

TAXONOMY OF LICHENICOLOUS FUNGI WITH EMPHASIS ON HENGDUAN MOUNTAINS IN CHINA

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BIOLOGICAL SCIENCE

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THIS DISSERTATION IS A PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN BIOLOGICAL SCIENCE

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ABSTRACT

Lichenicolous fungi, are a special group growing on the thallus or apothecia of lichens, and exhibit saprobic, symbiotic or parasitic life styles. I conducted a series of studies on lichenicolous fungi from three aspects, discovery of new species and records, molecular clock analysis, and review and illustration of obligated lichenicolous genera.

We collected 292 samples from five nature reserves (Baima Mountain, Jiaozi Mountain, Laojun Mountain, Meili Mountain, and Yulong Mountain) belonging to Hengduan Mountains region in Yunnan Province of China. A total of 201 sequences belonging to 71 samples were successfully sequenced. Based on morphological and molecular analysis, one species, Sclerococcum glaucomarioides growing on Ochrolechia sp., was reported from China for the first time. In addition, another species, Sclerococcum sticta growing on thallus of Sticta sp., was described as new to science. The collection, Kirschsteiniothelia laojunensis, growing on bark, surrounded by a thallus of Pertusaria sp., was identified as new to science. A novel genus Lijiangomyces, and new species L. laojunensis were introduced and placed within Mytilinidiaceae (Mytilinidiales, Dothideomycetes). Five new species of Abrothallus were described and illustrated based on morphological comparison and phylogenetic analysis. Molecular clock analysis was conducted for Abrothallales and 12 adjacent orders using three fossils (Aigialus 34 Mya, Muyocopron 54 Mya and Microthyriales 145 Mya) as the first calibration point and the divergence time of the class Dothideomycetes as the second calibration point. The results indicated that

Abrothallales had a divergence time of 99 Mya, 40 Mya earlier than previous research estimates. Among the other 12 neighboring orders, divergence times of nine orders are significantly earlier than the previous estimates, and four of which are slightly later.

A comprehensive lichenicolous species checklist has been compiled, encompassing all published lichenicolous species worldwide, totaling 2,673 species belong to two phyla (Ascomycota and Basidiomycota), 15 classes (Arthoniomycetes, Ascomycetes, Candelariomycetes, Dothideomycetes, Eurotiomycetes, Laboulbeniomycetes, Lecanoromycetes, Leotiomycetes, Lichinomycetes, Pezizomycetes, Sordariomycetes, Agaricomycetes, Tremellomycetes, Agaricostilbomycetes, Microbotryomycetes), 67 orders, 132 families and 424 genera. Among these genera, 225 genera are classified as obligated lichenicolous genera, meaning that more than half or even all of their species are lichenicolous. Notes are provided for these genera, along with redrawn illustrations of their type species based on the original descriptions.

Keywords: Divergence Time, Fungalpedia, Molecular Clock Analysis, New Species, New Genus, Collections, Taxonomy

TABLE OF CONTENTS

CHAPTER	Page
1 INTRODUCTION	**1**
1.1 Background and Rationale	1
1.2 Significance of the Study	5
1.3 Objectives	6
1.4 Expected Outcomes	6
1.5 Research Contents	6
2 COMPREHENSIVE CHECKLISTS OF LICHENICOLOUS SPECIES, WITH NOTES AND ILLUSTRATIONS OF OBLIGATE LICHENICOLOUS GENERA	**7**
2.1 Introduction	8
2.2 Checklist of Lichenicolous Species, with Notes and Illustrations Of Obligate Lichenicolous Genera	13
3 REASSESSING THE DIVERGENCE TIMES OF ABROTHALLALES AND ITS ADJACENT ORDERS, WITH THE DISCOVERY OF FIVE NEW LICHENICOLOUS SPECIES OF *ABROTHALLUS* (LICHENOCONIACEAE, ABROTHALLALES) FROM CHINA	**776**
3.1 Abstract	776
3.2 Introductiion	777
3.3 Materials and Method	782
3.4 Results	814
3.5 Discussion	850
4 A NOVEL SPECIES AND A NEW GEOGRAPHICAL RECORD OF CHINA OF *SCLEROCOCCUM* (DACTYLOSPORACEAE, SCLEROCOCCALES, EUROTIOMYCETES)	**869**
4.1 Abstract	869
4.2 Introductiion	869

TABLE OF CONTENTS

CHAPTER	Page
4.3 Materials and Method	871
4.4 Results	877
4.5 Discussion	883
5 *LIJIANGOMYCES*, A NOVEL GENUS AND SPECIES OF MYTILINIDIACEAE (MYTILINIDIALES, DOTHIDEOMYCETES)	**886**
5.1 Abstract	886
5.2 Introductiion	886
5.3 Materials and Method	887
5.4 Results	897
5.5 Discussion	904
6 MORPHOLOGICAL AND PHYLOGENETIC APPRAISAL OF A NEW *KIRSCHSTEINIOTHELIA* (DOTHIDEOMYCETES, KIRSCHSTEINIOTHELIALES) SPECIES FROM YUNNAN PROVINCE, CHINA	**907**
6.1 Abstract	907
6.2 Introductiion	907
6.3 Materials and Method	909
6.4 Results	917
6.5 Discussion	921
7 CONCLUSIONS	**923**
7.1 Overall Conclusion	923
7.2 Significance and Future Directions	924
REFERENCES	**928**
APPENDICES	**1073**
APPENDIX A MEDIA	1073
APPENDIX B ABSTRACT OF PUBLICATIONS	1074

TABLE OF CONTENTS

CHAPTER	Page
CURRICULUM VITAE	1077

LIST OF TABLES

Table	Page
2.1 Accepted lichenicolous species of *Arthonia*	13
2.2 Accepted lichenicolous species of *Lecanographa*	26
2.3 Accepted lichenicolous species of *Mixtoconidium*	28
2.4 Accepted lichenicolous species of *Phacographa*	32
2.5 Accepted lichenicolous species of *Plectocarpon*	35
2.6 Accepted lichenicolous species of *Lecanographa*	41
2.7 Accepted lichenicolous species of *Opegrapha*	41
2.8 Accepted lichenicolous species of *Enterographa*	50
2.9 Accepted lichenicolous species of *Arthophacopsi*	53
2.10 Accepted lichenicolous species of *Bryostigma*	56
2.11 Accepted lichenicolous species of *Perigrapha*	61
2.12 Accepted lichenicolous species of *Trichophyma*	63
2.13 Accepted lichenicolous species of *Lichenostigma*	67
2.14 Accepted lichenicolous species of *Minutoexcipula*	76
2.15 Accepted lichenicolous species of *Candelariella*	79
2.16 Accepted genera of Abrothallaceae	81
2.17 Accepted lichenicolous species of *Abrothallus*	84
2.18 Accepted lichenicolous species of *Lichenoconium*	93
2.19 Accepted lichenicolous species of *Gonatophragmium*	96
2.20 Accepted lichenicolous species of *Hemigrapha*	99
2.21 Accepted lichenicolous species of *Buelliella*	108
2.22 Accepted lichenicolous species of *Karschia*	111
2.23 Accepted lichenicolous species of *Labrocarpon*	113
2.24 Accepted lichenicolous species of *Stictographa*	117
2.25 Accepted lichenicolous species of *Ramichloridium*	122
2.26 Accepted lichenicolous species of *Psammina*	123
2.27 Accepted lichenicolous species of *Cladosporium*	124

LIST OF TABLES

Table	Page
2.28 Accepted lichenicolous species of *Verrucocladosporium*	126
2.29 Accepted lichenicolous species of *Didymellopsis*	129
2.30 Accepted lichenicolous species of *Zwackhiomyces*	133
2.31 Accepted lichenicolous species of *Melaspilea*	140
2.32 Accepted lichenicolous species of *Taeniolella*	143
2.33 Accepted lichenicolous species of *Lichenothelia*	147
2.34 Accepted lichenicolous species of *Lichenopeltella*	149
2.35 Accepted lichenicolous species of *Pseudocercospora*	155
2.36 Accepted lichenicolous species of *Sphaerellothecium*	157
2.37 Accepted lichenicolous species of *Sphaerulina*	163
2.38 Accepted lichenicolous species of *Stigmidium*	164
2.39 Accepted lichenicolous species of *Wernerella*	175
2.40 Accepted lichenicolous species of *Corynespora*	179
2.41 Accepted lichenicolous species of *Pyrenochaeta*	180
2.42 Accepted lichenicolous species of *Dacampia*	181
2.43 Accepted lichenicolous species of *Weddellomyces*	186
2.44 Accepted lichenicolous species of *Verrucoccum*	190
2.45 Accepted lichenicolous species of *Ascochyta*	192
2.46 Accepted lichenicolous species of *Microsphaeropsis*	193
2.47 Accepted lichenicolous species of *Leptosphaeria*	193
2.48 Accepted lichenicolous species of *Koordersiella*	195
2.49 Accepted lichenicolous species of *Didymocyrtis*	197
2.50 Accepted lichenicolous species of *Ophiobolus*	202
2.51 Accepted lichenicolous species of *Pseudopyrenidium*	203
2.52 Accepted lichenicolous species of *Pleospora*	208
2.53 Accepted lichenicolous species of *Homostegia*	209
2.54 Accepted lichenicolous species of *Paraëpicoccum*	211

LIST OF TABLES

Table	Page
2.55 Accepted lichenicolous species of *Clypeococcum*	212
2.56 Accepted lichenicolous species of *Polycoccum*	217
2.57 Accepted lichenicolous species of *Berkleasmium*	227
2.58 Accepted lichenicolous species of *Lichenotubeufia*	228
2.59 Accepted lichenicolous species of *Venturia*	230
2.60 Accepted lichenicolous species of *Keratosphaera*	232
2.61 Accepted lichenicolous species of *Myxophora*	234
2.62 Accepted lichenicolous species of *Pyrenidium*	238
2.63 Accepted lichenicolous species of *Ampullifera*	242
2.64 Accepted lichenicolous species of *Cercidospora*	245
2.65 Accepted lichenicolous species of *Echinothecium*	252
2.66 Accepted lichenicolous species of *Lanatosphaera*	254
2.67 Accepted lichenicolous species of *Monodictys*	256
2.68 Accepted lichenicolous species of *Rosellinula*	258
2.69 Accepted lichenicolous species of *Stromatopogon*	261
2.70 Accepted lichenicolous species of *Epibryon*	265
2.71 Accepted lichenicolous species of *Capronia*	266
2.72 Accepted lichenicolous species of *Cladophialophora*	269
2.73 Accepted lichenicolous species of *Lichenodiplis*	272
2.74 Accepted lichenicolous species of *Muellerella*	278
2.75 Accepted lichenicolous species of *Distopyrenis*	281
2.76 Accepted lichenicolous species of *Adelococcus*	283
2.77 Accepted lichenicolous species of *Sagediopsis*	286
2.78 Accepted lichenicolous species of *Sarcopyrenia*	289
2.79 Accepted lichenicolous species of *Bellemerella*	293
2.80 Accepted lichenicolous species of *Endococcus*	299
2.81 Accepted lichenicolous species of *Heteroplacidium*	309

LIST OF TABLES

Table	Page
2.82 Accepted lichenicolous species of *Halospora*	311
2.83 Accepted lichenicolous species of *Norrlinia*	312
2.84 Accepted lichenicolous species of *Phaeospora*	315
2.85 Accepted lichenicolous species of *Placocarpus*	318
2.86 Accepted lichenicolous species of *Placopyrenium*	319
2.87 Accepted lichenicolous species of *Telogalla*	320
2.88 Accepted lichenicolous species of *Verrucaria*	322
2.89 Accepted lichenicolous species of *Verrucula*	325
2.90 Accepted lichenicolous species of *Verruculopsis*	329
2.91 Accepted lichenicolous species of *Muellerella*	334
2.92 Accepted lichenicolous species of *Pseudostigmidium*	337
2.93 Accepted lichenicolous species of *Chaenothecopsis*	339
2.94 Accepted lichenicolous species of *Sphinctrina*	343
2.95 Accepted lichenicolous species of *Sclerococcum*	347
2.96 Accepted lichenicolous species of *Acarospora*	361
2.97 Accepted lichenicolous species of *Myriospora*	364
2.98 Accepted lichenicolous species of *Polysporina*	364
2.99 Accepted lichenicolous species of *Acolium*	365
2. 100 Accepted lichenicolous species of *Amandinea*	366
2.101 Accepted lichenicolous species of *Buellia*	367
2.102 Accepted lichenicolous species of *Diplotomma*	370
2.103 Accepted lichenicolous species of *Endohyalina*	371
2.104 Accepted lichenicolous species of *Monerolechia*	373
2.105 Accepted lichenicolous species of *Tetramelas*	374
2.106 Accepted lichenicolous species of *Rinodina*	376
2.107 Accepted lichenicolous species of *Catillaria*	378
2.108 Accepted lichenicolous species of *Carbonea*	380

LIST OF TABLES

Table	Page
2.109 Accepted lichenicolous species of *Lecanora*	382
2.110 Accepted lichenicolous species of *Lecidella*	384
2.111 Accepted lichenicolous species of *Miriquidica*	385
2.112 Accepted lichenicolous species of *Nesolechia*	388
2.113 Accepted lichenicolous species of *Phacopsis*	391
2.114 Accepted lichenicolous species of *Protoparmelia*	394
2.115 Accepted lichenicolous species of *Raesaenenia*	396
2.116 Accepted lichenicolous species of *Micarea*	397
2.117 Accepted lichenicolous species of *Kiliasia*	401
2.118 Accepted lichenicolous species of *Scutula*	402
2.119 Accepted lichenicolous species of *Thalloidima*	405
2.120 Accepted lichenicolous species of *Toninia*	405
2.121 Accepted lichenicolous species of *Scoliciosporum*	408
2.122 Accepted lichenicolous species of *Corticiruptor*	409
2.123 Accepted lichenicolous species of *Lichenosticta*	410
2.124 Accepted lichenicolous species of *Umushamyce*	416
2.125 Accepted lichenicolous species of *Cecidonia*	418
2.126 Accepted lichenicolous species of *Immersaria*	419
2.127 Accepted lichenicolous species of *Lecidea*	419
2.128 Accepted lichenicolous species of *Halecania*	421
2.129 Accepted lichenicolous species of *Tephromela*	422
2.130 Accepted lichenicolous species of *Epilichen*	423
2.131 Accepted lichenicolous species of *Rhizocarpon*	426
2.132 Accepted lichenicolous species of *Caloplaca*	431
2.133 Accepted lichenicolous species of *Kuettlingeria*	434
2.134 Accepted lichenicolous species of *Pachypeltis*	435
2.135 Accepted lichenicolous species of *Variospora*	436

LIST OF TABLES

Table	Page
2.136 Accepted lichenicolous species of *Flavoplaca*	438
2.137 Accepted lichenicolous species of *Shackletonia*	438
2.138 Accepted lichenicolous species of *Arthrorhaphis*	441
2.139 Accepted lichenicolous species of *Corticifraga*	447
2.140 Accepted lichenicolous species of *Gyalideopsis*	449
2.141 Accepted lichenicolous species of *Paragyalideopsis*	451
2.142 Accepted lichenicolous species of *Diploschistes*	455
2.143 Accepted lichenicolous species of *Protothelenella*	456
2.144 Accepted lichenicolous species of *Spirographa*	460
2.145 Accepted lichenicolous species of *Cryptodiscus*	465
2.146 Accepted lichenicolous species of *Lettauia*	468
2.147 Accepted lichenicolous species of *Nanostictis*	470
2.148 Accepted lichenicolous species of *Sphaeropezia*	471
2.149 Accepted lichenicolous species of *Microcalicium*	481
2.150 Accepted lichenicolous species of *Bachmanniomyces*	484
2.151 Accepted lichenicolous species of *Hainesia*	485
2.152 Accepted lichenicolous species of *Diplolaeviopsis*	487
2.153 Accepted lichenicolous species of *Llimoniella*	492
2.154 Accepted lichenicolous species of *Protounguicularia*	498
2.155 Accepted lichenicolous species of *Rhymbocarpus*	500
2.156 Accepted lichenicolous species of *Skyttea*	503
2.157 Accepted lichenicolous species of *Skyttella*	508
2.158 Accepted lichenicolous species of *Thamnogalla*	511
2.159 Accepted lichenicolous species of *Unguiculariopsis*	512
2.160 Accepted lichenicolous species of *Hyalopeziza*	515
2.161 Accepted lichenicolous species of *Trimmatostroma*	517
2.162 Accepted lichenicolous species of *Chalara*	520

LIST OF TABLES

Table	Page
2.163 Accepted lichenicolous species of *Neoechinodiscu*	528
2.164 Accepted lichenicolous species of *Epithamnolia*	531
2.165 Accepted lichenicolous species of *Epicladonia*	537
2.166 Accepted lichenicolous species of *Sporidesmium*	541
2.167 Accepted lichenicolous species of *Lasiosphaeriopsis*	543
2.168 Accepted lichenicolous species of *Rhagadostomella*	545
2.169 Accepted lichenicolous species of *Acremonium*	547
2.170 Accepted lichenicolous species of *Nectriopsis*	548
2.171 Accepted lichenicolous species of *Ovicuculispora*	552
2.172 Accepted lichenicolous species of *Paranectria*	553
2.173 Accepted lichenicolous species of *Pronectria*	554
2.174 Accepted lichenicolous species of *Trichonectria*	561
2.175 Accepted lichenicolous species of *Neobarya*	563
2.176 Accepted lichenicolous species of *Cylindromonium*	570
2.177 Accepted lichenicolous species of *Nectria*	574
2.178 Accepted lichenicolous species of *Xenonectriella*	577
2.179 Accepted lichenicolous species of *Atronectria*	581
2.180 Accepted lichenicolous species of *Niesslia*	583
2.181 Accepted lichenicolous species of *Leptobarya*	591
2.182 Accepted lichenicolous species of *Roselliniella*	593
2.183 Accepted lichenicolous species of *Stilbella*	595
2.184 Accepted lichenicolous species of *Graphium*	596
2.185 Accepted lichenicolous species of *Cirrenalia*	596
2.186 Accepted lichenicolous species of *Lichenochora*	599
2.187 Accepted lichenicolous species of *Endophragmiella*	605
2.188 Accepted lichenicolous species of *Roselliniomyces*	609
2.189 Accepted lichenicolous species of *Roselliniopsis*	612

LIST OF TABLES

Table	Page
2.190 Accepted lichenicolous species of *Physalospora*	614
2.191 Accepted lichenicolous species of *Biciliopsis*	616
2.192 Accepted lichenicolous species of *Thelocarpon*	618
2.193 Accepted lichenicolous species of *Obryzum*	621
2.194 Accepted lichenicolous species of *Acaroconium*	623
2.195 Accepted lichenicolous species of *Caeruleoconidia*	633
2.196 Accepted lichenicolous species of *Cladoniicola*	642
2.197 Accepted lichenicolous species of *Codonmyces*	645
2.198 Accepted lichenicolous species of *Coniambigua*	647
2.199 Accepted lichenicolous species of *Feltgeniomyces*	655
2.200 Accepted lichenicolous species of *Gyalectiphila*	661
2.201 Accepted lichenicolous species of *Gyrophthorus*	663
2.202 Accepted lichenicolous species of *Intralichen*	670
2.203 Accepted lichenicolous species of *Lawalreea*	681
2.204 Accepted lichenicolous species of *Leightoniomyces*	683
2.205 Accepted lichenicolous species of *Lichenohendersonia*	687
2.206 Accepted lichenicolous species of *Lichenostella*	693
2.207 Accepted lichenicolous species of *Milospium*	696
2.208 Accepted lichenicolous species of *Neolamya*	699
2.209 Accepted lichenicolous species of *Nigromacula*	701
2.210 Accepted lichenicolous species of *Nigropuncta*	702
2.211 Accepted lichenicolous species of *Pygmaeosphaera*	707
2.212 Accepted lichenicolous species of *Refractohilum*	710
2.213 Accepted lichenicolous species of *Talpapellis*	721
2.214 Accepted lichenicolous species of *Teratosperma*	724
2.215 Accepted lichenicolous species of *Trichoconis*	724
2.216 Accepted lichenicolous species of *Vouauxiella*	728

LIST OF TABLES

Table	Page
2.217 Accepted lichenicolous species of *Zwackhiomacromyces*	732
2.218 Accepted lichenicolous species of *Athelia*	735
2.219 Accepted lichenicolous species of *Burgella*	739
2.220 Accepted lichenicolous species of *Laetisaria*	746
2.221 Accepted lichenicolous species of *Zyzygomyces*	748
2.222 Accepted lichenicolous species of *Syzygospora*	749
2.223 Accepted lichenicolous species of *Biatoropsis*	750
2.224 Accepted lichenicolous species of *Tremella*	752
2.225 Accepted lichenicolous species of *Crittendenia*	767
2.226 Accepted lichenicolous species of *Cyphobasidium*	772
3.1 Primer pairs and Parameters for PCR amplification	783
3.2 Taxa name, voucher/culture and their GenBank accession numbers used in the phylogenetic analyses	785
3.3 The list of the fossils used as calibration	791
3.4 Taxa used as the calibrations and the GenBank accession numbers of their extant species	793
3.5 The GenBank accession numbers of the adjacent orders used in the molecular clock analysis	801
3.6 The crown age of the fossils used for calibrations	817
3.7 The comparison of crown ages between this study and previous studies	818
3.8 Sexual Characteristics of *Abrothallus* Species Growing on Parmeliaceae Lichens	863
3.9 Asexual Characteristics of *Abrothallus* Species Growing on Parmeliaceae Lichens	868
4.1 Sequences used in phylogenetic analysis of Dactylosporaceae with specimens or strains information and GenBank accession numbers	874

LIST OF TABLES

Table	**Page**
5.1 Sequences used in phylogenetic analysis of Mytilinidiales and adjacent orders, with specimens or strains information and GenBank accession numbers	890
6.1 Primer pairs and the parameters for PCR in *Kirschsteiniothelia* study	910
6.2 Taxa name, voucher/culture, and their GenBank accession numbers used in *Kirschsteiniothelia* study	912
7.1 Statistics of species, genera, families and orders	926

LIST OF FIGURES

Figure	Page
2.1 *Briancoppinsia cytospora*	25
2.2 Asexual morph of *Mixtoconidium insidens*	29
2.3 Sexual morph of *Mixtoconidium insidens* redrawn from Van den Boom (2017)	30
2.4 *Phacographa glaucomaria* redrawn from Hafellner (2009)	33
2.5 *Plectocarpon pseudosticta* redrawn from Hawksworth et al. (1984)	40
2.6 *Paralecanographa grumulosa* redrawn from Ertz et al. (2011) and Cannon et al. (2021)	49
2.7 *Arthophacopsis parmeliarum* redrawn from Hafellner (1998)	54
2.8 *Bryostigma leucodontis* redrawn from Poelt et al. (1979)	58
2.9 *Perigrapha superveniens* redrawn from Matzer (1996)	59
2.10 *Perigrapha superveniens* redrawn from Hafellner (1996b)	62
2.11 *Trichophyma bunchosiae* redrawn from Rehm (1904)	64
2.12 *Etayoa trypethelii* redrawn from Ertz et al. (2014)	65
2.13 *Lichenostigma maureri* redrawn from Hafellner (1983) & Ertz et al. (2014)	72
2.14 Asexual stage of *Lichenostigma maureri* redrawn from Hawksworth et al. (1986)	73
2.15 *Hobsoniopsis santessonii* redrawn from Lowen et al. (1986)	75
2.16 *Minutoexcipula tuckerae* redrawn from Atienza et al. (1994)	78
2.17 Sexual morph of *Abrothallus bertianus* redrawn from Pérez-Ortega et al. (2014)	90
2.18 Asexual morph of *Abrothallus bertianus* redrawn from Pérez-Ortega et al. (2014)	91
2.19 *Lichenoconium lichenicola* redrawn from Hawksworth (1977a)	96
2.20 *Hemigrapha asteriscus* redrawn from Diederich et al. (2000) & Dai et al. (2018)	101

LIST OF FIGURES

Figure	Page
2.21 *Hemigrapha asteriscus*	102
2.22 *Neobuelliella poetschii*	104
2.23 *Buelliella minimula* redrawn from Hafellner (1979)	110
2.24 *Labrocarpon canariensis* redrawn from *Melaspilea canariensis* of Hawksworth (1982a)	114
2.25 *Melaspileopsis diplasiospora* redrawn from Nylander (1863), Ertz et al. (2015)	116
2.26 *Stictographa lentiginosa* redrawn from Ertz et al. (2015)	118
2.27 *Knudsenia flavoparmeliarum* redrawn from Joshi et al. (2023a)	121
2.28 *Verrucocladosporium dirinae* redrawn from Crous et al. (2007)	127
2.29 *Didymellopsis latitans* redrawn from Grube et al. (1990)	130
2.30 *Rhagadodidymellopsis endocarpi* redrawn from Fernández-Brime et al. (2020)	132
2.31 *Zwackhiomyces coepulonus* redrawn from Grube et al. (1990)	139
2.32 *Lichenothelia scopularia* redrawn from Hawksworth (1981a)	148
2.33 *Lichenopeltella maculan* redrawn from Wu et al. (2011)	153
2.34 *Macrographa antarctica* redrawn from Etayo et al. (2008)	154
2.35 *Sphaerellothecium araneosum* redrawn fromChomnunti et al. (2011)	162
2.36 *Stigmidium schaereri* redrawn from Roux et al. (1994)	174
2.37 *Wernerella maheui* redrawn from Navarro-Rosinés et al. (1996)	176
2.38 *Stratisporella episemoides* redrawn from Hafellner (1979), Yacharoen et al. (2015)	178
2.39 *Dacampia hookeri* (=*Pleospora hookeri*) redrawn from Zschacke (1934), Ertz et al. (2015)	183
2.40 *Pseudonitschkia parmotrematis* redrawn from Coppins et al. (1995)	185

LIST OF FIGURES

Figure	Page
2.41 *Weddellomyces epicallopisma* redrawn from Navarro-Rosinés et al. (1995)	189
2.42 *Verrucoccum coppinsii* redrawn from Atienza et al. (2021)	191
2.43 *Koordersiella javanica* redrawn from Pem (2019)	196
2.44 *Didymocyrtis consimilis* redrawn from Ertz, et al. (2015)	201
2.45 *Pseudopyrenidium tartaricola* redrawn from Navarro-Rosinés et al. (2010)	204
2.46 *Xenophoma puncteliae* redrawn from Trakunyingcharoen et al. (2014)	205
2.47 *Lichenopyrenis galligena* redrawn from Calatayud et al. (2001)	207
2.48 *Clypeococcum cladonema* redrawn from Hawksworth (1977b)	215
2.49 *Polycoccum trypethelioides* redrawn from (Ertz, Diederich, et al. 2015)	226
2.50 *Lichenotubeufia eriodermatis* (= Tubeufia eriodermae) redrawn from Etayo (2002a)	229
2.51 *Keratosphaera batistae* redrawn from Matzer (1996)	233
2.52 *Myxophora amerospora* redrawn from Döbbeler (1978)	236
2.53 *Pyrenidium actinellum* redrawn from Huanraluek et al. (2019)	240
2.54 *Ampullifera foliicola* redrawn from Deighton (1960)	243
2.55 *Cercidospora macrospora* redrawn from Hafellner (1987b)	250
2.56 *Echinothecium reticulatum* redrawn from Chomnunti et al. (2011)	253
2.57 *Lanatosphaera porinicola* redrawn from Matzer (1996)	255
2.58 *Rosellinula haplospora* redrawn from the website: afl-lichenologie.fr	259
2.59 *Stromatopogon Baldwini* a–g from Zahlbruckner (1897), h–j from Diederich (1992b)	262
2.60 *Trematosphaeriopsis parmeliana* redrawn from Hafellner (2001), Zhurbenko (2021b)	264
2.61 *Lichenodiplis lecanorae* redrawn from (Hawksworth et al. 1979)	274

LIST OF FIGURES

Figure	Page
2.62 *Lichenodiplisiella makarevichiae* redrawn from Kondratyuk et al. (2002)	276
2.63 *Muellerella polyspora* redrawn from Müller (1862)	280
2.64 *Adelococcus alpestris* redrawn from Matzer et al. (1990)	284
2.65 *Sarcopyrenia gibba* redrawn from Navarro-Rosinés et al. (1990), Farkas et al. (2003)	292
2.66 *Bellemerella trapeliae* redrawn from Navarro et al. (1997)	294
2.67 *Clauzadella gordensis* redrawn from (Navarro-Rosinés & Roux 1996)	296
2.68 *Endococcus rugulosus* redrawn from Jayasiri et al. (2016)	306
2.69 *Haleomyces oropogonicola* redrawn from Hawksworth et al. (1993)	308
2.70 *Halospora deminuta* redrawn from Roux et al. (2002)	313
2.71 *Phaeospora rimosicola* redrawn from Pirogov et al. (2012)	317
2.72 *Telogalla olivieri* redrawn from Hoffmann et al. (2000)	321
2.73 *Verrucula egyptiaca* redrawn from Navarro-Rosinés et al. (2007)	328
2.74 *Verruculopsis poeltiana* redrawn from Navarro-Rosinés et al. (2007)	330
2.75 *Gemmaspora lecanorae* redrawn from Hawksworth et al. (2007)	332
2.76 *Merismatium lopadii* redrawn from Zopf (1898)	336
2.77 *Pseudostigmidium nephromiarium* redraw from Etayo et al. (2008)	338
2.78 *Gliocephalis hyalina* redrawn from Matruchot (1899)	360
2.79 *Oxnerella afghanica* redrawn from Steiner et al. (1987)	376
2.80 *Paralecia pratorum* redrawn from Liu et al. (2015)	379
2.81 *Nesolechia oxysporella* redrawn from description of Nylander (1858a)	390
2.82 *Phacopsis vulpina* redrawn from Triebel et al. (1995)	393
2.83 *Glyphopeltis eburina* redrawn from Brusse (1985)	399
2.84 *Lichenosticta podetiicola* redraw from Zopf (1898)	411
2.85 *Nimisiostella lichenicola* redraw from Calatayud et al. (1997)	413
2.86 *Umbilithecium pseudocyphellariae* redrawn from Etayo et al. (2008)	415

LIST OF FIGURES

Figure	Page
2.87 *Umushamyces kuturnum* redraw from Etayo et al. (2008)	417
2.88 RAxML and MrBayes analysis of *Epilichen* based on the combined ITS and mtSSU sequence data.	424
2.89 *Epilichen scabrosus* redrawn from website: italic.units.it	425
2.90 *Arthrorhaphis citrinella* redrawn from Obermayer (1994) and Frisch et al. (2022)	443
2.91 *Paralethariicola aspiciliae* redrawn from Calatayud et al. (2001)	445
2.92 *Corticifraga peltigerae* redraw from Puolasmaa et al. (2012)	449
2.93 *Paragyalideopsis floridae* redrawn from Etayo et al. (2001)	452
2.94 *Taitaia aurea* redraw from Suija, et al. (2018)	454
2.95 *Spirographa fusisporella* redrawn from Flakus et al. (2019b)	464
2.96 *Ingvariella bispora* redrawn from Lumbsch (1989)	467
2.97 *Lettauia hypotrachynae* redrawn from Etayo (2002a)	469
2.98 The section of ascomata of *Nanostictis peltigerae* redrawn from Etayo et al. (1996b).	471
2.99 *Aabaarnia siphulicola* redrawn from Diederich (2014)	475
2.100 *Biazrovia stereocaulicola* redrawn from Zhurbenko et al. (2013)	477
2.101 *Normanogalla cribriformis* redrawn from Diederich (2014)	479
2.102 *Diplolaeviopsis ranula* redrawn from Giralt et al. (1991)	488
2.103 *Lawreyella lobariella* redrawn from Flakus et al. (2019b)	490
2.104 *Llimoniella scabridula* redrawn from Hafellner (1993a)	495
2.105 *Macroskyttea parmotrematis* redrawn from Etayo et al. (2015a)	497
2.106 *Skyttea nitschkei* redrawn from Sherwood et al. (1980)	507
2.107 *Skyttella mulleri* redrawn from Moriyama et al. (2024)	509
2.108 *Thamnogalla crombiei* redrawn from Hawksworth (1980a)	511
2.109 *Brackelia lunkei* redrawn from Zhurbenko et al. (2017)	522
2.110 *Cecidioskyttea osorioi* redrawn from Etayo (2004)	524

LIST OF FIGURES

Figure	Page
2.111 *Kukwaea pubescens* redrawn from Suija et al. (2020)	526
2.112 *Neoechinodiscus lesdainii* redrawn from Etayo et al. (2000)	529
2.113 *Geltingia associata* redrawn from Diederich et al. (2010), Suija et al. (2015)	535
2.114 *Epicladonia sandstedei* redrawn from Hawksworth (1981b)	539
2.115 *Lasiosphaeriopsis salisburyi* redrawn from Hawksworth (1980b)	544
2.116 *Rhagadostomella gregaria* redrawn from Etayo (2002a)	546
2.117 *Neobaryopsis andensis* redrawn from Flakus et al. (2019b)	565
2.118 *Lichenobarya usneae* redrawn from Neobarya usneae Etayo (2002a)	568
2.119 *Cylindromonium eugeniicola* redrawn from Crous et al. (2019)	571
2.120 *Globonectria cochensis* redrawn from Etayo (2002a), Flakus et al. (2019b)	573
2.121 *Scolecofusarium ciliatum* redrawn from Crous, et al. (2021)	575
2.122 *Xenonectriella lutescens* redrawn from Weese (1919)	580
2.123 *Atronectria magellanica* redrawn from Etayo et al. (2008)	582
2.124 *Chondronectria eriodermaticola* redraw from Etayo (2017)	588
2.125 *Cylindronectria cyanobacteriicola* redrawn from Etayo (2017)	589
2.126 *Leptobarya nigra* redrawn from Etayo (2017)	591
2.127 *Lichenochora thallina* redrawn from Hafellner (1989)	604
2.128 *Globosphaeria jamesii* redrawn from Hawksworth (1990a)	606
2.129 *Reconditella physconiarum* redrawn from Matzer et al. (1990)	608
2.130 *Roselliniomyces trichotheliorum* redrawn from Matzer et al. (1990)	610
2.131 *Roselliniopsis tropica* redraw from Matzer et al. (1990)	613
2.132 *Biciliopsis leptogiicola* redraw from Aptroot et al. (1997)	617
2.133 *Obryzum corniculatum* redraw from Tulasne (1852), Maharachchikumbura et al. (2016)	622
2.134 *Acaroconium punctiforme* redrawn from Kocourkov et al. (2008)	624

LIST OF FIGURES

Figure	Page
2.135 *Arborillus llimonae* redraw from Muntañola-Cvetković et al. (1998)	626
2.136 *Asterophoma mazaediicola* redrawn from Hawksworth (1981b)	628
2.137 *Baliomyces taimyricus* redraw from Zhurbenko et al. (2024)	630
2.138 *Bicoloromyces kyffinensis* redrawn from Heuchert et al. (2015)	632
2.139 *Caeruleoconidia ochrolechiae* redraw from Zhurbenko et al. (2015)	634
2.140 *Calongeomyces gibelluloides* redraw from Hawksworth et al. (2010)	636
2.141 *Carnegieispora rimeliae* redraw from Etayo et al. (2009)	637
2.142 *Cecidiomyces santessonii* redrawn from Zhurbenko et al. (2012)	639
2.143 *Choreospora tibellii* redrawn from Constantinescu et al. (1987)	641
2.144 *Cladoniicola staurospora* redrawn from Diederich et al. (2001)	643
2.145 *Clauzadeomyces verrucosus* redrawn from Diederich (1994)	644
2.146 *Codonmyces lecanorae* redrawn from Calatayud et al. (1999a)	646
2.147 *Coniambigua phaeographidis* redrawn from Etayo et al. (1995)	648
2.148 *Deichmannia verrucispora* redrawn from Alstrup et al. (1990)	649
2.149 *Dictyophrynella bignoniacearum* redrawn from Hawksworth (1979a)	651
2.150 *Epaphroconidia hawksworthii* redrawn from Calatayud et al. (1995)	652
2.151 *Everniicola flexispora* redrawn from Hawksworth (1982c)	654
2.152 *Feltgeniomyces luxemburgensis* redrawn from (Diederich 1990)	657
2.153 *Fenestroconidia caloplacae* redrawn from Calatayud et al. (1999b)	659
2.154 *Gyrophthorus perforans* redrawn from Roux et al. (1997), Diederich et al. (2024)	662
2.155 *Gyrophthorus perforans* redrawn from Hafellner et al. (1990)	664
2.156 *Hawksworthiana peltigericola* redrawn from Hawksworth (1980a)	666
2.157 *Henfellra muriformis* redrawn from Hawksworth et al. (2016).	667
2.158 *Hymenobia insidiosa* redrawn from Etayo (2002a)	669
2.159 *Intralichen christiansenii* redrawn from (Hawksworth 1979a)	671
2.160 *Isthmoconidium bacidiicola* redrawn from Etayo et al. (2013)	673

LIST OF FIGURES

Figure	Page
2.161 *Kalchbrenneriella cyanescens* redrawn from Diederich (2002)	675
2.162 *Katherinomyces cetrariae* redraw from Khodosovtsev, et al. (2016)	676
2.163 *Keissleriomyces sandstedeanus* redrawn from Hawksworth (1981b)	678
2.164 *Lambinonia strigulae* redrawn from Sérusiaux (2005)	680
2.165 *Lawalreea lecanorae* redrawn from (Diederich 1990)	682
2.166 *Leightoniomyces phillipsii* redrawn from (Hawksworth 1977b)	684
2.167 *Lichenobactridium pertusariae* redrawn from Etayo et al. (1995)	686
2.168 *Lichenohendersonia squamarinae* redrawn from Calatayud et al. (2001)	688
2.169 *Lichenopenicillus versicolor* redrawn from Etayo (2017)	690
2.170 *Lichenopuccinia poeltii* redrawn from website: https://www.outerhebridesfungi.co.uk/lichenicolous-species.php?id=536.	692
2.171 *Lichenostella hypotrachynae* redrawn from Calatayud (1999a)	694
2.172 *Llanorella ramalinae* redrawn from (Diederich et al. 2024)	695
2.173 *Milospium graphideorum* redrawn from Hawksworth (1975b)	697
2.174 *Minutophoma chrysophthalmae* redrawn from Hawksworth (1981b)	698
2.175 *Neolamya peltigerae* redrawn from Kocourková (2009)	700
2.176 *Nigromacula hypotrachynae* redrawn from (Etayo 2002a)	701
2.177 *Nigropuncta rugulosa* redrawn from (Hawksworth 1981b)	703
2.178 *Patriciomyces valentinianus* redrawn from Cole et al. (2001)	704
2.179 P*atriciomyces valentinianus* edited from Diederich et al. (2024)	706
2.180 P*ygmaeosphaera coccocarpiae* redrawn from Etayo (2017)	708
2.181 *Randlanea usneicola* redrawn from Zhurbenko et al. (2023)	709
2.182 *Refractohilum galligenum* redrawn from (Hawksworth 1977b)	711
2.183 *Sarcoexcipula pannariae* redrawn from Etayo & Sancho (2008)	713
2.184 *Sessiliospora bicolor* redrawn from (Hawksworth 1979a)	715

LIST OF FIGURES

Figure	Page
2.185 *Stellifraga cladoniicola* redrawn from Alstrup (1993c)	716
2.186 *Stipititheca pyrenulae* redrawn from Diederich et al. (2024)	718
2.187 *Stygiomyces galliformis* redrawn from Coppins et al. (1995)	719
2.188 *Talpapellis peltigerae* redraw from Alstrup et al. (1998)	723
2.189 *Vagnia cirriformis* redrawn from Hawksworth et al. (1997)	726
2.190 *Vouauxiella verrucosa* redrawn from Hawksworth (1976)	729
2.191 *Zevadia peroccidentalis* redraw from the website: https://www.fungi.myspecies.info/all-fungi/zevadia-peroccidentalis.	731
2.192 *Zwackhiomacromyces constrictocarpus* redrawn from Van den Boom et al. (2014)	733
2.193 *Bergerella atrofusca* redrawn from Lawrey et al. (2020)	737
2.194 *Bulbilla applanata* redrawn from Diederich, et al. (2014)	738
2.195 *Burgella flavoparmeliae* redraw from Diederich et al. (2007)	740
2.196 *Burgellopsis nivea* redrawn from Diederich, et al. (2014)	741
2.197 *Neoburgoa freyi* redrawn from Lawrey et al. (2016)	743
2.198 *Parmeliicida pandemica* redrawn from Diederich et al. (2022)	745
2.199 *Biatoropsis usnearum* redrawn from Diederich et al. (2022)	751
2.200 *Crittendenia coppinsii* redrawn from Millanes et al. (2021)	770
2.201 *Cyphobasidium hypogymniicola* redrawn from Diederich et al. (2022)	773
2.202 *Kriegeriopsis livingstonensis* redrawn from Diederich et al. (2022)	775
3.1 Phylogenetic tree of Lichenoconiaceae	819
3.2 Phylogenetic tree of parts orders of Dothideomycetes	820
3.3 The maximum clade credibility (MCC) tree of orders in Class Dothideomycetes, generated using a Bayesian approach (BEAST)	824
3.4 *Abrothallus flavoparmeliae*, growing on thallus of *Flavoparmelia* sp. (Holotype: KUN-L 88643).	837

LIST OF FIGURES

Figure	Page
3.5 *Abrothallus hypogymniae*, growing on apothecia of of *Hypogymnia* sp. (Holotype: KUN-L 88540)	840
3.6 *Abrothallus parmelioidea*, growing on thallus or tuberculate strcutres of Parmelioid lichens (holotype: KUN-L 88638, collection number ml23-117-3)	844
3.7 *Abrothallus myelochroae*, growing on thallus of *Myelochroae* sp. (holotype: KUN-L 88665, collection number ml23-90)	847
3.8 *Abrothallus yunnanensis*, growing on apothecia of *Hypogymnia* sp. (holotype: KUN-L 88552, collection number ljs-203)	850
4.1 RAxML analysis of Dactylosporaceae based on the combined LSU, ITS and mtSSU sequence data	878
4.2 *Sclerococcum glaucomarioides* (KUN-L 88756) on the lichen thallus of *Ochrolechia akagiensis*	880
4.3 *Sclerococcum stictae* sp. nov., growing on the thallus of *Sticta* sp. (Holotype: KUN-L 88687).	882
5.1 RAxML analysis of Mytilinidiales based on the combined LSU, ITS and TEF1 sequence data	899
5.2 *Lijiangomyces laojunensis* sp. nov., (KUN-L 88703)	903
6.1 Phylogenetic tree of *Kirschsteiniothelia*	918
6.2 *Kirschsteiniothelia laojunensis* sp. nov. (KUN-L 88727, ljs-29)-Holotype.	919
7.1 Distribution of lichenicolous fungi	927

ABBREVIATIONS AND SYMBOLS

com.	combination
diam.	diameter
e.g.	for example
et al.	and others
h	hours
gen.	genus/genera
ibid.	ibidem
min	minute
ml	maximum likelihood support
mm	Millimetre
nov.	novum (Latin for new thing)
pp	posterior probabilities
sp.	species
spp.	species (plural)
viz.	that is
vs.	versus
$\bar{x}$	average
°C	degree centigrade
µm	micrometer
µl	microliter
%	percent

CHAPTER 1

INTRODUCTION

1.1 Background and Rationale

1.1.1 Overview of Lichenicolous Fungi

Lichenicolous fungi represent a specialized group which grow on lichens and establish a parasitic, saprobic or commensal relationship with them (Diederich et al., 2018). A fungus that is parasitic on one lichen species may behave parasymbiotically on another, or a species that is typically parasymbiotic may become parasitic if the host is not in optimal condition (Hawksworth, 1982). The lichenicolous fungi exist in various locations of lichens, including on or within the thallus of foliose lichens, on the branches of fruticose and crustose lichens or on or within the squama of the genus *Cladonia* (Lawrey et al., 2003). In the nineteenth century, these lichenicolous fungi were extensively studied by both mycologists and lichenologists, who produced beautifully detailed illustrations and critically informative accounts of selected species, which remain relevant and valuable to this day (Lindsay, 1869; Zopf, 1897a).

As a heterotrophic organism, lichenicolous fungi mainly obtain its nutrients from lichens. Their growth may affect the normal growth of lichen to varying degrees (parasitic), or it may only obtain organic matter from photobiont without affecting lichen (symbiotic). Unfortunately, the interactions between lichenicolous fungi and their hosts have rarely been extensively studied (Lawrey et al., 2003). The parasitic fungi can induce various necrotic patches. Among them, *Lichenoconium erodens* is the most pathogenic species, typically causing extensive whitish lesions on the host thalli (Hawksworth, 1981). *Lichenoconium echinosporum*, when growing on *Heterodea muelleri*, can cause brownish discolorations (Hawksworth, 1977). *Phoma cytospora*, on *Parmelia caperata*, forms several pycnidia within single infection spots (Hawksworth, 1976).

Some lichenicolous fungi are known to originate from lichens and derive their

nutrition from the photobiont of the lichen (Rambold et al., 1992). These are known as lichenicolous lichens, which facultatively grow on host lichens. They begin as free-living lichen mycobionts and become lichenized by associating with the photobiont of an unrelated lichenized thallus. Subsequently, the parasitic mycobiont becomes independent, either by continuing to utilize the original host's photobiont or by acquiring another photobiont later (Lawrey et al., 2003). They establish stable relationships with their lichen hosts, without causing discoloration or malformation, and have been referred to as parasymbionts by Zopf, signifying their association with an existing symbiosis (Zopf, 1897b). Commensal lichenicolous fungi constitute a large and diverse biological group, encompassing many taxa that belong to genera containing independent lichens or are closely related to lichen-forming taxa. The typical example is *Diploschistes muscorum*, in which, its mycobiont initially parasitizes squamules of *Cladonia* species and forms an association with the host photobiont. Over time, *Diploschistes muscorum* acquires its own distinct photobiont and becomes independent (Friedl, 1987).

Hawksworth documented several saprobic lichenicolous fungi found on decaying lichen thalli, including *Botrytis cinerea*, *Cladosporium herbarum*, and various species of *Aspergillus*, *Penicillium*, and *Trichoderma* (Hawksworth, 1979). Some lichenicolous fungi are exclusively known to inhabit decayed lichen thalli, suggesting that they are obligate lichenicolous saprobes, such as *Endophragmiella hughesii* on decaying *Lobaria pulmonaria* thalli, *Monodictys anaptychiae* on *Anaptychia ciliaris* thalli, and *Niesslia cladoniicola* on aged podetia of *Cladonia rangiformis* (Hawksworth 1975).

Although few studies have directly measured the impact of parasites on lichen fitness, Merinero & Gauslaa discovered that gall-forming parasites such as *Plectocarpon lichenum* and *P. scrobiculatae* reduced the growth and fitness of the *Lobaria* lichens they inhabit (Merinero et al., 2018).

1.1.2 Importance of Lichenicolous Fungi Taxonomy

Lichenicolous fungi represent an integral component of biodiversity, ecology, and evolutionary studies. Despite their inconspicuous nature, they play significant roles in shaping ecological interactions, driving evolutionary processes, and serving as indicators of environmental health. Understanding their taxonomy is crucial to

unlocking their ecological, evolutionary, and practical significance. Especially in biodiversity conservation, ecological functionality, evolutionary insights, systematic revisions, biogeographic patterns, and their broader applications.

The taxonomy of lichenicolous fungi is indispensable for revealing and preserving their diversity. These fungi are often highly host-specific, with some species confined to particular lichen hosts or habitats (Diederich, 1996). Taxonomic studies enable the identification of rare and endemic species, many of which are vulnerable to environmental changes such as pollution or habitat destruction (Etayo et al., 1998). For instance, the discovery of new lichenicolous fungi species from underexplored regions like tropical rainforests or alpine zones contributes to the global understanding of fungal diversity and informs conservation priorities (Hawksworth, 2001).

Lichenicolous fungi provide valuable insights into ecological interactions within lichen-dominated ecosystems. As parasites, commensals, or mutualists, these fungi influence lichen health, structure, and community dynamics (Lawrey et al., 2003). By studying their taxonomy, we can better understand their roles in nutrient cycling, competition, and symbiotic relationships.

Taxonomic studies of lichenicolous fungi significantly enhance our understanding of evolutionary processes. These fungi exhibit diverse modes of parasitism and host specialization, providing unique opportunities to study co-evolutionary dynamics between parasites and their lichen hosts. For instance, research has shown that specialized fungal parasites can reduce the fitness of their lichen hosts, indicating a complex evolutionary relationship (Merinero et al., 2018). Phylogenetic analyses have revealed multiple independent origins of lichenicolous lifestyles within fungal lineages, shedding light on the evolutionary transitions between free-living and parasitic states. A comprehensive classification and checklist of lichenicolous fungi, which includes over 2000 non-lichenized obligately lichenicolous taxa, provides a framework for studying these evolutionary patterns (Diederich et al., 2018). Understanding these patterns offers valuable insights into adaptive evolution and speciation within fungal lineages. Moreover, monographic works, such as the detailed study on the genus *Plectocarpon*, contribute to our knowledge of the diversity and evolutionary history of lichenicolous fungi (Ertz et al., 2005).

The taxonomy of lichenicolous fungi has historically been hindered by

morphological misinterpretations and insufficient data. Modern advances in molecular techniques, including DNA sequencing and barcoding, have provided crucial tools for resolving these issues. Multilocus phylogenetic analyses, such as those employing ITS and LSU regions, have become standard for clarifying species boundaries and evolutionary relationships (Ertz et al., 2015a, 2015b, 2015c).

Taxonomic research on lichenicolous fungi enhances our understanding of their geographic distribution and biogeographic patterns. Mapping their diversity across regions provides insights into the historical and ecological factors shaping fungal distributions and contributes to the broader field of fungal biogeography.

1.1.3 Current Knowledge Gaps in the Taxonomy of Lichenicolous Fungi

Lichenicolous fungi, despite their ecological significance and diverse interactions with lichen thalli, remain poorly studied in China, resulting in several knowledge gaps that hinder our understanding of their diversity and ecological roles. One of the most significant research gaps is the lack of comprehensive geographic and ecological surveys. The vast and varied ecosystems in China, ranging from high-altitude mountains to tropical rainforests, offer unique habitats for lichenicolous fungi. However, systematic investigations into the diversity and distribution of these fungi across different ecological zones are almost nonexistent. Given the biodiversity hotspots in China, especially in Hengduan Mountains regions like Tibet, Sichuan, and Yunnan, there is a high potential for the discovery of new and endemic lichenicolous species, which have yet to be documented.

Another critical gap is the underrepresentation of species diversity and taxonomy. Despite the rich lichen flora in China, the diversity of lichenicolous fungi in the country remains largely unexplored. Most of the fungi associated with lichens in China have not been formally described or classified, leaving a significant portion of fungal biodiversity unrecorded. Additionally, without comprehensive molecular data, such as DNA barcoding or phylogenetic analyses, the taxonomic placement of many lichenicolous fungi remains unclear, further complicating efforts to establish a robust and updated classification system (Lücking et al., 2021).

The insufficient molecular systematics research on lichenicolous fungi in China is another pressing gap. Molecular tools such as ITS and LSU sequencing have proven invaluable in resolving phylogenetic relationships within various fungal groups, yet

their application to Chinese lichenicolous fungi is still limited. The lack of molecular data hinders accurate species identification, particularly when traditional morphological features are insufficient for distinguishing between closely related species. This gap also contributes to the uncertainty surrounding the evolutionary relationships of these fungi and their placement within broader fungal lineages.

1.2 Significance of the Study

The taxonomy of lichenicolous fungi, particularly in the Hengduan Mountains region of China, holds profound importance for advancing our understanding of fungal biodiversity and ecological dynamics. Lichenicolous fungi are a specialized group of organisms that exhibit complicated relationships with their lichen hosts, ranging from parasitism to mutualism. Despite their ecological and evolutionary significance, the taxonomy of these fungi remains underexplored, especially in biodiversity hotspots like the Hengduan Mountains. This region, characterized by its complex topography, diverse microclimates, and rich lichen flora, is a potential reservoir of undiscovered lichenicolous species.

Accurate taxonomy is fundamental for identifying and describing the diversity of lichenicolous fungi, which is essential for understanding their evolutionary relationships, host specificity, and biogeographic patterns. Furthermore, taxonomic research in this field contributes to broader ecological studies, including the roles these fungi play in lichen community dynamics, nutrient cycling, and ecosystem resilience. The Hengduan Mountains, as part of the eastern extension of the Himalayan biodiversity hotspots, provide a unique opportunity to uncover novel taxa and expand the global knowledge of lichen-fungi interactions.

By addressing taxonomic gaps and integrating molecular, morphological, and ecological approaches, this study will not only enhance the understanding of lichenicolous fungi in China but also contribute to global fungal taxonomy. Moreover, it will provide a baseline for conservation efforts and facilitate further research on the impacts of environmental changes on these fungi and their host lichens.

1.3 Objectives

1.3.1 To compile a global checklist of all lichenicolous species (up to 2025) and to provide a critical revision of obligate lichenicolous genera.

1.3.2 To conduct systematic sampling in the Hengduan Mountains, combining a polyphasic approach to reveal novel lichenicolous species and to address a critical knowledge gap.

1.3.3 To integrate expanding molecular data from Abrothallales and 12 adjacent orders, coupled with a multi-fossil calibration strategy, to enhance the precision of divergence time estimates for Abrothallales.

1.4 Expected Outcomes

1.4.1 This study is expected to yield novel taxa, new host records of lichenicolous fungi in the Hengduan Mountains, accompanied by detailed morphological descriptions, illustrations, and phylogenetic trees.

1.4.2 This study is expected to provide a new checklist of lichenicolous fungi in the world to replenish the new published species in the last few years and the synonyms.

1.4.3 Reassess the divergence time estimates for Abrothallales using expanded molecular data.

1.5 Research Contents

This study focuses on the taxonomy and phylogeny of lichenicolous, and compiles the checklist of lichenicolous fungi of the world, comprising seven chapters.

Chapter 1 is a general introduction, introduces the background and rationale for the study, discussing the relationship between lichen and lichenicolous. It outlines the significance of the study, clearly stating the research objectives, expected outcomes and the outline of the thesis.

In Chapter 2, a comprehensive checklist of lichenicolous species worldwide, with notes and illustrations of obligate lichenicolous genera are provided.

Chapter 3, a reassessing of the divergence times of Abrothallales and its adjacent orders, with the discovery of five new lichenicolous species of *Abrothallus* (Lichenoconiaceae, Abrothallales) from China are provided.

Chapter 4 a novel species and a new geographical record of China of *Sclerococcum* (Dactylosporaceae, Sclerococcales, Eurotiomycetes).

Chapter 5 provides a novel genus, *Lijiangomyces* and a new species of Mytilinidiaceae (Mytilinidiales, Dothideomycetes).

Chapter 6 provides a morphological and phylogenetic appraisal of a new *Kirschsteiniothelia* (Dothideomycetes, Kirschsteiniotheliales) species from Yunnan Province, China.

Chapter 7 provides an overall conclusion and future work.

CHAPTER 2

COMPREHENSIVE CHECKLIST OF LICHENICOLOUS SPECIES, WITH NOTES AND ILLUSTRATIONS OF OBLIGATE LICHENICOLOUS GENERA

2.1 Introduction

Lichenicolous fungi represent a fascinating ecological and taxonomic group within the fungal kingdom, uniquely adapted to colonize and interact with lichens as their primary hosts. exhibit a diverse range of lifestyles, from obligate parasitism, where they cause significant structural or reproductive damage to their host, to commensalism, where they coexist with lichens without apparent harm, and even mutualism, in which both organisms may derive some benefit (Lawrey et al., 2003). These fungi are defined as fungi that grow on lichens, either on the thallus, apothecia, or other reproductive structures, without forming a lichenized thallus themselves (Hawksworth, 1979a). Most lichenicolous fungi do not engage directly in symbiosis with photobionts but rather interact with established lichen thalli. These interactions range from harmful parasitism, where the host lichen suffers structural or reproductive damage, to neutral or even beneficial commensal relationships (Diederich, 1996). Some lichens are juvenile lichenicolous on the thallus of other lichens, subsequently obtaining their own photobionts and form lichenicolous lichen, such as some species of *Kuettlingeria*, *Rhizocarpon*, *Monerolechia*, *Placocarpus*, *Verrucula* (Diederich et al., 2018).

2.1.1 History of lichenicolous research

The earliest examples of a lichenicolous fungus studied is *Biatoropsis usnearum*, which is a heterobasidiomycete inducing the formation of large, gall-like structures on the thalli of *Usnea* species. Dillenius (1742) described two species belonging to the *Usnea barbata* group, one of which is recognized as the basidiomata of *Biatoropsis usnearum*. Acharius (1795) provided a detailed discussion and illustrations of *Usnea* specimens infected by *B. usnearum*. Acharius (1810) further advanced this understanding by publishing fine color illustrations of *B. usnearum*, which showcased

the morphological details of the fungus and its interaction with its host. These early works not only highlighted the diversity of lichen-associated fungi but also underscored the intricate ecological relationships within lichen symbioses.

The systematic study of lichenicolous fungi gained momentum in the 19th and 20th centuries as taxonomists began to describe new species and genera. Rehm H. and De Notaris described several species of lichenicolous ascomycetes, providing detailed morphological descriptions and classifications in the late 19th century (De Notaris, 1844, 1846a, b, 1849; Rehm, 1881, 1888, 1889, 1896a, b). The 20th century witnessed significant advances in the understanding of lichenicolous fungi, facilitated by developments in microscopy and staining techniques. The studies of Poelt Josef emphasized the ecological and evolutionary significance of lichenicolous fungi (Poelt, 1958, 1960, 1961, 1962, 1970; Poelt et al., 1976; Poelt, 1985). While Hafellner's work provided a comprehensive framework for their classification, which remains influential today (Hafellner, 1979, 1982, 1983, 1985a, b, 1987a, b, 1993a, b, 1994a, 1996a, b, 1997, 1998a, b, 1999a, b, 2001, 2002a, b, 2004a).

In recent decades, molecular phylogenetics has revolutionized the study of lichenicolous fungi. DNA sequencing has revealed cryptic diversity within many genera and clarified phylogenetic relationships that were previously ambiguous. Frisch et al. (2014) conducted a molecular phylogenetic study using mtSSU, nLSU, and RPB2 sequence data to analyze *Plectocarpon*. Their work revealed significant cryptic diversity within the genus and clarified its placement within the Lecanographaceae clade. This study highlighted how molecular data can uncover hidden species diversity and refine higher-level taxonomic relationships. Millanes et al. (2016) used multi-gene phylogenetic analyses to introduce *Cyphobasidium*, resolving its placement within Cyphobasidiaceae (Cyphobasidiales). Diederich et al. (2022) used ITS and LSU sequence data to establish *Zyzygomyces*, accommodating eight lichenicolous species previously misclassified. Their study also revealed the genus's association with conspicuous gall formation on lichen thalli, illustrating how molecular tools can clarify ecological roles alongside phylogenetic relationships

Modern research continues to explore the ecological interactions between lichenicolous fungi and their hosts. These fungi exhibit a remarkable range of lifestyles, from obligate parasitism to commensalism and mutualism. Muggia et al. (2018)

discussed the diversity of fungi inhabiting lichen thalli, including lichenicolous fungi, and their interactions ranging from parasitism to mutualism.

Studies on the chemical ecology of lichenicolous fungi have also uncovered secondary metabolites with potential applications in medicine and biotechnology. Lawrey (1995) examined the chemical interactions between lichenicolous fungi and their lichen hosts, focusing on how these fungi tolerate or detoxify lichen secondary metabolites. The study provides insights into the co-evolutionary dynamics between lichenicolous fungi and their hosts.

2.1.2 The Relationship Between Lichenicolous Fungi and Lichen

Lichenicolous fungi as the specialized organisms that live on or within lichens, exhibiting diverse interactions ranging from parasitism to commensalism. Morphologically, lichenicolous fungi often produce distinct structures, such as darkly pigmented hyphae or reproductive bodies, which can be differentiated from the tissues of the host lichen. Lichenicolous fungi may form apothecia, pycnidia or perithecia that are morphologically distinct from the apothecia or other reproductive structures of the lichen mycobiont. Additionally, lichenicolous fungi may induce gall formation or other morphological changes in the host lichen. However, distinguishing these fungi can be challenging, especially when the lichenicolous fungus causes minimal visible damage or closely resembles the host's tissues. In such cases, molecular techniques can provide definitive identification by comparing genetic material from both the suspected lichenicolous fungus and the lichen mycobiont. These methods have become increasingly important in lichenology, allowing for accurate differentiation between these closely associated organisms (Cometto et al., 2023). Understanding the distinctions between lichenicolous fungi and lichen mycobionts is crucial for studies in lichen ecology, taxonomy, and the evolution of symbiotic relationships. Accurate identification informs ecological assessments and enhances our comprehension of the complex interactions within lichen communities (Lawrey et al., 2003).

Some lichenicolous fungi exhibit saprotrophic behavior, feeding on dead or decaying parts of the lichen thallus. This strategy allows them to avoid direct competition with the lichen symbionts while still utilizing the organic matter provided by the lichen structure (Lawrey, 1986). Many lichenicolous fungi are obligate parasites, directly penetrating the tissues of their lichen hosts to access nutrients. For example,

they may form specialized structures such as haustoria to extract nutrients from the photobiont or mycobiont cells. This process is well-documented in fungi like *Biatoropsis usnearum*, which develops tremelloid haustoria to parasitize the photobiont of *Usnea* species (Diederich, 1996). While rare, some lichenicolous fungi have been observed in associations where the fungal activity stimulates host growth or chemical production, potentially offering a degree of mutual benefit. These interactions, though not strictly mutualistic, highlight the diverse ecological roles these fungi can play (Lawrey et al., 2003)

2.1.3 Chemistry of Lichenicolous Fungi

Lichenicolous fungi, which inhabit lichen thalli, can produce unique secondary metabolites distinct from those of their lichen hosts. These compounds may play roles in mediating interactions between the fungi and their hosts, potentially influencing parasitism or commensalism dynamics. For instance, certain lichenicolous fungi have been found to produce specific secondary metabolites that are not present in their host lichens, suggesting a specialized metabolic capability (Kondratyuk, 1995). The study of secondary metabolites indicated that lichenicolous fungi may contribute to the chemical diversity observed within lichen communities.

2.1.3.1 Enzyme Activity and Host Specificity in *Nectriopsis parmeliae*

Nectriopsis parmeliae demonstrates a dependence on the chemical properties of its host lichen for its enzymatic performance. On *Flavoparmelia baltimorensis*, a lichen that commonly hosts this fungus, enzyme activity remains robust irrespective of the presence of acetone-soluble secondary compounds. Conversely, on *Lasallia papulosa*, which does not naturally support the growth of *N. parmeliae*, enzyme activity is significant only when secondary compounds like lecanoric acid are removed. This suggests that specific chemical defenses in *L. papulosa* hinder the enzymatic functionality of *N. parmeliae*, thereby restricting its host range (Torzilli et al., 1995).

2.1.3.2 Growth Suppression in *Marchandiomyces corallinus*

The necrotrophic fungus *Marchandiomyces corallinus* is frequently observed on *Flavoparmelia baltimorensis* but is rarely associated with *Lasallia papulosa*. Laboratory experiments indicate that *M. corallinus* cannot grow on *L. papulosa* unless secondary compounds such as lecanoric acid are extracted.

Interestingly, these compounds do not inhibit the enzyme activity of the fungus, pointing to a broader chemical suppression mechanism that limits its overall growth rather than specifically targeting its enzymatic processes (Lawrey et al., 1999; Torzilli et al., 1999).

2.1.3.3 Degradative Capabilities of *Fusarium* sp.

The lichen pathogen *Fusarium* sp. displays a remarkable capacity to colonize various lichens in the eastern United States, demonstrating resilience to secondary compounds that often inhibit other fungi. This species produces enzymes capable of breaking down both lichen cell walls and specific secondary compounds, such as lecanoric acid found in *Punctelia rudecta*. Its enzymatic capabilities are distinct within its clade, as closely related species lack the ability to degrade lichen compounds, reflecting their entomogenous lifestyles (Torzilli et al., 2002).

Understanding the chemistry of lichenicolous fungi is essential for comprehending their ecological roles and the evolutionary pressures shaping lichen symbioses.

2.1.4 Genera and species of lichenicolous fungi

The earliest studies on lichenicolous fungi focused on documenting obvious and morphologically distinct species, often using classical taxonomy. Hawksworth (1980) provided a key, including 183 lichenicolous species belonging to 79 genera in British Isles. (Hawksworth et al., 1980). This period established a foundational understanding of their diversity, morphology, and ecological roles. By the early 2000s, the number of known species had increased to approximately 1,550, encompassing over 300 genera (Lawrey et al., 2003). Diederich (2018) reviewed the diversity of lichenicolous fungi, reporting 398 genera and 2319 species, containing 2000 obligately lichenicolous species, subspecies or varieties, 257 lichenicolous lichens and 62 facultatively lichenicolous taxa (Diederich et al., 2018).

Lichenicolous fungi span multiple classes and orders, with representatives in Ascomycota and Basidiomycota. Families such as Adelococcaceae, Arthrorhaphidaceae, Crittendeniaceae, Cyphobasidiaceae, Dactylosporaceae, Hemigraphaceae, Lichenoconiaceae, Lichenotheliaceae, Neobuelliellaceae, Obryzaceae, Pyrenidiaceae, Sarcopyreniaceae, Spirographaceae and Stictographaceae are composed almost entirely of lichenicolous taxa. Based on our current statistics,

there are 16 classes, 67 orders, 129 families, and 403 genera encompassing 2,631 lichenicolous species, with 214 of these genera being obligately lichenicolous.

2.2 Checklist of Lichenicolous Species, with Notes and Illustrations of Obligate Lichenicolous Genera

Phylum ASCOMYCOTA Caval.-Sm.

Subphylum PEZIZOMYCOTINA O.E. Erikss. & Winka

Class ARTHONIOMYCETES O.E.Erikss. & Winka

Order Arthoniales D.Hawksw. & O.E.Erikss.

Family Arthoniaceae Rchb.

Arthonia Ach. (128-500+)

Type species: *Arthonia radiata* (Pers.) Ach. (Coppins et al., 2009)

= *Opegrapha radiata* Pers. (Persoon, 1794b)

Table 2.1 Accepted lichenicolous species of *Arthonia*

	Species name	**Host**	**References**
1	*Arthonia abrothallina* Nyl.	*Pseudocyphellaria*	(Nylander, 1856)
2	*Arthonia acanthotheciicola* Ertz & Common	*Acanthothecis floridensis*	(Diederich et al., 2019)
3	*Arthonia agelastica* R.C. Harris & Lendemer	*Lecanora louisiana*	(Lendemer et al., 2016)
4	*Arthonia albotrachynae* Etayo	*Hypotrachyna endochlora*	(Etayo, 2018)
5	*Arthonia almquistii* Vain.	*Amygdalaria, Koerberiella, Porpidia* and *Trapelia*	(Vainio, 1883)

Table 2.1 (continued)

	Species name	Host	References
6	*Arthonia amandineicola* van den Boom & Ertz	*Amandinea efflorescens*	(van den Boom et al., 2017)
7	*Arthonia amylospora* Almq.	*Porpidia* and *Farnoldia*	(Almquist, 1879)
8	*Arthonia anatolica* Halıcı & Candan	*Aspicilia contorta*	(Halıcı et al., 2011)
9	*Arthonia anjutii* S.Y. Kondr. & Alstrup	*Teloschistes velifer* f. *nodulosus*	(Moser, 1996)
10	*Arthonia arthoniicola* Diederich & Aptroot	*Arthonia catenulate*	(Diederich et al., 1995)
11	*Arthonia aspiciliae* Alstrup & E.S. Hansen	*Aspicilia elevate*	(Alstrup et al., 2001)
12	*Arthonia atropunctata* Vain.	on sterile foliicolous cf. *Echinoplaca*	(Vainio, 1921b)
13	*Arthonia ayseniae* Halıcı & Candan	*Acarospora cervina*	(Halici & Candan, 2009)
14	*Arthonia badia* Wedin & Hafellner	*Pseudocyphellaria granulata*	(Wedin et al., 1998)
15	*Arthonia brussei* Egea & Torrente	*Lecanographa*	(Egea et al., 1997)
16	*Arthonia buelliae* Zhurb.	*Buellia stellulata*	(Zhurbenko, 2021a)
17	*Arthonia caerulescens* (Almq.) Arnold	*Lecanora varia*	(Arnold, 1881)

Table 2.1 (continued)

	Species name	Host	References
18	*Arthonia calicii* Kantvilas & Wedin	*Calicium tricolor*	(Kantvilas et al., 2015)
19	*Arthonia catillarioides* Etayo	*Sticta*	(Etayo, 2017)
20	*Arthonia circinata* Th. Fr.	*Umbilicaria*	(Fries, 1865)
21	*Arthonia clemens* (Tul.) Th. Fr.	*Rhizoplaca*	(Fries, 1867a)
22	*Arthonia cohabitans* Coppins	*Arthothelium reagens*	(Coppins, 1989)
23	*Arthonia colombiana* Etayo	*Cladonia*	(Etayo, 2002a)
24	*Arthonia coniocraeae* Brackel	*Cladonia coniocraea*	(Brackel, 2010a)
25	*Arthonia coriifoliae* Wedin & Hafellner	*Pseudocyphellaria coriifolia*	(Wedin et al., 1998)
26	*Arthonia coronata* Etayo	*Flavoparmelia caperata*	(Etayo, 1996a)
27	*Arthonia cryptotheciae* R. Sant. ex Matzer & R. Sant.	on foliicolous *Myriostigma candida*	(Grube et al., 1995),
28	*Arthonia cryptotheciae* R. Sant. ex Matzer & R. Sant.	on foliicolous *Myriostigma candida*	(Grube et al., 1995),
29	*Arthonia darbishirei* Follmann & B. Werner	*Roccella nigerrima*	(Follmann et al., 2003)
30	*Arthonia destruens* Rabenh.	*Physcia*, *Xanthoria fallax*	(Rabenhorst, 1868)
31	*Arthonia digitatae* Hafellner	*Cladonia digitata*	(Hafellner, 1999b)
32	*Arthonia digitispora* Etayo	*Sticta canariensis*	(Etayo, 2002a)

Table 2.1 (continued)

	Species name	Host	References
33	*Arthonia diorygmatis* S. Joshi & Upreti	*Diorygma junghuhnii*	(Joshi et al., 2013)
34	*Arthonia diploiciae* Calat. & Diederich	*Diploicia canescens*	(Calatayu et al., 1995)
35	*Arthonia endocarpa* Kantvilas & Motiej.	*Amandinea neoconglomerata*	(Kantvilas et al., 2023)
36	*Arthonia epifarinosa* Etayo	*Pannaria farinosa*	(Etayo & Sancho, 2008)
37	*Arthonia epimela* (Norman ex Almq.) Minks	*Amandinea punctata*	(Carl, 1892)
38	*Arthonia epiparmelia* Zhurb.	*Parmelia sulcata*	(Zhurbenko et al., 2020)
39	*Arthonia epiramboldia*	*Ramboldia cinnabarina*	(Westberg et al., 2025)
40	*Arthonia epitoninia* Halıcı & Candan	*Toninia*	(Candan et al., 2009)
41	*Arthonia excentrica* Th. Fr.	*Lepraria*	(Fries, 1867a)
42	*Arthonia epitoninia* Halıcı & Candan	*Toninia*	(Candan, et al., 2009)
43	*Arthonia excentrica* Th. Fr.	*Lepraria*	(Fries, 1867a)
44	*Arthonia farinacea* (H. Olivier) R. Sant.	*Ramalina farinacea*	(Santesson, 1960)
45	*Arthonia flavicantis* Wedin & Hafellner	*Pseudocyphellaria flavicans*	(Wedin et al., 1998)

Table 2.1 (continued)

	Species name	Host	References
46	*Arthonia follmanniana* Diederich	*Roccella galapagoensis*	(Diederich, 1995)
47	*Arthonia frostiicola* Hollinger & Lendemer	*Dirinaria frostii*	(Jason et al., 2024)
48	*Arthonia fuscopurpurea* (Tul.) R. Sant.	*Peltigera*	(Santesson, 1960)
49	*Arthonia galligena* Hollinger, Lendemer & P.A. Scott	*Lecanora masana*	(Jason et al., 2024)
50	*Arthonia garajonayi* Etayo	*Porina guaranitica*	(Etayo, 1996a)
51	*Arthonia gelidae* R. Sant.	*Placopsis gelida*	(Santesson, 1986)
52	*Arthonia glacialis* Alstrup & E.S. Hansen	*Rhizoplaca melanophthalma*	(Alstrup et al., 2001)
53	*Arthonia graphidicola* Coppins	*Graphis scripta*	(Coppins, 1989)
54	*Arthonia griseopruinosa* F. Berger & E. Zimm.	*Pertusaria pseudocorallina*	(Berger et al., 2016)
55	*Arthonia glacialis* Alstrup & E.S. Hansen	*Rhizoplaca melanophthalma*	(Alstrup et al., 2001)
56	*Arthonia glacialis* Alstrup & E.S. Hansen	*Rhizoplaca melanophthalma*	(Alstrup et al., 2001)
57	*Arthonia graphidicola* Coppins	*Graphis scripta*	(Coppins, 1989)
58	*Arthonia griseopruinosa* F. Berger & E. Zimm.	*Pertusaria pseudocorallina*	(Berger et al., 2016)

Table 2.1 (continued)

	Species name	Host	References
59	*Arthonia haematommatum* Kalb & Hafellner	*Haematomma alpinum*	(Kalb et al., 1995)
60	*Arthonia haematostigma* Grube & Hafellner	*Ramalina gracilis*	(Grube et al., 1995)
61	*Arthonia hawksworthii* Halıcı	*Dimelaena oreina*	(Halici, 2008)
62	*Arthonia hertelii* (Calat., Barreno & V.J. Rico) Hafellner & Volk. John	*Aspicilia desertorum*	(Hafellner et al., 2006)
63	*Arthonia heterodermiae* Etayo	*Heterodermia*	(Etayo, 2017)
64	*Arthonia infectans* Egea & Torrente	*Lecanographa hypothallina* and *Sparria cerebriforme*	(Egea et al., 1995)
65	*Arthonia ingaderiae* Follmann	*Ingaderia gracillima*	(Follmann et al., 2003)
66	*Arthonia insularis* Kantvilas & Wedin	*Caloplaca eos*	(Kantvilas et al., 2015)
67	*Arthonia intermedia* Matzer	*Phyllobiale and Porina*	(Matzer, 1996)
68	*Arthonia intexta* Almq.	*Lecidella*	(Almquist, 1879)
69	*Arthonia invadens* Coppins	*Schismatomma*	(Coppins, 1989)
70	*Arthonia japewiae* Grube & Holien	*Japewia tornoensis*	(Grube et al., 1997)
71	*Arthonia lecaniicola* van den Boom & Moniri	*Lecania triseptata*	(van den Boom & Moniri, 2018)

Table 2.1 (continued)

	Species name	Host	References
72	*Arthonia lecanoricola* Alstrup & Olech	*Lecanora populicola*	(Alstrup et al., 1996)
73	*Arthonia lecanorina* (Almq.) R. Sant.	*Lecanora albella*	(Santesson et al., 2004)
74	*Arthonia lecideicola* Zhurb. & Stepanchikova	*Lecidea erythrophaea*	(Zhurbenko et al., 2020)
75	*Arthonia lepidiota* (H. Olivier) R. Sant.	*Fuscopannaria praetermissa*	(Santesson et al., 2004)
76	*Arthonia lethariicola* Alstrup & M.S. Cole	*Letharia*	(Alstrup et al., 1998)
77	*Arthonia leucomelodis* F. Berger & E. Zimm.	*Leucodermia leucomelos*	(Berger et al., 2016)
78	*Arthonia lobothalliae* Etayo	*Lobothallia alphoplaca*	(Etayo, 2010c)
79	*Arthonia maculiformis* Wedin & Hafellner	*Pseudocyphellaria glabra* and *P. homoeophylla*	(Wedin et al., 1998)
80	*Arthonia marginalis* Etayo	*Pseudocyphellaria freycinetii*	(Etayo & Sancho, 2008)
81	*Arthonia mazosiicola* Matzer & R. Sant.	*Mazosia phyllosema*	(Grube et al., 1995)
82	*Arthonia microsticta* Vain.	*Fellhanera bouteillei*	(Vainio, 1896)
83	*Arthonia minuta* Vain.	*Pseudocyphellaria coriifolia*	(Vainio, 1915)

Table 2.1 (continued)

	Species name	Host	References
84	*Arthonia navasiana* Etayo	*Lepraria nivalis*	(Etayo, 2010c)
85	*Arthonia obscurior* Triebel	*Pilophorus dovrensis*	(Triebel, 1989)
86	*Arthonia olechiana* Etayo	*Steinera olechiana*	(Etayo et al., 2023)
87	*Arthonia oligospora* Vězda	*Myriolecis crenulata*	(Vězda, 1973)
88	*Arthonia pannariae* Zhurb. & Grube	*Protopannaria pezizoides and Psoroma hypnorum*	(Zhurbenko & Grube, 2010)
89	*Arthonia pantherina* Etayo	*Pertusaria pustulata*	(Etayo, 1993)
90	*Arthonia parmeliae* (C.W. Dodge & G.E. Baker) D. Hawksw. & Iturr.	*Physcia caesia*	(Hawksworth & Iturriaga, 2006)
91	*Arthonia peltigerae* Th. Fr.	*Peltigera and Solorina*	(Fries, 1866)
92	*Arthonia pepei* Etayo & Pérez-Ort.	*Parmelina cryptotiliacea*	(Etayo et al., 2016)
93	*Arthonia physciae* Vain.	*Physcia*	(Vainio, 1909)
94	*Arthonia physcidiicola* Frisch & G. Thor	*Physcidia wrightii*	(Frisch et al., 2014)
95	*Arthonia plectocarpoides* (S.Y. Kondr., D.J. Galloway & D. Hawksw.) Wedin & S.Y. Kondr.	*Pseudocyphellaria scabrosa*	(Wedin et al., 1997)
96	*Arthonia polia* Etayo	*Diploicia canescens*	(Etayo, 2010a)
97	*Arthonia pragensis* Horáková	*Caloplaca teicholyta*	(Kocourková, 1994)

Table 2.1 (continued)

	Species name	Host	References
98	*Arthonia prominens* Follmann	*Ingaderia gracillima*	(Follmann et al., 2003)
99	*Arthonia protoparmeliae* Etayo	*Protoparmelia badia*	(Etayo, 2010c)
100	*Arthonia protoparmeliopsidis* Etayo & Diederich	*Protoparmeliopsis muralis*	(Etayo & Diederich, 2009)
101	*Arthonia pseudocyphellariae* Wedin	*Pseudocyphellaria multifida*	(Wedin, 1993)
102	*Arthonia pseudopegraphina* Matzer	*Mazosia*	(Matzer, 1996)
103	*Arthonia punctella* Nyl.	*Diplotomma alboatrum* and *D. chlorophaeum*	(Carroll 1859; Cannon et al., 2020)
104	*Arthonia rangiformicola* Brackel & Etayo	*Cladonia rangiformis*	(Brackel, 2015)
105	*Arthonia rimularum* (Wedd.) Monnat & Cl. Roux	*Myriolecis actophila*, *M. massei*, and *Lecanora helicopis.*	(Roux et al., 2020a)
106	*Arthonia rinodinicola* Candan & Halıcı	*Rinodina oleae*	(Clauzade et al., 1989; Candan et al., 2009)
107	*Arthonia rufidula* (Hue) D. Hawksw.	*Umbilicaria*	(Hawksworth, 1991)
108	*Arthonia sagenidii* Vězda & Kantvilas	*Sagenidium molle*	(Kantvilas et al., 1992)

Table 2.1 (continued)

	Species name	Host	References
109	*Arthonia sampaianae* (Diederich & Etayo) Ertz & Diederich	*Fuscopannaria sampaiana*	(Ertz et al., 2005)
110	*Arthonia santessoniana* Wedin & Hafellner	*Pseudocyphellaria scabrosa*	(Wedin et al., 1998)
111	*Arthonia santessonii* Matzer	*Porina applanata*	(Matzer, 1996)
112	*Arthonia scrobiculatae*	*Lobaria scrobiculata*	(Westberg et al., 2025)
113	*Arthonia scrobiculatae*	*Lobaria scrobiculata*	(Westberg et al., 2025)
114	*Arthonia semi-immersa* Wedin & Hafellner	*Pseudocyphellaria*	(Wedin et al., 1998)
115	*Arthonia sherparum* Grube & Matzer	*Lecanora sherparum*	(Grube et al., 1997)
116	*Arthonia squamarinae* Etayo	*Squamarina lentigera*	(Etayo, 2008)
117	*Arthonia stevensoniana* R.C. Harris & Lendemer	*Haematomma accolens*	(Lendemer et al., 2016)
118	*Arthonia stictaria* Nyl.	*Sticta aurata*	(Nylander, 1867)
119	*Arthonia stipitata* M.M.E. Alves, Aptroot & M. Cáceres	*Bacidina, Fellhanera*	(Alves et al., 2014)
	Arthonia subaggregata Wedin & Hafellner	*Pseudocyphellaria hirsuta*	(Wedin et al., 1998),
120	*Arthonia subconveniens* Nyl.	*Ricasolia dissecta*	(Nylander, 1867)

Table 2.1 (continued)

	Species name	Host	References
121	*Arthonia subclemens* Hafellner, Grube & Muggia	*Lecanora polytropa*	(Hafellner et al., 2023)
122	*Arthonia subfuscicola* (Linds.) Triebel	*Lecanora albella* and *L. carpinea*	(Triebel et al.,1991)
123	*Arthonia subgraphidicola* Ertz, Common & Diederich	*Graphis assimilis*	(Diederich et al., 2019)
124	*Arthonia sytnikii* S.Y. Kondr.	*Xanthoria ligulata*	(Moser, 1996)
125	*Arthonia tavaresii* Grube & Hafellner	*Anthracothecium and Pyrenula*	(Grube et al., 1995)
126	*Arthonia tetraspora* S.Y. Kondr. & Kärnefelt	*Caloplaca chilensis*	(Kärnefelt et al., 2002)
127	*Arthonia thelotrematis* Coppins	*Thelotrema lepadinum*	(Coppins, 1989)
128	*Arthonia toensbergii* Holien & Frisch	*Mycoblastus affinis*	(Frisch et al., 2018)
129	*Arthonia tremelloides* Etayo	*Heterodermia*	(Etayo, 2002a)
130	*Arthonia triebeliae* Zhurb.	*Dactylina arctica*	(Zhurbenko, 2002)
131	*Arthonia urceolata* (Elenkin) Calat., Barreno & V.J. Rico	*Aspicilia*	(Calatayud et al., 2004)
	Arthonia varians (Davies) Nyl.	*Lecanora rupicola* and *L. helicopis*	(Nylander, 1861)
132	*Arthonia vorsoeensis* Alstrup	*Buellia punctata*	(Alstrup et al., 2004),
133	*Arthonia xanthoparmeliarum* Etayo	*Xanthoparmelia*	(Etayo & Sancho, 2008)

Arthothelium A. Massal. (1-36)

Index Fungorum 331, Facesoffungi, MycoBank, GenBank

Classification: Arthoniaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Type species: *Arthothelium scandinavicum* Th. Fr.

Accepted lichenicolous species

Arthothelium hymeniicola Ertz & Fryday: in the hymenium *Bacidia* (Damien 2017)

Briancoppinsia Diederich, Ertz, Lawrey & van den Boom (1)

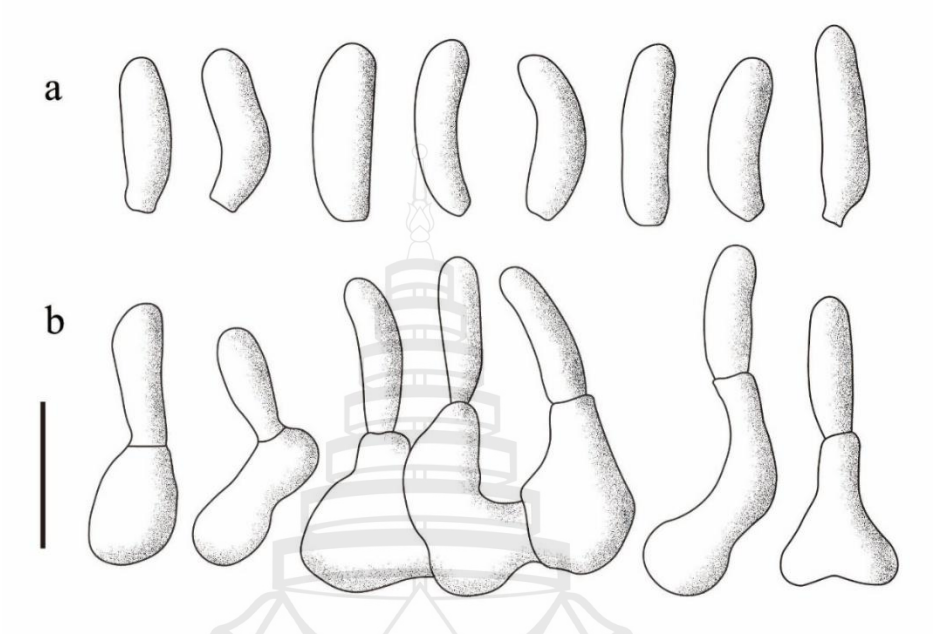
Index Fungorum 519655, Facesoffungi, MycoBank, GenBank

Classification: Arthoniaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Briancoppinsia (Arthoniaceae) was established based on phylogenic analysis by Diederich et al. (2012) to accommodate the sole lichenicolous *Briancoppinsia cytospora*, which grows on the thallus of the lichen *Lecanora conizaeoides*. This species was first introduced as *Phyllosticta cytospora* by Vouaux (1914). In the phylogenetic tree based on two loci (nuLSU +mtSSU), *Briancoppinsia* is sister to the clade containing *Arthothelium galapagoense* and *Crypthothecia candida* (Diederich et al., 2012).

Briancoppinsia is characterized by its pycnidial conidiomata partl, which are partly immersed in the host thallus or apothecia, with dark brown to black coloration. It has ampulliform conidiogenous cells, and hyaline, aseptate, basally truncate, narrowly ellipsoidal, and slightly curved conidia (Diederich et al., 2012; Cannon et al., 2020). This species is lichenicolous on various lichen species of Parmeliaceae, such as *Evernia, Hypogymnia* and *Parmelia* spp., and occasionally grows on *Lecanora* spp. (Cannon et al., 2020). Currently, there is only one species in this genus, with two genes (LSU and mtSSU) 4 sequences available in Genbank.

Type species: *Briancoppinsia cytospora* (Vouaux) Diederich, Ertz, Lawrey & van den Boom, on *Lecanora conizaeoides, Parmotrema, Evernia* and *Cladonia*.



Note a Conidia. b Conidiogenous cells and conidia. Scale bar = 5 μm.

Source Redrawn from Diederich et al. (2012)

Figure 2.1 *Briancoppinsia cytospora*

Reichlingia Diederich & Scheid. (1-6)

Index Fungorum 27633, Facesoffungi, MycoBank, GenBank

Classification: Arthoniaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Type species: *Reichlingia leopoldii* Diederich & Scheid.

