*, *Xylaria*, and *Trichoderma* as the most common genera in caves of Satun Geopark, Thailand (Suetrong et al. 2023).

Among the culture-dependent studies, around 185 *Ascomycota* species have been reported over the last two decades. In these studies, frequently isolated genera include *Aspergillus*, *Chaetomium*, *Fusarium*, *Trichoderma*, *Cladosporium*, *Penicillium*, *Talaromyces*, *Curvularia*, *Paecilomyces*, *Scopulariopsis*, *Ophiocordyceps* and *Scedosporium*. Some of the reported genera have moderate distribution in the soil, such as *Purpureocillium*, *Paecilomyces*, *Ophiocordyceps*, *Ephelis*, *Cladosporium*, *Scedosporium*, *Cephalosporium*, *Chaetomella*, *Chloridium*, *Geotrichum*, *Gliocladium*, *Heterocephalum*, *Humicola*, *Leptographium*, *Mariannaea*, *Monocillium*, *Penicillium*, *Hamigera*, *Eupenicillium*, *Nectria*, *Thielavia*, *Cephalosporium*, *Chaetomella*, *Pestalotiopsis*, *Phialophora*, *Scopulariopsis*, *Scytalidium*, *Cylindrocladium*, *Cylindrocarpon*, *Diheterospora*, *Drechslera*, *Emericella*, *Neurospora*, *Gilmaniella*, *Idriella*, *Mariannaea*, *Kionochaeta* and *Beltraniella*. Uncommon soil species like *Nigrospora*, *Monilia*, *Drechslera*, *Arthrrium*, *Leptographium*, *Byssochlamys* and *Thermoascus* have also been found (Manoch 2004, Kladwang et al. 2003, Pornsuriya et al. 2008, 2011, Puangsombat et al. 2010, Eamvijarn et al. 2013, Luplertlop et al. 2016, 2019, Liamthong et al. 2017, Seephueak et al. 2019, Wingfield et al. 2021, Maneeboon et al. 2023.). Compared to the rest of the world, there is a significant gap in soil *Ascomycota* discoveries in Thailand (Puangsombat et al. 2010, Farias et al. 2023). In contrast, the neighbouring countries like China, which share similar climatic regions with Thailand, have conducted extensive fungal studies across a wide range of habitats, revealing many new species (Man et al. 2015, 2018, Zhang et al. 2019a, 2021c, 2023d, Zheng & Song 2022). Moreover, most of the fungal studies in Thailand conducted before 2010 relied solely on morphological identification. Gradually, over time, studies have adopted morpho-molecular approaches for more accurate taxonomic identification. For fungal isolations, the dilution plate method has frequently been used, while several studies have also used the soil plate method, baiting method and heat treatment methods

(Table 267) (Manoch 1998, 2004, Puangsombat et al. 2010, Seephueak et al. 2019, Yasanthika et al. 2022a).

Table 267 The genera isolated from different soil habitats in Thailand from 2000 to 2024