Accepted lichenicolous species

Reichlingia leopoldii Diederich & Scheid, on sterile corticolous lichen. (Diederich et al., 1996)

Family Lecanographaceae Ertz, Tehler, G. Thor & Frisch

Lecanographa Egea & Torrente (5-37)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Lecanographaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Type species:

Lecanographa lyncea (Sm.) Egea & Torrente

Table 2.2 Accepted lichenicolous species of *Lecanographa*

	Species name	**Host**	**References**	**Remarks**
1	*Lecanographa dialeuca* (Cromb.) Egea & Torrente	*Roccella*	(Egea et al., 1994)	Facultative Lichenicolous =*Opegrapha dialeuca* Cromb.
2	*Lecanographa imitans* Werner & Follmann	*Roccella humboldtiana* var. *hypochromatica*	(Follmann et al., 2003)	
3	*Lecanographa occidentalis* Egea & Torrente	*Roccellina*	(Egea et al., 1994)	
4	*Lecanographa rosea* Etayo & Paz-Berm.	*Roccella montagnei*	(Paz-Bermúdez et al., 2019)	
5	*Lecanographa rinodinae* (Vˇezda) R. Sant.	*Rinodina nimbosa*	(Santesson et al., 2004)	=*Opegrapha rinodinae* Vezda

Mixtoconidium Etayo (3)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Lecanographaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Mixtoconidium was established by Etayo (1995) to accommodate the type species *M. canariense*, found on *Ramalina canariensis*. Etayo suggested that *M. canariense* might be identical to the asexual morph of *Celidium insidens*, a fungus associated with *Ramalina fraxinea*. Etayo (1996) described the sexual morph of *Mixtoconidium* from additional samples. Since *M. canariense* was initially based only on the asexual morph, Van den Boom & Etayo (2017) designated *M. insidens* as the neotype, as it exhibits both morphs. In addition, two new combinations were described: *Mixtoconidium insidens* from *Celidium insidens*, growing on *Ramalina fraxinea*, and *Mixtoconidium nashi*, from *Plectocarpon nashi*, found on the thallus of *Niebla robusta*.

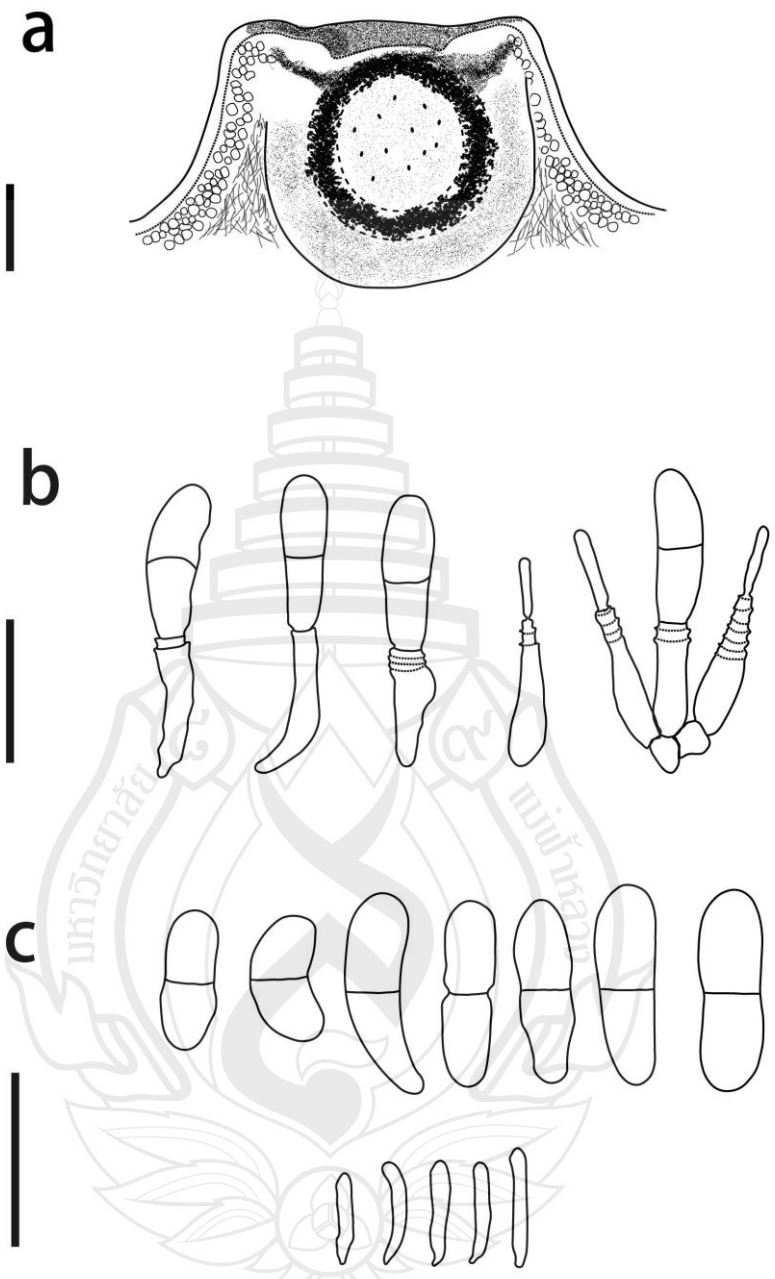
The asexual morph of *Mixtoconidium* is characterized by subglobose, dark brown to black conidiomata, subcylindrical or obclavate hyaline conidiogenous cells, and hyaline, cylindrical or allantoid macroconidia with a single septum, which are straight or slightly curved, as well as bacilliform, non-septate microconidia (Etayo 1995a). The sexual morph features flat to convex, dark brown ascomata covered with orange pruina, clavate asci containing eight spores each, and brownish ascospores with three septa and a surrounding halo (Van den Boom & Etayo, 2017). Diederich et al. (2018) placed *Mixtoconidium* within Arthoniales genera incertae sedis. Subsequently, Wijayawardene et al. (2020) and Hyde et al. (2024) placed it within Lecanographaceae (Arthoniales). The phylogenetic position of *Mixtoconidium* needs a confirmation when the molecular data available in the future.

Type species: *Mixtoconidium insidens* (Vouaux) Etayo & van den Boom

= *Celidium insidens* Vouaux

Table 2.3 Accepted lichenicolous species of *Mixtoconidium*

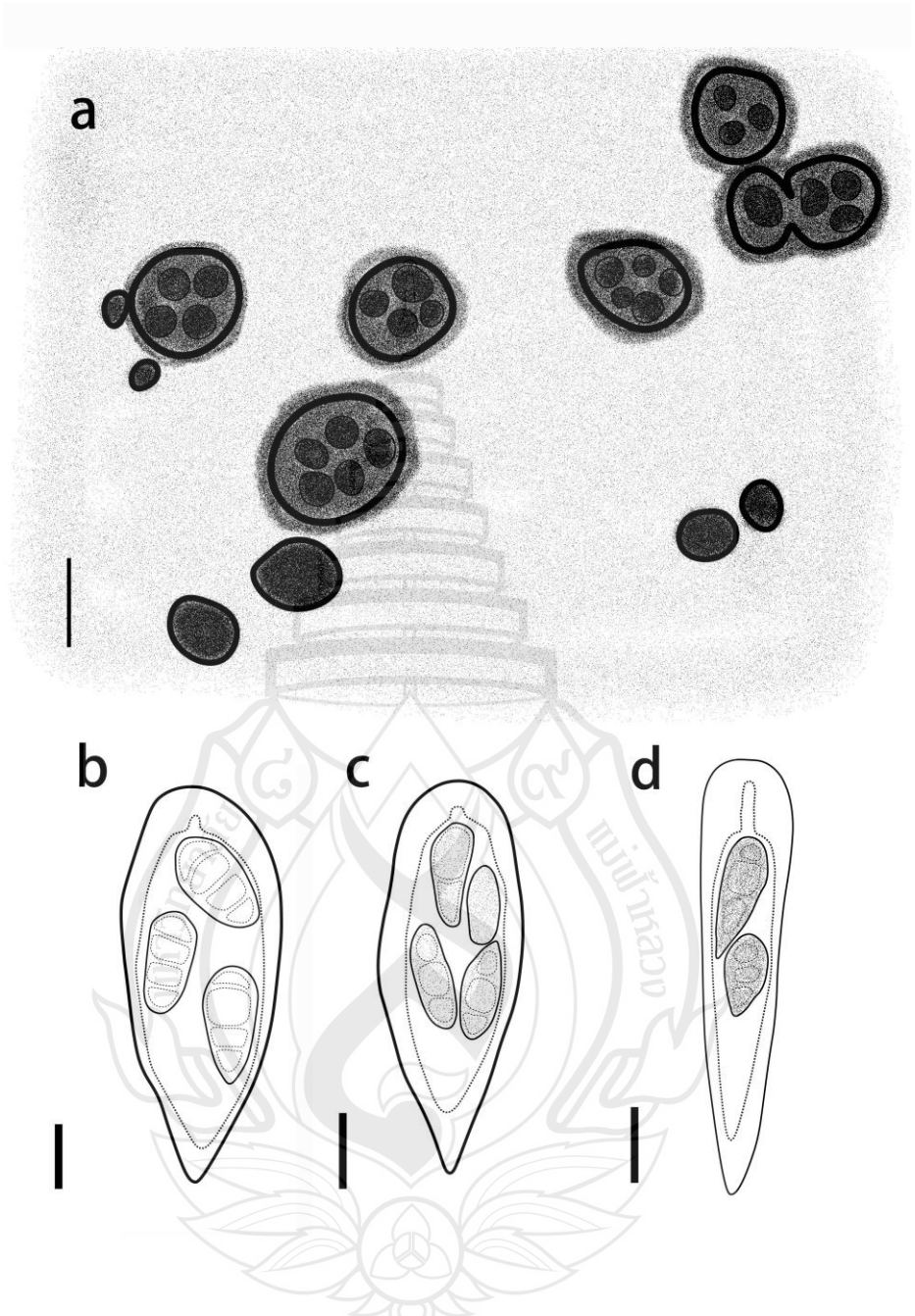
	Species name	**Host**	**References**	**Remarks**
1	*Mixtoconidium canariense* Etayo	*Ramalina canariensis*	(Etayo, 1995a)	
2	*Mixtoconidium insidens* (Vouaux) Etayo & van den Boom	*Ramalina fraxinea*	(Etayo, 1995a; Van den Boom & Etayo, 2017)	= *Celidium insidens* Vouaux
3	*Mixtoconidium nashi* (Hafellner) Etayo & van den Boom	*Niebla robusta*	(Van den Boom & Etayo, 2017)	= *Plectocarpon nashii* Hafellner



Note a Section of conidiomata; b Conidiogenous cells with macroconidia and microconidia; **c** Septate macroconidia and bacillar microconidia. Scale bars: a = 100 µm, b, c = 10µm.

Source Redrawn from Etayo (1995a)

Figure 2.2 Asexual morph of *Mixtoconidium insidens*



Note a Apothecia; b-c Immature ascus with colorless spores or light brown spores; c Mature ascus with brownish spores. Scale bars: a = 1mm, b-d = 10µm.

Source Redrawn from Van den Boom (2017) & webpage Fungi of Great Britain and Ireland (2024)

Figure 2.3 Sexual morph of *Mixtoconidium insidens*

Phacographa Hafellner (4)

Index Fungorum 513173, Facesoffungi, MycoBank, GenBank

Classification: Lecanographaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Phacographa was introduced by Hafellner (2009) to accommodate some lichenicolous ascomycetes commonly treated as *Opegrapha* species. The genus is characterized by roundish, carbonized ascomata with a persistently unilocular centrum, a well-developed exciple, and broadly cylindrical to subclavate, short-stalked asci with a hemiamyloid apical ring. The ascospores are colourless, 3-septate, with rounded ends and surrounded by a thin gelatinous sheath that degenerates to form verruculose ornamentation with age (Cannon et al., 2021).

Hafellner (2009) consider the ascomatal shape of *Phacographa* is more similar to *Lecanactis* than *Opegrapha*, which is characterized by hysterothecioid ascomata. Therefore, the new genus *Phacographa* was proposed. In addition, a new species and two new combinations was described, *Phacographa protoparmeliae*, which grows on *Protoparmelia badia* (Hoffm.) Hafellner, *P. glaucomaria* (Nyl.) Hafellner, originally descrbied as *Lecidea glaucomaria* Nyl., and *P. zwackhii* (A. Massal. ex Zwackh) Hafellner, originally described as *Leciographa zwackhii* A. Massal. ex Zwackh. *Phacographa glaucomaria* was designated as the type species (Hafellner 2009). Frisch et al. (2022) transferred *Phacographa lapponica* from *Epicladonia lapponica* Ihlen, which grows on *Pleopsidium chlorophanum*.

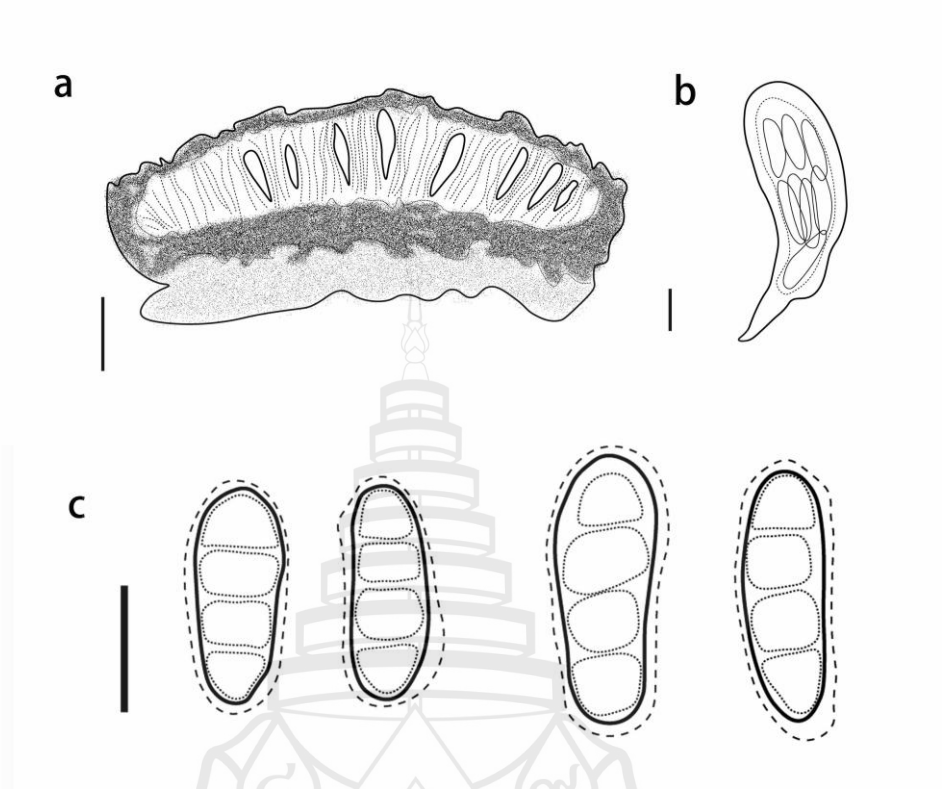
To date, four species are recognized in this genus, with 16 sequences belong to LSU, RPB2, mtSSU and ITS in Genbank (2024). The *Phacographa* was included in the phylogenetic analysis for the first time by Frisch et al. (2014), which was placed within Lecanographaceae (Arthoniales).

Type species:

Phacographa glaucomaria (Nyl.) Hafellner

Table 2.4 Accepted lichenicolous species of *Phacographa*

	Species name	Host	References	Remarks
1	*Phacographa glaucomaria* (Nyl.) Hafellner	*Parmelia glaucoma*	(Hafellner, 2009)	= *Lecidea glaucomaria* Nyl.
2	*Phacographa lapponica* (Ihlen) Frisch & Ihlen	*Pleopsidium chlorophanum*	(Ihlen et al., 2005; Frisch et al., 2022)	= *Epicladonia lapponica* Ihlen
3	*Phacographa protoparmeliae* Hafellner	*Protoparmeliae badiae*	(Hafellner, 2009)	
4	*Phacographa zwackhii* (A.Massal. ex Zwackh) Hafellner	*Phlyctis argena* and *Phlyctis agelaea*	(Hafellner, 2009)	= *Leciographa zwackhii* A. Massal. ex Zwackh



Note a section of apothecium. b Asci. c Ascospores. Scale bar: a = 100 μm, b, c = 10 μm.

Source Redrawn from Hafellner (2009)

Figure 2.4 *Phacographa glaucomaria*

Plectocarpon Fée (44-45)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Lecanographaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Plectocarpon was introduced by Fée (1825) to replace the invalid name '*Delisea* Fée', because the latter was considered as the homonym of '*Delisea* Lamouroux' which was published in 1819. The epithet '*pseudosticta*' was illustrated with a coloured picture by Fée (1825) but not simultaneously combined into *Plectocarpon*. Fée (1837) combined the epithet *pseudosticta* into *Plectocarpon*, with a brief description including

ovoid thecae, ending in blunt points, thecae arranged in a double series, numerous, small, rounded, and difficult to escape from their envelopes. Dodge (1948) used to treat *Plectocarpon pseudosticta* as a synonym of *Pseudocyphellaria glabra* (Hook. f. & Taylor) C.W. Dodge. However, Hawksworth & Gallowy (1984) rechecked the original material from Delise's herbarium and proposed the species *Pseudocyphellaria delisea* (Delise) D. Gallowy & P. James, as the synonym of *Plectocarpon pseudosticta* and designated *Pl. pseudosticta* as the type species of *Plectocarpon* (Fée 1825 & 1837; Dodge 1948; Hawksworth et al., 1984).

Santesson (1960) strongly recalled *Plectocarpon* as dothideaceous fungi based on its multilocular ascomata. Eriksson & Hawksworth (1991) included the genus in the Arthoniales incertae sedis, then Galloway (1992) considered it as a member of the Arthoniaceae. Diederich & Etayo (1994) placed *Plectocarpon* within the family Opegraphaceae (Opegraphales) and gave a detailed description.

Ertz et al. (2005) provided a comprehensive description of *Plectocarpon* and introduced 14 new species in the first monograph on the genus. Although the relationships between *Plectocarpon* and related genera were discussed, and the similarities and differences with *Opegrapha* were noted, the delimitation between the two remained unclear. Frisch et al. (2014) conducted a phylogenetic study of Arthoniales using mtSSU, nLSU, and RPB2 sequence data, which showed that *Plectocarpon* clusters with *Alyxoria* and *Zwackhia* within the Lecanographaceae clade. Consequently, the genus is broadly accepted within this family.

The genus is characterized by gall-forming ascomata lichenicolous on the thallus of macrolichens and with verrucose surface, often divided in several confluent or isolated apothecia- or perithecia-like loculi by stromatic tissues, clavate-cylindrical *Opegrapha*-type asci with 2-8 spores and the colorless, fusiform ascospores with 3 septa and a distinct perispore. The pycnidia immersed in the stromata and the hyaline, bacilliform conidia with a truncate base (Santesson 1960; Eriksson et al., 1991;

Galloway 1992; Diederich & Etayo 1994).

To date, 45 species are recognized in *Plectocarpon*, 44 of which are lichenicolous, with five sequences from three species (*P. lichenum*, *P. nephromeum*, and *P. scrobiculatae*) available in GenBank.

Type species: *Plectocarpon pseudosticta* (Fée) Fée', on *Pseudocyphellaria freycinetii* and *Ps. glabra*

= *Delisea pseudosticta* Fée

Table 2.5 Accepted lichenicolous species of *Plectocarpon*

	Species name	Host	References	Remarks
1	*Plectocarpon aequatoriale* Etayo	*Sticta*	(Etayo, 2017)	
2	*Plectocarpon armoricum* Brackel	*Xanthoparmelia*	(Brackel, 2024)	
3	*Plectocarpon arthonioides* Diederich	*Lobaria isidiophora*	(Aptroot et al., 1997)	
4	*Plectocarpon bunodophori* Wedin, Ertz & Diederich	*Bunodophoron patagonicum*	(Ertz et al., 2005)	
5	*Plectocarpon cladoniae* R. Sant.	*Cladonia pyxidata*	(Santesson, 1994a)	
6	*Plectocarpon concentricum* Ertz, Diederich & Wedin	*Pseudocyphellaria homeophylla*	(Ertz et al., 2005)	
7	*Plectocarpon coppinsii* Ertz & Diederich	*Pseudocyphellaria crocata*	(Ertz et al., 2005)	
8	*Plectocarpon cristalliferum* Christnach, Ertz & Diederich	*Sticta*	(Ertz et al., 2005)	

Table 2.5 (continued)

	Species name	Host	References	Remarks
9	*Plectocarpon diedertzianum* Y. Joshi, S. Upadhyay & K. Chandra	*Flavoparmelia, Myelochroa, Parmotrema* and *Punctelia*	(Joshi et al., 2016)	
10	*Plectocarpon dimorphosporum* Etayo, Flakus & Kukwa	*Ricasolia patinifera*	(Etayo et al., 2018)	
11	*Plectocarpon dirinariae* Ertz & van den Boom	*Dirinaria applanata*	(Ertz et al., 2012)	
12	*Plectocarpon encausticum* (Nyl.) R. Sant.	*Parmelia encausta*; *Brodoa intestiniformis*	Santesson, 1993a)	= *Epiphora encaustica* Nyl.
13	*Plectocarpon galapagoense* Ertz & Bungartz	*Sarcographa tricosa*	(Hyde et al., 2019)	
14	*Plectocarpon gallowayi* (S.Y. Kondr.) Ertz & Diederich	*Pseudocyphellaria dissimilis*	(Ertz et al., 2005)	= *Melaspilea gallowayi* S.Y. Kondr.
15	*Plectocarpon gayanum* Etayo	*Siphula*	(Etayo & Sancho, 2008)	
16	*Plectocarpon hypogymniae* Zhurb. & Diederich	*Hypogymnia bitteri*	(Zhurbenko et al., 2008)	
17	*Plectocarpon lambinonii* Diederich & Etayo	*Lobaria retigera*	(Diederich & Etayo, 1994)	

Table 2.5 (continued)

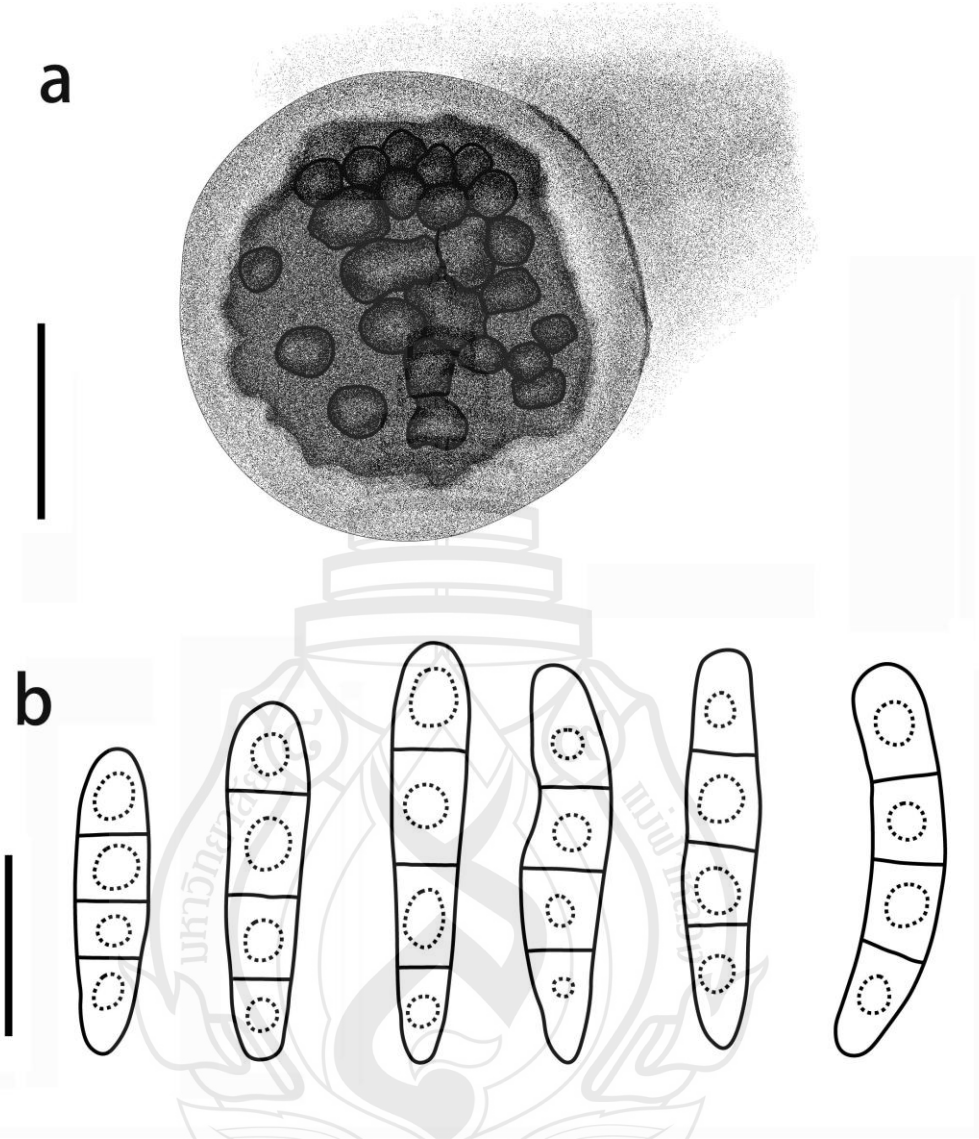
	Species name	Host	References	Remarks
18	*Plectocarpon latisporum* Ertz, Diederich & Wedin	*Pseudocyphellaria coriifolia*	(Ertz et al., 2005)	
19	*Plectocarpon leuckertii* (S.Y. Kondr. & D.J. Galloway) Ertz & Diederich	*Pseudocyphellaria intricata* and *P. norvegica*	(Ertz et al., 2005)	= *Opegrapha leuckertii* S.Y. Kondr. & D.J. Galloway
20	*Plectocarpon lichenum* (Sommerf.) D. Hawksw.	*Lobaria anomala, L. anthraspis* and *L. pulmonaria*	(Hawksworth et al., 1984)	= *Dothidea lichenum* Sommerf.
21	*Plectocarpon linitae* (R. Sant.) Wedin & Hafellner	*Lobaria linita*	(Wedin et al., 1998)	= *Arthonia linitae* R. Sant.
22	*Plectocarpon macaronesiae* Diederich, Etayo & Sérus.	*Lobaria immixta* and *L. macaronesiae*	(Diederich & Etayo, 1994)	
23	*Plectocarpon melanohaleae* Christnach, Ertz & Diederich	*Melanohalea ushuaiensis*	(Ertz et al., 2005)	
24	*Plectocarpon nephromeum* (Norman) R. Sant.	*Nephroma bellum*	(Santesson, 1993a)	= *Celidium lichenum* var. *nephromea* Norman
25	*Plectocarpon obtectum* Ertz & Diederich	*Pseudocyphellaria encoensis*	(Ertz et al., 2005)	
26	*Plectocarpon opegraphoideum* Christnach, Ertz, Diederich & Wedin	*Pseudocyphellaria homeophylla* and *P. multifida*	(Ertz et al., 2005)	

Table 2.5 (continued)

	Species name	Host	References	Remarks
27	*Plectocarpon parmeliarum* Y. Joshi	*Parmelia meiophora*	(Joshi et al., 2018)	
28	*Plectocarpon parmotrematis* Etayo, Flakus & Kukwa	*Parmotrema reticulatum*	(Etayo et al., 2018)	
29	*Plectocarpon peltigerae* Zhurb., Ertz, Diederich & Miądl.	*Peltigera leucophlebia*	(Ertz et al., 2003)	
30	*Plectocarpon pseudocyphellariae* Diederich	*Pseudocyphellaria gilva*	(Aptroot et al., 1997)	
31	*Plectocarpon pseudoleuckertii* Diederich, Ertz & Wedin	*Pseudocyphellaria coriifolia*	(Ertz et al., 2005)	
32	*Plectocarpon pseudosticta* (Fée) Fée	*Pseudocyphellaria freycinetii* and *P. glabra*	(Fée, 1825 & 1837)	= *Delisea pseudosticta* Fée
33	*Plectocarpon ramalinae* Etayo & Flakus	*Ramalina celastri*	(Aptroot et al., 1997)	
34	*Plectocarpon santessonii* Zhurb.	*Parmotrema pseudonilgherrense*	(Zhurbenko, 2021e)	
35	*Plectocarpon scrobiculatae* Diederich & Etayo	*Lobaria scrobiculata*	(Diederich & Etayo, 1994)	
36	*Plectocarpon serusiauxii* Diederich & Etayo	*Sticta*	(Ertz et al., 2005)	

Table 2.5 (continued)

	Species name	Host	References	Remarks
37	*Plectocarpon stereocaulicola* Kukwa, Etayo & Flakus	*Stereocaulon*	(Kukwa et al., 2012)	
38	*Plectocarpon sticticola* Wedin & Diederich	*Sticta caliginosa*	(Ertz et al., 2005)	
39	*Plectocarpon tibellii* Ertz & Diederich	*Pseudocyphellaria rubella*	(Ertz et al., 2005)	
40	*Plectocarpon triebeliae* Ertz & Diederich	R*icasolia quercizans*	(Ertz et al., 2005)	
41	*Plectocarpon usnea* Diederich & Etayo	*Usnea exasperata*	(Diederich & Etayo, 1994)	
42	*Plectocarpon usneaustralis* Etayo	*Usnea*	(Etayo, 2007)	
43	*Plectocarpon venustum* Ertz, Coppins & Diederich	*Nephroma papillosum*	(Ertz et al., 2005)	
44	*Plectocarpon violaceum* Ertz, R. Sant., Diederich & Wedin	*Nephroma antarcticum*	(Ertz et al., 2005)	



Note a Apothecia. b, Ascospores. scale bar: a = 1mm, b = 10μm.

Source Redrawn from Hawksworth et al. (1984).

Figure 2.5 *Plectocarpon pseudosticta*

Family Opegraphaceae Stizenb.

Leciographa A. Massal. (3-39)

Index Fungorum 2702, Facesoffungi, MycoBank, GenBank

Classification: Opegraphaceae, Arthoniales, Arthoniomycetes, Ascomycota,

Fungi

Type species: *Lecanographa lyncea* (Sm.) Egea & Torrente

Table 2.6 Accepted lichenicolous species of *Lecanographa*

	Species name	Host	References	Remarks
1	*Leciographa furfuracea* (Anzi) Rehm ex Sacc. & D. Sacc.	*Lecanora rupicola* and *Rhizocarpon*	(Saccardo et al., 1906)	= *Celidium furfuraceum* Anzi
2	*Leciographa gyrolophii* (A. Massal.) Vouaux	*Dictyonema*	(Vouaux, 1914)	= *Celidiopsis gyrolophii* A. Massal.
3	*Leciographa nephromatis* Stein	*Nephroma*	(Fritze et al., 1870)	

Opegrapha Ach. (73-500^{+})

Index Fungorum 3582, Facesoffungi, MycoBank, GenBank

Classification: Opegraphaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Type species:

Opegrapha vulgata (Ach.) Ach. (lichen)

Table 2.7 Accepted lichenicolous species of *Opegrapha*

	Species name	Host	References	Remarks
1	*Opegrapha agelaea* Fée	pyrenocarpous lichen	(Fée, 1837)	
2	*Opegrapha anomea* Nyl.	*Lepra, Ochrolechia, Pertusaria* and *Varicellaria*	(Nylander, 1857)	

Table 2.7 (continued)

	Species name	Host	References	Remarks
3	*Opegrapha arthoniicola* Coppins & S.Y. Kondr.	*Arthonia radiata*	(Coppins et al., 2021)	
4	*Opegrapha bacidiae* R. Sant.	*Bacidia brasiliensis*	(Santesson, 1952)	
5	*Opegrapha blakii* Ertz & Diederich	*Ochrolechia*	(Ertz et al., 2004)	
6	*Opegrapha brevis* Coppins	*Thelotrema petractoides*	(Coppins, 1987)	
7	*Opegrapha brevissima* Kalb & Hafellner	*Haematomma hilare*	(Kalb et al., 1995)	
8	*Opegrapha briancoppinsii* S.Y. Kondr., Lőkös & Hur	*Porpidia albocaerulescens*	(Kondratyuk et al., 2016)	
9	*Opegrapha brigantina* Hafellner	*Brigantiaea*	(Hafellner, 1985a)	
10	*Opegrapha bryoriae* Zhurb.	*Bryoria capillaris*	(Zhurbenko & Vershinina, 2014)	
11	*Opegrapha buelliae* Zhurb.	*Buellia insignis*	(Zhurbenko, 2013b)	
12	*Opegrapha chapsae* Etayo	*Chapsa*	(Etayo, 2017)	
13	*Opegrapha cladoniicola* Ertz & Diederich	*Cladonia ochrolechia*	(Ertz & Diederich, 2003)	
14	*Opegrapha cryptotheciae* Matzer	*Cryptothecia candida*	(Matzer, 1996)	
15	*Opegrapha diffracticola* R.C. Harris & Ladd	*Bacidia diffracta*	(Harris et al., 2007)	

Table 2.7 (continued)

	Species name	Host	References	Remarks
16	*Opegrapha ectolechiacearum* Matzer & R. Sant.	*Calopadia, Loflammia* and *Sporopodium leprieurii*	(Matzer, 1996)	
17	*Opegrapha encephalographoidea* Diederich	*Pyrenula*	(Aptroot et al., 1997)	
18	*Opegrapha enterographae* Etayo	*Enterographa*	(Etayo, 2010a)	
19	*Opegrapha epiporina* Matzer	*Phyllobiale* and *Porina epiphylla*	(Matzer, 1996)	
20	*Opegrapha foreaui* (C. Moreau & M. Moreau) Hafellner & R. Sant.	*Heterodermia*	(Hafellner, 1998a)	= *Telimena foreaui* C. Moreau & M. Moreau
21	*Opegrapha foreaui* (C. Moreau & M. Moreau) Hafellner & R. Sant.	*Heterodermia*	(Hafellner, 1998a)	= *Telimena foreaui* C. Moreau & M. Moreau
22	*Opegrapha geographicicola* (Arnold) Hafellner	*Rhizocarpon geographicum*	(Hafellner, 1994a)	= *Phaeospora geographicicola* Arnold
23	*Opegrapha gregalis* Vain.	pyrenocarpous lichen	(Vainio, 1921b)	
24	*Opegrapha gyalolechiae* Y. Joshi	*Gyalolechia flavorubescens*	(Joshi, 2018)	

Table 2.7 (continued)

	Species name	Host	References	Remarks
25	*Opegrapha hafellneri* E. Zimm., Etayo & F. Berger	*Placopsis gelida*	(Berger et al., 2016)	
26	*Opegrapha hellespontica* Vondrák & Kocourk.	*Caloplaca aurantia*	(VondrAK et al., 2008)	
27	*Opegrapha hochstetteri* Coppins	*Verrucaria hochstetteri* and *V. muralis*	(Coppins et al., 2021)	
28	*Opegrapha inconspicua* Ertz, S.R. Clayden & K.E. Driscoll	*Verrucaria aethiobola*	(Ertz et al., 2021)	
29	*Opegrapha insidens* (J. Steiner) S.Y. Kondr.	*Caloplaca* and *Verrucaria*	(Kondratyuk & Kudratov, 2002)	= *Leciographa insidens* J. Steiner
30	*Opegrapha invadens* Etayo	*Pannaria farinosa*	(Etayo, 2007)	
31	*Opegrapha kalbii* Matzer	*Byssoloma polychromum*	(Matzer, 1996)	
32	*Opegrapha lamyi* (O.J. Rich. ex Nyl.) Triebel	*Lecanora*	(Triebel, 1989)	= *Lecidea lamyi* O.J. Rich. ex Nyl.
33	*Opegrapha lepidella* Nyl.	*Pertusaria*	(Nylander, 1886)	
34	*Opegrapha lichenicola* G. Thor, Lücking & Tat.	*Matsumoto Porina*	(Thor et al., 2000)	
35	*Opegrapha lopezariae* Etayo & Sipman	*Lopezaria*	(Etayo, 2017)	
36	*Opegrapha matzeri* Lücking	*Amazonomyces sprucei*	(Lücking, 1998)	

Table 2.7 (continued)

	Species name	Host	References	Remarks
37	*Opegrapha maligna* Triebel	*Lecidea fuscoatra*	(Triebel, 1989)	
38	*Opegrapha mazosiae* Matzer	*Mazosia melanophthalma*	(Matzer, 1996)	
39	*Opegrapha melanospila* Müll. Arg.	*Parmelia perforata var. ciliata*, *Parmotrema*	(Müller, 1877)	
40	*Opegrapha nigeriensis* C.W. Dodge	*Thelotrema*	(Dodge, 1953)	
41	*Opegrapha parasitica* (A. Massal.) H. Olivier	*Aspicilia calcarea*	(Olivier, 1906)	= *Leciographa parasitica* A. Massal.
42	*Opegrapha parmeliiperda* Ertz, K.E. Driscoll & S.R. Clayden	*Parmelia squarrosa*	(Ertz et al., 2021)	
43	*Opegrapha perturbans* Follmann	*Ingaderia pulcherrima*	(Follmann et al., 2003)	
44	*Opegrapha pertusariicola* Coppins & P. Jame	*Pertusaria leioplaca*	(Coppins et al., 1979)	
45	*Opegrapha phaeophysciae* R. Sant., Diederich, Ertz & Christnach	*Phaeophyscia hispidula*	(Ertz et al., 2005)	
46	*Opegrapha phlyctidicola* (Vouaux) Etayo	*Phlyctis*	(Etayo, 1996a)	= *Celidium phlyctidicola* Vouaux
47	*Opegrapha phyllobathelii* Matzer & R. Sant.	*Phyllobathelium epiphyllum*	(Matzer, 1996)	

Table 2.7 (continued)

	Species name	Host	References	Remarks
48	*Opegrapha phylloporinae* Müll. Arg.	*Phylloporina epiphylla*, *Porina*	(Müller, 1890)	
49	*Opegrapha physciae* Y. Joshi Physcia	*Physcia sorediosa*	(Joshi, 2019)	
	Opegrapha physcidiae Kalb & Elix	*Physcidia australasica*	(Kalb & Elix, 1995)	
50	*Opegrapha pigozziana* Etayo & Aptroot	*Thelotrema glaucopallens*	(Javier et al., 2005)	
51	*Opegrapha plectocarpoidea* Diederich	*Phaeographis*	(Aptroot et al., 1997)	
52	*Opegrapha porinicola* Matzer	*Phyllobiale* and *Porina epiphylla*	(Matzer, 1996)	
53	*Opegrapha pulvinata* var. *pulvinata* Rehm ex Arnold	*Dermatocarpon*, *Catapyrenium, Endocarpon* and *Staurothele*		
54	*Opegrapha reactiva* (Alstrup & D. Hawksw.) Etayo & Diederich	*Hymenelia lacustris*	(Etayo & Sancho, 2008)	= *Kalaallia reactiva* Alstrup & D. Hawksw.
55	*Opegrapha reinkellae* Follmann	*Roccella lirellina*	(Follmann et al., 2003)	
56	*Opegrapha rotunda* Hafellner	*Physconia distorta*	(Hafellner, 1994a)	
57	*Opegrapha rouxiana* Nav.-Ros. & Hladun	*Polyblastia nidulans*	(Navarro-Rosinés & Hladun, 1995)	

Table 2.7 (continued)

	Species name	Host	References	Remarks
58	*Opegrapha rupestris* Pers.	*Verrucaria*	(Persoon, 1794c)	
59	*Opegrapha sawyeriana* Coppins	*Coniocarpon cinnabarinum*	(Coppins et al., 2021)	
60	*Opegrapha sipmanii* Matzer	*Porina epiphylla*	(Matzer, 1996)	
61	*Opegrapha sphaerophoricola* Isbrand & Alstrup	*Sphaerophorus globosus*	(Isbrand et al., 1992)	
62	*Opegrapha sphaerophoricola* Isbrand & Alstrup	*Sphaerophorus globosus*	(Isbrand et al., 1992)	
63	*Opegraphoidea staurothelicola* Fink	*Staurothele umbrina*	(Hedrick, 1933)	
64	*Opegrapha stellanigra* Etayo	*Sticta*	(Etayo, 2017)	
65	*Opegrapha stereocaulicola* Alstrup & D. Hawksw.	*Stereocaulon alpinum*	(Alstrup et al., 1990)	
66	*Opegrapha stigmodes* Nyl.	*Verrucaria eminentior*, *Porina*	(Nylander, 1868c)	
67	*Opegrapha strigulae* R. Sant. ex Matzer & R. Sant.	*Strigula subelegans*	(Matzer, 1996)	
68	*Opegrapha submaritima* Hafellner	*Tephromela atra*	(Hafellner, 2007)	
69	*Opegrapha uniseptata* Matzer	*Strigula smaragdula*	(Matzer, 1996)	
70	*Opegrapha thelotrematis* Coppins	*Thelotrema lepadinum* and *T. macrosporum*	(Coppins, 1987)	

Table 2.7 (continued)

	Species name	Host	References	Remarks
71	*Opegrapha tenuior* Stirt.	*Thelotrema*	(Stirton, 1879)	
72	*Opegrapha verseghyklarae* S.Y. Kondr., Lőkös & Hur	*Ochrolechia pallescens*	(Kondratyuk et al., 2015)	
73	*Opegrapha velata* (Müll. Arg.) Vain.	*Actinoplaca*, *Calenia*, *Echinoplaca* and *Gyalectidium*		= *Aulaxina velata* Müll. Arg.
74	*Opegrapha vulpina* Vondrák, Kocourk. & Tretiach	*Caloplaca erodens*	(VondrAK et al., 2008)	

Paralecanographa Ertz & Tehler (1)

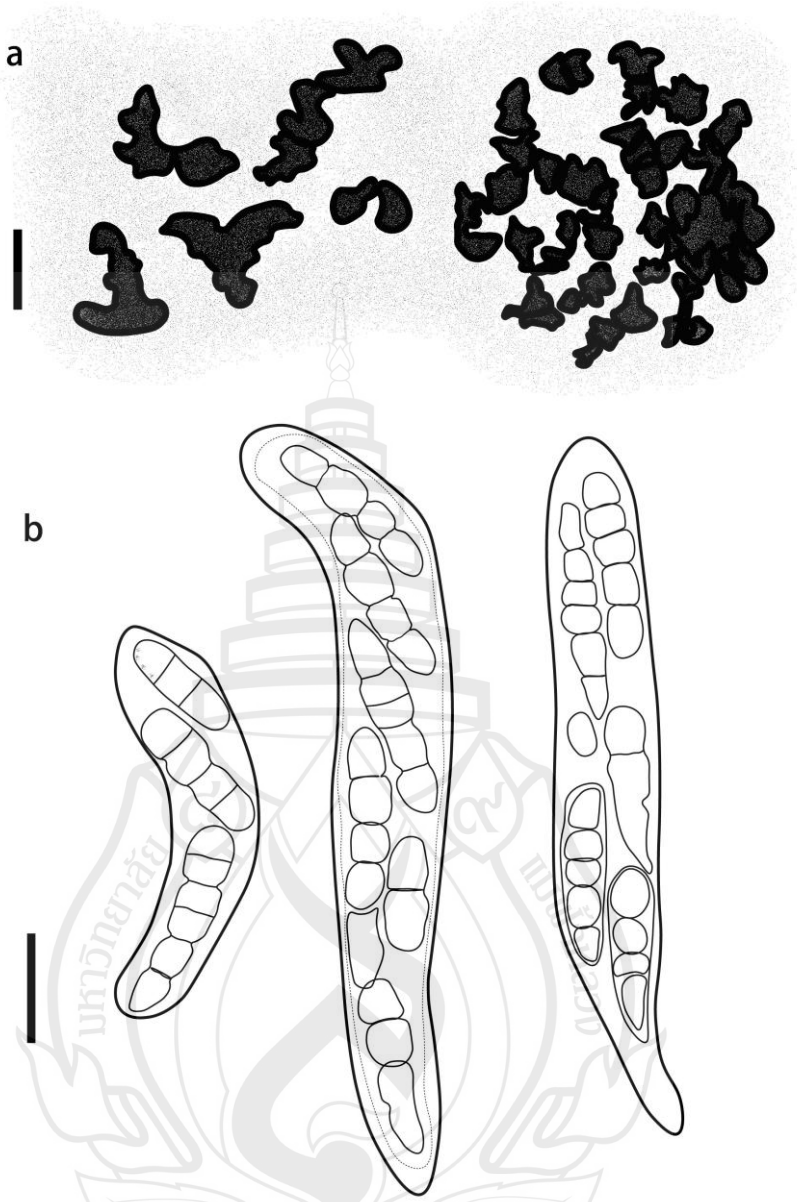
Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Opegraphaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Paralecanographa was introduced by Ertz & Tehler (2011), based on phylogenetic analysis, to accommodate the species *Paralecanographa grumulosa*, transferred from *Opegrapha grumulosa* Dufour. It initially grows on *Roccella*, then develops its own thallus, eventually becoming a lichenicolous lichen (Dufour, 1818). This species is characterized by black, roundish to angular apothecia, with a flat disc that is usually white or bluish-white pruinose, cylindrical-clavate asci and ellipsoidal to fusiform ascospores with 3-5 septa. Phylogenetic analysis by Ertz & Tehler (2011) indicated that *Paralecanographa* clusters within the family Opegraphaceae, and Frisch et al. (2014) confirmed this result in their later study.

Type species: *Paralecanographa grumulosa* (Dufour) Ertz & Tehler, on *Roccella* (Ertz et al., 2011)

= *Opegrapha grumulosa* Dufour



Note a Apothecia. b Asci and ascospores. Scale bar: a = 1 mm, b = 10 µm.

Source Redrawn from Ertz et al. (2011) and Cannon et al. (2021).

Figure 2.6 *Paralecanographa grumulosa*

Family Roccellaceae Chevall.

Cresponea Egea & Torrentee (1-22)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Roccellaceae, Arthoniales, Arthoniomycetes, Ascomycota,

Fungi

Type species: *Cresponea premnea* (Ach.) Egea & Torrente

= *Lecidea premnea* Ach.

Accepted lichenicolous species:

Cresponea lichenicola Aptroot & M. Cáceres, on *Pyrenula* (CÁCeres et al., 2014)

Enterographa Fée (10-66)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Roccellaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Type species: *Enterographa crassa* (DC.) Fée (lichen)

Table 2.8 Accepted lichenicolous species of *Enterographa*

	Species name	**Host**	**References**	**Remarks**
1	*Enterographa bagliettoae* F.Seavey & J.Seavey	*Bagliettoa baldensis*	(Seavey et al., 2017)	
2	*Enterographa brezhonega* Sparrius & Aptroot	*Porina rosei*	(Sparrius et al., 2007)	
3	*Enterographa confusa* Ertz & Van den Broeck	*Arthonia ochraceella*	(Van Den Broeck et al., 2018)	
4	*Enterographa epigraphis* Etayo & Sipman	*Graphis*	(Etayo, 2017)	
5	*Enterographa epiphylla* (S′erus.) Ertz, Diederich & Sparrius	*Coenogonium geralense*	(Aptroot et al., 1997; Ertz et al., 2005)	= *Chiodecton epiphyllum* Sérus.

Table 2.8 (continued)

	Species name	Host	References	Remarks
6	*Enterographa fellhaneroides* Yeshitela, Eb.Fisch	*Coenogonium*	(Yeshitela et al., 2009)	
7	*Enterographa mazosiae* Matzer & R.Sant.	*Mazosia phyllosema*	(Matzer, 1996)	
8	*Enterographa meklitiae* Yeshitela, Eb.Fisch., Killmann & S′erus.	*Coenogonium*	(Yeshitela et al., 2009)	
9	*Enterographa osagensis* C.A.Morse	*Bacidina egenula*	(Morse, 2013)	
10	*Enterographa punctata* Ertz & Diederich	*Lobaria*	(Ertz et al., 2005)	

Mazosia A. Massal. (1-20)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Roccellaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Type species:

Mazosia rotula (Mont.) A. Massal.

= *Strigula rotula* Mont.

Accepted lichenicolous species:

Mazosia adelphoparasitica Matzer, on *Mazosia rotula* (Matzer, 1996)

Schismatomma Flot. & Körb. ex A. Massal. (1-7)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Roccellaceae, Arthoniales, Arthoniomycetes, Ascomycota,

Fungi

Type species: *Schismatomma pericleum* Branth & Rostr.

Accepted lichenicolous species:

Schismatomma physconiicola Ertz & Diederich, on *Physconia*. (Ertz et al., 2006)

Sigridea Tehler (1-5)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Roccellaceae, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Type species: *Sigridea californica* (Tuck.) Tehler

= *Dirina californica* Tuck.

Accepted lichenicolous species:

Sigridea labyrinthica (Follmann) Ertz & Diederich, on *Roccella portentosa* (Ertz et al., 2005)

Arthoniales Genera incertae sedis

Arthophacopsis Hafellner (3)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Arthoniales genera incertae sedis, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Arthophacopsis was established by Hafellner (1998) to accommodate the type species *Arthophacopsis parmeliarum* Hafellner, which grows on *Parmelia sulcata* Taylor from Austria. *Arthophacopsis* is characterized by apothecioid ascomata, often rounded to elongated with slit-like or rarely largely exposed discs, lacking margins, fissitunicate asci without an internal hemiamyloid layer at the tip, and hyaline, narrowly ellipsoid to oblong-ellipsoid ascospores without septum (Hafellner, 1998c).

Later, Zhurbenko et al. (2020) added a second species, *Arthophacopsis heterodermiae* Zhurb. & Diederich, which grows on the thallus of *Heterodermia obscurata* (Nyl.) Trevis. This species differs from the type *A. parmeliarum* in having

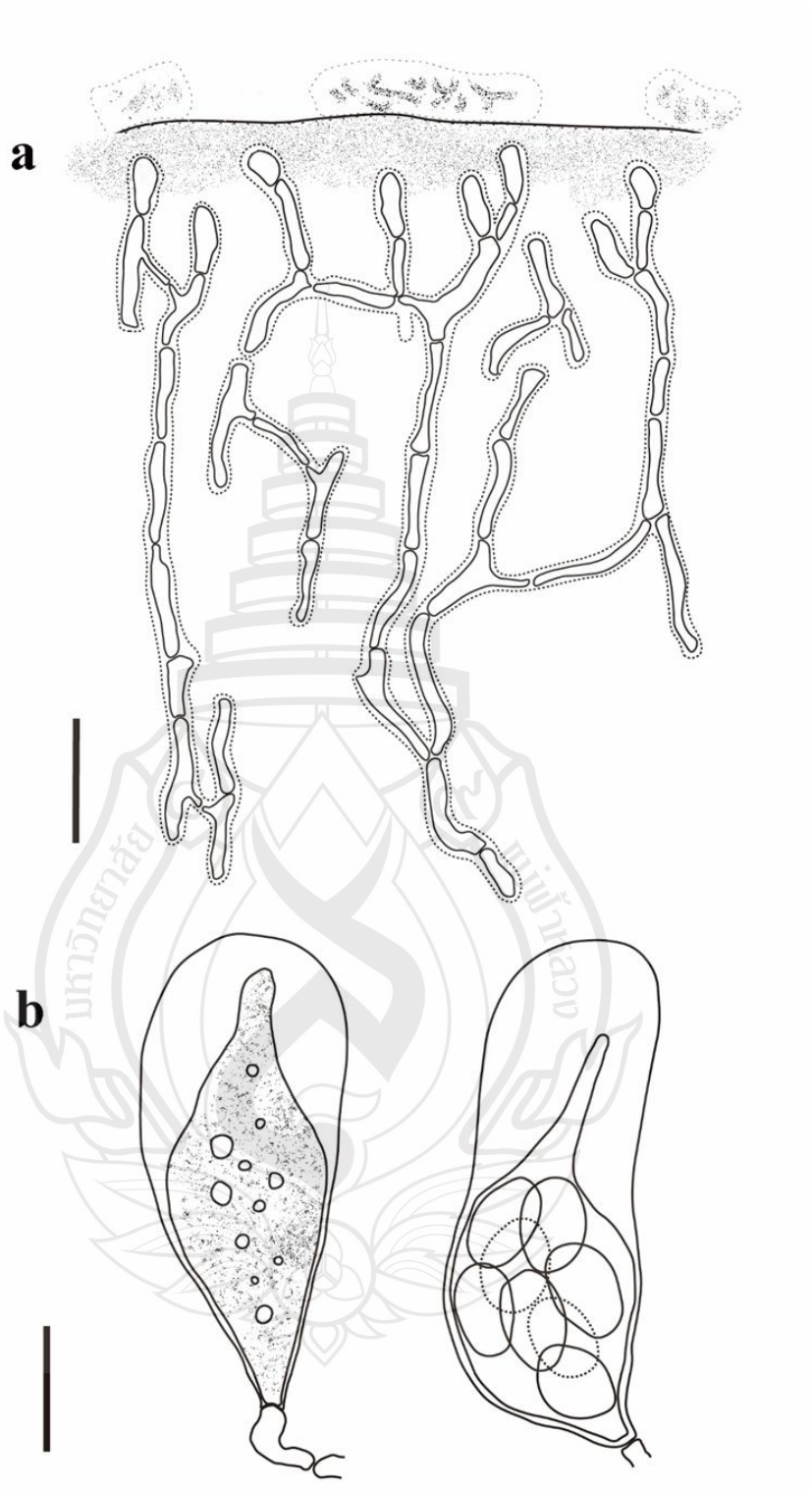
simple paraphysoids, elongate clavate to subcylindrical, narrower asci with an apically not or only slightly thickened wall, and narrowly ellipsoid, longer, and narrower ascospores. Joshi & Bansal (2023) introduced a third species, *Arthophacopsis zhurbenkoi*, which grows on the thallus of *Heterodermia dissecta* (Kurok.) D.D. Awasthi (Joshi et al., 2023b).

Due to the lack of molecular data, *Arthophacopsis* is tentatively placed within Arthoniales genera incertae sedis.

Type species: *Arthophacopsis parmeliarum* Hafellner

Table 2.9 Accepted lichenicolous species of *Arthophacopsis*

	Species name	Host	References	Remarks
1	*Arthophacopsis heterodermiae* Zhurb. & Diederich.	*Heterodermia*	(Hafellner, 1998c)	
2	*Arthophacopsis parmeliarum* Hafellner	*Parmelia*	(Zhurbenko et al., 2020)	
3	*Arthophacopsis zhurbenkoi* Y. Joshi	*Heterodermia dissecta*	(Joshi et al., 2023b)	



Note a Paraphysoides; b Asci and ascospores. Scale bars a, b = 10 µm.

Source Redrawn from Hafellner (1998)

Figure 2.7 Sexual morph of *Arthophacopsis parmeliarum*

Bryostigma Poelt & Döbbeler(13-16)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Arthoniales genera incertae sedis, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Bryostigma was established by Poelt & Döbbeler (1979) to accommodate the muscicolous lichen *B. leucodontis*. However, Coppins (1989) transferred the only species to *Arthonia leucodontis*. Frisch et al. (2014) conducted a phylogeny of Arthoniales based on mtSSU, nLSU and RPB2 sequence data. The result revealed that *Bryostigma muscigenum* (Th.Fr.) Frisch & G.Thor is included in a distinct phylogenetic lineage sister to the Arthoniaceae clade, together with eight mainly parasitic *Arthonia* species. The members included in the *Bryostigma* clade differ from other Arthoniaceae species by their blackish, adnate, moderately to strongly convex ascomata reminiscent of *Micarea*, in combination with *Arthonia*-type asci with or without amyloid ring structures, small hyaline, 2-celled spores with enlarged upper cell, and a dark brown epithecium formed of the tips of the interascal filaments (Frisch et al., 2014).

Frisch et al. (2014) transferred *Bryostigma muscigena* from *Arthonia muscigena* Fr., and treated *B. leucodontis* as a synonym of *B. muscigena*. Kondratyuk et al. (2019) constructed a phylogenetic analysis of the Arthoniaceae based on concatenated mtSSU and RPB2 sequences along with introducding a new lichenicolous species *Arthonia dokdoensis*. The phylogenetic tree showed that eight *Arthonia* species form a clade with *Bryostigma muscicola*. Subsequently, Kondratyuk et al. (2020) transferred twelve species to *Bryostigma* based on the phylogenetic analysis. Later, the new species *Bryostigma huriellae* was introduced by Kondratyuk, Lőkös, et al. (2020). Etayo et al. (2023) found *Arthonia excentrica* Th. Fr. clusters into the same clade with *Bryostigma molendoi* and *B. dokdoense*, leading to the transfer of *A. excentrica* to *Bryostigma excentricum* (Etayo et al., 2023).

16 species are recognized in *Bryostigma* according to Index Fungorum (2024),

13 of which are lichenicolous, except *Bryostigma lapalmae*, *B. lapidicola* and *B. muscigenum* are lichens. This genus was placed within Arthoniales genera incertae sedis (Hyde et al., 2024).

Type species: *Bryostigma leucodontis* Poelt & Döbbeler

Table 2.10 Accepted lichenicolous species of *Bryostigma*

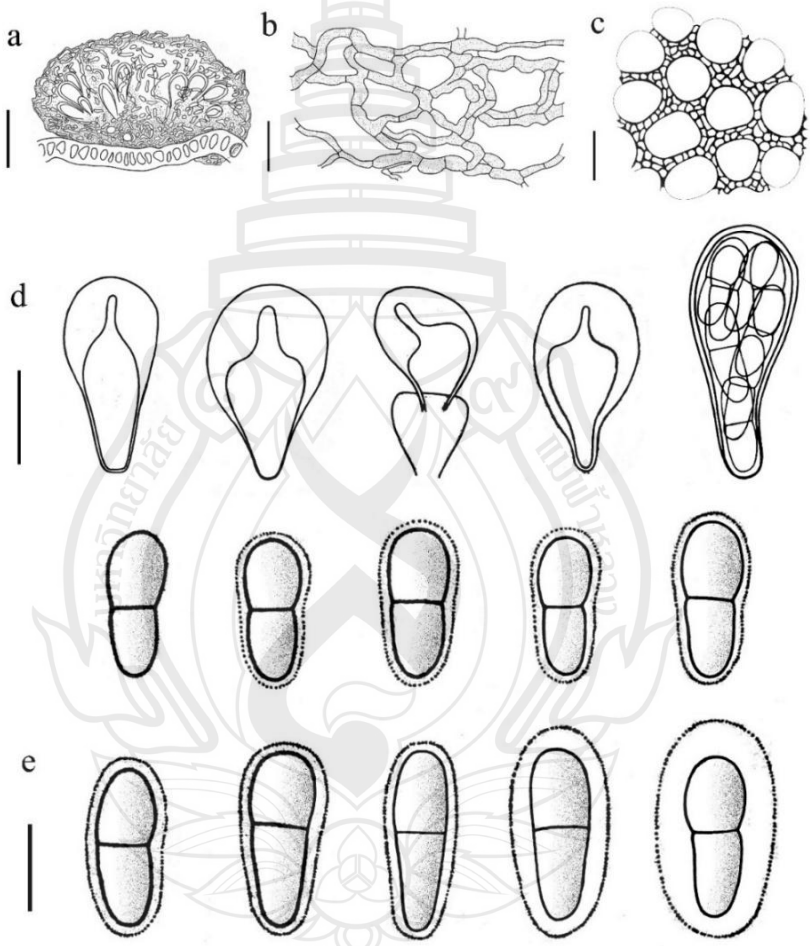
	Species name	**Host**	**References**	**Remarks**
1	*Bryostigma apotheciorum* (A. Massal.) S.Y. Kondr. & Hur	*Myriolecis albescens*	(Kondratyuk et al., 2020)	= *Sphaeria apotheciorum* A. Massal.
2	*Bryostigma biatoricola* (Ihlen & Owe-Larss.) S.Y. Kondr. & Hur	*Biatora efflorescens*	(Kondratyuk et al., 2020)	= *Arthonia biatoricola* Ihlen & Owe-Larss.
3	*Bryostigma dokdoense* (S.Y. Kondr., Lőkös, B.G. Lee, J.J. Woo & Hur) S.Y. Kondr. & Hur	*Orientophila*	(Kondratyuk et al., 2019; Kondratyuk et al., 2020)	= *Arthonia dokdoensis* S.Y. Kondr., Lőkös, B.G. Lee, J.J. Woo & Hur
4	*Bryostigma epiphyscium* (Nyl.) S.Y. Kondr. & Hur	*Physcia*	(Kondratyuk et al., 2020)	= *Arthonia epiphyscia* Nyl.
5	*Bryostigma excentricum* (Th. Fr.) Etayo & Pino-Bodas	*Lepraria* and *Leprocaulon*	(Etayo et al., 2023)	= *Arthonia excentrica* Th. Fr.

Table 2.10 (continued)

	Species name	Host	References	Remarks
6	*Bryostigma huriellae* S.Y. Kondr. & Hur	*Huriella pohangensis*	(Fries 1867a; Kondratyuk et al., 2020)	
7	*Bryostigma lobariellae* (Etayo) S.Y. Kondr. & Hur	*lobariellae*	(Kondratyuk et al., 2020)	= *Arthonia lobariellae* Etayo
8	*Bryostigma molendoi* (Heufl. ex Arnold) S.Y. Kondr. & Hur	*Caloplaca* and *Xanthoria*	(Kondratyuk et al., 2020)	
9	*Bryostigma neglectulum* (Nyl.) S.Y. Kondr. & Hur	*Lepraria neglecta*	(Kondratyuk et al., 2020)	
10	*Bryostigma parietinarium* (Hafellner & Fleischhacker) S.Y. Kondr. & Hur	*Xanthoria parietina*	(Kondratyuk et al., 2020)	
11	*Bryostigma peltigerinum* (Almq.) S.Y. Kondr. & Hur	*Peltigera* and *Solorina*	(Kondratyuk et al., 2020)	
12	*Bryostigma phaeophysciae* (Grube & Matzer) S.Y. Kondr. & Hur	*Phaeophyscia orbicularis*	(Kondratyuk et al., 2020)	

Table 2.10 (continued)

	Species name	Host	References	Remarks
13	*Bryostigma stereocaulinum* (Ohlert) S.Y. Kondr. & Hur	*Stereocaulon*	(Kondratyuk et al., 2020)	



Note a Apothecium. b Hyphae crawling over a host. c Algal cells enveloped by hyphae in cross-section. d Asci. e Ascospores. Scale bars: a = 40 μm, b–d = 10 μm, e = 5 μm.

Source Redrawn from Poelt et al. (1979)

Figure 2.8 Sexual morph of *Bryostigma leucodontis*

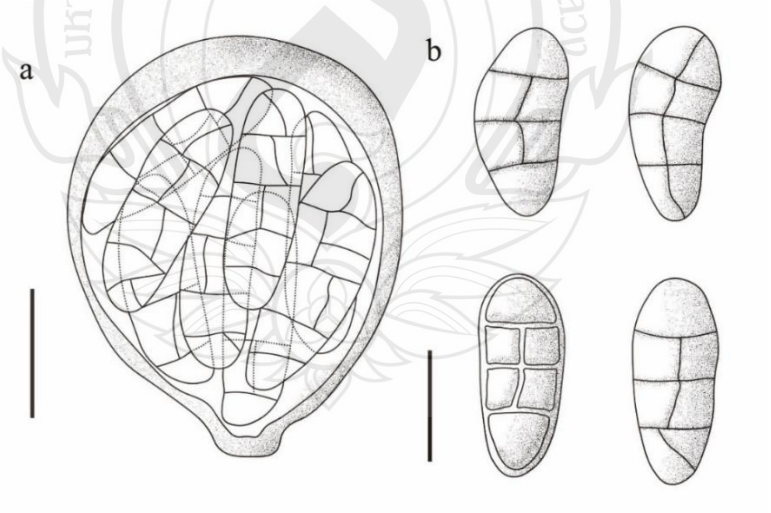
Paradoxomyces Matzer (1)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Genera incertae sedis, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Paradoxomyces was introduced by Matzer (1996) to describe the li species *Paradoxomyces nymanii*, which grows on *Strigula nitidula*. This genus is characterized by lirellate, black ascomata with a unique, well-developed, carbonaceous lateral exciple. Asci are fissitunicate, subglobose, shortly stipitate, and contain eight hyaline, obovoid, smooth, muriform ascospores with rounded ends. Kirk et al. (2008) placed it within the family Arthoniaceae, while Diederich et al. (2018) classified *Paradoxomyces* within Arthoniales genera incertae sedis (Kirk et al., 2008; Diederich et al., 2018). As no available sequences, *Paradoxomyces* was tentatively placed in Arthoniales genera incertae sedis by Hyde et al. (2014).

Type species: *Paradoxomyces nymanii* Matzer, on *Strigula nitidula* (Matzer, 1996)



Note a Asci. b Ascospores. Scale bars: a–b = 10 μm.

Source Redrawn from Matzer (1996)

Figure 2.9 *Perigrapha superveniens*

Perigrapha Hafellner (5)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Arthoniales genera incertae sedis, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Perigrapha was introduced by Hafellner (1996) to accommodate the lichenicolous species *P. superveniens* (Nyl.) Hafellner, transferred from *Melanotheca superveniens* Nyl., found on the thallus of *Parmelia sulcata* Taylor. This genus is characterized by the presence of black pseudostromata aggregated many ascomata. These pseudostromata feature perithecium-like structures were called "Carpocentra" with dot-like ostioles, surrounded by a collar of the host thallus. Other characteristics include slightly clavate to cylindrical arthonial asci containing 4–8 spores, as well as slender, spindle-shaped ascospores with 3 septa and tails formed from the perisporic layer (Hafellner 1996b). Initially, this genus was placed within Opegraphaceae by Hafellner (1996), however, Lumbsch & Huhndorf (2007) relocated this genus to Arthoniales genera incertae sedis, and this viewpoint was widely accepted (Lumbsch et al., 2007; Wijayawardene et al., 2017; Diederich et al., 2018; Hyde et al., 2024). Due to the absence of molecular data, its definitive phylogenetic position remains unresolved.

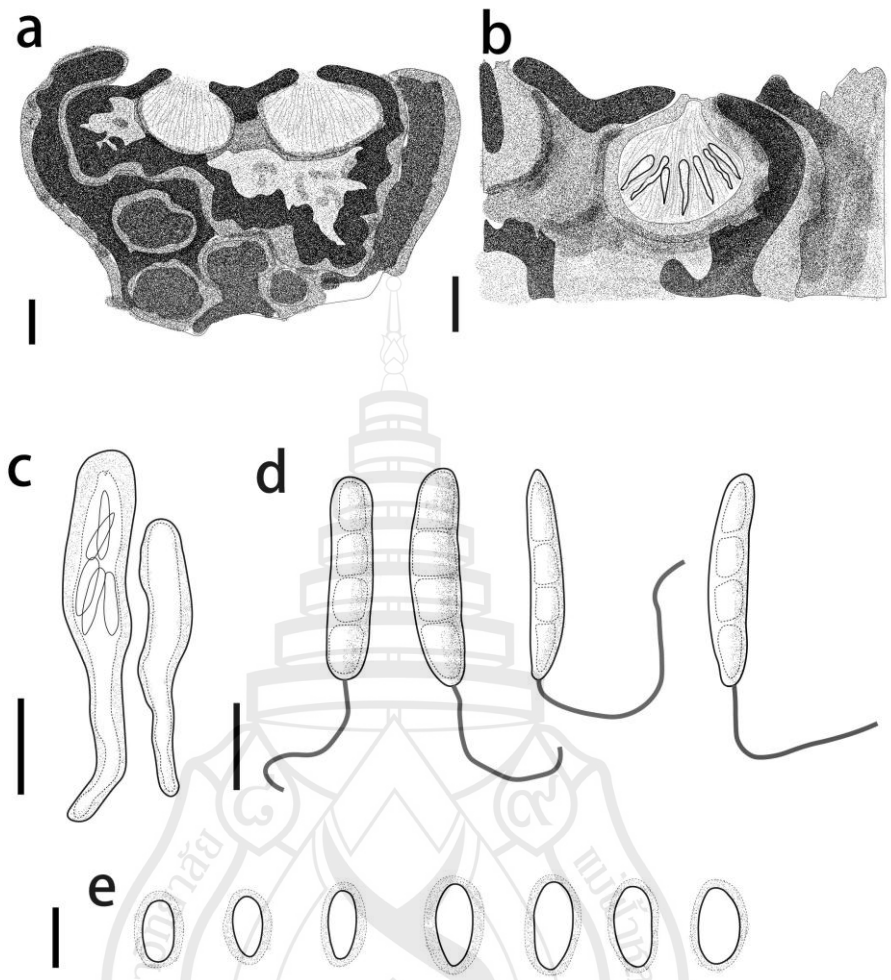
Ertz et al. (2005) introduced the second species, *Perigrapha nitida*, growing on the thallus of *Pseudocyphellaria glabra*. Pérez-Vargas et al. (2013) introduced the third species, *Perigrapha phaeophysciae*, which inhabits *Phaeophyscia orbicularis*. Additionally, Zhurbenko et al. (2015) published a new species, *Perigrapha lobariae*, growing on the thallus of *Lobaria japonica*, from Hokkaido of Japan. The most recently published species is *Perigrapha cetrariae* which grows on *Cetraria laevigata*, and was introduced by Zhurbenko et al. (2018). It is characterized by having loculi completely embedded in a stroma and ascospores lacking caudate appendages (Zhurbenko & Ohmura, 2018). To date, five species are recognized in this genus, and all of which are

lichenicolous.

Type species:*Perigrapha superveniens* (Nyl.) Hafellner, on *Parmelia sulcata*

Table 2.11 Accepted lichenicolous species of *Perigrapha*

	Species name	Host	References	Remarks
1	*Perigrapha cetrariae Zhurb.*	*Cetraria*	(Zhurbenko & Ohmura, 2018)	
2	*Perigrapha lobariae* Zhurb.	*Lobaria japonica*	(Zhurbenko et al., 2015)	
3	*Perigrapha nitida* Ertz, Diederich, Christnach & Wedin	*Pseudocyphellaria glabra*	(Ertz et al., 2005)	
4	*Perigrapha phaeophysciae* Etayo & Pérez-Vargas	*Phaeophyscia orbicularis*	(Pérez-Vargas et al., 2013)	
5	*Perigrapha superveniens* (Nyl.) Hafellner	*Parmelia sulcata*	(Hafellner, 1996b)	= *Melanotheca superveniens* Nyl.



Note a–b Section of apothecium. c Asci. d Ascospores of *P. superveniens*. e Ascospores of *Parmelia*. Scale bars a, b = 100 μm, c–e = 10 μm.

Source Redrawn from Hafellner (1996b)

Figure 2.10 *Perigrapha superveniens*

Trichophyma Rehm (2)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Arthoniales genera incertae sedis, Arthoniales, Arthoniomycetes, Ascomycota, Fungi

Trichophyma was introduced by Rehm (1904) to accommodate the type species *Trichophyma bunchosiae* Rehm, a folicolous fungus. Initially, it was placed within

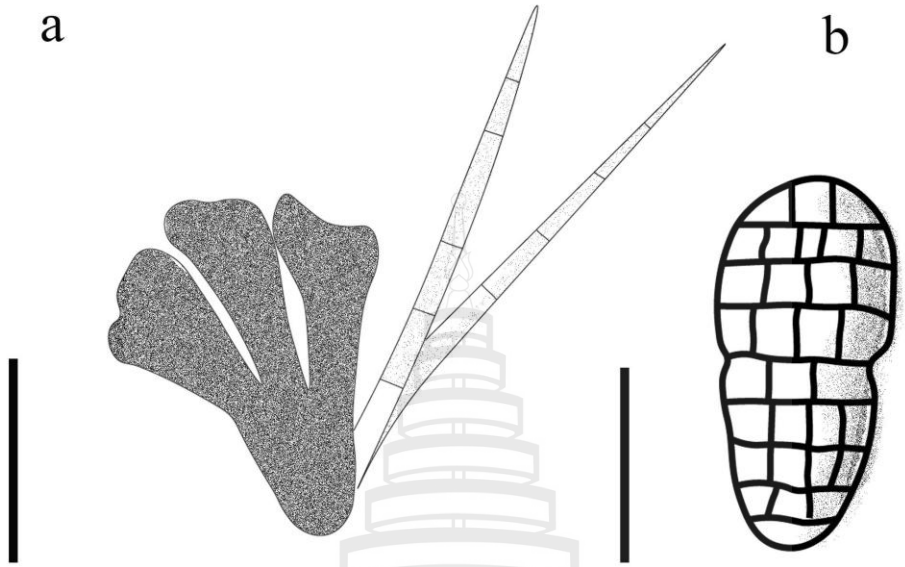
Myriangiales by Rehm (1904), however, Lumbsch & Huhndorf (2007) assigned this genus to Arthoniales genera incertae sedis, and this viewpoint was widely accepted (Lumbsch et al., 2007; Wijayawardene et al., 2017; Diederich et al., 2018; Hyde et al., 2024). Since the lack of molecular data, its phylogenetic position remains unresolved.

This genus is characterized by a radially arranged hyaline mycelium forming a prosenchymatous context, covered with long, septate, hyaline hairs. The perithecia are scattered, featuring tubercles and a thin membrane. The asci are globose, containing eight hyaline spores that are oblong and 3-septate, eventually becoming muriform. Matzer (1996) introduced a second species, *T. similis*, which is lichenicolous on *Strigula smaragdula*. To date, only two species are recognized in this genus.

Type species: *Trichophyma bunchosiae* Rehm

Table 2.12 Accepted lichenicolous species of *Trichophyma*

	Species name	Host	References	Remarks
1	*Trichophyma bunchosiae* Rehm	foliicolous *Strigula*	(Rehm, 1904)	
2	*Trichophyma similis* Matzer	*Strigula smaragdula*	(Matzer, 1996)	



Note a Part of Apothecium. b Ascospore. Scale bars a = 1 mm, b = 10 µm.

Source Redrawn from Rehm (1904)

Figure 2.11 *Trichophyma bunchosiae*

Order Lichenostigmatales Ertz, Diederich & Lawrey

Family Phaeococcomycetaceae McGinnis & Schell

Etayoa Diederich & Ertz (1)

Index Fungorum, Facesoffungi, MycoBank, GenBank

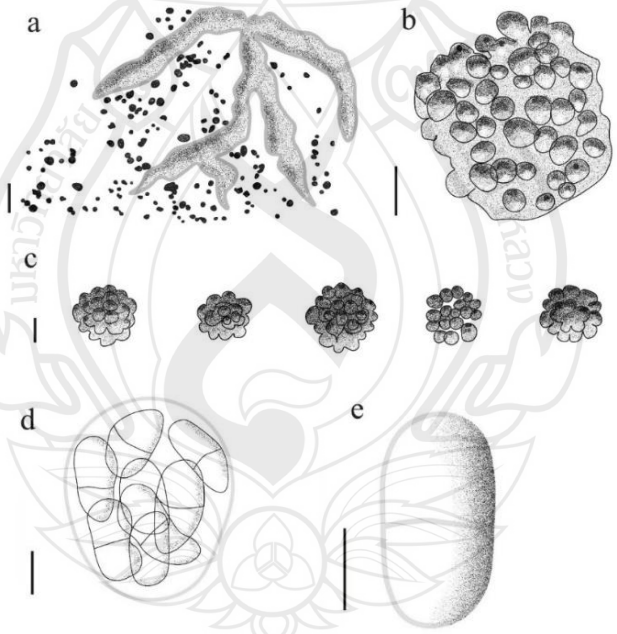
Classification: Phaeococcomycetaceae, Lichenostigmatales, Arthoniomycetes, Ascomycota, Fungi

Etayoa was introduced by (Ertz et al., 2014) based on molecular data to accommodate the type species *Etayoa trypethelii* (Flakus & Kukwa) Diederich & Ertz, which was originally classified as *Phaeosporobolus trypethelii* by Flakus & Kukwa. This species grows on the thallus of *Trypethelium ochroleucum* (Eschw.) Nyl. The genus is characterized by dark brown to blackish stromata with an elongate shape,

frequently slightly or distinctly centrally depressed, and sometimes resembling lirellae when old. The asci are 8-spored, subspherical to shortly ellipsoid, with a distinct ocular chamber. The ascospores are hyaline, 1-septate, and ellipsoid with roundish apices.

The conidiomyata are smaller, with conidiogenous cells that are pale to medium brown, shortly subcylindrical to ellipsoid, and have an indistinctly truncate base. The conidia are multicellular, subspherical, brown, verrucose, dry, single, and schizolytically seceding, with conidial cells that are subspherical to ellipsoid. Morphologically, this genus is very similar to *Lichenostigma* but differs in conidia shape, size, and the external cells of stromata. To date, there are eight sequences in Genbank, including LSU and mtSSU, belong to the only species *Etayoa trypethelii*.

Type species: *Etayoa trypethelii* (Flakus & Kukwa) Diederich & Ertz



Note a Conidiamata on thallus of *Phaeographis major*. b Young conidioma showing mosaic-like ornamentation. c Conidia. d Ascus and ascospores. e Ascospore. Scale bars a = 200 μm, b = 10 μm, c–e = 5 μm.

Source Redrawn from Ertz et al. (2014)

Figure 2.12 *Etayoa trypethelii*

Lichenostigma Hafellner (35)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Phaeococcomycetaceae, Lichenostigmatales, Arthoniomycetes, Ascomycota, Fungi

Lichenostigma was introduced by Hafellner (1983) to describe the lichenicolous fungus *L. maureri*. Initially, this genus was placed within the order *Athroniales* based on the type of its asci. To clarify its phylogenetic position, Ertz et al. (2014) conducted a comprehensive analysis using molecular data from both the sexual and asexual stages of various genera. The phylogenetic analyses revealed that these species form two primary lineages, one of which was a poorly supported clade comprising the genera *Phaeococcomyces* and *Lichenostigma*. As a result, the new order *Lichenostigmatales* was proposed to accommodate the family *Phaeococcomycetaceae*. This family includes the black yeast genus *Phaeococcomyces*, along with two genera producing both ascomata and conidiomata, *Etayoa* and *Lichenostigma*. Additionally, two new species were described, and three *Phaeosporobolus* species were reassigned to *Lichenostigma* (Ertz et al., 2014).

The genus is distinguished by its dark brown to blackish, dispersed stromata, which are initially subspherical but later become elongate. The asci are subspherical to shortly ellipsoid, (4–)8-spored, with a thickened apical wall and a distinct ocular chamber. The ascospores are hyaline when young, with the outer wall occasionally reacting K/I+ blue, and become hyaline or dark brown with age. They are 1-septate, ellipsoid to elongate, with rounded or attenuated, sometimes pointed apices. Its conidiomata are often intermixed with ascomata and macroscopically indistinguishable, although they are sometimes smaller. Conidiogenous cells are pale to medium brown, developing from spherical stromatic cells. They are shortly subcylindrical to almost ellipsoid, with an indistinctly truncate base. The conidia are multicellular, composed of the conidiogenous cell and additional conidial cells. They are ellipsoid, brown, and

smooth but may exhibit a verrucose to echinulate ornamentation when over-mature. Conidia are dry, solitary, and undergo schizolytic secession (Ertz et al., 2014).

To date, 35 species are recognized in this genus, all of which are lichenicolous, and 24 sequences available in Genbank, include LSU and mtSSU.

Type species: *Lichenostigma maureri* Hafellner, on *Usnea* and other macrolichens

Table 2.13 Accepted lichenicolous species of *Lichenostigma*

	Species name	**Host**	**References**	**Remarks**
1	*Lichenostigma alpinum* (R. Sant., Alstrup & D. Hawksw.) Ertz & Diederich	*Ochrolechia frigida*	(Ertz et al., 2014)	= *Phaeosporobolus alpinus* R. Sant., Alstrup & D. Hawksw.
2	*Lichenostigma amplum* Calatayud & Hafellner	*Buellia*	(Diederich, 2004b)	
3	*Lichenostigma anatolicum* Halici & Kocakaya	*Acarospora*	(Halıcı et al., 2009)	
4	*Lichenostigma bolacinae* Navarro-Rosinés, Calatayud & Hafellner	*Caloplaca bolacina*	(Diederich, 2004b)	
5	*Lichenostigma canariense* Etayo & van den Boom	*Aspicilia calcarea*	(Boom et al., 2006)	

Table 2.13 (continued)

	Species name	Host	References	Remarks
6	*Lichenostigma chlaroterae* (F. Berger & Brackel) Ertz & Diederich	*Lecanora* and other lichens	(Ertz et al., 2014)	
7	*Lichenostigma cosmopolites* Hafellner & Calatayud	*Xanthoparmelia tinctina*	(Hafellner et al., 1999)	'*Lichenostigma* (subgen. *Lichenogramma*) *cosmopolites*'
8	*Lichenostigma cupreogriseae* P. Pinault & Cl. Roux	*Aspicilia cupreogrisea*	(Roux et al., 2021)	
9	*Lichenostigma dimelaenae* Calatayud & Hafellner	*Dimelaena oreina*	(Diederich, 2004b)	
10	*Lichenostigma diploiciae* Calatayud, Navarro-Rosinés & Hafellner	*Diploicia subcanescens*	(Calatayud et al., 2002)	
11	*Lichenostigma elongatum* Navarro-Rosinés & Hafellner	*Aspicilia* and *Lobothallia*	(Navarro-Rosinés & Hafellner, 1996)	
12	*Lichenostigma epipolina* Diplotomma	*Diplotomma epipolium*	(Calatayud et al., 2002)	

Table 2.13 (continued)

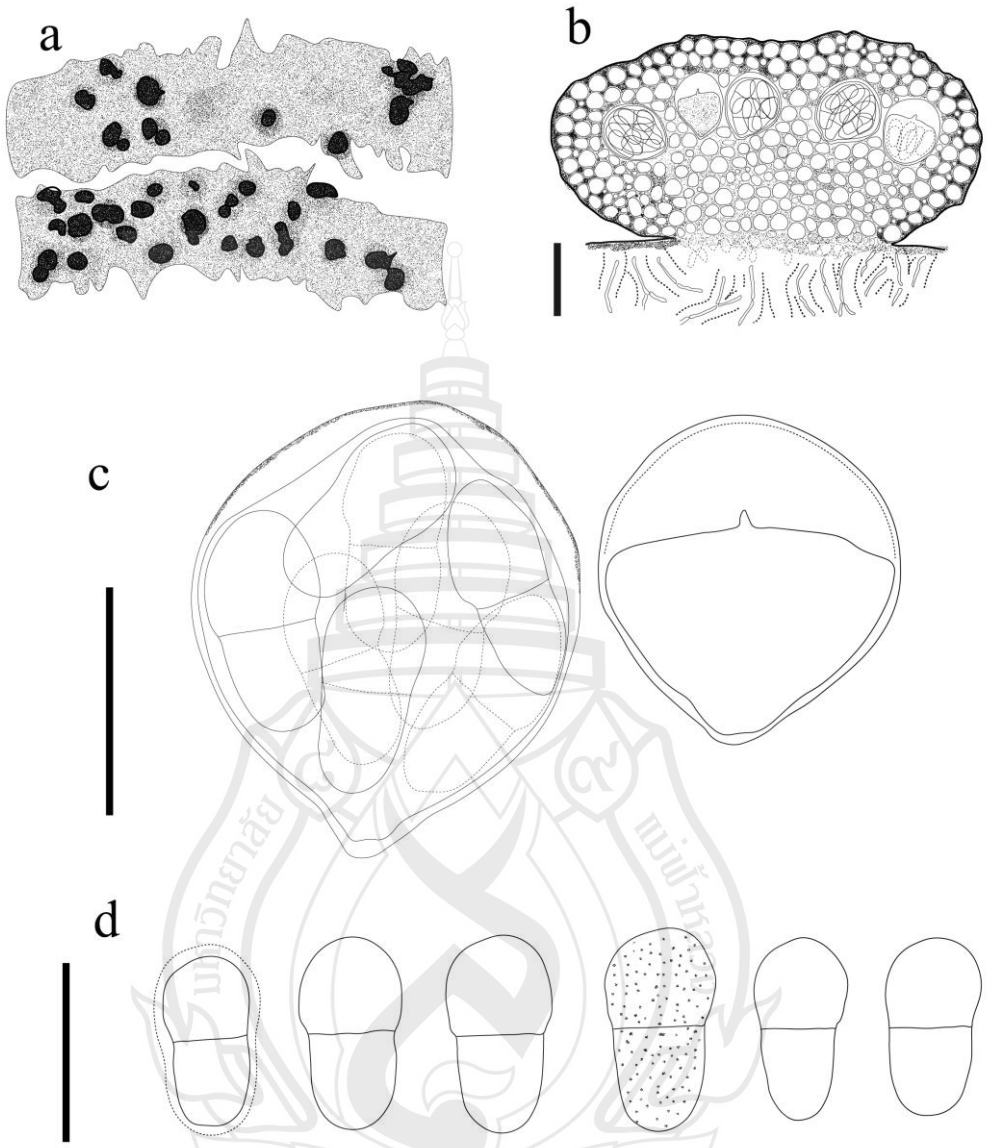
	Species name	Host	References	Remarks
13	*Lichenostigma epiporpidiae* S.Y. Kondratyuk, L. Lőkös & J.-S. Hur	*Porpidia*	(Kondratyuk et al., 2017)	
14	*Lichenostigma epirupestre* Pérez-Ortega & Calatayud	*Pertusaria pertusa*	(Pérez-Ortega & Calatayud, 2009)	
15	*Lichenostigma episulphurella* Etayo & van den Boom	*Lecanora sulphurella*	(Boom et al., 2006)	
16	*Lichenostigma epiumbilicariae* P. Pinault & Cl. Roux	*Umbilicaria crustulosa*	(Roux & Pinault, 2023)	
17	*Lichenostigma fellhanerae* (R.C. Harris & Lendemer) Ertz & Diederich	*Fellhanera granulosa*	(Ertz et al., 2014)	
18	*Lichenostigma gracile* Calat., Nav.-Ros. & Hafellner	*Acarospora fuscata*	(Calatayud et al., 2002)	
19	*Lichenostigma heterodermiae* S.Y. Kondratyuk, L. Lőkös & J.-S. Hur	*Heterodermia microphylla*	(Kondratyuk et al., 2013)	

Table 2.13 (continued)

	Species name	Host	References	Remarks
20	*Lichenostigma hyalosporum* Kalb & Hafellner	*Haematomma eremaeum*	(Kalb et al., 1995)	
21	*Lichenostigma iranicum* Brackel & Valadbeigi	*Lobothallia praeradiosa*	(Valadbeigi et al., 2011)	
22	*Lichenostigma lecanorae* Calatayud & Navarro-Rosinés	*Lecanora farinacea*	(Diederich, 2004b)	
23	*Lichenostigma maureri* Hafellner	*Usnea* and other macrolichens	(Pegler, 1983)	
24	*Lichenostigma minutum* (Etayo) Diederich & Ertz	*Pertusaria microcarpa* and *Coccotrema cucurbitula*	(Etayo & Sancho, 2008; Diederich et al., 2024)	= *Phaeosporobolus minutus* Etayo
25	*Lichenostigma radicans* Calat. & Barreno	*Aspicilia hispida*	(Calatayud & Barreno, 2003)	
26	*Lichenostigma rouxii* Nav.-Ros., Calat. & Hafellner	*Squamarina stella-petraea*	(Calatayud et al., 2002)	
27	*Lichenostigma rupicolae* Fern.-Brime & Navarro-Rosinés	*Pertusaria rupicola*	(Fernandez-Brime et al., 2010)	
28	*Lichenostigma svandae* Vondrák & Soun	*Acarospora cervina*	(Vondrak et al., 2007)	

Table 2.13 (continued)

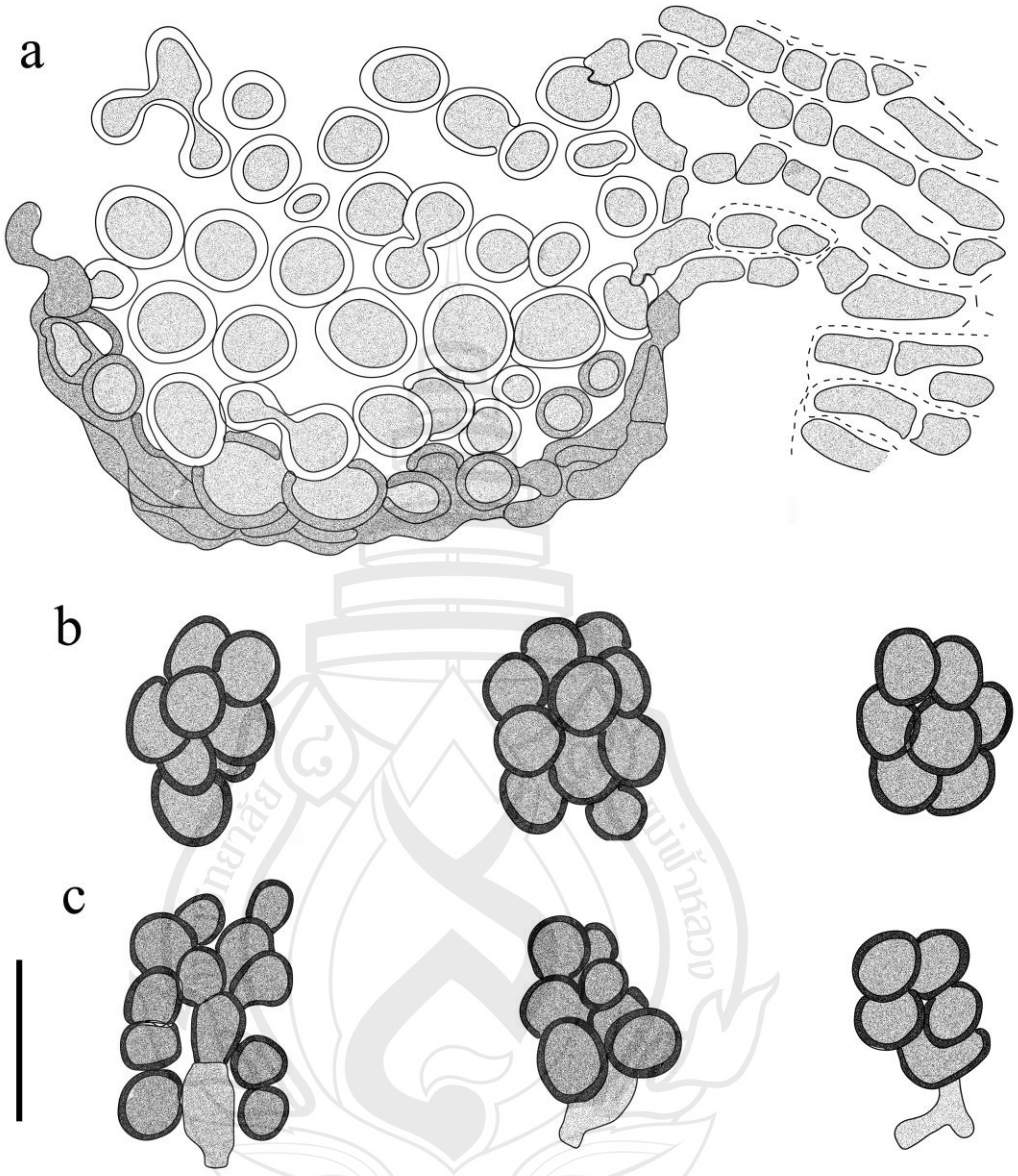
	Species name	Host	References	Remarks
29	*Lichenostigma saxicola* K. Knudsen & Kocourková	*Polysporina simplex*	(Knudsen et al., 2010a)	
30	*Lichenostigma semiimmersum* Hafellner	*Buellia elegans*	(Hafellner, 1999b)	as '*Lichenostigma* (subgen. *Lichenogramma*) *semiimmersa*'
31	*Lichenostigma spermatomanis* P. Pinault & Cl. Roux	*Aspicila spermatomanes*	(Roux et al., 2021)	
32	*Lichenostigma subradians* Hafellner, Calatayud & Navarro-Rosinés	*Acarospora*	(Calatayud et al., 2002)	
33	*Lichenostigma supertegentis* Ihlen & R. Santesson	*Aspicilia supertegens*	(Ihlen, 2004)	
34	*Lichenostigma triseptatum* Halici & D. Hawksworth	*Aspicilia caesiocinerea*	(Halıcı & Hawksworth, 2007)	
35	*Lichenostigma verrucosum* Brackel & Valadbeigi	*Pleopsidium gobiense*	(Valadbeigi et al., 2011)	



Note a Ascomata on the thallus of *Usnea hirta*. b Section of Apothecium. c Asci (mature and immature). d Ascospores. Scale bars: b = 20µm, c-d = 10µm.

Source Redrawn from Hafellner (1983) and Ertz et al. (2014)

Figure 2.13 *Lichenostigma maureri*



Note a Vertical section of portion of Stroma. b Multicellular conidia. c Developing conidia showing conidiogenous cells. Scale bars: c = 10μm.

Source Redrawn from Hawksworth et al. (1986)

Figure 2.14 Asexual stage of *Lichenostigma maureri*

Class ASCOMYCETES G. Winter

Ascomycetes genera incertae sedis

Ajaysinghia Y. Joshi (1)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Ascomycetes genera incertae sedis, Ascomycetes, Pezizomycotina, Ascomycota, Fungi

The commensalistic lichenicolous genus *Ajaysinghia* was introduced by Joshi (2022) to accommodate the type species *A. dendriscostictae*, which grows on the upper and lower sides of thallus of *Dendriscosticta praetextat*a (Räsänen) B. Moncada & Lücking. It is characterized by single or contiguous to confluent, multilocular, pseudoperithecial ascomata, narrowly cylindrical, bitunicate asci with 8 spores and brown, ellipsoid ascospores with one septum. Tye type species, *A. dendriscostictae*, has brown vegetative hyphae that penetrates inside the host thallus, but does not show any sign of discoloration, necrosis, or injury to the host. Additionally, the lichen also produces apparently healthy apothecia. Therefore, the author proposed that this new taxon seems to be a parasymbiont or a weak parasite. Up to now, the type species is the only species in this genus and no available sequence in GenBank.

Type species: *Ajaysinghia dendriscostictae* Y. Joshi, on *Dendriscosticta praetextata* (Joshi 2022a)

Hobsoniopsis D. Hawksw. (1)

Index Fungorum 28490, faceoffungi, MycoBank, GenBank

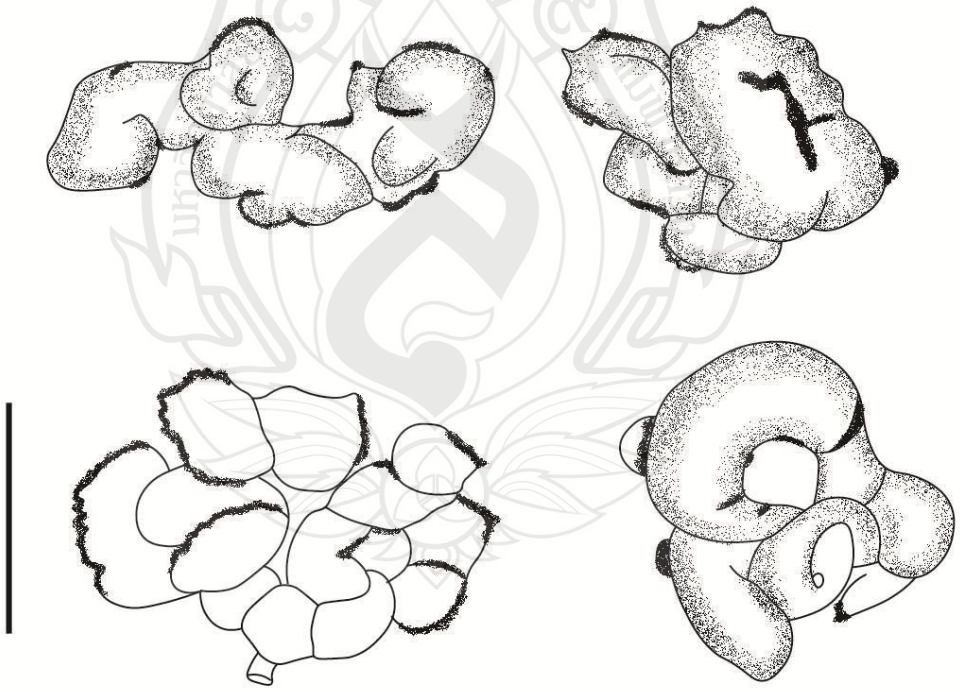
Classification: Ascomycetes genera incertae sedis, Ascomycetes, Pezizomycotina, Ascomycota, Fungi

Hobsoniopsis was introduced by Hawksworth (2001) based on phylogenetic analysis to accommodate *H. santessonii*, which was transferred from *Hobsonia christiansenii* B. L. Brady & D. Hawksw. This genus is characterized by lichenicolous lifestyle, gray, erumpent sporodochial colonies, micronematous conidiophores,

monoblastic conidiogenous cells, and solitary conidia that are pale brown, filamentous, helicoid, septate and irregularly verrucose. The type species, *Hobsoniopsis santessonii*, is the only species in this genus. Although SSU sequence data are available for the type species, the phylogenetic analysis by Sikaroodi et al. (2001) revealed that its closest relative is *Coccodinium bartschii*, which belongs to Eurotiomycetes, with another slightly more distant clade belonging to *Dothidea* in Dothideomycetes. Determining the precise systematic position of *Hobsoniopsis* within these groups is challenging. Additional sequence data and more detailed phylogenetic analysis are needed to clarify its classification.

Type species: *Hobsoniopsis santessonii* (Lowen & D. Hawksw.) D. Hawksw. (Sikaroodi et al., 2001)

= *Hobsonia santessonii* Lowen & D. Hawksw., on *Peltigersa scabrosa*



Note Conidia. Scale bar = 5 μm.

Source Redrawn from Lowen et al. (1986)

Figure 2.15 *Hobsoniopsis santessonii*

Minutoexcipula V. Atienza & D. Hawksw. (14)

Index Fungorum 27273, faceoffungi, MycoBank, GenBank

Classification: Ascomycetes genera incertae sedis, Ascomycetes, Pezizomycotina, Ascomycota, Fungi

Minutoexcipula was introduced by Atienza et al. (1994) to accommodate the deuteromycete species *M. tuckerae*, which grows on *Pertusaria texana* and is characterized by the formation of black, convex, sporodochia-like conidiomata with a well differentiated exciple. Its branched conidiophores bear proliferating holoblastic conidiogenous cells with distinct annellations, and the solitary conidia are brown and 1-septate. Subsequently, Hafellner (1994) described the second species *M. tuerkii* which grows on thallus of *Pertusaria glomerata*. Atienza (2002, 2009) added three new species. Etayo et al. (2008), Lendemer et al. (2016), Zhurbenko et al. (2020) separately indroded new species in this genus, and lead to total eight species. Diederich et al. (2024) introduced six new species based on morphological features. To date, 14 species are recognized in this genus, all of which are lichenicolous. Due to the lack of sequence data, its phylogenetic position remains unclear.

Type species: *Minutoexcipula tuckerae* V. Atienza & D. Hawksw.

Table 2.14 Accepted lichenicolous species of *Minutoexcipula*

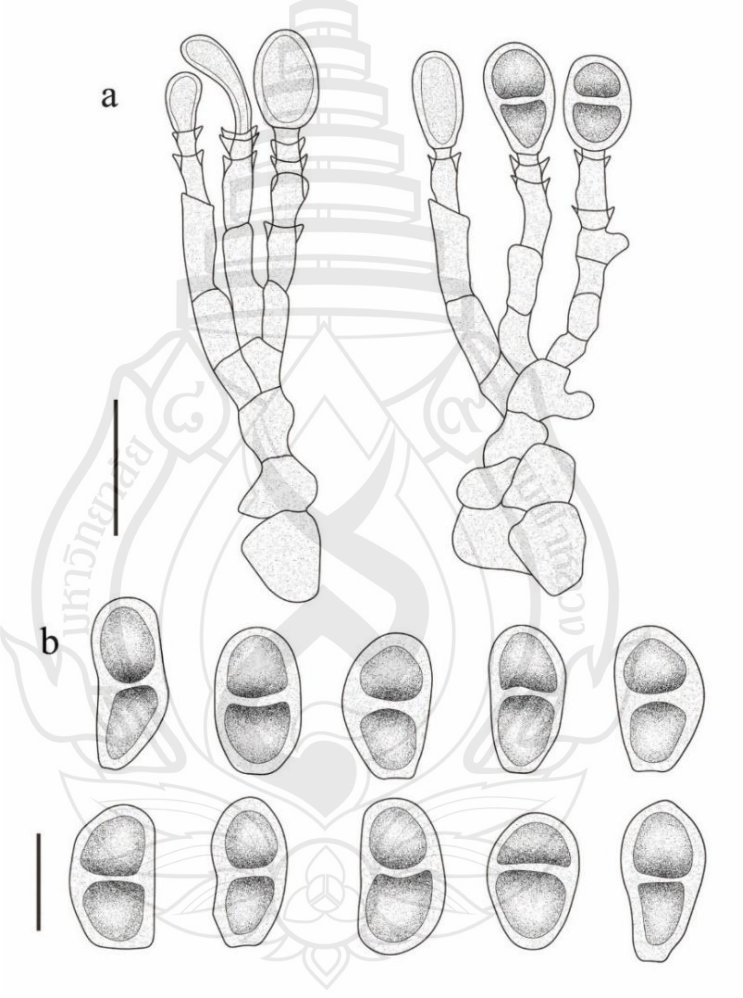
	Species name	Host	References
1	*Minutoexcipula bacidiae* Diederich & van den Boom	*Bacidia laurocerasi*	(Diederich et al., 2024)
2	*Minutoexcipula beaglei* Etayo	*Lecanora*	(Etayo & Sancho, 2008)
3	*Minutoexcipula calatayudii* V. Atienza	*Hypogymnia tubulosa*	(Atienza, 2002)

Table 2.14 (continued)

	Species name	Host	References
4	*Minutoexcipula kovalenkoi* Zhurb. & Diederich	*Lecanora pulicaris*	(Zhurbenko et al., 2020)
5	*Minutoexcipula manamiana* Diederich	*Lecanora* sp.	(Diederich et al., 2024)
6	*Minutoexcipula mariana* V. Atienza	*Pertusaria heterochroa*	(Atienza, 2002)
7	*Minutoexcipula megalariae* Diederich, F. Berger & Etayo,	*Megalaria laureri*	(Diederich et al., 2024)
8	*Minutoexcipula miniatoexcipula* R.C. Harris & Lendemer	*Pertusaria epixantha*	(Lendemer et al., 2016)
9	*Minutoexcipula ohmurae* Zhurb. & Diederich	*Menegazzia terebrata* and *Anzia colpota*	(Zhurbenko et al., 2024)
10	*Minutoexcipula physciae* Zhurb., P. Pinault & Diederich	*Physcia stellaris*	(Diederich et al., 2024)
11	*Minutoexcipula tephromelae* V. Atienza, Etayo & Pérez-Ort.	*Tephromela atra*	(Atienza et al., 2009)
12	*Minutoexcipula toensbergii* Diederich	On the thallus of an unidentified, sterile, sorediate, corticolous lichen	(Diederich et al., 2024)

Table 2.14 (continued)

	Species name	Host	References
13	*Minutoexcipula tuckerae* V. Atienza & D. Hawksw.	*Carpinus caroliniana*	(Atienza et al., 1994)
14	*Minutoexcipula tuerkii* Hafellner	*Pertusaria glomerata*	(Hafellner, 1994a)



Note a Conidiophores and conidiogenous cells showing a series of annellations and different stages of conidiogenesis. b Mature conidia. Scale bars: a = 10 μm, b = 5 μm.

Source Redrawn from Atienza et al. (1994)

Figure 2.16 *Minutoexcipula tuckerae*

Class CANDELARIOMYCETES Voglmayr & Jaklitsch

SubClass CANDELARIOMYCETIDAE Miądl. et al., ex Timdal & M. Westb.

Order Candelariales Miądl., Lutzoni & Lumbsch

Family Candelariaceae Hakul.

Candelariella Müll. Arg. (2-50)

Index Fungorum 787, Facesoffungi, MycoBank, GenBank

Classification: Candelariaceae, Candelariales, Candelariomycetidae, Candelariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Candelariella vitellina* (Hoffm.) Müll. Arg.

= *Patellaria vitellina* Hoffm.

Table 2.15 Accepted lichenicolous species of *Candelariella*

	Species name	**Host**	**References**	**Remarks**
1	*Candelariella dispersa* (Räsänen) Hakul.	*Placynthium*	(Hakulinen, 1954)	= *Candelariella coralliza* f. *dispersa* Räsänen
2	*Candelariella superdistans* (Nyl.) Malme	*Lecanora populicola*	(Nylander, 1879b)	= *Lecanora superdistans* Nyl.

Class DOTHIDEOMYCETES O.E.Erikss. & Winka

Order Abrothallales Pérez-Ort. & Suija

= Lichenoconiales Diederich, Lawrey & K. D. Hyde

Family Lichenoconiaceae Diederich & Lawrey

= Abrothallaceae Pérez-Ort. & Suija, in Pérez-Ortega, Suija, Crespo & Ríos, Fungal Diversity 64(1): 303 (2013)

Index Fungorum 803667,Facesoffungi, MycoBank, GenBank

Classification: Abrothallales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

= Abrothallaceae Pérez-Ort. & Suija

The lichenicolous family Lichenoconiaceae was introduced by Diederich & Lawrey (2013) to accommodate *Lichenoconium* which only has asexual morph (Hyde et al., 2013). It is characterized by pycnidial conidiomata, dispersed or slightly aggregated, immersed to superficial, subsphaerical to ellipsoid, black pycnidia with an irregular pore-like opening. Pycnidial wall pseudoparenchymatic, composed of 2–4 layers of rounded to polyhedral, flattened cells, becoming more olivaceous in 10 % KOH. The conidiogenous cells are phialidic, often percurrently proliferating, hyaline and smooth, elongate ampulliform to subcylindrical, covering the entire wall of the inner pycnidial cavity up to the pore. Conidia are subsphaerical, ellipsoid, obpyriform or elongate-clavate, basally indistinctly or distinctly truncate, with the basal scar variable in size, arising singly, aseptate, not visibly guttulate, surface always ornamented, varying from indistinctly verruculose to distinctly verrucose or echinulate, medium to dark brown, becoming more olivaceous in 10 % KOH (Hyde et al., 2013).

Abrothallaceae and Abrothallales were established by Pérez-Ort. & Suija (2014) to accommodate *Abrothallus* having sexual and asexual morph (Pérez-Ortega et al., 2014). The family is distinguished by apothecioid ascomata protruding through the host cortex, sessile or partly immersed, spherical to flattened, often with a greenish or yellowish pruina. Its hamathecium is composed of thick-walled, unequally dichotomously branched and anastomosed, septate interascal filaments. Asci are bitunicate, functionally fissitunicate, broadly to narrowly clavate, I–, comprising of four to eight ascospores. Ascospores are initially hyaline, later brown, often verruculose, one-, two- or three septate, breaked into part-spores from septa in some species, asymmetric in shape. Its anamorph is characterized by phynidial, black, immersed or

semi-immersed conidiamata with a small ostiole, Vouauxiomyces-type. Conidiogenous cells are percurrently proliferating, ampulliform to lageniform, lining the cavity of the pycnidium, hyaline, smooth walled. Conidia are holoblastic, clavate to obpyriform, hyaline, smooth to very slightly echinulate, in muscilage (Pérez-Ortega et al., 2014). The anamorph of *Abrothallus* is mainly different from *Lichenoconium* by the conidia color and ornamentation. *Abrothallus* conidia are hyaline and smooth walled, however, *Lichenoconium* conidia are brown and always ornamented, varying from verruculose to echinulate.

Liu et al. (2017) conducted a molecular clock analysis which indicated Abrothallales and Lichenoconiales form two closely related sister clades. Diederich et al. (2018) synonymized Lichenoconiales with Abrothallales and tentatively proposed Lichenoconiaceae to be synonymous with Abrothallaceae. Hongsanan et al. (2020) accepted the viewpoint of Diederich et al. (2018) and suggested Abrothallaceae as a synonym of Lichenoconiaceae due to the latter being the older name.

Type genus: *Lichenoconium* Petr. & Syd.

Table 2.16 Accepted genera of Abrothallaceae

	genera name	**Type species**	**Reference**	**Remarks**
1	*Abrothallus* De Not.	*Abrothallus bertianus* De Not.	(De Notaris, 1846a)	
2	*Lichenoconium* Petr. & Syd.	*Lichenoconium lichenicola* (P. Karst.) Petr. & Syd.	(Petrak et al., 1927)	

Abrothallus De Not. (52-54)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Lichenoconiaceae, Abrothallales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Abrothallus was initially described as a lichenized genus by De Notaris (1846) to accommodate the species *A. bertianus*. Meanwhile, De Notaris also proposed that it might be a parasite. Lindsay (1857) confirmed its lichenicolous habit through critical microscopic studies. Clements & Shear (1931) designated *A. parmeliarum* (Sommerf.) Arnold as the lectotype. However, Suija et al. (2018) re-examined the type and other materials in the corresponding Herbarium, re-designated *A. bertianus* as the lectotype. Diederich (1989) gave a detailed description of *A. bertianus*.

This genus is characterized by the almost globose ascomata often covered with green or yellow pruina, bitunicate and fissitunicate asci with 4–8 spores, and its 2–4-celled, brown and warted, asymmetric, trans-septate ascospores. Some members are distinguished by only asexual morph, including the immersed or erumpent conidiomata of *Vouauxiomyces*-type (Suija et al., 2018). The asexual morph, first described under *Vouauxiomyces* Dyko & D.Hawksw., is characterized by coelomycetous, dark brown pycnidia with a small ostiole, conidiogenous cells lining the pycnidial cavity, ampulliform to lageniform, and conidia that are hyaline to slightly yellowish, 1-3 guttulate, with a rounded apex and truncate base, clavate to obpyriform, or almost roundish (Hawksworth et al., 1979). The conidia are holoblastic, smooth to slightly echinulate, often embedded in mucilage (Pérez-Ortega et al., 2014).

To date, 52 lichenicolous fungi and two lichens are recognized in *Abrothallus* listed in Index Fungorum (2024). These species mainly grow on the large foliose lichens, such as those in Parmeliaceae (*Flavoparmelia, Melanelixia, Parmdia, Parmelina, Sphyridium, Usnea*), Lobariaceae (*Sticta*), and Nephromataceae (*Nephroma*) families (De Notaris, 1846a; Montagne, 1851; Tulasne, 1852; Lindsay, 1866; Anzi, 1868; Arnold, 1874a; Cohn, 1879a; Stein, 1879a; Schröter, 1885). One species *Abrothallus lepidophilus* Anzi grows on the fruticose lichen *Cladonia pyxidata* (Cladoniaceae) (Anzi, 1868). The two species combined from *Lecidea* are *Abrothallus parmeliarum* (Sommerf.) Arnold, which grows on *Parmelia omphalodes* and was

combined from *Lecidea parmeliarum* Sommerf., and *Abrothallus urceolariae* (Nyl.) Arnold, which grows on the crustose lichen Graphidaceae and was combined from *Lecidea urceolariae* Nyl. by Arnold (1874).

Most members of *Abrothallus* grow on the thallus of foliose lichen, such as Lobariaceae, Parmeliaceae, Peitigeraceae, Physciaceae, Pannariaceae and Nephromataceae (Diederich, 1990; Hawksworth, 1990b; Hafellner, 1994a; Wedin, 1994; Etayo, 2002a; Suija et al., 2011, Suija et al., 2015; Etayo, 2017). Little species found on crustose and fruticose lichens. *Abrothallus mairei* Werner, was recorded growing on the crustose lichen *Acarospora hilaris* (Dufour ex Nyl.) Arnold (Maire, 1937), and several species were recorded on fruticose lichens, such as Cladoniaceae, Stereocaulonaceae (Hawksworth, 1990b; Diederich, 2003; Diederich et al., 2017; Diederich et al., 2018). Suija et al. (2024) introduced three species growing on Peltigeraceae and Pannariaceae.

The systematic status of *Abrothallus* has undergone several changes. Pérez-Ortega et al. (2014) introduced Abrothallales Pérez-Ort. & Suija and Abrothallaceae Pérez-Ort. & Suija based on a phylogenetic analysis utilizing six genes (SSU, LSU, mtSSU, RPB1, RPB2 and TEF1) to accommodate *Abrothallus* De Notaris. However, molecular clock analysis by Liu et al. (2017) showed that Abrothallales and Lichenoconiales form two closely related sister clades, sharing a congruent divergence time of 56 (24–102) Mya. Subsequently, Diederich et al. (2018) synonymized Lichenoconiales with Abrothallales and tentatively proposed Lichenoconiaceae to be synonymous with Abrothallaceae. In a parallel phylogenetic analysis by Hongsanan et al. (2020), *Abrothallus* (Abrothallaceae, Abrothallales) and *Lichenoconium* (Lichenoconiaceae, Lichenoconiales) form a single clade with a minimum crown age of 58.84 Mya. Consequently, Hongsanan et al. (2020) concurred with the viewpoint of Diederich et al. (2018) and suggested retaining Lichenoconiaceae over Abrothallaceae due to the former being the older name.

Type species:

Abrothallus bertianus De Not.

Table 2.17 Accepted lichenicolous species of *Abrothallus*

	Species name	Host	Reference	Remarks
1	*Abrothallus acetabuli* Diederich	*Parmelia acetabulum*	(Diederich, 1990)	
2	*Abrothallus altoandinus* Flakus, Etayo & Rodr. Flakus	*Usnea durietzii*	(Senanayake et al., 2023)	
3	*Abrothallus bertianus* De Not.	*Melanelixia subaurifera*	(De Notaris, 1846a)	
4	*Abrothallus boomii* Pérez-Ort. & Suija	*Nephroma*	(Suija et al., 2015)	
5	*Abrothallus brattii* (S.Y. Kondr.) Suija & Pérez-Ort.	*Pseudocyphellaria faveolata*	(Suija et al., 2015)	= *Vouauxiomyces brattii* S.Y. Kondr.
6	*Abrothallus bryoriarum* Hafellner	*Bryoria capillaris*	(Hafellner, 1994a)	
7	*Abrothallus buellianus* De Not.	*Parmelina tiliacea*	(De Notaris, 1846a)	= *Abrothallus puntilloi* Brackel
8	*Abrothallus caerulescens* I. Kotte	*Xanthoparmelia conspersa*	(Kotte, 1909; Suija et al., 2018)	
9	*Abrothallus canariensis* Pérez-Ort., van den Boom & Suija	*Pseudocyphellaria aurata*, *Crocodia aurata*	(Suija et al., 2015)	

Table 2.17 (continued)

	Species name	Host	Reference	Remarks
10	*Abrothallus cetrariae* I. Kotte	*Platismatia glauca*	(Kotte, 1909)	
11	*Abrothallus chrysanthus* Stein	*Usnea*	(Cohn 1879a; Urbanavichus et al., 2013)	
12	*Abrothallus cladoniae* R. Sant. & D. Hawksw.	*Cladonia polycarpoides*	(Hawksworth, 1990b)	
13	*Abrothallus curreyi* Linds.	*Parmdia perforata*	(Lindsay, 1866)	
14	*Abrothallus diederichii* Suija & F. Berger	*Lobaria pulmonaria*	(Suija et al., 2024)	
15	*Abrothallus doliiformis* Pérez-Ort. & Suija	*Sticta*	(Suija et al., 2015)	
16	*Abrothallus epiclathratus* Suija, Etayo & Flakus	*Crocodia* cf. *clathrata*	(Suija et al., 2024)	
17	*Abrothallus eriodermae* Suija, Etayo & Pérez-Ortega	*Erioderma*	(Suija et al., 2015)	
18	*Abrothallus ertzii* Suija, Etayo & Pérez-Ortega	*Lobaria pulmonaria*	(Suija et al., 2015)	
19	*Abrothallus etayoi* Pérez-Ortega & Suija	*Sticta*	(Suija et al., 2015)	
20	*Abrothallus granulatae* Wedin	*Pseudocyphellaria*	(Wedin, 1994)	

Table 2.17 (continued)

	Species name	Host	Reference	Remarks
21	*Abrothallus halei* Pérez-Ort., Suija, D. Hawksw. & R. Sant.	*Lobaria quercizans*	(Suija et al., 2011)	
22	*Abrothallus heterodermiicola* Etayo & F. Berger	*Heterodermia*	(Etayo, 2017)	
23	*Abrothallus hypotrachynae* Etayo & Diederich	*Hypotrachyna*	(Etayo, 2002a)	
24	*Abrothallus kamchatica* (Zhurb. & Stepanchikova) Pérez-Ortega & Suija	*Nephroma*	(Zhurbenko et al., 2012; Suija et al., 2015)	= *Epinephroma kamchatica* Zhurb. & Stepanch.
25	*Abrothallus leifidii* Etayo & Zhurb.	*Leifidium tenerum*	(Zhurbenko, 2023c)	
26	*Abrothallus lobariae* (Diederich & Etayo) Diederich & Ertz	*Lobaria pulmonaria*	(Etayo et al., 1995; Diederich et al., 2018)	= *Phoma lobariae* Diederich & Etayo
27	*Abrothallus macrosporus* Etayo & R. Sant.	*Durietzia crenulata*	(Etayo, 2010a)	
28	*Abrothallus mairei* Werner	*Acarospora hilaris*	(Maire, 1937)	
29	*Abrothallus microspermus* Tul.	*Flavoparmelia caperata*	(Tulasne, 1852)	

Table 2.17 (continued)

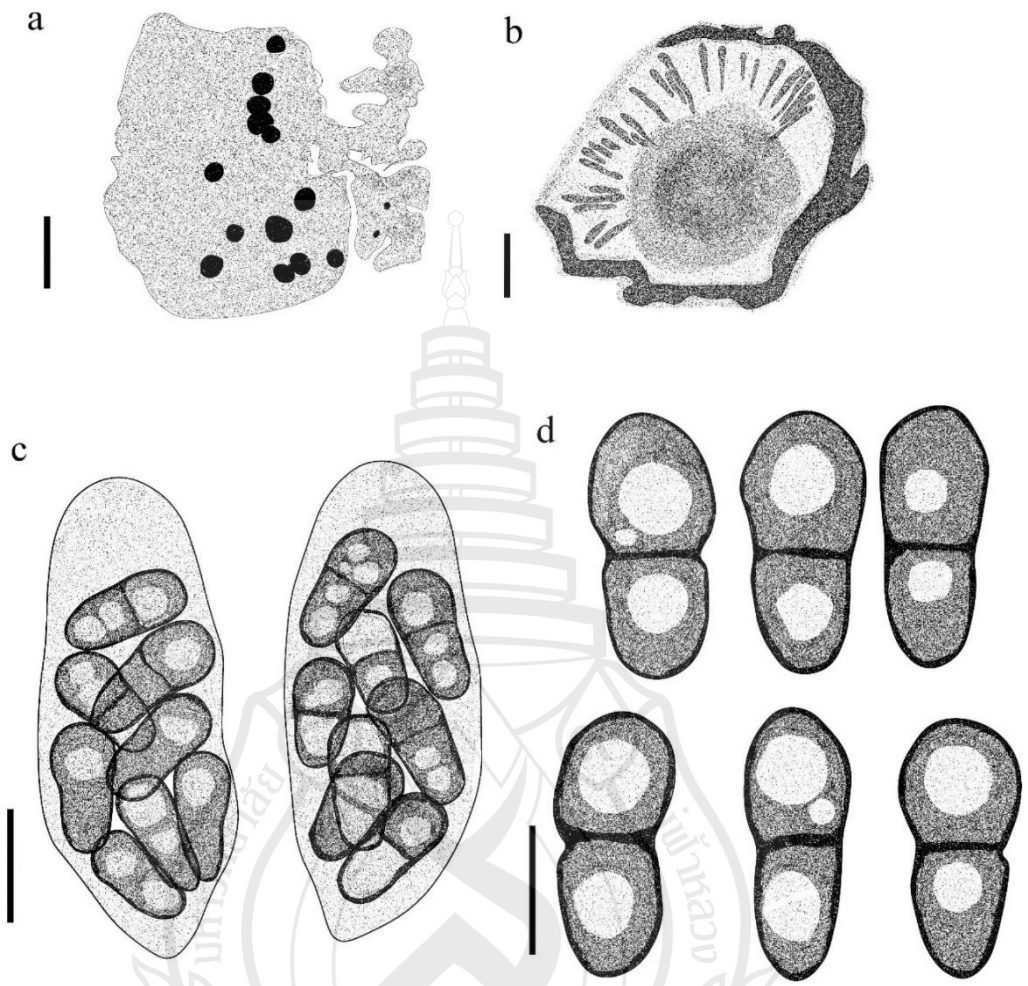
	Species name	Host	Reference	Remarks
30	*Abrothallus nephromatis* Suija & Pérez-Ortega	*Nephroma*	(Lindsay, 1866)	
31	*Abrothallus niger* Etayo	*Everniastrum*, and possibly *Parmotrema* and *Usnea*	(Etayo, 2017)	
32	*Abrothallus nitassinan* Arsenault, P. Baines & Suija	*Erioderma pedicellatum*	(Suija et al., 2024)	
33	*Abrothallus parmeliarum* (Sommerf.) Arnold	*Parmelia omphalodes*	(Arnold, 1874a; Diederich, 2004a)	= *Lecidea parmeliarum* Sommerf.
34	*Abrothallus parmotrematis* Diederich	*Parmotrema crinitum*	(Clauzade et al., 1989)	
35	*Abrothallus peyritschii* (Stein) Kotte	*Vulpicida pinastri*	(Kotte, 1909; Suija et al., 2018)	= *Lecidea parmeliarum* Sommerf.
36	*Abrothallus pezizicola* Diederich & R.C. Harris	*Cladonia peziziformis*	(Diederich, 2003)	
37	*Abrothallus prodiens* (Harm.) Diederich & Hafellner	*Hypogymnia physodes*	(Diederich, 1990)	= *Lecidea prodiens* Harm.
38	*Abrothallus psoromatis* (Zhurb. & U.Braun) Diederich & Zhurb.	*Psoroma hypnorum*	(Diederich et al., 2018)	= *Phoma psoromatis* Zhurb. & U. Braun

Table 2.17 (continued)

	Species name	Host	Reference	Remarks
39	*Abrothallus ramalinae* Diederich	*Ramalina*	(Diederich et al., 2017)	
40	*Abrothallus santessonii* (D. Hawksw.) A. Suija, D. Hawksw. & Pérez-Ort.	*Platismatia glauca*	(Diederic et al., 2018)	= *Vouauxiomyces santessonii* D. Hawksw.
41	*Abrothallus secedens* Wedin & R. Sant.	*Pseudocyphellaria dubia*	(Wedin, 1994)	
42	*Abrothallus stereocaulorum* Etayo & Diederich	*Stereocaulon*	(Etayo, 2002a)	
43	*Abrothallus stictarum* Etayo	*Sticta fuliginosa*	(Etayo, 2002a)	
44	*Abrothallus stroblii* Hafellner	*Menegazzia terebrata*	(Hafellner et al., 2008)	
45	*Abrothallus subhalei* Etayo, Flakus & Kukwa	*Lobariella crenulata*	(Flakus et al., 2019b)	
46	*Abrothallus suecicus* (Kirschst.) Nordin	*Ramalina*	(Nordin, 1964)	= *Leciographa suecica* Kirschst.
47	*Abrothallus teloschistis* Brackel, Pérez-Ortega & Suija	*Seirophora and Teloschistes*	(Brackel, 2015)	
48	*Abrothallus tetrasporus* (Etayo & Osorio) Etayo, Flakus & Rodr. Flakus	*Usnea* and *Biatoropsis usnearum*	(Senanayake et al., 2023)	= *Abrothallus usneae* var. *tetrasporus* Etayo & Osorio

Table 2.17 (continued)

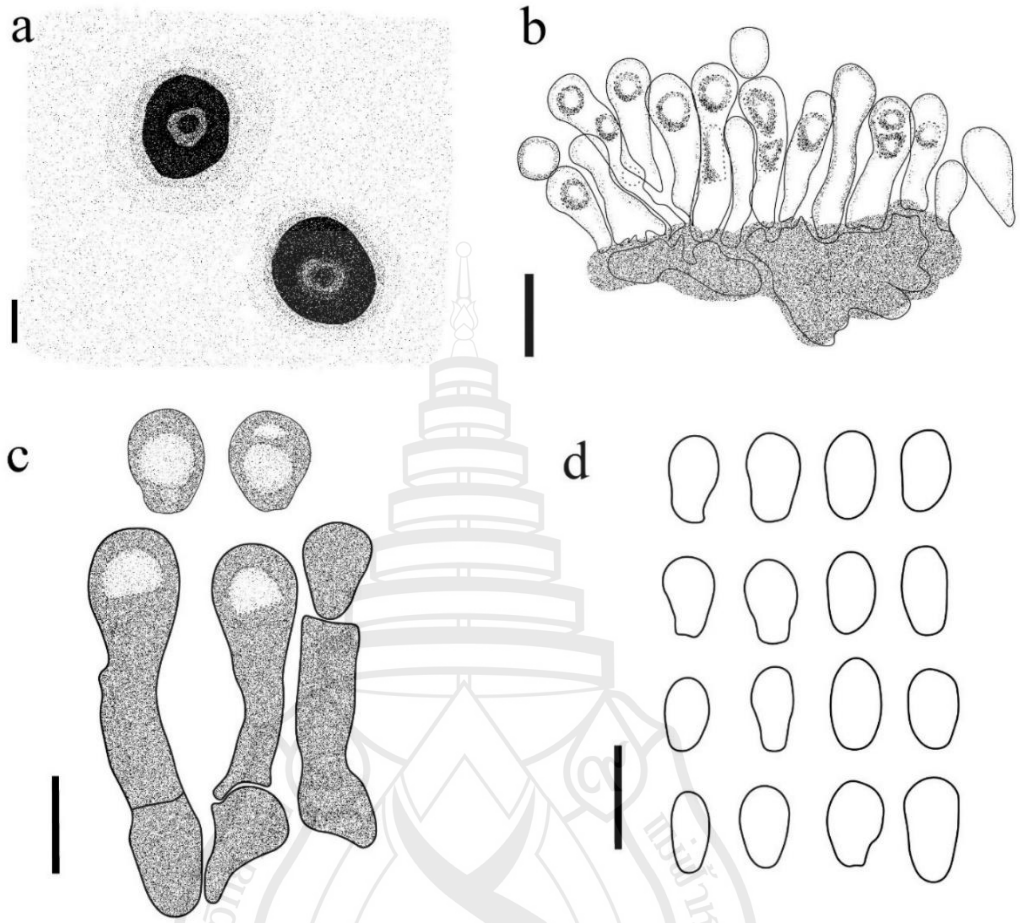
	Species name	Host	Reference	Remarks
49	*Abrothallus tulasnei* M.S. Cole & D. Hawksw.	*Xanthoparmelia somloensis*	(Cole et al., 2001)	
50	*Abrothallus usneae* Rabenh.	*Usnea barbata* v. *florida*	(Rabenhorst, 1861)	
51	*Abrothallus viduus* Körb.	*Sticta pulmonaria*	(Cohn, 1879a; Schröter, 1885)	
52	*Abrothallus welwitschii* Mont.	*Sticta*	(Montagne, 1851)	



Note a Apothecia on the thallus of host. b Section of Apothecium. c Asci. d Ascospores. Scale bars: a = 500 µm, b = 50µm, c = 10µm, d = 5µm.

Source Redrawn from Pérez-Ortega et al. (2014) & website: Fungi of Great Britain and Ireland (2024)

Figure 2.17 Sexual morph of *Abrothallus bertianus*



Note a Surface view of pycnidia. b, c Conidiogenous cells with conidiospores. d Conidia. Scale bars: a = 100 µm, b, d = 10µm, c = 5µm

Source Redrawn from Pérez-Ortega et al. (2014)

Figure 2.18 Asexual morph of *Abrothallus bertianus*

Lichenoconium Petr. & Syd. (17)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Lichenoconiaceae, Abrothallales, Dothideomycetes, Ascomycota, Fungi

Lichenoconium was established by Petrak and Sydow (1927) to accommodate the type species *L. lichenicola* (P. Karst.) Petr. & Syd. which was transferred from

Dactylium dendroides subsp. *lichenicola*. P. Karst. The original simple description by Karsten in 1877 included characteristics such as conidia size 25–36 × 9–12 µm, with a thickened base and an apiculate apex. Hawksworth (1977) provided a monograph of *Lichenoconium*, discussing the genus and describing ten species. According to Hawkswroth, this genus is characterized by pycnidia with an irregular opening rather than a well-defined ostiole, distinguishing it from *Coniothyrium*. The conidiogenous cells are essentially phialidic, percurrently proliferate, and produce annellide-like conidiogenous cells. Conidia arise singly from the apices of conidiogenous cells, become pigmented prior to separation, are non-septate, brown, and generally not evidently guttulate. The conidial size proved to be of major taxonomic value (Hawksworth, 1977a).

Christ (1956) described a new species, *Lichenoconium xanthoriae* M.S. Christ., found on *Xanthoria polycarpa* (Hoffm.) Rieber also reported on *Caloplaca, Cetraria, Cetrelia, Heterodermia, Melanelia, Physcia*, and *Teloschistes*. Hawksworth (1979) introduced a combination, *Lichenoconium lecanorae* (Jaap) D. Hawksw., which was transferred from *Coniosporium lecanorae* Jaap. Diederich (1986) described a new species, *Lichenoconium reichlingii* Diederich, which grows on the fruticose lichen *Ramalina*. Kondratyuk et al. (1994, 1995) published two new species, *Lichenoconium plectocarpoides*, on *Pseudocyphellaria*, and *Lichenoconium follmannii* S. Y. Kondr. & D. J. Galloway, growing on *Lobaria pulmonaria*. Kalb and Hafellner (1995), introduced one new species, *Lichenoconium laevisporum* Kalb & Hafellner, which grows on *Haematomma stevensiae* R.W. Rogers. Alstrup and Cole (1998) described a new species, *Lichenoconium edgewoodensis* Alstrup & M. S. Cole, which grows on *Parmelia sulcata* Taylor (Alstrup et al., 1998).

Into the 21 century, three species have been introduced: *Lichenoconium christiansenii* M.S. Cole & D. Hawksw., found on *Nodobryoria abbreviata* (Müll. Arg.) Common & Brodo, *Lichenoconium aeruginosum* Diederich, M. Brand, van den Boom

& Lawrey, which grows on the lichen host *Cladonia pocillum* (Ach.) O.J. Rich., and *Lichenoconium hawksworthii* Flakus, Etayo, Kukwa & Rodr. Flakus, growing on *Heterodermia comosa* (Eschw.) Follmann & Redón (Cole et al., 2004; Lawrey et al., 2011; Wijayawardene et al., 2021). To date, there are 17 species in this genus, and Genbank contains 16 sequences belonging to the LSU, ITS, and mtSSU genes.

Type species: *Lichenoconium lichenicola* (P. Karst.) Petr. & Syd.

= *Dactylium dendroides* subsp. *lichenicola* P. Karst.

Table 2.18 Accepted lichenicolous species of *Lichenoconium*

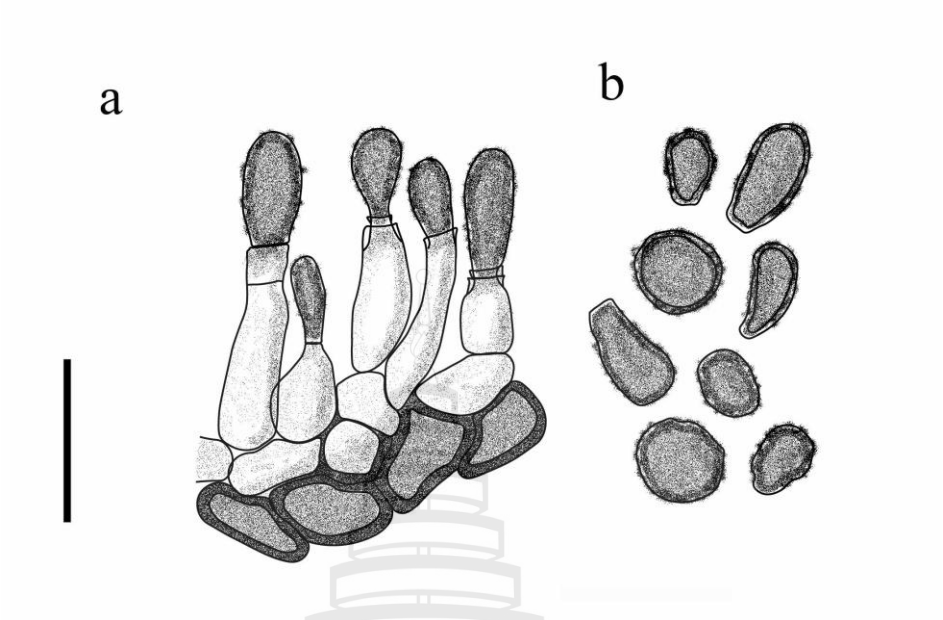
	Species	**Host**	**References**	**Remarks**
1	*Lichenoconium aeruginosum* Diederich, M. Brand, van den Boom & Lawrey	*Cladonia pocillum*	(Lawrey et al., 2011)	
2	*Lichenoconium cargillianum* (Linds.) D. Hawksw.	*Letharia, Parmotrema, Platismatia, Ramalina* and *Usnea*	(Hawksworth, 1977a)	= *Microthelia cargilliana* Linds.
3	*Lichenoconium christiansenii* M. S. Cole & D. Hawksw.	*Nodobryoria abbreviata*	(Cole et al., 2004)	
4	*Lichenoconium echinosporum* D. Hawksw.	*Heterodea muelleri*	(Hawksworth, 1977a)	

Table 2.18 (continued)

	Species	Host	References	Remarks
5	*Lichenoconium edgewoodensis* Alstrup & M. S. Cole	*Parmelia sulcata*	(Alstrup et al., 1998)	
6	*Lichenoconium erodens* M. S. Christ. & D. Hawksw.	*Hypogymnia physodes*	(Hawksworth, 1977a)	
7	*Lichenoconium follmannii* S. Y. Kondr. & D. J. Galloway	*Lobaria pulmonaria*	(Kondratyuk et al., 1995b)	
8	*Lichenoconium hawksworthii* Flakus, Etayo, Kukwa & Rodr. Flakus	*Heterodermia comosa*	(Wijayawardene et al., 2021)	
9	*Lichenoconium laevisporum* Kalb & Hafellner	*Haematomma stevensiae*	(Kalb et al., 1995)	
10	*Lichenoconium lecanorae* (Jaap) D. Hawksw.	*Lecanora subfusca* and *Sorbus aucuparia*	(Hawksworth, 1979a)	= *Coniosporium lecanorae* Jaap
11	*Lichenoconium plectocarpoides* S. Y. Kondr. & D. J. Galloway	*Pseudocyphellaria*	(Kondratyuk et al., 1994)	

Table 2.18 (continued)

	Species	Host	References	Remarks
12	*Lichenoconium lichenicola* (P. Karst.) Petr. & Syd.	*Physcia, Parmelia*	(Petrak et al., 1927)	= *Dactylium dendroides* subsp. *lichenicola* P. Karst.
13	*Lichenoconium parasiticum* D. Hawksw.	*Lecanora conizaeoides*	(Hawksworth, 1977a)	
14	*Lichenoconium pyxidatae* (Oudem.) Petr. & Syd.	*Cladonia pyxidata*	(Petrak et al., 1927)	=*Coniothyrium pyxidatae* Oudem.
15	*Lichenoconium reichlingii* Diederich	*Ramalina fraxinea*	(Diederich, 1986)	
16	*Lichenoconium usneae* (Anzi) D. Hawksw.	various lichens	(Hawksworth, 1977a)	=*Epicoccum usneae* Anzi
17	*Lichenoconium xanthoriae* M. S. Christ.	*Xanthoria polycarpa,*	(Christiansen, 1956)	



Note a Conidiogenous cells and conidia. b conidia. Scale bars = 10μm.

Source Redrawn from Hawksworth (1977a)

Figure 2.19 *Lichenoconium lichenicola*

Order Acrospermales Minter, Peredo & A.T. Watson

Family Acrospermaceae Fuckel

Gonatophragmium Deighton (2-18)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Acrospermaceae, Acrospermales, Dothideomycetes, Ascomycota, Fungi

Type species: *Gonatophragmium mori* (Sawada) Deighton

= *Spondylocladium mori* Sawada

Table 2.19 Accepted lichenicolous species of *Gonatophragmium*

	Species name	**Host**	**References**
1	*Gonatophragmium lichenophilum* F.Berger & U.Braun	*Xanthoria parietina*	(Berger et al., 2015)

Table 2.19 (continued)

	Species name	Host	References
2	*Gonatophragmium physciae* Crous & Boers	*Physcia caesia*	(Crous et al., 2022)

Order Asterinales M.E. Barr ex D. Hawksw. & O.E. Erikss.

Family Hemigraphaceae D.Q. Dai & K.D. Hyde

Index Fungorum 554062, Facesoffungi , MycoBank, GenBank

Classification: Asterinales, Dothideomycetes, Ascomycota, Fungi

Hemigraphaceae was introduced by D.Q. Dai & K.D. Hyde (2018) to accommodate *Hemigrapha* which is typified by *H. asteriscus* (Müll. Arg.) R. Sant. ex D. Hawksw. In the phylogenetic trees by Ertz & Diederich (2015) and Dai et al. (2018), *H. asteriscus* forms a distinct lineage within Asterinales. In addition, after studying the type of *H. asteriscus*, Dai et al. (2018) found that it is different from the family type of Parmulariaceae. Consequently, the family Hemigraphaceae was established in Asterinales to include the sole lichenicolous genus *Hemigrapha* (Dai et al., 2018).

The family is characterized by solitary to gregarious, superficial, black to dark brown, coriaceous, stellateascomata with irregularly opening from the centre to margin. *Peridium* is composed of two parts: a black outer layer composed of thick-walled cells, and a thin inner part, composed of light brown cells. *Hamathecium* is composed of a few brown, unbranched, filamentous, septate, pseudoparaphyses around asci. Asci are bitunicate, clavate to cylindric-clavate, subglobose, 8-spored, with an ocular chamber and a short pedicel. Ascospores are 3-seriate to irregularly arranged, brown, ellipsoid, 1-septate, asymmetric, smooth-walled.

Type genus: *Hemigrapha* (Müll. Arg.) R. Sant. ex D. Hawksw. (Hawksworth, 1975a)

Hemigrapha (Müll. Arg.) R. Sant. ex D. Hawksw. (9)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Hemigraphaceae, Asterinales, Dothideomycetes, Ascomycota, Fungi

Hemigrapha was initially established by Müller (1882) as a section of *Melanographa* Müll. Arg. Hawksworth (1975) transferred the species *Melanographa astericus* Müll. Arg. to *Hemigrapha asteriscus* (Müll. Arg.) R. Sant. ex D. Hawksw., which grows on *Sticta dufourii* Del. from the Northern Hemisphere, and was designated as the type species (Müller, 1882; Hawksworth, 1975a). The genus is characterized by dark, superficial, star-shaped ascomata forming on a thallus of lichens, clavate to subglobose asci, and brown, ellipsoid, 2-celled ascospores. The conidiomata are pycnothyria, with holoblastic, discrete, determinate conidiogenous cells that are subspherical, ellipsoid to shortly ampulliform, simple or rarely 1-septate, hyaline, smooth, and lacking proliferations. Conidia are hyaline, aseptate, smooth, with a truncate or non-truncate base, and are of two types: narrowly ellipsoid to rod-shaped microconidia and larger, ellipsoid macroconidia (Diederich et al., 2000).

The taxonomic position of *Hemigrapha* has undergone several changes. Eriksson & Hawksworth (1991) suggested placing it in the Hysteriaceae (Dothideales) but with a question mark. Diederich & Wedin (2000) proposed placing this genus in the family Microthyriaceae (Dothideales) based on its thyriothecial ascomata with radiating rows of cells, the hamathecium formed of paraphysoids, the fissitunicate asci not becoming blue in iodine, and the mostly 1-septate ascospores. Eriksson et al. (2001) transferred this genus to Parmulariaceae with a question mark (Eriksson et al., 2001). Hyde et al. (2013) included the genus in Parmulariaceae but explained that it is incertae sedis until the molecular data is available (Hyde et al., 2013). Ertz & Diederich (2015) conducted the first phylogenetic analysis of Dothideomyceta based on LSU and mtSSU data sets. Two *Hemigrapha* species were included in the phylogenetic tree, and *Hemigrapha atlantica* forms a single clade clustering within the order Asterinales (Ertz

et al., 2015). Consequently, Dai et al. (2018) introduced the new family Hemigraphaceae to accommodate this single genus. Wijayawardene et al. (2022) included this genus within Hemigraphaceae (Asterinales) (Dai et al., 2018; Wijayawardene et al., 2022)

To date, nine species are recognized in this genus, all of which are lichenicolous. After Hawksworth (1975) published the first combined species, Matzer (1996) introduced two new species, *Hemigrapha phaeospora* Matzer & Lücking growing on *Pseudocyphellaria* and *Hemigrapha strigulae* Matzer growing on *Strigula*, and one combination *Hemigrapha tenellular* (Müll. Arg.) R. Sant. ex Matzer from *Melanographa tenellula* Müll. Arg. Diederich & Wedin (2000) revised *Hemigrapha* growing on Peltigerales and discussed the genus's taxonomic position. Three new species, *Hemigrapha atlantica* Diederich & Wedin, growing on *Sticta canariensis* (Bory) Bory ex Delise, *H. nephromatis* Wedin & Diederich, growing on *Nephroma australe* A. Rich., and *H. pseudocyphellariae* Diederich & Wedin, growing on *Pseudocyphellaria argyracea* (Delise) Vain. were introduced simultaneously. Cáceres & Lücking (2000) introduced *Hemigrapha pilocarpacearum* M. Cáceres & Lücking, which grows on the lichen *Byssoloma minutissimum* Kalb & Vězda. The latest new species is *Hemigrapha graphidicola* Diederich & Common, growing on *Graphis assimilis* Nyl., introduced by Diederich et al. (2019)

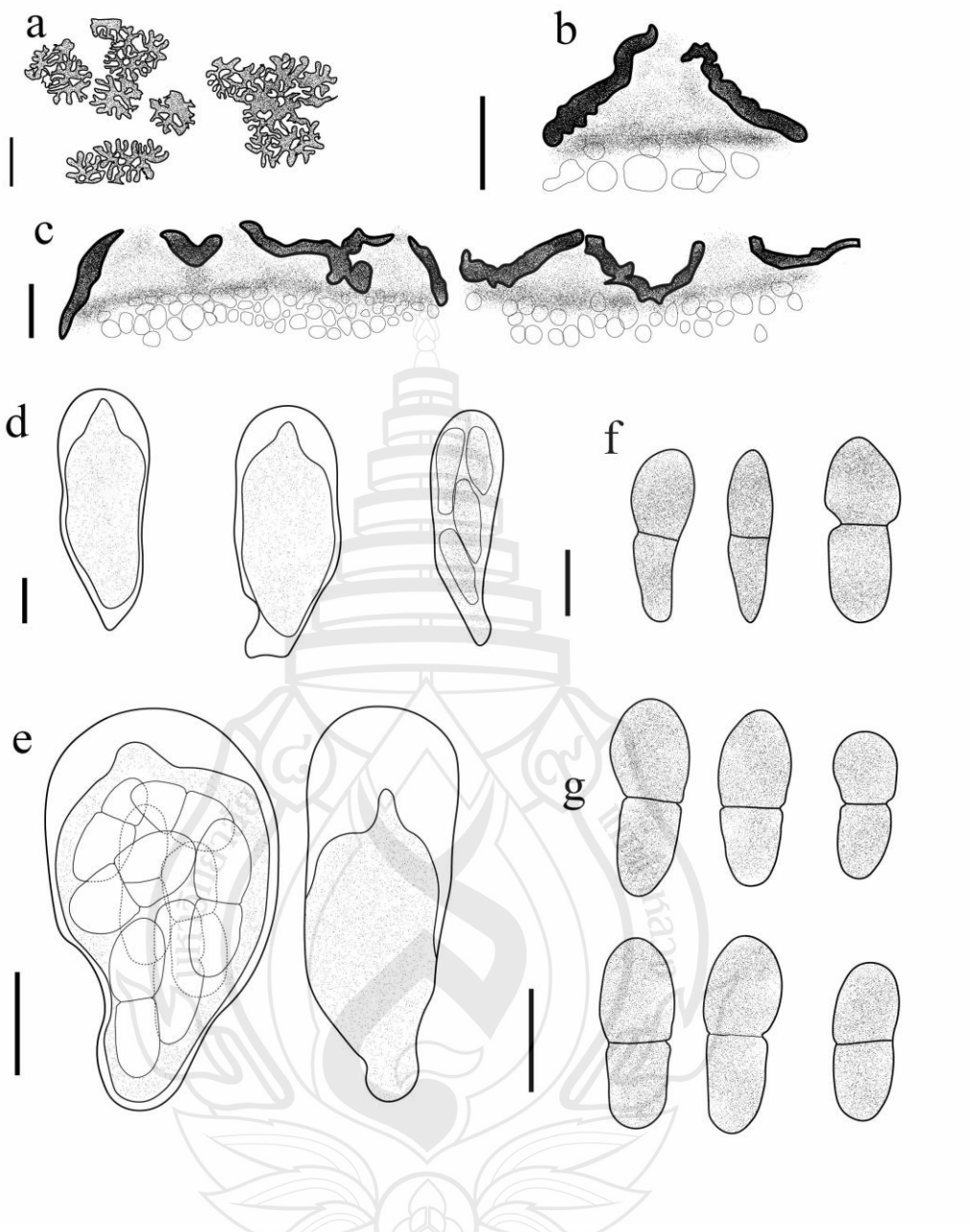
Type species: *Hemigrapha asteriscus* (Müll. Arg.) R. Sant. ex D. Hawksw., on *Peltigera*

Table 2.20 Accepted lichenicolous species of *Hemigrapha*

	Species name	Host	References	Remarks
1	*Hemigrapha asteriscus* (Müll. Arg.) R. Sant. ex D. Hawksw.	*Peltigera*	(Hawksworth, 1975a)	= *Melanographa asteriscus* Müll. Arg.

Table 2.20 (continued)

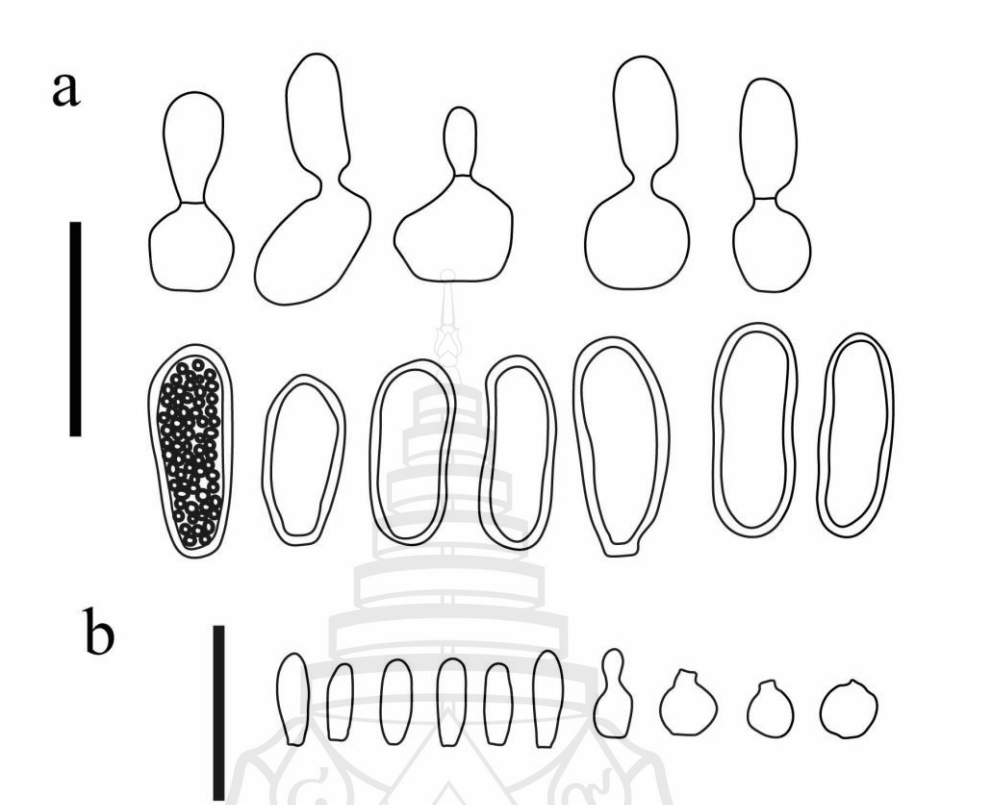
	Species name	Host	References	Remarks
2	*Hemigrapha atlantica* Diederich & Wedin	*Sticta canariensis*	(Diederich et al., 2000)	
3	*Hemigrapha graphidicola* Diederich & Common	*Graphis assimilis*	(Diederich et al., 2019)	
4	*Hemigrapha nephromatis* Wedin & Diederich	*Nephroma australe*	(Diederich et al., 2000)	
5	*Hemigrapha phaeospora* Matzer & Lücking	*Pseudocyphellaria*	(Matzer, 1996)	
6	*Hemigrapha pilocarpacearum* M. Cáceres & Lücking	*Byssoloma minutissimum*	(Cáceres et al., 2000)	
7	*Hemigrapha pseudocyphellariae* Diederich & Wedin	*Pseudocyphellaria argyracea*	(Diederich et al., 2000)	
8	*Hemigrapha strigulae* Matzer	*Strigula maculata*	(Matzer, 1996)	
9	*Hemigrapha tenellula* (Müll. Arg.) R. Sant. ex Matzer	*Porina epiphylla*	(Matzer, 1996)	= *Melanographa tenellula* Müll. Arg.



Note a Appearance of ascostromata. b, c Section of ascostromata. d–e Asci. f-g Ascospores. Scale bars: a = 500μm, b-c = 50μm, d–g = 5μm.

Source Redrawn from Diederich et al. (2000) and Dai et al. (2018)

Figure 2.20 *Hemigrapha asteriscus*



Note a Macroconidial morph. b Microconidial morph. Scale bars: a–b = 10μm.

Source Redrawn from Diederich et al. (2000)

Figure 2.21 *Hemigrapha asteriscus*

Family Neobuelliellaceae Hongsanan & K.D. Hyde

Index Fungorum 558103, Facesoffungi , MycoBank, GenBank

Classification: Asterinales, Dothideomycetes, Ascomycota, Fungi

Neobuelliellaceae was introduced by Hongsanan & K.D. Hyde (2020) to accommodate *Neobuelliella* Hongsanan & K.D. Hyde. In the phylogenetic analysis of Dai et al. (2018), two strains of *Neobuelliella poetschii* form a distinct clade separate from Stictographaceae, and sister to Hemigraphaceae. Then Neobuelliellaceae was introduced to accommodate this clade. The lichenicolous family is characterized by apothecioid ascomata which are dispersed over the host thallus as black dots, grouped,

rounded, globose when young, oval when mature. Excipulum is dark brown, K+ greenish-brown, and the discs are olive-brown. Hamathecium is composed of branched, anastomosing, cellular pseudoparaphyses, capitate at apical and intercalary cells with pigment, thick at tips, with dark-brown pigment. Asci are bitunicate, fissitunicate, cylindrical, 4–6-spored. Ascospores are long, cells rounded, the upper cell sometimes tapered, hyaline, later ± brown, 1-septate, clearly constricted at the septa, thin-walled (Ertz & Diederich 2015; Dai et al., 2018; Hongsanan et al., 2020).

Type genus: *Neobuelliella* Hongsanan & K.D. Hyde

Neobuelliella Hongsanan & K.D. Hyde (1)

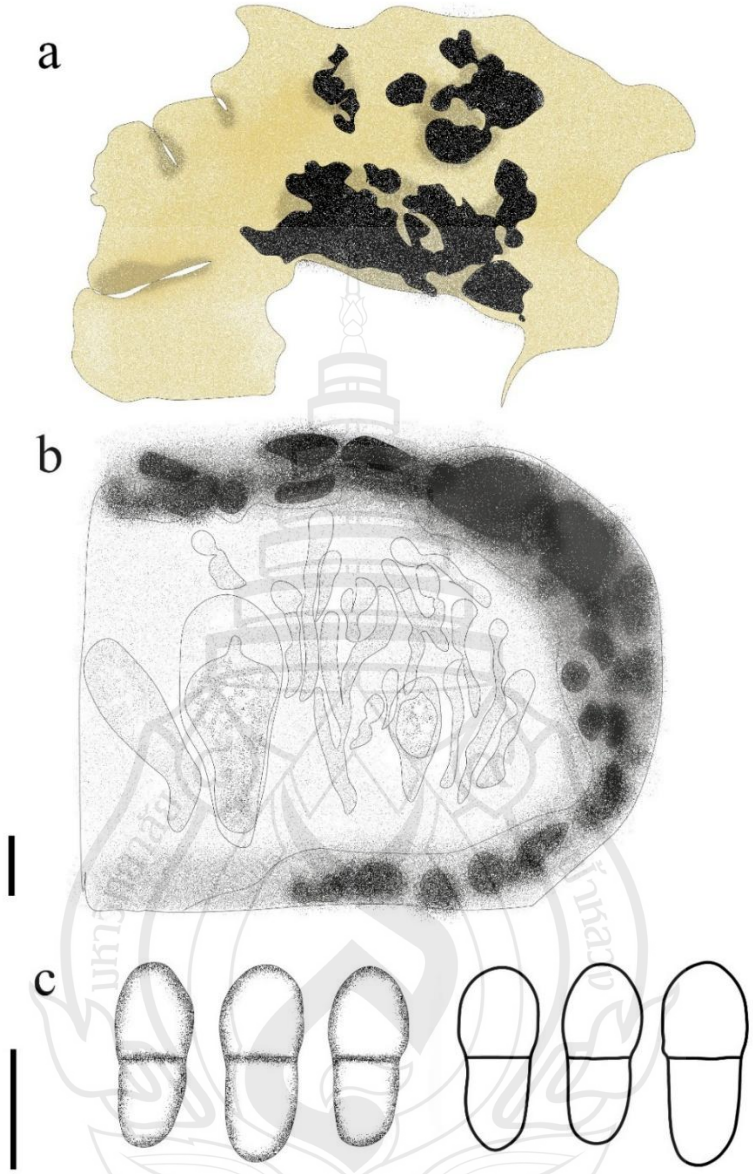
Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Neobuelliellaceae, Asterinales, Dothideomycetes, Ascomycota, Fungi

Neobuelliella was introduced by Hongsanan et al. (2020) to accommodate *N. poetschii* (Hafellner) Hongsanan & K.D. Hyde, which was transferred from *Buelliella poetschii* Hafellner. This type species is the sole lichenicolous member of the genus, characterized by apothecioid ascomata that initially appear as black dots, grouped, rounded, and globose. As the ascomata mature, they become oval and flattened at the edges. The asci are bitunicate, fissitunicate, and cylindrical, typically containing 4–6 spores. The ascospores are elongated with rounded cells, hyaline to brown, 1-septate, and possess thin walls (Hongsanan et al., 2020).

Type species: *Neobuelliella poetschii* (Hafellner) Hongsanan & K.D. Hyde, on *Endocarpon adsurgens*.

= *Buelliella poetschii* Hafellner



Note a Ascomata. b Section through ascoma. c Ascospores. Scale bars: b = 10µm, c = 5µm.

Source redraw from *Buelliella poetschii* of Ertz et al. (2015) and Hongsanan et al. (2020)

Figure 2.22 *Neobuelliella poetschii*

Family Stictographaceae D.Q. Dai & K.D. Hyde

Index Fungorum 554064, Faceoffungi, MycoBank, GenBank

Classification: Stictographaceae, Asterinales, Dothideomycetes, Ascomycota, Fungi

Stictographaceae is a lichenicolous family which was introduced by D.Q. Dai & K.D. Hyde (2018) to accommodate several lichenicolous genera or with saprobic lifecycles. The family is characterized by lichenicolous habit, cymbiform to lirelliform, or a slit-like disc, black to dark brown ascomata, wide clavate to subglobose asci and brown, ellipsoid ascospores with a single septum (Dai et al., 2018).

The family contains seven genera, most of them have lichenicolous species, except for *Neoacrodictys* J.W. Xia & X.G. Zhang which has only one species growing on dead branches (Xia et al., 2022). *Actinocladium* was introduced by Ehrenb. (1819), included nine species, and one of which is lichenicolous. This genus was initially placed within Ascomycota genera incertae sedis. Yang et al. (2023) introduced a new species of *Actinocladium*, and placed this genus within Stictographaceae based on phylogenetic analysis. *Buelliella* Fink has 13 species, all of which are lichenicolous.

Karschia was introduced by Körb. (1865), typified by *K. talcophila* (Ach.) Körb. It contains 51 species, 23 of which are lichenicolous. *Labrocarpon* Etayo & Pérez-Ort. contains two species, both of which are lichenicolous. Barr (1979) placed *Karschia* in *Patellariaceae* Corda. Then it was transferred to *Lichenotheliaceae*, *Lichenotheliales* by Thambugala et al. (2014) based on the morphology observed from herbarium material. Ertz & Diederich (2015) re-examined the type specimen and sequenced the type species. Phylogenetic analysis indicated that *Karschia* forms a single clade close to *Labrocarpon*, *Melaspileopsis* and *Stictographa*. Dai et al. (2018) got the same result in the phylogenetic, leading to placement of *Karschia* within *Stictographaceae*.

Melaspileopsis and *Stictographa* Mudd are two monotypic genera, their type species are lichenicolous. *Melaspileopsis* was introduced by Ertz & Diederich (2015)

and is typified by *M. diplasiospora* (Nyl.) Ertz & Diederich. *Stictographa* was collected on the exclusive host *Phaeographis dendritica* Muell in western Europe. It is morphologically similar to *Labrocarpon* in having cymbiformis ascomata opening by a long slit. The monotypic genus *Labrocarpon* was introduced by Pérez-Ortega & Etayo (2010) and is typified by *L. canariense* (D. Hawksw.).

Type genus: *Stictographa* Mudd

Actinocladium Ehrenb. (1-7)

Index Fungorum 22003, Faceoffungi, MycoBank, GenBank

Classification: Stictographaceae, Asterinales, Dothideomycetes, Ascomycota, Fungi

Type species: *Actinocladium rhodosporum* Ehrenb., facultatively lichenicolous on *Flavoparmelia, Hypotrachyna, Lecanora, Lepra* and *Lepraria*. (Ehrenberg, 1819)

Buelliella Fink (13)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Stictographaceae, Asterinales, Dothideomycetes, Ascomycota, Fungi

Buelliella was established by Fink (1935) to accommodate the type species *B. minimula* (Tuck.) Fink growing on *Pergusaria*, along with six other species that were transferred from other genera. *Buelliella* is characterized by adnate to sessile apothecia with a flat to convex blackish disk, a brown to black hypothecium, clavate or cylindrico-clavate asci with 8 spores, and brown, oblong-ovoid to ellipsoid or oblong 1-septate spores (Fink, 1935).

Initially, *Buelliella* was placed in Buelliaceae Zahlbr. (Lecanorales). However, Lumbsch & Huhndorf (2007) reclassified it within Dothideomycetes genera incertae sedis. This placement persisted until Ertz & Diederich (2015) conducted the first phylogenetic study that included *Buelliella*, suggesting its placement within Asterinales genera incertae sedis based to phylogenetic result. Further phylogenetic analysis by Ertz

et al. (2016) revealed that three *Buelliella* species intermixed with species of other genera in Asterinales, failing to form a single clade. Consequently, Wijayawardene et al. (2018) supported the viewpoint of Ertz & Diederich (2015), placing the genus within Asterinales genera incertae sedis.

Dai et al. (2018) re-analyzed sequence data for taxa of the family Parmulariaceae E. Müll. & Arx ex M.E. Barr and related genera, including *Buelliella*. Although *Buelliella physciicola* Poelt & Hafellner formed a strongly supported clade with the genera *Karschia* Körb., *Labrocarpon* Etayo & Pérez-Ort., *Melaspileopsis* (Müll. Arg.) Ertz & Diederich, and some species of family Stictographaceae D.Q. Dai & K.D. Hyde, *Buelliella* was not included in Stictographaceae due to limited sequence data (Dai et al., 2018). Subsequently, Wijayawardene et al. (2020, 2022) placed *Buelliella* within the family Stictographaceae (Asterinales).

To date, there are 13 lichenicolous taxa in *Buelliella*. Following the initial species combined by Fink (1935), Hafellner (1979) introduced the second new species, *Buelliella physciicola*, which grows on *Phaeophyscia* & *Physcia*, and a combination, *B. trypethelii*, which grows on *Trypethelium*. Hafellner (1985) introduced the third new species, *Buelliella pusilla*, which grows on *Brigantiaea leucoxantha*. Aptroot et al. (1997) introduced the fourth new lichenicolous species, *Buelliella dirinariae*, which grows on *Dirinaria picta*. Kalb (1990) introduced the fifth new species, *Buelliella eximia*, which grows on *Pyxine cocoes*.

Etayo (2002) and Hafellner et al. (2002) introduced two new taxa. One new species, *Buelliella colombiana*, grows on *Phlyctis andensis*, and the other, a combination *Buelliella inops*, was transferred from *Karschia inops* Triebel & Rambold. In the last twenty years, five new species were introduced by various scholars. Suija & Alstrup (2004) introduced *B. lecanorae*, which grows on *Lecanora*. Van Den Boom (2010) and Perez-Ortega & Etayo (2010) separately introduced two new species, *Buelliella heppiae* van den Boom growing on *Heppia arenacea* and *Buelliella*

protoparmeliopsidis Etayo & Pérez-Ort. growing on *Protoparmeliopsis*. Singh & Singh (2019) introduced *Buelliella indica* Pushpi Singh & Kr.P. Singh, which grows on *Graphis longiramea*. The latest new species, *B. ohmurae*, which was introduced by Zhurbenko & Ohmura (2020).

Type species: *Buelliella minimula* (Tuck.) Fink, on *Pertusaria*

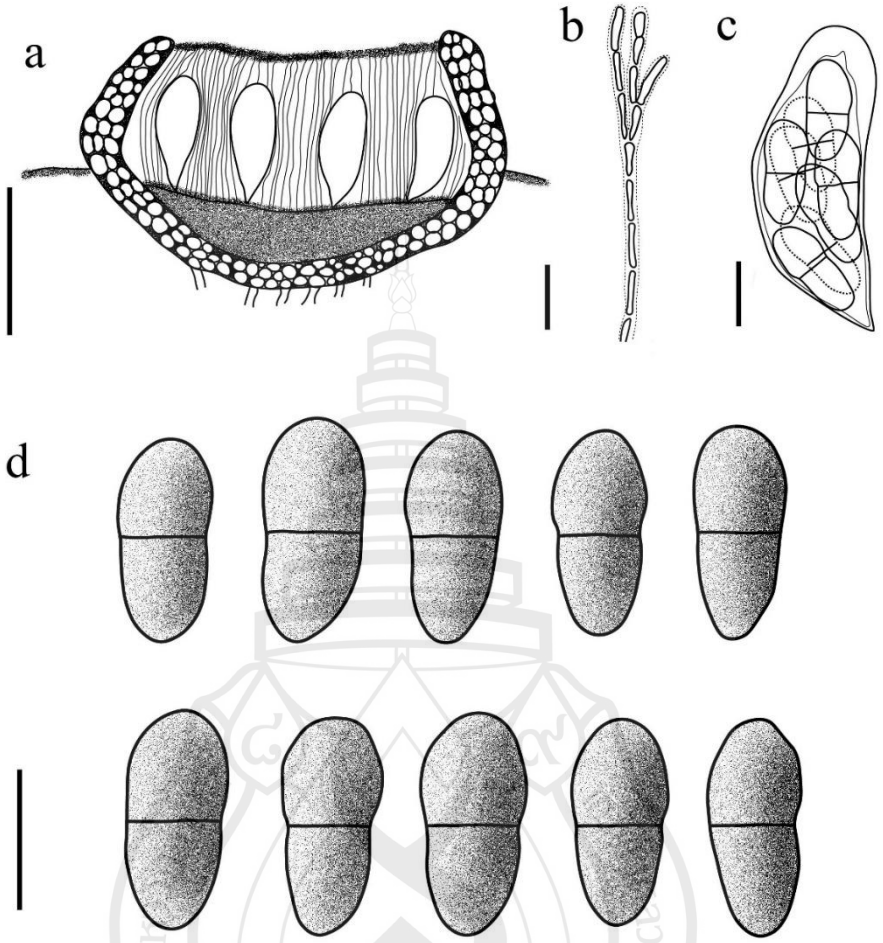
= *Buellia minimula* Tuck.

Table 2.21 Accepted lichenicolous species of *Buelliella*

	Species name	**Host**	**References**	**Remarks**
1	*Buelliella colombiana* Etayo	*Phlyctis andensis*	(Etayo, 2002a)	
2	*Buelliella dirinariae* Feminine	*Dirinaria picta*	(Aptroot et al., 1997)	
3	*Buelliella eximia* Kalb & Hafellner	*Pyxine cocoes*	(Kalb, 1988)	
4	*Buelliella heppiae* van den Boom	*Heppia arenacea*	(Van Den Boom, 2010)	
5	*Buelliella indica* Pushpi Singh & Kr.P. Singh	*Graphis longiramea*	(Singh et al., 2019)	
6	*Buelliella inops* (Triebel & Rambold) Hafellner	*Caloplaca*	(Hafellner et al., 2002)	= *Karschia inops* Triebel & Rambold
7	*Buelliella lecanorae* Suija & Alstrup	*Lecanora*	(Suija et al., 2004)	
8	*Buelliella minimula* (Tuckerman) Fink	*Pertusaria*	(Fink, 1935)	= *Buellia minimula* Tuck.

Table 2.21 (continued)

	Species name	Host	References	Remarks
9	*Buelliella ohmurae* Zhurbenko & Diederich	*Icmadophila ericetorum*	(Zhurbenko et al., 2020)	
10	*Buelliella physciicola* Poelt & Hafellner	*Phaeophyscia* and *Physcia*	(Hafellner, 1979)	
11	*Buelliella protoparmeliopsidis* Etayo & Pérez-Ort.	*Protoparmeliopsis*	(Perez-Ortega et al., 2010)	
12	*Buelliella pusilla* Hafellner	*Brigantiaea leucoxantha*	(Hafellner, 1985a)	
13	*Buelliella trypethelii* (Tuckerman) Fink ex Hafellner	*Trypethelium*	(Hafellner, 1979)	= *Buellia trypethelii* Tuck.



Note a Longitudinal section of apothecium. b Paraphysis. c Ascus. d Ascospores.

Scale bars a = 50 µm; b–d = 10 µm.

Source Redrawn from Hafellner (1979)

Figure 2.23 *Buelliella minimula*

Karschia Körb. (18-51)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Stictographaceae, Asterinales, Dothideomycetes, Ascomycota, Fungi

Type species: *Karschia talcophila* (Ach.) Körb., on *Diploschistes.*

= *Lecidea talcophila* Ach.

Table 2.22 Accepted lichenicolous species of *Karschia*

	Species name	Host	References	Remarks
1	*Karschia alpicolae* D. Hawksw. & Alstrup	*Allantoparmelia alpicola*	(Alstrup et al., 1990)	
2	*Karschia artemisiae* Velen.	Crustose lichen	(Velenovský, 1934)	
3	*Karschia brachyspora* (Müll. Arg.) Vouaux	*Buellia innata*	(Balfour, 1882; Vouaux, 1913c)	= *Lecidea brachyspora* Müll.
4	*Karschia crassaria* Vouaux	*Squamaria crassa*	(Vouaux, 1913c)	
5	*Karschia egedeana* (Linds.) Vouaux	*Parmelia*	(Vouaux, 1913c)	= *Lecidea egedeana* Linds.
6	*Karschia glomelliferae* (Harm.) Vouaux	*Parmelia glomellifera*	(Vouaux, 1913c)	= *Lecidea glomelliferae* Harm.
7	*Karschia juniperi* Velen.	Crustose lichen	(Velenovský, 1934)	
8	*Karschia laeta* K. Gerber	*Placodii chrysoleuci*	(Gerber, 1931)	
9	*Karschia linitaria* Vouaux	*Lobaria linita*	(Vouaux, 1913c)	

Table 2.22 (continued)

	Species name	Host	References	Remarks
10	*Karschia minuta* Velen.	Crustose lichen	(Velenovský, 1934)	
11	*Karschia pertusariae* Vouaux	*Pertusaria*	(Vouaux, 1913c)	
12	*Karschia rimulicola* (Müll. Arg.) Rehm	*Pertusaria degradata*	(Rehm, 1896b)	= *Lecidea rimulicola* Müll. Arg.
13	*Karschia santessonii* Hafellner	*Porpidia*	(Hafellner, 1979)	
14	*Karschia sordidae* J. Steiner	*Lecanora sordida*	(Steiner, 1898)	
15	*Karschia sphyridii* Stein	*Sphyridium byssoides*	(Stein, 1872)	
16	*Karschia strickeri* Körb.	*Biatorina pineti*	(Körber, 1865a)	
17	*Karschia urceolariae* (Nyl.) Rehm	*Urceolaria scruposa*	(Rehm, 1896b)	= *Lecidea urceolariae* Nyl.
18	*Karschia vagans* (Müll. Arg.) Arnold	*Lecanora polytropa*	(Arnold, 1874b)	

Labrocarpon Etayo & Pérez-Ort. (2)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Stictographaceae, Asterinales, Dothideomycetes, Ascomycota, Fungi

Labrocarpon was established by Pérez-Ortega et al. (2010) to accommodate the type species *L. canariensis* (D. Hawksw.) Etayo & Pérez-Ortega, which was transferred from *Melaspilea canariensis* D. Hawksw. This genus is characterized by lirelliform, lip-shaped black ascomata with a broader center, narrow sides, and a distinct groove. The excipulum is dark brown to carbonaceous, pseudoparenchymatous, and continuous, with the base immersed in host lichens. The periphysoids are highly inflated, and the paraphyses are septate. The asci are broadly clavate and bitunicate, while the ellipsoidal, brown, 1-septate ascospores are constricted and smooth.

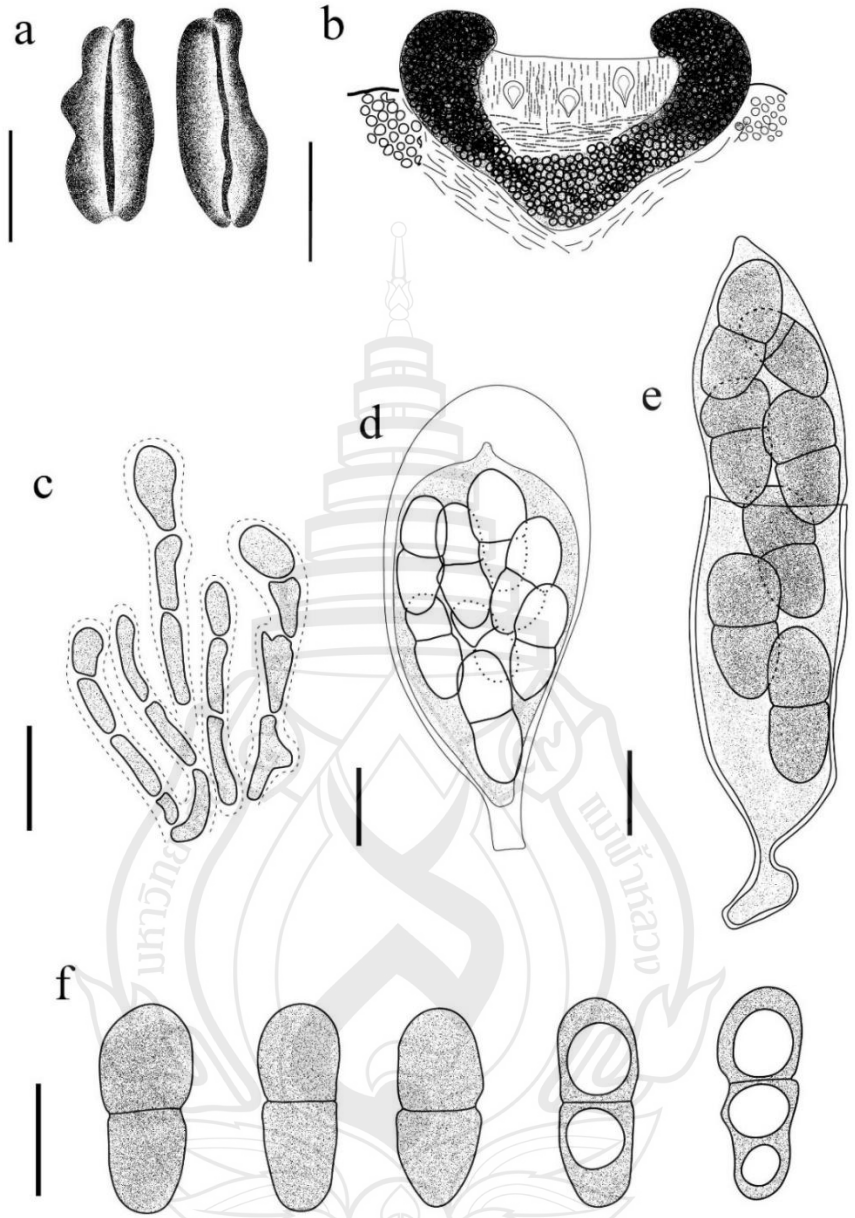
Ertz and Diederich (2015) conducted a phylogenetic analysis using LSU sequence data and confirmed that *Labrocarpon* belongs to a clade within Asterinales. Their results also suggested that parts of the genera in this clade might represent a new family. Dai et al. (2018) introduced the lichenicolous family *Stictographaceae* to accommodate several genera with either lichenicolous or saprobic life cycles based on phylogenetic analyses using available sequence data. Currently, *Labrocarpon* is included in the family *Stictographaceae*.

Joshi (2022) described a second species of this genus, *Labrocarpon submuriforme*, which grows on the thallus and apothecial disc of *Ochrolechia*, further expanding the diversity of this genus.

Type species: *Labrocarpon canariense* (D. Hawksw.) Etayo & Pérez-Ortega

Table 2.23 Accepted lichenicolous species of *Labrocarpon*

	Species name	**Host**	**References**	**Remarks**
1	*Labrocarpon canariense* (D. Hawksw.) Etayo & Pérez-Ortega	*Pertusaria*	(Perez-Ortega et al., 2010)	= *Melaspilea canariensis* D. Hawksw.
2	*Labrocarpon submuriforme* Y. Joshi	*Ochrolechia*	(Joshi, 2022b)	



Note a Apothecia. b Section of apothecium. c paraphyses. d Young ascus with hyaline ascospores. e Discharging ascus with brown ascospores. f Ascospores. Scale bars a = 200µm, b = 100µm, c–f = 10µm.

Source Redrawn from *Melaspilea canariensis* of Hawksworth (1982a)

Figure 2.24 *Labrocarpon canariensis*

Melaspileopsis (Müll. Arg.) Ertz & Diederich (1)

Index Fungorum, Facesoffungi , MycoBank, GenBank

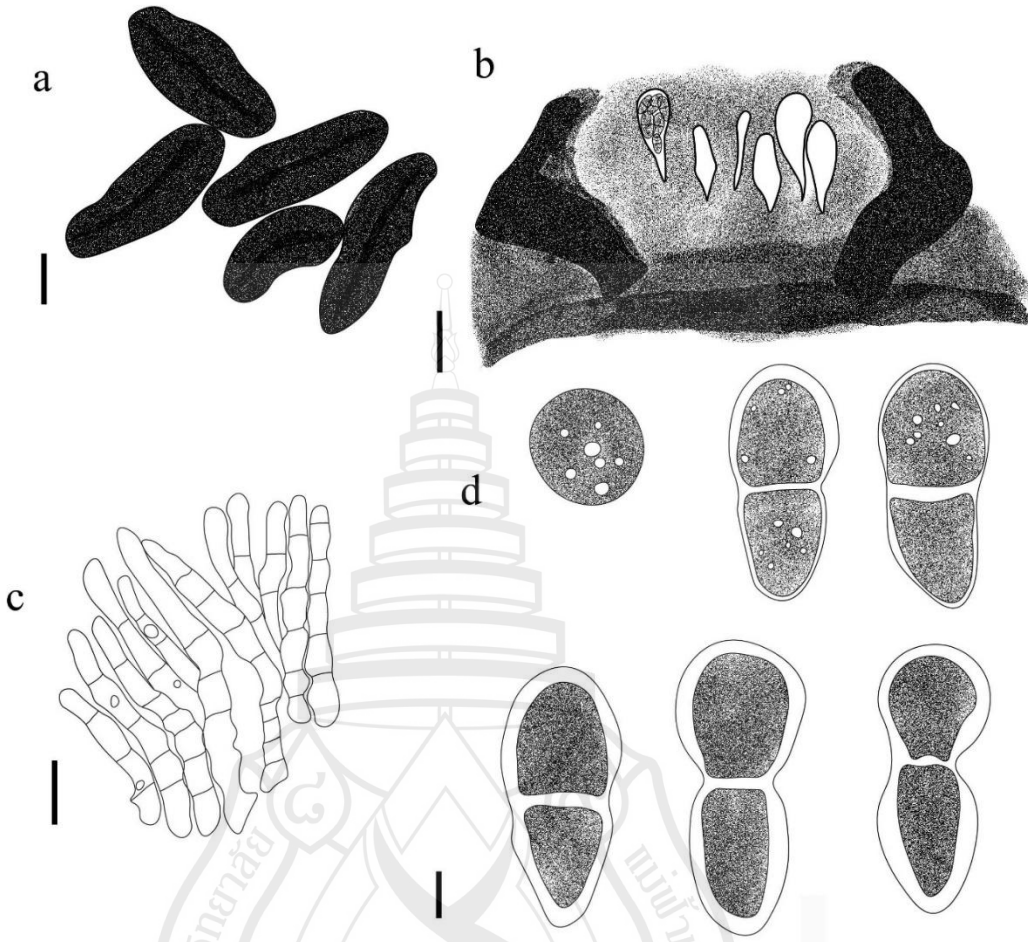
Classification: Stictographaceae, Asterinales, Dothideomycetes, Ascomycota, Fungi

= *Melaspilea* sect. *Melaspileopsis* Müll. Arg.