Genera	Soil habitat or soil type	Isolation method	References
<i>Acremonium</i>	Limestone areas, rhizosphere soil	Modified soil plate method	Ito et al. (2001), Kladwang et al. (2003)
<i>Alternaria</i>	Rice field	Soil dilution series method	Seephueak et al. (2019), Wingfield et al. (2021)
<i>Aspergillus</i>	Pig farm, coastal forest soil, pineapple and sugar cane fields, fertile soil, mangrove areas, rice field, poultry farms, man-made solar saltern, mountain forests, chicken-feather dumping soil, rhizosphere soil	Soil dilution series method, modified soil plate method, alcohol treatment, modified heat treatment method, moist chamber and baiting technique	Dethoup & Manoch (2010), Ali et al. (2013), Reanprayoon & Pathomsiriwong (2012) Seephueak et al. (2019)
<i>Bipolaris</i>	Rice field, agricultural lands	Soil dilution series method	Reanprayoon & Pathomsiriwong (2012), Seephueak et al. (2019)
<i>Byssochlamys</i>	Mountain forests, agricultural lands	Soil plate method, soil dilution series method	Luangsa-ard et al. (2004), Dethoup & Manoch (2010)
<i>Cephalosporium</i>	Forest	Soil dilution series method	Puangsoombat et al. (2010)
<i>Chaetomella</i>	Forest	Soil dilution series method	Puangsoombat et al. (2010)
<i>Chloridium</i>	Forest	Soil dilution series method	Puangsoombat et al. (2010)
<i>Chaetomium</i>	Pineapple plantations, forest reserve, rice field, poultry farms, chicken-feather dumping soil	Soil plate method, soil dilution series method, baiting technique (sterilized straws, filter paper, tissue paper and pineapple leaves) and moist chamber method	Pornsuriya et al. (2008, 2011), Reanprayoon & Pathomsiriwong (2012) Seephueak et al. (2019)
<i>Cladosporium</i>	Pig farm, rice field, chicken-feather dumping soil, rhizosphere soil	Modified soil plate method, soil dilution series method, moist chamber and baiting technique	Penkhrue et al. (2015), Seephueak et al. (2019), Kitisin et al. (2021), Wingfield et al. (2021)
<i>Colletotrichum</i>	Rice field	Soil dilution series method, moist chamber and baiting technique	Seephueak et al. (2019)
<i>Curvularia</i>	Pig farm, rice field	Modified soil plate method, soil dilution series method, moist chamber and baiting technique	Seephueak et al. (2019), Wingfield et al. (2021)
<i>Emericella</i>	Agricultural lands	Heat treatments, soil plate method, alcohol treatment	Dethoup & Manoch (2010)
<i>Eurotium</i>	Agricultural lands	Alcohol treatment	Dethoup & Manoch

Genera	Soil habitat or soil type	Isolation method	References
<i>Eupenicillium</i>	Agricultural lands	Heat treatments	(2010) Dethoup & Manoch (2010)
<i>Fusarium</i>	Pig farm, chicken-feather dumping soil, rhizosphere soil	Modified soil plate method, Soil dilution series method	Ito et al. (2001), Dalee et al. (2018), Kitisin et al. (2021)
<i>Heterocephalum</i>	Forests	Soil dilution series method	Puangsoombat et al. (2010)
<i>Humicola</i>	Forests	Soil dilution series method	Puangsoombat et al. (2010)
<i>Hypoxylon</i>	Caves	Soil dilution series method	Preedanon et al. (2023)
<i>Gleocladium</i>	Chicken-feather dumping soil	Soil dilution series method	Dalee et al. (2018)
<i>Geotrichum</i>	Pig farm, forests	Modified soil plate method, Soil dilution series method	Puangsoombat et al. (2010), Kitisin et al. (2021)
<i>Gliomastrix</i>	Limestone areas	Soil plate method	Kladwang et al. (2003)
<i>Leptographium</i>	Forests	Soil dilution series method	Puangsoombat et al. (2010)
<i>Leptobacillium</i>	Caves	Soil dilution series method	Preedanon et al. (2023)
<i>Malbranchea</i>	Caves, agricultural lands	Soil plate, Soil dilution series method	Dethoup & Manoch (2010), Preedanon et al. (2023)
<i>Myceliophthora</i>	Agricultural lands	Alcohol treatment	Ito et al. (2001), Dethoup & Manoch (2010)
<i>Myrothecium</i>	Rhizosphere soil	Soil dilution series method	Ito et al. (2001)
<i>Neosartoya</i>	Agricultural lands	Alcohol treatment	Dethoup & Manoch (2010)
<i>Neurospora</i>	Rhizosphere soil	Soil dilution series method	Ito et al. (2001)
<i>Nigrospora</i>	Rhizosphere soil, rice field	Soil dilution series method, moist chamber and baiting technique	Ito et al. (2001)
<i>Penicillium</i>	Pig farm, pineapple and sugar cane fields, forests, mangrove areas, rice field, chicken-feather dumping soil, rhizosphere soil	Modified soil plate method, modified heat treatment method, soil dilution series method, moist chamber and baiting technique	Ito et al. (2001), , Puangsoombat et al. (2010), Liamthong et al. (2017), Seephueak et al. (2019) Kitisin et al. (2021), Maneeboon et al. (2023)
<i>Pithomyces</i>	Rhizosphere soil	Soil dilution series method	Kitisin et al. (2021)
<i>Pestalotiopsis</i>	Forests	Soil dilution series method	Puangsoombat et al. (2010)
<i>Talaromyces</i>	Pig farm, forests, pineapple and sugar cane fields, longan field soil, non-agricultural soil, agricultural lands, caves	Modified soil plate method, modified heat treatment method, soil dilution series method, soil plate, heat treatment, alcohol treatment methods	Luangsa-ard et al. (2004), Dethoup et al. (2007), Puangsoombat et al. (2010), Dethoup & Manoch (2010), Kitisin et al. (2021), Nuankaew et al. (2022), Maneeboon et al. (2023),
<i>Thielavia</i>	Agricultural lands	Alcohol treatment, soil	Dethoup & Manoch