Melaspileopsis was reinstated by Ertz and Diederich (2015) from the *Melaspilea* sect. *Melaspileopsis* Müll. Arg. It is characterized by a saprobic lifestyle; black, simple to occasionally branched lirelliform sessile ascomata; a slit-like or narrowly exposed disc; a well-developed, brownish-black exciple with a hyaline inner layer, widely open below the hymenium; a hyaline hymenium that is I– and K/I– or K/I+ blue, then quickly turning orange; predominantly simple paraphyses; periphyses arising from the inner excipular layer; clavate asci with thickened upper walls, a distinct ocular chamber, and I–, K/I– reactions; and 1-septate ascospores that are initially hyaline and later turn brown.

The type species, *Melaspileopsis diplasiospora*, was transferred from *Opegrapha diplasiospora* Nyl., which had previously been combined as *Melaspilea diplasiospora* (Nyl.) Müll. Arg. It was also described by Etayo (1998). Sanderson et al. (2009) appear to have identified a lichenicolous population on *Graphis elegans* as *Melaspilea diplasiospora*. Therefore, we tentatively list *Melaspileopsis* as a lichenicolous fungus here. (Etayo 1998a; Sanderson et al., 2009; Ertz & Diederich 2015)

Type species: *Melaspileopsis diplasiospora* (Nyl.) Ertz & Diederich, on *Pertusaria* (Ertz et al., 2015)



Note a Ascomata. b Section of apothecium. c Periphyses. d Ascospores. Scale bars: a = 200µm, b = 50µm, c = 10µm, d = 5µm

Source Redrawn from Nylander (1863) and Ertz et al. (2015)

Figure 2.25 *Melaspileopsis diplasiospora*

Stictographa Mudd (2)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Stictographaceae, Asterinales, Dothideomycetes, Ascomycota, Fungi

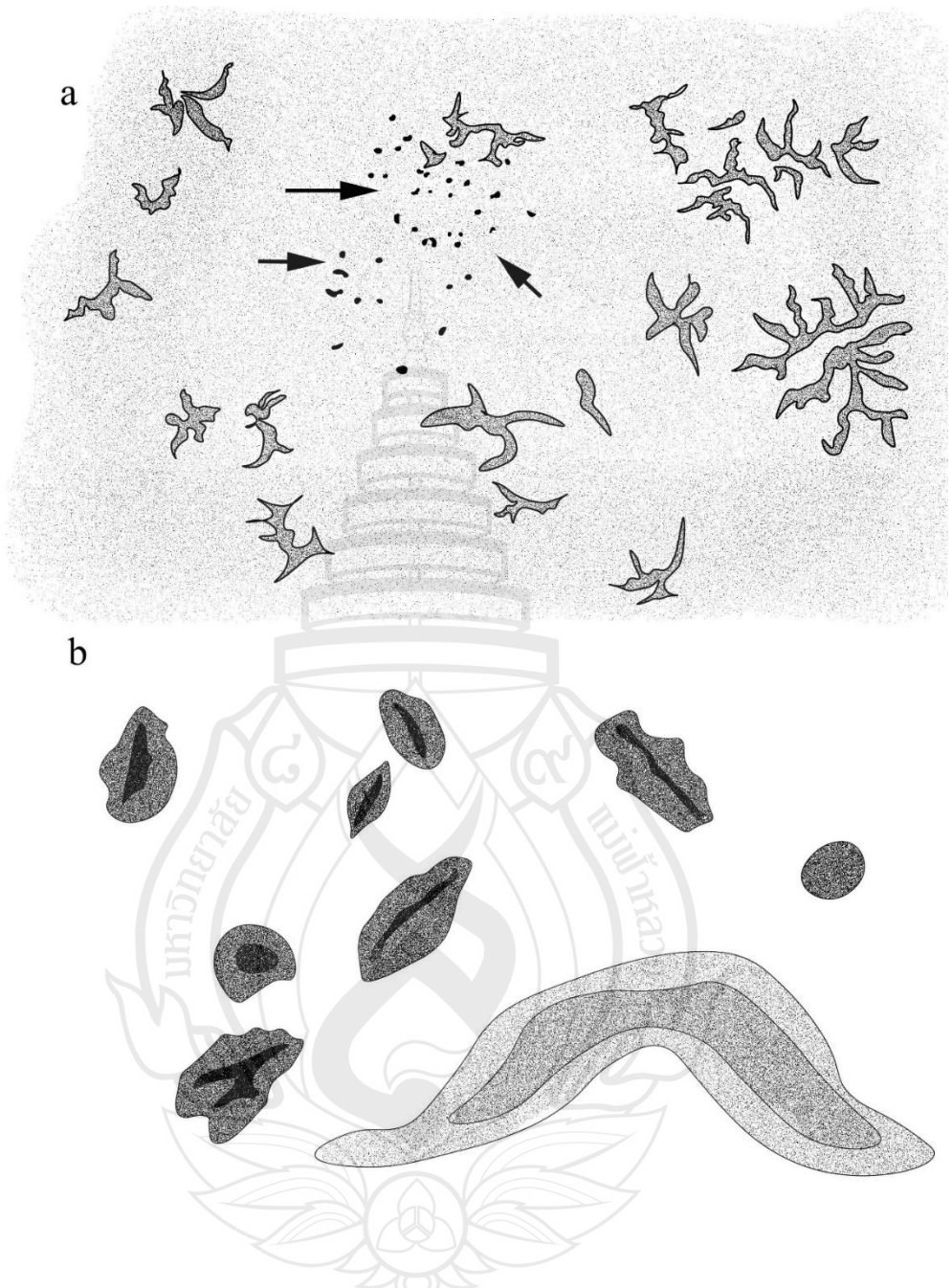
Stictographa was originally introduced by Mudd (1861) for a lichenized species with lirelliform ascomata and an exciple continuous below the hymenium. The type

Stictographa lentiginose is combined from *Opegrapha lentiginosea* which was originally described as a lichenized species, but it is now generally accepted as being a lichenicolous fungus, confined to *Phaeographis dendritica* (Ertz et al., 2015). Redinger (1938) and Sanderson et al. (2009) also gave descriptions and illustrations of this species (Redinger 1938; Sanderson et al., 2009). This genus is characterized by a lichenicolous life-style; black, simple to occasionally shortly branched lirelliform ascomata; a slit-like disc; a well-developed, brownish black, K– (brownish pigment disappears) exciple continuous below the hymenium; a hyaline hymenium, I+ and K/I+ blue turning orange; mainly simple paraphyses; periphyses developing from the inner excipular layer; clavate, thick-walled (upper part), asci with a distinct ocular chamber, I–, K/I–; and 1-septate, hyaline then brown ascospores (Ertz & Diederich, 2015). Another lichenicolous is *Stictographa dirinariicola* which is introduced by Diederich, Lücking, et al. (2017), characterized by very small ascomata, 100–150 × 75–100 µm, ascospores measuring 15.0 –17.8 × 6.3 –7.8 µm and the lichenicolous habitat on *Dirinaria* (Diederic et al., 2017).

Type species: *Stictographa lentiginosa* (Lyell ex Leight.) Mudd

Table 2.24 Accepted lichenicolous species of *Stictographa*

	Species name	**Host**	**References**
1	*Stictographa dirinariicola* Diederich & Ertz	*Dirinaria picta*	(Diederich, et al., 2017)
2	*Stictographa lentiginosa* (Lyell ex Leight.) Mudd	*Phaeographis dendritica*	(Mudd, 1861)



Note a, b Apothecia of *Stictographa lentiginose* (arrows points) and *Phaeographis*.

Source Redrawn from Ertz et al. (2015) and website: Lichens marins (2024)

Figure 2.26 *Stictographa lentiginosa*

Order Asterotexiales Firmino, O.L. Pereira & Crou

Asterotexiales genera incertae sedis

Melanographa Müll. Arg. (1-10)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Asterotexiales genera incertae sedis, Asterotexiales, Dothideomycetes, Ascomycota, Fungi

Type species: *Melanographa tribulodes* (Tuck.) Müll. Arg., on *Trypethelium cruentum* (Müller 1882)

Order Botryosphaeriales C.L. Schoch, Crous & Shoemaker

Family Phyllostictaceae Fr.

Phyllosticta Pers. (1-1499)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Phyllostictaceae, Botryosphaeriales, Dothideomycetes, Ascomycota, Fungi

Type species: *Phyllosticta convallariae* Pers.

Accepted lichenicolous species:

Phyllosticta galligena C. Moreau & M. Moreau, on *Parmelia perforate* (Moreau, 1951)

Family Planistromellaceae M.E. Barr

Knudsenia Y. Joshi (1)

Index Fungorum 850287, Facesoffungi, MycoBank, GenBank

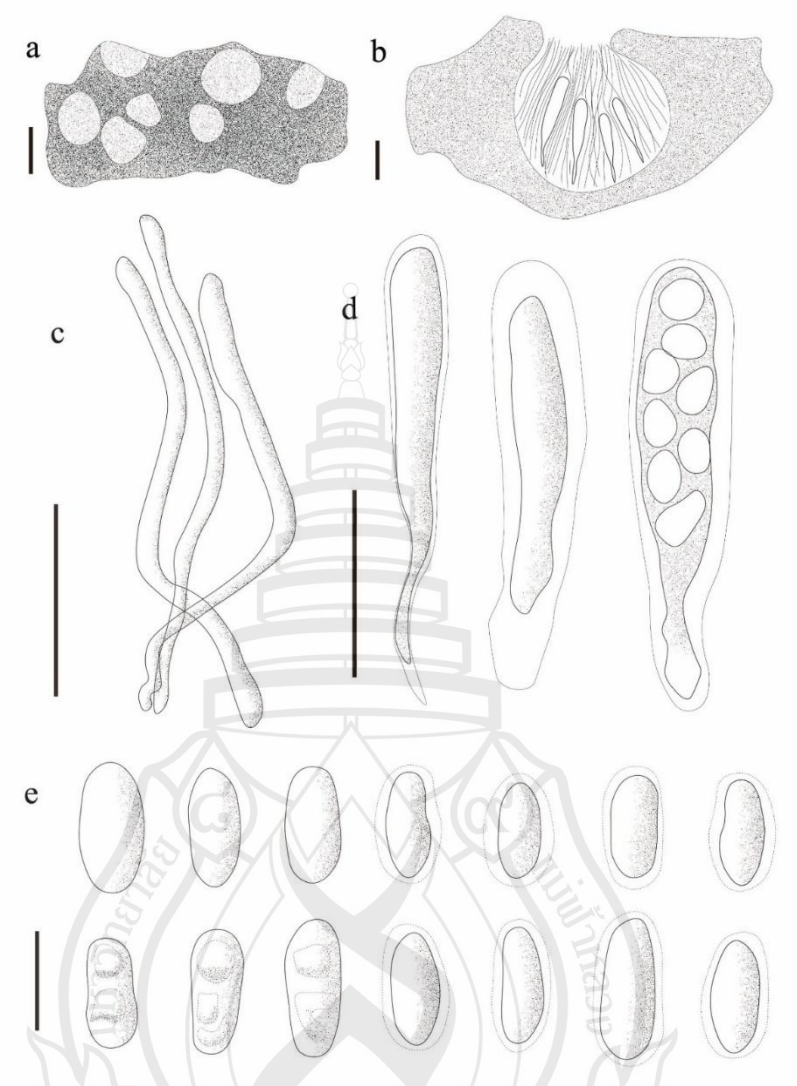
Classification: Planistromellaceae, Botryosphaeriales, Dothideomycetes, Ascomycota, Fungi

The monotypic genus *Knudsenia* was introduced by Joshi & Bansal (2023) to accommodate the type species *Knudsenia flavoparmeliarum* Y. Joshi which colonizes the thalli of *Flavoparmelia* Hale and *Flavopunctelia* (Krog) Hale in India, causing some discoloration and necrosis in the host thallus.

Knudsenia is characterized by its lichenicolous lifestyle and inconspicuous galls. The stromatic ascomata have sterile brownish-black to black tissue, which reacts K+ magenta, N–, and I–. The exciple is distinct, and the hymenial gel is K/I–. Paraphyses are simple to sparsely branched and lack pigmentation at the apex. The asci are bitunicate, elongate, clavate to subcylindrical, with an indistinct ocular chamber and a very short stalk, and are 8-spored, reacting K/I+ reddish brown. The ascospores are hyaline, spherical to ellipsoid at maturity, simple to rarely 1-pseudoseptate, I–, and lack a perispore.

This genus was placed in Planistromellaceae (Botryosphaeriales, Dothideomycetes) based on morphological characteristics. Its phylogenetic position is unconfirmed due to the lack of molecular data.

Type species: *Knudsenia flavoparmeliarum* Y. Joshi (Joshi et al., 2023a)



Note a–b Section of ascomata. c Paraphyses. d Asci. e Ascospores. Scale bars: a = 200 µm, b = 50 µm, c–d = 20 µm, e = 10 µm.

Source Redrawn from Joshi et al. (2023a)

Figure 2.27 *Knudsenia flavoparmeliarum*

Order Capnodiales Woron.

Family Dissoconiaceae Crous & de Hoog

Ramichloridium Stahel ex de Hoog (2-23)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Dissoconiaceae, Capnodiales, Dothideomycetes, Ascomycota,

Fungi

Type species: *Ramichloridium apiculatum* (J.H. Mill., Giddens & A.A. Foster) de Hoog

Table 2.25 Accepted lichenicolous species of *Ramichloridium*

	Species name	Host	References	Remarks
1	*Ramichloridium cladoniicola* U. Braun & Heuchert	*Cladonia portentosa* and *C. stygia*	(Braun et al., 2009)	
2	*Ramichloridium tropicum* U. Braun & Diederich	unidentified crustose lichen	(Diederich et al., 2017)	

Capnodiales genera incertae sedis

Psammina Sacc. & M. Rousseau ex E. Bommer & M. Rousseau (6-11)

Index Fungorum 9544, Faceoffungi, MycoBank, GenBank

Classification: Capnodiales genera incertae sedis, Capnodiales, Dothideomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Psammina was introduced by Sacc. & M. Rousseau (1890) to accommodate the saprobic species *Psammina bommerae*. This genus is characterized by colonies forming black, gelatinous sporodochia or large, subspherical, dark brown to black, dry mat-like conidia, either dispersed or agglomerated in dense groups. The mycelium is immersed, with pale brown, branched hyphae. Conidiophores are erect, straight, unbranched, and septate, with monoblastic, terminal conidiogenous cells. Conidia are acrogenous, multiseptate, and palmate, with numerous pale brown, smooth-walled arms (Bommer et al., 1890).

Species of *Psammina* exhibit diverse life strategies, including saprophytic, algicolous, lichenicolous, or lichenized lifestyles. Currently, six facultative lichenicolous species are recognized, all of which are also capable of growing on green

algae. In lichenicolous species, a distinct hymenial layer is absent, and colonies range from blackish, gelatinous sporodochia (e.g., *P. filamentosa*) to brownish agglomerations of dry, subspherical conidia (Diederich et al., 2024).

The sequence of *P. bommerae* (MH878435) is suspected to represent contamination by a *Torula* species and is therefore not considered reflective of the actual phylogenetic position of *P. bommerae*. Diederich et al. (2024) conducted a phylogenetic analysis using three genes from six strains of three species, which indicated that this genus belongs to *Capnodiales*.

Type species: *Psammina bommerae* Sacc. & M. Rousseau (Bommer et al., 1890)

Table 2.26 Accepted lichenicolous species of *Psammina*

	Species name	**Host**	**References**	**Remarks**
1	*Psammina angustata* van der Kolk	*Lecanora expallens* or over green algae	(Diederich et al., 2024)	Facultatively lichenicolous
2	*Psammina filamentosa* Kolk & Earl.-Benn.	*Lecanora expallens*, *Lepraria incana* and *Psilolechia lucida*	(van Der Kolk et al., 2020)	Facultatively lichenicolous
3	*Psammina inflata* Earl.-Benn. & D. Hawksw.	*Lepraria incana*	(Earland-Bennett et al., 1999b)	Facultatively lichenicolous

Table 2.26 (continued)

	Species name	Host	References	Remarks
4	*Psammina lobariae* (Diederich & Etayo) Earl.-Benn. & D. Hawksw.	*Lobaria pulmonaria*	(Etayo & Diederich 1998; Earland-Bennett et al., 2005)	Facultatively lichenicolous = *Pycnopsammina lobariae* Diederich & Etayo
5	*Psammina simplex* Earl.-Benn. & D. Hawksw.	*Lecania cyrtella* and *Lecanora expallens*	(Earland-Bennett et al., 1999b)	Facultatively lichenicolous
6	*Psammina stipitata* D. Hawksw.	*Schismatomma decolorans*	(Hawksworth, 1979a)	Facultatively lichenicolous

Order Cladosporiales Abdollahz. & Crous

Family Cladosporiaceae Chalm. & R.G. Archibald

Cladosporium Link (6-350)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Cladosporiaceae, Cladosporiales, Dothideomycetes, Ascomycota, Fungi

Type species: *Cladosporium herbarum* Pers.

Table 2.27 Accepted lichenicolous species of *Cladosporium*

	Species name	Host	References	Remarks
1	*Cladosporium antarcticum* K. Schubert, Crous & U. Braun	*Caloplaca regalis*	(Schubert et al., 2007)	Probably lichenicolous

Table 2.27 (continued)

	Species name	Host	References	Remarks
2	*Cladosporium diploschisticola* Diederich	*Diploschistes*	(Diederich et al., 2024)	
3	*Cladosporium licheniphilum* Heuchert & U. Braun	*Pertusaria alpin* and macrolichens	(HeucHert et al., 2006)	
	Cladosporium macrocarpum Preuss	*Cetraria islandica* and *Xanthoria parietina*	(Preuss, 1848)	Facultative lichenicolous
4	*Cladosporium peltigerae* Diederich & Schiefelbein	*Peltigera rufescens*	(Diederich et al., 2024)	
5	*Cladosporium tenuissimum* Cooke	*Cetrelia cetrarioides*	(Bensch et al., 2010)	Facultative lichenicolous

Verrucocladosporium K. Schub., Aptroot & Crous (2-4)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Cladosporiaceae, Cladosporiales, Dothideomycetes, Ascomycota, Fungi

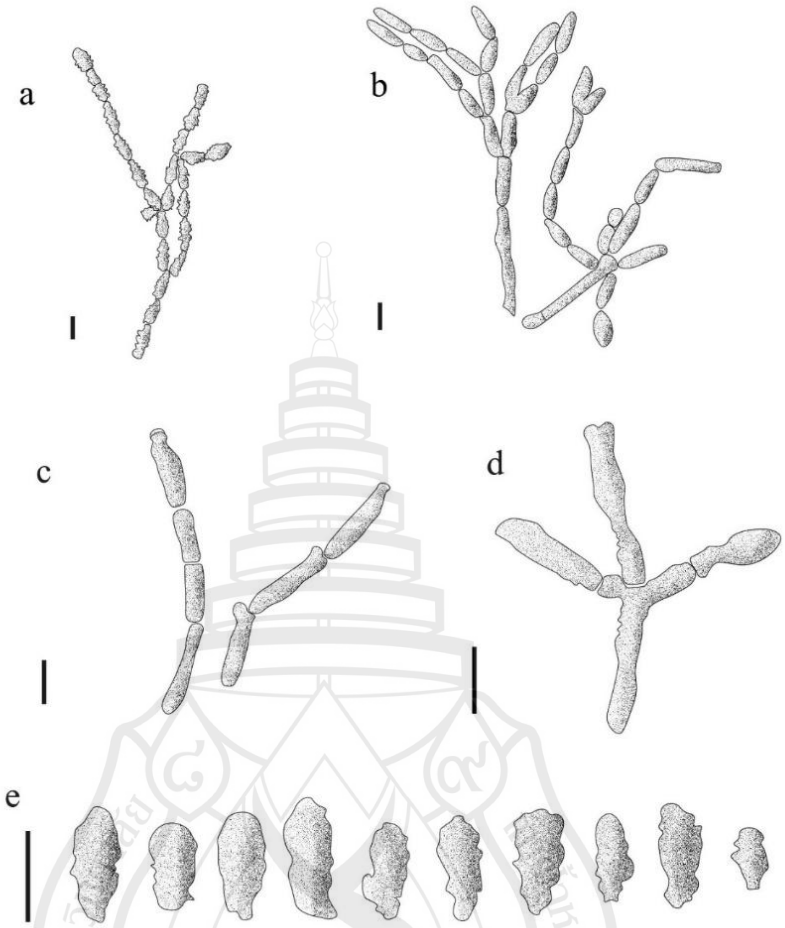
Verrucocladosporium was established by Crous et al. (2007) to accommodate the type *V. dirinae* K. Schub., Aptroot & Crous. Which is a lichenicolous fungus growing on *Dirina massiliensis*. *Verrucocladosporium* differs from *Cladosporium* by having hyphae often verrucose, hyaline, conidiophores cylindrical-filiform, straight or

slightly geniculate, non-nodulose, conidiogenous loci slightly thickened, distinctly dark-refractive but not crowned, and conidia often hightly variable, irregularly shaped, and coarsely verrucous-rugose (Crous et al., 2007). In the genus, another lichenicolous *V. rocellae* U. Braun, Diederich & Heuchert which was found on the thalli of *Roccella boergesenii* by Braun et al. (2009). *Verrucocladosporium rocellae* is characterized by having rugose-verrucose conidiophores and conida, and conidiogenous loci with a similar structure to the type *V. dirinae*. But this species has a wider conidiophore (15 – 50 × 3 –5 µm of *V. rocellae* vs. 85 × 2–3 µm of *V. dirinae*. To date, only two lichenicolous taxa in *Verrucocladosporium* and 29 sequence data are available in NCBI.

Type species: *Verrucocladosporium dirinae* K. Schub., Aptroot & Crous, on *Dirina massiliensis*

Table 2.28 Accepted lichenicolous species of *Verrucocladosporium*

	Species name	Host	References	Remarks
1	*Verrucocladosporium dirinae* K. Schub.	*Dirina massiliensis*	(Crous et al., 2007)	
2	*Verrucocladosporium roccellae* U. Braun, Diederich & Heuchert	*Roccella boergesenii*	(Braun et al., 2009)	



Note a–b Conidial chains. c–e Ramoconidia and conidia. Scale bars = 10 μm.

Source Redrawn from Crous et al. (2007)

Figure 2.28 *Verrucocladosporium dirinae*

Order Collemopsidiales Pérez-Ort., Garrido-Ben. & Grube

Family Xanthopyreniaceae Zahlbr.

Collemopsidium Nyl. (1-18)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Xanthopyreniaceae, Collemopsidiales, Dothideomycetes, Ascomycota, Fungi

Type species: *Collemopsidium iocarpum* (Nyl.) Nyl.

Accepted lichenicolous species:

Collemopsidium cephalodiorum (Triebel & Grube) Grube, on *Pilophorus cephalodiorum* (Grube 2005)

Didymellopsis (Sacc. & D. Sacc.) Clem. & Shear (8)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Xanthopyreniaceae, Collemopsidiales, Dothideomycetes, Ascomycota, Fungi

Didymellopsis was established by Clements & Shear (1931) to accommodate the type species *D. latitans*, which was transferred from *Obryzum latitans* Nyl. This species grows on the genera *Gonohymenia* and *Lempholemma* (Clements & Shear, 1931). The genus is characterized by globose to pear-shaped pseudothecia, which are completely sunken into the host thallus or laterally attached, typically with preformed openings. The peridium is dark brown to reddish-brown and distinctly demarcated from the substrate. The asci are fissitunicate, ± flexible, cylindrical to club-shaped, with 4, 6, or 8 spores. They have a thickened apex forming a distinct ocular chamber. The ascospores are hyaline, two-celled, thin-walled, often enclosed in a mucilaginous sheath when young. Mature spores lack ornamentation, with the upper cell being larger, broader, and more rounded than the lower cell (Grube et al., 1990).

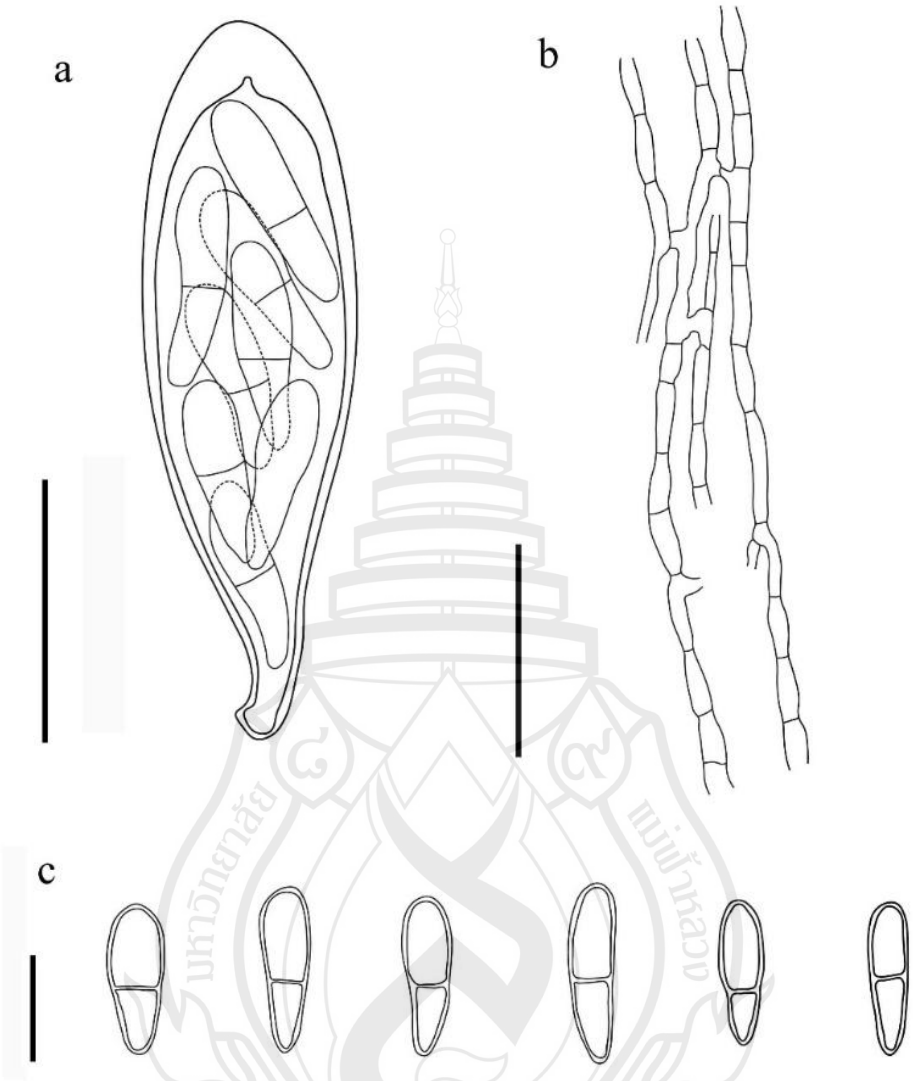
Diederich et al. (2018) listed eight species in *Didymellopsis*, including *Pharcidia collematis* Dughi and *Verrucaria symbiotica* Nyl., which were provisionally placed in this genus. However, these two species are poorly understood and require further study for confirmation. Alstrup et al. (2018) introduced a new species, *Didymellopsis antarctica*, which grows on *Acarospora macrocyclos*. Similarly, Zhurbenko (2021) described *Didymellopsis solorinae*, found on *Solorina saccata*.

To date, *Didymellopsis* includes eight confirmed lichenicolous species, with two additional species remaining provisional.

Type species: *Didymellopsis latitans* (Nyl.) Nyl.

Table 2.29 Accepted lichenicolous species of *Didymellopsis*

	Species name	Host	References	Remarks
1	*Didymellopsis antarctica* Alstrup & Olech	*Acarospora macrocyclos*	(Alstrup et al., 2018)	
2	*Didymellopsis collematum* (J. Steiner) Grube & Hafellner	*Collema*	(Grube et al., 1990)	= *Cercidospora collematum* J. Steiner
3	*Didymellopsis latitans* (Nylander) Saccardo ex Clements & Shear	*Gonohymenia* and *Lempholemma*	(Clements et al., 1931)	= *Obryzum latitans* Nyl.
4	*Didymellopsis nephromatis* Zhurb. & Etayo	*Nephroma cellulosum*	(Zhurbenko et al., 2015)	
5	*Didymellopsis perigena* (Nylander) Grube & Hafellner	*Placidium squamulosum*	(Grube et al., 1990)	= *Sphaeria perigena* Nyl.
	Didymellopsis pulposi (Zopf) Grube & Hafellner	*Collema* and *Leptogium*	(Grube et al., 1990)	= *Didymosphaeria pulposi* Zopf
6	*Didymellopsis solorinae* Zhurb.	*Solorina saccate*	(Zhurbenko, 2021d)	
7	*Didymellopsis viridireagens* Etayo	*Leptogium*	(Etayo, 2017)	



Note a Ascus. b Hamathecium. c Ascospores. Scale bars: a–b = 20 µm, c = 10 µm.

Source Redrawn from Grube et al. (1990)

Figure 2.29 *Didymellopsis latitans*

Rhagadodidymellopsis Fern.-Brime, Gaya, Llimona & Nav.-Ros. (1)

Index Fungorum, faceoffungi, MycoBank, GenBank

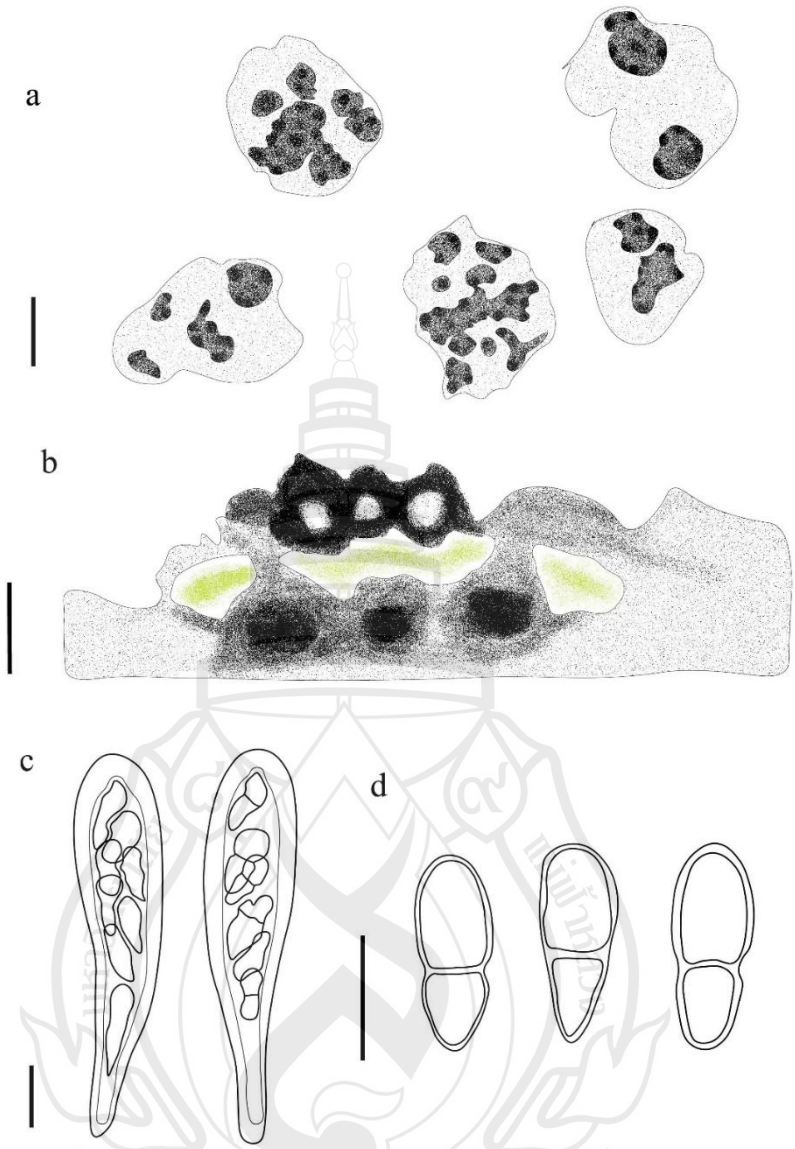
Classification: Xanthopyreniaceae, Collemopsidiales, Dothideomycetes, Ascomycota, Fungi

Rhagadodidymellopsis was established by Fernández-Brime et al. (2020) to

accommodate the only species *R. endocarpi*, which grows on the crustose lichen *Endocarpon pusillum*. It is characterized by black, perithecioid ascomata with unilocular and a clearly rugose and irregular surface. The interascal filaments are branched and anastomosing. The 8-spored asci are fissitunicate, clavate, stipitate, thickened at the apex, and have a distinct ocular chamber. The hyaline ascospores are narrowly obovate to elongate ellipsoid, with a smooth surface and a conspicuous gelatinous sheath. They are 1-septate, constricted at septum, heteropolar, and contain oil droplets (Fernández-Brime et al., 2020).

Due to its similarities to the two genera *Didymellopsis* and *Zwackhiomyces* (Xanthopyreniaceae, Collemopsidiales, Dothideomyceta), *Rhagadodidymellopsis* was also included in the same family. Hyde et al. (2024) accepted this classification pending the availability of molecular data.

Type species: *Rhagadodidymellopsis endocarpi* Fdez.-Brime, Gaya, Llimona & Nav.-Ros. (Fernández-Brime et al., 2020)



Note a Ascomata. b Section of ascomata. c Asci. d Ascospores. Scale bars: a = 500 μm, b = 200 μm, c, d = 10 μm.

Source Redrawn from Fernández-Brime et al. (2020)

Figure 2.30 *Rhagadodidymellopsis endocarpi*

Zwackhiomyces Grube & Hafellner (44)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Xanthopyreniaceae, Collemopsidiales, Dothideomycetes,

Ascomycota, Fungi

Zwackhiomyces was established by Grube & Hafellner (1990) to accommodate nine species, including the type species *Z. coepulonus* (Norman) Grube & R. Sant. The genus is characterized by pear-shaped to globose, sessile pseudothecia with a slightly ornamented peridium; filamentous, branched paraphysoids with anastomosing elements embedded in a viscous matrix; and cylindrical to broadly cylindrical bitunicate asci that are 4-, 6-, or 8-spored. The ascospores are hyaline, two-celled, with the upper cell larger and broader than the lower cell. The pycnidia resemble the ascomata in shape and wall structure but are smaller. Conidiogenous cells are slender, bottle-shaped, and colorless, producing hyaline, single-celled, short rod-shaped pycnospores (Grube et al., 1990).

Diederich et al. (2018) listed 35 species in *Zwackhiomyces*, and six additional species have since been introduced: *Z. fuscatus* Poumarat, Daval & Cl. Roux, *Z. khodosovtsevii* Darmostuk, *Z. lecaniae* D. Gonnet, O. Gonnet & Cl. Roux, *Z. lecideae* Y. Joshi, *Z. parmotrematis* van den Boom, and *Z. protoparmeliopsidis* Y. Joshi (Diederich et al., 2018; Van den Boom et al., 2018; Joshi et al., 2020; Darmostuk 2021b; Joshi 2022c; Poumarat 2022; Roux 2023). To date, *Zwackhiomyces* comprises 44 recognized species according to Index Fungorum (2024), with three gene sequences available in GenBank.

Type species: *Zwackhiomyces coepulonus* (Norman) Grube & R. Sant.

= *Arthopyrenia coepulona* Norman

Table 2.30 Accepted lichenicolous species of *Zwackhiomyces*

	Species name	Host	References	Remarks
1	*Zwackhiomyces arenicola* R.C. Harris	unidentified areolate, saxicolous thallus	(Harris, 1995)	

Table 2.30 (continued)

	Species name	Host	References	Remarks
2	*Zwackhiomyces argentinae* (Räsänen) D. Hawksworth & V. Atienza	*Acarospora*	(Hawkswort et al., 1994)	=*Pharcidia argentina* Räsänen
3	*Zwackhiomyces aspiciliae* Halici & Candan	*Aspicilia contorta* subsp. *hoffmanniana*	(Halici & Candan, 2009)	
4	*Zwackhiomyces bagliettoanus* Brien, Cl. Roux, P. Diederich et Poumarat	*Toniniopsis bagliettoana*	(Roux, 2024b)	
5	*Zwackhiomyces berengerianus* (Arnold) Grube & Triebel	*Lecidea berengeriana*	(Grube et al., 1990)	= *Endococcus hygrophilus* var. *berengerianus* Arnold
6	*Zwackhiomyces calcariae* (Flagey) Hafellner & Nik. Hoffmann	*Aspicilia*	(Hoffmann et al., 2000)	= *Arthopyrenia calcariae* Flagey
7	*Zwackhiomyces calcisedus* Cl. Roux	Verrucariaceae	(Roux, 2014)	
8	*Zwackhiomyces cervinae* Calatayud, Triebel & Pérez-Ortega	*Acarospora cervina*	(Calatayud et al., 2007)	
9	*Zwackhiomyces cladoniae* (C.W. Dodge) Diederich	*Cladonia*	(Aptroot et al., 1997)	= *Didymella cladoniae* C.W. Dodge

Table 2.30 (continued)

	Species name	Host	References	Remarks
10	*Zwackhiomyces coepulonus* (Norman) Grube & R. Santesson	*Caloplaca* and *Xanthoria elegans*	(Grube et al., 1990)	= *Arthopyrenia coepulona* Norman
11	*Zwackhiomyces diederichii* D. Hawksworth & Iturriaga	*Cladonia yunnana*	(Hawksworth & Iturriaga, 2006)	
12	*Zwackhiomyces dispersus* (J. Lahm ex Körber) Triebel & Grube	*Protoblastenia rupestris*	(Grube et al., 1990)	= *Arthopyrenia dispersa* J. Lahm ex Körb.
13	*Zwackhiomyces echinulatus* Brackel	*Physconia distorta*	(Brackel, 2008)	
14	*Zwackhiomyces errinundrensis* Zhurb.	*Pannaria microphyllizans*	(Zhurbenko, 2023b)	
15	*Zwackhiomyces euplocinus* Hafellner, Grube & Egan	*Speerschneidera euploca*	(Grube et al., 1990)	
16	*Zwackhiomyces fuscatus* Poumarat, Daval & Cl. Roux	*Acarospora fuscata*	(Poumarat, 2022)	
17	*Zwackhiomyces heppiae* van den Boom	*Heppia arenacea*	(Van Den Boom, 2010)	
18	*Zwackhiomyces immersae* (Arnold) Grube & Triebel	*Clauzadea monticola, C. metzleri, Bacidia bagliettoana, B. muscorum*	(Grube et al., 1990)	= E*ndococcus sphinctrinoides* var. *immersae* Arnold

Table 2.30 (continued)

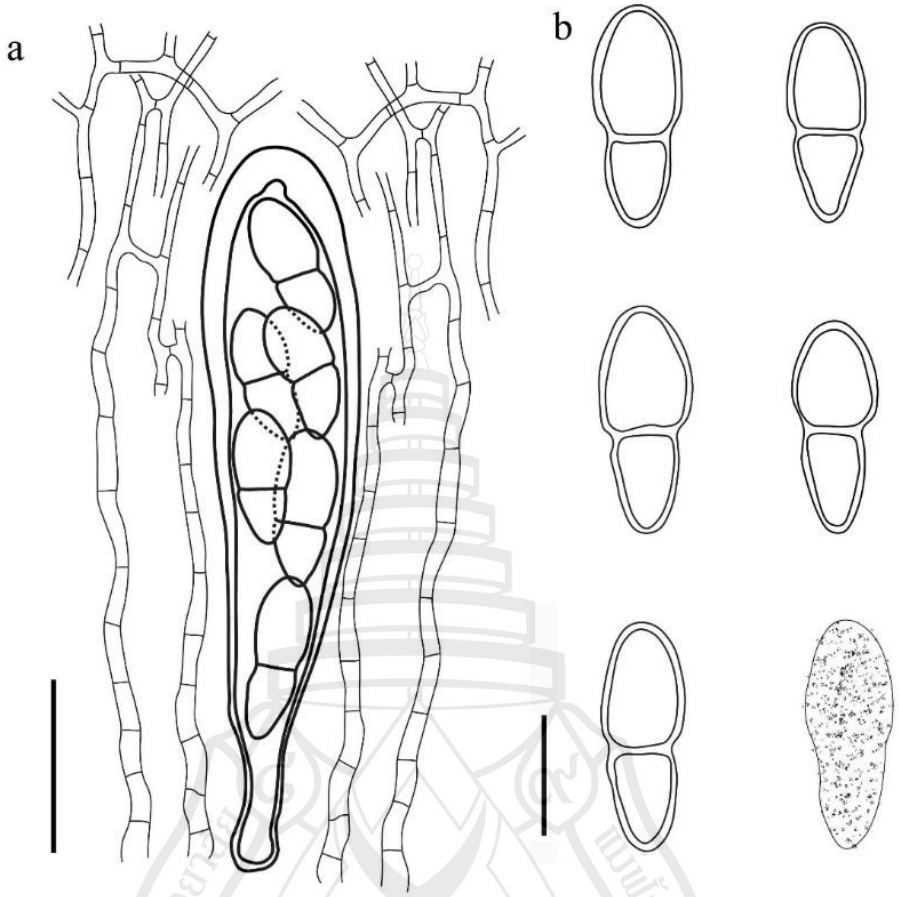
	Species name	Host	References	Remarks
19	*Zwackhiomyces inconpicuus* Grube & Hafellner	*Myriolecis dispersa*	(Grube et al., 1990)	
20	*Zwackhiomyces kantvilasii* S.Y. Kondratyuk	*Parmotrema chinense*	(Kondratyuk, 1996)	
21	*Zwackhiomyces khodosovtsevii* Darmostuk	*Verrucaria nigrescens*	(Darmostuk, 2021b)	
22	*Zwackhiomyces kiszkianus* D. Hawksworth & Miadlikowska	*Peltigera canina*	(Hawksworth & Miądlikowska, 1997)	
23	*Zwackhiomyces lacustris* (Arnold) Orange	*Ionaspis lacustris*	(Orange, 2002)	= *Thelidium lacustre* Arnold
24	*Zwackhiomyces lecaniae* D. Gonnet, O. Gonnet & Cl. Roux	*Lecania olivacella*	(Roux, 2023)	
25	*Zwackhiomyces lecanorae* (Stein) Nik. Hoffmann & Hafellner	*Lecanora subfuscae* var. *saxicolae*	(Hoffmann et al., 2000)	= *Thrombium lecanorae* Stein
26	*Zwackhiomyces lecideae* Y. Joshi	*Lecidea auriculata*	(Joshi, Kumar, et al., 2020)	
27	*Zwackhiomyces lithoiceae* (de Lesdain) Hafellner & Volk. John	*Verrucaria*	(Hafellner et al., 2006)	= *Pharcidia lithoiceae* B. de Lesd.
28	*Zwackhiomyces macrosporus* Alstrup & Olech	*Pannaria pezizoides, Protopannaria*	(Alstrup, 1993c)	

Table 2.30 (continued)

	Species name	Host	References	Remarks
29	*Zwackhiomyces martinatianus* (Arnold) Triebel & Grube	*Porpidia*	(Grube et al., 1990)	= *Arthopyrenia martinatiana* Arnold
30	*Zwackhiomyces melanohaleae* Etayo & van den Boom	*Melanohalea exasperata*	(Van den Boom & Etayo, 2014)	
31	*Zwackhiomyces namibiensis* Diederich & M. Schultz	*Psorotichia schaereri*	(Diederich & Schultz, 2009)	
32	*Zwackhiomyces parmotrematis* van den Boom	*Parmotrema praesorediosum*	(Van den Boom et al., 2018)	
33	*Zwackhiomyces peltigerae* Miadlikowska & Alstrup	*Peltigera praetextata*	(Miądlikowska et al., 1995)	
34	*Zwackhiomyces physciicola* Alstrup	*Physcia caesia*	(Alstrup, 1993a)	
35	*Zwackhiomyces polischukii* Darmostuk & Khodosovtsev	*Bacidia*	(Khodosovtsev et al., 2017)	
36	*Zwackhiomyces protoparmeliopsidis* Y. Joshi	*Protoparmeliopsis garovaglii*	(Joshi, 2022c)	
37	Zwackhiomyces rolfii Etayo	*Candelina*	(Etayo, 2010a)	
38	*Zwackhiomyces sipmanii* Diederich & Zhurbenko	*Phaeorrhiza sareptana*	(Diederich & Zhurbenko, 2009)	
39	*Zwackhiomyces socialis* (Körber) Cl. Roux	*Clauzadea* and *Bacidia bagliettoana*	(Roux, 2009)	= *Arthopyrenia socialis* Körb.

Table 2.30 (continued)

	Species name	Host	References	Remarks
40	*Zwackhiomyces solenopsorae* van den Boom	*Solenopsora holophaea*	(Van Den Boom, 2010)	
41	*Zwackhiomyces sphinctriniformis* Grube & Hafellner	*Romjularia lurida*	(Grube et al., 1990)	
42	*Zwackhiomyces sphinctrinoides* (Zwackh) Grube & Hafellner	*Lecanora campestris*	(Grube et al., 1990)	= *Endococcus sphinctrinoides* Zwackh
43	*Zwackhiomyces sulcatus* Pérez-Ortega & Etayo	*Austroparmelina macrospora*	(Pérez-Ortega et al., 2011)	
44	*Zwackhiomyces turcicus* Kocakaya, Halici & Aksoy	*Physcia magnussonii*	(Kocakaya et al., 2011)	



Note a Asci and paraphysoid. b Ascospores. Scale bars: a = 20 µm, b = 10 µm

Source Redrawn from Grube et al. (1990)

Figure 2.31 *Zwackhiomyces coepulonus*

Order Dothideales Lindau

Family Dothideaceae Chevall.

Plowrightia Sacc. (1-17)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Dothideaceae, Dothideales, Dothideomycetes, Ascomycota, Fungi

Type species: *Plowrightia ribesia* (Pers.) Sacc.

= *Sphaeria ribesia* Pers.

Accepted lichenicolous species:

Plowrightia mereschkowskyi Vouaux, on *Aspicilia hispida* (Vouaux, 1912a)

Family Saccotheciaceae Bonord.

Pseudoseptoria Speg. (1-7)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Saccotheciaceae, Dothideales, Dothideomycetes, Ascomycota, Fungi

Type species: *Pseudoseptoria donacicola* Speg.

Accepted lichenicolous species:

Pseudoseptoria usneae (Vouaux) D. Hawksw., on *Usnea barbata*

Order Eremithallales Lücking & Lumbsch

Family Melaspileaceae W. Watson

= Eremithallaceae Lücking & Lumbsch

Melaspilea Nyl. (10-37)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Melaspileaceae, Eremithallales, Dothideomycetes, Ascomycota, Fungi

Type species: *Melaspilea arthonioides* (A. Massal.) Nyl.

Table 2.31 Accepted lichenicolous species of *Melaspilea*

	Species name	Host	References	Remarks
1	*Melaspilea amarkantakensis* S. Joseph & G.P. Sinha	*Pertusaria amarkantakana*	(Joseph et al., 2015)	
2	*Melaspilea cupularis* Müller Arg.	*Pyrenula*	(Müller, 1895)	
3	*Melaspilea epigean* Müller Arg.	*Reimnitzia santensis*	(Müller, 1888)	

Table 2.31 (continued)

	Species name	Host	References	Remarks
4	*Melaspilea epigraphella* (Nylander) Müller Arg.	*Acanthothecis consocians*	(Müller, 1887a)	= *Opegrapha epigraphella* Nyl.
5	*Melaspilea galligena* Zhurb. & I. Zhdanov	*Pertusaria*	(Zhurbenko & Zhdanov, 2013)	
6	*Melaspilea insitiva* Stirton	*Pertusaria leioplaca*	(Stirton, 1879)	
7	*Melaspilea leciographoides* Vouaux	*Verrucaria*	(Vouaux, 1913c)	
8	*Melaspilea lekae* Brackel & Kalb	*Sarcographa*	(Kalb et al., 2012)	
9	*Melaspilea nitidochapsae* Pushpi Singh, Y. Joshi & Kr.P. Singh	*Nitidochapsa leprieurii*	(Singh et al., 2017)	
10	*Melaspilea tucumana* Flakus, Etayo & Kukwa	*Pertusaria*	(Flakus et al., 2014)	

Order Kirschsteiniotheliales Hern.-Restr., R.F. Castañeda, Gené & Crous

Kirschsteiniotheliales genera incertae sedis

Taeniolella S. Hughes (33-65)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Kirschsteiniotheliales genera incertae sedis, Kirschsteiniotheliales, Pleosporomycetidae, Dothideomycetes, Ascomycota, Fungi

Taeniolella was established by Hughes, (1958) to accommodate the 14

combined species include the type *Taeniolella exilis* which is combined from *Septonema exile*. This genus is characterized by septate and branched hyphae with subhyaline or brown color. The conidiophores are simple or sparingly branched at the base and short, septate, brown, dispersed or aggregated into small pustules. The conidia are oval or cylindrical, smooth or verrucose, phragmosporous, 2-multiseptate, brown or dark brown, arranged in simple or branched chains, short or longer in length, with scars at both ends (Hughes, 1958).

The polyphyly of this genus have been demonstrated by recent phylogenetic analyses (Ertz et al., 2016). Heuchert et al. (2018) gave a monograph of *Taeniolella*, 29 lichenicolous species and 16 saprobic species are described in detail and illustrated by drawings, macroscopic photographs, light microscopic and SEM micrographs. The genus encompasses a diverse array of species with varying ecological preferences and habitats, spanning from saprobes to lichenicolous taxa. Morphological distinctions exist between saprobic species, typically featuring pluriseptate conidia in elongated chains, and lichenicolous species, characterized by amero- to phragmosporous conidia, often in short, easily disarticulating chains. However, certain lichenicolous species also form long, firm chains (Heuchert et al., 2018).

Diederich et al. (2024) introduced two new species and two combinations, in addition to conduct a phylogenetic analysis which indicated that the lichenicolous *Taeniolella* species belong to Stictographaceae (Asterinales) rather than Kirschsteiniotheliales. Due to the molecular data is not enough to accommodate *Taeniolella* species in other genera. It tentatively remains in the Kirschsteiniotheliales. To date, 66 species are recognized in this genus, 32 of which are lichenicolous, one is facultative lichenicolous.

Type species: *Taeniolella exilis* (P. Karst.) S. Hughes

Table 2.32 Accepted lichenicolous species of *Taeniolella*

	Species name	Host	References	Remarks
1	*Taeniolella arctoparmeliae* Heuchert & Zhurbenko	*Arctoparmelia separata*	(Heuchert et al., 2018)	
2	*Taeniolella arthoniae* (M.S. Christ. & D. Hawksw.) Heuchert & U. Braun	*Arthonia impolita*	(Heuchert et al., 2018)	=*Cladosporium arthoniae* M.S. Christ. & D. Hawksw.
3	*Taeniolella atricerebrina* Hafellner	*Tephromela*	(Hafellner, 2007)	
4	*Taeniolella breviuscula* (Berkeley & M.A. Curtis) S. Hughes	on corticolous lichens	(Hughes, 1958)	Facultative lichenicolous =*Septonema breviusculum* Berk. & M.A. Curtis
5	*Taeniolella caespitosa* M.S. Cole & D. Hawksworth	*Pertusaria*	(Cole et al., 2001)	
6	*Taeniolella christiansenii* Alstrup & D. Hawksworth	*Stereocaulon*	(Alstrup et al., 1990)	
7	*Taeniolella chrysothricis* Diederich	*Chrysothrix candelaris*	(Diederich, 1990)	

Table 2.32 (continued)

	Species name	Host	References	Remarks
8	*Taeniolella cladinicola* Alstrup	*Cladonia* subgen. *Cladina*	(Alstrup, 1993b)	
9	*Taeniolella commonii* (Diederich, Zhurb. & van den Boom) Ertz, Diederich & Heuchert	*Phaeographis*	(Diederich et al., 2020; Diederich et al., 2024)	= *Trimmatostroma commonii* Diederich, Zhurb. & van den Boom
10	*Taeniolella delicata* M.S. Christiansen & D. Hawksworth	various lichens	(Hawksworth, 1979a)	
11	*Taeniolella diederichiana* Etayo & Calatayud	*Placopsis*	(Etayo & Calatayud, 2005)	
12	*Taeniolella diminuta* Diederich & Ertz	*Fissurina* sp.	(Diederich et al., 2024)	
13	*Taeniolella diploschistis* Heuchert, U. Braun, Diederich & Zhurbenko	*Diploschistes scruposus*	(Heuchert et al., 2019)	
14	*Taeniolella fissurinae* Diederich, Ertz & Heuchert	*Fissurina dumastii*	(Diederich et al., 2024)	
15	*Taeniolella glebarum* (Brackel) Diederich	*Flavoparmelia caperata*	(von Brackel 2015; Diederich et al., 2024)	=*Trimmatostroma glebarum* Brackel
16	*Taeniolella friesii* (Hepp) Hafellner	*Strigula stigmatella*	(Hafellner, 1998b)	=*Abrothallus friesii* Hepp

Table 2.32 (continued)

	Species name	Host	References	Remarks
17	*Taeniolella hawksworthiana* Heuchert, Ertz & Common	*Phaeographis*	(Ertz et al., 2016)	
18	*Taeniolella ionaspisicola* Alstrup & E.S. Hansen	*Ionaspis odora*	(Alstrup et al., 2001)	
19	*Taeniolella lecanoricola* Heuchert & Diederich	*Lecanora rupicola*	(Heuchert et al., 2018)	
20	*Taeniolella pertusariicola* D. Hawksworth & H. Mayrhofer	*Pertusaria* and possibly other lichens	(Alstrup et al., 1990)	
21	*Taeniolella phaeophysciae* D. Hawksworth	*Phaeophyscia orbicularis*, possibly also on *Physcia* and *Physconia*	(Hawksworth, 1979a)	
22	*Taeniolella punctata* M.S. Christiansen & D. Hawksworth	*Graphis*, more rarely on *Arthonia*, *Fissurina*, *Pertusaria* and *Phaeographis*	(Hawksworth, 1979a)	
23	*Taeniolella pyrenulae* Heuchert & Diederich	*Pyrenula*	(Ertz et al., 2016)	

Table 2.32 (continued)

	Species name	Host	References	Remarks
24	*Taeniolella rolfii* Diederich & Zhurbenko	*Cetraria* and *Cetrariella*	(Diederich et al., 1997)	
25	*Taeniolella santessonii* Etayo & Heuchert	*Roccellina cerebriformis*	(Etayo, 2010a)	
26	*Taeniolella strictae* Alstrup	*Cladonia stricta*	(Zhurbenko et al., 2004)	
27	*Taeniolella thelotrematis* Heuchert & Brackel	*Thelotrema*	(Heuchert et al., 2018)	
28	*Taeniolella toruloides* Heuchert & Diederich	*Thelotrema*	(Ertz et al., 2016)	
29	*Taeniolella trapeliopseos* Diederich	*Trapeliopsis*	(Diederich, 1989)	
30	*Taeniolella umbilicariae* Heuchert & Etayo	*Umbilicaria*	(Heuchert et al., 2018)	
31	*Taeniolella umbilicariicola* Heuchert & Etayo	*Umbilicaria*	(Heuchert et al., 2018)	
32	*Taeniolella verrucosa* M.S. Christiansen & D. Hawksworth	*Arthonia pruinata*	(Hawksworth, 1979a)	
33	*Taeniolella weberi* Heuchert & Sparrius	*Thelotrema weberi*	(Heuchert et al., 2018)	

Order Lichenotheliales K. Knudsen, Muggia & K.D. Hyde

Family Lichenotheliaceae Henssen

Lichenothelia D. Hawksw. (6-30)

Index Fungorum, faceoffungi, MycoBank, GenBank

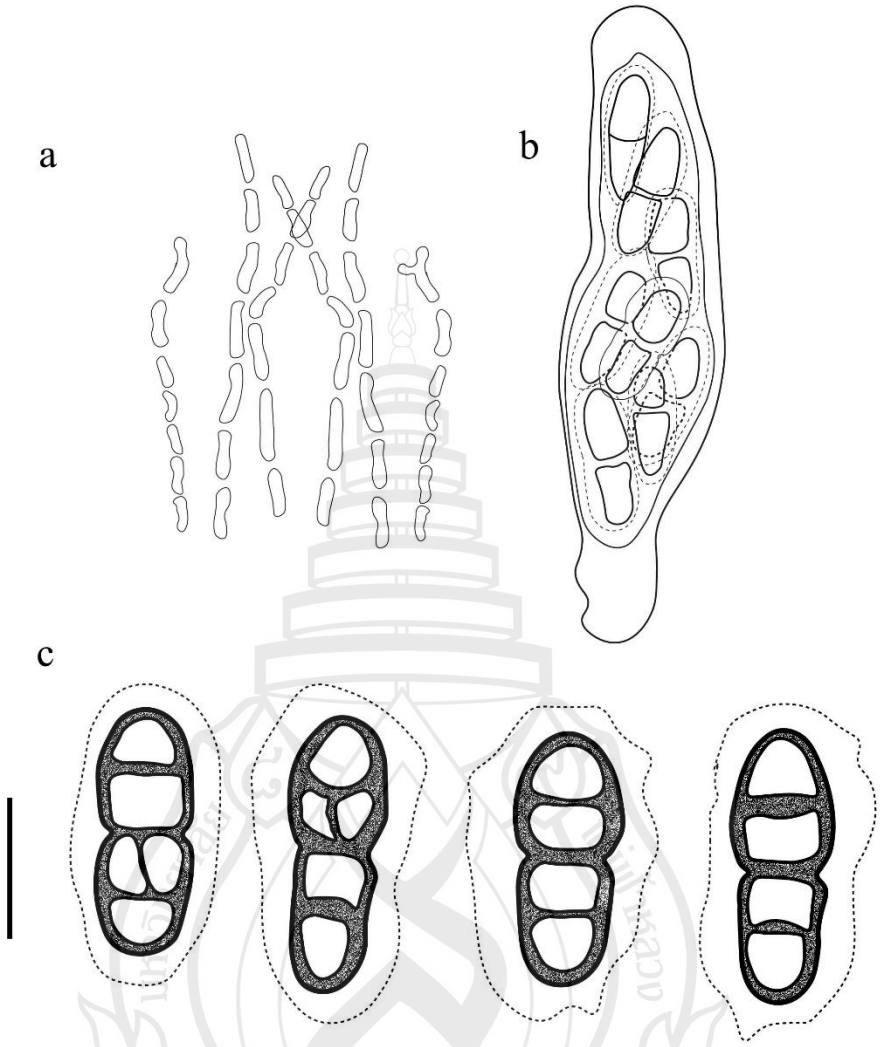
Classification: Lichenotheliaceae, Lichenotheliales, Dothideomycetes, Ascomycota, Fungi

Type species: *Lichenothelia scopularia* (Nyl.) D. Hawksw.

= *Verrucaria scopularia* Nyl.

Table 2.33 Accepted lichenicolous species of *Lichenothelia*

	Species name	Host	References	Remarks
1	*Lichenothelia convexa* Henssen	facultative lichenicolous over siliceous rocks	(Henssen, 1987)	
2	*Lichenothelia renobalesiana* D. Hawksworth & V. Atienza	endolithic Verrucariaceae *(Bagliettoa, Thelidium, Verrucaria)*	(Atienza et al., 2008)	
3	*Lichenothelia rugosa* (G. Thor) Ertz & Diederich	*Diploschistes*	(Ertz et al., 2014)	= *Lichenostigma rugosum* G. Thor
4	*Lichenothelia scopularia* (Nylander) D. Hawksworth	facultative lichenicolous over siliceous rocks	(Hawksworth, 1981a)	= *Verrucaria scopularia* Nyl.
5	*Lichenothelia spiralispora* Etayo	*Acarospora sphaerospora*	(Etayo, 2010c)	
6	*Lichenothelia umbrophila* L. Muggia, J. Kocourkova & K. Knudsen	facultatively lichenicolous over rocks	(Muggia et al., 2015)	



Note a Paraphyses. b Asci. c Ascospores. Scale bars = 10 µm

Source Redrawn from Hawksworth (1981a)

Figure 2.32 *Lichenothelia scopularia*

Order Microthyriales G. Arnaud

Family Microthyriaceae Sacc.

Lichenopeltella Höhn. (40-51)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Microthyriaceae, Microthyriales, Dothideomycetes,

Pezizomycotina, Ascomycota, Fungi

Lichenopeltella was introduced by Höhnel (1919) to accommodate the type species *Lichenopeltella maculans* (Zopf.) Höhn., which was previously known as *Microthyrium maculans* Zopf and was initially placed in the order Phacidiales. It is characterized by superficial ascomata inhabiting lichens, along with hyaline spores with two-celled (Höhnel, 1919a). Müller & von Arx (1962) and Von Arx & Müller (1975) assigned *Lichenopeltella* to the family Leptopeltidaceae, which was recognized as one of three families in Microthyriales by Kirk et al. (2008). However, Lumbsch & Huhndorf (2010) disagreed with this classification and placed the genus in Microthyriaceae (Müller et al., 1962; Von Arx et al., 1975; Lumbsch et al., 2010). Wu et al. (2011) placed *Lichenopeltella* in Trichothyriaceae, but without support by sequence data. Recently, one LSU sequence of *Lichenopeltella pinophylla* was obtained and used for the phylogenetic analysis. The result suggested that this species formed a clade with three other genera of Microthyriaceae (Le Renard et al., 2020). Therefore, we accept the placement of *Lichenopeltella* in Microthyriaceae.

To date, there are 40 lichenicolous species in this genus from Index Fungorum, but only one sequence is available in GenBank.

Type species: *Lichenopeltella maculans* (Zopf) Höhn.

Table 2.34 Accepted lichenicolous species of *Lichenopeltella*

	Species name	**Host**	**References**
1	*Lichenopeltella arctomiae* Pérez-Ortega & T. Sprib.	*Arctomia delicatula*	(Pérez-Ortega & Spribille, 2009)
2	*Lichenopeltella biatorae* Pérez-Ortega & T. Sprib.	*Biatora flavopunctata*	(Pérez-Ortega & Spribille, 2009)
3	*Lichenopeltella bunodophoronis* Diederich	*Bunodophoron*	(Aptroot et al., 1997)

Table 2.34 (continued)

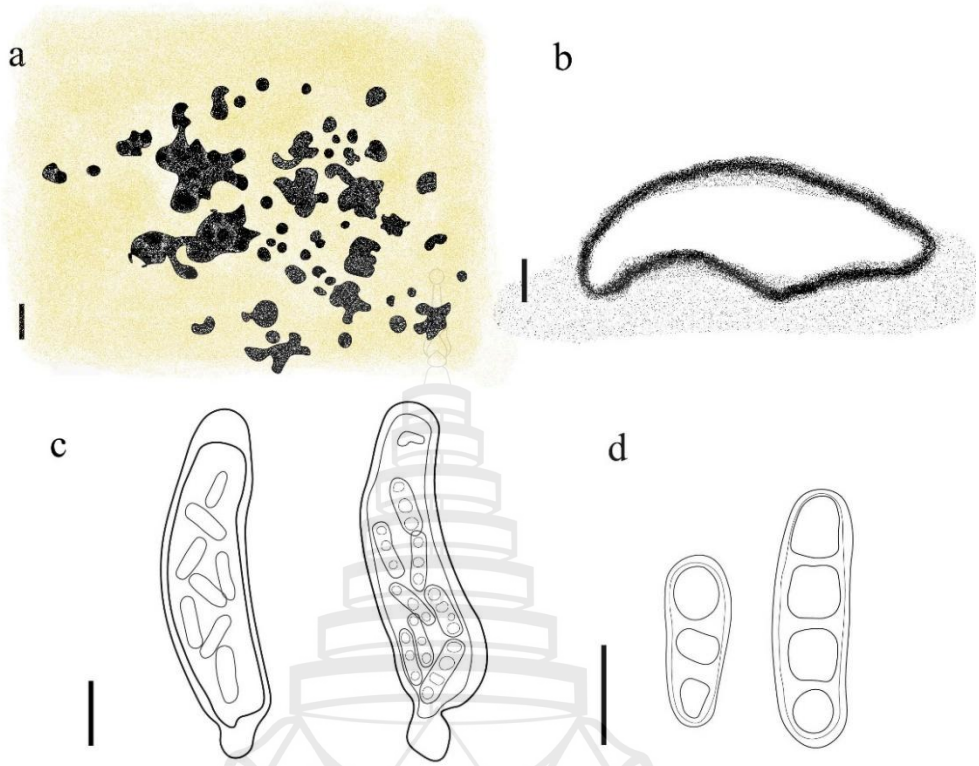
	Species name	Host	References
4	*Lichenopeltella cetrariae* (Bres.) Höhn.	*Cetraria*	(Höhnel, 1919b)
5	*Lichenopeltella cetrariicola* (Nyl.) R. Sant.	*Cetraria* and *Cetrariella*	(Santesson, 1989)
6	*Lichenopeltella cladoniarum* E.S. Hansen & Alstrup	*Cladonia* subgen. *Cladina*	(Hansen et al., 1995)
7	*Lichenopeltella communis* Etayo	*Hypotrachyna*	(Etayo, 2010a)
8	*Lichenopeltella coppinsii* Earl.-Benn. & D. Hawksw.	*Verrucaria*	(Earland-Bennett et al., 1999a)
9	*Lichenopeltella epiphylla* R. Sant.	*Mazosia and Porina*	(Santesson, 1988)
10	*Lichenopeltella heppiae* van den Boom	*Heppia*	(van den Boom & Giralt, 2012)
11	*Lichenopeltella heterodermiae* Diederich	*Heterodermia*	(Aptroot et al., 1997)
12	*Lichenopeltella heterodermiicola* M.S. Cole & D. Hawksw.	*Heterodermia*	(Cole et al., 2002)
13	*Lichenopeltella hydrophila* R. Sant.	*Verrucaria*	(Santesson, 2001)
14	*Lichenopeltella hypogymniae* Diederich	*Hypogymnia zeylanica*	(Aptroot et al., 1997)
15	*Lichenopeltella hypotrachynae* Diederich	*Hypotrachyna*	(Aptroot et al., 1997)
16	*Lichenopeltella inconspicua* (J. Lahm) Cl. Roux	*Verrucaria muralis*	(Roux et al., 2020b)

Table 2.34 (continued)

	Species name	Host	References
17	*Lichenopeltella leprosulae* Pérez-Ortega & T. Sprib.	*Myochroidea leprosula*	(Pérez-Ortega & Spribille, 2009)
18	*Lichenopeltella leptogii* Diederich	*Leptogium*	(Aptroot et al., 1997)
19	*Lichenopeltella lobariae* Etayo & Diederich	*Lobaria*	(Etayo & Diederich, 1996b)
20	*Lichenopeltella maculans* (Zopf) Höhn.	*Umbilicaria*	(Höhnel, 1919a)
21	*Lichenopeltella megalosporae* Diederich	*Megalospora*	(Aptroot et al., 1997)
22	*Lichenopeltella microspora* Diederich	*Parmeliella*	(Aptroot et al., 1997)
23	*Lichenopeltella minuta* R. Sant.	*Marchandiomphalina foliacea*	(Santesson, 1989)
24	*Lichenopeltella mobergii* Zhurb.	*Hypogymnia kiboensis*	(Zhurbenko, 2021e)
25	*Lichenopeltella pannariacearum* Diederich	Pannariaceae	(Aptroot et al., 1997)
26	*Lichenopeltella peltigericola* (D. Hawksw.) R. Sant.	*Peltigera*	(Santesson, 1993a)
27	*Lichenopeltella physciae* Diederich	*Physcia*	(Aptroot et al., 1997)
28	*Lichenopeltella pseudocyphellariae* Diederich	*Pseudocyphellaria*	(Aptroot et al., 1997)

Table 2.34 (continued)

	Species name	Host	References
29	*Lichenopeltella ramalinae* Etayo & Diederich	*Ramalina*	(Aptroot et al., 1997)
30	*Lichenopeltella rangiferinae* Brackel	*Cladonia*	(von Brackel, 2011b)
31	*Lichenopeltella santessonii* (P.M. Kirk & Spooner) R. Sant.	*Peltigera*	(Santesson, 1993a)
32	*Lichenopeltella sclerenchymatica* Etayo	*Pseudocyphellaria*	(Etayo & Sancho, 2008)
33	*Lichenopeltella setifera* Matzer	*Bacidia*	(Matzer, 1996)
34	*Lichenopeltella soiliae* Zhurb. & Pino-Bodas	*Cladia*	(Zhurbenko & Pino-Bodas, 2015)
35	*Lichenopeltella stereocaulorum* Zhurb.	*Stereocaulon*	(Zhurbenko, 2010b)
36	*Lichenopeltella swaminathaniana* Harih., Mibey & D. Hawksw.	*Porina*	(Hariharan et al., 1996)
37	*Lichenopeltella thalamica* Etayo, Flakus & Kukwa	*Pseudocyphellaria*	(Etayo, 2017)
38	*Lichenopeltella thamnoliae* R. Sant.	*Thamnolia*	(Santesson, 1998)
39	*Lichenopeltella thelidii* Diederich	*Thelidium*	(Molitor et al., 1997)
40	*Lichenopeltella uncialicola* Brackel	*Cladonia uncialis*	(von Brackel, 2010)



Note a Appearance of ascomata on the host surface. b Section of ascoma. c Asci. d Ascospores. Scale bars: a = 200 μm, b–d = 10 μm.

Source Redrawn from Wu et al. (2011)

Figure 2.33 *Lichenopeltella maculan*

Macrographa Etayo (1)

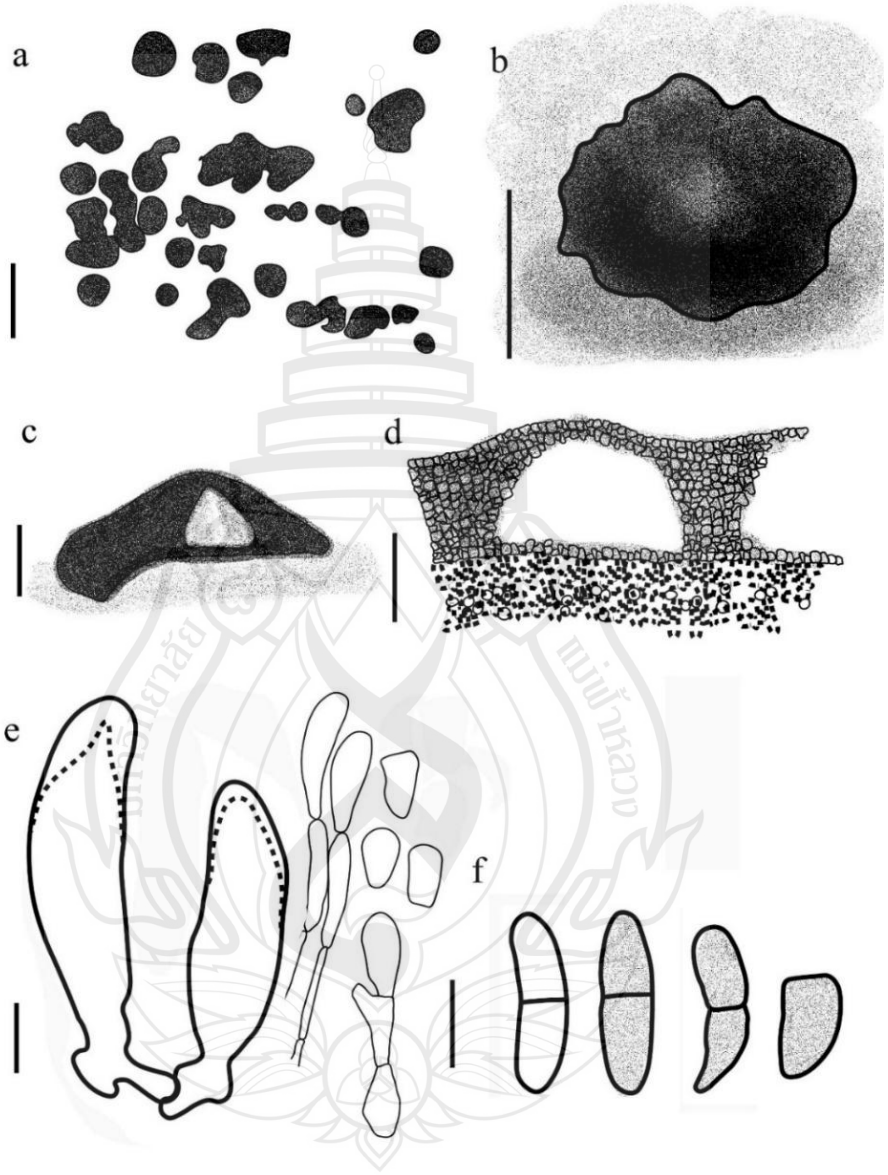
Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Microthyriaceae, Microthyriales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Macrographa was established by Etayo (2008) to accommodate the new species *Macrographa antarctica* Etayo which grows on the thallus of *Nephroma antarcticum*. This is the only species in the genus and characterized by multilocular and suborbicular stromatic ascomata, clavate asci with 6-8 spores and hyaline ascospores with 1-septum (Etayo & Sancho, 2008). This genus was placed in the family Microthyriaceae with

only one species and without sequence data available.

Type species**:** *Macrographa antarctica* Etayo, On thallus of *Nephroma antarcticum* (Etayo & Sancho, 2008)



Note a, b stromata on the thallus of *Nephroma antarcticum*. c, d section of the stromata. e Asci, paraphysoids and periphysoids. f Ascospores. Scale bars: a, b = 1mm, c = 100 µm, d = 50 µm, e, f = 10 µm.

Source Redrawn from Etayo et al. (2008)

Figure 2.34 *Macrographa antarctica*

Rhabdospora (Durieu & Mont.) Sacc. (1-370)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Microthyriaceae, Microthyriales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Rhabdospora oleandri* (Durieu & Mont.) Sacc.

Accepted lichenicolous species:

Rhabdospora haematommatum Kalb & Hafellner, on *Haematomma* (Kalb et al., 1995)

Order Mycosphaerellales (Nannf.) P.F. Cannon

Family Mycosphaerellaceae Lindau

Pseudocercospora Speg. (3-1000+)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Mycosphaerellaceae, Mycosphaerellales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Pseudocercospora vitis* (Lév.) Speg.

Table 2.35 Accepted lichenicolous species of *Pseudocercospora*

	Species name	Host	References	Remarks
1	*Pseudocercospora lichenum* (Keissl.) D. Hawksw.	*Haematomma cismonicum*	(Hawksworth, 1979a)	= *Cladosporium lichenum* Keissl.
2	*Pseudocercospora normandinae* Diederich	*Normandina pulchella*	(Diederich et al., 2024)	
3	*Pseudocercospora spadicea* Diederich, Boers & Kukwa	*Lecanora* sp.	(Diederich et al., 2024)	

Sphaerellothecium Zopf (42)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Mycosphaerellaceae, Mycosphaerellales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

The lichenicolous genus *Sphaerellothecium* Zopf was established by Zopf (1897) to accommodate the species *S. araneosum* (Rehm ex Arnold) Zopf. This species, originally named *Sphaerella araneosa* Rehm ex Arnold, exhibits characteristics intermediate between the genera *Sphaerella* and *Tichothecium* (Zopf, 1897). *Sphaerellothecium* is characterized by perithecial ascomata and the formation of a reticulum of superficial dark hyphae on the thallus and apothecia of its host. Its ascospores are hyaline, sometimes turning brown at maturity and have 1-3 septa (Roux & Triebel, 1994; Knudsen et al., 2009).

Etayo (2008) placed the species *Echinothecium reticulatum* in *Sphaerellothecium* (Etayo, 2008). This was accepted by Chomnunti (2011) after examining the holotype of *Sphaerellothecium*, leading to the conclusion that *Echinothecium* is synonymous with *Sphaerellothecium* due to the similarity between *Echinothecium reticulatum* and *Sphaerellothecium araneosum*. Currently, 42 species are accepted as lichenicolous species within this genus, except for the species *Sphaerellothecium alpestre* Friederich, which is only listed in MycoBank. Due to the lack of detailed references verifying its lifestyle, it has not been included in the lichenicolous list until more literature is available.

Type species**:**

Sphaerellothecium araneosum (Rehm ex Arnold) Zopf

= *Sphaerella araneosa* Rehm ex Arnold, Verh. Kaiserl.-Königl. zool.-bot. Ges. Wien 23: 115 (1873)

Table 2.36 Accepted lichenicolous species of *Sphaerellothecium*

	Species name	Host	References	Remarks
1	*Sphaerellothecium abditum* Triebel	*Immersaria* and *Lecidea*	(Triebel, 1989)	
2	*Sphaerellothecium aculeatae* Khodos., Gavrylenko & Klymenko	*Cetraria aculeata*	(Khodosovtsev et al., 2016)	
3	*Sphaerellothecium aipoliae* (Vouaux) Nav.-Ros. & Cl. Roux	*Physcia phaea*	(Navarro-Rosinés, 2017)	= *Didymella aipoliae* Vouaux
4	*Sphaerellothecium araneosum* (Arnold) Zopf	*Ochrolechia, Lepra* and *Varicellaria*	(Zopf, 1897)	≡*Sphaerella araneosa* Rehm ex Arnold
5	*Sphaerellothecium arctoparmeliae* (Brackel & Schiefelb.) Diederich, Zhurb. & Brackel	*Arctoparmelia incurva*	(Diederich, 2021)	≡ *Trimmatostroma arctoparmeliae* Brackel & Schiefelb.
6	*Sphaerellothecium arnoldii* (A. Massal.) Hafellner	*Urceolaria scruposa* var. *bryophila*	(Hafellner, 2019a)	≡ *Tichothecium arnoldii* A. Massal.
7	*Sphaerellothecium atryneae* (Arnold) Cl. Roux & Triebel	*Lecanora bicincta, L. cenisia, L. rupicola* and *L. swartzii*	(Roux & Triebel, 1994)	≡ *Endococcus atryneae* Arnold

Table 2.36 (continued)

	Species name	Host	References	Remarks
8	*Sphaerellothecium breussii* K. Knudsen, Kocourk. & Etayo	*Placidium lacinulatum*	(Knudsen et al., 2009)	
9	*Sphaerellothecium buelliae* (C.W. Dodge) D. Hawksw. & Iturr	*Buellia*	(Hawksworth & Iturriaga, 2006)	≡ *Orbicula buelliae* C.W. Dodge
10	*Sphaerellothecium cinerascens* Etayo & Diederich	*Cladonia parasitica*	(Etayo & Diederich, 1998)	
11	*Sphaerellothecium cladoniae* (Alstrup & Zhurb.) Hafellner	*Cladonia* subgen. *Cladonia* and *Stereocaulon*	(Hafellner et al., 2005)	≡ *Sphaerellothecium araneosum* var. *cladoniae* Alstrup & Zhurb.
12	*Sphaerellothecium cladoniicola* E. S. Hansen & Alstrup	*Cladonia* subgen. *Cladina*	(Hansen et al., 1995)	
13	*Sphaerellothecium coniodes* (Nyl.) Cl. Roux & Diederich	*Baeomyces rufus*	(Roux & Triebel, 1994)	≡ *Verrucaria coniodes* Nyl.
14	*Sphaerellothecium contextum* Triebel	*Calvitimela, Protoparmelia, Rhizocarpon, Rhizoplaca* and *Sporastatia*	(Triebel, 1989)	

Table 2.36 (continued)

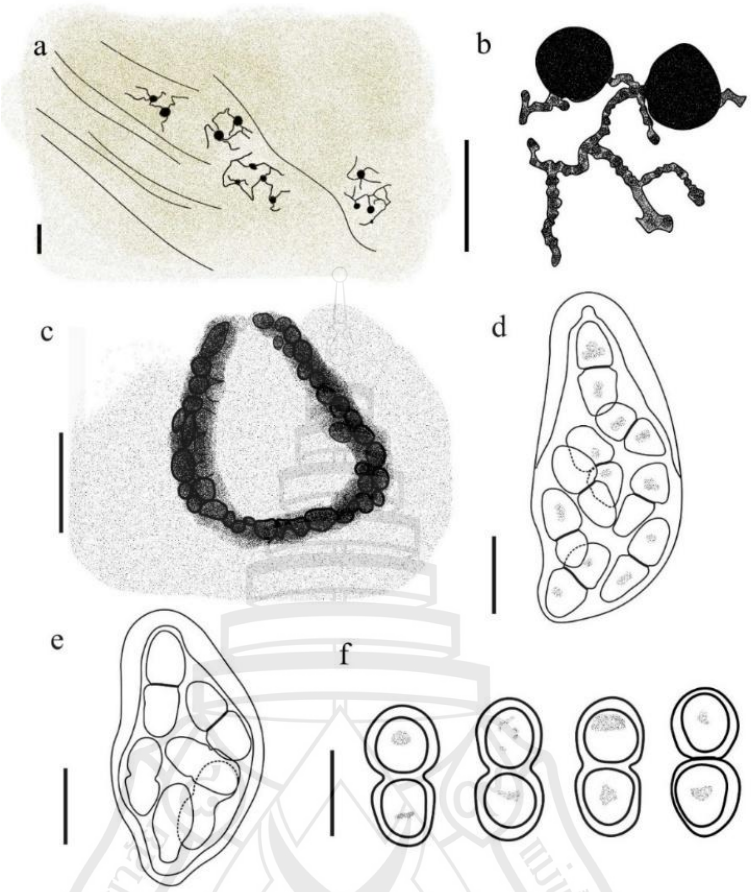
	Species name	Host	References	Remarks
15	*Sphaerellothecium epilecanora* Zhurb.	*Lecanora epibryon*	(Zhurbenko & Brackel, 2013)	
16	*Sphaerellothecium episoralium* Etayo	*Heterodermia*	(Etayo, 2017)	
17	*Sphaerellothecium episquamarinae* Etayo	*Squamarina lentigera*	(Etayo, 2008)	
18	*Sphaerellothecium gallowayi* Diederich	*Heterodermia*	(Diederich, 2007b)	
19	*Sphaerellothecium giraltiae* van den Boom	*Rinodina*	(Van Den Boom, 2010)	
20	*Sphaerellothecium gowardii* Alstrup & M. S. Cole	*Acarospora schleicheri*	(Alstrup et al., 1998)	
21	*Sphaerellothecium griseae* Darmostuk & Guttová	*Solenopsora grisea*	(Darmostuk et al., 2022)	
22	*Sphaerellothecium heterodermiae* van den Boom	*Heterodermia*	(Van den Boom, 2016)	
23	*Sphaerellothecium icmadophilae* (R. Sant.) Zhurbenko	*Icmadophila ericetorum*	(Zhurbenko, 2008b)	≡ *Stigmidium icmadophilae* R. Sant.
24	*Sphaerellothecium leratianum* Gardiennet & Cl. Roux	*Brodoa*	(Zhurbenko, 2008b)	

Table 2.36 (continued)

	Species name	Host	References	Remarks
25	*Sphaerellothecium minutum* Hafellner	*Sphaerophorus*	(Hafellner, 1993b)	
26	*Sphaerellothecium nimisii* Brackel & Puntillo	*Xanthoparmelia conspersa*	(von Brackel & Puntillo, 2023)	
27	*Sphaerellothecium pannariacearum* Etayo	*Pannaria*	(Etayo & Sancho, 2008)	
28	*Sphaerellothecium parietinarium* (Linds.) Hafellner & V. John	*Xanthoria*	(Hafellner et al., 2006)	≡ *Microthelia parietinaria* Linds.
29	*Sphaerellothecium parmeliae* Diederich & Etayo	*Parmelia*	(Etayo & Diederich, 1998)	
30	*Sphaerellothecium parmotremae* van den Boom	*Parmotrema*	(Van den Boom, 2016)	
31	*Sphaerellothecium phaeorrhizae* Diederich & Zhurb	*Phaeorrhiza sareptana*	(Diederich & Zhurbenko, 2009)	
32	*Sphaerellothecium propinquellum* (Nyl.) Cl. Roux & Triebel	*Lecanora carpinea*	(Roux & Triebel, 1994)	≡ *Sphaeria propinquella* Nyl.
33	*Sphaerellothecium soechtingii* Zhurb. & Alstrup	*Arthrorhaphis alpina*	(Zhurbenko, 2007b)	

Table 2.36 (continued)

	Species name	Host	References	Remarks
34	*Sphaerellothecium pumilum* (Lettau) Nav.-Ros., Cl. Roux & Hafellner	*Physcia caesia*	(Navarro-Rosinés et al., 2018)	= *Rosellinia pumila* Lettau
35	*Sphaerellothecium reticulatum* (Zopf) Etayo	*Parmelia sulcata*	(Roux & Triebel, 1994)	≡ *Echinothecium reticulatum* Zopf
36	*Sphaerellothecium siphulae* Zhurb.	*Siphula ceratites*	(Zhurbenko, 2015)	
37	*Sphaerellothecium stereocaulorum* Zhurb	*Stereocaulon*	(Zhurbenko & Triebel, 2008)	
38	*Sphaerellothecium subtile* Triebel & Rambold	*Teloschistes*	(Triebel et al., 1991)	
39	*Sphaerellothecium taimyricum* (Zhurb.) Zhurb.	*Thamnolia vermicularis* var. *subuliformis*	(Zhurbenko et al., 2019)	= *Sphaerellothecium thamnoliae* var. *taimyricum* Zhurb.
40	*Sphaerellothecium thamnoliae Zhurb.*	*Thamnolia*	(Zhurbenko, 2012)	
41	*Sphaerellothecium umbilicariae* Brackel & Er. Zimm.	*Umbilicaria polyphylla*	(Brackel, 2023)	
42	*Sphaerellothecium usneicola* Etayo	*Usnea*	(Etayo, 2017)	



Note a Fruiting bodies on host tissue. b Ascomata with hyphae. c Section through ascoma. d, e Ascus. f Ascospores. Scale bars: a = 200 µm, b = 100 µm, c= 25 µm, d–f = 10 µm.

Source Redrawn fromChomnunti et al. (2011)

Figure 2.35 *Sphaerellothecium araneosum*

Sphaerulina Sacc. (4-74)

Index Fungorum, Facesoffungi , MycoBank, GenBank

Classification: Mycosphaerellaceae, Mycosphaerellales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Sphaerulina myriadea* (DC.) Sacc.