Genera	Soil habitat or soil type	Isolation method	References
<i>Phialophora</i>	Forests	plate Soil dilution series method	(2010) Puangsombat et al. (2010)
<i>Purpureocillium</i>	ND	Soil dilution series method	Penkhrue et al. (2015)
<i>Paecilomyces</i>	Rice fields, forests, poultry farms, pineapple and sugar cane fields	Soil dilution series method and heat treatments	Dethoup & Manoch (2010), Wingfield et al. (2021), Maneeboon et al. (2023)
<i>Ophiocordyceps</i> <i>Microsporium</i>	ND Chicken-feather dumping soil, poultry farm	ND Soil dilution series method	Maneeboon et al. (2023) Dalee et al. (2018), Wingfield et al. (2021)
<i>Trichoderma</i>	Forests, mangrove areas, poultry farms, rice fields, pig farm	Modified soil plate method, Soil dilution series method	Dethoup & Manoch (2010), Puangsombat et al. (2010), Kitisin et al. (2021), Liamthong et al. (2017), Wingfield et al. (2021)
<i>Scedosporium</i>	Caves, Public parks	Modified soil plate method, soil dilution series method	Luplertlop et al. (2019), Preedanon et al. (2023)
<i>Scolecobasidium</i>	Rhizosphere soil	Soil dilution series method	Ito et al. (2001)
<i>Scopulariopsis</i>	Poultry farms, forests	Soil dilution series method	Puangsombat et al. (2010), Wingfield et al. (2021)
<i>Staphylotrichum</i>	Chicken-feather dumping soil	Soil dilution series method	(Dalee et al. (2018))
<i>Hamigera</i>	Pineapple and sugar cane fields	Modified heat treatment method	Maneeboon et al. (2023)
<i>Nectria</i>	Forests	Soil dilution series method	Puangsombat et al. (2010)
<i>Verticillium</i>	Forests, limestone areas	Soil dilution series method, modified soil plate method	Kladwang et al. (2003), Puangsombat et al. (2010)
<i>Xylaria</i>	On soil near termite nest	Stromata of <i>Xylaria</i> species were collected	Wangsawat et al. (2021)

In Thailand, the land use patterns have been changing rapidly, with highlands being converted for farming and tourism, while lowland plains are increasingly occupied by urbanization, affecting soil biodiversity (Pansak et al. 2024). As a result, fungal communities in these soils may become restricted to certain locations or adapt to different ecosystems in response to these changes (Tedersoo et al. 2022, Farias et al. 2023). To obtain a diverse collection of *Ascomycota* species, we selected three different soil-based habitats: forests, caves, and urban areas, including both disturbed and undisturbed locations. Notably, caves and urban areas remain understudied habitats in Thailand (Table 267).

In this study, 30 species are discovered, including nine new species and 21 new records, belonging to three classes (*Dothideomycetes*, *Eurotiomycetes* and *Sordariomycetes*), isolated from forests, caves and urban areas in Thailand. In addition, under the same project two new species and seven new records (*Dothideomycetes* and *Sordariomycetes*) were previously published: *Neptunomyces soli*, *Curvularia dactylocteniicola* (Yasanthika et al. 2024), *Verruconis soli* and *Verruconis thailandica* (Yasanthika et al. 2023a), *Chloridium gonytrichii* and *Kionochaeta microspora* (Yasanthika et al. 2022a), *Beltraniella fertilis* (Yasanthika et al. 2020), and *Pochonia*

chlamydosporia and *Cordana terrestris* (Chethana et al. 2023). These species were isolated from Thai forest soils. Thereby, bringing the total number of soil-inhabiting species identified in our research to 42, across three different habitats. As shown in Figure 194 (a), our collection consists of 26 *Dothideomycetes* species, 15 *Sordariomycetes* species and one *Eurotiomycetes*. They belong to 21 families and 35 genera, as illustrated in Figure 194 (b).

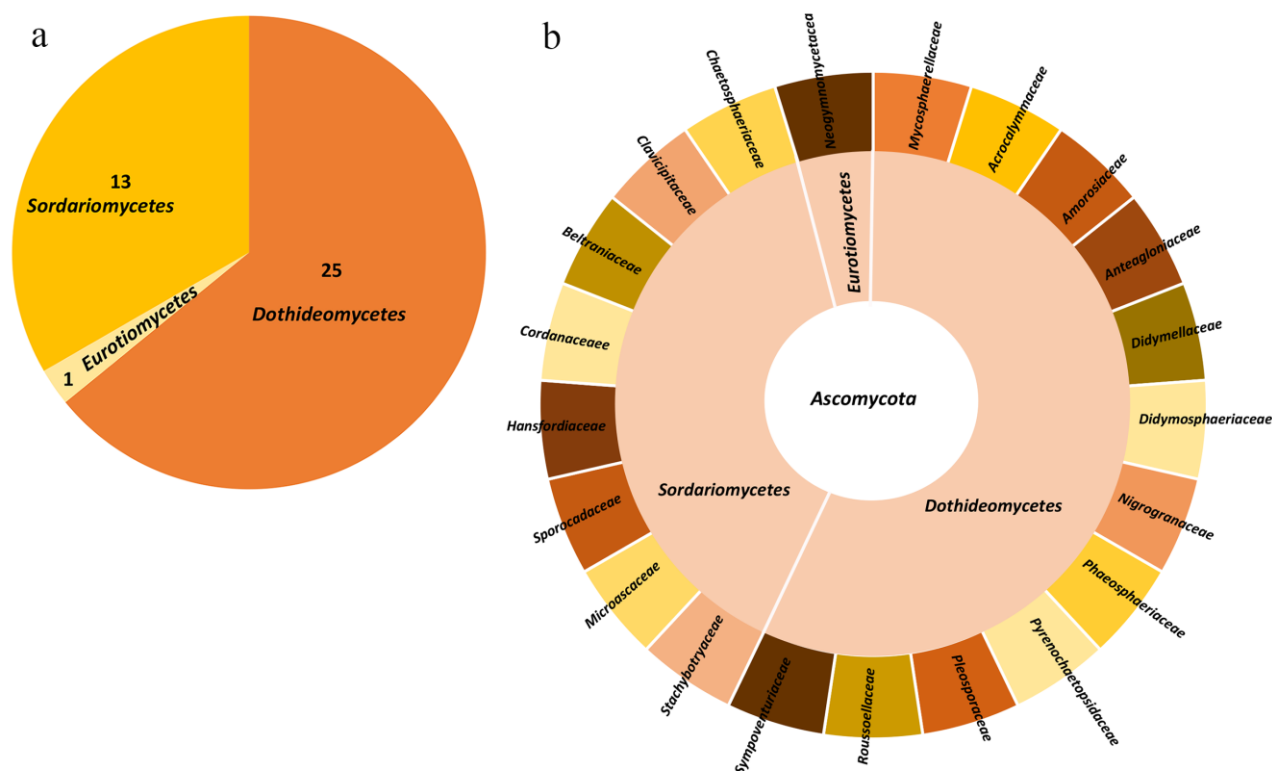


Figure 194 – a The number of soil-inhabiting species collected in our research (total 39 species). b The species are distributed in 21 families in *Dothidiomycetes*, *Eurotiomycetes* and *Sordariomycetes*.