Table 2.37 Accepted lichenicolous species of *Sphaerulina*

	Species name	Host	References	Remarks
1	*Sphaerulina dolichotera* (Nyl.) Vouaux	Collemataceae	(Vouaux, 1913c)	= *Obryzum dolichoterum* Nyl.
2	*Sphaerulina dubiella* (Nylander) D. Hawksworth	crustose lichen	(Hawksworth, 1983)	= *Verrucaria dubiella* Nyl.
3	*Sphaerulina intermedia* Vouaux	*Leptogium microscopicum*	(Vouaux, 1913c)	
4	*Sphaerulina lepidiotae* (Anzi) Vainio	*Fuscopannaria praetermissa*	(Vainio, 1899)	= *Sphaerella lepidiotae* Anzi

Stigmidium Trevis. (104-109)

Index Fungorum: 5261, facesoffungi, MycoBank, GenBank

Classification: Mycosphaerellaceae, Mycosphaerellales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

The lichenicolous genus *Stigmidium* was established by Trevisan (1860) and is characterized by the completely black, carbonaceous apothecia parasitizing the thallus of other lichens, initially closed, later pierced at the apex with an indehiscent pore-like ostiole. Its hymenium is conglobated, nucleiform and gelatinous. The asci are subclavate, eight-spored, and mixed with paraphyses imperfectly flocculent-mucilaginous. The ascospores are ellipsoidal to subcymbiform, bilocular, colorless with transparent episporium. The species *Stigmidium schaereri*, which was originally identified as *Sphaeria schaereri* A. Massal., was transferred to this genus and

designated as type species by Trevisan (1860)

Stigmidium was placed in the family Mycosphaerellaceae (Capnodiales) by Lumbsch & Huhndorf (2007). However, Diederich (2018) placed this genus within Verrucariales genera incertae sedis. Wijayawardene (2022) placed this genus back to Mycosphaerellaceae, and include in the list of dubious genera because of the lacking of phylogenetic placement (Lumbsch et al., 2007; Wijayawardene et al., 2022)

To date, this genus has 109 species including 104 lichenicolous species and 5 lichenized species. there are two sequences in Genbank but without phylogenetic analysis.

Type species: *Stigmidium schaereri* (A. Massal.) Trevis.

= *Sphaeria schaereri* A. Massal.

Table 2.38 Accepted lichenicolous species of *Stigmidium*

	Species name	**Host**	**References**	**Remarks**
1	*Stigmidium acetabuli* Calat. & Triebel	*Pleurosticta acetabulum*	(Calatayud & Triebel, 2001)	
2	*Stigmidium aggregatum* (Mudd) D. Hawksw	*Aspicilia calcarea*	(Hawksworth, 1975a)	= *Thelidium aggregatum* Mudd
3	*Stigmidium ahtii* Etayo & Palice	Cladonia lopezii	(Etayo, 2017)	
4	*Stigmidium alectoriae* (Lindsay) Etayo	*Usnea*	(Etayo & Sancho, 2008)	= *Lecidea alectoriae* Linds.
5	*Stigmidium allogenum* (Nyl.) D. Hawksw.	*Rhizocarpon*	(Hawksworth, 1975a)	= *Verrucaria allogena* Nyl.
6	*Stigmidium anguinellicola* Etayo & Aptroot	*Nyungwea anguinella*	(Etayo et al., 2020)	

Table 2.38 (continued)

	Species name	Host	References	Remarks
7	*Stigmidium arthoniae* (Arnold) Hafellner	*Arthonia astroidea*	(Hafellner, 1994a)	= *Sphaerella arthoniae* Arnold
8	*Stigmidium arthrorhaphidis* Hafellner & Obermayer	*Arthrorhaphis citrinella*	(Hafellner et al., 1995)	
9	*Stigmidium aspiciliae* (J. Lahm) Cl. Roux	*Aspicilia calcarea*	(Roux, 2014)	= *Arthopyrenia aspiciliae* J. Lahm ex Körb.
10	*Stigmidium bellemerei* Cl. Roux & Nav.-Ros.	*Lecania nylanderiana*	(Roux et al., 1998)	
11	*Stigmidium beringicum* Zhurb. & Triebel	*Stereocaulon alpinum*	(Zhurbenko & Triebel, 2008)	
12	*Stigmidium buelliae* Zhurb. & Himelbrant	*Buellia disciformis*	(Zhurbenk et al., 2012)	
13	*Stigmidium bulbothricis* Y. Joshi	*Bulbothrix setschwanensis*	(Joshi et al., 2023c)	
14	*Stigmidium californicum* K. Knudsen & Kocourk.	*Caloplaca stanfordensis*	(Knudsen et al., 2010b)	
15	*Stigmidium calopadiae* Matzer	*Calopadia subcoerulescens*	(Matzer, 1996)	
16	*Stigmidium caloplacae* Alstrup & Olech	*Caloplaca stillicidiorum*	(Alstrup et al., 1996)	
17	*Stigmidium cartilagineae* Calat. & Triebel	*Squamarina cartilaginea*	(Calatayud & Triebel, 2003)	
18	*Stigmidium catapyrenii* Cl. Roux & Triebel	*Catapyrenium daedaleum*	(Roux & Triebel, 1994)	

Table 2.38 (continued)

	Species name	Host	References	Remarks
19	*Stigmidium cerinae* Cl. Roux & Triebel	*Caloplaca stillicidiorum*	(Roux & Triebel, 1994)	
20	*Stigmidium cladoniicola* Zhurb. & Diederich	*Cladonia macrophylla*	(Zhurbenko & Diederich, 2008)	
21	*Stigmidium clauzadei* Cl. Roux & Nav.-Ros.	*Verrucaria nigrescens*	(Roux & Navarro-Rosinés, 1994)	
22	*Stigmidium coarctatae* S. Y. Kondr., L. Lőkös & J.-S. Hur	*Trapelia coarctata*	(Kondratyuk et al., 2016)	
23	*Stigmidium collematis* Cl. Roux & Triebel	*Collema polycarpon*	(Roux & Triebel, 1994)	
24	*Stigmidium congestum* (Körb.) Triebel	*Lecanora subfusca*	(Triebel et al., 1991)	= *Pharcidia congesta* Körb.
25	*Stigmidium conspurcans* (Th. Fr.) Triebel & R. Sant	*Psora rubiformis*	(Triebel, 1989)	*Arthopyrenia conspurcans* Th. Fr.
26	*Stigmidium croceae* (Arnold) Cl. Roux & Triebel	*Solorina*	(Roux & Triebel, 1994)	= *Pharcidia croceae* Arnold
27	*Stigmidium cupulare* (Pat.) D. Hawksw.	*Sticta*	(Hawkworth et al., 2003)	= *Pharcidia cupularis* Pat.
28	*Stigmidium degelii* R. Sant.	*Degelia plumbea*	(Santesson, 1993c)	

Table 2.38 (continued)

	Species name	Host	References	Remarks
29	*Stigmidium disconephromeum* Etayo	*Nephroma antarcticum*	(Etayo & Sancho, 2008)	
30	*Stigmidium ephebes* (Henssen) D. Hawksw.	*Ephebe lanata*	(Hawksworth, 1975a)	= *Pharcidia ephebes* Henssen
31	*Stigmidium epinesolechia* Etayo	*Punctelia*	(Etayo, 2017)	
32	*Stigmidium epiphyllum* Matzer	*Actinoplaca vulgaris* and *Echinoplaca*	(Matzer, 1996)	
33	*Stigmidium epiramalina* (Vouaux) Hafellner		(Hafellner, 1994b)	= *Pharcidia epiramalina* Vouaux
34	*Stigmidium epistigmellum* (Vouaux) Kocourk. & K. Knudsen	*Placodium festivum*	(Kocourková et al., 2009b)	= *Pharcidia epistigmella* Nyl. ex Vouaux
35	*Stigmidium epixanthum* Hafellner	*Acarospora*	(Hafellner et al., 2002)	
36	*Stigmidium eucline* (Nyl.) Vězda	*Pertusaria* and *Varicellaria*	(Vězda, 1970)	= *Mycoporum eucline* Nyl.
37	*Stigmidium exasperatum* Etayo	*Melanohalea exasperata*	(Etayo, 2010c)	
38	*Stigmidium fellhanerae* Van den Boom	*Fellhanera christiansenii*	(Van den Boom, 2020)	
39	*Stigmidium frigidum* (Sacc.) Alstrup & D. Hawksw	*Thamnolia vermicularia*	(Alstrup et al., 1990)	= *Epicymatia frigida* Th. Fr. ex Sacc.

Table 2.38 (continued)

	Species name	Host	References	Remarks
40	*Stigmidium fuscatae* (Arnold) R. Sant.	*Acarospora fuscata*	(Santesson, 1988)	= *Pharcidia lichenum* f. *fuscatae* Arnold
41	*Stigmidium glebarum* (Arnold) Hafellner	*Thalloidima coeruleonigricans*	(Nimis et al., 1987)	= *Arthopyrenia glebarum* Arnold
42	*Stigmidium grex* Alstrup & Olech	*Ochrolechia frigida*	(Alstrup et al., 1996)	
43	*Stigmidium gyrophorarum* (Arnold) D. Hawksw.	*Gyrophora cylindrica, Umbilicaria*	(Hawksworth, 1975a)	= *Arthopyrenia gyrophorarum* Arnold
44	*Stigmidium haesitans* (Nyl.) Diederich	*Verrucaria sphinctrinoides*	(Diederich et al., 2018)	= *Verrucaria haesitans* Nyl.
45	*Stigmidium hafellneri* Zhurb.	*Flavocetraria cucullata*	(Zhurbenko, 2009d)	
46	*Stigmidium hageniae* (Rehm) Hafellner	*Hagenia ciliaris*	(Santesson, 1988)	= *Sphaerella hageniae* Rehm
47	*Stigmidium heterodermiae* Etayo	*Heterodermia boryi*	(Etayo, 2002a)	
48	*Stigmidium hesperium* Kocourk., K. Knudsen & Diederich	*Caloplaca coralloides*	(Kocourková et al., 2009a)	
49	*Stigmidium humidum* Pérez-Ortega, Halıcı & K. Knudsen	*Thelenella muscorum*	(PÉRez-Ortega et al., 2010)	

Table 2.38 (continued)

	Species name	Host	References	Remarks
50	*Stigmidium hygrophilum* (Arnold) R. Sant.	*Buellia rivularis*	(Santesson, 1993a)	= *Endococcus hygrophilus* Arnold
51	*Stigmidium hypogymniae* Brackel	*Hypogymnia tubulosa*	(von Brackel & Puntillo, 2023)	
52	*Stigmidium hypotrachynicola* Etayo	*Hypotrachyna*	(Etayo, 2017)	
53	*Stigmidium joergensenii* R. Sant.	*Omphalina foliacea*	(Santesson, 1989)	
54	*Stigmidium johnii* Halıcı & D. Hawksw.	*Caloplaca*	(Halıcı & Hawksworth, 2007)	
55	*Stigmidium kashiwadanii* Zhurb.	*Siphula coriacea*	(Motiejunaite et al., 2019)	
56	*Stigmidium lecidellae* Triebel, Cl. Roux & Le Coeur	*Lecidella elaeochroma*	(Roux et al., 1995)	
57	*Stigmidium leptogii* Etayo	*Leptogium*	(Etayo, 2002a)	
58	*Stigmidium lendemeri* Kocourk. & K. Knudsen	*Aspicilia*	(Kocourková et al., 2012)	
59	*Stigmidium leprariae* Zhurb.	*Lepraria neglecta*	(Zhurbenko, 2007b)	
60	*Stigmidium lichenum* (Arnold) Triebel & P. Scholz	*Verrucaria maculiformis*	(Triebel et al., 2001)	= *Arthopyrenia lichenum* Arnold

Table 2.38 (continued)

	Species name	Host	References	Remarks
61	*Stigmidium lobariae* Zhurb. & Etayo	*Lobaria pulmonaria*	(Zhurbenko & Etayo, 2012)	
62	*Stigmidium marinum* (Deakin) Swinscow	*Verrucaria*	(Swinscow, 1965)	= *Sagedia marina* Deakin
63	*Stigmidium mayrhoferi* Er. Zimm. & F. Berger	*Evernia divaricata*	(Zimmermann et al., 2018)	
64	*Stigmidium micareae* van den Boom	*Micarea alabastrites*	(Van den Boom, 2016)	
65	*Stigmidium microcarpum* Alstrup & J.C. David	*Cetraria cucullata*	(Alstrup, 1993a)	
66	*Stigmidium microspilum* (Körb.) D. Hawksw.	*Graphis scripta*	(Hawksworth, 1975a)	= *Arthopyrenia microspila* Körb.
67	*Stigmidium microsporum* Etayo & Osorio	*Teloschistes exilis*	(Etayo & Osorio, 2004)	
68	*Stigmidium parvum* (Henssen)Diederich	*Ephebe lanata*	(Diederich et al., 2018)	= *Pharcidia parva* Henssen
69	*Stigmidium mitchellii* Cl. Roux & Bricaud	*Pannaria conoplea*	(Roux & Triebel, 1994)	
70	*Stigmidium mycobilimbiae* Cl. Roux, Triebel & Etayo	*Mycobilimbia*	(Roux & Triebel, 1994)	
71	*Stigmidium neofusceliae* Calat. & Triebel	*Neofuscelia pulla*	(Calatayud & Triebel, 1999)	
72	*Stigmidium parmotrematis* F. Berger & E. Zimm.	*Parmotrema reticulatum*	(Berger et al., 2016)	

Table 2.38 (continued)

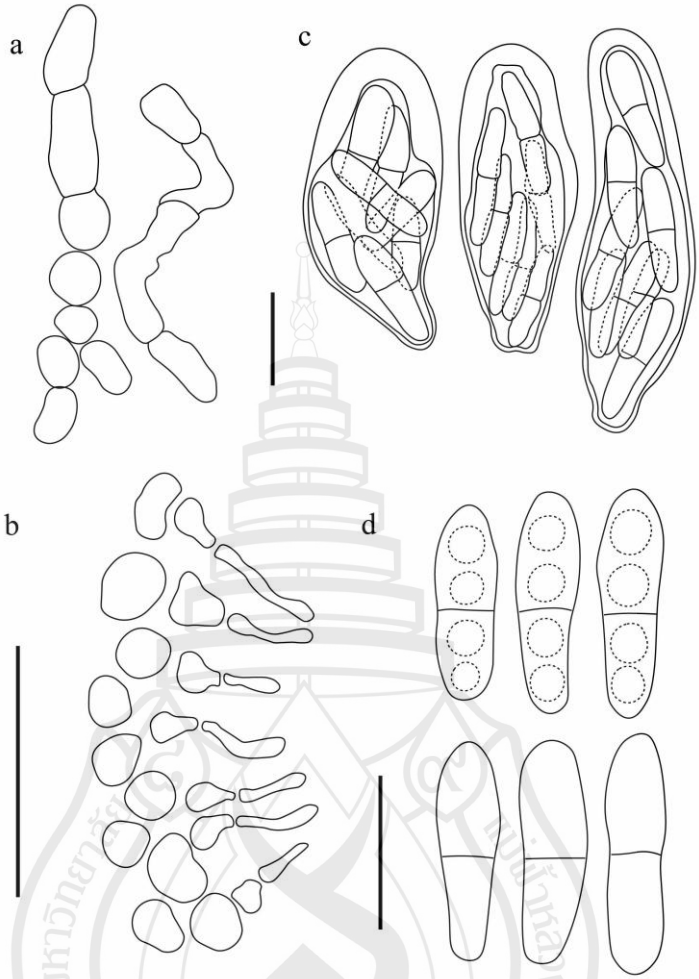
	Species name	Host	References	Remarks
73	*Stigmidium peltideae* (Vain.) R. Sant.	*Peltigera aphthosa*	(Santesson, 1960)	= *Pharcidia peltideae* Vain.
74	*Stigmidium petri* Hafellner	*Clauzadea monticola*	(Hafellner et al., 2008)	
75	*Stigmidium phyllobaeidis* Zhurb., Etayo & Flakus	*Phyllobaeis erythrella*	(Zhurbenko & Ohmura, 2020)	
76	*Stigmidium placopsidis* E. Zimm. & F. Berger	*Placopsis gelida*	(Berger et al., 2016)	
77	*Stigmidium placynthii* Cl. Roux & Nav.-Ros.	*Placynthium nigrum*	(Roux & Triebel, 1994)	
78	*Stigmidium pseudopeltideae* Cl. Roux & Triebel	*Peltigera britannica*	(Diederich, 2003)	
79	*Stigmidium pumilum* (Lettau) Matzer & Hafellner	*Physcia caesia*	(Matzer et al., 1990)	= *Rosellinia pumila* Lettau
80	*Stigmidium punctillum* (Arnold) D. Hawksw.	*Biatorina cyrtella*	(Hawksworth, 1975a)	= *Arthopyrenia punctillum* Arnold
81	*Stigmidium porinae* Matzer	*Porina epiphylla*	(Matzer, 1996)	
82	*Stigmidium pyrenulae* van den Boom	*Pyrenula*	(Boom, 2020)	
83	*Stigmidium ramalinae* (Müll. Arg.) Etayo & Diederich	*Ramalina complanata*	(Etayo & Osorio, 2004)	= *Arthopyrenia ramalinae* Müll. Arg.
84	*Stigmidium rivulorum* (Kernst.) Cl. Roux & Nav.-Ros.	*Verrucaria*	(Roux & Navarro-Rosinés, 1994)	= *Arthopyrenia rivulorum* Kernst.

Table 2.38 (continued)

	Species name	Host	References	Remarks
85	*Stigmidium rouxianum* Calat. & Triebel	*Acarospora cervina*	(Calatayud & Triebel, 2003)	
86	*Stigmidium schaereri* (A. Massal.) Trevis.	*Lecidea hookeri*	(Trevisan, 1860)	= *Sphaeria schaereri* A. Massal.
87	*Stigmidium schizosporum* Matzer	*Porina similis*	(Matzer, 1996)	
88	*Stigmidium seirophorae* Etayo & van den Boom	*Seirophora scorigena*	(Van den Boom & Etayo, 2017)	
89	*Stigmidium solenopsoricola* Darmostuk & Guttová	*Solenopsora candicans*	(Darmostuk et al., 2022)	
90	*Stigmidium solorinarium* (Vain.) D. Hawksw.	*Solorina saccata*	(Hawksworth, 1983)	= *Pharcidia coniodes* var. *solorinaria* Vain.
91	*Stigmidium spegazzinii* Etayo	*Pseudocyphellaria freycinetii*	(Etayo & Sancho, 2008)	
92	*Stigmidium squamariae* (B. de Lesd.) Cl. Roux & Triebel	*Squamaria saxicola*	(Roux & Triebel, 1994)	= *Pharcidia squamariae* B. de Lesd.
93	*Stigmidium squamarinicola* Calat. & Triebel	*Squamarina*	(Calatayud & Triebel, 2003)	
94	*Stigmidium stereocaulorum* Zhurb. & Triebel	*Stereocaulon rivulorum*	(Zhurbenko & Triebel, 2008)	

Table 2.38 (continued)

	Species name	Host	References	Remarks
95	*Stigmidium stygnospila* (Minks) R. Sant.	*Endocarpon miniatum*	(Santesson, 1960)	= *Cyrtidula stygnospila* Minks
96	*Stigmidium subcladoniicola* van den Boom	*Cladonia*	(Van den Boom, 2016)	
97	*Stigmidium superpositum* (Nyl.) D. Hawksw.	*Lecanora*	(Hawksworth, 1975a)	= *Verrucaria superposita* Nyl.
98	*Stigmidium tabacinae* (Arnold) Triebel	*Toninia*	(Triebel, 1989)	= *Pharcidia tabacinae* Arnold
99	*Stigmidium tetrasporum Etayo*	Verrucariaceae	(Etayo, 1994)	
100	*Stigmidium trichotheliorum* Matzer	*Trichothelium epiphyllum*	(Matzer, 1996)	
101	*Stigmidium triebelae* Etayo	*Parmotrema*	(Etayo, 2000)	
102	*Stigmidium verrucariopsidis* Monnat & Cl. Roux	*Verrucariopsis suaeda*	(Gueidan, 2022)	
103	*Stigmidium vezdae* Matzer	*Bacidina colchica*	(Matzer, 1996)	
104	*Stigmidium xanthoparmeliarum* Hafellner	*Xanthoparmelia somloensis*	(Hafellner, 1994b)	



Note a Vegetative hyphae. b Pseudoparaphyses. c Asci. d Ascospores. Scale bars: b–d = 10 μm

Source Redrawn from Roux et al. (1994)

Figure 2.36 *Stigmidium schaereri*

Wernerella Nav.-Ros., Cl. Roux & Giralt (2)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Mycosphaerellaceae, Mycosphaerellales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

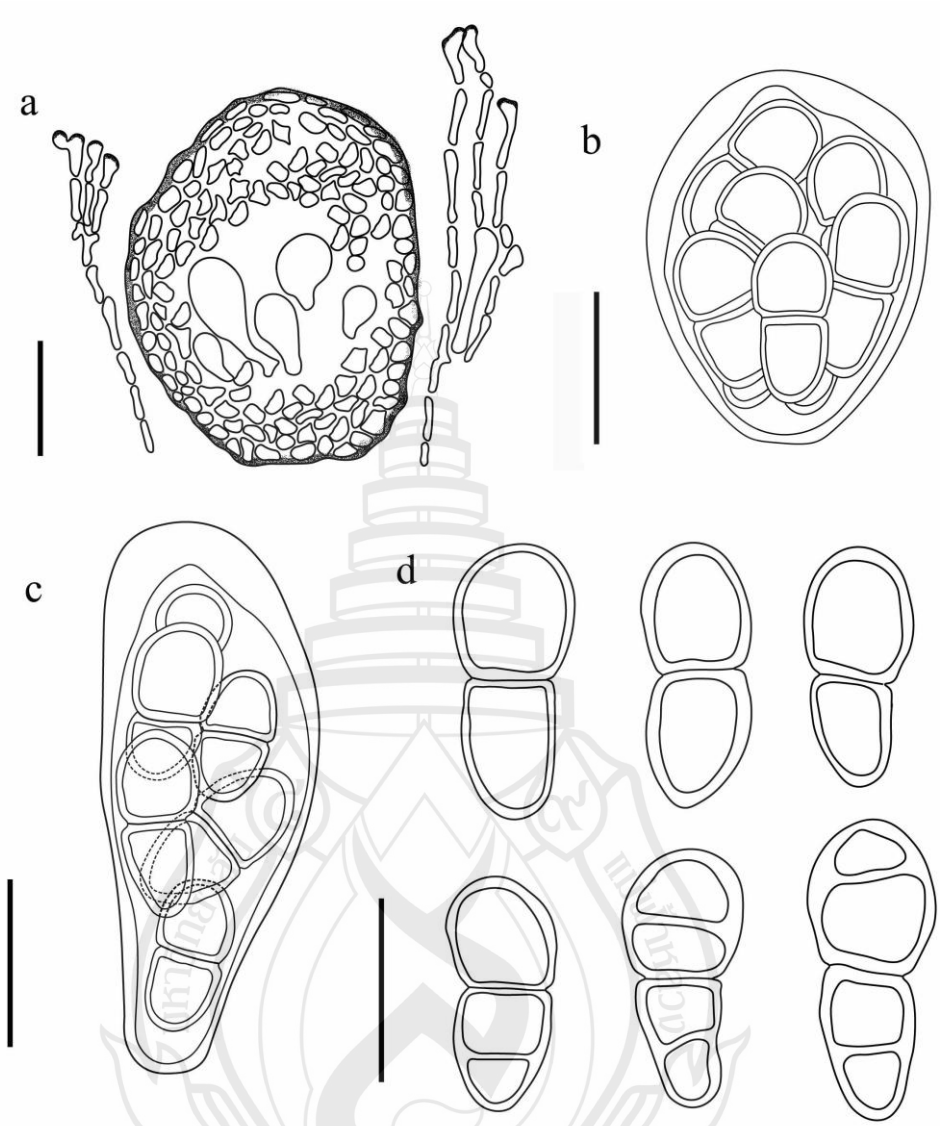
Wernerella was established by Navarro-Rosinés, (1996) to accommodate the non-lichenized lichenicolous fungus, *W. maheui*, which was combined from

Leptosphaeria maheui Werner. This species grows on the hymenium of several *Rinodina* species. *Wernerella* is characterized by its colourless vegetative hyphae, consistently immersed in the hymenium of the host, with a wall that is colorless to pale brown and never emerges to the surface of the host (Navarro-Rosinés & Hafellner, 1996). Another lichenicolous species of the genus is *Wernerella acarosporae*, growing on *Acarospora*, which was introduced by Etayo, (2010). This species is different from *W. maheui* by the colonizing the thallus of *Acarospora* instead of the hymenium of *Rinodina*, the erumpent ascomata, the thicker paraphyses with guttules inside, and the uniseptate spores with a thin wall (Etayo, 2010c).

Type species: *Wernerella maheui* (Werner) Navarro-Rosinés, Cl. Roux & Giralt

Table 2.39 Accepted lichenicolous species of *Wernerella*

	Species name	**Host**	**References**	**Remarks**
1	*Wernerella acarosporae* Etayo	*Acarospora nodulosa* var. *reagens*	(Etayo, 2010c)	
2	*Wernerella maheui* (Werner) Navarro-Rosinés, Cl. Roux & Giralt	*Rinodina colletica*	(Navarro-Rosinés, 1998)	= *Leptosphaeria maheui* Werner



Note a Ascoma with asci and paraphysoids. b, c Asci. d Ascospores. Scale bars: a = 20 μm, b–d = 10 μm.

Source Redrawn from Navarro-Rosinés et al. (1996)

Figure 2.37 *Wernerella maheui*

Order Patellariales D. Hawksw. & O.E. Erikss.

Family Patellariaceae Corda

Stratisporella Hafellner (1)

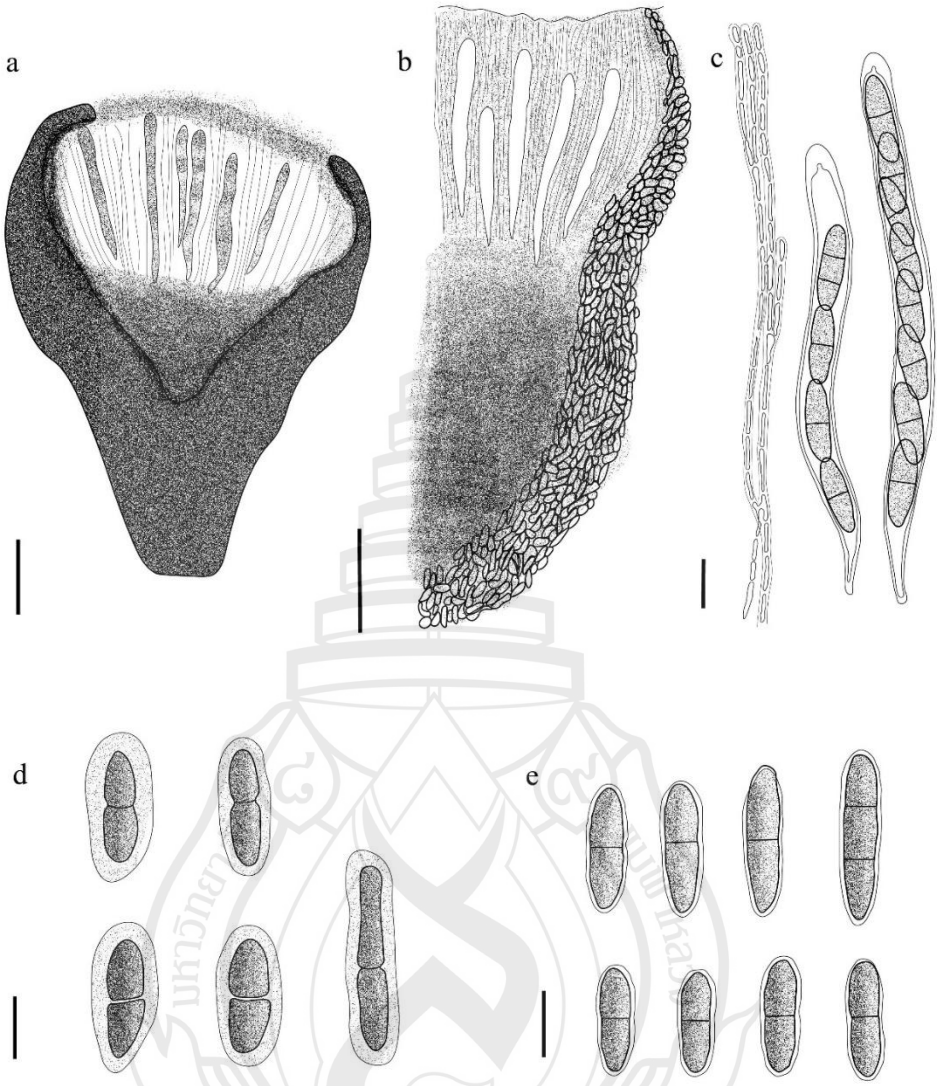
Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Patellariaceae, Patellariales, Dothideomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Stratisporella was established by Hafellner, (1979) to accommodate the single species *Stratisporella episemoides*, which was transferred here from *Lecidea episemoides* Nylander, growing on *Enterographa* (Hafellner, 1979). The type is the only species of *Atratisporella* which is characterized by the black and flat disk, brown paraplectenchymatous exicipulum, narrowly cylindrical asci with unitunicate and the two-celled ascospores with inner layer brown, outer layer hyaline to yellowish but lacking a halo. Kutorga & Hawksworth (1997) treated this genus in Patellariaceae as they observed that the asci are bitunicate. Yacharoen et al. (2015) examed a single herbarium slide, however, the characters of the genus were hard to determine and the asci appear to be bitunicate. The taxon needs to be recollected and the epitype established with sequence data (Yacharoen et al., 2015).

Type species: *Stratisporella episemoides* (Nyl.) Hafellner, on *Enterographa* (Hafellner 1979).

= *Lecidea episemoides* Nyl.



Note a–b Vertical section of apothecium. c Hamathecium of pseudoparaphyses, and asci. d–e Ascospores. Scale bars: a–b = 50 µm, c-e = 10 µm.

Source Redrawn from Hafellner (1979) and Yacharoen et al. (2015)

Figure 2.38 *Stratisporella episemoides*

Tryblidaria (Sacc.) Rehm (1-27)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Patellariaceae, Patellariales, Dothideomycetidae,

Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Tryblidaria fenestrata* (Cooke & Peck) M.E. Bar

Accepted lichenicolous species:

Tryblidaria capensis (Stizenberger) Vouaux, on *Buellia callaina*

Order Pleosporales Luttr. ex M.E. Barr

Family Corynesporascaceae

Corynespora (2-201)

Classification: Corynesporascaceae, Pleosporales, Dothideomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Corynespora mazei* Güssow

Table 2.40 Accepted lichenicolous species of *Corynespora*

	Species name	**Host**	**References**	**Remarks**
1	*Corynespora laevistipitata* (M.S.Cole & D.Hawksw.) Heuchert & U.Braun	*Gaphis, Lecanora, Lepra, Pertusaria, Phaeophysicia* and *Xanthoria*	(HeucHert et al., 2006)	= *Taeniolella laevistipitata* M.S. Cole & D. Hawksw.
2	*Corynespora thorii* U. Braun, Zhurb. & Frisch	*Lecanora*	(Zhurbenk et al., 2015)	

Family Cucurbitariaceae C. Luerssen

Pyrenochaeta De Not. (2-128)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Cucurbitariaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota

Type species: *Pyrenochaeta nobilis* De Not.

Table 2.41 Accepted lichenicolous species of *Pyrenochaeta*

	Species name	Host	References	Remarks
1	*Pyrenochaeta collematis* Vouaux	*Collema tenax*	(Bouly de Lesdain, 1910)	
2	*Pyrenochaeta xanthoriae* Diederich	*Xanthoria*	(Diederich, 1990)	

Pyrenochaetopsis Gruyter, Aveskamp & Verkley (1-23)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Cucurbitariaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Pyrenochaetopsis leptospora* (Sacc. & Briard) Gruyter, Aveskamp & Verkley

Accepted lichenicolous species:

Pyrenochaetopsis microspora (Gruyter & Boerema) Gruyter, Aveskamp & Verkley, on *Buellia.*

Family Dacampiaceae Körb.

Dacampia A. Massal. (16)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dacampiaceae, Pleosporales, Pleosporomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Dacampia was established by Massalongo, (1853) to accommodate the type species *D. hookeri*, originally named *Verrucaria hookeri* Borrer. While most species in this genus are lichenicolous, the type species *Dacampia hookeri* is lichenized. In its juvenile stages, it may facultatively transform the thallus of *Solorina bispora*, forming white lichenized thalli in association with *Coccomyxa* and external cephalodia with *Nostoc* (Henssen, 1995).

The genus is characterized by black perithecioid ascomata with a central ostiole, which are immersed to semi-immersed in the thallus. The asci are bitunicate, subcylindrical, apically thickened when mature, with a small ocular chamber, and are 8-spored. The ascospores are pale brown to dark brown, 1–2-seriate, pigmented early in development, muriform, ellipsoid to fusiform, and often constricted at the septa (Ertz et al., 2015).

Dacampia includes 15 species. LSU sequence data are available in GenBank for *D. hookeri* and *D. engeliana*. Halici & Hawksworth (2008) introduced two new species, *D. muralicola* and *D. rhizocarpicola*, and provided a key to seven species.

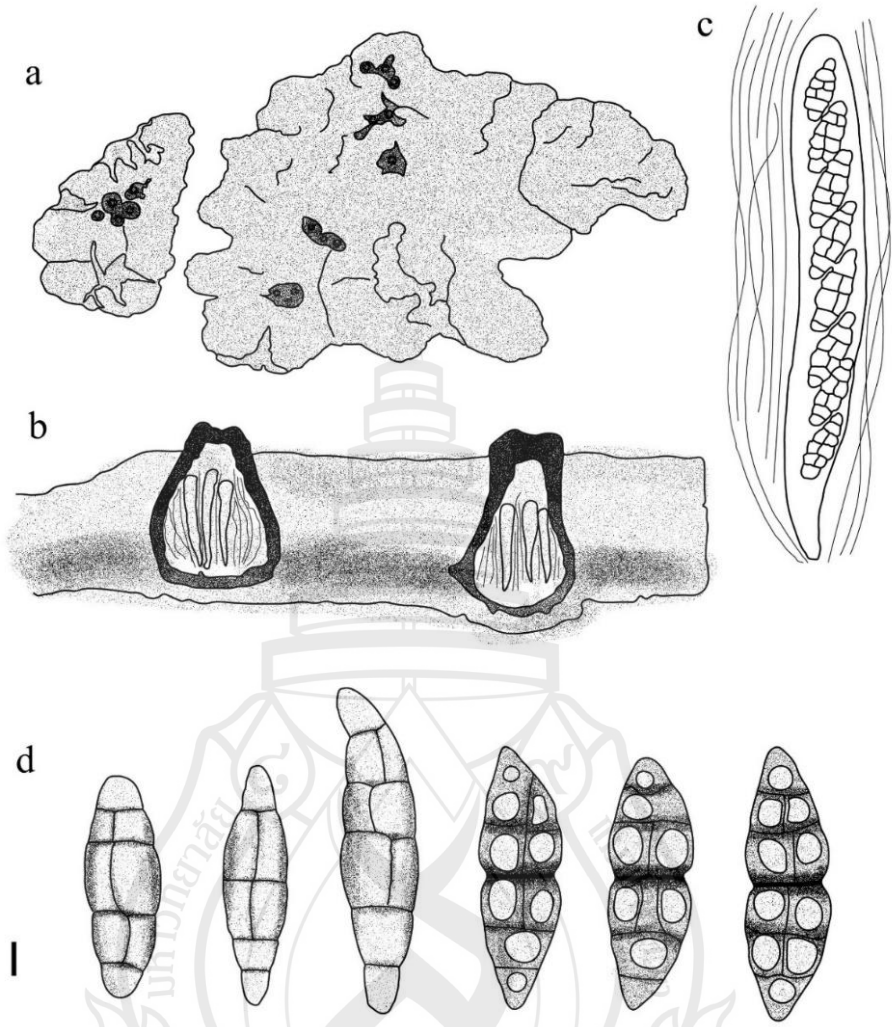
Type species: *Dacampia hookeri* (Borrer) A. Massal.

Table 2.42 Accepted lichenicolous species of *Dacampia*

	Species name	**Host**	**References**	**Remarks**
1	*Dacampia caloplacicola* Halici, Candan & Etayo	*Caloplaca crenularia*	(Halici et al., 2009)	
2	*Dacampia cladoniicola* Halici & A.Ö. Türk	*Cladonia*	(Halici et al., 2008)	
3	*Dacampia cyrtellae* Brackel	*Lecania cyrtella*	(Brackel, 2010b)	
4	*Dacampia engeliana* (Sauter) A. Massalongo	*Solorina saccata*	(Massalongo, 1854)	=*Sagedia engeliana* Saut.
5	*Dacampia hookeri* (Borrer) A. Massalongo	*Solorina,* probably lichenized	(Massalongo, 1853b)	=*Verrucaria hookeri* Borrer
6	*Dacampia lecaniae* Kocourková & K. Knudsen	*Lecania fuscella*	(Kocourková et al., 2010)	

Table 2.42 (continued)

	Species name	Host	References	Remarks
7	*Dacampia leptogiicola* (D. Hawksworth) D. Hawksworth	*Leptogium burgessii*	(Halici & Hawksworth, 2008)	=*Pleospora leptogiicola* D. Hawksw.
8	*Dacampia muralicola* Halici & D. Hawksworth	*Protoparmeliopsis muralis*	(Halici & Hawksworth, 2008)	
9	*Dacampia neglecta* Stein	*Solorina saccata*	(Stein, 1872)	
10	*Dacampia peltigericola* D. Hawksworth & C.J.B. Hitch	*Peltigera rufescens*	(Earland-Bennett et al., 2006)	
11	*Dacampia pentaseptata* Etayo	*Parmotrema*	(Etayo, 2017)	
12	*Dacampia rhizocarpicola* D. Hawksworth	*Rhizocarpon obscuratum*	(Halici & Hawksworth, 2008)	
13	*Dacampia rubra* Halici, Candan & Calatayud	*Aspicilia*	(Halıcı et al., 2009)	
14	*Dacampia rufescentis* (Vouaux) D. Hawksworth	*Peltigera rufescens*	(Hawksworth, 1986)	=*Pleospora rufescentis* Vouaux
15	*Dacampia thamnoliicola* Zhurbenko	*Thamnolia*	(Zhurbenko, 2012)	
16	*Dacampia xanthomendozae* Etayo & Halici	*Xanthomendoza*	(Halici et al., 2009)	



Note a Thallus with marginal ascomata. b Vertical section of ascomata. c Asci and paraphysis. d Ascopores. Scale bars: d = 5 μm.

Source Redrawn from Zschacke (1934) and Ertz et al. (2015)

Figure 2.39 *Dacampia hookeri* (=*Pleospora hookeri*)

Pseudonitschkia Coppins & S.Y. Kondr. (1)

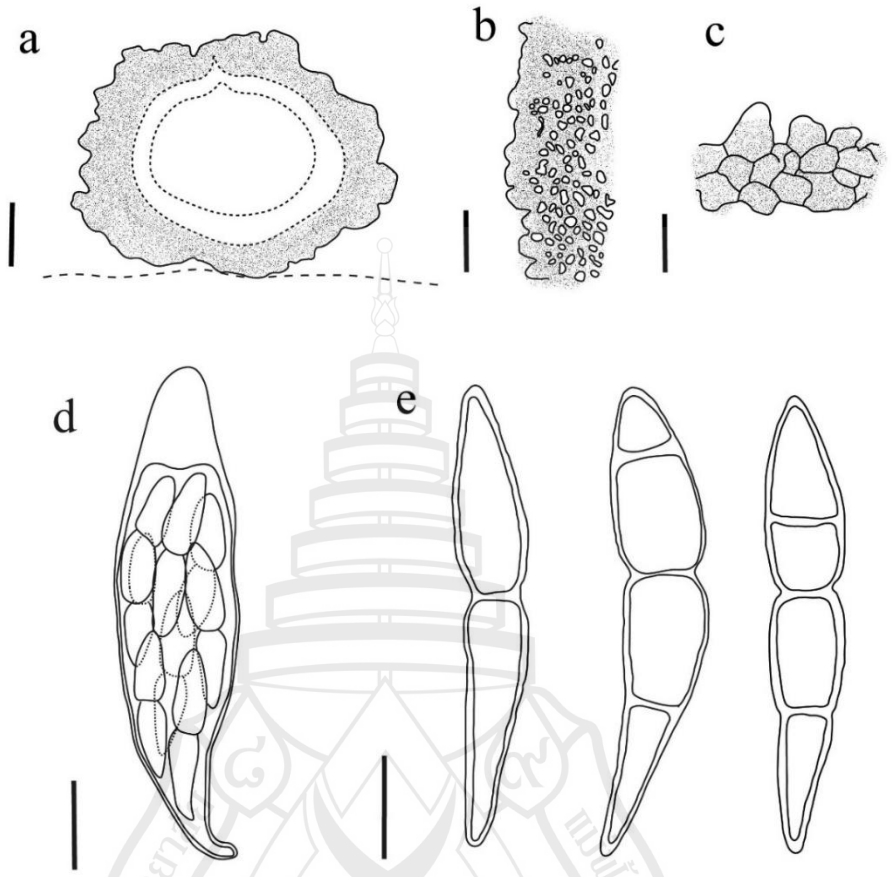
Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dacampiaceae, Pleosporales, Pleosporomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

The lichenicolous genus *Pseudonitschkia* was established by Coppins & Kondratyuk (1995) to accommodate the type species *P. parmotrematis* Coppins & S.Y. Kondr, which grows on *Parmotrema tinctorum* (Despr. ex Nyl.) Hale and *P. pseudotinctorum* (Abbayes) Hale. This genus is characterized by perithecial, black, spherical or collapsed cupulate ascomata that are rimose and rugose, branched and anastomosing slender hamathecial filaments, fissitunicate, club-shaped asci and hyaline, smooth, fusiform, septate ascospores with brownish veins and finely verruculose surfaces (Coppins et al., 1995).

Pseudonitschkia was initially placed in the order Dothideales (Dothideomycetidae, Dothideomycetes), and was tentatively assigned to the family Dacampiaceae by Coppins & Kondratyuk (1995), based on the features. However, Lumbsch et al. (2007, 2010) later classified this genus within Dothideomycetes genera incertae sedis (Lumbsch et al., 2007; Lumbsch et al., 2010). More recently, Wijayawardene et al. (2017) placed it within Dacampiaceae (Pleosporales). To date, no molecular data are available for this genus, so its phylogenetic status remains uncertain and requires further study as molecular data become available.

Type species: *Pseudonitschkia parmotrematis* Coppins & S.Y. Kondr.



Note a Section of Perithecium. b Section of perithecial wall. c Texture of perithecia wall. c Ascus with ascospores. d Ascospores. Scale bars: a = 25 µm, b & d = 18 µm, c & e = 10 µm.

Source Redrawn from Coppins et al. (1995)

Figure 2.40 *Pseudonitschkia parmotrematis*

Weddellomyces D. Hawksw. (12)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dacampiaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Weddellomyces was established by Hawksworth (1986) to accommodate the type species *W. epicallopisma*, which grows on various crustose lichens, including

Caloplaca, *Lecanora*, *Protoblastenia*, *Pyrenodesmia*, and *Variospora*. This genus is characterized by black, subglobular perithecioid ascomata with an ostiolar region that opens by irregular fissures and a pseudoparenchymatous excipulum. The hamathecium consists of branched and anastomosed interascal filaments that are not ascendant. The asci are subcylindrical to elongate-clavate, bitunicate, and eight-spored, while the ascospores are ellipsoidal, 3-septate, golden brown, and have a verrucose surface (Navarro-Rosinés & Roux, 1995).

Kirk et al. (2001) placed *Weddellomyces* within the family *Dacampiaceae*, a viewpoint later accepted by Lumbsch & Huhndorf (2007), Hyde et al. (2013), and Hyde et al. (2024). However, Diederich (2018) placed the genus in *Dothideomycetes* as genera incertae sedis. The phylogenetic position of *Weddellomyces* remains uncertain and requires further investigation once molecular data become available. Until then, we temporarily follow its placement within *Dacampiaceae* (Pleosporales).

12 species are recognized in *Weddellomyces*, all of which are lichenicolous. Most species grow on crustose lichens, such as *Acarospora*, *Aspicilia*, *Caloplaca*, *Lecanora*, and *Pertusaria*, with the exception of *Weddellomyces xanthoparmeliae*, which grows on the foliose lichen *Xanthoparmelia*. (Calatayud & Navarro-Rosines, 1998).

Type species: *Weddellomyces epicallopisma* (Wedd.) D. Hawksw.

Table 2.43 Accepted lichenicolous species of *Weddellomyces*

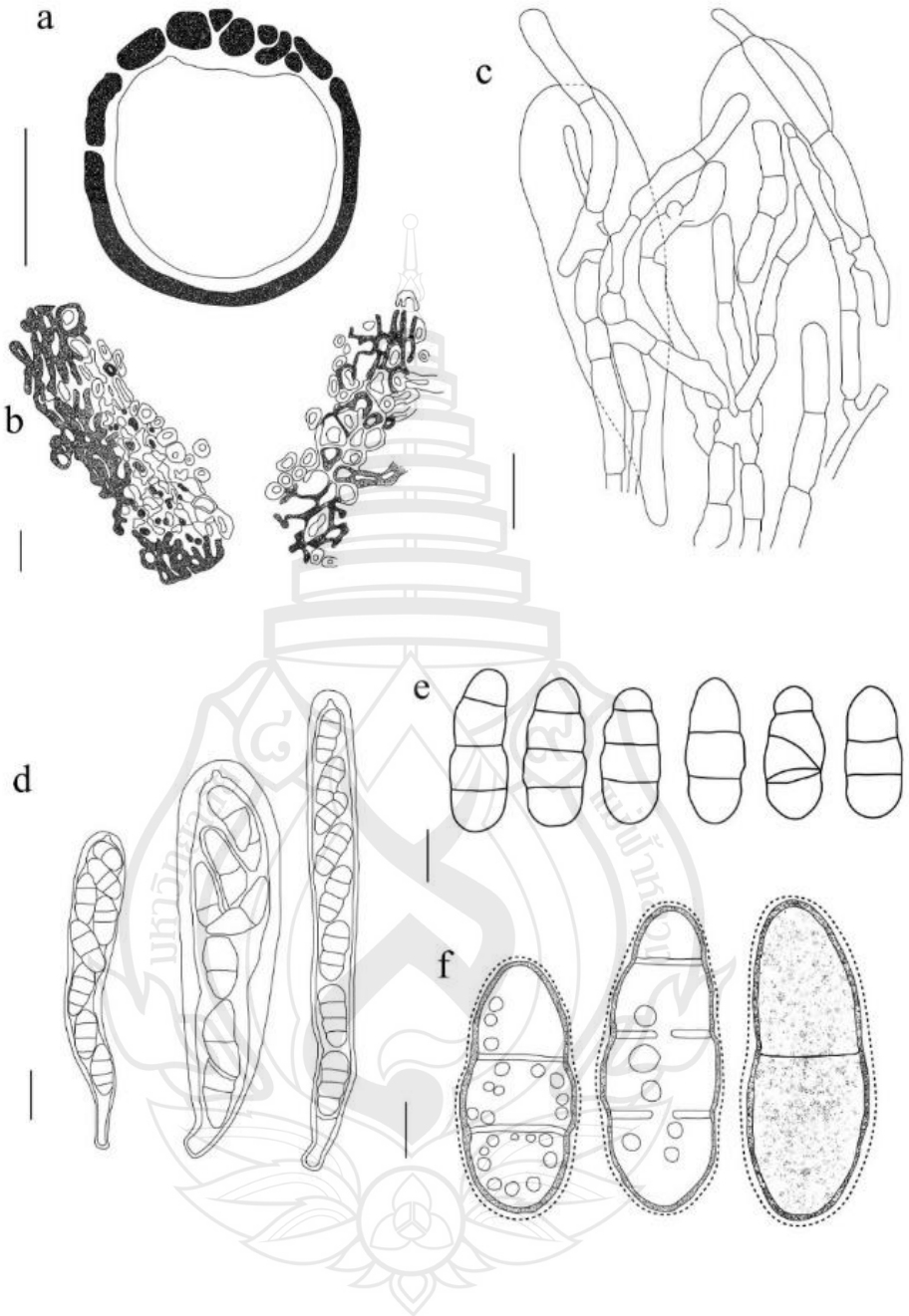
	Species name	Host	References	Remarks
1	*Weddellomyces aspiciicola* Alstrup	*Aspicilia radiosa*	(Alstrup, 1992)	
2	*Weddellomyces epicallopisma* (Wedd.) D. Hawksw.	*Caloplaca, Lecanora, Protoblastenia, Pyrenodesmia* and *Variospora*	(Hawksworth, 1986)	= *Verrucaria epicallopisma* Wedd.

Table 2.43 (continued)

	Species name	Host	References	Remarks
3	*Weddellomyces erythrocarpae* Nav.-Ros. & Cl. Roux	*Caloplaca erythrocarpa*	(Navarro-Rosinés & Roux, 1995)	
4	*Weddellomyces gasparriniae* (C.W. Dodge) D. Hawksw. & Iturr.	*Caloplaca*	(Hawksworth & Iturriaga, 2006)	= *Phaeospora gasparriniae* C.W. Dodge
5	*Weddellomyces heterochrous* Nav.-Ros. & Cl. Roux	*Aspicilia calcarea*	(Navarro-Rosinés & Roux, 1995)	
6	*Weddellomyces macrosporus D. Hawksw., Renob. & Coppins*	*Aspicilia calcarean*	(Hawksworth, 1990b)	
7	*Weddellomyces pachyosporicola* Nav.-Ros. & Cl. Roux	*Aspicilia*	(Navarro-Rosinés & Roux, 1995)	
8	*Weddellomyces periphericus* (Taylor) Alstrup & D. Hawksw.	*Pertusaria pseudocorallina*	(Alstrup et al., 1990)	= *Verrucaria peripherica* Taylor
9	*Weddellomyces pertusariicola* Halici	*Pertusaria lactea*	(Halıcı, 2010)	

Table 2.43 (continued)

	Species name	Host	References	Remarks
	Weddellomyces protearius Nav.-Ros. & Cl. Roux	*Caloplaca proteus*	(Navarro-Rosinés et al., 1997)	
10	*Weddellomyces turcicus* Halıcı & Orange	*Acarospora*	(Halici et al., 2005)	
11	*Weddellomyces xanthoparmeliae* Calat. & Nav.-Ros.	*Xanthoparmelia*	(Calatayud & Navarro-Rosines, 1998)	



Note a Vertical section of perithecium. b Parts of the wall of the perithecium. c Structure of the hymenium. d Asci. e–f Ascospores. Scale bars: a = 200 µm, b, c, e = 10 µm, d = 20 µm, f = 5 µm.

Source Redrawn from Navarro-Rosinés et al. (1995)

Figure 2.41 *Weddellomyces epicallopisma*

Family Dictyosporiaceae Boonmee & K.D. Hyde

Verrucoccum V. Atienza, D. Hawksw. & Pérez-Ort. (3)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dictyosporiaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Verrucoccum is the only genus of lichenicolous fungi so far known in Dictyosporiaceae, which was established by Atienza et al. (2021) and has two types of reproductive stuctures, sexual morph and the asexual morph. The sexual morph is characterized by perithecioid ascomata, brown-black, subglobose with a rough surface, ostiolate; elongate-clavate to subcylindrical asci with a short ocular chamber, short-stalked, bitunicate, discharge fissitunicate, (4–)6–8-spored; brown ascospores, 1-septate. The asexual morph is characterized by pycnidial conidiomata immersed to sessile, arising in contiguous groups associated with ascomata, ostiolate, from hyaline when young to brown when mature, globose; Conidiogenous cells elliptic to ampulliform, hyaline, smooth, not proliferating, holoblastic; acrogenous conidia, ellipsoid, narrowed to a truncated base simple, pale brown to dark brown. In the phylogenetic analyses of Atienza et al. (2021), two phylogenetic trees respectively based on 28S-18S sequence data and ITS of *Verrucoccum coppinsii* and *V. spribil* were presented (Atienza et al., 2021).

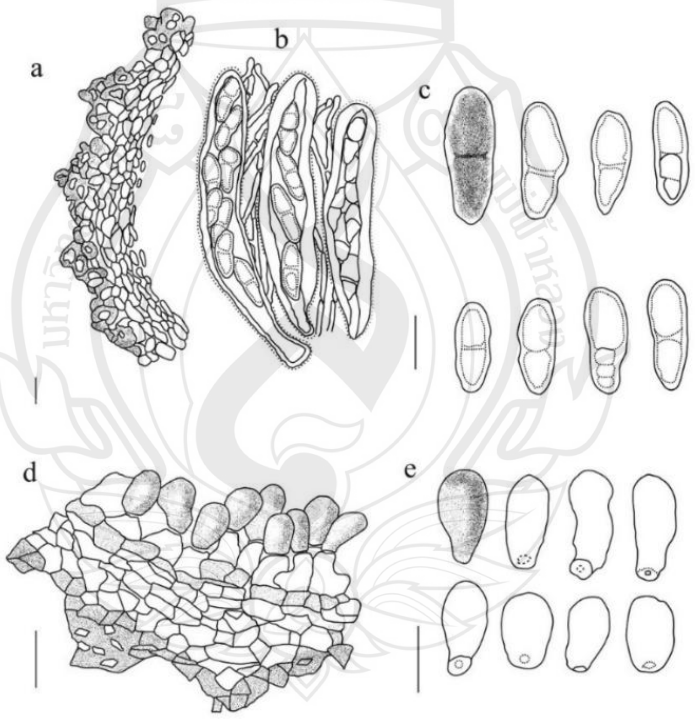
Type species: *Verrucoccum coppinsii* V. Atienza, D. Hawksw. & Pérez-Ort.

Table 2.44 Accepted lichenicolous species of *Verrucoccum*

	Species name	Host	References	Remarks
1	*Verrucoccum coppinsii* V. Atienza, D. Hawksworth & Pérez-Ortega	*Lobaria pulmonaria*	(Atienza et al., 2021)	

Table 2.44 (continued)

	Species name	Host	References	Remarks
2	*Verrucoccum hymeniicola* (Berk. & Broome) D. Hawksw., V. Atienza & Pérez-Ort.	*Sticta*	(Atienza et al., 2021)	= *Dothidea hymeniicola* Berk. & Broome
3	*Verrucoccum spribil* V. Atienza, D. Hawksworth & Pérez-Ortega	*Lobaria linita* or *L. oregana*	(Atienza et al., 2021)	



Note a Vertical section of a portion of the ascoma wall. b Asci and pseudoparaphyses. c Ascospores. d Vertical section of the conidioma (conidiogenous cells and young conidia). e Conidia. Scale bars: a = 15 μm, c, d, e= 10 μm.

Source Redrawn from Atienza et al. (2021)

Figure 2.42 *Verrucoccum coppinsii*

Family Didymellaceae Gruyter, Aveskamp & Verkley

Ascochyta Lib. (2-1003)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Didymellaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Ascochyta pisi* Lib.

Table 2.45 Accepted lichenicolous species of *Ascochyta*

	Species name	Host	References	Remarks
1	*Ascochyta candelariellicola* D. Hawksworth & Kalb	*Candelariella aurella*	(Hawksworth et al., 1992)	
2	*Ascochyta santessonii* Alstrup & D. Hawksworth	*Phaeophyscia sciastra*	(Alstrup et al., 1990)	

Epicoccum Link (1-123)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Didymellaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Epicoccum nigrum* Link

Accepted lichenicolous species:

Epicoccum nigrum Link, facultatively lichenicolous on various lichens

Leptosphaerulina McAlpine (1-54)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Didymellaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Leptosphaerulina australis* McAlpine

Accepted lichenicolous species:

Leptosphaerulina peltigerae (Fuckel) Riedl, on *Peltigera canina*

Microsphaeropsis Höhn. (3-51)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Didymellaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Microsphaeropsis olivacea* (Bonord.) Höhn.

Table 2.46 Accepted lichenicolous species of *Microsphaeropsis*

	Species name	**Host**	**References**
1	*Microsphaeropsis caloplacae* Etayo & Yazici	*Caloplaca persica*	(Etayo & Yazici, 2009)
2	*Microsphaeropsis lichenicola* Etayo	*Pannaria sphinctrina*	(Etayo & Sancho, 2008)
3	*Microsphaeropsis physciae* Brackel	*Physcia adscendens*	(Brackel, 2014)

Family Leptosphaeriaceae M.E. Barr

Leptosphaeria Ces. & De Not. (3-1114)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Leptosphaeriaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Leptosphaeria doliolum* (Pers.) Ces. & De Not.

Table 2.47 Accepted lichenicolous species of *Leptosphaeria*

	Species name	**Host**	**References**	**Remarks**
1	*Leptosphaeria clarkii* D. Hawksw.	*Peltigera rufescens*	(Hawksworth, 1980b)	

Table 2.47 (continued)

	Species name	Host	References	Remarks
2	*Leptosphaeria oxneriae* Cl. Roux & S.Y. Kondr.	*Xanthomendoza ulophyllodes*	(Kondratyuk et al., 2017)	
3	*Leptosphaeria pycnostigma* (Nyl.) Sacc. & D. Sacc.	*Baeomyces rufus*	(Saccardo et al., 1905)	= *Verrucaria pycnostigma* Nyl.

Family Lophiotremataceae

Koordersiella Höhn. (5-7)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Lophiotremataceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Koordersiella was established by Höhnel (1909) to accommodate the type species *K. javanica* Höhnel. This genus is characterized by small, black, regular perithecia with a multilayered perithecial wall, thin-walled 4–8-spored asci, and hyaline, cylindric to spindle-shaped ascospores (Pem, 2019). Hawksworth (2016) considered *K. javanica* to be congeneric with *Hansfordiellopsis aburiensis* Deighton, which had been regarded as a synonym of *Koordersiella insectivora* (Hansf.) D. Hawksw. & O.E. Erikss. As a result, *Hansfordiellopsis* was synonymized with *Koordersiella*, and two species, *Hansfordiellopsis tenuissima* and *H. variegata*, were transferred to *Koordersiella* (Höhnel 1909; Hawksworth 2016). Lumbsch & Huhndorf (2010) placed *Koordersiella* in *Dothideomycetes* as genus incertae sedis in the outline of *Ascomycota* – 2019. Rossman et al. (2016) accepted this classification and recommended treating the genera *Hansfordiellopsis* Deighton and *Ascohansfordiellopsis* D. Hawksw. as synonyms of *Koordersiella*. Diederich et al. (2018) listed six species in *Koordersiella*,

including *Hansfordiellopsis minuta* D. Hawksw. which was not formally combined into the genus. Since we have not examined the type specimen and molecular data are unavailable, it was not included in the *Koordersiella* species list. Pem et al. (2019) re-examined the type specimen and placed *Koordersiella* within *Lophiotremataceae* based on morphological evidence.

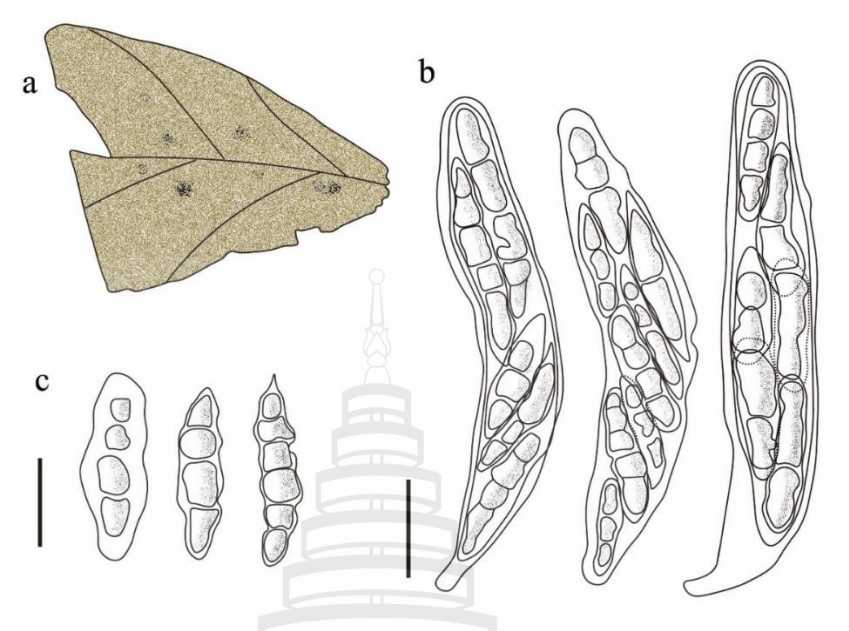
According to Index Fungorum (2024), *Koordersiella* currently includes seven species, five of which are lichenicolous, while the other two occur on plants.

Type species:

Koordersiella javanica Höhn.

Table 2.48 Accepted lichenicolous species of *Koordersiella*

	Species name	**Host**	**References**	**Remarks**
1	*Koordersiella deightonii* (D. Hawksworth) D. Hawksworth & O.E. Eriksson	*Porina trichothelioides*	(Eriksson et al., 1987)	= *Ascohansfordiellopsis deightonii* D. Hawksw.
2	*Koordersiella insectivore* (Hansford) D. Hawksworth & O.E. Eriksson	*Asterothyrium*	(Eriksson et al., 1987)	= *Ascohansfordiellopsis deightonii* D. Hawksw.
3	*Koordersiella javanica* Höhn.	Gomphillacea e	(Höhnel, 1909)	
4	*Koordersiella tenuissima* (D. Hawksw.) D. Hawksw.	foliicolous lichen-forming Fungi	(Hawksworth, 2016)	= *Hansfordiellopsis tenuissima* D. Hawksw.
5	*Koordersiella variegate* (D. Hawksw.) D. Hawksw.	*Gyalectidium aspidotum*	(Hawksworth, 2016)	= *Hansfordiellopsis variegata* D. Hawksw.



Note a Herbarium material. b Asci. c Ascospores. Scale bars: b = 20 μm, c = 10 μm.

Source Redrawn from Pem (2019)

Figure 2.43 *Koordersiella javanica*

Family Phaeosphaeriaceae M.E. Barr

Didymocyrtis Vain. (24-28)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Phaeosphaeriaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Didymocyrtis was introduced by Vainio (1921) to accommodate the species *D. consimilis* and placed in Dothideomycetes genera incertae sedis, however, it was not designated as a holotype in the original description (Vainio, 1921c). Then, this species was selected as lectotype by Ertz et al. (2015), and another two genera *Diederichia* D. Hawksw and *Diederichomyces* Crous & Trakunyingcharoen were treated as synonyms of *Didymocyrtis*. In addition, *Didymocyrtis* was placed in the family Phaeosphaeriaceae according to the phylogenetic analysis of Ertz et al., 2015. The characteristics of the genus include perithecioid ascomata, paraphysoid hamathecial filaments, fissitunicate

asci withapically thickened when mature and brown ascospores with 1–3-transversal septa. The asexual morph includes phoma-like conidiomata, hyaline conidiogenous cells and hyaline conidia with smooth wall and rounded ends (Hawksworth 2003; Trakunyingcharoen et al., 2014; Ertz et al., 2015). This genus includes 28 records in Index Fungorum (2024), and most of them are lichenicolous, only four non-lichencilous, *Didymocyrtis banksiae*, *D. brachylaenae*, *D. pini* collecting from plant and *D. septata* from soil.

Type species: *Didymocyrtis consimilis* Vain.

Table 2.49 Accepted lichenicolous species of *Didymocyrtis*

	Species name	**Host**	**References**	**Remarks**
1	*Didymocyrtis assimilis* Vain.	*Placodium gilvum* var. *cyanolepra*	(Vainio, 1921c)	
2	*Didymocyrtis azorica* Etayo & Pino-Bodas	*Hypotrachyna rockii*	(Etayo et al., 2021)	
3	*Didymocyrtis bryonthae* (Arnold) Hafellner	*Lecanora epibryon*	(Ertz et al., 2015)	= *Endococcus bryonthae* Arnold
4	*Didymocyrtis canariensis* van den Boom & Etayo	*Ramalina subgeniculata*	(van den Boom & Clerc, 2017)	
5	*Didymocyrtis cladoniicola* (Diederich, Kocourková & Etayo) Ertz & Diederich	*Cladonia, Flavoparmelia, Parmelina, Ramalina* and *Squamarina*	(Ertz et al., 2015)	= *Phoma cladoniicola* Diederich, Kocourk. & Etayo

Table 2.49 (continued)

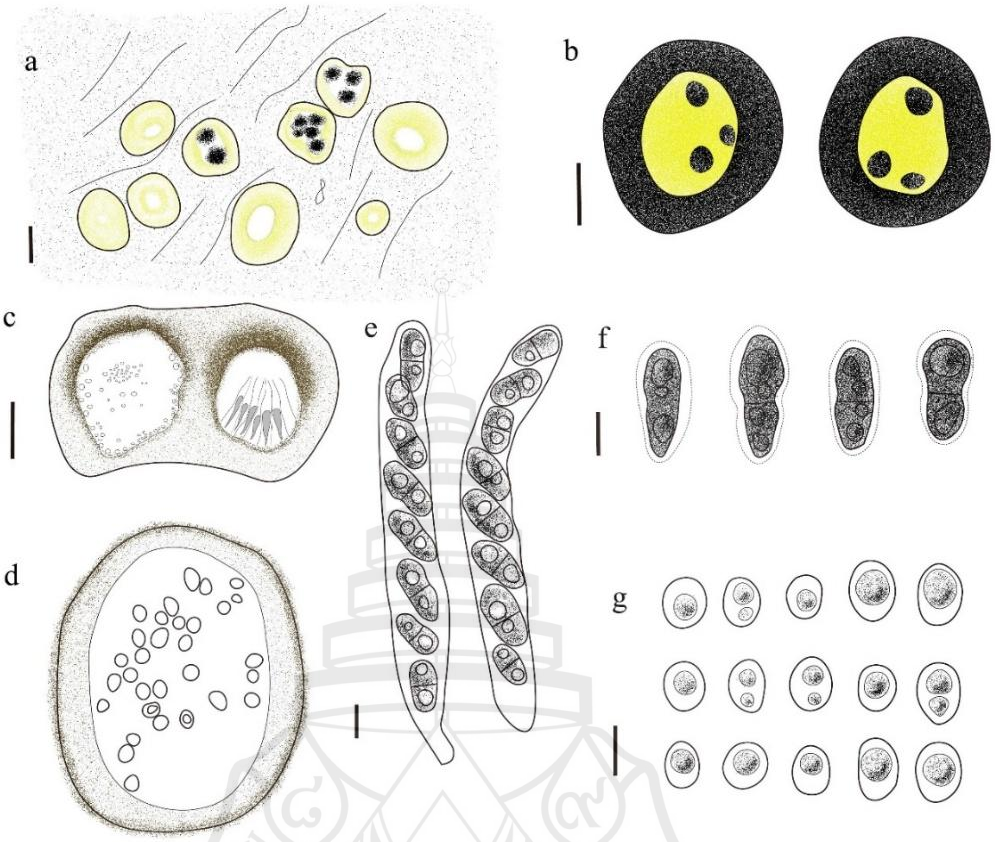
	Species name	Host	References	Remarks
6	*Didymocyrtis consimilis* Vainio	*Caloplaca cerina, C. stillicidiorum* and *C. tirolensis*	(Vainio, 1921c)	
7	*Didymocyrtis epiphyscia* Ertz & Diederich	*Physcia aipolia,* probably also on *Physcia adscendens, P. stellaris, P. tenella* and *Xanthoria parietina*	(Ertz et al., 2015)	
8	*Didymocyrtis foliaceiphila* (Diederich, Kocourk. & Etayo) Ertz & Diederich	*Cladonia, Parmelia* and *Pseudevernia*	(Ertz et al., 2015)	= *Phoma foliaceiphila* Diederich, Kocourk. & Etayo
9	*Didymocyrtis graphidacearum* van den Boom & Ertz	*Pallidogramme*	(Van Den Boom et al., 2017)	
10	*Didymocyrtis grumantiana* (Zhurb. & Diederich) Zhurb. & Diederich	*Cladonia*	(Diederic et al., 2018)	=*Phoma grumantiana* Zhurb. & Diederich
11	*Didymocyrtis infestans* (Speg.) Hafellner	*Teloschistes chrysophthalmus* and *T. flavicans*	(Ertz et al., 2015)	=*Didymosphaeria infestans* Speg.

Table 2.49 (continued)

	Species name	Host	References	Remarks
12	*Didymocyrtis kaernefeltii* (S. Y. Kondr.) Hafellner	*Teloschistes chrysophthalmus*	(Ertz et al., 2015)	= *Polycoccum kaernefeltii* S.Y. Kondr.
13	*Didymocyrtis melanelixiae* (Brackel) Diederich, Harris & Etayo	*Canoparmelia, Cetraria, Evernia, Hypotrachyna, Melanelixia, Parmotrema, Platismatia, Pseudevernia, Punctelia* and *Usnea*	(Ertz et al., 2015)	= *Phoma melanelixiae* Brackel
14	*Didymocyrtis micropunctum* Etayo	*Parmotrema*	(Etayo, 2017)	
15	*Didymocyrtis microxanthoriae* Poumarat, Delhoume, Diederich & Suija	*Xanthoria parietina*	(Suija et al., 2021)	
16	*Didymocyrtis peltigerae* (Fuckel) Hafellner	*Peltigera canina*	(Hafellner, 2019b)	=*Didymosphaeria peltigerae* Fuckel
17	*Didymocyrtis physciae* (Brackel) Hafellner	*Physcia*	(Ertz et al., 2015)	= *Merismatium physciae* Brackel
18	*Didymocyrtis rhizoplacae* Y. Joshi & K. Bisht	*Rhizoplaca chrysoleuca*	(Joshi et al., 2018)	

Table 2.49 (continued)

	Species name	Host	References	Remarks
19	*Didymocyrtis pseudeverniae* (Etayo & Diederich) Ertz & Diederich	*Pseudevernia*	(Ertz et al., 2015)	= *Macrophomina pseudeverniae* Etayo & Diederich
20	*Didymocyrtis ramalinae* (Roberge ex Desm.) Ertz, Diederich & Hafellner	*Ramalina*	(Ertz et al., 2015)	= *Sphaeria ramalinae* Roberge ex Desm.
21	*Didymocyrtis slaptoniensis* (D. Hawksw.) Hafellner & Ertz	*Xanthoria parietina*	(Ertz et al., 2015)	= *Polycoccum slaptonense* D. Hawksw.
22	*Didymocyrtis thamnoliicola* Y. Joshi, R. Bajpai & Upreti	*Thamnolia vermicularis*	(Joshi et al., 2016)	
23	*Didymocyrtis trassii* Suija, Darmostuk & Khodos.	*Cetraria aculeata*	(Khodosovtsev et al., 2018)	
24	*Didymocyrtis xanthomendozae* (Diederich & Freebury) Diederich & Freebury	*Xanthomendoza*	(Ertz et al., 2015)	= *Phoma xanthomendozae* Diederich & Freebury,



Note a On *Caloplaca tirolensis*. b On *C. cerina*. c Section through conidioma (left) and ascoma (right). d Section through conidioma. e Asci with ascospores. f Ascospores. g Conidia. Scale bars: a–b = 200 µm, c = 50 µm, d = 10 µm, e–g = 5 µm

Source Redrawn from Ertz, et al. (2015)

Figure 2.44 *Didymocyrtis consimilis*

Ophiobolus Riess (2-166)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Phaeosphaeriaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Ophiobolus disseminans Riess

Table 2.50 Accepted lichenicolous species of *Ophiobolus*

	Species name	Host	References	Remarks
1	*Ophiobolus aspiciliae* (H. Olivier) Vouaux	*Aspicilia*	(Vouaux, 1913c)	= *Bacidia aspiciliae* H. Olivier
2	*Ophiobolus thallicola* (Ces. & De Not.) Sacc.	*Peltigera*	(Saccardo, 1883)	= *Rhaphidophora thallicola* Ces. & De Not.

Phaeoseptoria Speg. (1-39)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Phaeosphaeriaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Phaeoseptoria papayae* Speg.

Accepted lichenicolous species:

Phaeoseptoria peltigerae Punith. & Spooner, on *Peltigera*

Pseudopyrenidium Nav.-Ros., Zhurb. & Cl. Roux (2)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Phaeosphaeriaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Pseudopyrenidium is a lichenicolous genus established by Navarro-Rosinés et al. (2010) to accommodate the type species *P. tartaricola* (Linds.) Nav.-Ros., Zhurb. & Cl. Roux, a parasite on terricolous *Ochrolechia*. The type species was transferred from *Verrucaria tartaricola* Linds. The genus is characterized by perithecioid, black, globose to subglobose, ostiolate ascomata; a prosoplectenchymatous excipulum with two layers (outer layer brownish-brown, inner layer colorless); septate paraphyses; bitunicate, subcylindrical to elongate-clavate, 4-spored asci; and ellipsoid to broadly

fusiform ascospores that are initially colorless, later becoming brownish, multi-septate, and granulose-verrucose in texture (Navarro-Rosinés et al., 2010). Based on its morphological features, *Pseudopyrenidium* was initially placed in *Adelococcaceae* (Verrucariales) by Navarro-Rosinés et al. (2018). However, Diederich et al. (2018) suggested that the genus should instead belong to *Pleosporales* incertae sedis.

Another lichenicolous species in this genus, *P. epipertusariae* Etayo & Pino-Bodas, parasitizes *Pertusaria pertusa* (Etayo et al., 2021). Phylogenetic analyses by Etayo & Pino-Bodas (2021) showed that *P. epipertusariae* was related to a clade comprising *Acericola italica* Wanas, *Jeremyomyces labinae*, and *Xenophoma puncteliae*, all members of the family *Phaeosphaeriaceae* M.E. Barr. In addition to its morphological similarities with *Pseudopyrenidium tartaricola*, the genus *Pseudopyrenidium* was subsequently placed in *Phaeosphaeriaceae*.

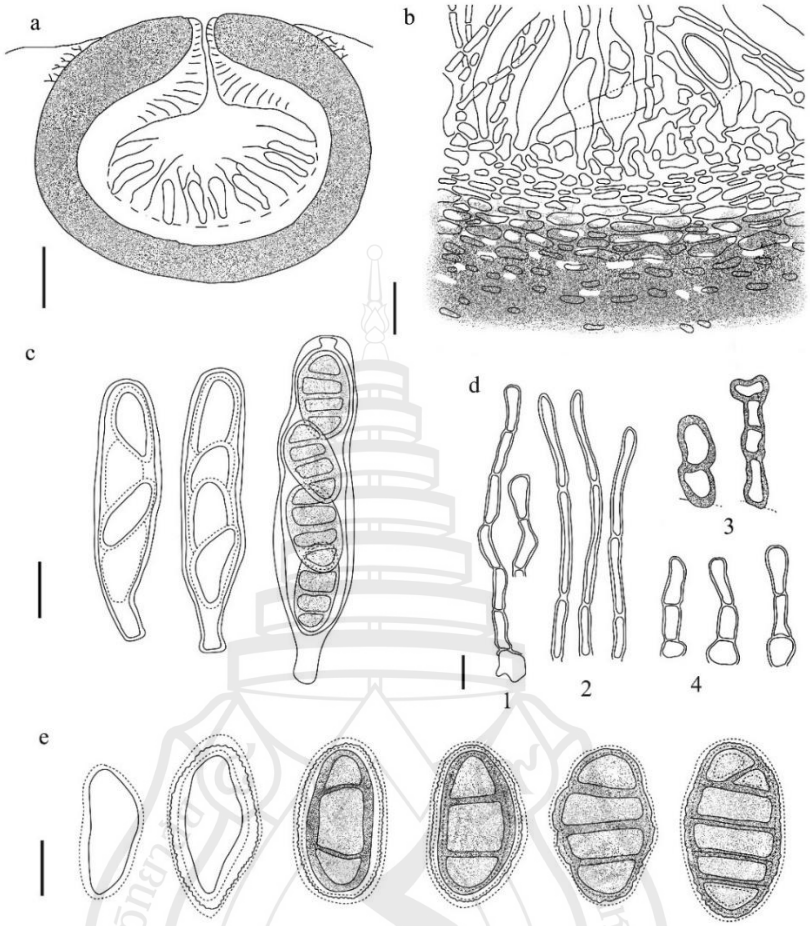
Type species:

Pseudopyrenidium tartaricola (Linds.) Nav.-Ros., Zhurb. & Cl. Roux, on *Ochrolechia*

= *Verrucaria tartaricola* Linds

Table 2.51 Accepted lichenicolous species of *Pseudopyrenidium*

	Species name	Host	References	Remarks
1	*Pseudopyrenidium epipertusariae* Etayo & Pino-Bodas	*Pertusaria pertusa*	(Etayo et al., 2021)	
	Pseudopyrenidium tartaricola (Linds.) Nav.-Ros., Zhurb. & Cl. Roux	*Ochrolechia a*	(Navarro-Rosinés et al., 2010)	= *Verrucaria tartaricola* Linds



Note a Section of apothecia. b Lower part of the ascomata. c Asci. d (1 Paraphysis, 2 periphyses, 3 hyphal appendages, 4 short pseudoparaphyses). e Ascospores. Scale bars: a = 50 μm, b–c = 10 μm, d–e = 5 μm.

Source Redrawn from Navarro-Rosinés et al. (2010)

Figure 2.45 *Pseudopyrenidium tartaricola*

Xenophoma Crous & Trakun. (1-2)

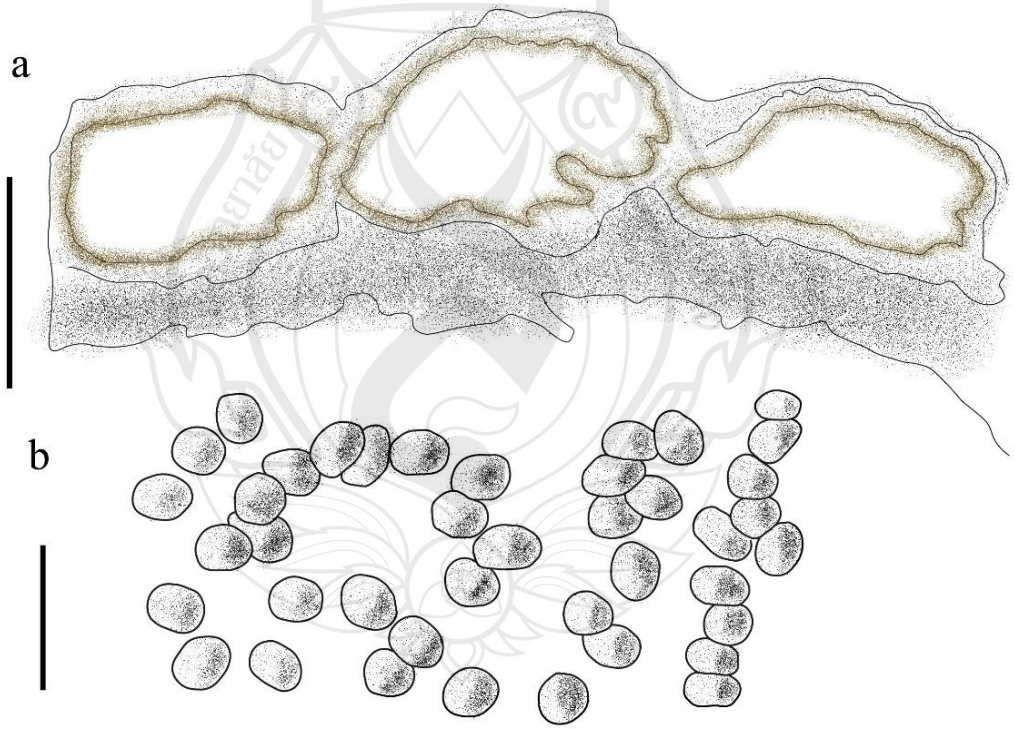
Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Phaeosphaeriaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Xenophoma (Phaeosphaeriaceae) was established based on phylogenetic

analysis by Crous & Trakunyingcharoen (2014) to accommodate the type species *Xenophoma puncteliae* which originally described as *Phoma puncteliae* Diederich & Lawrey (Lawrey et al., 2012; Trakunyingcharoen et al., 2014). The type is the only lichenicolous species, and another species *X. microspora* Magaña-Dueñas, Stchigel & Cano-Lira was found on plant debris in freshwater in Spain (Magaña-Dueñas et al., 2021). This genus is characterized by irregular to cauliflower-shaped conidiomata with uni- to multilocular, hyaline conidiogenous cells with ampulliform and solitary, hyaline conidia with guttulate and subspherical to ellipsoid shape (Trakunyingcharoen et al., 2014).

Type species: *Xenophoma puncteliae* (Diederich & Lawrey) Crous & Trakun.



Note a Sections throuch conidiomata. b Conidia. Bars: a = 50 μm, b = 10 μm.

Source Redrawn from Trakunyingcharoen et al. (2014)

Figure 2.46 *Xenophoma puncteliae*

Family Pleomassariaceae M.E. Barr

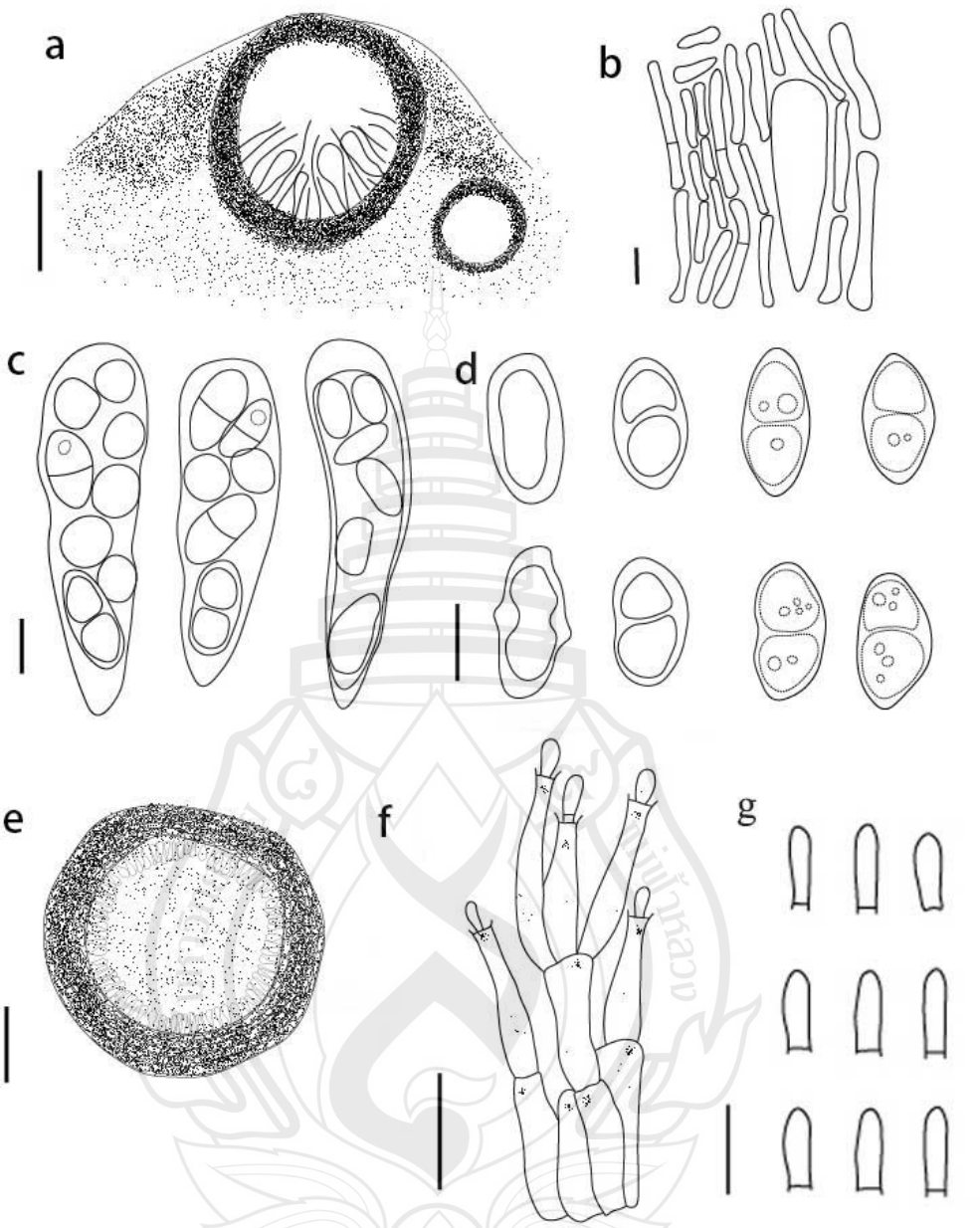
Lichenopyrenis Calat., M.J. Sanz & Aptroot (1)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Pleomassariaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Lichenopyrenis was established by Calatayud, Sanz & Aptroot (2001) to accommodate the cecidiogenous species *Lichenopyrenis galligena* parasitic on the lichen *Leptochidium albociliatum*. The genus is characterized by perithecioid, black, globose ascomata, hyaline, vide, septate hamathecium filaments, clavate asci and ellipsoidal, 1-distoseptate, pale brown, thick-walled ascospores (Calatayud et al., 2001). So far, the type species is the only species in this genus and is also a licheniferous fungus.

Type species: *Lichenopyrenis galligena* Calat., M.J. Sanz & Aptroot, on *Leptochidium albociliatum*



Note a Transverse section of an ascoma. b Hamathecium filaments and a young ascus. c Asci. d Ascospores. e Transverse section of a conidioma. f Conidiophores bearing conidiogenous cells. g Conidia, Scale bars: a = 100 μm, b–f = 10 μm, g = 5 μm.

Source Redrawn from Calatayud et al. (2001)

Figure 2.47 *Lichenopyrenis galligena*

Family Pleosporaceae Nitschke

Pleospora Rabenh. ex Ces. & De Not. (5-738)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Pleosporaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Pleospora herbarum* (Pers.) Rabenh. ex Ces. & De Not.

Table 2.52 Accepted lichenicolous species of *Pleospora*

	Species name	Host	References	Remarks
1	*Pleospora bernadetiae* van den Boom	*Protoparmeliopsis muralis*	(van den Boom, 2015)	
2	*Pleospora collematum* Zukal	Collemataceae	(Zukal, 1887)	
3	*Pleospora crozalsii* Vouaux	*Sticta sylvatica*	(Vouaux, 1913c)	
4	*Pleospora tretiachii* Hafellner	*Aspicilia*	(Hafellner et al., 2012)	= *Pleospora aquatica* Tretiach & Nimis
5	*Pleospora xanthoriae* Khodos. & Darmostuk	*Xanthoria parietina*	(Khodosovtsev & Darmostuk, 2016)	

Family Sporormiaceae Munk

Preussia Fuckel (1-103)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Sporormiaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Preussia funiculata* (Preuss) Fuckel

Accepted lichenicolous species:

Preussia peltigerae (Brackel) Diederich, on *Peltigera rufescens.*

Family Trematosphaeriaceae K.D. Hyde, Y. Zhang ter, Suetrong & E.B.G. Jones

Trematosphaeria Fuckel (1-140)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Trematosphaeriaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Trematosphaeria pertusa* (Pers.) Fuckel

Accepted lichenicolous species:

Trematosphaeria lophiostoma Choisy & Werner, on *Staurothele font-queri*

Pleosporales Genera incertae sedis

Homostegia Fuckel (5-16)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Genera incertae sedis, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Homostegia adusta* Fuckel

Table 2.53 Accepted lichenicolous species of *Homostegia*

	Species name	Host	References	Remarks
1	*Homostegia adusta* Fuckel	*Parmelia saxatilis*	(Fuckel, 1870)	
2	*Homostegia dermatocarpi* Alstrup & M.S. Cole	*Dermatocarpon reticulatum*	(Alstrup et al., 1998)	
3	*Homostegia hertelii* D. Hawksw., V. Atienza & M. S. Cole	*Flavoparmelia caperata*	(Hawksworth et al., 2004)	

Table 2.53 (continued)

	Species name	Host	References	Remarks
4	*Homostegia parmeliana* (Jacz. & Elenkin) Vouaux	*Parmelia molliuscula* var. *vagans*	(Vouaux, 1912a)	= *Trematosphaeriopsis parmeliana* Jacz. & Elenkin
5	*Homostegia piggotii* (Berk. & Broome) P. Karst.	*Parmelia* s. str.	(Karsten, 1873)	= *Dothidea piggotii* Berk. & Broome

Paraepicoccum Matsush. (2-3)

Index Fungorum 26487, faceoffungi, MycoBank, GenBank

Classification: Pleosporales genera incertae sedis, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Paraepicoccum was introduced by Matsush. (1993) to accommodate a saprobic fungus *P. amazonense*. Diederich et al. (2024) introduced two new species, *P. hypotrachynae* and *P. ocellulariae*, which are lichenicolous fungi. This genus is characterized by dark brown to blackish colonies forming flattened sporodochia. The conidiophores are relatively short, simple or branched, subhyaline to pale olivaceous or golden brown, smooth, and septate, with one or several apical conidiogenous loci. The conidiogenous cells are monoblastic and integrated, producing dry, ellipsoidal to subspherical conidia. These conidia are smooth and pale brown when young, becoming brown and submuriform with several longitudinal or oblique septa. They are slightly to distinctly flattened and possess a subhyaline to pale brown basal cell.