In the current study, we isolated *Curvularia*, *Paraconiothyrium*, *Pyrenochaetopsis*, *Stachybotrys*, and *Microascus* common to various soil habitats. In contrast, we obtained *Anteaglonium*, *Diaporthosporella*, *Neoceratosperma*, *Paraleptospora* and *Pararoussoella* genera that have not been recovered from the soils before. Additionally, *Beltraniella fertilis*, *Chloridium gonytrichii*, *Kionochaeta microspora*, and *Neptunomyces soli* are some uncommon species that we have published previously (Yasanthika et al. 2020, Yasanthika et al. 2022a, Yasanthika et al. 2024).

Figure 195 shows the distribution of the 39 species isolated from three habitats (Forests, caves and urban areas). Forests are undisturbed habitats, comprising 34.06% of the country's area. However, due to the ongoing deforestation, this area is continuously decreasing (Pansak et al. 2024). *Talaromyces thailandensis*, *Wickerhamomyces anomalus*, *Cyberlindnera subsufficiens*, *Aspergillus restrictus* and *Paecilomyces variotii* have previously been reported from Thai forest soils (Manoch 1998, 2004, Puangsombat et al. 2010). However, this study recovers eight additional genera from forest soils: *Neopestalotiopsis terricola*, *Neoroussoella entadae*, *Paraconiothyrium cyclothyrioides*, *Paraleptospora thailandica*, *Pararoussoella lincangensis*, *Pseudopithomyces chartarum*, *Pyrenochaetopsis tropicalis* and *Roussoella terrestris*. Additionally, our previous publications revealed nine species from forest soils (*Neptunomyces soli*, *Curvularia dactylocteniicola*, *Kionochaeta microspora* and *Beltraniella fertilis*, *Chloridium gonytrichii*, *Pochonia chlamydosporia* and *Cordana terrestris*, accounting for a total of 17 species from forest soils in our study (Figure 195).

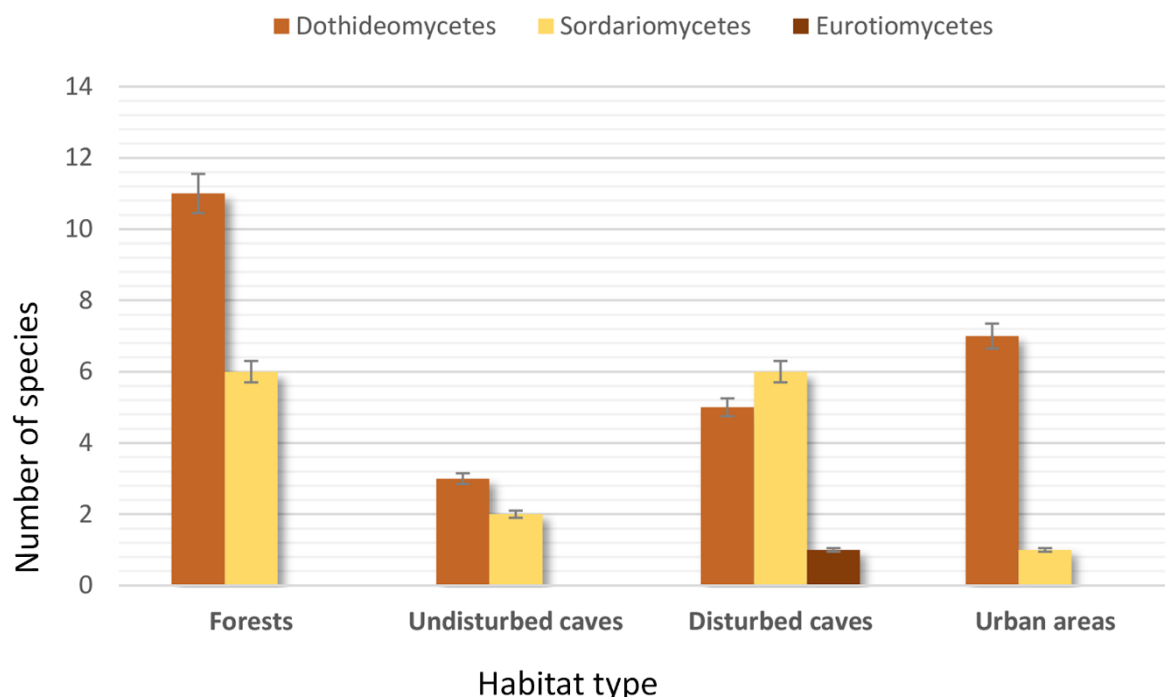


Figure 195 – The number of species collected from each soil habitat (Forests, undisturbed caves, disturbed caves and urban areas) in our study.

As cave inhabitants, we discovered 12 species from disturbed caves, namely *Anteaglonium soli*, *Acrocalymma medicaginis*, *Currahmyces indicus*, *Diaporthosporella soli*, *Hansfordia pruni*, *H. pulvinata*, *Microascus croci*, *Neoceratosperma soli*, *Neopyrenochaeta telephoni*, *Remotididymella ageratinae*, *Wardomycopsis fusca* and *Yunnania penicillate* and five species from undisturbed caves, including *Amorocoelophoma soli*, *Cumuliphoma indica*, *Nigrograna speluncae*, *Microascus croci* and *Wardomycopsis fusca*, totaling 15 species across 14 genera (Figure 195). We have isolated *Microascus croci* and *Wardomycopsis fusca* from both disturbed and undisturbed cave soils (Figure 196). Interestingly, these two species have previously been reported from cave air and soil as well (Jurado et al. 2021, Zhang et al. 2021c). In addition, Zhang et al. (2021c) reported *Microascus levis*, *M. trigonus* and *Wardomycopsis dolichi* from cave soils, suggesting that these genera may be well-adapted to cave ecosystems. Furthermore, *Yunnania* was also isolated in Thai caves in this study, while *Pseudoscopulariopsis* and *Scopulariopsis* have been previously reported from caves in China (Zhang et al. 2017b, 2021c). These studies highlight the preference of *Microascaceae* members for cave habitats. Previously, *Hypoxylon phuphaphetense*, *Leptobacillium latisporum*, *Malbranchea phuphaphetensis*, *Scedosporium satunense*, *Talaromyces phuphaphetensis*, *T. satunensis* have been isolated from Thai caves (Nuankaew et al. 2022, Preedanon et al. 2023). Most of these reported species are *Eurotiomycetes* and *Sordariomycetes*, whereas we were able to recover *Dothideomycetes* species as well. As shown in Table 267, the studies on soil fungi in Thai caves are relatively few compared to other habitats. Based on our results, we suggest that further study of Thai caves could provide valuable insights into the country's fungal diversity.

Urbanization is rapidly increasing in Thailand, which considerably impacts the natural properties of soils (Kachenchart et al. 2020, Pansak et al. 2024). We isolated eight species (Figure 195), namely *Curvularia suttoniae*, *Ectophoma multirostrata*, *Epicoccum catenisporum*, *Paraconiothyrium zingiberacearum*, *Pyrenochaetopsis thailandensis*, *Remotididymella ageratinae*, *Setophoma thailandica* and *Stachybotrys phaeophialis* from urban soils, representing eight genera from urban soils. *Scedosporium* species have previously been investigated in city soils in Thailand, where they are associated as human pathogens (Luplertlop et al. 2016, 2019). We isolated