To date, three species are recognized in *Paraepicoccum*, two of which are lichenicolous. Phylogenetic analysis based on multi-gene by Thambugala et al. (2017) indicated that *Paraepicoccum* should be placed in Pleosporineae, Pleosporales.

However, no specific family has been identified. Therefore, this genus is tentatively placed within Pleosporales genera incertae sedis.

Type species: *Paraepicoccum amazonense* Matsush. (Matsushima, 1993)

Table 2.54 Accepted lichenicolous species of *Paraëpicoccum*

	Species name	Host	References	Remarks
1	*Paraëpicoccum hypotrachynae* Diederich, Etayo, van den Boom & Giavarini	*Hypotrachyna minarum*	(Diederich et al., 2024)	
2	*Paraëpicoccum ocellulariae* Diederich	*Ocellularia* sp.	(Diederich et al., 2024)	

Order Trypetheliales Lücking, Aptroot & Sipman

Family Polycoccaceae Ertz, Hafellner & Diederich

Clypeococcum D. Hawksw. (17)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Polycoccaceae, Trypetheliales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Clypeococcum was established by Hawksworth (1977) to accommodate the lichenicolous *C. cladonema* (Wedd.) D. Hawksw. which was transferred from *Lecidea cladonema* Wedd. It grows on the thalli of *Parmelia verruculifera* Nyl. on volcanic rocks (Hawksworth, 1977b). Initially, it belongs to the family Pleosporaceae Wint. (Pleosporales). However, in the first molecular phylogenetic analysis conducted by Ertz et al. (2015), two *Clypeococcum* species and five *Polycoccum* species formed a clade with strong statistical support, nested within the Trypetheliales clade. Consequently, the new family Polycoccaceae Ertz, Hafellner & Diederich (Trypetheliales) was established to accommodate the two genera, *Clypeococcum* and *Ploycoccum* (Ertz,

Diederich, et al., 2015). This genus is characterized by globose, black, ostiolate pseudothecia united in groups by a common black clypeus, filiform, hyaline, septate, anastomosing pseudoparaphyses, subcylindrical, short-stalked, bitunicate, 8-spored asci and ellipsoid, uniseptate, dark brown ascospores with delicately verruculose walls (Hawksworth, 1977b). There are 17 species in Index Fungorum (2024), and all of them are lichenicolous. Three LSU sequences belonging to three species are available in GenBank (2024).

Type species: *Clypeococcum cladonema* (Wedd.) D. Hawksw.

Table 2.55 Accepted lichenicolous species of *Clypeococcum*

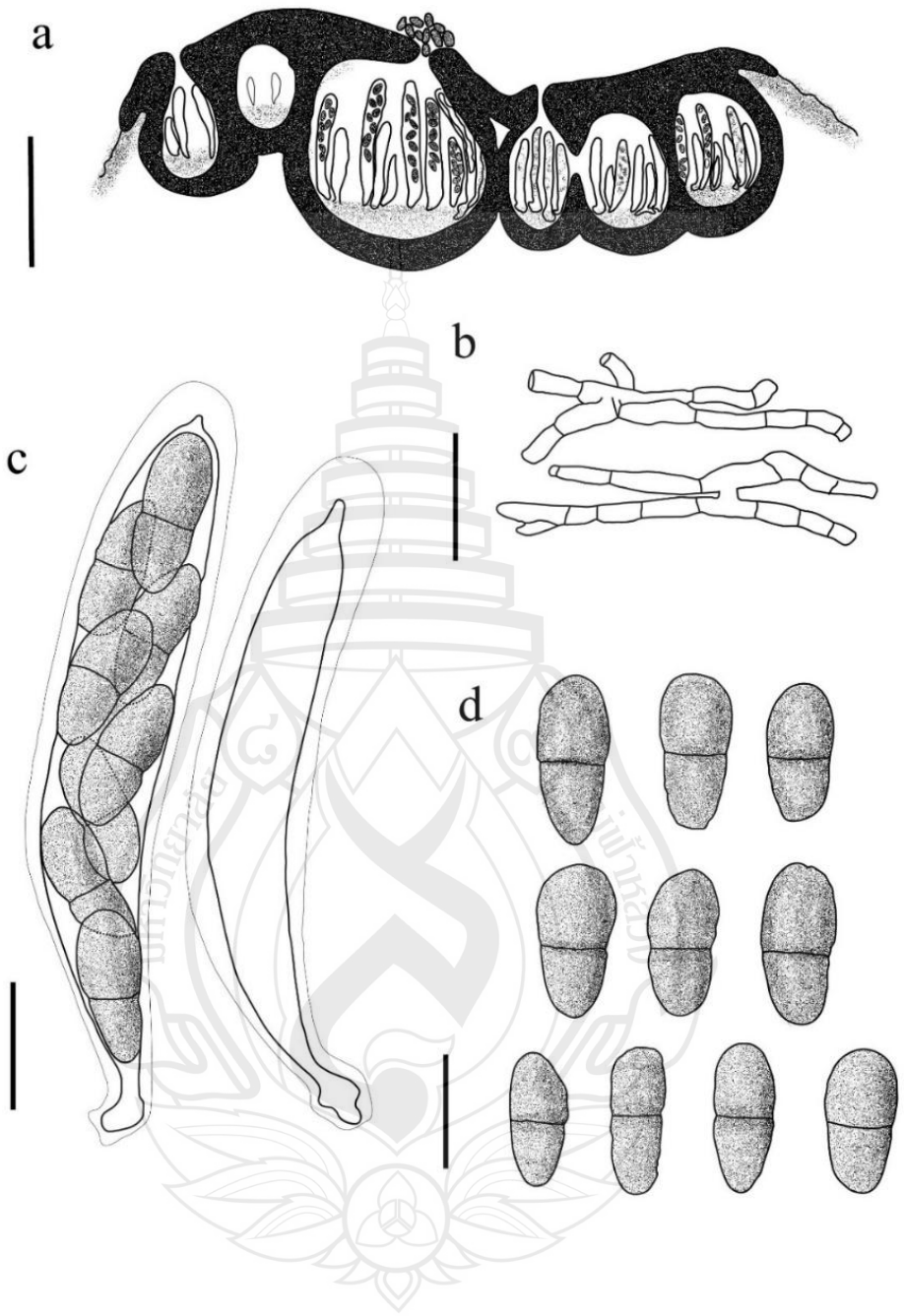
	Species name	Host	References	Remarks
1	*Clypeococcum amylaceum* Etayo	*Parmotrema*	(Etayo, 2017)	
2	*Clypeococcum bisporum* Zhurb.	*Cetraria* and *Flavocetraria*	(Zhurbenko, 2009d)	
3	*Clypeococcum cajasense* Etayo	*Hypotrachyna*	(Etayo, 2017)	
4	*Clypeococcum cetrariae* Hafellner	*Cetraria islandica*	(Hafellner, 1994a)	
5	*Clypeococcum cladonema* (Wedd.) D. Hawksw.	*Cetrelia* and *Xanthoparmelia*	(Hawksworth, 1977b)	= *Lecidea cladonema* Wedd.
6	*Clypeococcum epicrassum* (H. Olivier) Hafellner & Nav.-Ros.	*Squamaria crassa*	(Navarro-Rosinés et al., 1994)	= *Buellia epicrassa* H. Olivier

Table 2.55 (continued)

	Species name	Host	References	Remarks
7	*Clypeococcum epimelanostolum* (D. Hawksw. & Øvstedal) Grube & Hafellner	*Buellia melanostola*	(Grube et al., 1990)	= *Buellia epicrassa* H. Olivier
8	*Clypeococcum galloides* Etayo	*Lecidea s. lat.*	(Etayo, 2010a)	
9	*Clypeococcum grossum* (Körb.) D. Hawksw.	*Umbilicaria*	(Hawksworth, 1982c)	= *Tichothecium grossum* Körb.
10	*Clypeococcum hemiamyloideum* Shivarov	*Verrucaria latebrosa*	(Shivarov, 2019)	
11	*Clypeococcum hypocenomycis* D. Hawksw.	*Hypocenomyce scalaris*	(Hawksworth, 1980a)	
12	*Clypeococcum lenae* Zhurbenko	*Solorina bispora*	(Zhurbenko, 2020)	
13	*Clypeococcum lichenostigmoides* Flakus, Etayo & Rodr. Flakus	*Lecanora rupicola*	(Senanayake et al., 2023)	
14	*Clypeococcum placopsiiphilum* Øvstedal & D. Hawksw.	*Placopsis*	(Øvstedal et al., 1986)	

Table 2.55 (continued)

	Species name	Host	References	Remarks
15	*Clypeococcum psoromatis* (A. Massal.) Etayo	*Squamarina*	(Etayo et al., 2010)	= *Sphaeria psoromatis* A. Massal.
16	*Clypeococcum rugosisporum* Etayo & Zhurb.	*Parmotrema*	(Etayo, 2017)	
17	*Clypeococcum wedinii* Zhurbenko	*Bunodophoron*	(Zhurbenko, 2023a)	



Note a Vertical section of ascomata. b Pseudoparaphyses. c Asci. d Ascospores. Scale bars: a = 100 μm, b–d = 10 μm.

Source Redrawn from Hawksworth (1977b)

Figure 2.48 *Clypeococcum cladonema*

Polycoccum Saut. ex Körb. (62)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Polycoccaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

= Lophothelium Stirt., Scott. Naturalist 9: 37 (1887).

Type: *Lophothelium acervatum* Stirt.

Polycoccum was originally established by Körb. (1865) to accommodate the lichenicolous species *Polycoccum sauteri* Körb., which was initially found on *Stereocaulon condensatum* Hoffm. Later, Santesson (1960) reintroduced this genus and designated *Polycoccum trypethelioides* (Th. Fr.) R. Sant. as the type species of this genus. Vězda (1969) further developed a key to the lichenicolous species within *Polycoccum*. A phylogenetic analysis conducted by Ertz et al. (2015) revealed that *Polycoccum* and *Clypeococcum* form a single clade in Trypetheliales clade. Consequently, the family Polycoccaceae was established, and *Lophothelium* was synonymized with *Polycoccum*, leading to the transfer of its sole species, *Lophothelium acervatum*. The genus is characterized by the formation of gall-like ascomata on the host thallus, gelatinous hamathecia, broadly cylindrical to subclavate asci, and broadly ellipsoid, dark brown to almost black, thick-walled, ornamented ascospores (Hawksworth & Diederich 1988; Ertz et al., 2015).

Among the 85 records listed in Index Fungorum (2024), 62 were retained within this genus *Polycoccum*, while others have been transferred to different genera or synonymized. *Polycoccum arnoldii* (Hepp) D. Hawksw. was transferred to *Sphaerellothecium arnoldii* by Hafellner (2019), but it is still listed under *Polycoccum* in MycoBank, leading to its exclusion from our checklist. *Polycoccum condensatum* Saut. is listed in both Index Fungorum and MycoBank but was considered invalid by Hawksworth et al. (1988), so it was also excluded from our checklist. *Polycoccum opulentum* was transferred from *Endococcus opulentus* Th. Fr. & Almq. by Arnold

(1891). Although this species was subsequently transferred to *Didymosphaeria opulenta* (1905) and *Discothecium opulentum* (1913), these combinations were invalid or illegitimate. *Polycoccum psoromatis* was transferred by Hafellner (2018) from *Sphaeria psoromatis* A. Massal., but MycoBank erroneously lists *Clypeococcum psoromatis* as the current name in. *Polycoccum sauteri* was included by Hawksworth (1988) as a synonym of *P. trypethelioides*, a record found in MycoBank but not in the synonym list of *P. trypethelioides* in Index Fungorum and Species Fungorum. *Polycoccum stellulatae* was transferred from *Didymosphaeria bryonthae* var. *stellulatae* Vouaux by Hafellner (2015), but the basionym was incorrectly classified as the current name in MycoBank.

Type species:

Polycoccum trypethelioides (Th. Fr.) R. Santo

= *Polycoccum sauteri* Körb., holotype

Table 2.56 Accepted lichenicolous species of *Polycoccum*

	Species name	Host	References	Remarks
1	*Polycoccum acarosporicola* Halıcı & D. Hawksw.	*Acarospora cervina*	(Halici et al., 2007)	
2	*Polycoccum aksoyi* Halıcı & V. Atienza	*Aspicilia intermutans*	(Halici et al., 2007)	
3	*Polycoccum alboatrae* (Vouaux) Etayo	*Diplotomma venustum*	(Etayo, 2010c)	= *Didymosphaeria microstictica* var. *alboatri* Vouaux

Table 2.56 (continued)

	Species name	Host	References	Remarks
4	*Polycoccum alpinum* E. Zimm. & F. Berger	*Thamnolia vermicularis*	(Zimmermann et al., 2021)	
5	*Polycoccum amygdalariae* F. Berger & Triebel	*Amygdalaria*	(Berger, 2000)	
6	*Polycoccum anatolicum* Halıcı & E.Akgül	*Lepraria incana*	(Halici et al., 2013)	
7	*Polycoccum atrostriatae* van den Boom	*Physcia atrostriata*	(van den Boom, 2012)	
8	*polycoccum cartilaginosum* (Arnold) D. Hawksw.	unidentified saxicolous lichen	(Hawksworth, 1985b)	= *Microthelia cartilaginosa* Arnold
9	*Polycoccum cladoniae* Diederich & D. Hawksw	*Cladonia*	(Hawksworth & Diederich, 1988)	
10	*Polycoccum clauderouxii* S. Y. Kondr., L. Lőkös & J.-S. Hur	*Zeroviella laxa*	(Kondratyuk et al., 2016)	
11	*Polycoccum clauzadei* Nav.-Ros. & Cl. Roux	*Xanthoria elegans*	(Navarro-Rosinés & Roux, 1998)	
12	*Polycoccum crassum* Vězda Peltigera	*Peltigera lepidophora*	(Vězda, 1970)	

Table 2.56 (continued)

	Species name	Host	References	Remarks
13	*Polycoccum crespoae* Váczi & D. Hawksw.	*Chondropsis*	(Váczi et al., 2001)	
14	*Polycoccum decolorans* Calat. & Triebel	*Immersaria*	(Calatayud & Rambold, 1998)	
15	*Polycoccum deformans* R.Sant. & Brackel.	*Placopsis*	(von Brackel & Berger, 2010)	
16	*Polycoccum dictyonematis* Etayo & R. Sant.	*Dictyonema*	(Etayo, 2010a)	
17	*Polycoccum dzieduszyckii* (Boberski) D. Hawksw	*Bagliettoa*	(Hawksworth et al., 1980)	
18	*Polycoccum epiphyllum* Matzer	*Trichothelium*	(Matzer, 1996)	
19	*Polycoccum epizoharyi* Calat. & V. Atienza	*Buellia zoharyi*	(Calatayud & Atienza, 2000)	
20	*Polycoccum clauzadei* Nav.-Ros. & Cl. Roux	*Xanthoria elegans*	(Navarro-Rosinés & Roux, 1998)	
21	*Polycoccum crassum*	*Peltigera*	(Vězda, 1970)	

Table 2.56 (continued)

	Species name	Host	References	Remarks
	Vězda Peltigera	*lepidophora*		
22	*Polycoccum crespoae* Váczi & D. Hawksw.	*Chondropsis*	(Váczi et al., 2001)	
23	*Polycoccum decolorans* Calat. & Triebel	*Immersaria*	(Calatayud & Rambold, 1998)	
24	*Polycoccum deformans* R.Sant. & Brackel.	*Placopsis*	(von Brackel & Berger, 2010)	
25	*Polycoccum dictyonematis* Etayo & R. Sant.	*Dictyonema*	(Etayo, 2010a)	
26	*Polycoccum dzieduszyckii* (Boberski) D. Hawksw	*Bagliettoa*	(Hawksworth et al., 1980)	
27	*Polycoccum epiphyllum* Matzer	*Trichothelium*	(Matzer, 1996)	
28	*Polycoccum epizoharyi* Calat. & V. Atienza	*Buellia zoharyi*	(Calatayud & Atienza, 2000)	
29	*Polycoccum evae* Calat. & V.J. Rico	*Dimelaena*	(Calatayud & Rico, 1995)	
30	*Polycoccum follmannii* (C.W. Dodge) Alstrup	*Lecidea cremoricolor*	(Alstrup, 2002)	= *Heterocarpon follmannii* C.W. Dodge

Table 2.56 (continued)

	Species name	Host	References	Remarks
31	*Polycoccum Hawksworthianum* Y. Joshi	*Lepra* and *Varicellaria*	(Joshi, 2020)	
32	*Polycoccum heterodermiae* Calat	*Heterodermia*	(Nash et al., 2004)	
33	*Polycoccum hymeniicola* (Berk. & Broome) Zhurb	*Lobaria*	(Zhurbenko & Dillman, 2010)	
34	*Polycoccum ibericum* Etayo & van den Boom	*Rinodina*	(Van den Boom & Etayo, 2014)	
35	*Polycoccum innatum* (Müll. Arg.) D. Hawksw.	unidentified corticolous lichen	(Hawksworth, 1985b)	= *Microthelia innata* Müll. Arg.
36	*Polycoccum islandicum* Brackel & F.Berger	*Placopsis gelida*	(von Brackel & Berger, 2010)	
37	*Polycoccum jamesii* D. Hawksw.	*Psoromidium*	(Hawksworth, 1985a)	
38	*Polycoccum kerneri* J. Steiner	*Lecidea fuscoatra*	(Steiner, 1893)	
39	*Polycoccum laursenii* Zhurb.	*Cladonia*	(Zhurbenko et al., 2004)	
40	*Polycoccum lecanorum* Y. Joshi	*Lecanora frustulosa*	(Joshi, 2022c)	

Table 2.56 (continued)

	Species name	Host	References	Remarks
41	*Polycoccum longisporum* Etayo	*Pseudocyphellaria*	(Etayo & Sancho, 2008)	
42	*Polycoccum marmoratum* D. Hawksw.	*Thelidium* and *Verrucaria*	(Hawksworth et al., 1980)	
43	*Polycoccum microcarpum* Diederich & Etayo	*Cladonia*	(Etayo & Diederich, 1998)	
44	*Polycoccum microstictum* Arnold	*Acarospora*, possibly *Buellia* and *Rhizocarpon*	(Arnold, 1891)	
45	*Polycoccum minus* (Kernst.) Brackel	*Lecidella carpathica*	(Brackel et al., 2019)	
46	*Polycoccum minutulum* Kocourk. & F. Berger	*Trapelia*	(Kocourková et al., 1999)	
47	*Polycoccum montis-wilhelmii* Diederich	*Hypotrachyna*	(Aptroot et al., 1997)	
48	*Polycoccum nigrosporum* Etayo	*Buellia aethalea*	(Etayo, 2010c)	
49	*Polycoccum ochvarianum* Y.Joshi	*Ochrolechia, Pertusaria* and *Varicellaria*	(Joshi et al., 2017)	
50	*Polycoccum opulentum* (Th. Fr. & Almq.) Arnold	*Polyblastia*	(Arnold, 1891)	= *Endococcus opulentus* Th. Fr. & Almq.

Table 2.56 (continued)

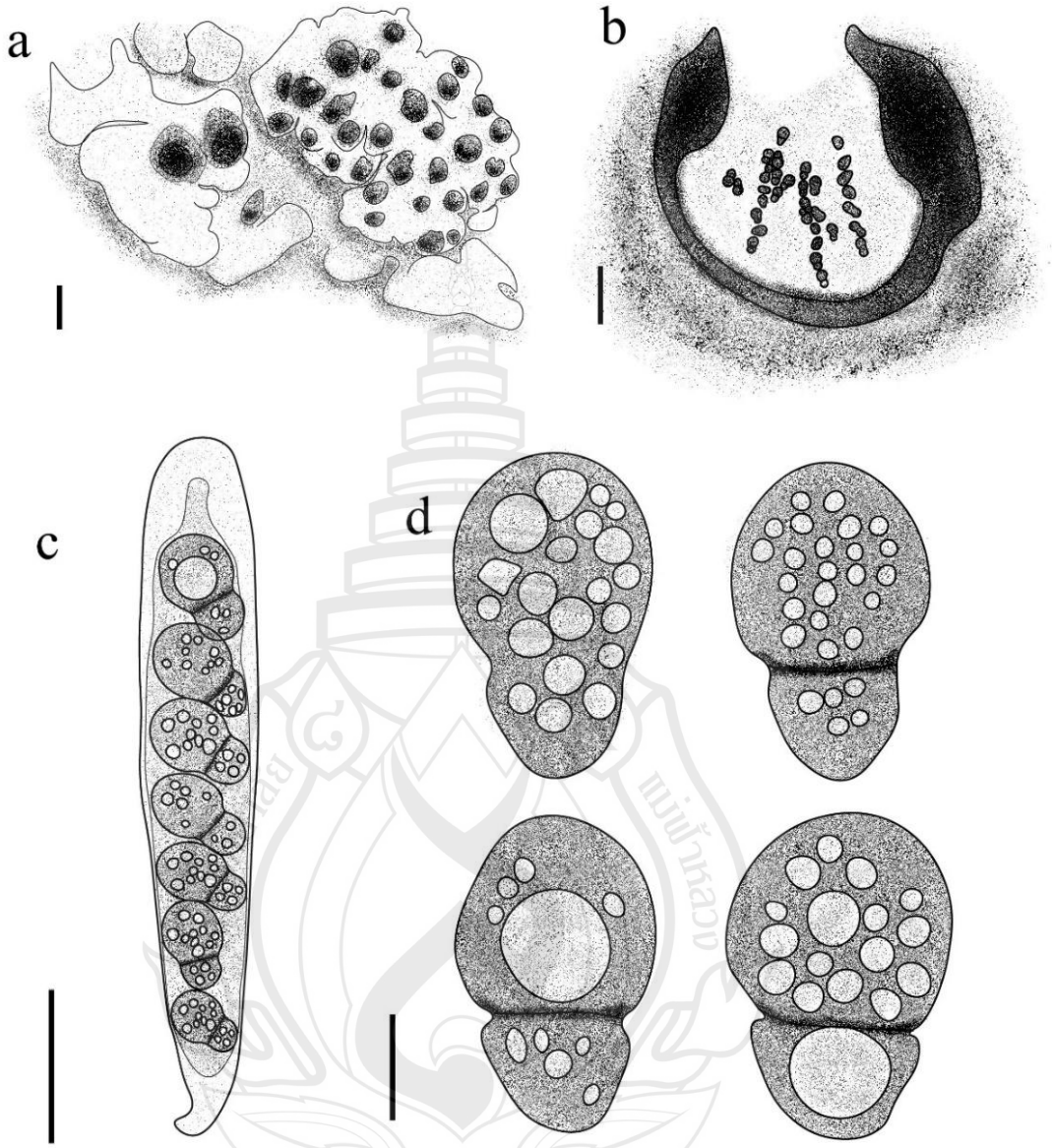
	Species name	Host	References	Remarks
51	*Polycoccum parmotrematis* van den Boom	*Parmotrema*	(Boom, 2020)	
52	*Polycoccum perrugosae* Brackel	*Placopsis perrugosa*	(von Brackel & Berger, 2010)	
53	*Polycoccum psorae* Zhurb. & Triebel	*Anamylopsora pulcherrima*	(Zhurbenko, 2010a)	
54	*Polycoccum psoromatis* (A. Massal.) Hafellner	*Psoroma crassa*	(Hafellner, 2018)	= *Sphaeria psoromatis* A. Massal.
55	*Polycoccum pulvinatum* (Eitner) R. Sant	*Physcia stellaris*	(Santesson, 1993a)	= *Tichothecium pulvinatum* Eitner
56	*Polycoccum rinodinae* van den Boom	*Rinodina*	(Van Den Boom, 2010)	
57	*Polycoccum rubellianae* Calat. & V. Atienza	*Caloplaca*	(Atienza et al., 2003)	
58	*Polycoccum rugulosarium* (Linds.) D. Hawksw.	*Caloplaca*	(Pegler et al., 1980)	= *Microthelia rugulosaria* Linds.
59	*Polycoccum serusiauxii* Matzer	*Byssolecania*	(Matzer, 1996)	

Table 2.56 (continued)

	Species name	Host	References	Remarks
60	*Polycoccum sporastatiae* Arnold	*Sporastatia*	(Arnold, 1874c)	
61	*Polycoccum squamarioides* (Mudd) Arnold	*Placopsis*	(Arnold, 1874c)	=*Sphaeria squamarioides* Mudd
62	*Polycoccum stellulatae* (Vouaux) Hafellner	*Buellia stellulata*	(Hafellner, 2015)	=*Didymosphaeria bryonthae* var. *stellulatae* Vouaux
63	*Polycoccum stictaria* (Linds.) D.J. Galloway	*Pseudocyphellaria*	(Galloway, 2004)	= *Microthelia stictaria* Linds.
64	*Polycoccum superficiale* D. Hawksw. & Miądl.	*Peltigera*	(Hawksworth & Miądlikowska, 1997)	
65	*Polycoccum teresum* Halıcı & K. Knudsen	*Xanthoria*	(Halici et al., 2009)	
66	*Polycoccum thallicola* Arnold	*Aspicilia candida*	(Arnold, 1896)	
67	*Polycoccum tinantii* Diederich	*Caloplaca*	(Diederich, 1990)	
68	*Polycoccum trypethelioides* (Th. Fr.) R. Sant.	*Stereocaulon*	(Santesson, 1960)	= *Diatrype trypethelioides* Th. Fr.

Table 2.56 (continued)

	Species name	Host	References	Remarks
69	*Polycoccum ventosicola* Zhurb.	*Ophioparma ventosa*	(Zhurbenko, 2007b)	
70	*Polycoccum vermicularium* (Linds.) D. Hawksw.	*Thamnolia*	(Hawksworth, 1985b)	= *Lecidea vermicularia* Linds.
71	*Polycoccum versisporum* (Bagl. & Carestia) D. Hawksw.	*Rhizocarpon geographicum* and an unidentified saxicolous lichen	(Hawksworth, 1985b)	= *Microthelia versispora* Bagl. & Carestia



Note a Galls on *Stereocaulon* with immersed ascomata. b Section through ascoma. c Ascus with ascospores. d Ascospores in water. Scale bars: a = 200 µm, b = 50 µm, c= 20 µm, d = 5 µm.

Source Redrawn from (Ertz et al., 2015)

Figure 2.49 *Polycoccum trypethelioides*

Order Tubeufiales Boonmee & K.D. Hyde

Family Tubeufiaceae M.E. Barr

Berkleasmium Zobel (2-44)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Tubeufiaceae, Tubeufiales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Berkleasmium concinnum (Berk.) S. Hughes

Table 2.57 Accepted lichenicolous species of *Berkleasmium*

	Species name	Host	References	Remarks
1	*Berkleasmium parmeliellae* Etayo & Diederich	*Parmeliella testacea*	(Etayo et al., 1995)	
2	*Berkleasmium lichenicola* Diederich & W. R. Buck	on a sterile lichen	(Diederich et al., 2024)	

Lichenotubeufia Etayo (9)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Tubeufiaceae, Pleosporales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Lichenotubeufia was introduced by Etayo (2017) to accommodate the type species *Lichenotubeufia eriodermae*, transferred from *Tubeufia eriodermatis* Etayo, along with four other species, including two new species and two combinations transferred from *Tubeufia*. This genus is characterized by light-colored, sessile ascomata; interascal filaments or branched-anastomosing filiform pseudoparaphyses; fissitunicate, cylindrical asci with an apical widening and a small ocular chamber; and long, fusiform to acicular, hyaline, multi-septate spores (Etayo, 2002a; Etayo, 2002b; Etayo, 2017). Subsequently, Etayo & Flakus (2019) described *Lichenotubeufia cryptica*

Etayo & Flakus, which grows on *Lobariella pallida*, while Zhurbenko (2022) introduced two new species: *L. etayoi*, found on *Trachyderma*, and *L. tibellii*, found on *Coccocarpia*. The most recent addition is *L. calabrica* Brackel, introduced by Brackel last year, found on *Parmelina* (von Brackel & Puntillo, 2023). The most recent addition is *L. calabrica*, introduced by von Brackel et al. (2023), discovered on *Parmelina*.

To date, *Lichenotubeufia* includes nine recognized species, none of which have available molecular data.

Type species:

*Lichenotubeufia eriodermatis (*Etayo*)* Etayo

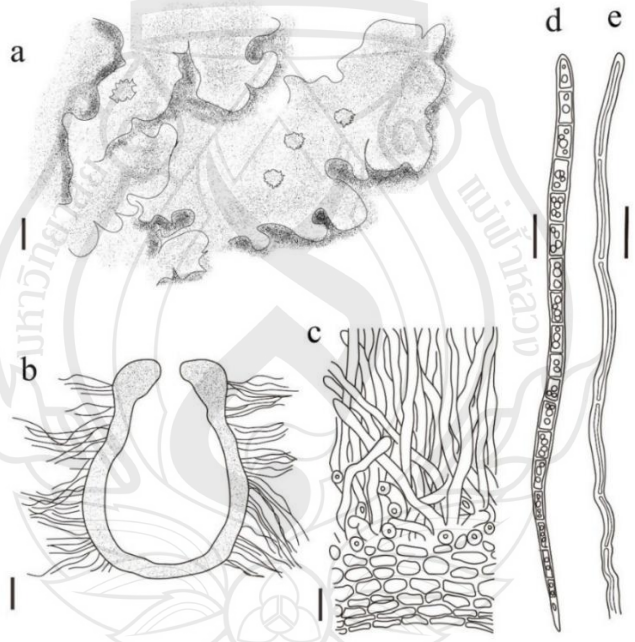
= *Tubeufia eriodermae* Etayo

Table 2.58 Accepted lichenicolous species of *Lichenotubeufia*

	Species name	**Host**	**References**	**Remarks**
1	*Lichenotubeufia boomiana* Etayo	*Sticta*	(Etayo, 2017)	
2	*Lichenotubeufia calabrica* Brackel	*Parmelina*	(von Brackel & Puntillo, 2023)	
3	*Lichenotubeufia cryptica* Etayo & Flakus	*Lobariella pallida*	(Flakus et al., 2019b)	
4	*Lichenotubeufia eriodermatis* (Etayo) Etayo	*Erioderma*	(Etayo, 2002a & 2017)	= *Tubeufia eriodermatis* Etayo
5	*Lichenotubeufia etayoi* Zhurb.	*Trachyderma*	(Zhurbenko, 2022d)	
6	*Lichenotubeufia heterodermiae* (Etayo) Etayo	*Heterodermia* and *Physcia*	(Etayo, 2002a & 2017)	= *Tubeufia heterodermiae* Etayo

Table 2.58 (continued)

	Species name	Host	References	Remarks
7	*Lichenotubeufia pannariae* (Etayo) Etayo	*Pannaria rubiginosa*	(Etayo, 2002a & 2017)	= *Tubeufia pannariae* Etayo
8	*Lichenotubeufia tafallae* Etayo	*Leptogium*	(Etayo, 2017)	
9	*Lichenotubeufia tibellii* Zhurb.	*Coccocarpia*	(Zhurbenko, 2022d)	



Note a *Lichenotubeufa eriodermae* on *Erioderma*. b Cross-section of the ascoma with long and abundant setae. c Detail of the ascomal wall in cross-section. d Ascospores. e seta of the ascomal wall. Scale bars: a = 200 µm, b = 50 µm, c–e = 10 µm.

Source Redrawn from Etayo (2002a)

Figure 2.50 *Lichenotubeufia eriodermatis* (= *Tubeufia eriodermae*)

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

Family Venturiaceae E. Müll. & Arx ex M.E. Barr

Spilodochium Syd. (1-4)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Venturiaceae, Venturiales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Spilodochium vernoniae* Syd.

Accepted lichenicolous species:

Spilodochium parmotrematis Diederich & Etayo, on *Parmotrema arnoldii*

Venturia Sacc. (2-120)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Venturiaceae, Venturiales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Venturia inaequalis* (Cooke) G. Winter

Table 2.59 Accepted lichenicolous species of *Venturia*

	Species name	Host	References	Remarks
1	*Venturia lichenophila* U. Braun, Diederich & Brackel	*Physcia tenella*	(Diederich et al., 2024)	
2	*Venturia peltigericola* (Crous & Diederich) Crous, M. Shen & Y. Zhang ter	Isolated from *Peltigera rufescens*	(Shen et al., 2020)	Probably lichenicolous

DOTHIDEOMYCETES Familiae incertae sedis

Family Naetrocymbaceae

Leptorhaphis Körb. (1-8)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Naetrocymbaceae, Familiae incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Leptorhaphis epidermidis* (Ach.) Th. Fr. (Fries 1861)

=*Verrucaria oxyspora Nyl.* (Nylander, 1852)

Accepted lichenicolous species:

Leptorhaphis haematommatum Hafellner & Kalb, on *Haematomma* (Kalb et al., 1995)

Family Pseudoperisporiaceae

Keratosphaera H.B.P. Upadhyay (5-6)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Pseudoperisporiaceae, Familiae incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

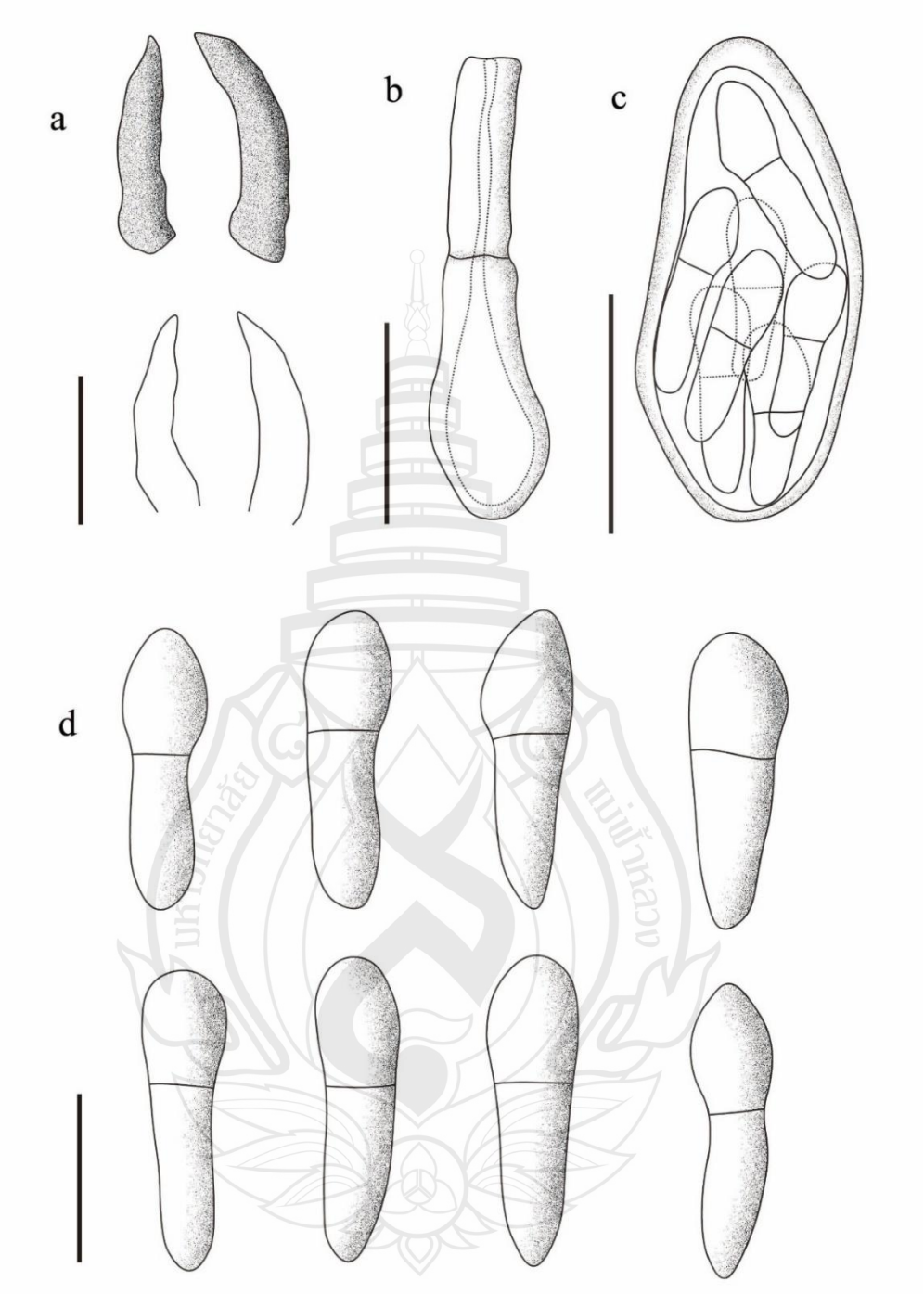
Keratosphaera was established by Upadhyay (1964) to accommodate the type species *K. batistae* H.B.P. Upadhyay, which is lichenicolous, growing on the thallus of *Mazosia phyllosema* (Nyl.) Zahlbr. (Upadhyay, 1964). This genus is characterized by lichenicolous ascomata which are perithecioid, furnished with dark brown and unbranched setae above, (sub-)globose, ellipsoid to broadly ovoid, more or less hyaline to black but setae always dark brown. Asci are fissitunicate, often with a protruded endoascus, ovoid, elliptical or cylindrical, shortly or not distinctly stipitate, 6- to 8-spored. Ascospores are hyaline, ellipsoid to obovoid, with rounded ends, 1-septate, slightly or not constricted at the septum, smooth, without a gelatinous sheath (Matzer, 1996). Matzer (1996) introduced another three species, *Keratosphaera dimerellae* growing on *Dimerella*, *K. furcatiseta* and *K. porinae* rowing on *Porina*. Flakus et al., introduced two species separately, but one grows on leaves of Arecaceae and another one, *Keratosphaera antoniana* is lichenicolous, growing on *Trichothelium* (Flakus et al., 2008; Farkas, 2010). Up to now, six records of this genus in Index Fungorum, with

five being lichenicolous. However, no molecular data is available for this genus, so its placement remains unclear. *Keratosphaera* was tentatively placed within Dothideomycetes genera incertae sedis by Hyde (2024).

Type species: *Keratosphaera batistae* H.B.P. Upadhyay

Table 2.60 Accepted lichenicolous species of *Keratosphaera*

	Species name	**Host**	**References**	**Remarks**
1	*Keratosphaera antoniana* Flakus, Farkas & Lücking	*Trichothelium argenteum*	(Farkas, 2010)	
2	*Keratosphaera batistae* H. B. P. Upadhyay	*Mazosia phyllosema*	(Upadhyay, 1964)	Two anamorphs: *Sphaeromma mazosiae* H. B. P.Upadhyay *Sporhaplus rondoniensis* H. B. P. Upadhyay
3	*Keratosphaera dimerellae* Matzer	*Dimerella*	(Matzer, 1996)	
4	*Keratosphaera furcatiseta* Matzer	*Porina epiphylla*	(Matzer, 1996)	anamorph: *Sphaeromma furcatiseta* Matzer
5	*Keratosphaera porinae* Matzer	*Porina epiphylla*	(Matzer, 1996)	anamorph: *Sphaeromma porinae* Matzer



Note a Ascomatal setae. b Ascus with ascospores. c ascus with ruptured exoascus and protruded endoascus. d Ascospores. Scale bars: a–c = 10 µm, d = 5 µm.

Source Redrawn from Matzer (1996)

Figure 2.51 *Keratosphaera batistae*

Myxophora Döbbeler & Poelt (5-7)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Pseudoperisporiaceae, Familiae incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Myxophora was established by Döbbeler & Poelt (1978) to accommodate the type species *Myxophora amerospora* Döbbeler & Poelt which grows on *Campylium haller* from Austria, and it was initially placed in the family Dimeriaceae. However, the family name Dimeriaceae was placed in Fungi incertae sedis according to Mycobank (2024). Although Diederich et al. (2018) assigned this genus to the Pseudoperisporiaceae Toro, we believe further study is needed once molecular data becomes available. For now, we accepted the viewpoint of Diederich et al. (2018).

This genus is characterized by ovoid or spherical, dark brown to mostly black ascomata, filiform paraphysoid, bitunicate, subcylindrical asci contracted into short stalk with 8-spored, and ellipsoidal, unicellular, colorless spores with homogeneous content or adorned with a large single guttule (Döbbeler, 1978). Hoffman & Hafellner (2000) published five lichenicolous species, including four new species: *Myxophora apotheciicola* growing on *Leptogium azureum*, *M. ovalispora* and *M. tetraspora* growing on *Collema*, *M. placynthii* growing on *Placynthium caesium*, and one combination *M. leptogiophia* growing on *Collema* and *Leptogium plicatile* (Hoffmann et al., 2000).

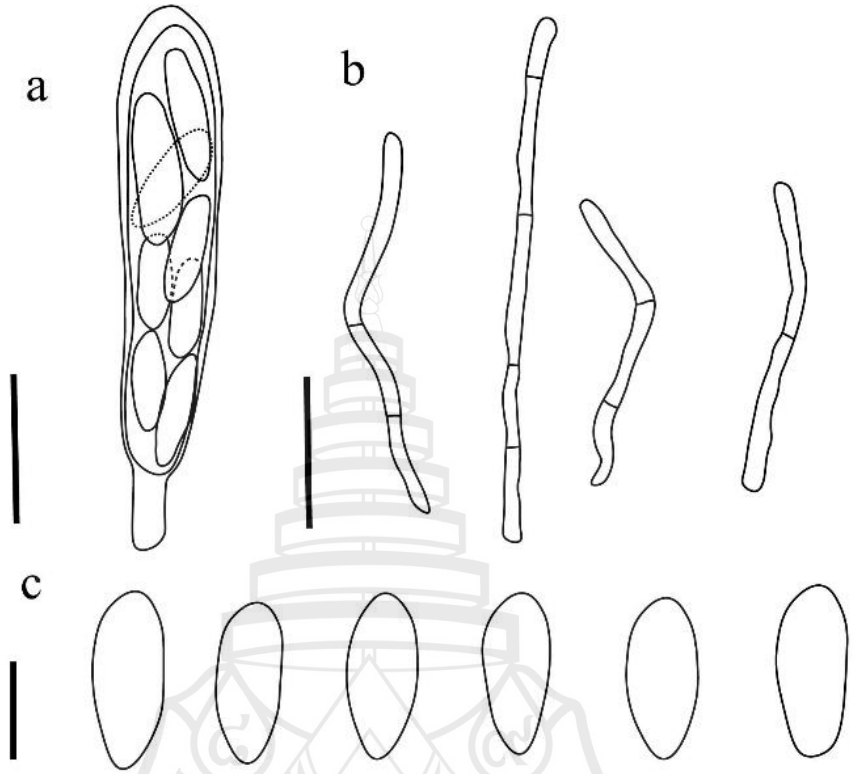
Type species: *Myxophora amerospora* Döbbeler & Poelt

Table 2.61 Accepted lichenicolous species of *Myxophora*

	Species name	Host	References	Remarks
1	*Myxophora apotheciicola* Nik. Hoffm. & Hafellner	*Leptogium azureum*	(Hoffmann et al., 2000)	

Table 2.61 (continued)

	Species name	Host	References	Remarks
2	*Myxophora leptogiophila* (G. Winter) Nik. Hoffm. & Hafellner	*Collema* and *Leptogium plicatile*	(Hoffmann et al., 2000)	= *Leptorhaphis leptogiophila* Minks ex G. Winter
3	*Myxophora ovalispora* Nik. Hoffm. & Hafellner	*Collema*	(Hoffmann et al., 2000)	
4	*Myxophora placynthii* Nik. Hoffm. & Hafellner	*Placynthium caesium*	(Hoffmann et al., 2000)	
5	*Myxophora tetraspora* Nik. Hoffm. & Hafellner	*Collema flaccidum*	(Hoffmann et al., 2000)	



Note a Ascus. b Paraphyses. c Ascospores. Scale bars: a, b = 10 μm, c = 5 μm.

Source Redrawn from Döbbeler (1978)

Figure 2.52 *Myxophora amerospora*

Neocoleroa Petr. (1-5)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Pseudoperisporiaceae, Familiae incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Neocoleroa sibirica* Petr.

Accepted lichenicolous species:

Neocoleroa inundata (Vain.) Diederich, on *Bacidina*

Family Pyrenidiaceae

Pyrenidium Nyl. (14)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Pyrenidiaceae, Familiae incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

The first species, *Pyrenidium actinellum*, was initially introduced by Nylander (1865) as a lichen species, and the genus was also believed to be established simultaneously. The type species is characterized by a dirty thallus with small spots, entirely black perithecia, 4-spored asci, and tawny or brownish-olive, oblong spores with 3-septate (Nylander, 1865). In the original descriptions, the author proposed its specialty that this species differs from *Collema* species in its pyrenocarpic apothecia and darkened spores but resembles *Leptogium* in thallus texture. All the species of this genus are lichenicolous with perithecioid ascomata that have blue-green pigment located in upper peridial wall and are immersed to erumpent in host thalli with the upper part exposed or are prominently covered by thalli tissue, sometimes causing gall-like malformations of the host (Hawksworth, 1982d; Matzer, 1996; Diederich et al., 2018; Huanraluek et al., 2019). Hawksworth (1980) suggested a close relationship between Dacampiaceae and Pyrenidiaceae, and the later has been considered as a synonym of Dacampiaceae. Crivelli (1983) also suggested that *Pyrenidium* is similar to *Dacampia* by having similar ascomatal structures and wall tissues (Hawksworth, 1980b, Crivelli, 1983). However, these assumptions were not verified based on phylogenetic analyses until Huanraluek et al. (2019) obtained sequence data from three *Pyrenidium* species, and these sequences formed a distinct clade far from Dacampiaceae in the phylogenetic analysis. Therefore, the family Pyrenidiaceae was resurrected to accommodate *Pyrenidium* (Huanraluek et al., 2019).

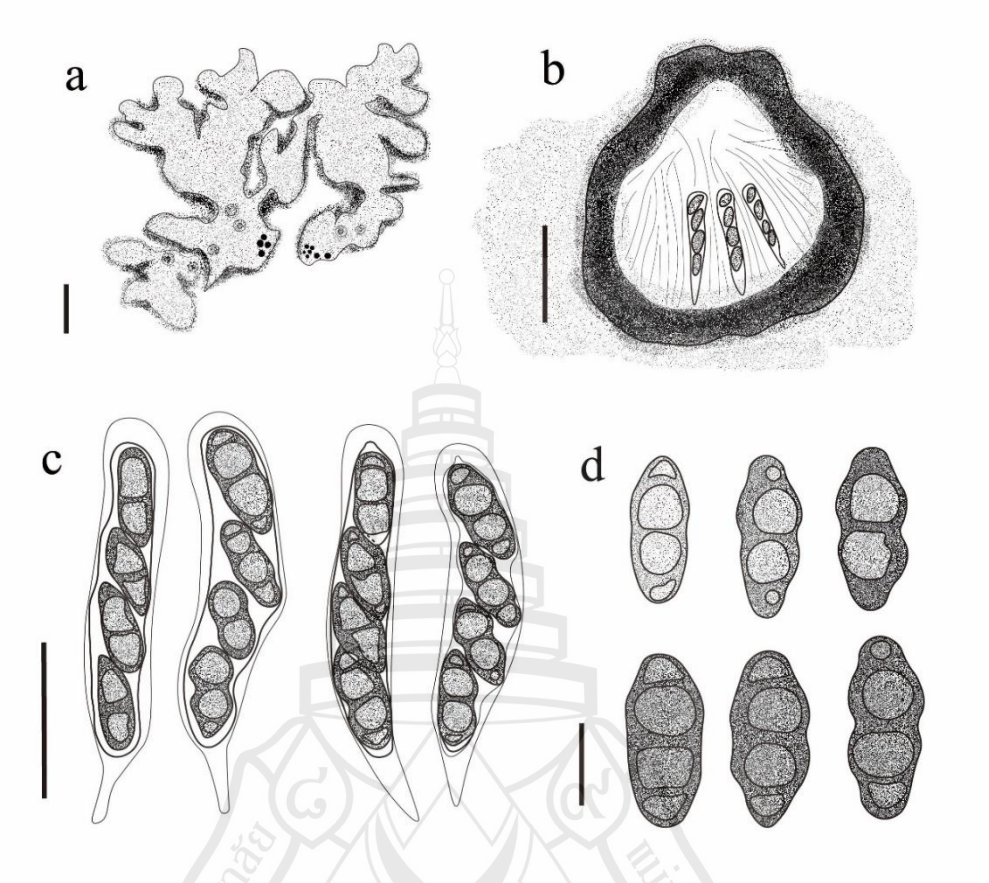
Type species: *Pyrenidium actinellum* Nyl.

Table 2.62 Accepted lichenicolous species of *Pyrenidium*

	Species name	Host	References	Remarks
1	*Pyrenidium actinellum* Nyl.	*Leptogium, Peltigera thallina*	(Nylander, 1865)	
2	*Pyrenidium aggregatum* Knudsen & Kocourk.	*Phaeophyscia* and *Physcia*	(Knudsen et al., 2010c)	
3	*Pyrenidium borbonicum* Huanraluek, Ertz & K.D. Hyde,	*Sticta*	(Huanraluek et al., 2019)	
4	*Pyrenidium coccineum* Aptroot	*Siphula decumbens*	(Aptroot, 2014)	
5	*Pyrenidium cryptotheciae* Matzer	*Cryptothecia candida*	(Matzer, 1996)	
6	*Pyrenidium dimelaenae* Y. Joshi	*Dimelaena oreina*	(Joshi, 2021a)	
7	*Pyrenidium hetairizans* (Leight.) D. Hawksw.	*Verrucaria hydrela*, *Staurothele*	(Hawksworth, 1986)	= *Verrucaria hetairizans* Leight.
8	*Pyrenidium hypotrachynae* Y. Joshi	*Hypotrachyna coorgiana*	(Joshi et al., 2018)	

Table 2.62 (continued)

	Species name	Host	References	Remarks
9	*Pyrenidium macrosporum* Motiejunaite, Zhurbenko, Suija & Kantvilas	*Parasiphula jamesii*	(Motiejunaite et al., 2019)	
10	*Pyrenidium octosporum* Looman	On unidentified lichens	(Looman, 1962)	
11	*Pyrenidium santessonii* Lücking	*Bacidia psychotriae* and *Bapalmuia*	(Lücking, 1998)	
12	*Pyrenidium sporopodiorum* Matzer	*Sporopodium*	(Matzer, 1996)	
13	*Pyrenidium ucrainicum* S.Y. Kondr., Lőkös & Hur	*Ramalina*	(Kondratyuk et al., 2014)	
14	*Pyrenidium zamiae* (Müll. Arg.) Matzer	*Porina*	(Matzer, 1996)	



Note a Appearance of ascomata on host surface. b Vertical section ascomata. c Asci. d Ascospores. Scale bars: a = 500 μm, b = 50 μm, c = 10 μm, d = 5 μm.

Source Redrawn from Huanraluek et al. (2019)

Figure 2.53 Sexual morph of *Pyrenidium actinellum*

DOTHIDEOMYCETES Genera incertae sedis

Ampullifera Deighton (6-7)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dothideomycetes genera incertae sedis, Familiae incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

=*Ampulliferella* Bat. & Cavalc. Type: *A. amoeboides*

=*Ampulliferopsis* Bat. & Cavalc. Type: *A. myriapoda*, i.e. *A. amoeboides*

=*Teratoschaeta* Bat. & O.M. Fonseca Type: *T. rondoniensis*, i.e. *A. amoeboides*

Ampullifera was established by Deighton (1960) to accommodate the type species *A. foliicola* Deighton and other two species, *A. ugandensis* Deighton and *A. leonensis* Deighton, most of which are associated with foliicolous lichens. This genus is characterized by superficial mycelium, lateral mucronate ampulliform hyphopodia, olivaceous, straight, septate conidiophores, and olivaceous, catenulate, ellipsoid conidia without a true hilum (Deighton, 1960).

Deighton & Pirozynski (1965) later introduced *Ampullifera brasiliensis* Deighton, a species found on foliicolous lichens on *Gustavia augusta*. However, this species was later considered synonymous with *A. hippocrateacearum*. Hawksworth (1979) described a new species, *Ampullifera pirozynskii,* and made two new combinations: *A. amoeboides* (formerly *Ampulliferella amoeboides* Bat. & Cavalc.) and *A. hippocrateacearum* (formerly *Ampulliferopsis hippocrateacearum* Bat. & Cavalc.). Since *Ampulliferopsis myriapoda*, the type species of *Ampulliferopsis*, was combined with *A. amoeboides*, the genus was considered synonymous with *Ampullifera*. Similarly, as *Ampulliferella amoeboides*, the type species of *Ampulliferella*, was transferred, *Ampulliferella* was also considered synonymous with *Ampullifera*.

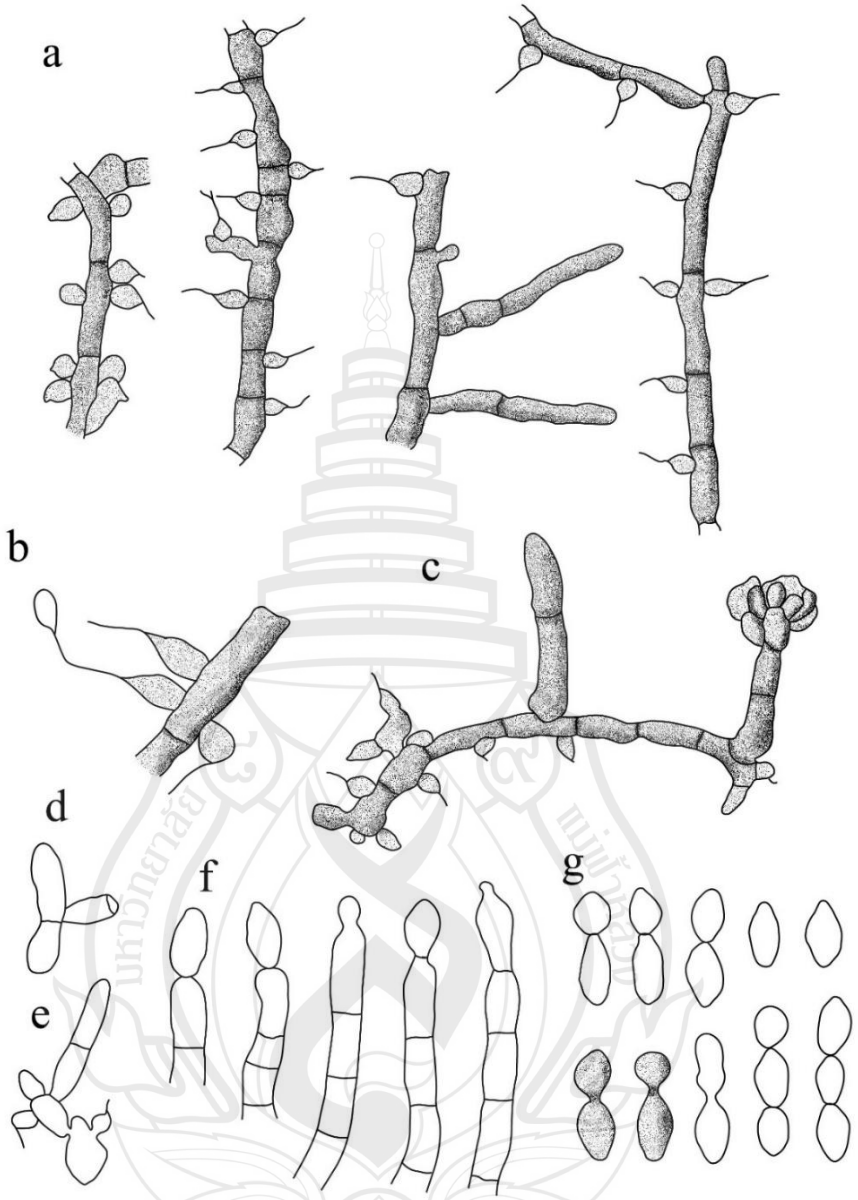
Locquin (1984) established the family Ampulliferaceae to accommodate *Ampullifera* (Locquin, 1984). However, Sandoval-Denis et al. (2015) transferred *Ampullifera seudatica* to *Acrophialophora* after uploading some sequences of this species (Sandoval-Denis et al., 2015). Thus, the systematic status of *Ampullifera* and the family Ampulliferaceae remains unclear, and further studies based on molecular data are needed. To date, seven species are listed in the Index Fungorum, six of which are lichenicolous fungi, but no sequence data are available in GenBank.

Type species:

Ampullifera foliicola Deighton

Table 2.63 Accepted lichenicolous species of *Ampullifera*

	Species name	Host	References	Remarks
1	*Ampullifera amoeboides* (Bat. & Cavalc.) D. Hawksw.	Foliicolous *Mazosia* and other Roccellaceae	(Hawksworth, 1979a)	= *Ampulliferella amoeboides* Bat. & Cavalc. = *Ampulliferopsis myriapoda* Bat. & Caval.
2	*Ampullifera foliicola* Deighton	Foliicolous lichens	(Deighton, 1960)	
3	*Ampullifera hippocrateacearum* (Bat. & Cavalc.) D. Hawksw.	Foliicolous *Mazosia* and other lichens	(Hawksworth, 1979a)	= *Ampulliferopsis hippocrateacearum* Bat. & Caval., = *Ampullifera brasiliensis* Deight.
4	*Ampullifera leonensis* Deighton	Foliicolous lichens	(Deighton, 1960)	
5	*Ampullifera pirozynskii* D. Hawksw.	Foliicolous lichens	(Hawksworth, 1979a)	
6	*Ampullifera ugandensis* Deighton	Foliicolous lichens	(Deighton, 1960)	



Note a Mycelium with hyphopodia. b Hyphopodia showing a hyaline feeding hypha. c Hyphopodiate mycelium bearing a simple and a penicillately branched conidiophore. d Germinating conidium. e Apical portion of a conidiophore. f Conidiophores. g Conidia.

Source Redrawn from Deighton (1960)

Figure 2.54 Asexual morph of *Ampullifera foliicola*

Cercidospora Körb. (36)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dothideomycetes genera incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Cercidospora was established by. Körber (1865) to accommodate the type species *C. ulothii* Körb, characterized by immersed, globular apothecia with endocarp and black exciple, oligosporous asci and oblong, boat-shapeed, hyaline spores with two cells (Körber, 1865b). However, Santesson (1960) and Grube & Hafellner (1990) consider *Phacopsis macrospora* a possible synonym of *C. ulothii*, as both taxa were described based on material from the same collection. Hafellner (1987) redefined the concept of *Cercidospora*, mainly based on variations in ascospore shape, size and the host's difference and provided illustrations for the species *C. ulothii* (Hafellner, 1987b). Grube & Hafellner (1990) compared *Cercidospora* with two other hyalodidymo-spored genera, *Didymellopsis* and *Zwackhiomyces*, and clarified the generic concept. Subsequently, the generic concept was expanded to include species with pluriseptate ascospores referred to *Metasphaeria* (Hafellner, 1987b) and species with simple ascospores (Navarro-Rosinés et al., 2004).

Of the 177 records in index fungorum (2024), many species were transferred to other families, such as Apiosporaceae, Clypeosphaeriaceae, Didymellaceae, Dothideaceae etc. In the lichenicolous checklist of *Cercidospora* by Diederich (2018), 40 species were listed. Upon our review, some species names were found to be invalid or were combined with other species or no longer in use. The name *C. apiosporoides* (Vouaux) Nav.-Ros., Hafellner & Calatayud was considered invalid and treated as a synonym of *C. epipolytropa* (Mudd) Arnold. Names such as *C. epidesertorum* Nav.-Ros. & Calat. ad int., *C. etayoana* Nav.-Ros. & Calat. Ad int., *C. javalambrensis* Calat. & Nav.-Ros. ad int., *C. mutabilicola* Nav.-Ros., Calat. & Hafellner. ined. and *C. stenotropae* Nav.-Ros. & Hafellner ad int. were also deemed invalid, and thus removed

from the checklist. *C. epicallopisma* Arnold was transferred to *Nectria epicallopisma* (Arnold) Sacc. & D. Sacc (Saccardo et al., 1905). *C. exiguella* (Nyl.) Arnold, originally transferred from *Verrucaria exiguella* Nyl., was later transferred to *Prolisea exiguella* (Nyl.) Clem. (Clements, 1909). Two species *C. cephalodiorum* Triebel & Grube growing on *Pilophorus dovrensis* (Nyl.) Timdal, Hertel & Rambold and *C. collematum* var. *collematum* J. Steiner growing on *Collema* sp. were thought to have been missed, so we add them to our checklist. The species *C. pertusariicola* Alstrup & Olech growing on *Lepra corallophora* (Vain.) Hafellner was considered invalid and therefore not include in our list.

After Diederich et al. (2018), two new species were introduced: *Cercidospora navarroi* Y. Joshi growing on *Rinodina intermedia* Bagl. and *C. santessonii* Motiejunaite, Zhurbenko, Suija & Kantvilas growing on *Siphula fastigiata* (Nyl.) Nyl. (Motiejunaite et al., 2019; Joshi et al., 2022). As of now, 36 were valid lichenicolous species with uncertain placement in the class Dothideomycetes. Due to the lack of sequence data in GenBank, the phylogenetic status remains unclear, and further studies based on molecular sequence are needed.

Type species:

Cercidospora macrospora (Uloth) Hafellner & Nav.-Ros.

≡ *Phacopsis macrospora* Uloth, Flora 44: 653 (1861)

=*Cercidospora ulothii* Körb., Parerga Lichenol.: 466 (1865)

Table 2.64 Accepted lichenicolous species of *Cercidospora*

	Species name	Host	References	Remarks
1	*Cercidospora alpina* Ihlen & Wedin	*Stereocaulon cumulatum*	(Kuntze, 1898)	
2	*Cercidospora anomala* Etayo	*Pertusaria pertusa*	(Etayo, 2010b)	

Table 2.64 (continued)

	Species name	Host	References	Remarks
3	*Cercidospora arthroraphidicola* Alstrup	*Arthrorhaphis alpina*	(Alstrup et al., 1992)	
4	*Cercidospora barrenoana* Calat. & Nav.-Ros.	*Rhizoplaca peltata*	(Calatayud et al., 2013)	
5	*Cercidospora caudata* Kernst	*Caloplaca*	(Kernstock, 1894)	
6	*Cercidospora cecidiiformans* Grube & Hafellner	*Rhizocarpon*	(Hafellner, 1993b)	
7	*Cercidospora cephalodiorum* Triebel & Grube	*Pilophorus dovrensis*	(Triebel, 1989)	
8	*Cercidospora cladoniicola* Alstrup	*Cladonia arbuscula*	(Kuntze, 1898)	
9	*Cercidospora collematum* var. *collematum* J. Steiner	*Collema*	(Steiner, 1898)	
10	*Cercidospora crozalsiana* (H. Olivier) Nav.-Ros., Cl. Roux & Casares	*Squamarina*	(Navarro-Rosinés et al., 1995)	= *Sphaeria crozalsiana* H. Olivier
11	*Cercidospora decolorella* (Nyl.) O. Eriksson & Yue	terricolous algae, mosses and lichens	(Eriksson, 1992)	= *Verrucaria decolorella* Nyl.

Table 2.64 (continued)

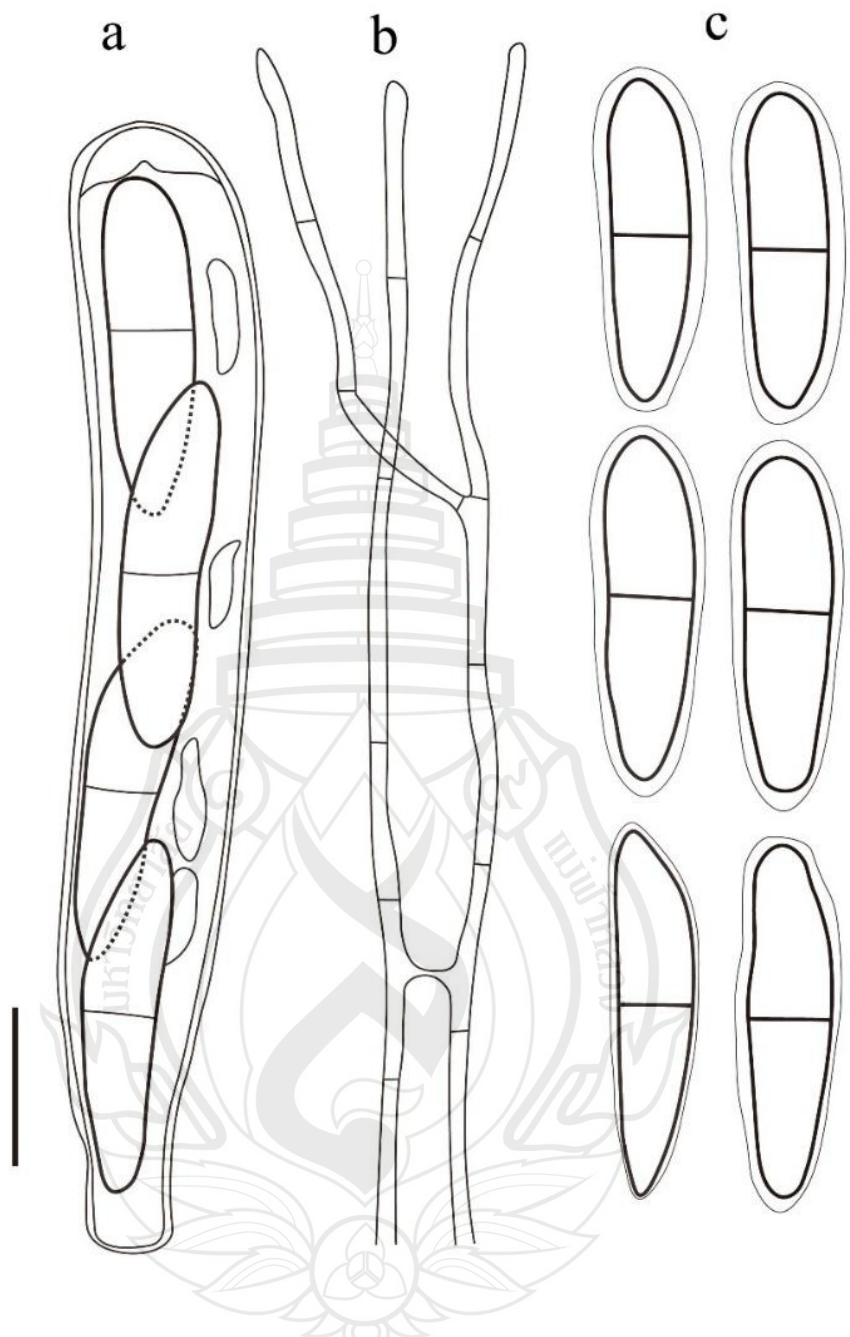
	Species name	Host	References	Remarks
12	*Cercidospora epicarphinea* (Nyl.) Grube & Hafellner	*Caloplaca gr. carphinea*	(Grube et al., 1990)	= *Verrucaria epicarphinea* Nyl.
13	*Cercidospora epipolytropa* (Mudd) Arnold	*Lecanora*	(Arnold, 1874a)	= *Thelidium epipolytropum* Mudd
14	*Cercidospora epithamnolia* Zhurb.	*Thamnolia*	(Zhurbenko, 2012)	
15	*Cercidospora galligena* Hafellner & Nav.-Ros.	*Aspicilia caesiocinerea*	(Navarro-Rosinés et al., 2009)	
16	*Cercidospora hypotrachynicola* Etayo	*Hypotrachyna*	(Etayo, 2017)	
17	*Cercidospora lobothalliae* Nav.-Ros. & Calat.	*Lobothallia*	(Navarro-Rosinés et al., 2004)	
18	*Cercidospora macrospora* (Uloth) Hafellner & Nav.-Ros.	*Protoparmeliopsis muralis*	(Navarro-Rosinés et al., 2004)	= *Phacopsis macrospora* Uloth
19	*Cercidospora lecidomae* Zhurb. & Triebel	*Lecidoma demissum*	(Zhurbenko et al., 2002)	
20	*Cercidospora melanophthalmae* Nav.-Ros., Calat. & Hafellner	*Rhizoplaca melanophthalma*	(Calatayud et al., 2013)	

Table 2.64 (continued)

	Species name	Host	References	Remarks
21	*Cercidospora navarroi* Y. Joshi	*Rinodina intermedia*	(Joshi et al., 2022)	
22	*Cercidospora ochrolechiae* Zhurb.	*Ochrolechia* and *Pertusaria coriaceae*	(Zhurbenko, 2010a)	
23	*Cercidospora parva* Hafellner & Ihlen	*Baeomyces*	(Ihlen, 1998)	
24	*Cercidospora punctillata* (Nyl.) R. Sant.	*Solorina* and *Peltigera*	(Santesson et al., 2004)	= *Verrucaria punctillata* Nyl.
25	*Cercidospora rinodinae* Etayo & van den Boom	*Rinodina conradii*	(Etayo & Boom, 2005)	
26	*Cercidospora soror* Obermayer & Triebel	*Arthrorhaphis citrinella*	(Hafellner et al., 1995)	
27	*Cercidospora santessonii* Motiejunaite, Zhurbenko, Suija & Kantvilas	*Siphula fastigiate*	(Motiejunaite et al., 2019)	
28	*Cercidospora solearispora* Calat., Nav.-Ros. & Hafellner	*Aspicilia*	(Navarro-Rosinés et al., 2009)	
29	*Cercidospora stereocaulorum* (Arnold) Hafellner	*Stereocaulon*	(Hafellner, 1987b)	= *Leptosphaeria stereocaulorum* Arnold

Table 2.64 (continued)

	Species name	Host	References	Remarks
30	*Cercidospora thamnogalloides* Zhurb.	*Thamnolia*	(Zhurbenko, 2012)	
31	*Cercidospora thamnoliae* Zhurb.	*Thamnolia*	(Zhurbenko, 2012)	
32	*Cercidospora thamnoliicola* Ihlen	*Thamnolia*	(Ihlen, 1995)	
33	*Cercidospora trypetheliza* (Nyl.) Hafellner & Obermayer	*Arthrorhaphis alpina*	(Hafellner et al., 1995)	= *Lecidea trypetheliza* Nyl.
34	*Cercidospora werneri* Nav.-Ros., Calat. & Hafellner	*Aspicilia*	(Navarro-Rosinés et al., 2009)	
35	*Cercidospora xanthoriae* (Wedd.) R. Sant.	*Xanthoria*	(Santesson, 1993a)	= *Verrucaria xanthoriae* Wedd.



Note a Asci. b Paraphyses. c Ascospores. Scale bar = 10 μm.

Source Redrawn from Hafellner (1987b)

Figure 2.55 *Cercidospora macrospora*

Echinothecium Zopf (6)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dothideomycetes genera incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

The lichenicolous genus *Echinothecium* was established by Zopf (1898) to accommodate the type species *E. reticulatum* Zopf. This genus is characterized by a superficial thallus, globose, ostiolate ascomata with stiff, simple appendages, 8-spored asci, and hyaline, oval, asymmetric ascospores with two cells (Chomnunti et al., 2011).

Eriksson & Hawksworth (1993) placed *Echinothecium* in the family *Capnodiaceae* due to its superficial ascomata with free hyphoid appendages and colorless spores. However, Roux & Triebel (1994) compared the hamathecium of *Sphaerellothecium* and *Echinothecium* and argued that the presence of free ascomatal appendages in *Echinothecium* is not a definitive distinguishing feature, as similar appendages are found in some species of *Sphaerellothecium* and *Stigmidium*. Furthermore, they noted that the absence of interascal filaments in *Echinothecium* cannot serve as a genus-level character since these filaments are often not visible in saprophytic *Sphaerellothecium*. (Eriksson et al., 1993; Roux & Triebel 1994).

Calatayud et al. (2002) misidentified *Lichenostigma cosmopolites* Hafellner & Calat., confusing it with *Echinothecium reticulatum*. This misidentification was based on the presence of ascomata with septate, seta-like hyphae, which appear to be restricted to *Parmelia*. Etayo (2008) later transferred *E. reticulatum* to *Sphaerellothecium*, a move supported by Chomnunti et al. (2011) after examining the holotype of *Sphaerellothecium*. As a result, *Echinothecium reticulatum* was synonymized with *Sphaerellothecium reticulatum*, and the genus was transferred to Mycosphaerellaceae (Etayo 2008; Chomnunti et al., 2011). Roux (2021) introduced a new species, *Echinothecium rhizoplacae*, and discussed five additional species within the genus. In this study, Roux demonstrated that the hamathecium of *E. rhizoplacae* and *E. reticulatum* differs significantly from *Sphaerellothecium* due to the presence of short rudimentary pseudoparaphyses and the absence of paraphysoids. These distinctive

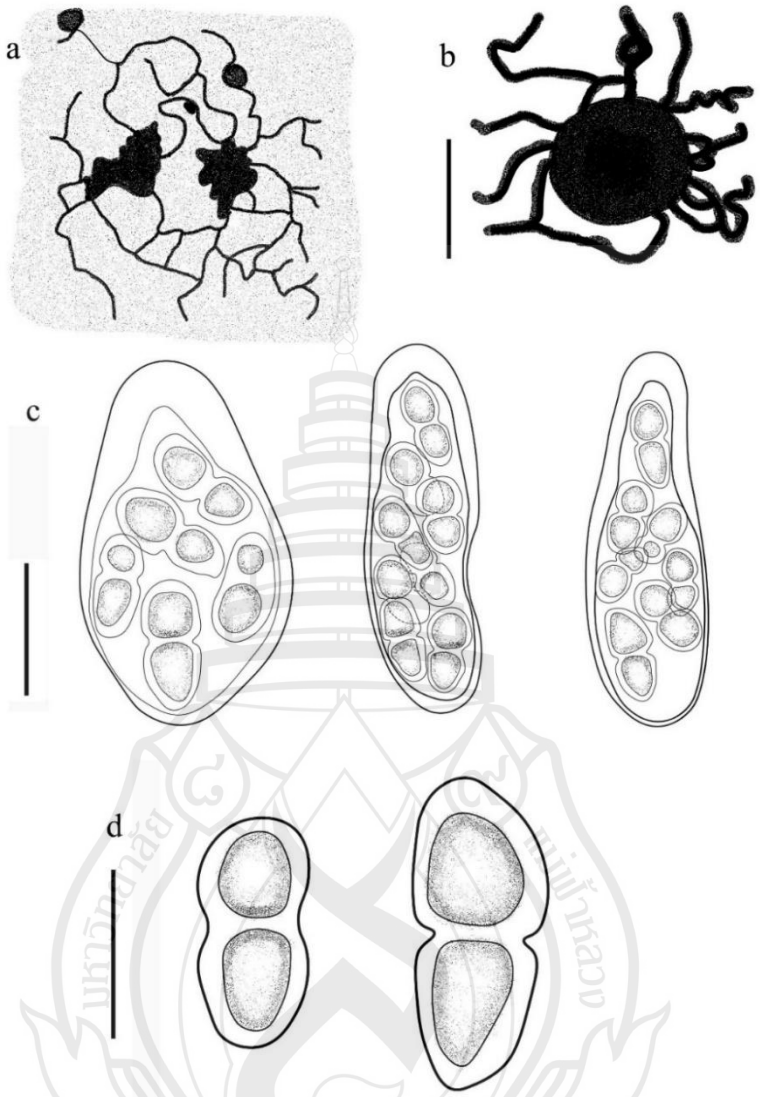
features, along with the presence of ascomata with free hyphoid appendages, reinforce the validity of *Echinothecium* as a separate genus (Roux, 2021).

Although several scholars have proposed placements for *Echinothecium* based on morphological characteristics, its phylogenetic position remains uncertain due to the lack of molecular data. Hyde et al. (2024) placed this genus within *Dothideomycetes* as genera incertae sedis. Based on this evidence, we accept this classification and retain *Echinothecium glabrum* and *E. reticulatum* within *Echinothecium*, with *E. reticulatum* as the type species.

Type species: *Echinothecium reticulatum* Zopf

Table 2.65 Accepted lichenicolous species of *Echinothecium*

	Species name	**Host**	**References**	**Remarks**
1	*Echinothecium aerophilum* Alstrup & M.S. Cole	*Alectoria sarmentosa*	(Alstrup et al., 1998)	
2	*Echinothecium cladoniae* Keissl.	*Cladonia*	(Keissler, 1930)	
3	*Echinothecium glabrum* M.S. Christ., Alstrup & D. Hawksw.	*Ochrolechia upsaliensis*	(Alstrup et al., 1990)	
4	*Echinothecium hypogymniae* Zhurb.	*Hypogymnia bitteri*	(Zhurbenko et al., 2019)	
5	*Echinothecium reticulatum* Zopf	*Parmelia*	(Zopf, 1898)	
6	*Echinothecium rhizoplacae* P. Pinault & Cl. Roux	*Rhizoplaca subdiscrepans*	(Roux, 2021)	



Note: a Ascomata on *Parmelia sulcata*. b Ascomata. c Bitunicate asci. d Ascospores. Scale bars: b = 20 µm, c = 10 µm, d = 5 µm.

Source Redrawn from Chomnunti et al. (2011)

Figure 2.56 *Echinothecium reticulatum*

Lanatosphaera Matzer (2)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dothideomycetes genera incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Lanatosphaera was established by Matzer (1996) to accommodate two lichenicolous species: L. dimerellae Matzer, found on Dimerella epiphylla (Müll. Arg.) Malme, and L. porinicola Matzer, found on Porina epiphylla Fée, with the latter designated as the type species.

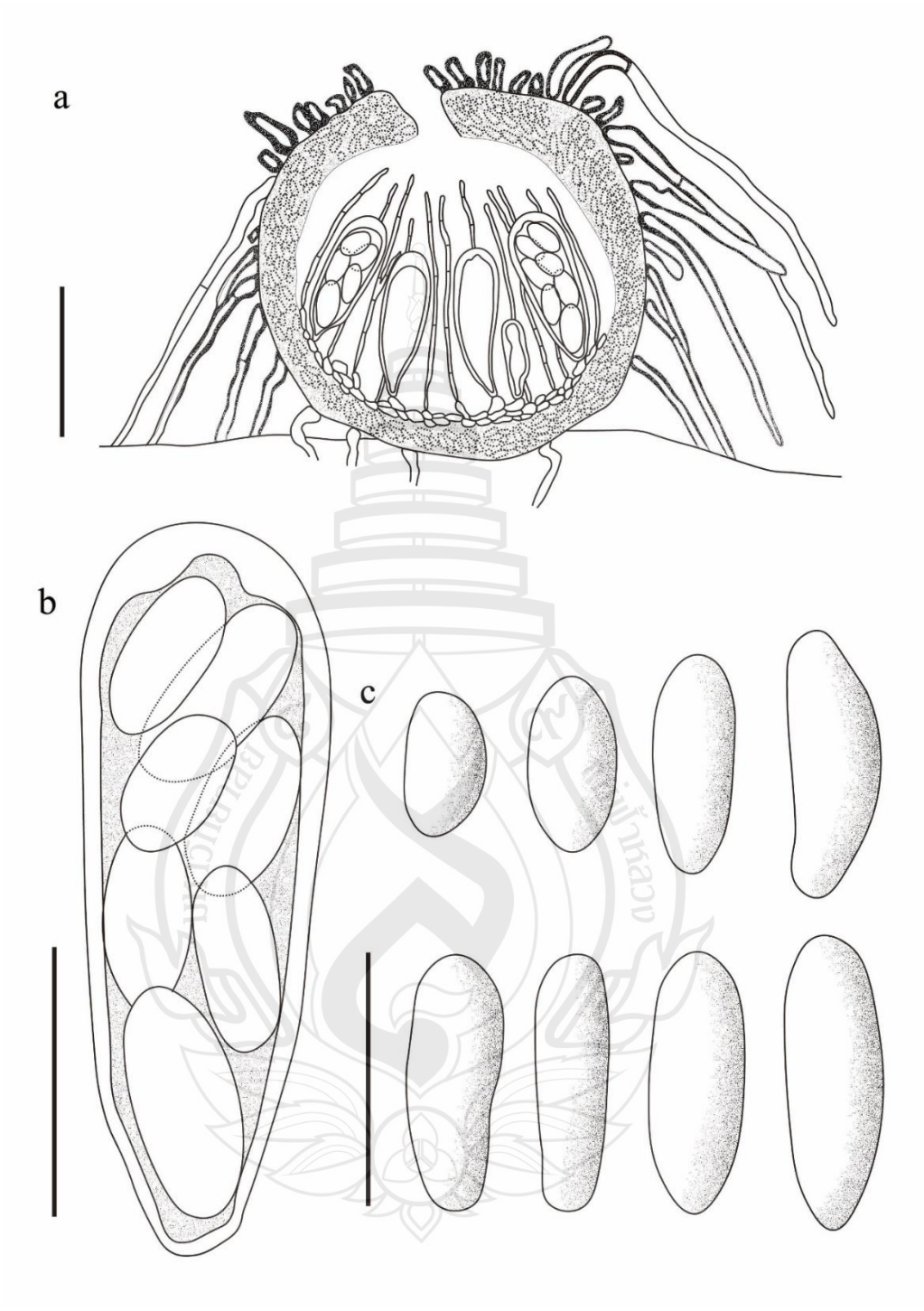
This genus is characterized by globose to ellipsoidal ascomata with outwardly protruding dark brown cells and long brown hyphae on the peridium. Numerous interascal filaments are present, which are septate, simple, or branched. The asci are fissitunicate, clavate to cylindrical, shortly stipitate, 2–8-spored, and have an endoascus that is thickened at the apex. The ascospores are hyaline, ellipsoidal, non-septate, smooth, and lack a halo (Matzer, 1996).

To date, only two species are recognized in this genus. Due to the absence of molecular data, *Lanatosphaera* has been temporarily placed within Dothideomycetes as genus incertae sedis. (Hyde et al., 2024).

Type species: *Lanatosphaera porinicola* Matzer

Table 2.66 Accepted lichenicolous species of *Lanatosphaera*

	Species name	Host	References	Remarks
1	*Lanatosphaera dimerellae* Matzer	*Dimerella epiphylla*	(Matzer, 1996)	
2	*Lanatosphaera porinicola* Matzer	*Porina epiphylla*	(Matzer, 1996)	



Note a Ascomata. b Ascus. c Ascospores. Scale bars: a = 20 μm, b–c = 10 μm.

Source Redrawn from Matzer (1996)

Figure 2.57 *Lanatosphaera porinicola*

Monodictys S. Hughes (8-57)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dothideomycetes genera incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Monodictys putredinis* (Wallr.) S. Hughes

= *Melanconium putredinis* Wallr.

Table 2.67 Accepted lichenicolous species of *Monodictys*

	Species name	Host	References	Remarks
1	*Monodictys anaptychiae* (Lindau) D. D. Hawksw.	*Anaptychia ciliaris*	(Hawksworth, 1975b)	= *Coniothecium anaptychiae* Lindau
2	*Monodictys cellulose* S. Hughes	various crustose, corticolous lichens	(Hughes, 1958)	
3	*Monodictys cladoniae* Brackel & Kukwa	*Cladonia coniocraea*	(von Brackel, 2019)	= *Monodictys lepraria* (Berk.) M. B. Elli
4	*Monodictys epicladonia* (Zhurb.) Diederich	On the thallus of *Cladonia coniocraea, C. caespiticia, C. chlorophaea, C. digitata, C. grayi, C. macilenta, C. ochrochlora, C. parasitica, C. polydactyla* and *Cladonia sp.,*	(Zhurbenko & Pino-Bodas, 2017; Diederich et al., 2024)	= *Sclerococcum epicladonia* Zhurb.

Table 2.67 (continued)

	Species name	Host	References	Remarks
5	*Monodictys epilepraria* Kukwa & Diederich	*Lepraria*	(Kukwa et al., 2005)	
6	*Monodictys pachnolepiae* Diederich & Ertz	*Pachnolepia pruinata*	(Diederich et al., 2024)	
7	*Monodictys phlyctidis* R.C.Harris	*Phlyctis speirea*	(Muscavitch et al., 2017)	
8	*Monodictys fuliginosa* Etayo	*Lobaria*	(Etayo & Diederich, 1996b)	

Rosellinula R. Sant. (4)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dothideomycetes genera incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Rosellinula was established by R. Sant (1986) to accommodate the type species *R. haplospora*, which was originally described as *Endococcus haplospora* Th. Fr. & Almq., growing on *Lecanora cinerea* (Eriksson & Hawksworth, 1986). The type species is characterized by globose, immersed, semi-exposed, black perithecia, 0.25–0.3 mm in diameter. with hymenial gelatin that initially truns blue with iodine, and then quickly changs to a wine-red color. The paraphyses are robust and gelatinously

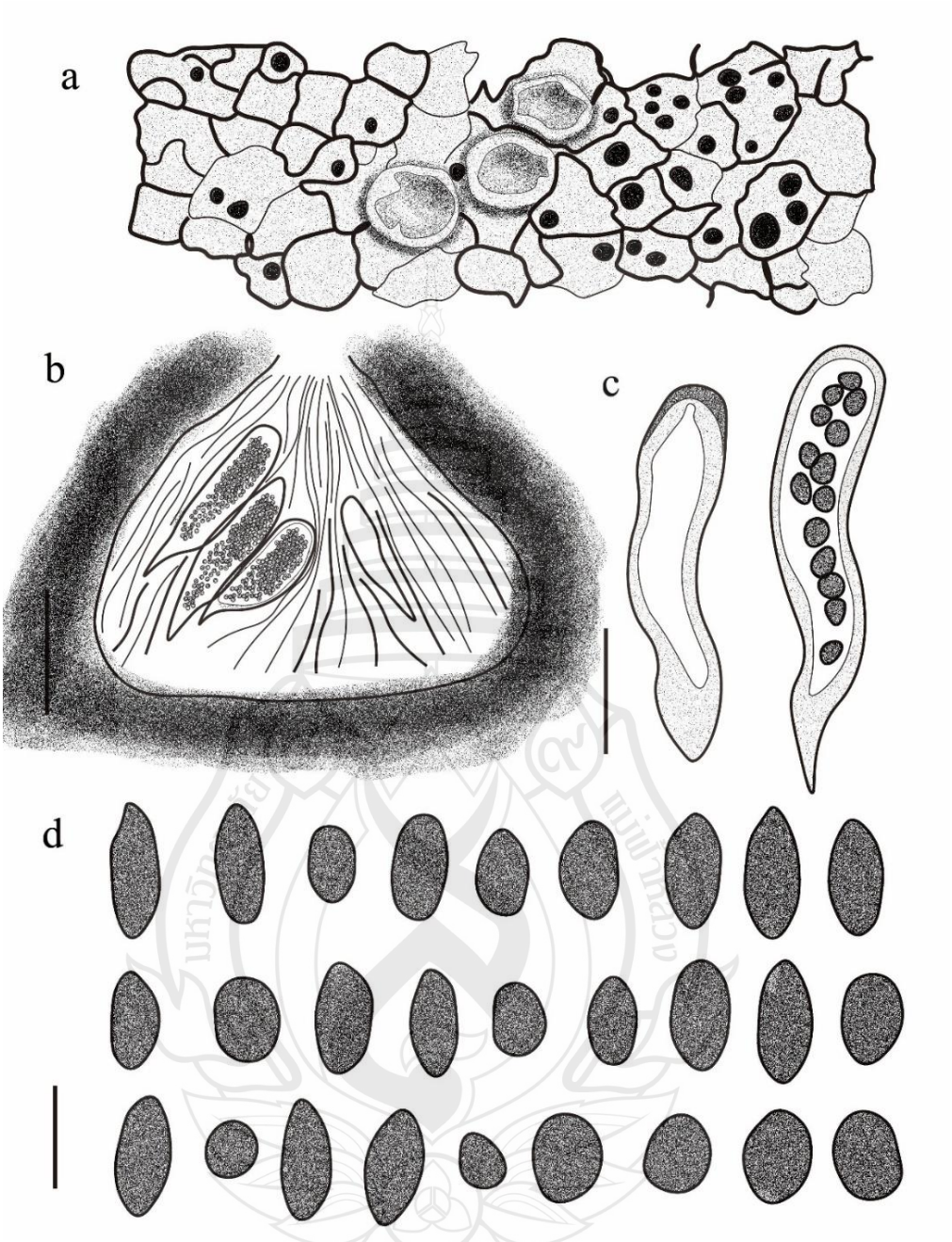
conglutinate, and the ascospores are ellipsoid, simple, blackish, and numerous within inflated-clavate asci (Fries 1867c).