Curvularia and *Stachybotrys*, both of which are known to cause respiratory diseases in humans (Lombard et al. 2016, Iturrieta-González et al. 2020,). *Stachybotrys* has also been reported from building materials, indicating its potential to thrive in indoor environments (Lombard et al. 2016). We isolated two *Pyrenochaetopsis* species from both forests and urban areas. This genus has been formerly recorded in urban soils associated with parks in Finland and lawns in China (Hui et al. 2017). Similarly, we have obtained *Curvularia* from both urban environments (this study) and forest habitats (Yasanthika et al. 2024). That indicates their ability to survive in diverse environments. This adaptability of *Curvularia* and *Pyrenochaetopsis* highlights their ecological plasticity and their potential to be found in a wide range of habitats. In our study, *Remotididymella ageratinae* was recovered from both urban areas and disturbed caves (Figure 196), environments impacted by anthropogenic activities, showing its adaptability to stressful environments. Fungi in urban soils, such as *Remotididymella ageratinae*, may possess mechanisms for stress tolerance, including the production of secondary metabolites, which could be useful in extracting bioactive compounds (Shi et al. 2021). While several recent studies have focused on urban soil fungi, there is still a need to further explore these communities in urban areas of Thailand. Many of these fungi can be beneficial to maintain ecological balance and soil nutrition levels in urban environments. However, due to their high tolerance to harsh and artificial environments, some of these fungi can adversely affect humans. Thus, having a deeper understanding of the fungal communities in these environments is crucial to mitigate health concerns and manage potential risks.