Santesson (1988) transferred *Muellerella frustulosae* Vouaux to *Rosellinula frustulosae* (Vouaux) R. Sant. Rogers & Hafellner (1988) reclassified *Roselliniella kalbi* Hafellner as *Rosellinula kalbi*, and Galloway (2004) transferred *Mullerella lopadii* Vouaux to *Rosellinula lopadii*. To date, four species are congnized in this genus, all of which are lichenicolous on the crustose lichens. No available molecular data are currently available from NCBI, so the genus has been tentatively placed within Dothideomycetes genera incertae sedis by Wijayawardene (2022)

Type species: *Rosellinula haplospora* (Th. Fr. & Almq.) R. Sant.

Table 2.68 Accepted lichenicolous species of *Rosellinula*

	Species name	**Host**	**References**	**Remarks**
1	*Rosellinula frustulosae* (Vouaux) R. Sant	*Lecanora frustulosa* and *L. argopholis*	(Santesson, 1988)	=*Muellerella frustulosae* Vouaux
2	*Rosellinula haplospora* (Th. Fr.) R. Sant	*Lecanora cinerea*	(Fries, 1867c; Eriksson & Hawksworth, 1986)	=*Endococcus haplospora* Th. Fr. & Almq.
3	*Rosellinula kalbii* (Hafellner) Hafellner & R. W. Rogers	*Haematomma puniceum*	(Rogers et al., 1988)	=*Roselliniella kalbii* Hafellner
4	*Rosellinula lopadii* (Vouaux) D. J. Galloway	*Brigantiaea*	(Galloway, 2004)	=*Muellerella lopadii* Vouaux



Note a Ascomata growing on the thallus of *Lecanora* sp. b Section of ascomata. c Asci. d Ascospores. Scale bars: b = 50 µm, c = 25 µm, d = 5 µm.

Source Redrawn from the website: Association francaise de LICHENOLOGIE (2024)

Figure 2.58 *Rosellinula haplospora*

Stromatopogon Zahlbr. (3)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dothideomycetes genera incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

The lichenicolous genus *Stromatopogon* was established by Zahlbruckner (1897) to accommodate the type species *Stromatopogon baldwinii* Zahlbr. According to the original description, the genus is characterized by its lichenicolous lifestyle on *Usena*, parasitic ascomata, and pycnoconidia mixed within stromata. The distinction between lichen and the lichenicolous fungus was not well-defined. The ascomata was considered a different fructification from *Usnea*, leading to the proposal of the new name '*Stromatopogon*'. Diederich (1992) re-studied the type species *S. baldwinii* and discovered that it is an *Usnea* thallus attacked by parasitic fungi. Due to the poor condition of the type specimen, with almost all examined fructifications empty, one conidioma contained microconidia but no spores. Consequently, the type species *S. baldwinii* was lectotypified based on the macroconidial element. However, it remains uncertain whether the perithecia described in the original reference represent the teleomorph of the same fungus. Diederich (1992) also studied new samples of *S. baldwinii* from Tasmania and found that this species produces two completely different kinds of conidia within the same conidioma.

The type species, *Stromatopogon baldwinii*, is characterized by pycnidial conidiomata, which are immersed in the thick galls of the host, dark brown to black and subspherical. The conidiomata irregularly open from the upper part of the wall by breaking and becoming cupulate. The inner layer of the dark brown wall, formed by pale brown cells, produces two kinds of conidia from separate regions within the same conidioma. The macroconidial morph often predominates but is sometimes absent in young conidiomata. The macroconidia holoblastic, arising singly, often filling the conidiomatal cavity, composed of 2-7 cells, spherical, ellipsoid or obpyriform, rounded

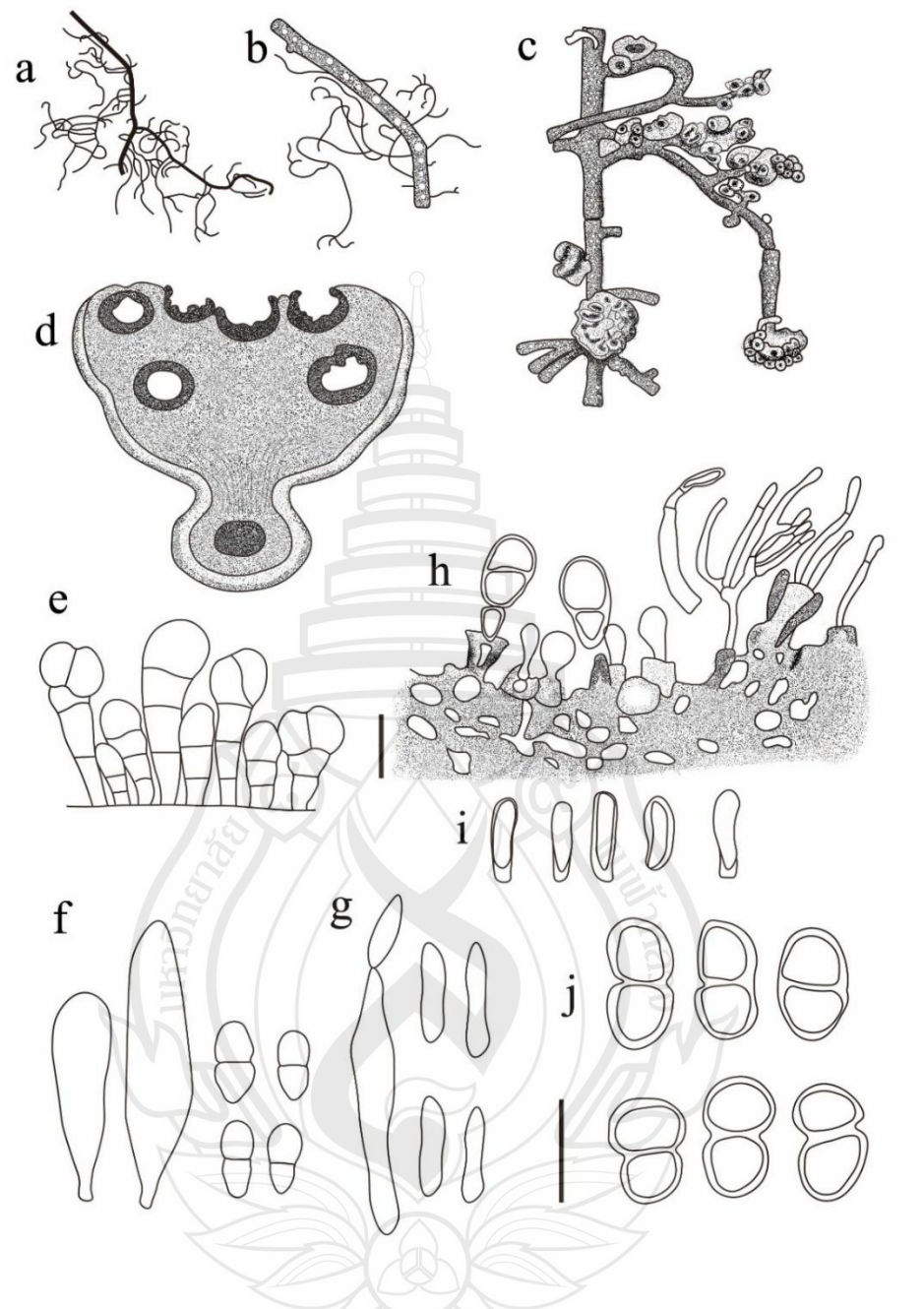
at the apex and base, hyaline, thick-walled, and smooth. The conidiophores of microconidia arise from cells identical to the conidiogenous cells of macroconidia, simple or branched, often septate, and hyaline. The microconidia are subcylindrical, with a rounded apex and distinctly truncate base, simple, hyaline, and smooth (Diederich, 1992b).

There are three species in *Stromatopogon*. Besides the type species *S. baldwinii* which grows on *Usena*, Diederich & Sérusiaux (2003) introduced the second species, *S. cladoniae* Diederich & Sérus., which grows on *Cladonia polydactyla*. Etayo & Breuss (2004) introduced the third species, *S. geminatum*, which also grows on *Usena* like the type species. Due to the lack of molecular data, the systematic position of this genus remains unclear and it is currently placed within Ascomycota genera incertae sedis (Wijayawardene et al., 2022).

Type species: *Stromatopogon baldwinii* Zahlbr.

Table 2.69 Accepted lichenicolous species of *Stromatopogon*

	Species name	Host	References	Remarks
1	*Stromatopogon baldwinii* Zahlbr.	*Usnea*	(Zahlbruckner, 1897)	
2	*Stromatopogon cladoniae* Diederich & Sérus.	*Cladonia polydactyla*	(Diederich et al., 2003)	
3	*Stromatopogon geminatum* Etayo & Breuss	*Usnea*	(Etayo & Breuss, 2004)	



Note a–c Stromata on the *Usnea* sp. d Cross-section through a stroma. e Stylospores. f Asci. g Pycnoconidia. h Conidiomatal wall, conidiogenous cells, conidiophores, microconidia and macroconidia. i Microconidia. j Macroconidia. Scale bars: h, j = 10 μm.

Source a–g from Zahlbruckner (1897), h–j from Diederich (1992b)

Figure 2.59 Asexual morph of *Stromatopogon Baldwini*

Trematosphaeriopsis Elenkin (1)

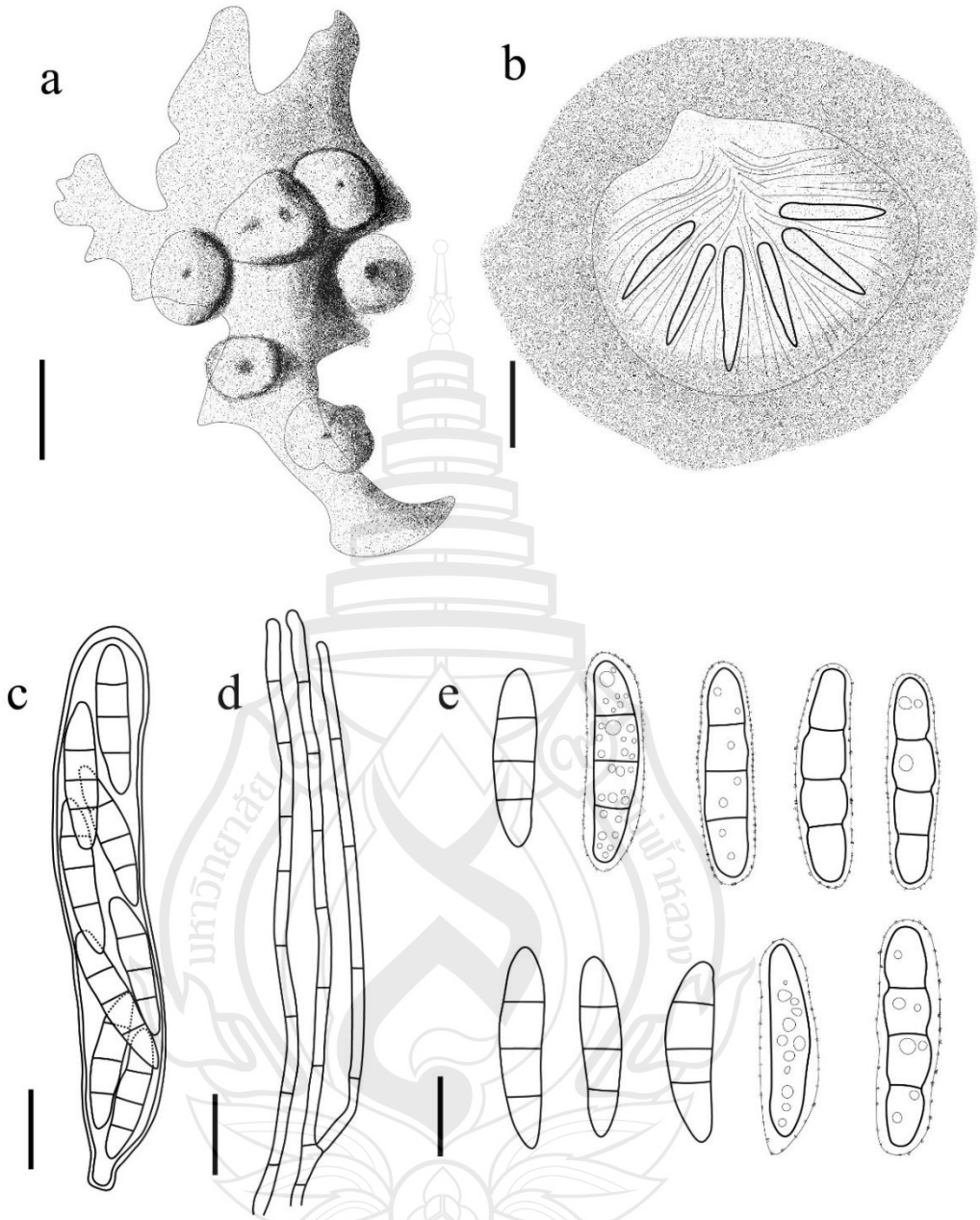
Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Dothideomycetes genera incertae sedis, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Trematosphaeriopsis was established by Elenkin (1901) to accommodate the only species *Trematosphaeriopsis parmeliana* Jacz. & Elenkin, which grows on the thallus of *Parmelia*. Vouaux (1912) considered the presence of a stroma of the nature described by Elenkin to naturally place this species in *Homostegia*, therefore, he combined this species as *H. parmeliana* (Jacz. & Elenkin) Vouaux (Vouaux, 1912a). However, Hafellner (2001) reinvestigated this monotypic genus, accepted it as a separate genus, and provided a detailed description and line drawing of the type species (Hafellner 2001). Diederich (2018) accepted this viewpoint and included this genus and its type species in the lichenicolous list (Zhurbenko, 2021) published a new report for the Asian part of Russia from Mongolian border region and provided a color illustration to this species (Zhurbenko, 2021b).

Trematosphaeriopsis is characterized by hemisphaerical to somewhat flattened gall-like ascomata that are entirely immersed and protruding only at the ostiole, cylindrical asci that are fissitunicate, 8-spored, and hyaline ascospores narrowly ellipsoid, with three septa (Hafellner, 2001).

Type species: *Trematosphaeriopsis parmeliana* Jacz. & Elenkin, on *Xanthoparmelia*



Note a Galls with immersed pseudothecia. b Section of pseudothecium. c Ascus. d Interascal filaments. e Ascospores. Scale bars: a = 1mm, b = 50 µm, c–e = 10 µm.

Source Redrawn from Hafellner (2001) and Zhurbenko (2021b)

Figure 2.60 *Trematosphaeriopsis parmeliana*

Class EUROTIOMYCETES O.E. Erikss. & Winka

SubClass CHAETOTHYRIOMYCETIDAE Doweld

Order Chaetothyriales M.E. Barr

Family Epibryaceae S. Stenroos & Gueidan

Epibryon Döbbeler (4-48)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Herpotrichiellaceae, Chaetothyriales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Epibryon plagiochilae* (Gonz. Frag.) Döbbeler

Table 2.70 Accepted lichenicolous species of *Epibryon*

	Species name	Host	References	Remarks
1	*Epibryon conductrix* (Norman ex Th. Fr.) Nik. Hoffm. & Hafellner	*Catapyrenium cinereum* and *C. daedaleum*	(Hoffmann et al., 2000)	= *Verrucaria conductrix* Norman ex Th. Fr.
2	*Epibryon lichenicola* Matzer	*Mazosia*	(Matzer, 1996)	
3	*Epibryon parvipunctum* (Stein) Diederich	*Thelidium*	(Sérusiaux et al., 1999)	= *Sagedia parvipuncta* Stein
4	*Epibryon solorinae* (Vain.) Nik. Hoffm. & Hafellner	*Solorina*	(Hoffmann et al., 2000)	= *Laestadia solorinae* Vain.

Family Herpotrichiellaceae Munk

Capronia Sacc. (26-83)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Herpotrichiellaceae, Chaetothyriales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Capronia sexdecimspora* (Cooke) Sacc.

Table 2.71 Accepted lichenicolous species of *Capronia*

	Species name	Host	References	Remarks
1	*Capronia amylacea* Etayo	*Peltigera*	(Etayo, 2017)	
2	*Capronia andina* Etayo	*Placopsis gelida*	(Etayo, 2002c)	
3	*Capronia baeomycetis* Diederich	*Baeomyces*	(Aptroot et al., 1997)	
4	*Capronia cogtii* Zhurb.	*Vahliella leucophaea*	(Zhurbenko et al., 2019)	
5	*Capronia diederichiana* P. Pinault & Cl. Roux	*Cladonia phyllophora*	(Roux, Pinault, et al., 2020)	
6	*Capronia epilobarina* S. Y. Kondr. & D. J. Galloway	*Lobaria*	(Kondratyuk et al., 1995a)	
7	*Capronia etayoi* Flakus & Kukwa	*Dictyonema*	(Flakus et al., 2012)	
8	*Capronia guatemalensis* Etayo	*Parmotrema*	(Etayo & van Den Boom, 2006)	
9	*Capronia harrisiana* Hollinger & Lendemer	*Crocodia aurata*	(Hollinger et al., 2021)	

Table 2.71 (continued)

	Species name	Host	References	Remarks
10	*Capronia hypotrachynae* Etayo & Diederich	*Hypotrachyna*	(Etayo & Diederich, 1998)	
11	*Capronia josefhafellneri* Zhurb. & Etayo	*Septotrapelia triseptata*	(Zhurbenko et al., 2016)	
12	*Capronia leopoldiana* Etayo	*Leptogium menziesii*	(Etayo & Sancho, 2008)	
13	*Capronia leptogii* Etayo	*Leptogium*	(Etayo, 2002a)	
14	*Capronia magellanica* Etayo	*Fuscopannaria*	(Etayo & Sancho, 2008)	
15	*Capronia marginalis* Zhurb. & Etayo	*Chromatochlamys muscorum*	(Zhurbenko, 2023b)	
16	*Capronia minutosetosa* Halıcı, D. Hawksw., A.Ö. Türk & Candan	*Thelenella muscorum*	(Halıcı et al., 2010)	
17	*Capronia muellerelloides* Etayo	*Heterodermia*	(Etayo, 2017)	
18	*Capronia normandinae* R. Sant. & D. Hawksw.	*Parmeliella plumbea*	(Hawksworth, 1990b)	

Table 2.71 (continued)

	Species name	Host	References	Remarks
19	*Capronia paranectrioides* Etayo, Flakus & Kukwa	*Erioderma leylandii*	(Etayo et al., 2013a)	
20	*Capronia pseudonormandinae* Diederich	*Lauderlindsaya simodense*	(Aptroot et al., 1997)	
21	*Capronia santessoniana* Etayo	*Dictyonema*	(Etayo, 2010a)	
22	*Capronia solitaria* Etayo	*Heterodermia* and perhaps on *Lobaria, Lobariella* and *Sticta*	(Etayo, 2017)	
23	*Capronia suijae* Tsurykau & Etayo	*Xanthoria parietina*	(Tsurykau et al., 2017)	
24	*Capronia thamnoliae* Zhurb.	*Thamnolia vermicularis var. subuliformis*	(Zhurbenko, 2012)	
25	*Capronia triseptata* (Diederich) Etayo	*Buellia griseovirens*	(Etayo, 1996b)	= *Muellerella triseptata* Diederich
26	*Capronia amylacea* Etayo	*Peltigera*	(Etayo, 2017)	

Cladophialophora Borelli (7-50)

Index Fungorum 7677, faceoffungi FOF 10373, MycoBank, GenBank

Classification: Herpotrichiellaceae, Chaetothyriales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Cladophialophora ajelloi* Borelli

Table 2.72 Accepted lichenicolous species of *Cladophialophora*

	Species name	Host	References	Remarks
1	*Cladophialophora cladoniae* (Diederich) Diederich,	*Cladonia pocillum* and *Cladonia subulate*	(Diederich et al., 2013)	= *Sclerococcum cladoniae* Diederich
2	*Cladophialophora denigrans* (Diederich) Boers, Diederich & Ertz	*Lecanora horiza*	(Diederich, 2021; Diederich et al., 2024)	= *Trimmatostroma denigrans* Diederich
3	*Cladophialophora dimorphospora* P. Pinault, Diederich & Etayo	*Parmelina quercina*	(Diederich et al., 2024)	
4	*Cladophialophora dirinae* Diederich & Sérusiaux	*Dirina ceratoniae*	(Diederich et al., 2024)	
5	*Cladophialophora endolichena* Cometto, de Hoog & Muggia,	*Rhizoplaca melanophthalma*	(Cometto et al., 2023)	

Table 2.72 (continued)

	Species name	Host	References	Remarks
6	*Cladophialophora haematommatis* Boers, Ertz & Diederich	*Haematomma ochroleucum*	(Diederich et al., 2024)	
7	*Cladophialophora harrisii* Diederich	*Dirinaria confluens*	(Diederich et al., 2024)	
8	*Cladophialophora hawksworthii* (Etayo & Diederich) Diederich	*Megalospora tuberculosa*	(Diederich et al., 2013)	= *Sclerococcum hawksworthii* Etayo & Diederich
9	*Cladophialophora hepatica* Diederich	*Megalospora* sp.	(Diederich et al., 2024)	
10	*Cladophialophora megalosporae* Diederich	*Megalospora pachycheila*	(Diederich et al., 2013)	
11	*Cladophialophora normandinae* (Diederich & Etayo) Diederich	*Normandina pulchella*	(Diederich et al., 2013)	= *Sclerococcum normandinae* Diederich & Etayo
12	*Cladophialophora novozhilovii* Zhurb. & Diederich	*Psoroma hypnorum*	(Zhurbenko, 2023b)	
13	*Cladophialophora parmeliae* (Etayo & Diederich) Diederich & Unter	*Parmelia saxatilis*	(Diederich et al., 2013)	= *Sclerococcum parmeliae* Etayo & Diederich

Table 2.72 (continued)

	Species name	Host	References	Remarks
14	*Cladophialophora zimmermannii* Diederich & F.Berger	*Mycoblastus affinis*	(Diederich et al., 2024)	

Family Trichomeriaceae Chomnunti & K.D. Hyde

Knufia L.J. Hutchison & Unter. (1-20)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Chaetothyriales Genera incertae sedis, Chaetothyriales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Knufia cryptophialidica* L.J. Hutchison & Unter.

Accepted lichenicolous species:

Knufia peltigerae Etayo & Pérez-Vargas *Peltigera*

= *Trichosphaeria peltigerae* Fuckel

Chaetothyriales Genera incertae sedis

Lichenodiplis Dyko & D. Hawksw. (13)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Chaetothyriales Genera incertae sedis, Chaetothyriales, Pezizomycotina, Ascomycota, Fungi

= *Laeviomyces* D. Hawksw., Bull. Br. Mus. nat. Hist., Bot. 9(1): 26 (1981)

= *Spilomium* Nyl., Mém. Soc. Imp. Sci. Nat. Cherbourg 5: 91 (1858)

Lichenodiplis was established by Hawksworth & Dyko (1979), and typed by *L. lecanorae* (Vouaux) Dyko & D. Hawksw. which was transferred from *Diplodina lecanorae* Vouaux. It is characterized by pycnidial conidiomata which arise singly, scattered with a dark brown coloration. The conidiogenous cells are lining in the whole pycnidial cavity, cylindrical to lageniform, percurrently proliferating, with a hyaline to

pale brown coloration. The holoblastic conidia are crlindrical to obovate, pale to dark brown, smooth-walled, 1-septate, apex obtuse and base truncate.

This genus was originally placed in the order Sphaeropsidales (Coelomycetes) by Hawksworth & Dyko (1979). Diederich (2003) transferred all four species from *Laeviomyces* D. Hawksw. to *Lichenodiplis*, making *laeviomyces* a synonym of *Lichenodiplis*. Additionally, another species, *Spilomium pertusariicola* Nyl., which was the type species of *Spilomium*, was also transferred to *Lichenodiplis*. Consequently, *Spilomium* was proposed as a synonym of the *Lichenodiplis*. Wijayawardene (2018) placed *Lichenodiplis* within Chaetothyriales genera incertae sedis, and this viewpoint has been accepted to date.

Type species: *Lichenodiplis lecanorae* (Vouaux) Dyko & D. Hawksw.

Table 2.73 Accepted lichenicolous species of *Lichenodiplis*

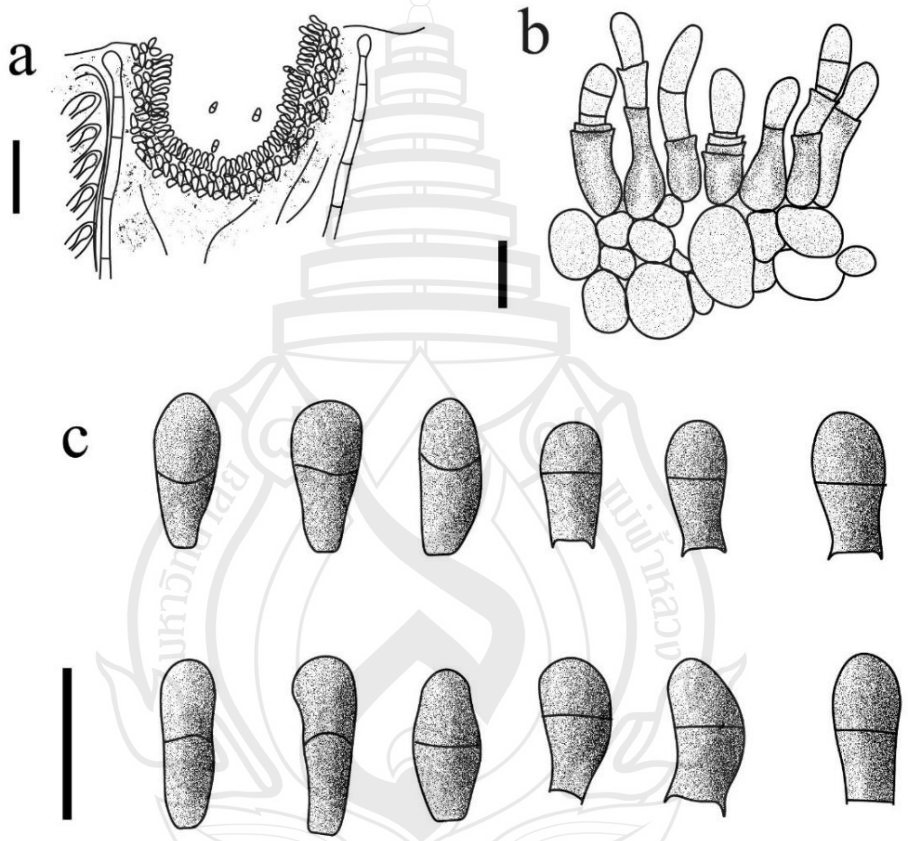
	Species name	Host	References	Remarks
1	*Lichenodiplis anomala* Etayo & Pérez-Vargas	*Ochrolechia*	(Pérez-Vargas et al., 2013)	
2	*Lichenodiplis crespoae* Pérez-Ort. & V. Atienza	*Calicium notarisii*	(Atienza et al., 2009)	
3	*Lichenodiplis dendrographae* Diederich & van den Boom	*Dendrographa*	(Diederich, 2003)	
4	*Lichenodiplis fallaciosa* (Hafellner & Kalb) Diederich	*Buellia* and *Orcularia*	(Diederich, 2003)	= *Laeviomyces fallaciosus* Hafellner & Kalb

Table 2.73 (continued)

	Species name	Host	References	Remarks
5	*Lichenodiplis hawksworthii* F. Berger & Diederich	*Pertusaria pustulata*	(Berger et al., 1997)	
6	*Lichenodiplis lecanorae* (Vouaux) Dyko & D. Hawksw.	*Caloplaca, Lecanora* and other crustose lichens	(Hawksworth et al., 1979)	≡ *Diplodina lecanorae* Vouaux
7	*Lichenodiplis lecanoricola* (M. S. Cole & D. Hawksw.) Diederich	*Lecanora*	(Diederich, 2003)	≡ *Laeviomyces lecanoricola* M.S. Cole & D. Hawksw.
8	*Lichenodiplis lichenicola* Dyko & D. Hawksw.	*Rinodina*	(Hawksworth et al., 1979)	
9	*Lichenodiplis ochrolechiae* Y. Joshi & M. Tripathi	*Ochrolechia*	(Joshi et al., 2017)	
10	*Lichenodiplis opegraphae* (D. Hawksw.) Diederich	*Opegrapha*	(Diederich, 2003)	≡ *Laeviomyces opegraphae* D. Hawksw.
11	*Lichenodiplis pertusariicola* (Nylander) Diederich	*Pertusaria*	(Diederich, 2003)	≡ *Spilomium pertusariicola* Nyl.
12	*Lichenodiplis poeltii* S. Y. Kondr. & D. Hawksw.	*Xanthoria parietina*	(Moser, 1996)	

Table 2.73 (continued)

	Species name	Host	References	Remarks
13	*Lichenodiplis rinodinicola* Kocourk. & K. Knudsen	*Rinodina*	(Knudsen & Kocourková, 2009)	



Note a Section of conidima. b Conidiogenous cells with diveloping conidia. c Conidia. Scale bars: a = 25 µm, b–c = 5 µm

Source Redrawn from Hawksworth et al. (1979)

Figure 2.61 *Lichenodiplis lecanorae*

Lichenodiplisiella S.Y. Kondr. & Kudratov (1)

Index Fungorum 28495, faceoffungi, MycoBank, GenBank

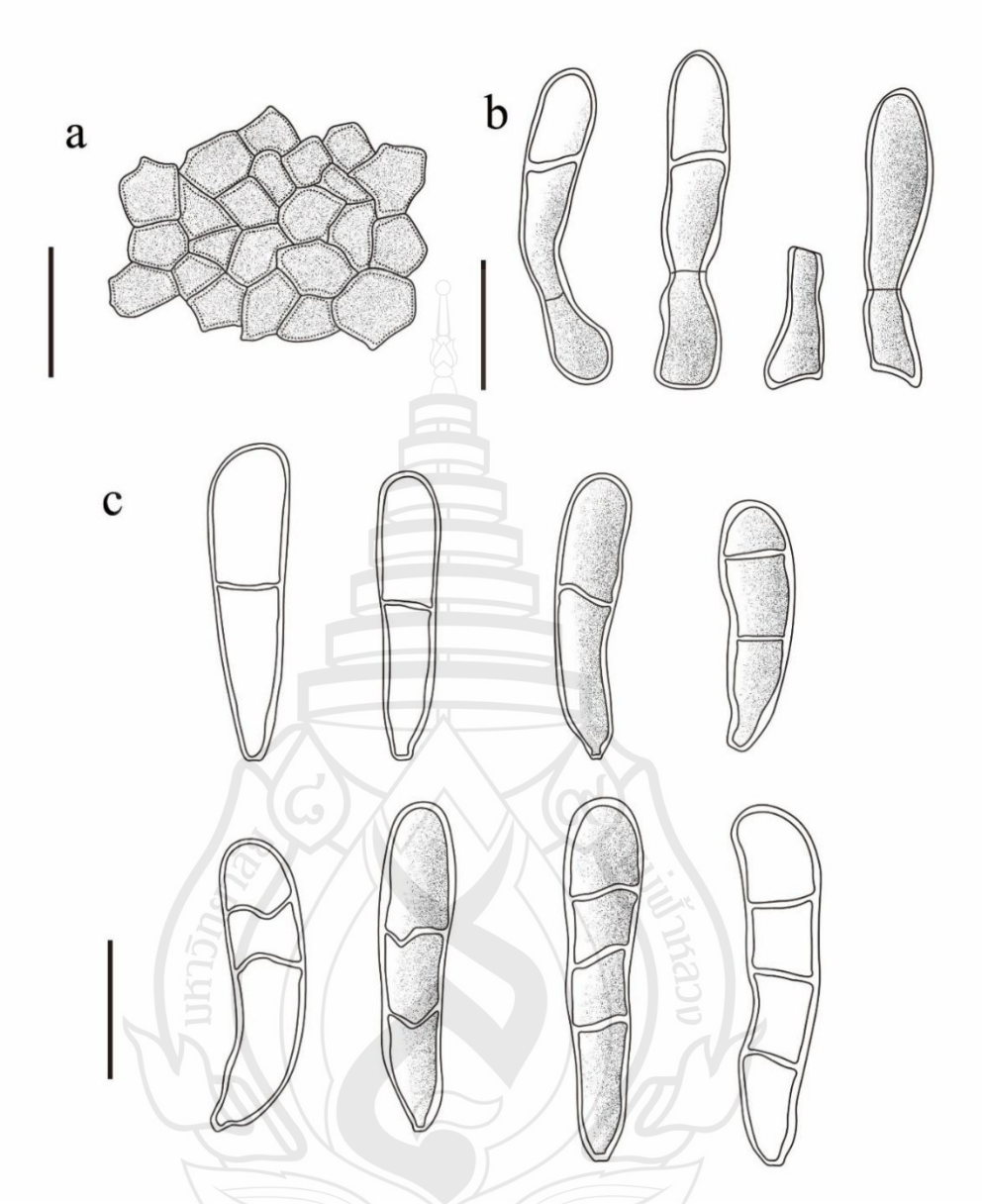
Classification: Chaetothyriales genera incertae sedis, Chaetothyriales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Lichenodiplisiella was introduced by Kondratyuk et al. (2002) to accommodate the new species *L. makarevichae*, distinguished from all species of *Lichenodiplis* by its longer conidia with 1–2(–3) septa and distinct conidiomatal structure. It was noted that more than 50% of the examined conidia are 2- or 3-septate, which is characteristic and diagnostic for this genus. In contrast, 1-septate conidia are only found in young conidia of *Lichenodiplisiella makarevichae*. This genus is characterized by a lichenicolous lifestyle, forming grey-blackish conidiomata on the apothecia of *Teloschistes brevior* (Nyl.) Vain., which grows alongside *Physcia biziana* (A. Massal.) Zahlbr., and sometimes aggregating in regular circles. The conidiomata are pycnidial, either aggregated or scattered, initially immersed but becoming erumpent, unilocular, globose or broadly ellipsoid, and greyish-black. The conidiogenous cells are narrowly cylindrical to lageniform, lining the entire pycnidial cavity, percurrently proliferating, discrete, hyaline to pale greyish, and smooth-walled. The conidia are produced holoblastically, narrowly obpyriform to cylindrical, sometimes slightly curved, pale greyish, smooth-walled, 1–2(–3) septate, with septa often wrinkled, an obtuse apex, and a truncate base, measuring 15–18(–21) × (3.0–)3.5–4.5 μm (Kondratyuk, Kudratov, et al., 2002).

Wijayawardene et al. (2020, 2022) placed *Lichenodiplisiella* within *Chaetothyriales* genera incertae sedis. The genus lacks available sequence data, leaving its systematic position unclear. To date, the type species remains the only species within this genus.

Type species:

Lichenodiplisiella makarevichiae S.Y. Kondr. & Kudratov, on *Teloschistes brevior* (Kondratyuk et al., 2002)



Note a Texture of conidiomata wall. b Conidiogenous cells with young conidia. c Conidia. Scale bars: a–c = 10 µm.

Source Redrawn from Kondratyuk et al. (2002)

Figure 2.62 *Lichenodiplisiella makarevichiae*

Muellerella Hepp ex Müll. Arg. (16-19)

Index Fungorum: 3283, faceoffungi, MycoBank, GenBank

Classification: Chaetothyriales Genera incertae sedis, Chaetothyriales,

Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Synonymy:

= *Muellerellomyces* Cif. & Tomas., Atti Ist. bot. Univ. Lab. crittog. Pavia, sér. 5 10(1): 33, 60 (1953)

= *Pleothelis* M. Choisy, Bull. mens. Soc. linn. Soc. Bot. Lyon 18: 140 (1949)

= *Polycarpella* Theiss. & Syd., Annls mycol. 16(1/2): 28 (1918)

= *Spolverinia* sect. *Muellerella* A. Massal., Flora, Regensburg 57: 351 (1874)

= *Sychnogonia* Körb., Syst. lich. germ. (Breslau): 332 (1855)

= *Thelidiola* C.W. Dodge, Nova Hedwigia 15: 299 (1968)

Muellerella was established by Müller in 1862, and with *M. polyspora* as the type species. It is characterized by black apothecia, polysporous asci and brown spores (Müller, 1862). Lumbsch (2007, 2010) and Wijayawardene (2018) placed this genus within Verrucariaceae (Verrucariales). However, the phylogenetic analysis by Muggia et al. (2015) showed that this genus forms a monophyletic lineage with *Licheodiplis* strains and sister to the family Epibryaceae within Chaetothyriales (Chaetothyriomycetidae). In addition, the co-occurrence of *Lichenodiplis* and *Muellerella* species on other hosts was confirmed based on an in-depth screening of herbarium collections by Muggia et al. (2015). Diederich (2018) reclassified it within the Chaetothyriales genera incertae sedis, a viewpoint subsequently accepted by Wijavawardene (2020, 2022). This genus is characgerized by the conspicuous black, sometimes slightly shiny, perithecioid, ostiolate ascomata, with multispore asci containing 1-septate, ellipsoid, brown ascospores.

Ciffrri & Tomaselli (1953) introduced *Muellerellomyces* and its only species, *M. polysporae*, which was later considered synonymy with *Muellerella polyspora* (Ciffrri et al., 1953; Lamb, 1963). *Muellerella pygmaea* was transferred from *Microthelia pygmaea* Körb. which had previously been transferred to *Tichothecium pygmaeum* (Körb.) Körb. However, *Tichothecium pygmaeum* was synonymized with

Pleothelis myriocarpa Choisy, the type species of *Pleothelis* (Körber; 1865b; Lamb; 1963). Thus, *Pleothelis* was also synonymized with *Muellerella*.

Muellerella lichenicola was originally introduced by Sommerf. in 1826 and later synonymized with *Polycarpella cookei* (Linds.) Theiss. & Syd., the type species of *Polycarpella* (Sommerfelt, 1826; Theissen et al., 1918a). Consequently, *Polycarpella* became a synonym of *Muellerella*. Another synonym, *Sychnogonia*, introduced by Körb. (1855), was rejected in favor of Thelopsis Nyl. (1855). As a result, the species *S. erratica* and *S. pygmaea* were transferred to *Muellerella* as *M. erratica* and *M. pygmaea*, respectively, making *Sychnogonia* another synonymy of *Muellerella* (Körber 1865b).

Accroding to Index Fungorum, there are 37 records in *Muellerella*. eight species have been transferred to other genera, and eight are varieties which are not included in this list. *Muellerella atricola* has been combined with *M. lichenicola*, and both *M. haplospora* and *M. opegraphicola* have been combined with *M. polyspora*. Currently, 19 species are recognized in this genus, and 16 of which are lichenicolous.

Type species: *Muellerella polyspora* Hepp ex Müll. Arg

Table 2.74 Accepted lichenicolous species of *Muellerella*

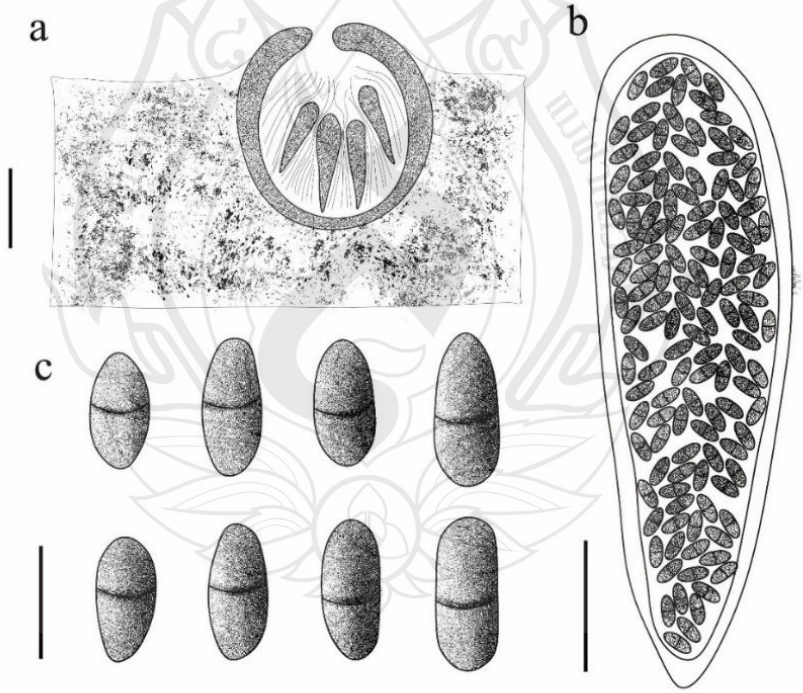
	Species name	**Host**	**References**	**Remarks**
1	*Muellerella antarctica* Etayo	*Hypogymnia antarctica*	(Etayo & Sancho, 2008)	
2	*Muellerella dilatata* J. Steiner	*Lecanora trachytica*	(von Halácsy, 1894)	
3	*Muellerella erratica* (A. Massal.) Hafellner & V. John	diverse lichens	(Hafellner et al., 2006)	= *Tichothecium erraticum* A. Massal.
4	*Muellerella hospitans* Stizenb	*Bacidia rubella*	(Stizenberger, 1863)	

Table 2.74 (continued)

	Species name	Host	References	Remarks
5	*Muellerella lecanactidis* Diederich & van den Boom	*Sigridea californica*	(Diederich, 2003)	
6	*Muellerella lichenicola* (Sommerf.) D. Hawksw	Diverse lichens	(Hawksworth, 1979b)	= *Sphaeria lichenicola* Sommerf.
7	*Muellerella polyspora* Hepp ex Müll. Arg.	Diverse lichens	(Müller, 1862)	
8	*Muellerella pygmaea* (Körb.) D. Hawksw.	Diverse lichens	(Hawksworth, 1979b)	= *Microthelia pygmaea* Körb.
9	*Muellerella rhizocarpicola* Brackel	*Rhizocarpon geographicum*	(Brackel, 2023)	
10	*Muellerella solenopsorae* Brien, Cl. Roux & Monnat	*Solenopsora holophaea*	(Roux et al., 2022)	
11	*Muellerella stictinae* (H. Olivier) Vouaux	*Stictina sylvatica*	(Vouaux, 1913a)	= *Sphaeria stictinae* H. Olivier
12	*Muellerella thalamita* (Nyl.) D, Hawksw., F. Berger & LaGreca	*Baculifer, Orcularia* and *Hafellia*	(Berger et al., 2014)	= *Endococcus thalamita* Nyl.
13	*Muellerella thallophila* Arnold	*Aspicilia caesiocinerea*	(Arnold, 1888)	

Table 2.74 (continued)

	Species name	Host	References	Remarks
14	*Muellerella triseptata* Diederich	*Buellia griseovirens* and other lichens	(Diederich, 1986)	
15	*Muellerella ventosicola* (Mudd) D. Hawksw.	*Ophioparma*, possibly also on *Rhizocarpon*	(Hawksworth, 2003)	= *Microthelia ventosicola* Mudd
16	*Muellerella vesicularia* (Linds.) D. Hawksw.	*Toninia caeruleonigricans*	(Hawksworth, 1985b)	= *Microthelia vesicularia* Linds.



Note a Section of ascomata. b Ascus. c Ascospores. Scale bars: a = 50 μm, b = 10 μm, c = 5 μm.

Source Redrawn from Müller (1862)

Figure 2.63 Sexual morph of *Muellerella polyspora*

Order Pyrenulales Fink ex D. Hawksw. & O.E. Erikss.

Family Pyrenulaceae

Distopyrenis Aptroot (2-9)

Index Fungorum: 25555, faceoffungi, MycoBank, GenBank

Classification: Pyrenulaceae, Pyrenulales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Distopyrenis americana* Aptroot

Table 2.75 Accepted lichenicolous species of *Distopyrenis*

	Species name	Host	References	Remarks
1	*Distopyrenis epidiorygma* Etayo & van den Boom	*Diorygma*	(Boom et al., 2022)	
2	*Distopyrenis japonica* Harada	*Graphis proserpens*	(Harada, 2000)	

Order Verrucariales Mattick ex D. Hawksw. & O.E. Erikss.

Family Adelococcaceae Triebel

Index Fungorum: 81961, faceoffungi, MycoBank, GenBank

Classification: Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Adelococcaceae was introduced by Triebel (1993) to accommodate the genera *Adelococcus* Theiss. & Syd. and *Sagediopsis* Sacc. ex Vain. Both genera exhibit features considered primitive within the Verrucariales, such as the presence of paraphysoids and a simple pseudoparenchymatous, aclypeate ascomatal wall structure. These characteristics led to the placement of the family within Verrucariales, with *Adelococcus* designated as the type genus (Triebel, 1993).

The family is characterized by perithecioid, globose to pyriform, black

ascomata. The ascomatal wall is apically dark brown and thickened, becoming dark brown to pale brown at the base and pseudoparenchymatous in structure. The hymenial gel is hemiamyloid, showing an ILugol (1:6) + bluish reaction and ILugol + red to red-violet. Periphyses and periphysoids are numerous and distinct, while paraphysoids are more or less evident. Asci are clavate or broadly cylindrical, thick-walled, and of the *Verrucaria*-type (Triebel, 1993).

Navarro-Rosinés et al. (2010) introduced *Pseudopyrenidium*, typified by *P. tartaricola* (Lindsay) Nav.–Ros., Zhurb. & Cl. Roux, and suggested placing it within *Adelococcaceae*. However, when Etayo et al. (2021) described a second species, *Pseudopyrenidium epipertusariae*, and published molecular data, phylogenetic analyses indicated that *Pseudopyrenidium* is more closely related to *Acericola*, *Melanomma*, and *Jeremyomyces* within Phaeosphaeriaceae.

Although Hyde et al. (2024) placed *Pseudopyrenidium* within Adelococcaceae, molecular evidence supports its placement within Phaeosphaeriaceae, making this classification more scientifically accurate. Consequently, Adelococcaceae currently includes only two recognized genera: *Adelococcus*, comprising four species, and *Sagediopsis*, comprising 12 species. All members of these two genera are lichenicolous.

Type genus: *Adelococcus* Theiss. & Syd.

Adelococcus Theiss. & Syd. (4)

Index Fungorum: 76, faceoffungi, MycoBank, GenBank

Classification: Adelococcaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

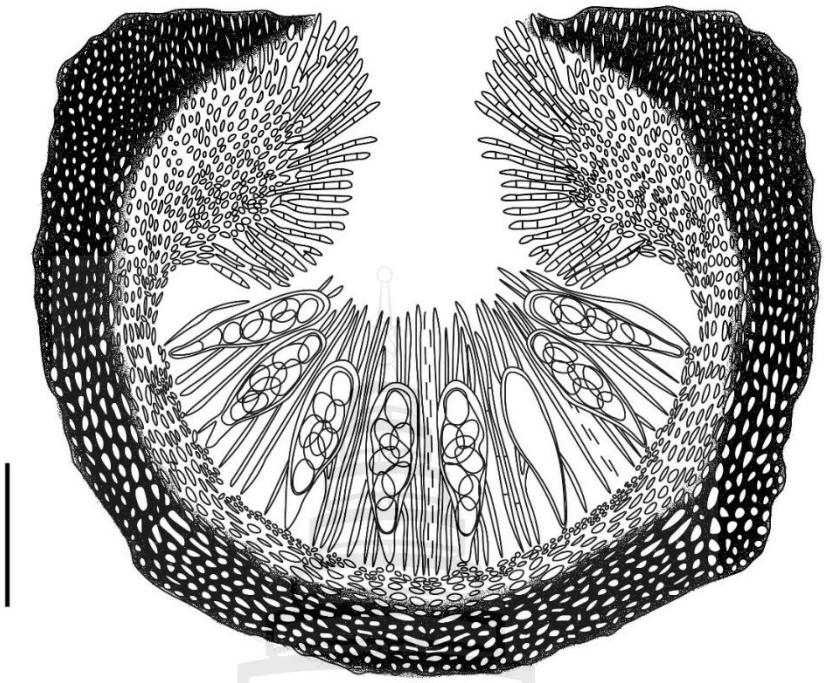
Adelococcus was established by Theissen & Sydow (1918) to accommodate the type species *A. alpestris*, which was transferred from *Rosellinia alpestris* Zopf. This genus is characterized by black, perithecioid ascomata that erupt from the thallus or fruiting bodies of the host. The longitudinal section of ascomata shows them to be spherical, cylindrical, or short and broad pear-shaped, with a broad, flat truncated apex

and a brown wall. The non-fissitunicate asci are bulging to broadly cylindrical, short-stalked, broadly rounded at the apex, and 8-spored. The ascospores are usually 1-celled, rarely 2-celled with a media transverse septum, elliptical, hyaline and finely haloed when young, and brown and microrugulate when mature (Matzer et al., 1990). Currently, four species are classified within this genus, all are lichenicolous, and three of which grow on crustose lichens, including: *Adelococcus alpestris* on *Acarospora glaucocarpa* and *A. macrospora*; *Adelococcus interlatens* on *Clauzadea immersa, Hymenelia prevostii* and *Sarcogyne regularis*; and *Adelococcus porocyphi* on *Porocyphus rehmicus*. Only *Adelococcus immersus* grows on the foliose lichen *Dermatocarpon biennense*. To date, no sequence is available in GenBank.

Type species: *Adelococcus alpestris* (Zopf) Theiss. & Syd.

Table 2.76 Accepted lichenicolous species of *Adelococcus*

	Species name	**Host**	**References**	**Remarks**
1	*Adelococcus alpestris* (Zopf) Theiss. & Syd.	*Acarospora glaucocarpa* and *A. macrospora*	(Theissen et al., 1918a)	= *Rosellinia alpestris* Zopf
2	*Adelococcus immersus* Etayo & Breuss	*Dermatocarpon biennense*	(Etayo & Breuss, 1998)	
3	*Adelococcus interlatens* (Arnold) Matzer & Hafellner	*Clauzadea immersa, Hymenelia prevostii, Sarcogyne regularis*	(Matzer et al., 1990)	= *Verrucaria interlatens* Arnold
4	*Adelococcus porocyphi* S. Zelanko & S. Y. Kondr.	*Porocyphus rehmicus*	(Kondratyuk & Zelenko, 2002)	



Note Section of ascomata. Scale bar = 50 μm.

Source Redrawn from Matzer et al. (1990)

Figure 2.64 *Adelococcus alpestris*

Sagediopsis Sacc. ex Vainio (12)

Index Fungorum: 4825, faceoffungi, MycoBank, GenBank

Classification: Adelococcaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Synonymy: *Metasphaeria* subgen. *Sagediopsis* Sacc. & D. Sacc., Syll. fung. (Abellini) 17: 705 (1905)

The genus name *Sagediopsis* was originally introduced by Saccardo (1905) as a subgenus of *Metasphaeria* Sacc. to accommodate seven lichenicolous pyrenomycetes, six of which were transferred to other genera. Vainio (1921) elevated it to genus status with the species *Sagediopsis tartarina*, which had been transferred from *Verrucaria tartarina* Nyl. This species was later reclassified as *S. campsteriana* by Alstrup et al.

(1990). *Sagediopsis koerberi* was designated as the type species by Clements & Shear (1931), which was initially described as *Leptosphceria koerberi* by Stein in Cohn (1879) and subsequently transferred to *Metasphaeria koerberi* by Schrot in Sacc. (1905). However, this species is not listed in MycoBank, and *Catocarpus koerberi* Stein was mistakenly recorded as its basionym in Index Fungorum, this error may have occurred because both species were introduced in the same publication.

This genus is characterized by dark brown, perithecioid ascomata with a distinctive pseudoparenchymatous ascomatal wall structure. It features somewhat distinct paraphysoids, along with numerous periphysoids and periphyses. The asci are clavate, thick-walled, 8-spored, and of the *Verrucaria* type. The ascospores vary significantly in shape and septation. According to Vainio (1921), the spores are colorless, oblong or fusiform-oblong, eventually becoming 3- or more septate, with non-lenticular cells. *Sagediopsis* was initially placed within Sphaeriaceae (Sphaeriales) by Clements & Shear (1931). Matzer & Hafellner (1990) expanded the concept of the Verrucariales by including the lichenicolous genus *Adelococcus* Theissen & Sydow, characterized by more or less persistent interascal filaments, within this order. Given its close relationship to *Adelococcus*, *Sagediopsis* is also considered part of the Verrucariales (Matzer et al., 1990; Triebel, 1993).

After the genus was established, Triebel (1989) transferred two species: *S. aquatica* from *Gongylia aquatica* Stein and *S. barbara* from *Segestria barbara* Th. Fr. Subsequently, three species were transferred from other genera, and six new species were introduced. Currently, the genus comprises 12 species, all of which are lichenicolous, primarily growing on crustose lichens such as *Acarospora*, *Aspicilia*, *Ionaspis*, *Koerberiella*, *Ochrolechia*, *Paraporpidia*, *Pertusaria*, *Porpidia*, and *Rhizocarpon*.

Type species: *Sagediopsis koerberi* (Stein) Clem. & Shear

= *Leptorhaphis koerberi* Stein

Table 2.77 Accepted lichenicolous species of *Sagediopsis*

	Species name	Host	References	Remarks
1	*Sagediopsis aquatica* (Stein) Triebel	*Koerberiella wimmeriana*	(Triebel, 1989)	= *Gongylia aquatica* Stein
2	*Sagediopsis aspiciliae* (Zopf ex Sacc. & D. Sacc.) Nik. Hoffm. & Hafellner	*Aspicilia myrinii*	(Hoffmann et al., 2000)	= *Physalospora aspiciliae* Zopf ex Sacc. & D. Sacc.
3	*Sagediopsis barbara* (Th. Fr.) R. Sant. & Triebel	*Porpidia glaucophaea*	(Triebel, 1989)	= *Segestria barbara* Th. Fr.
4	*Sagediopsis bayozturkii* Halıcı, Güllü & Parnikoza	*Acarospora mycrocyclos*	(Halıcı et al., 2017)	
5	*Sagediopsis campsteriana* (Linds.) D. Hawksw. & R. Sant.	*Ochrolechia*	(Alstrup et al., 1990)	= *Verrucaria campsteriana* Linds.
6	*Sagediopsis dissimilis* Triebel	*Paraporpidia leptocarpa*	(Triebel, 1993)	
7	*Sagediopsis epimalvinae* Etayo, T.B. Wheeler & Fryday	*Aspicilia malvinae*	(Fryday et al., 2021)	

Table 2.77 (continued)

	Species name	Host	References	Remarks
8	*Sagediopsis fissurisedens* Hafellner	*Aspicilia myrinii*	(Hafellner, 1993b)	
9	*Sagediopsis koerberi* (Stein) Clem. & Shear	*Koerberiella wimmeriana*	(Cohn 1879b; Clements et al., 1931)	= *Catocarpus koerberi* Stein
10	*Sagediopsis lomnitzensis* (Stein) Orange	*Ionaspis lacustris and I. odora*	(Orange, 2002)	= *Arthopyrenia lomnitzensis* Stein
11	*Sagediopsis pertusariicola* Zhurb.	*Pertusaria*	(Zhurbenko, 2009b)	
12	*Sagediopsis vasilyevae* Zhurb.	*Rhizocarpon*	(Zhurbenko & Yakovchenko, 2014)	

Family Sarcopyreniaceae Nav.-Ros. & Cl. Roux

Sarcopyreniaceae Nav.-Ros. & Cl. Roux

Index Fungorum: 881987, faceoffungi, MycoBank, GenBank

Classification: Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Sarcopyreniaceae was introduced by Nav.-Ros. & Cl. Roux (1998) to accommodate the type genus *Sarcopyrenia* Nyl. This family is characterized by its non-lichenized, lichenicolous fungi that inhabit poorly developed crustose lichen thalli. The ascomata are black, highly prominent, ostiolate, and enclosed within a

paraplectenchymatous stroma surrounding an excipulum composed of two layers. The hamathecium consists of periphyses, short pseudoparaphyses, and evanescent paraphysoids originating from the paraplectenchymatous centrum. The asci are unitunicate, thin-walled, with a moderately thick tholus, lacking a conspicuous apical apparatus, and are 8-spored. Dehiscence occurs through gelification of the ascus wall. The spores are simple or transversely multiseptate (restricted to the width), colorless, elongate (ranging from bacilliform to thread-like), and often somewhat helicoid (Navarro-Rosinésv et al., 1998).

Nav.-Ros. & Cl. Roux (1998) placed this family within *Verrucariales*. However, due to the lack of molecular data, the phylogenetic position of this monotypic family remains uncertain, and it continues to be retained within *Verrucariales*.

Type species: *Sarcopyrenia* Nyl.

Sarcopyrenia Nyl. (12)

Index Fungorum: 4853, faceoffungi, MycoBank, GenBank

Classification: Sarcopyreniaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Synonymy:

= *Hassea* Zahlbr., Beih. Botan. Centralbl., Abt. B 13: 150 (1902)

= *Sarcopyreniomyces* Cif. & Tomas., Atti Ist. bot. Univ. Lab. crittog. Pavia, sér. 5 10(1): 32, 60 (1953)

= *Sarcopyreniopsis* Cif. & Tomas., Atti Ist. bot. Univ. Lab. crittog. Pavia, sér. 5 10(1): 36, 60 (1953)

Sarcopyrenia was established by Nylander in 1858 with a single species, *S. gibba*, designated as the type species. The species of this genus primarily grow on saxicolous crustose lichens such as *Acarospora, Aspicilia, Caloplaca*, *candelariella*, *Lecania*, *Lichinella*, *Protoblastenia*, *Thelidium* and saxicolous lichens of Verrucariaceae. The distinguishing characteristics of this genus are the hemispherical

apothecia with a thick wall composed of two layers, and colorless spores with an elongated cylindrical shape, more or less slightly curved, worm-like in type species.

Based on the original description, *Sarcopyrenia* had traditionally been treated within the family Verrucariaceae (Verrucariales). Navarro-Rosinés et al. (1998) compared the structure of the ascomata of *Sarcopyrenia* with other genera in the family Verrucariaceae and proposed the new family Sarcopyreniaceae Nav.-Ros. & Cl. Roux within the order Verrucariales.

For a long time, *Sarcopyrenia gibba* was the only species in this genus and was widely considered as a lichen by most authors (Zahlbruckner 1922-1924; Poelt et al., 1969; Clauzade et al., 1985). It wasn't until revisions by Clauzade et al. (1989), Navarro-Rosinés & Hladun (1990), and Aguirre-Hudson (1991) that *Sarcopyrenia* was recognized as a genus of lichenicolous fungi. Since then, the number of recognized taxa has progressively increased. Navarro-Rosinés & Hladun (1990) described *S. bacillospora* on *Thelidium* and *Verrucaria*, and combined *S. beckhausina S. cylindrospora*, and *S. gibba* var. *geisleri*, primarily found on various saxicolous crustose lichens. Navarro-Rosinés et al. (1998, 2009) further described *S. acutispora*, *S. baetica*, *S. lichinellae* and *S. pluriseptata*. Lendemer et al. (2013) introduced the new species *S. calcarea*, which grows on *Protoblastenia rupestris*. Most recently, Cannon et al. (2023) combined *S. geisleri* from *Lithosphaeria geisleri* Beckh. ex Körb., which grows on *Caloplaca*. To date, there are 12 species in this genus, all of which are lichenicolous.

Type species: *Sarcopyrenia gibba* Nyl.

Table 2.78 Accepted lichenicolous species of *Sarcopyrenia*

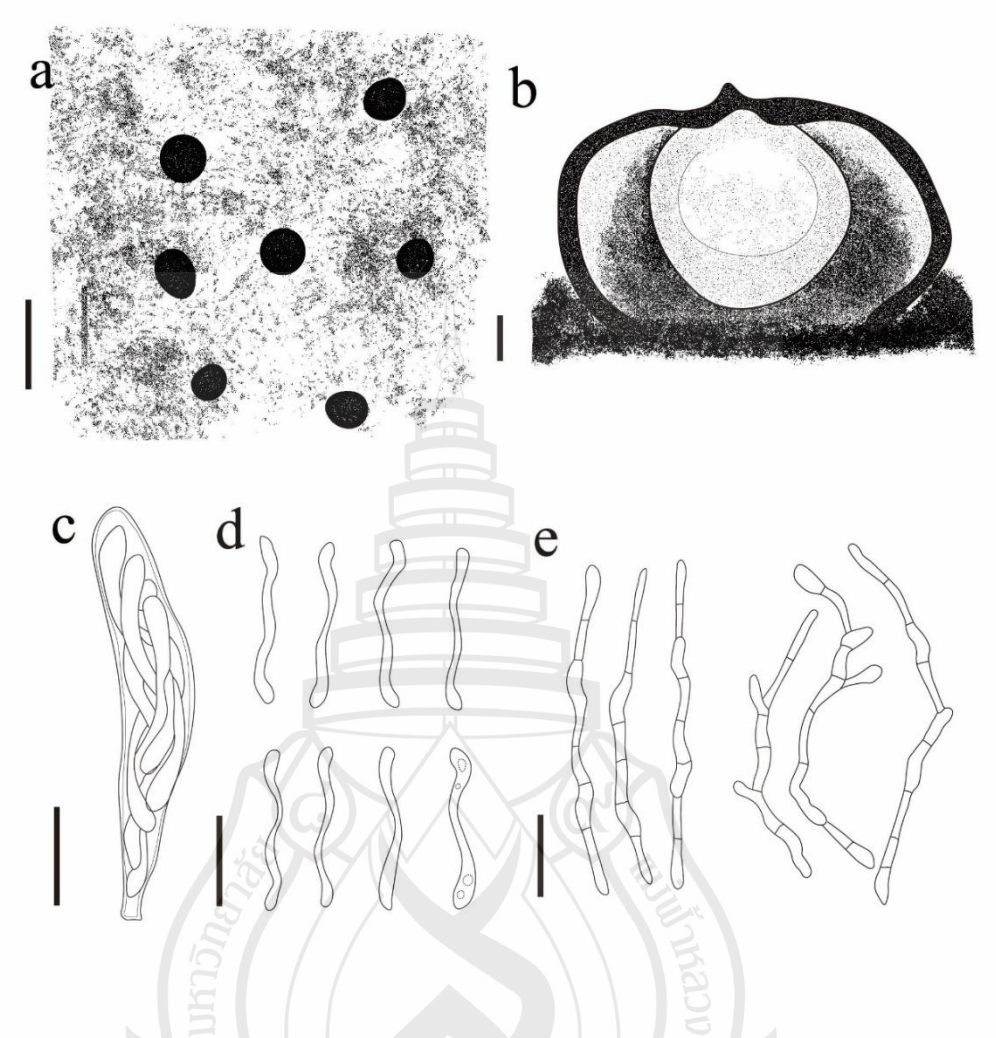
	Species name	Host	References	Remarks
1	*Sarcopyrenia acutispora* Nav.-Ros. & Cl. Roux	*Bagliettoa calciseda*	(Navarro-Rosinés et al., 1998)	

Table 2.78 (continued)

	Species name	Host	References	Remarks
2	*Sarcopyrenia bacillosa* (Nyl.) Nav.-Ros. & Hladun	Saxicolous lichens	(Diederich, 2004b)	= *Verrucaria bacillosa* Nyl.
3	*Sarcopyrenia bacillospora* Nav.-Ros. & Hladun	*Thelidium* and *Verrucaria*	(Navarro-Rosinés et al., 1990)	
4	*Sarcopyrenia baetica* Nav.-Ros. & Hladun	*Lecania* cf. *erysibe*	(Navarro-Rosinés et al., 2009)	
5	*Sarcopyrenia beckhausiana* (J. Lahm) M. B. Aguirre, Nav.-Ros. & Hladun	Saxicolous lichens, mainly Verrucariaceae	(Navarro-Rosinés et al., 1990)	= *Leptorhaphis beckhausiana* J. Lahm
6	*Sarcopyrenia calcarea* Lendemer & R.C. Harris	*Protoblastenia rupestris*	(Lendemer et al., 2013)	
7	*Sarcopyrenia cylindrospora* (P. Crouan & H. Crouan) M. B. Aguirre	*Circinaria* cf. *contorta, Candelariella vitellina*	(Navarro-Rosinés et al., 1990)	= *Verrucaria cylindrospora* P. Crouan & H. Crouan
8	*Sarcopyrenia geisleri* (Beckh. ex Körb.) P.F. Cannon	*Caloplaca*	(Cannon et al., 2023)	= *Lithosphaeria geisleri* Beckh. ex Körb.
9	*Sarcopyrenia gibba* Nyl.	Saxicolous lichens, incl. *Acarospora* and *Aspicilia*	(Nylander, 1858b)	

Table 2.78 (continued)

	Species name	Host	References	Remarks
10	*Sarcopyrenia lichinellae* Nav.-Ros. & Hladun	*Lichinella stipatula*	(Navarro-Rosinés et al., 2009)	
11	*Sarcopyrenia plurisepta* Nav.-Ros. & Cl. Roux	*Caloplaca variabilis*	(Navarro-Rosinés et al., 2009)	
12	*Sarcopyrenia sigmoideospora* Tretiach & Nav.-Ros.	*Verrucaria parmigera*	(Tretiach et al., 1996)	



Note a Perithecia on thallus. b Section of perithecium. c Ascus. d Ascospores. e Germinated spores. Scale bars: a = 2mm, b = 100 µm, c–e = 20 µm

Source Redrawn from Navarro-Rosinés et al. (1990) and Farkas et al. (2003)

Figure 2.65 *Sarcopyrenia gibba*

Family Verrucariaceae Eschw.

Bellemerella Nav.-Ros. & Cl. Roux (4)

Index Fungorum: 27839, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Bellemerella was introduced by Navarro & Roux (1997) to accommodate the

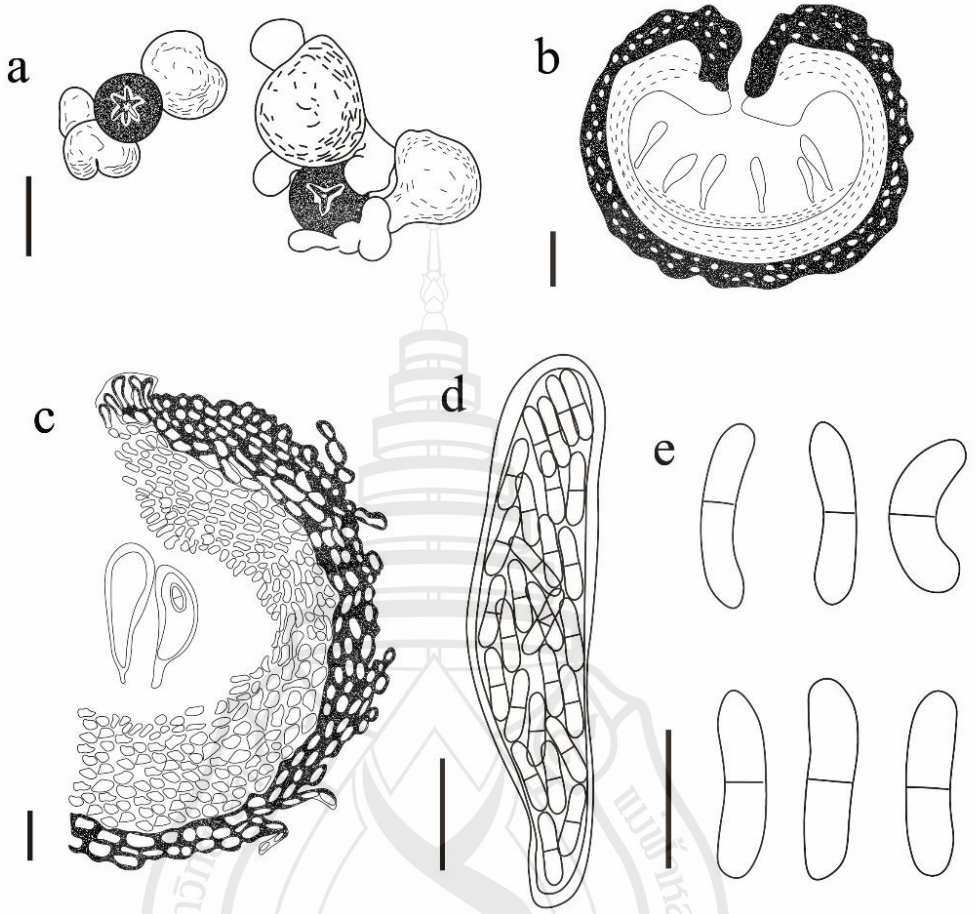
newly discovered species *B. trapeliae*, which grows on *Trapelia involute* (Tayl.) Hertel. The genus is characterized by perithecioid ascomata with a globular shape and a black coloration and elongate-clavate or subcylindrical, bitunicate asci with abundant colorless spores. Among lichenicolous fungi with perithecioid ascomata, three genera have multispored asci. Two of these, *Rosellinula* R. Sant. and *Muellerella* Hepp ex Müll. Arg. contain numerous brown spores per ascus, while the spores of *Bellemerella* are colorless for a long time and only eventually turn light brown (Navarro et al., 1997).

Calatayud & Navarro-Rosinés (2001) introduced two additional species to this genus: *Bellemerella acarosporae* on *Acarospora fuscata* and *B. polysporinae* on *Polysporina simplex*. These new species differ in ascospore characteristics, with *B. polysporina* having larger ascospores and *B. acarosporae* having medialy septate ascospores. Pérez-Ortega & Spribille (2007) introduced the fourth species of this genus, *Bellemerella ritae*, which grows on *Xylographa* sp. To date, there are four species in this genus, and no molecular data are available in Genbank.

Type species: *Bellemerella trapeliae* Nav.-Ros. & Cl. Roux

Table 2.79 Accepted lichenicolous species of *Bellemerella*

	Species name	**Host**	**References**
1	*Bellemerella acarosporae* Calat. & Nav.-Ros.	*Acarospora fuscata*	(Calatayud & Navarro-Rosinés, 2001)
2	*Bellemerella polysporinae* Calat. & Nav.-Ros.	*Polysporina simplex*	(Calatayud & Navarro-Rosinés, 2001)
3	*Bellemerella ritae* Pérez-Ortega & T. Sprib.	*Xylographa*	(Pérez-Ortega et al., 2007)
4	*Bellemerella trapeliae* Nav.-Ros. & Cl. Roux	*Trapelia involute*	(Navarro et al., 1997)



Note a Ascomata on the verrucose squamules. b–c Vertical section of ascoma. d Ascus. e Ascospores. Scale bars: a = 150 μm, b–d = 10 μm, e = 5 μm.

Source Redrawn from Navarro et al. (1997)

Figure 2.66 *Bellemerella trapeliae*

Clauzadella Nav.-Ros. & Cl. Roux (1)

Index Fungorum: 27692, faceoffungi, MycoBank, GenBank

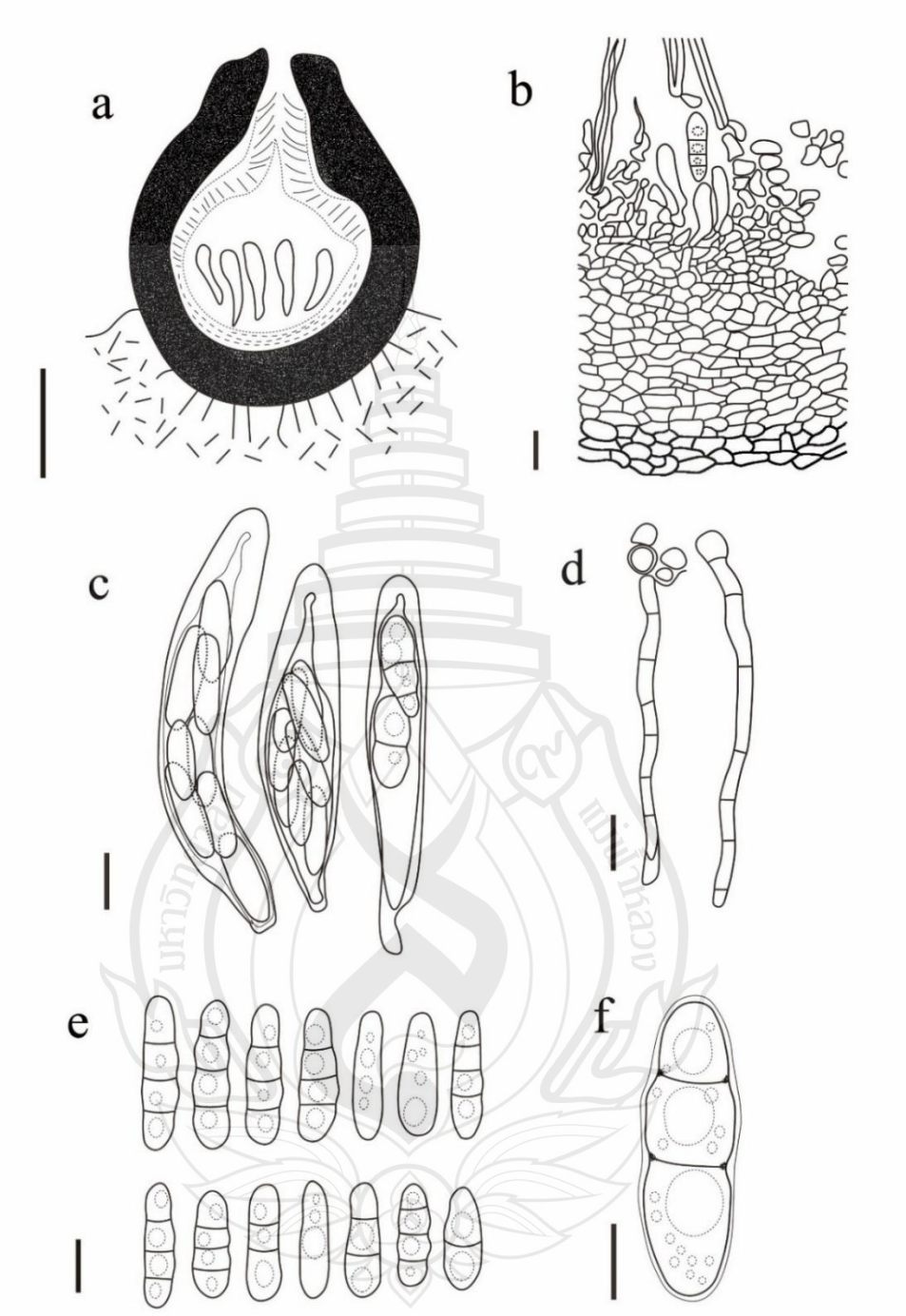
Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Clauzadella was introduced by Navarro-Rosinés & Roux (1996) to accommodate the only species *C. gordensis* which grows on *Verrucaria viridula*. This

genus is characterized by perithecioid, subglobular ascomata with a violet-pigmented excipulum, and elongate-clavate, eight-spored asci with colorless triseptate spores.

Due to this genus affinities with *Stigmidium*, Navarro-Rosinés & Roux (1996) initially attempted to place *Claduzdella* in the same family, Mycosphaerellaceae (Dothideales), according to the viewpoint of Eriksson and Hawksworth (1993). However, the systematic position of *Stigmidium* is controversial due to the differences in periphysate structures and supramycelium. Roux & Triebel (1994) considered *Stigmidium* to be closer to the Verrucariaceae (Verrucariales). In several respects, *Clauzadella* is intermediate between typical Verrucariaceae and *Stigmidium*, a viewpoint confirmed by Roux & Triebel (1994). Navarro-Rosinés & Roux (1996) argued that these differences were not significant enough to warrant a separate family designation. Therefore, they proposed that both *Clauzadella* and *Stigmidium* be placed in the family Verrucariaceae. To date, no molecular data are available for these two genera in Genbank, so their precise familial placement requires further study. In the meantime, we tentatively accept the placement of *Clauzadella* within Verrucariaceae.

Type species: *Clauzadella gordensis* Nav.-Ros. & Cl. Roux, On *Verrucaria viridula* (Navarro-Rosinés & Roux 1996)



Note a Section of ascoma. b Detail of low part of ascoma. c Asci. d Vegetative hyphae. e–f Ascospores. Scale bars: a = 100 µm, b–e = 10 µm, f = 5 µm.

Source Redrawn from Navarro-Rosinés & Roux (1996)

Figure 2.67 *Clauzadella gordensis*

Endococcus Nyl. (55-58)

Index Fungorum: 1791, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Synonymy:

= *Discothecium* Zopf, Nova Acta Acad. Caes. Leop.-Carol. German. Nat. Cur. 70(2): 131 (1897)

= *Pseudoendococcus* Marchand, Énum. Méth. Rais Fam. Genres Mycophytes (Paris): 1-334 (1896)

= *Sorothelia* Körb., Parerga lichenol. (Breslau) 5: 471 (1865)

Endococcus was introduced by Nylander (1855) to accommodate two species. Among them, the type species *E. rugulosus* was transferred from *Verrucaria rugulosa* Borrer ex Leight., which is more like a lichen growing on a wall based on the original description. Nylander (1855) redescribed it as parasitic on *Verrucaria*, with globose, immersed, or partially emergent black perithecia, 8-spored asci, and brown or light blackish, oblong, uniseptate spores.

Three synonymy genera are listed under *Endococcus* in Species Fungorum. *Discothecium* Zopf was considered a synonym of *Endococcus* as its sole species *Discothecium stigma* (Körb.) Zopf transferred to *Endococcus*. This species underwent several nomenclatural changes. Initially introduced as *Tichothecium stigma* by Körber (1865), it was later transferred to *Microthelia stigma* by Jatta (1892). Zopf (1897) established the new genus *Discothecium* and combined this species as its type. Olivier (1907) combined it into *Endococcus stigma*. This species is now considered synonymous with *E. macrosporus* (Hepp ex Arnold) Nyl. Marchand (1896) introduced *Pseudoendococcus*, which was later synonymized with *Endococcus*. Körber (1865) introduced *Sorothelia* with the species *S. confluens*, which grows on *Phlyctis orgena*. Currently, this genus is also considered a synonym of *Endococcus*.

Endococcus includes 58 species, with 55 being lichenicolous and three being lichens (Index Fungorum). In the 1800s, only 15 species were recognized in this genus, including four combinations and two non-lichenicolous species. These species primarily grow on crustose lichens such as *Bacidia*, *Buellia*, *Graphis*, *Lecanora*, *Lecidea*, *Rhizocarpon* (Ohlert, 1870; Leighton, 1871; Nylander, 1872; Nylander, 1873; Arnold, 1874c; Lamy, 1878; Wainio, 1878; Nylander, 1879b). Only one species, *Endococcus nanellus* Ohlert, grows on the fruticose lichen *Stereocaulon* (Ohlert, 1870).

In the 1900s, six new species were introduced, and six were combined from other genera. Of these, five species grow on crustose lichens and other seven grow on foliose or fruticose lichens such as *Alectoria*, *Collema*, *Platismatia*, *Ramalina*, *Usnea*, *Zahlbrucknerella* (Hawksworth, 1979b; Alstrup, 1993a; Hafellner, 1994a; Santesson, 1994b; David & Etayo, 1995; Sérusiaux et al., 1999). In the 21st century, 31 species have been added in the last 24 years. Most are new species, except for three combinations: *Endococcus sendtneri* (Arnold) Hafellner from *Tichothecium calcaricola* var. *sen*

dtneri Arnold, *Endococcus hafellneri* (Zhurb.) Zhurb. From *Stigmidium hafellneri* Zhurb. and *Endococcus umbilicariae* (Linds.) Hafellner from *Microthelia umbilicariae* Linds.

The systemic status of *Endococcus* had been classified as Dothideomycetes genera incertae sedis since its establishement. Jayasiri et al. (2016) re-examined the type species of this genus, *Endococcus rugulosus*, provding a detailed description and illustration. During this examination, they placed the genus in the family Lichenotheliaceae, a view accepted by Wijayawardene (2018). However, Wijayawardene (2020) placed *Endococcus* in the family Verrucariaceae. Then,

To date, there are only two sequences of this genus available in GenBank, and no phylogenetic analysis has been published. Therefore, the precise systematic location of this genus will require further analysis as more sequences become available.

Type species: *Endococcus rugulosus* (Borrer ex Leight.) Nyl.

=*Verrucaria rugulosa* Borrer ex Leight.

Table 2.80 Accepted lichenicolous species of *Endococcus*

	Species	**Host**	**References**	**Remarks**
1	*Endococcus alectoriae* (D. Hawksw.) D. Hawksw.	*Alectoria ochroleuca*	(Hawksworth , 1979b)	=*Tichothecium alectoriae* D. Hawksw.
2	*Endococcus apiciicola* (J. Steiner) R. Sant.	*Usnea submollis var. ferroensis*	(Santesson, 1994b)	=*Sorothelia apicicola* J. Steiner
3	*Endococcus brachysporus* (Zopf) M. *Brand* & Diederich	*Porpidia, Rhizocarpon excentrici*	(Sérusiaux et al., 1999)	=*Tichothecium gemmiferum* var. *brachysporum* Zopf
4	*Endococcus caesiocinereae* Diederich, Cl. Roux & M. Brand	*Aspicilia caesiocinerea*	(Roux et al., 2023)	
5	*Endococcus calcareus* Nyl.	*Lecanora calcarea*	(Crombie, 1871)	
6	*Endococcus caudisporus* J. C. David & Etayo	*Collema auriforme*	(David & Etayo, 1995)	

Table 2.80 (continued)

	Species	Host	References	Remarks
7	*Endococcus cladiae* Zhurb. & Pino-Bodas	*Cladia sullivanii*	(Zhurbenko & Pino-Bodas, 2015)	
8	*Endococcus collematis* Brackel	*Lathagrium auriforme*	(Brackel, 2021a)	
9	*Endococcus complanatae* Arnold	*Lecanora complanata*	(Gesellschaft, 1873)	
10	*Endococcus epiacarosporus* Cl. Roux	*Acarospora impressula*	(Roux et al., 2020b)	
11	*Endococcus exerrans* Nyl.	*Rhizocarpon*	(Nylander, 1879b)	
12	*Endococcus freyi* Hafellner	*Umbilicaria cylindrica*	(Hafellner, 2019b)	
13	*Endococcus fusiger* Th. Fr. & Almq.	*Rhizocarpon geminatum*	(Fries, 1867c)	
14	*Endococcus gennarii* Cl. Roux, Diederich & Schiefelb.	*Rinodina gennarii*	(Roux et al., 2023)	
15	*Endococcus graphidicolus* Leight.	*Graphis anguilliformis*	(Leighton, 1871)	
16	*Endococcus grumantianus Zhurbenko*	*Steinia geophana*	(Zhurbenko, 2022b)	

Table 2.80 (continued)

	Species	Host	References	Remarks
17	*Endococcus hafellneri* (Zhurb.) Zhurb.	*Flavocetraria cucullata*	(Zhurbenko et al., 2019)	=*Stigmidium hafellneri* Zhurb.
18	*Endococcus hafellnerianus Motiejunaite*, Suija & Kantvilas	*Parasiphula georginae*	(Motiejunaite et al., 2019)	
19	*Endococcus incrassatus* Etayo & *Breuss*	*Placidiopsis cinerascens*	(Etayo & Breuss, 2001)	
20	*Endococcus janae* K. Knudsen	*Acarospora rhabarbarina*	(Knudsen, 2008)	
21	*Endococcus karlstadtensis* Kocourk. & *Brackel*	*Endocarpon pusillum*	(Von Brackel et al., 2006)	
22	*Endococcus lichenicolus* (A. Massal.) Arnold	*Pachyospora viridescens*	(Arnold, 1874c)	=*Dothidea lichenicola* A. Massal.
23	*Endococcus macrosporus* (Hepp ex *Arnold*) Nyl.	*Rhizocarpon, Buellia alpicola, Lecidea geographica*	(Lamy, 1878)	=*Tichothecium macrosporum* Hepp ex *Arnold*
24	*Endococcus matzeri* D. Hawksw. & Iturr.	*Buellia muscicola*	(Hawksworth & Iturriaga, 2006)	

Table 2.80 (continued)

	Species	Host	References	Remarks
25	*Endococcus microphorus* (Nyl.) *Nyl*.	Various crustose lichens	(Nylander, 1896)	=*Endococcus erraticus* subsp. *microphorus* Nyl.
26	*Endococcus montanus* Brackel	*Lecanora polytropa*	(Brackel, 2023)	
27	*Endococcus nanellus* Ohlert	*Stereocaulon*	(Ohlert, 1870)	
28	*Endococcus oreinae* Hafellner	*Dimelaena oreina*	(Hafellner et al., 2002)	
29	*Endococcus oropogonicola* Etayo	*Oropogon*	(Etayo, 2002a)	
30	*Endococcus pallidosporus* Etayo	*Pseudocyphellaria lechleri*	(Etayo & Sancho, 2008)	
31	*Endococcus parentium* Etayo	*Pseudocyphellaria freycinetii*	(Etayo & Sancho, 2008)	
32	*Endococcus parmeliarum* Etayo	*Parmelia saxatilis*	(Etayo & Sancho, 2008)	
33	*Endococcus peltigericola* Zhurb. & Stepanchikova	*Peltigera membranacea*	(Zhurbenko et al., 2012)	
34	*Endococcus perminutus* Vain.	*Bacidia subincompta*	(Wainio, 1878)	
35	*Endococcus physciae* Y. Joshi	*Physcia gomukhensis*	(Joshi, 2018)	

Table 2.80 (continued)

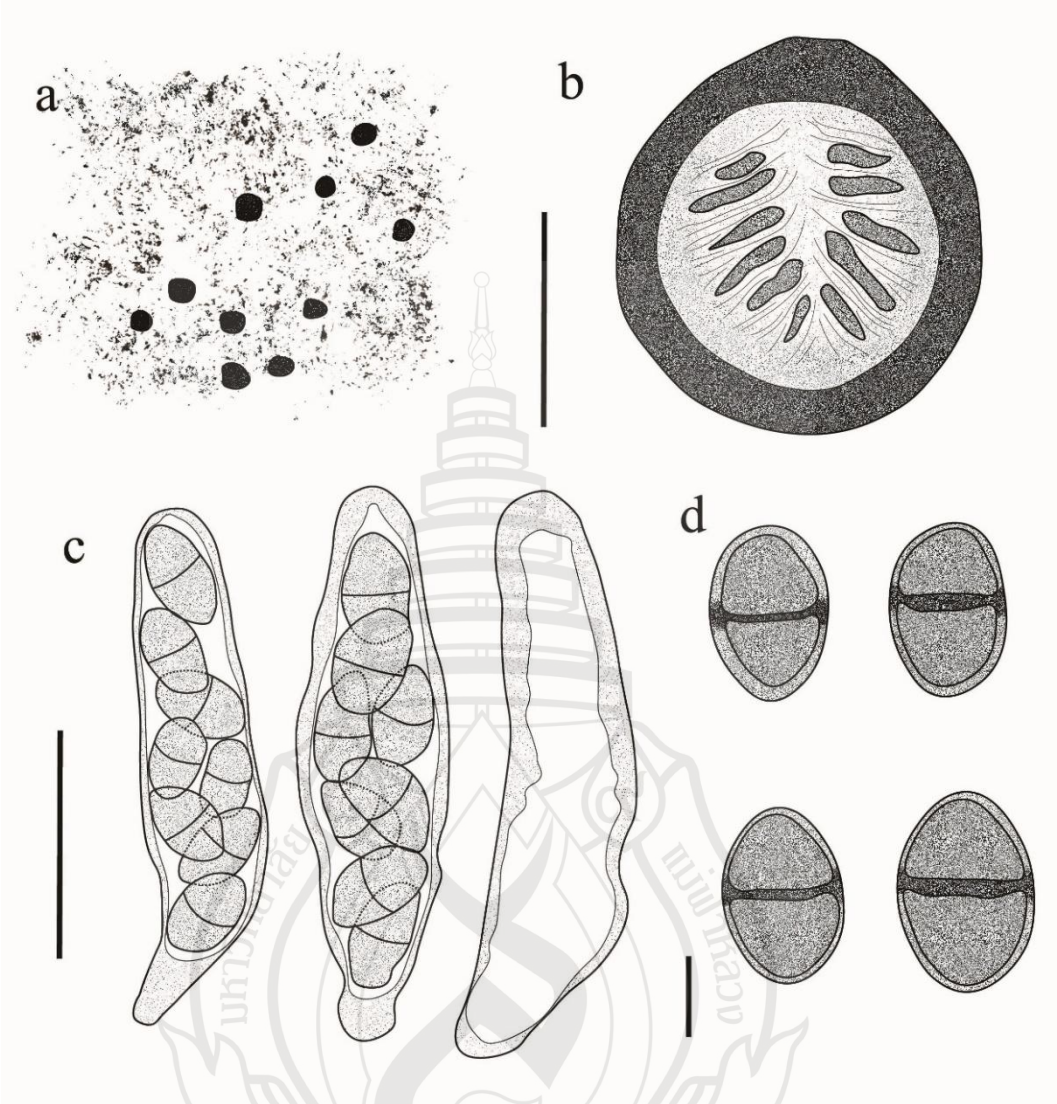
	Species	Host	References	Remarks
36	*Endococcus propinquus* (Körb.) *Trevis*.	*Porpidia tuberculosa*	(Hawksworth, 1979b)	=*Microthelia propinqua* Körb.
37	*Endococcus protoblasteniae* Diederich	*Protoblastenia rupestris*	(Sérusiaux et al., 1999)	
38	*Endococcus pseudocyphellariae* Etayo	*Pseudocyphellaria coriifolia* (also *Nephroma*)	(Etayo & Sancho, 2008)	
39	*Endococcus ramalinarius* (*Lindsay*) D. Hawksw.	*Ramalina leiodea*	(Hawksworth, 1979b)	=*Microthelia ramalinaria* Linds.
40	*Endococcus rugulosus* (Borrer ex Leight.) *Nyl*.	*Verrucaria,* other saxicolous lichens	(Nylander, 1855)	=*Verrucaria rugulosa* Borrer ex Leight.
41	*Endococcus sardous* Brackel	*Rhizocarpon geographicum*	(Brackel et al., 2019)	
42	*Endococcus sendtneri* (Arnold) Hafellner	*Polyblastia sendtneri*	(Hafellner et al., 2008)	=*Tichothecium calcaricola* var. *sendtneri* Arnold
43	*Endococcus sipmanii* Etayo	*Heterodermia*	(Etayo, 2017)	

Table 2.80 (continued)

	Species	Host	References	Remarks
44	*Endococcus thamnoliae* Etayo & R. Sant.	*Thamnolia*	(Etayo, 2010a)	
45	*Endococcus thelommatis* Kocourk. & K. Knudsen	*Thelomma santessonii*	(Kocourková et al., 2011)	
46	*Endococcus tricolorans* Alstrup	*Platismatia glauca*	(Alstrup, 1993b)	
47	*Endococcus triphractus* Nyl.	*Lecidea umbonatulae*	(Nylander, 1872)	
48	*Endococcus triplicantis* Nyl.	*Lecidea triplicantem*	(Haftet, 1883)	
49	*Endococcus truncatus* Cl. Roux & Diederich	*Porpidia albocaerulescens*	(Roux et al., 2023)	
50	*Endococcus umbilicariae* (Linds.) Hafellner	*Microthelia umbilicariae*	(Hafellner, 2019b)	=*Microthelia umbilicariae* Linds.
51	*Endococcus variabilis* Halıcı, Kocourk. & Diederich	*Staurothele areolata*	(Halıcı et al., 2007)	
52	*Endococcus verrucisporus* Alstrup	*Ionaspis lacustris*	(Alstrup et al., 1992)	

Table 2.80 (continued)

	Species	Host	References	Remarks
53	*Endococcus verrucosus* Hafellner	*Aspicilia lacustris*	(Hafellner, 1994a)	
54	*Endococcus xanthoparmeliae* Y. Joshi, S. Y. Kondr., L. Lökös & Hur	*Xanthoparmelia coreana*	(Joshi et al., 2015)	
55	*Endococcus zahlbrucknerella* (Henssen) D. Hawksw.	*Zahlbrucknerella calcarea*	(Hawksworth, 1979b)	=*Tichothecium zahlbrucknerella e* Henssen



Note a Ascomata on host substrate. b Section of ascoma. c Asci. d Ascospores. Scale bars: b = 60 μm, c = 20 μm, d = 10 μm.