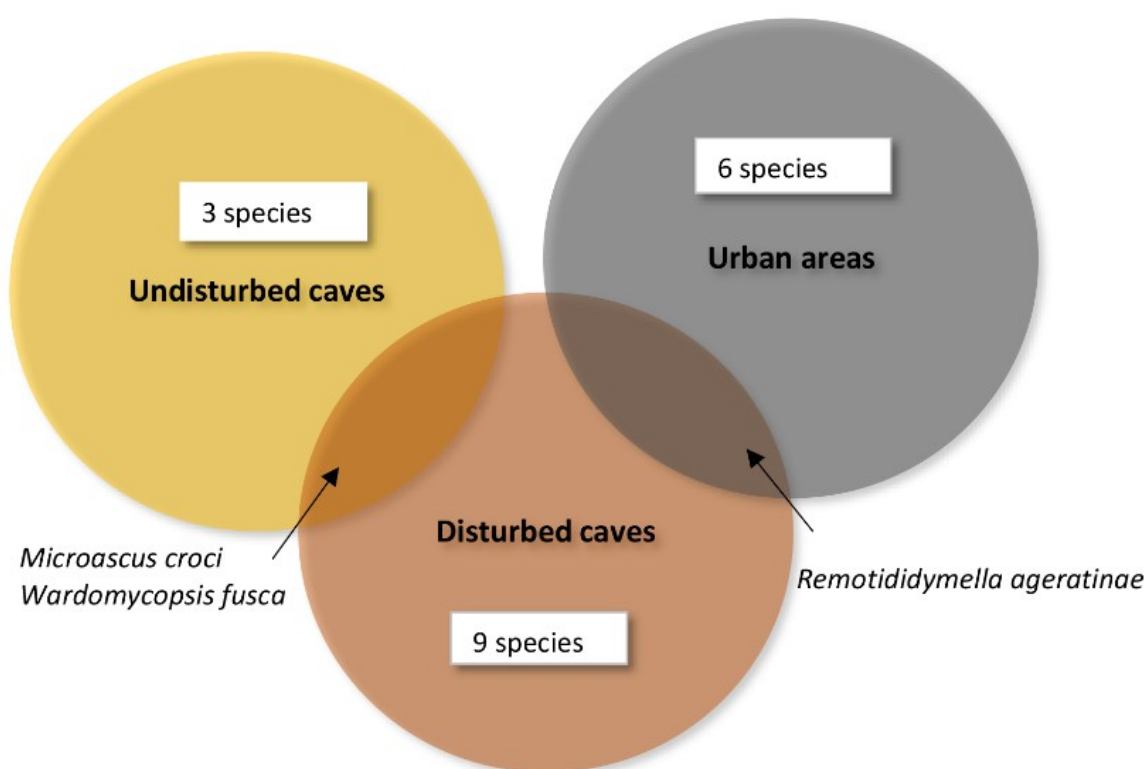


Figure 196 – *Microascus croci* and *Wardomyopsis fusca* are collected from both disturbed and undisturbed caves and *Remotididymella ageratinae* was collected from disturbed caves and urban areas.

Many of the previously recorded species from Thailand were identified as hyphomycetous asexual morphs (Manoch 1998, 2004, Seephueak et al. 2019), whereas our study recovered ten *Dothidiomycetes* (*Anteaglonium soli*, *Cumuliphoma indica*, *Ectophoma multirostrata*, *Nigrograna speluncae*, *Paraconiothyrium cyclothyrioides*, *P. zingiberacearum*, *Pararoussoella lincangensis*,

Pyrenochaetopsis orizicola, *P. tropicalis*, and *Roussioella terrestris*), which produced coelomycetes asexual morphs. Additionally, we also isolated one *Sordariomycetes* (*Diaporthosporella soli*), which also exhibited a coelomycetes asexual morph. Numerous studies have revealed the high diversity of *Dothideomycetes* genera in Thailand soils, including *Ascochyta*, *Calophoma*, *Didymocyrtis*, *Paraboeremia*, and *Parathyridaria* (Pem et al. 2021). Members of this class are known to resist extreme environmental conditions, such as high temperatures, severe droughts, and high levels of solar radiation (Hou et al. 2020a). Similarly, we explored *Dothideomycetes* from cave and urban environments. Additionally, we encountered *Epicoccum catenispurum*, *Paraleptospora thailandica*, *Setophoma thailandica* and *Neopyrenochaeta telephoni*, all of which did not produce asexual or sexual morphs, but some of these produced chlamydospores. Chlamydospores are characterized by solitary, intercalary, and relatively thick-walled asexual spores, produced from swellings in young, aseptate mycelia. They function as survival structures under unfavorable conditions (Krug et al. 2004). We employed the soil dilution plate method and baiting method to isolate colonies of *Ascomycota* species from the soil, which is recognized as an effective method to recover soil fungi. In order to obtain slow-growing and rare taxa, relatively high dilution levels, ranging from 10^{-3} to 10^{-6} have been used. It was found that low dilution levels can result in more fast-growing fungal colonies (Yasanthika et al. 2022b).

Ascomycota, being one of the most abundant and diverse groups, is found across a wide range of genera in different ecosystems, suggesting that they are more adapted to environmental changes and stress (Tedersoo et al. 2022, Farias et al. 2023, Hyde et al. 2024b, Thiagaraja et al. 2025). This study has contributed to uncovering some of the uncommon taxa in soil, which is an important step toward revealing the true diversity of below-ground *Ascomycota* in Thailand. When compared to neighboring countries such as China, fungal investigations in Thailand, especially in diverse habitats such as caves, urban cities and hot springs, are still limited (Table 267). Thus, we suggest focusing on investigating different types of habitats in Thailand to gain a more comprehensive understanding of the diversity of below-ground *Ascomycota*. Thereby, we can discover the full extent of soil-dwelling *Ascomycota* species and their ecological roles, which is crucial for biodiversity conservation and understanding soil ecosystems.

ACKNOWLEDGEMENTS

The authors extend their appreciation to the Researchers Supporting Project number (RSP2025R114), King Saud University, Riyadh, Saudi Arabia. We also would like to thank the National Research Council of Thailand (NRCT) grant “Total fungal diversity in a given forest area with implications towards species numbers, chemical diversity and biotechnology” (grant no. N42A650547) and the Mushroom Research Foundation (Thailand).

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