Source Redrawn from Jayasiri et al. (2016)

Figure 2.68 *Endococcus rugulosus*

Haleomyces D. Hawksw. & Essl. (1)

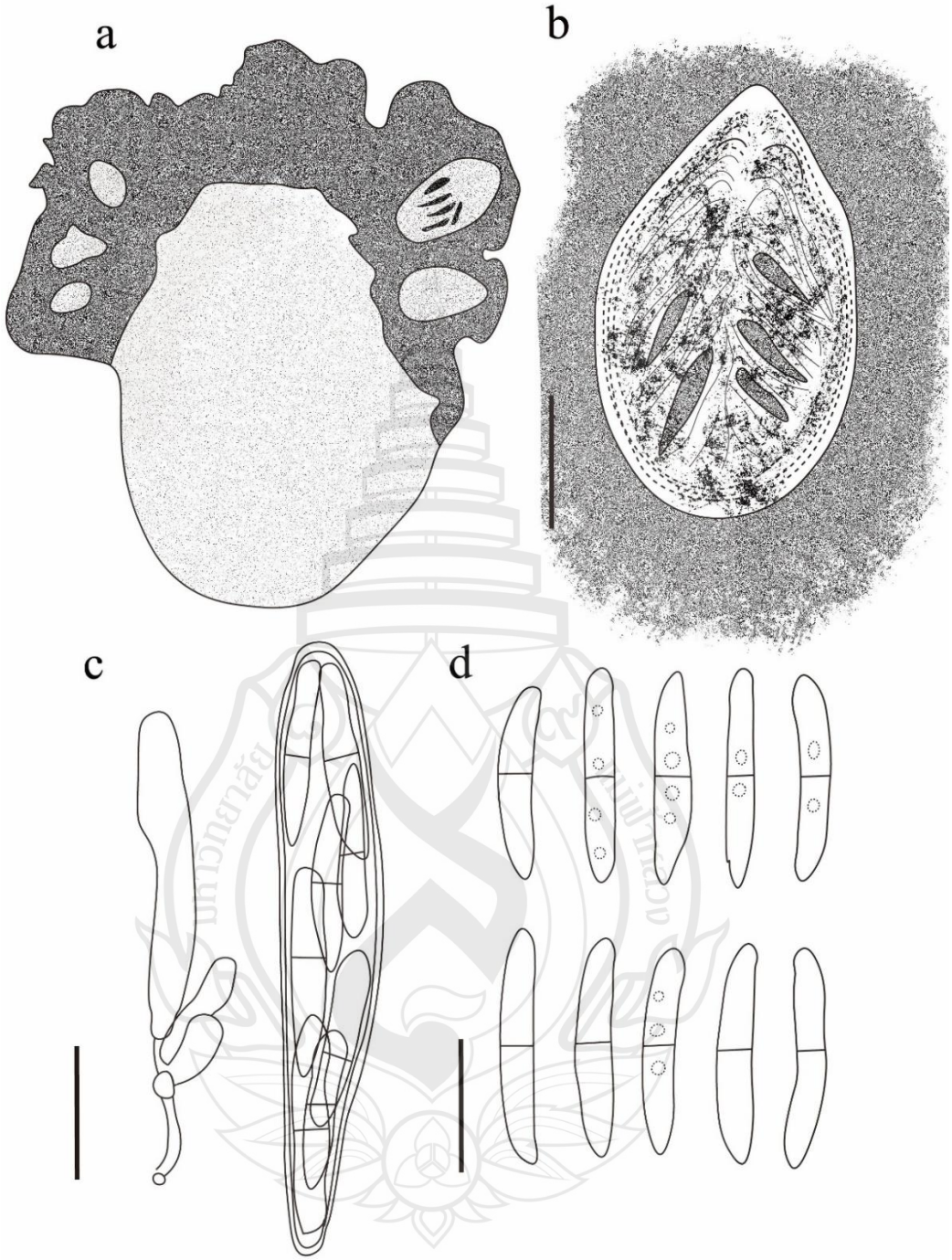
Index Fungorum: 27193, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Haleomyces was introduced by Hawksworth & Esslinger (1993) to accommodate the only lichenicolous species *H. oropogonicola*, which grows on the fruticose lichen *Oropogon lopezii* on the tree. *Haleomyces* is characterized by subgolobose to ovoid ascomata that are brown to black, ostiolate, aggregated into a common stroma. It has a multilayered exciple and tends to exhibit periphysoidal periphyses. The asci are subcylindrical to elongate-clavate, not fissitunicate, and contain 8 spores. The ascospores are hyaline, more or less fusiform, 1-septate and irregularly distichous (Hawksworth et al., 1993).

Due to *Haleomyces* exhibiting an unusual combination of characters, Hawksworth tentatively referred to this genus as Verrucariales but did not specify a family. Lumbsch (2007, 2010) placed this genus within Verrucariaceae, albeit with a question mark. Wijayawardene (2018, 2020, 2022) accepted the placement of this genus in the family Verrucariaceae (Verrucariales). To date, no molecular data of this genus are available in GenBank, so the precise systemic location of this genus will require further study when molecular data become available.

Type species: *Haleomyces oropogonicola* D. Hawksw. & Essl., on *Oropogon lopezii* Essl.



Note a Vertical section of stroma on host thallus. b Vertical section of perithecium. c Asci. d Ascospores. Scale bars: b = 50 μm, c–d = 10 μm.

Source Redrawn from Hawksworth et al. (1993)

Figure 2.69 *Haleomyces oropogonicola*

Heteroplacidium Breuss (3-12)

Index Fungorum: 27734, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Heteroplacidium imbricatum* (Nyl.) Breuss

Table 2.81 Accepted lichenicolous species of *Heteroplacidium*

	Species name	Host	References	Remarks
1	*Heteroplacidium fusculum* (Clauzade & Cl.Roux)	*Aspicilia calcarea*	(Gueidan et al., 2007)	Lichen, juvenile parasite = *Verrucaria fuscula* Nyl.
2	*Heteroplacidium transmutans* K. Knudsen, Breuss & Kocourk.	*Acarospora socialis*	(Knudsen et al., 2014)	Lichen, juvenile parasite
3	*Heteroplacidium zamenhofianum* (Clauzade & Cl. Roux) Gueidan & Cl. Roux	*Staurothele areolata*	(Roux 2007; Roux et al., 2009)	lichenicolous lichen = *Verrucaria zamenhofiana* Clauzade & Cl. Roux

Halospora (Zschacke) Tomas. & Cif. (4)

Index Fungorum: 2211, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

= *Polyblastia* subgen. Halospora Zschacke, Hedwigia 55: 289 (1914)

Halospora was elevated from subgenus status within *Polyblastia* by Ciferri &

Tomaselli (1952). The species *Halospora deminuta*, initially classified as *Polyblastia deminuta* Arnold, was designated as the type species of this genus. This species had long been misidentified and considered a lichen. Roux et al. (2002) cited the original description without examining the specimen and reclassified it as *Merismatium deminutum*. However, Hafellner (2011) re-examined the materials, resurrecting *Halospora* from synonymy. He affirmed *Halospora* as the correct name for taxa with halonate ascospores and designated a lectotype and a paratype. He also proposed three combinations: *Halospora discrepans* from *Polyblastia deminuta* Arnold, *Halospora longispora* from *Merismatium deminutum* subsp. *longisporum* Cl. Roux & Nav.-Ros. And *Halospora scammoeca* from *Merismatium scammoecum* Lettau.

Halospora is characterized by perithecioid ascomata that are immersed to semi-immersed, scattered, black, with the ostiolar region flattened or not. The ascomata wall is dark brown to black-brown in the upper part, often with a greenish to purplish violet tinge, and pale brown in the lower part, with pigmentation fading towards the center. The asci are verrucarialean, broadly cylindrical to slightly clavate, with an apex surrounded by hemiamyloid gel, containing 8 spores. The ascospores are initially middle brown, becoming dark brown, and vary from subspherical to broadly ellipsoid, ovoid, or almost oblong. They are phragmospored to submuriform or muriform with transverse and longitudinal septa when mature, thick walled, and have a distinct perispore when young. These characters highlight verrucarealean lichenicolous *Polyblastia*-like species with thick-walled halonate ascospores and ascomata with a typically verrucarialean shape in longitudinal section (Hafellner, 2011).

Type species:

Halospora deminuta (Arnold) Tomas. & Cif.

= *Polyblastia deminuta* Arnold

Table 2.82 Accepted lichenicolous species of *Halospora*

	Species name	Host	References	Remarks
1	*Halospora deminuta* (Arnold) Tomas. & Cif.	*Hymenelia caerulea*	(Ciferri et al., 1952)	= *Polyblastia deminuta* Arnold
2	*Halospora discrepans* (Cl. Roux & Nav.-Ros.) Hafellner	*Protoblastenia rupestris*	(Hafellner, 2011)	= *Polyblastia discrepans* J. Lahm ex Arnold
3	*Halospora longispora* (Cl. Roux & Nav.-Ros.) Hafellner	On calcicolous lichen	(Hafellner, 2011)	= *Merismatium deminutum* subsp. *longisporum* Cl. Roux & Nav.-Ros.
4	*Halospora scammoeca* S. Y. Kondr	*Thelidium dionatense*	(Hafellner, 2011)	= *Merismatium scammoecum* Lettau

Norrlinia Theiss. & Syd. (2)

Index Fungorum: 3518, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Norrlinia was established by Theiss. & Syd. (1918) for *Norrlinia peltigericola*, originally described as *Verrucaria peltigericola* Nyl., which grows on *Peltigera canina*. It is characterized by perithecioid apotheia, entirely black or dark brownish-black, with hyaline, ellipsoidal, finely muriform spores arranged in pairs (Nylander, 1874). Kondratyuk & Galloway (1995) later introduced *N. medoborensis*, found on *Peltigera rufescens*. Since its inception, this genus has been placed in Verrucariaceae and

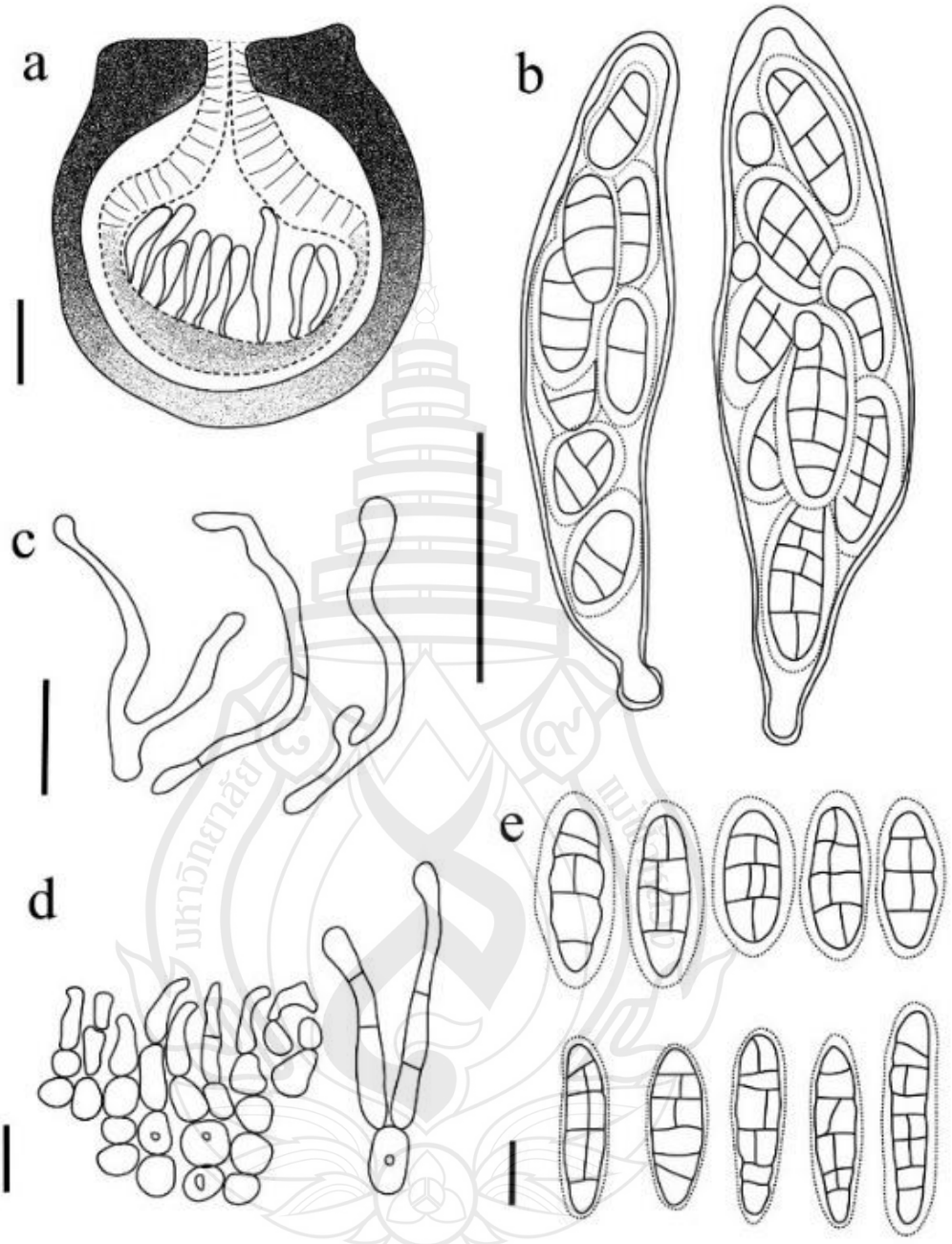
confirmed within verrucariales by phylogenetic studies (Lumbsch et al., 2004; Lumbsch et al., 2005). *Norrlinia* contains two species with four available sequences of *N. peltigericola* in the Genbank.

Type species: *Norrlinia peltigericola* (Nyl.) Theiss. & Syd.

= *Verrucaria peltigericola* Nyl.

Table 2.83 Accepted lichenicolous species of *Norrlinia*

	Species name	**Host**	**References**	**Remarks**
1	*Norrlinia medoborensis* S.Y. Kondr.	*Peltigera rufescens*	(Kondratyuk et al., 1995a)	
2	*Norrlinia peltigericola* (Nyl.) Theiss. & Syd	*Peltigera canina*	(Nylander, 1874; Theissen et al., 1918b)	= *Verrucaria peltigericola* Nyl.



Note a Section of ascoma. b Asci. c Periphyses. d Pseudoparaphyses. e Ascospores. Scale bars: a–b = 50 µm, c–e = 10 µm.

Source Redrawn from Roux et al. (2002)

Figure 2.70 Sexual morph of *Halospora deminuta*

Phaeospora Hepp ex Stein (17-20)

Index Fungorum: 562291, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Synonymy:

= *Pharcidiella* (Sacc. & D. Sacc.) Clem. & Shear, Gen. fung., Edn 2 (Minneapolis): 272 (1931)

= *Pyreniococcus* Wheldon & A. Wilson, J. Bot., Lond. 53(Suppl.): 69 (1915)

= *Pyrenulella* Fink, Lich. Fl. U.S.: 58 (1935)

= *Sphaerulina* subgen. *Pharcidiella* Sacc. & D. Sacc., Syll. Fung. (Abellini) 17: 695 (1905)

Phaeospora was originally proposed by Hepp (1867) to accommodate the species *Ph. rimosicola*, transferred from *Verrucaria rimosicola* Leight., however, this name was invalid. Later, Stein (1879) validly published *Phaeospora*, designating *Phaeospora rimosicola* as the type species. *Phaeospora* has four recognized synonyms. *Pharcidiella* was elevated to genus status by Clem. & Shear (1931), having originally been introduced by Saccardo & Saccardo (1905) as a subgenus of *Sphaerulina*. The type species, *Pharcidiella endococcoidea*, was transferred from *Verrucaria endococcoidea* Nyl. and later to *Pyrenulella endococcoidea* by Fink (1935). Both names are now synonyms of *Phaeospora endococcoidea*. *Pyreniococcus* was synonymized with *Phaeospora* after *Pyreniococcus exoriens* (Stirt.) Wheldon & A. Wilson reclassified as *Phaeospora exoriens* by Smith (1926).

Phaeospora is characterized by perithecioid ascomata, fissitunicate asci with (4–) 8 spores, periphyses (no paraphyses), and brown 3 (–7)-septate ascospores (McCarthy et al., 2020). It contains 20 species, 17 of which are lichenicolous.

Type species: *Phaeospora rimosicola* (Leight.) Hepp ex Stein

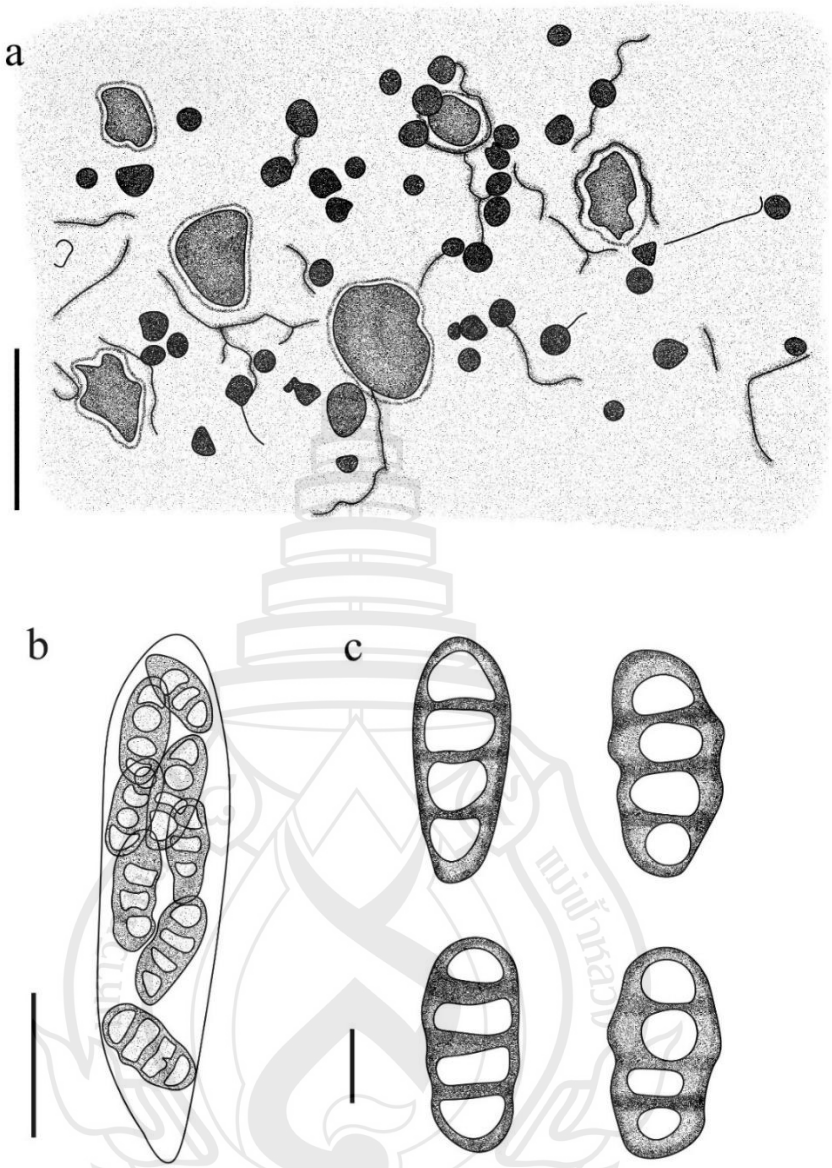
= *Verrucaria rimosicola* Leight.

Table 2.84 Accepted lichenicolous species of *Phaeospora*

	Species name	Host	References	Remarks
1	*Phaeospora arctica* Horáková & Alstrup	*Allocetraria, Arctocetraria andrejevii* and *Arctoparmelia*	(Horáková et al., 1994)	
2	*Phaeospora australiensis* P.M.McCarthy & Elix	*Sarcogyne terrulenta*	(McCarthy et al., 2020)	
3	*Phaeospora catolechiae* Zopf	*Catolechia wahlenbergii*	(Saccardo, 1902)	
4	*Phaeospora consocians* (Nyl.) Vouaux	*Lecidea vernalis*	(Vouaux, 1913a)	= *Mycoporum consocians* Nyl.
5	*Phaeospora everniae* Etayo & van den Boom	*Evernia prunastri*	(Van den Boom & Etayo, 2014)	
6	*Phaeospora exoriens* (Stirt.) A.L. Sm.	*Pannaria*	(Smith, 1926)	= *Parmelia exoriens* Stirt.
7	*Phaeospora fritzei* Stein	*Parmelia saxatilis*	(Stein, 1882)	
8	*Phaeospora granulosae* Arnold	*Trapeliopsis granulosa*	(Magnus, 1895)	
9	*Phaeospora lecanorae* Eitner	*Lecanora cenisia* and *Myriolecis* sp.	(Eitner, 1900)	

Table 2.84 (continued)

	Species name	Host	References	Remarks
10	*Phaeospora perrugosaria* (Linds.) R. Sant.	*Placopsis*	(Galloway, 2004)	= *Microthelia perrugosaria* Linds.
11	*Phaeospora protoblasteniae* Alstrup & Olech	*Protoblastenia incrustans*	(Alstrup et al., 1996)	
12	*Phaeospora quaterna* Eitner	*Rhizocarpon obscuratum* f. *lavatum*	(Eitner, 1895)	
13	*Phaeospora rimosicola* (Leight.) Hepp ex Stein	*Rhizocarpon concentricum*	(Stein, 1879b)	= *Verrucaria rimosicola* Leight.
14	*Phaeospora squamarinae* Etayo	*Squamarina cartilaginea*	(Etayo, 2010c)	
15	*Phaeospora subantarctica* Øvstedal & D. Hawksw.	*Lecania gerlachei*	(Øvstedal et al., 1986)	
16	*Phaeospora triphractoides* (Nyl. ex Cromb.) Zopf	*Lecidea scotinodes*	(Zopf, 1896)	= *Endococcus triphractoides* Nyl. ex Cromb.
17	*Phaeospora verrucariae* Alstrup & E.S. Hansen	*Verrucaria placynthiae*	(Alstrup et al., 2001)	



Note a Perithecia on the thallus of *Rhizocarpon petraeum*. b Asci. c Ascospores. Scale bars: a = 1 mm, b = 20 μm, c = 5 μm.

Source Redrawn from Pirogov et al. (2012)

Figure 2.71 *Phaeospora rimosicola*

Placidiopsis Beltr. (1-8)

Index Fungorum: 4119, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Placidiopsis grappae* Beltr.

Accepted lichenicolous species:

Placidiopsis minor K. Knudsen, Breuss & Kocourk., lichenicolous lichen on *Diploschistes*

Placocarpus Trevis. (3-8)

Index Fungorum: 4123, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Placocarpus schaereri* (Fr.) Breuss

Table 2.85 Accepted lichenicolous species of *Placocarpus*

	Species name	Host	References	Remarks
1	*Placocarpus americanus* K. Knudsen, Breuss & Kocourk.	*Protoparmeliopsis muralis*	(Knudse et al., 2009)	Lichen, juvenile parasite
2	*Placocarpus melanophthalmosus* Cl. Roux & Gueidan	*Rhizoplaca melanophthalma*	(Roux & Gueidan, 2011)	Lichen, juvenile parasite
3	*Placocarpus schaereri* (Fr.) Breuss	*Parmelia schaereri* Fr. & *Protoparmeliopsis muralis*	(Breuß, 1985)	Lichen, juvenile often parasite = *Parmelia schaereri* Fr.

Placopyrenium Breuss (7-21)

Index Fungorum: 25126, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Placopyrenium bucekii* (Nádv. & Servít) Breuss

Table 2.86 Accepted lichenicolous species of *Placopyrenium*

	Species name	**Host**	**References**	**Remarks**
1	*Placopyrenium breussii* Cl. Roux & Gueidan	*Aspicilia calcitrapa*	(Roux & Gueidan, 2011)	Lichen, juvenile parasite
2	*Placopyrenium canellum* (Nyl.) Gueidan & Cl. Roux	*Aspicilia*	(Navarro-Rosinés et al., 2007)	Lichen, juvenile parasite = *Verrucaria canella* Nyl
3	*Placopyrenium cinereoatratum* (Degel.) Orange	*Staurothele fissa*	(Orange, 2009)	= *Verrucaria cinereoatrata* Degel.
4	*Placopyrenium formosum* Orange	*Aspicilia aquatica*	(Orange, 2009)	Lichen, juvenile parasite
5	*Placopyrenium fuscellum* (Turner) Gueidan & Cl. Roux	*Baglietto*a and *Verrucaria*	(Navarro-Rosinés et al., 2007)	Lichen, juvenile facultatively = *Lichen fuscellus* Turner
6	*Placopyrenium pseudocineroatrum* Thüs & Nascimbene	*Circinaria ochracea*	(Nascimbene et al., 2023)	
7	*Placopyrenium noxium* Breuss	*Staurothele areolata*	(Breuss, 1998)	lichenicolous lichen

Telogalla Nik. Hoffm. & Hafellner (2)

Index Fungorum: 28448, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Telogalla was established by Hoffmann & Hafellner (2000) to accommodate *Telogalla olivieri*, originally classified as *Laestadia olivieri* Vouaux, which grows on *Xanthoria*. It was placed within Verrucariaceae (Verrucariales). Its key features include perithecioid ascomata with a hyaline peridium, branched periphysoid filaments, eight-spored asci of the verrucaria type, and hyaline, unicellular ascospores. Etayo (2017) added a second species, *T. cajasensis*, found on *Leptogium*. There are two species recognized in this genus (table 1), with no molecular data available in GenBank.

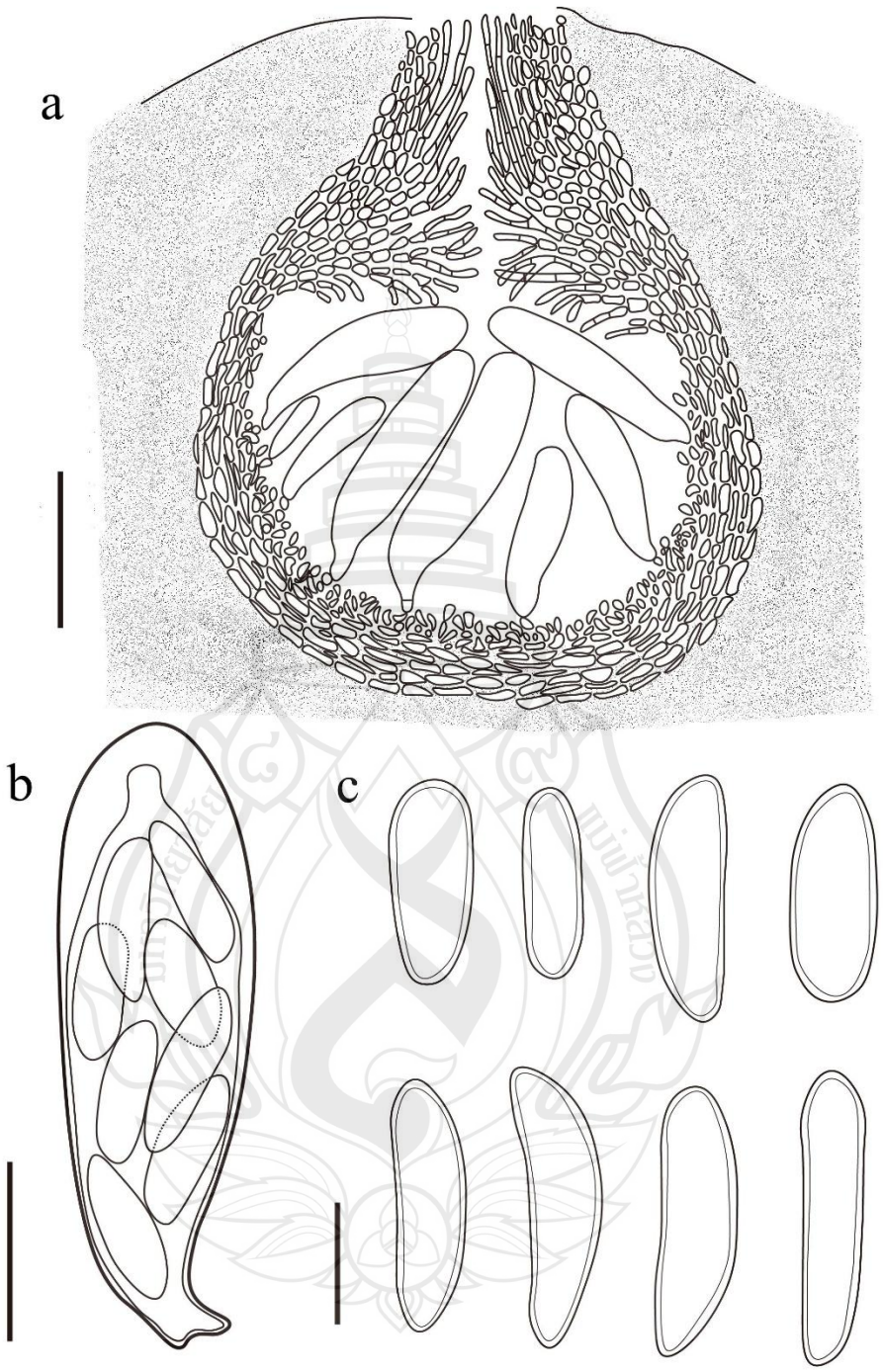
Type species:

Telogalla olivieri (Vouaux) Nik. Hoffm. & Hafellner

= *Laestadia olivieri* Vouaux

Table 2.87 Accepted lichenicolous species of *Telogalla*

	Species name	**Host**	**References**	**Remarks**
1	*Telogalla cajasensis* Etayo	*Leptogium*	(Etayo, 2017)	
2	*Telogalla olivieri* (Vouaux) Nik. Hoffm. & Hafellner	*Xanthoria*	(Hoffmann et al., 2000)	= *Laestadia olivieri* Vouaux



Note a Section of perithecium. b Ascus. c Ascospores. Scale bars: a, b = 20 μm, c = 10 μm.

Source Redrawn from Hoffmann et al. (2000)

Figure 2.72 *Telogalla olivieri*

Thelidium A. Massal. (1-100+)

Index Fungorum: 5427, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Thelidium amylaceum* A. Massal.

Accepted lichenicolous species:

Thelidium impressulum Zschacke, on *Verrucaria hockstetteri* f. *alpina*

Verrucaria Schrad. (7-1000+)

Index Fungorum: 5725, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Verrucaria rupestris* Schrad.

Table 2.88 Accepted lichenicolous species of *Verrucaria*

	Species name	Host	References	Remarks
1	*Verrucaria bernardinensis* Breuss	*Staurothele drummondii*	(Breuss, 2007)	Lichenicolous lichen
2	*Verrucaria cetera* Breuss	*Staurothele areolata*	(Breuss, 1998)	Lichenicolous lichen
3	*Verrucaria congestula* Cromb.	*Placopsis macrophthalma*	(Crombie, 1877)	
4	*Verrucaria conturmatula* Nyl.	*Ionaspis lacustris*	(Nylander, 1879a)	
5	*Verrucaria falcata* Breuss	*Verrucaria maculicarpa*	(Breuss, 2007)	Lichenicolous lichen
6	*Verrucaria fumosaria* Leight.	*Lecidea fuscoatra*	(Leighton, 1878)	

Table 2.88 (continued)

	Species name	Host	References	Remarks
7	*Verrucaria inficiens* Breuss	*Staurothele areolata* and *S. elenkinii*	(Breuß, 1998)	Lichenicolous lichen
8	*Verrucaria monstrosa* (Schaer.) Jatta	*Lecanora muralis*	(Jatta, 1900)	= *Endocarpon miniatum* var. *monstrosum* Schaer.
9	*Verrucaria placynthiae* Alstrup & E. S. Hansen	*Placynthium nigrum*	(Alstrup et al., 2001)	Lichenicolous lichen

Verrucula J. Steiner (21)

Index Fungorum:5731, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Verrucula was established by Steiner (1896) with a brief diagnosis to accommodate two species: *V. egyptiaca* and *V. cahirensis*. In the monograph by Navarro-Rosinés et al. (2007), *Verrucula aegyptiaca* was designated as the lectotype. Although *Verrucula aegyptiaca* was synonymized with *Guignardia egyptiaca* in *Index Fungorum*, the two species have different basionyms: *Guignardia egyptiaca* was transferred from *Laestadia aegyptiaca* (Reichert, 1921), while *Verrucula aegyptiaca* came from *Verrucaria aegyptiaca* (Steiner 1896). As a result, *Verrucula aegyptiaca* remains valid within *Verrucula*.

This genus is characterized by whitish, grayish, or brown areolate to squamulose thalli parasitic on *Caloplaca* and *Xanthoria elegans*. The perithecioid

ascomata are globose, deeply immersed, and black in the upper part. Asci are eight-spored, clavate, and slightly thickened at the top. Ascospores are colorless, mostly simple, occasionally uniseptate, and vary from globose to fusiform. Pycnidia are globose or pyriform, resembling smaller ascomata, and have ampulliform conidiogenous cells. Conidia are simple, straight or slightly curved and bacilliform (Navarro-Rosinés et al., 2007).

There are 34 records in Index Fungorum (2024), however, only 22 were included in the monograph of Navarro-Rosinés et al. (2007), excluding *Verrucula glaucina* and *V. monstrosa*. *Verrucula glaucina* was introduced by Steiner (1897) and is listed in Index Fungorum (2024) and Mycobank (2024). *Verrucula monstrosa* was included in Index Fungorum, but later transferred to *Verrucaria monstrosa* by Jatta (1900), according to the MycoBank.

Verrucula subcrustosa was transferred from *Endocarpon cinerascens* var. *subcrustosum* Nyl. by Steiner (1898) and later transferred to *Dermatocarpon subcrustosum* by Zahlbruckner in (1921). Despite its listing under *Verrucula* in Index fungorum (2024) and its synonymization with *Endocarpon* in MycoBank, it should be classified under *Dermatocarpon*, following the synonym date. *Verrucula tarraconensis* was described by Navarro-Rosinés et al., Roux (2007) and accepted by Diederich (2018), however, it is listed as invalid in Mycobank (2024) and Index Fungorum (2024). So, we included it in our list.

Verrucula ahlesiana was transferred from *Sagedia ahlesiana* Hepp by Steiner (1898), and later to *Laestadia ahlesiana* by Vouaux (1912), and *Guignardia ahlesiana* by Keissl. (1930). However, *Guignardia ahlesiana* is considered invalid according to Art. 36.1(a) (Shenzhen) in Index Fungorum (2024) and MycoBank (2024). Thus, *Laestadia ahlesiana* remains the current name.

Verrucula granulosaria was transferred from *Verrucaria granulosaria* Clauzade & Zehetl. by Navarro-Rosinés et al. (2001), but later included under

Verrucaria latericola in Species Fungorum (2024) and Index Fungorum (2024), contrary to Mycobank (2024). Here, we accept its placement within *Verrucula*.

In conclusion, *Verrucula* comprises 21 lichenicolous species. Phylogenetic analysis by Gueidan et al. (2009) showed that *Verrucula* is closely related to the *Placocarpus* within Verrucariaceae.

Type species: *Verrucula egyptiaca* (Müll. Arg.) J. Steiner

= *Verrucaria egyptiaca* Müll. Arg.

Table 2.89 Accepted lichenicolous species of *Verrucula*

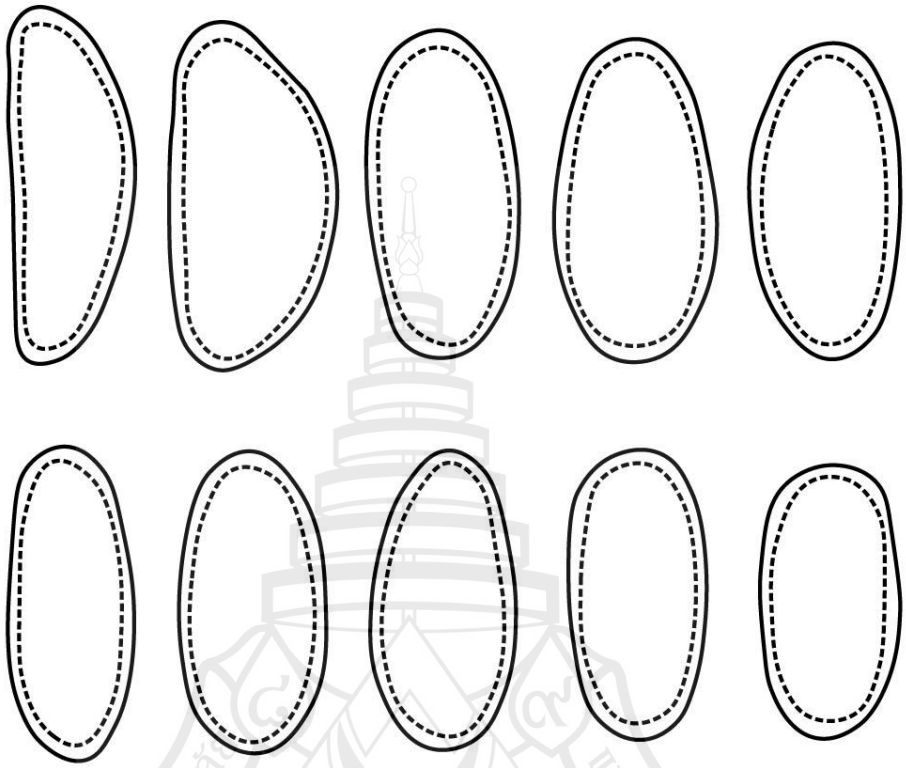
	Species name	Host	References	Remarks
1	*Verrucula arnoldaria* Nav.-Ros. & Cl. Roux	*Caloplaca arnoldii*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen
2	*Verrucula biatorinaria* (Zehetl.) Nav.-Ros. & Cl. Roux	*Caloplaca biatorina*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen = *Verrucaria biatorinaria* Zehetl.
3	*Verrucula clauzadaria* Nav.-Ros. & Cl. Roux	*Caloplaca clauzadeana*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen
4	*Verrucula coccinearia* (Zehetl.) Nav.-Ros. & Cl. Roux	*Caloplaca coccinea*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen = *Verrucaria coccinearia* Zehetl.
5	*Verrucula coronataria* Nav.-Ros. & Cl. Roux	*Caloplaca coronata*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen
6	*Verrucula egyptiaca* (Müll. Arg.) J. Steiner	*Caloplaca* gr. *Velana*	(Steiner, 1896)	Lichenicolous lichen = *Verrucaria egyptiaca* Müll. Arg.
7	*Verrucula elegantaria* (Zehetl.) Nav.-Ros. & Cl. Roux	*Xanthoria elegans*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen = *Verrucaria elegantaria* Zehetl.

Table 2.89 (continued)

	Species name	Host	References	Remarks
8	*Verrucula glaucina* (Nyl.) J. Steiner	*Caloplaca* sp.	(Steiner, 1897)	Lichenicolous lichen
9	*Verrucula granulosaria* (Clauzade & Zehetl.) Nav.-Ros. & Cl. Roux	*Caloplaca granulosa, Flavoplaca granulosa*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen = *Verrucaria granulosaria* Clauzade & Zehetl.
10	*Verrucula helvetica* (B. de Lesd.) Nav.-Ros. & Cl. Roux	*Caloplaca cirrochroa*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen = *Endopyrenium helveticum* B. de Lesd.
11	*Verrucula hladuniana* (Nav.-Ros. & Cl. Roux) Nav.-Ros. & Cl. Roux	*Caloplaca marina*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen = *Verrucaria hladuniana* Nav.-Ros. & Cl. Roux
12	*Verrucula inconnexaria* Nav.-Ros. & Cl. Roux	*Caloplaca inconnexa*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen
13	*Verrucula lactearia* Nav.-Ros. & Cl. Roux	*Caloplaca lactea s.str.*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen
14	*Verrucula latericola* (Erichsen) Nav.-Ros. & Cl. Roux	*Calogaya pusilla*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen = *Verrucaria latericola* Erichsen

Table 2.89 (continued)

	Species name	Host	References	Remarks
15	*Verrucula maritimaria* Nav.-Ros. & Cl. Roux	*Caloplaca maritima*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen
16	*Verrucula microspora* Nav.-Ros. & Cl. Roux	*Caloplaca velana*	(Roux et al., 2020a)	Lichenicolous lichen
17	*Verrucula navasaria* Nav.-Ros. & Cl. Roux	*Caloplaca navasiana*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen
18	*Verrucula polycarparia* Nav.-Ros. & Cl. Roux	*Caloplaca polycarpa*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen
19	*Verrucula protearia* (Zehetl.) Nav.-Ros. & Cl. Roux	*Caloplaca proteus*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen = *Verrucaria protearia* Zehetl.
20	*Verrucula pusillaria* Nav.-Ros. & Cl. Roux	*Caloplaca pusilla*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen
21	*Verrucula tarraconensis* Nav.-Ros. & Cl. Roux	*Caloplaca velana*	(Navarro-Rosinés et al., 2007)	Lichenicolous lichen



Source Redrawn from Navarro-Rosinés et al. (2007)

Figure 2.73 *Verrucula egyptiaca*

Verruculopsis Gueidan, Nav.-Ros. & Cl. Roux (3-5)

Index Fungorum: 29128, faceoffungi, MycoBank, GenBank

Classification: Verrucariaceae, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Verruculopsis was established by Navarro-Rosinés et al. (2007) for species resembling *Verrucula*, but distinguished by ascomata with a light brown basal part and a darker upper portion. It is characterized by perithecioid ascomata, globose or slightly elongated, with a completely paraplectenchymatous excipulum, light to medium brown except around the ostiole. The asci are broadly clavate, 8-spored, and bitunicate, with

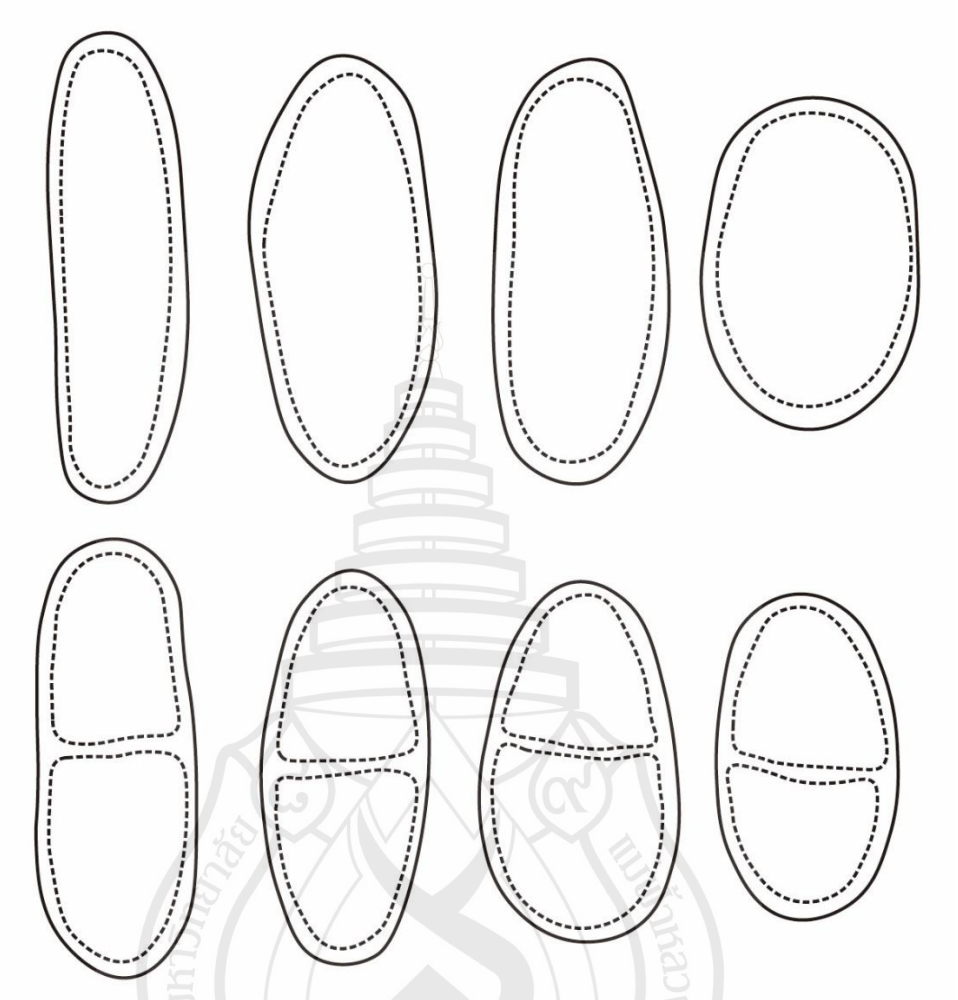
thin upper parts. Ascospores are colorless, globose to ellipsoid, typically non-septate, and filled with oil droplets. (Navarro-Rosinés et al., 2007). Five species are recognized in this genus, including two lichens and three lichenicolous species. Phylogenetic analysis by Gueidan et al. (2009) indicated that *Verruculopsis* is sister to *Placopyrenium* within Verrucariaceae.

Type species: *Verruculopsis poeltiana* (Clauzade & Cl. Roux) Gueidan, Nav.-Ros. & Cl. Roux

= *Verrucaria poeltiana* Clauzade & Cl. Roux

Table 2.90 Accepted lichenicolous species of *Verruculopsis*

	Species name	**Host**	**References**	**Remarks**
1	*Verruculopsis flavescentaria* Gueidan, Nav.-Ros. &Cl.Roux	*Calogaya flavescens*	(Navarro-Rosinés et al., 2007)	lichenicolous lichen
2	*Verruculopsis irrubescentis* (Ménard & Cl. Roux) Gueidan, Nav.-Ros. & Cl. Roux	*Caloplaca irrubescens*	(Navarro-Rosinés et al., 2007)	lichenicolous lichen = *Verrucaria irrubescentis* Ménard & Cl. Roux
3	*Verruculopsis poeltiana* (Clauz. & Cl. Roux) Gueidan, Nav.-Ros. & Cl. Roux	*Caloplaca aurantia*, *Variospora*	(Navarro-Rosinés et al., 2007)	lichenicolous lichen = *Verrucaria poeltiana* Clauzade & Cl. Roux



Source Redrawn from Navarro-Rosinés et al. (2007)

Figure 2.74 *Verruculopsis poeltiana*

Verrucariales Genera incertae sedis

Gemmaspora D. Hawksw. & Halıcı (1)

Index Fungorum: 510164, faceoffungi, MycoBank, GenBank

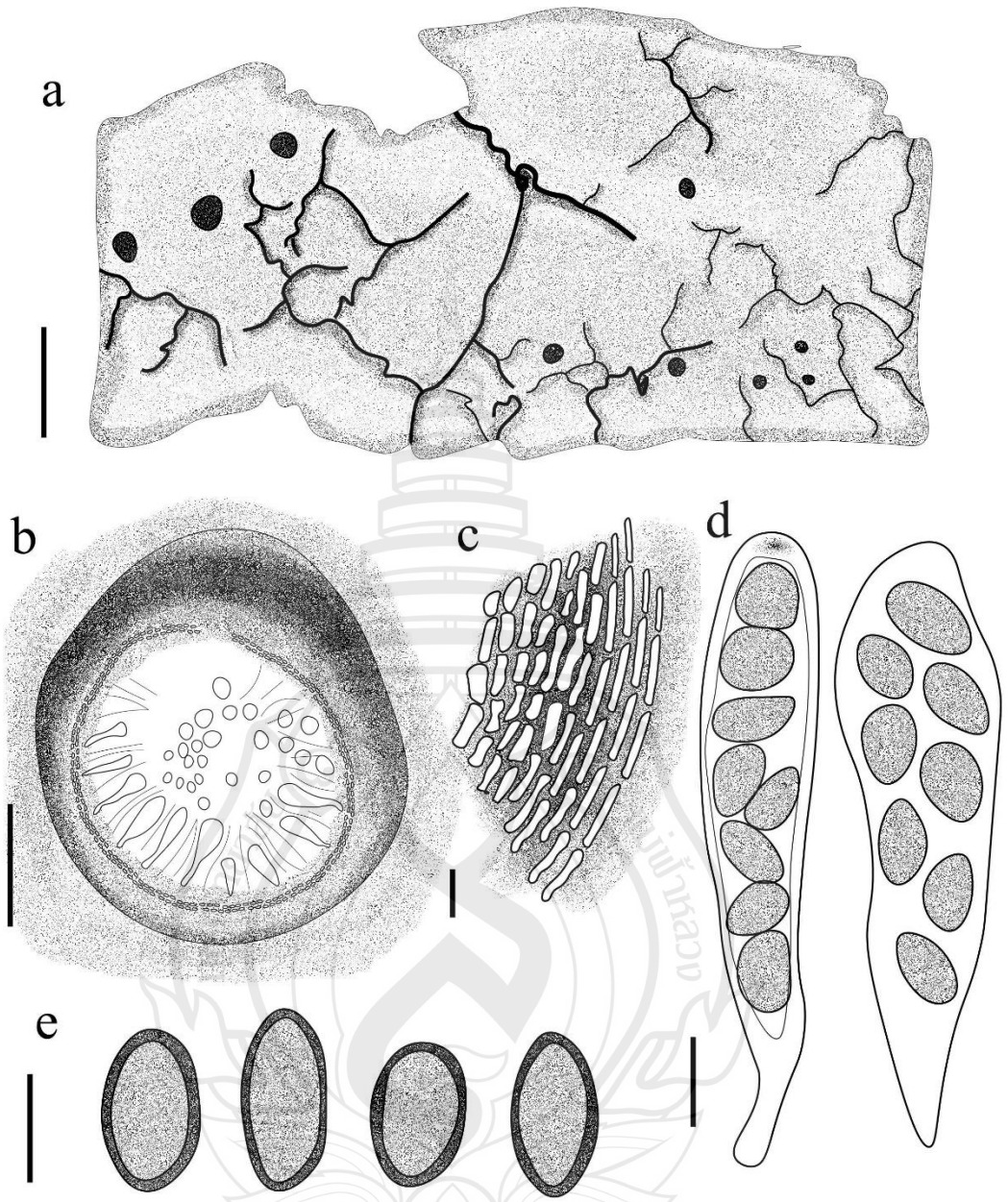
Classification: Verrucariales Genera incertae sedis, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Gemmaspora was introduced by Hawksworth & Halıcı (2007) to accommodate the lichenicolous fungus *G. lecanorae*, originally described as *Adelococcus lecanorae* Werner, which grows on the thallus of *Aspicilia* cf. *farinose*. The genus is characterized

by black, carbonaceous perithecia that are immersed to erumpent, with a thick, two-layered exciple—an outer colorless layer and an inner red-brown to dark brown layer. The hamathecium consists of periphyses, lacking interascal filaments, and the centrum reacts I+ reddish, turning intensely blue after KOH pretreatment. Asci are elongate-clavate, bitunicate, with a broad internal apical beak that diminishes with maturity, 8-spored, and of the Verrucaria-type. Ascospores are globose to subglobose, red-brown, (0)–1 distoseptate, with thick, two-layered walls. Due to a lack of molecular data, its phylogenetic status remains uncertain, tentatively placed in Verrucariales, Genera incertae sedis (Hawksworth et al., 2007).

Type species: *Gemmaspora lecanorae* (Werner) D. Hawksw. & Halıcı (Hawksworth et al., 2007)

=*Adelococcus lecanorae* Werner (Werner 1963)



Note a Apothecia on thallus. b Section of apothecium. c Part of ascomata wall. d Asci. e Ascospores. Scale bars: a = 1 mm, b = 100 µm, c–e = 10 µm.

Source Redrawn from Hawksworth et al. (2007)

Figure 2.75 *Gemmaspora lecanorae*

Merismatium Zopf (16-19)

Index Fungorum: 3125, faceoffungi, MycoBank, GenBank

Classification: Verrucariales Genera incertae sedis, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

The lichenicolous genus *Merismatium* was established by Zopf (1898) to accommodate the type species *M. lopadii*, transferred from *Celidium lopadii* Anzi. This species has muriform, brown spores and grows on *Lopadium pezizoideum* (Ach.) var. *muscicolum* in the alpine region of the Tyrolean Alps. It is characterized by small, black, apothecia that only emerge at the apex from the thallus of *Lopadium*, with a pierced apex. The perithecia are dark brown, and the hymenium is wine-colored when treated with iodine. The spores are spindle-shaped, brown and oval.

In Species Fungorum (2024), *Merismatium lopadii* is listed as synonymy of *M. nigritellum* which was transferred from *Verrucaria nigritella* Nyl. by Vouaux in 1913. However, there is no record of *M. lopadii* being treated as a synonym of *M. nigritellum* in the original reference, so *M. lopadii* is still kept in the list of *Merismatium*.

Merismatium was placed in the Dothideales incertae sedis by Eriksson & Hawksworth (1987), later, Triebel (1989) proposed to place it within the order Verrucariales. Triebel recognized species as two groups: those with spores having a distinct perispore (halo) and those lacking this feature, but retained both groups within *Merismatium*. Hafellner (2011) revised this genus and restricted it to species with thin-walled, non-halonate ascospores. Species with thick-walled ascospores provided with a halo were classified into another genus, *Halospora* (Hafellner, 2011).

To date, 13 species are recognized in *Merismatium* according to Index Fungorum (2024) and MycoBank (2024), all of which are lichenicolous. No sequence data is available from NCBI.

Type species:

Merismatium lopadii (Anzi) Zopf

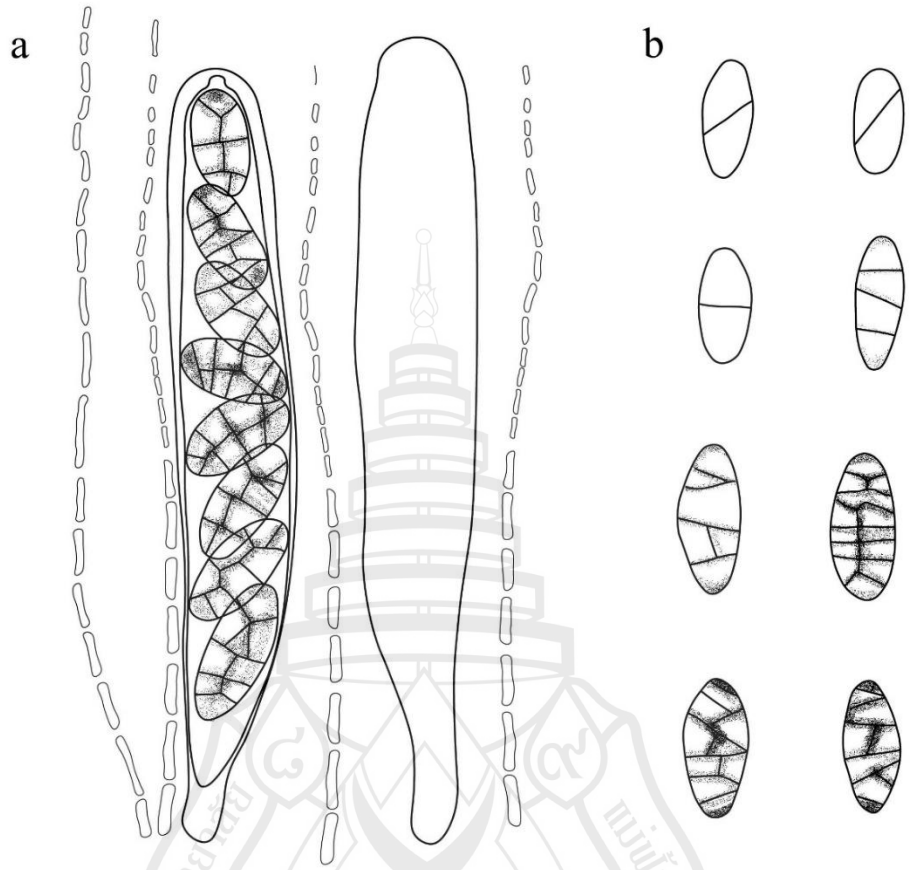
= *Celidium lopadii* Anzi

Table 2.91 Accepted lichenicolous species of *Muellerella*

	Species name	Host	References	Remarks
1	*Muellerella antarctica* Etayo	*Hypogymnia antarctica*	(Etayo & Sancho, 2008)	
2	*Muellerella dilatata* J. Steiner	*Lecanora trachytica*	(von Halácsy, 1894)	
3	*Muellerella erratica* (A. Massal.) Hafellner & V. John	Diverse lichens	(Hafellner et al., 2006)	*Tichothecium erraticum* A. Massal.
4	*Muellerella hospitans* Stizenb	*Bacidia rubella*	(Stizenberger, 1863)	
5	*Muellerella lecanactidis* Diederich & van den Boom	*Sigridea californica*	(Diederich, 2003)	
6	*Muellerella lichenicola* (Sommerf.) D. Hawksw	*Lecanora atra*, diverse lichens	(Hawksworth, 1979b)	*Sphaeria lichenicola* Sommerf.
7	*Muellerella polyspora* Hepp ex Müll. Arg.	Diverse lichens	(Müller, 1862)	
8	*Muellerella pygmaea* (Körb.) D. Hawksw.	Diverse lichens	(Körber, 1865a, Hawksworth, 1979b)	*Microthelia pygmaea* Körb.
9	*Muellerella rhizocarpicola* Brackel	*Rhizocarpon geographicum*	(Brackel, 2023)	

Table 2.91 (continued)

	Species name	Host	References	Remarks
10	*Muellerella solenopsorae* Brien, Cl. Roux & Monnat	*Solenopsora holophaea*	(Roux et al., 2022)	
11	*Muellerella stictinae* (H. Olivier) Vouaux	*Stictina sylvatica*	(Vouaux, 1914)	*Sphaeria stictinae* H. Olivier
12	*Muellerella thalamita* (Nyl.) D, Hawksw., F. Berger & LaGreca	*Baculifer, Orcularia* and *Hafellia*	(Crombie, 1877; Berger et al., 2014)	*Endococcus thalamita* Nyl.
13	*Muellerella thallophila* Arnold	*Aspicilia caesiocinerea*	(Arnold, 1888)	
14	*Muellerella triseptata* Diederich	*Buellia griseovirens* and *other lichens*	(Diederich, 1986)	
15	*Muellerella ventosicola* (Mudd) D. Hawksw.	*Ophioparma,* possibly also on *Rhizocarpon*	(Hawksworth, 2003)	*Microthelia ventosicola* Mudd
16	*Muellerella vesicularia* (Linds.) D. Hawksw.	*Toninia caeruleonigricans*	(Hawksworth, 1985b)	*Microthelia vesicularia* Linds.



Note a Asci and paraphyses. b Ascospores

Source Redrawn from Zopf (1898)

Figure 2.76 *Merismatium lopadii*

Pseudostigmidium Etayo (5)

Index Fungorum: 532868, faceoffungi, MycoBank, GenBank

Classification: Genera incertae sedis, Verrucariales, Chaetothyriomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Pseudostigmidium was established by Etayo & Sancho (2008) to include five species characterized by small, black perithecia that are subconical or subglobose, often immersed and protruding from the lichen thallus. These fungi have eight-spored,

bitunicate asci, and three-septate, hyaline spores. The type species, *Pseudostigmidium nephromiarium*, was originally described as *Microthelia nephromiaria* Linds. and later transferred by Vouaux (1913) to *Sphaerulina* as *S. nephromiaria* (Lindsay) Vouaux (Lindsay, 1869). Etayo & Sancho (2008) reclassified this species into the newly established genus *Pseudostigmidium* and designated it as the type species.

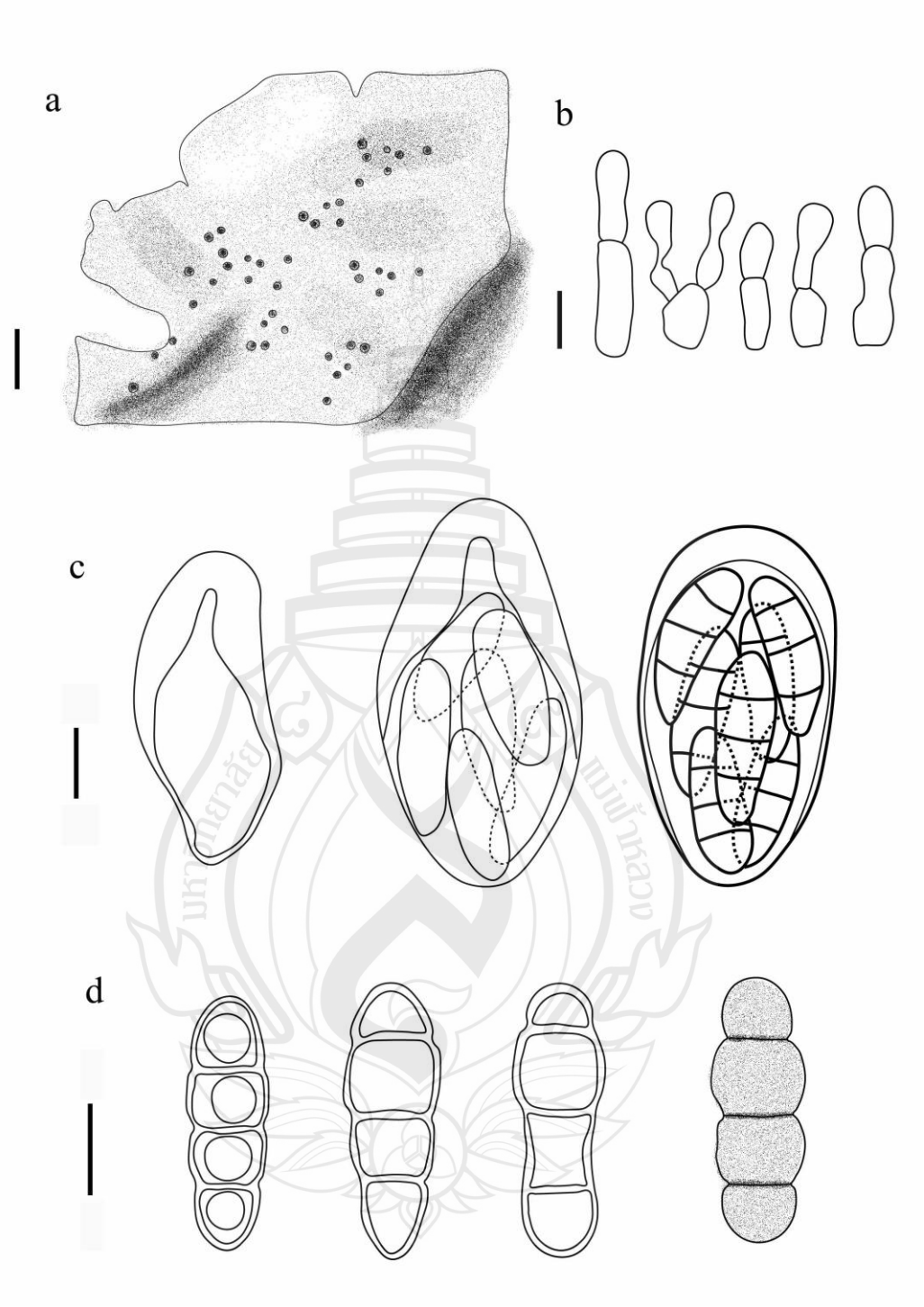
Wijayawardene (2022) listed *Pseudostigmidium* as a dubious genus within the family Mycosphaerellaceae due to the lack of confirmed phylogenetic placement based on DNA data. To date, five lichenicolous species are recognized in this genus, but no sequence data is available in GenBank.

Type species: *Pseudostigmidium nephromiarium* (Linds.) Etayo

= *Microthelia nephromiaria* Linds.

Table 2.92 Accepted lichenicolous species of *Pseudostigmidium*

	Species name	Host	References	Remarks
1	*Pseudostigmidium biseptatum* Etayo	*Pseudocyphellaria*	(Etayo & Sancho, 2008)	
2	*Pseudostigmidium confusum* Etayo	*Pseudocyphellaria*	(Etayo & Sancho, 2008)	
3	*Pseudostigmidium disparatum* Etayo	*Pseudocyphellaria*	(Etayo & Sancho, 2008)	
4	*Pseudostigmidium fumosum* Etayo	*Pseudocyphellaria*	(Etayo & Sancho, 2008)	
5	*Pseudostigmidium nephromiarium* (Lindsay) Etayo	*Nephroma antarcticum*	(Lindsay, 1869; Etayo & Sancho, 2008)	= *Microthelia nephromiaria* Linds.



Note a *P. nephromiarium* growing on host. b Peirphyses. c Asci. d Ascospores. Scale bars: a = 500 μm, b–d = 5 μm.

Source Redraw from Etayo et al. (2008)

Figure 2.77 *Pseudostigmidium nephromiarium*

SubClass MYCOCALICIOMYCETIDAE Tibell

Order Mycocaliciales Tibell & Wedin

Family Mycocaliciaceae A.F.W. Schmidt

Chaenothecopsis Vain. (33-98)

Index Fungorum: 934, faceoffungi, MycoBank, GenBank

Classification: Mycocaliciaceae, Mycocaliciales, Mycocaliciomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Chaenothecopsis rubescens* Vain.

Table 2.93 Accepted lichenicolous species of *Chaenothecopsis*

	Species name	Host	References	Remarks
1	*Chaenothecopsis arthoniae* Tibell	*Arthonia vinosa*	(Tibell, 1998)	
2	*Chaenothecopsis australis* Tibell	*Lecanactis abietina*	(Tibell, 1998)	
3	*Chaenothecopsis brevipes* Tibell	*Arthonia* and *Lecanactis*	(Tibell, 1987)	
4	*Chaenothecopsis cinerea* Tibell	*Lecanactis abietina*	(Tibell, 1998)	
5	*Chaenothecopsis consociata* (Nádv.) A. F. W. Schmidt	*Arthonia leucopellaea*	(Schmidt, 1970)	= *Calicium consociatum* Nádv.
6	*Chaenothecopsis dibbleandersoniarum* Selva	*Chaenotheca trichialis*	(Selva, 2013)	
7	*Chaenothecopsis epithallina* Tibell	*Chaenotheca sphaerocephala*	(Tibell, 1975)	

Table 2.93 (continued)

	Species name	Host	References	Remarks
8	*Chaenothecopsis formosa* Titov	*Chaenotheca sphaerocephala*	(Titov, 2006; Selva et al., 2023)	
9	*Chaenothecopsis haematopus Tibell*		(Tibell, 1987)	Facultatively lichenicolous
10	*Chaenothecopsis hospitans* (Th. Fr.) Tibell	*Haematomma ochroleucum* and *Lecanora*	(Tibell et al., 1995)	= *Calicium hospitans* Th. Fr.
11	*Chaenothecopsis kalbii* Tibell & K. Ryman	*Lecanora caesiorubella*	(Tibell et al., 1995)	
12	*Chaenothecopsis lecanactidis* Tibell	*Lecanactis abietina*	(Tibell, 1998)	
13	*Chaenothecopsis lignicola* (Na´dv.) A.F.W.Schmidt	*Chaenotheca*	(Schmidt, 1970)	
14	*Chaenothecopsis leifiana* Titov	*Arthonia*	(Titov et al., 2004)	
15	*Chaenothecopsis nigra* Tibell	*Chaenotheca*	(Tibell, 1987)	
16	*Chaenothecopsis ochroleuca* (Körb.) Tibell & K. Ryman	*Haematomma ochroleucum*	(Tibell et al., 1995)	= *Calicium ochroleucum* Körb.
17	*Chaenothecopsis parasitaster* (Bagl. & Carestia) D. Hawksw.	*Cladonia*	(Hawksworth, 1978)	= *Calicium pusillum* var. *parasitaster* Bagl. & Carestia

Table 2.93 (continued)

	Species name	Host	References	Remarks
18	*Chaenothecopsis pilosa* Tibell & Kalb	*Tylophoron moderatum*	(Tibell et al., 1995)	
19	*Chaenothecopsis pusilla* (Ach.) A.F.W.Schmidt	*Calicium*	(Schmidt, 1970)	= *Calicium claviculare* var. *pusillum* Ach.
20	*Chaenothecopsis pusiola* (Ach.) Vain.	*Chaenotheca* or saprophytic	(Vainio, 1927)	= *Calicium pusiolum* Ach.
21	*Chaenothecopsis retinens* (Nyl.) Tibell	*Schismatomma cretaceum* and *Arthonia byssacea*	(Tibell, 1991)	= *Calicium retinens* Nyl.
22	*Chaenothecopsis rubescens* Vain.	*Arthonia byssacea,* other lichens with *Trentepohlia* or saprophytic	(Vainio, 1927)	
23	*Chaenothecopsis rubina* Tibell	*Pyrgidium montellicum*	(Tibell, 1982)	
24	*Chaenothecopsis sagenidii* Tibell	*Sagenidium molle*	(Tibell, 1987)	
25	*Chaenothecopsis savonica* (Räsänen) Tibell	*Chaenotheca* or saprophytic	(Tibell, 1984)	= *Mycocalicium savonicum* Räsänen

Table 2.93 (continued)

	Species name	Host	References	Remarks
26	*Chaenothecopsis sinensis* Titov	on unidentified lichen with chlorococcoid algae	(Titov, 2006)	
27	*Chaenothecopsis subparoica* (Nyl.) Tibell	*Chaenotheca chrysocephala*	(Tibell et al., 1995)	= *Calicium subparoicum* Nyl.
28	*Chaenothecopsis tasmanica Tibell*	*Arthonia, Lecanactis abietina, Calicium salicinum*	(Tibell, 1985)	
29	*Chaenothecopsis treicheliana* (Stein) Kalb	*Lecanora*	(Kalb, 1982)	= *Calicium treichelianum* Stein
30	*Chaenothecopsis vainioana* (Nádv.) Tibell	*Arthonia, Lecanactis abietina, Calicium salicinum*	(Tibell, 1979)	= *Calicium vainioanum* Nádv.
31	*Chaenothecopsis vinosa* Titov	On thallus of lichen	(Titov, 2001)	
32	*Chaenothecopsis viridialba* (Kremp.) A.F.W. Schmidt	*Chaenotheca chryscephala* or saprophytic	(Schmidt, 1970)	= *Calicium viridialbum* Kremp.

Table 2.93 (continued)

	Species name	Host	References	Remarks
33	*Chaenothecopsis viridireagens* (Nádv.) A. F. W. Schmidt	*Calicium* or on free-living algae	(Schmidt, 1970)	= Calicium viridireagens Nádv.

Family Sphinctrinaceae M. Choisy

Sphinctrina Fr. (10-34)

Index Fungorum: 5134, faceoffungi, MycoBank, GenBank

Classification: Sphinctrinaceae, Mycocaliciales, Mycocaliciomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Sphinctrina turbinata* Fr.

Table 2.94 Accepted lichenicolous species of *Sphinctrina*

	Species name	Host	References	Remarks
1	*Sphinctrina anglica* Nyl.	*Protoparmelia*	(Nylander, 1860)	
2	*Sphinctrina benmargana* Selva	*Pertusaria* and *Diploschistes*	(Selva, 2004)	
3	*Sphinctrina intermedia* Tibell	*Pertusaria*	(Tibell et al., 2014)	
4	*Sphinctrina leucopoda* Nyl.	*Pertusaria*	(Nylander, 1860)	
5	*Sphinctrina ophioparmae* Kalb	*Ophioparma araucariae*	(Kalb, 2001)	
6	*Sphinctrina pallidella* (Willey) Selva	*Pertusaria paramera*	(Selva, 2004)	= *Calicium pallidellum* Willey

Table 2.94 (continued)

	Species name	Host	References	Remarks
7	*Sphinctrina paramerae* D. Muñiz & Hladun	*Pertusaria*	(Muniz et al., 2013)	
8	*Sphinctrina sessilis* Etayo & Pino-Bodas	*Pertusaria excludens*	(Etayo et al., 2023)	
9	*Sphinctrina tubaeformis* A. Massal.	*Pertusaria*	(Massalongo, 1853a)	
10	*Sphinctrina turbinata* Fr.	*Pertusaria*	(De Notaris, 1846b)	

SubClass SCLEROCOCCOMYCETIDAE Réblová, Unter. & W. Gams

Order Sclerococcales Réblová, Unter. & W. Gams

Family Dactylosporaceae Bellem. & Hafellner

Index Fungorum 81680, Facesoffungi, MycoBank, GenBank

Classification: Sclerococcales, Sclerococcomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Dactylosporaceae was established by Bellemère et al. (1982) to accommodate species of *Dactylospora*. This family is characterized by unitunicate asci with an apical thickening of the wall, a unique ascus dehiscence mechanism, and ornamented ascospore walls (Bellemère et al., 1982). Members of *Dactylosporaceae* are predominantly saprotrophic, occurring on bark, wood, and liverworts, with some species exhibiting lichenicolous behavior (Pang et al., 2014; Jaklitsch et al., 2016). Phylogenetic analysis by Ekanayaka et al. (2019) positioned this family within the class *Eurotiomycetes*, prompting the introduction of the new order *Dactylosporales* Ekanayaka, E.B.G. Jones, Q. Zhao & K.D. Hyde to accommodate it.

The family *Sclerococcaceae* and the order *Sclerococcales* were introduced by

Réblová, Untereiner & W. Gams (2017) based on phylogenetic analyses to encompass taxa with diverse ecological roles, including terrestrial and marine lignicolous species, lichenicolous species, and those associated with beetles as part of their intestinal microbiota. Ascomata of *Sclerococcales* are apothecium-like, subglobose to discoid, flat or convex, superficial or sometimes erumpent. The asci are unitunicate, 8-spored, non-amyloid, with an external amyloid gelatinous cap. The hamathecium consists of persistent pseudoparaphyses, and ascospores are hyaline to lightly pigmented, septate, often with appendages or ornamentation. Asexual morphs include dematiaceous hyphomycetes producing sporodochia with irregular chains of pigmented conidia, or effuse colonies with macronematous or semimacronematous conidiophores bearing phialides and catenate, hyaline, clavate, or fusiform conidia. (Réblová et al., 2017)

Phylogenetic analyses by Diederich et al. (2013) revealed that *Sclerococcum sphaerale* clusters with two species of *Dactylospora* Körb. A subsequent study with expanded molecular data led Diederich et al. (2018) to propose *Dactylosporaceae* as the valid family name, synonymizing *Sclerococcaceae*.(Diederich et al., 2013). *Dactylosporaceae* currently comprises five genera: *Cylindroconidiis* Huang Zhang & X.D. Yu, *Fusichalara* S. Hughes & Nag Raj, *Gamsomyces* Hern.-Restr. & Réblová, *Rhopalophora* Réblová, Untereiner & W. Gams, and *Sclerococcum*, along with three beetle-associated strains (Hyde et al., 2024).

Type genus: *Dactylospora* Körb.

Sclerococcum Fr. (76-102)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Dactylosporaceae, Sclerococcales, Sclerococcomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Sclerococcum was originally described by Fries (1819, 1825) to accommodate the parasitic fungi *S. sphaerale*, which was transferred from *Spiloma sphaerale*. Diederich et al. (2013) conducted a phylogenetic analysis and found that the generic

type of *Sclerococcum*, *Sclerococcum sphaerale*, form a strongly supported clade basal to the Eurotiomycetes that also includes *Dactylospora* spp. In additions, Diederich et al. (2018) considerd *Dactylospora* and *Sclerococcum* as a monophyletic group based on the phylogenetic analysis. The genus name *Sclerococcum* was used, and 46 species of *Dactylospora* were transferred to *Sclerococcum*. The family name Dactylosporaceae has been used, and Sclerococcaceae became a synonym (Diederich et al., 2013; Diederich et al., 2018).

Fries (1825) gave a short diagnosis about the characteristic of *Sclerococcum* as spores globose, opaque, tightly adhering to each other and to the thin receptacle, forming a rounded tubercle. Since then, none described this genus in detail until Hawksworth (1975) described and illustrated the type species, *Sclerococcum sphaerale*. It is characterized by sporodochia-like, circular and punctiform or hemispherical, convex and wart-like colonies scattered on the surface of the host lichen. The conidiophores are semi-macronematous, sporodochial, subglobose to ellipsoid or polyhedral, hyaline, sometimes becoming pale brown in parts. The conidiogenous cells are monoblastic or polyblastic, integrated, terminal, determinate, subglobose, shortly cylindrical or ellipsoid, hyaline to pale brown. Conidia are irregular but frequently biseriate chains, acropleurogenous, irregularly subglobose to ellipsoid, brown to dark brown, almost black in mass (Hawksworth, 1975b). Dong et al. (2020) noted that the terrestrial and marine genus *Sclerococcum* encompasses saprotrophic species and lichenicolous species. Joshi (2021) further elaborated that *Sclerococcum* is characterised by blackish apothecia, cylindrical to clavate asci, amyloid with I– tholus covered by an I+ blue external gelatinous cap, 8-spored, and ascospores that are subglobose to ellipsoid with one to several transverse septa.

In the past five years, 40 new species or new combinations have been described, but mostly are saprotrophic species. Olariaga et al. (2019) combined 14 saprotrophic species under *Sclerococcum* from *Dactylospora* based on ascal characters and

interpretation of the phylogenetic analyses (Olariaga et al., 2019). Only two species, *Sclerococcum arthrobotryinum* growing on *Arthrobotryum spongiosum*, and *Sclerococcum inopinum* growing on *Radula magellanica*, are lichenicolous fungi. In the same year, three more species, *Sclerococcum ricasoliae* growing on *Ricasolia*, *Sclerococcum stigma* growing on *Lecidea platycarpa* and *Sclerococcum thelotrematicola* growing on *Thelotrema*, were combined (Flakus et al., 2019b; Fryday, 2019; Navarro-Rosinés et al., 2019). From then on, nine new lichenicolous species were introduced (Elix et al., 2019; Spribille et al., 2020; Zhurbenko et al., 2020; Joshi, 2021b; Øvstedal et al., 2021b; Zimmermann et al., 2021; Zhurbenko 2022c; Paz-Bermúdez et al., 2023). Currently, *Sclerococcum* has become a species-rich lichenicolous genus with 102 accepted species according to Index Fungorum and Species Fungorum, with 76 of which being lichenicolous. It has 127 sequences of *Sclerococcum* and 106 sequeces of *Dactylospora*, mostly belonging to LSU, ITS and mtSSU, with a smaller portion in RPB2 and SSU.

Type species: *Sclerococcum sphaerale* (Ach.) Fr.

= *Spiloma sphaerale* Ach.

Table 2.95 Accepted lichenicolous species of *Sclerococcum*

	Species name	Host	References	Remarks
1	*Sclerococcum acarosporae* S.Y. Kondr.	*Acarospora*	(Kondratyuk & Zelenko, 2002)	
2	*Sclerococcum acarosporicola* Ertz & Diederich	*Acarospora*	(Diederich et al., 2018)	
3	*Sclerococcum aeruginosum* (Holien & Ihlen) Ertz & Diederich	*Juniperus communis*, various lichens	(Ihlen et al., 2004; Diederich et al., 2018)	= *Dactylospora aeruginosa* Holien & Ihlen

Table 2.95 (continued)

	Species name	Host	References	Remarks
4	*Sclerococcum ahtii* (Zhurb. & Pino-Bodas) Ertz & Diederich	*Cladonia gracilis* subsp. *vulnerata*	(Pino-Bodas et al., 2017; Diederich et al., 2018)	= *Dactylospora ahtii* Zhurb. & Pino-Bodas
5	*Sclerococcum allantoideum* (Alstrup & D. Hawksw.) Ertz & Diederich	*Xanthoparmelia pulla*	(Alstrup et al., 1990; Diederich et al., 2018)	= *Dactylospora allantoidea* Alstrup & D. Hawksw.
6	*Sclerococcum amygdalariae* (Triebel) Ertz & Diederich	*Amygdalaria pelobotryon*	(Triebel 1989; Diederich et al., 2018)	= *Dactylospora amygdalariae* Triebel
7	*Sclerococcum anziae* (Zhurb., Ezhkin, Skirina & Y. Ohmura) Ertz & Diederich	*Anzia colpota*, *Philo dendron sakhalinense*	(Zhurbenko et al., 2017; Diederich et al., 2018)	= *Dactylospora anziae* Zhurb., Ezhkin, Skirina & Y. Ohmura
8	*Sclerococcum areolatum* Etayo	*Xylographa*	(Etayo & Sancho, 2008)	
9	*Sclerococcum arthrobotryinum* (Hafellner) Olariaga, Teres, J.M.	*Arthrobotryum spongiosum*	(Hafellner, 1979; Olariaga et al., 2019)	fungicolous = *Dactylospora arthrobotryina* Hafellner
10	*Sclerococcum aspiciliicola* (Alstrup & D. Hawksw.) Ertz & Diederich	*Aspicilia leucophyma*	(Alstrup et al., 1990; Diederich et al., 2018)	= *Dactylospora aspiciliicola* Alstrup & D. Hawksw.

Table 2.95 (continued)

	Species name	Host	References	Remarks
11	*Sclerococcum athallinum* (Müll. Arg.) Ertz & Diederich	*Baeomyces*	(Smith, 1911; Hafellner, 1979;; Diederich et al., 2018)	= *Buellia athallina* Müll. Arg.
12	*Sclerococcum attendendum* (Nyl.) Ertz & Diederich	*Amygdalaria, Icmadophila, Pilophorus* and *Porpidia*	(Nylander, 1866c; Diederich et al., 2018)	= *Lecidea attendenda* Nyl.
13	*Sclerococcum australe* (Triebel & Hertel) Ertz & Diederich	*Lecidea lygomma*, *Coccotrema, Lecidea, Paraporpidia, Poeltiaria, Poeltidea, Porpidia, Rimularia* and *Tremolecia*	(Triebel, 1989; Diederich et al., 2018)	= *Dactylospora australis* Triebel & Hertel
14	*Sclerococcum bloxamii* (Berk.) Olariaga, Teres, J.M. Martín, M. Prieto & Baral	On rotten wood	(Hafellner, 1979; Olariaga et al., 2019)	= *Patellaria bloxamii* Berk. & W. Phillips
15	*Sclerococcum boreale* (Holien & Ihlen) Ertz & Diederich	*Mycoblastus affinis*	(Ihlen et al., 2004; Diederich et al., 2018)	= *Dactylospora borealis* Holien & Ihlen
16	*Sclerococcum caledonicum* (Hafellner) Olariaga, Teres, J.M. Martín, M. Prieto & Baral	on wood	(Hafellner, 1979; Olariaga et al., 2019)	= *Dactylospora caledonica* Hafellner

Table 2.95 (continued)

	Species name	Host	References	Remarks
17	*Sclerococcum canariense* (Kohlm. & Volkm.-Kohlm.) Olariaga, Teres, J.M. Martín, M. Prieto & Baral	on wood	(Kohlmeyer, 1998; Olariaga et al., 2019)	= *Dactylospora canariensis* Kohlm. & Volkm.-Kohlm.
18	*Sclerococcum chiangraiense* (Ekanayaka, E.B.G. Jones, Q. Zhao & K.D. Hyde) Haelew., Stallman & Aime	On dead stems	(Ekanayaka et al., 2019; Haelewaters et al., 2022)	= *Dactylospora chiangraiensis* Ekanayaka, E.B.G. Jones, Q. Zhao & K.D. Hyde
19	*Sclerococcum cladoniicola* (Alstrup & Olech) Ertz & Diederich	*Cladonia macrophyllodes*	(Alstrup, 1993c; Diederich et al., 2018)	= *Dactylospora cladoniicola* Alstrup & Olech
20	*Sclerococcum crassitunicatum* Zhurb., Diederich & U. Braun	*Cladonia gracilis*	(Zhurbenko & Pino-Bodas, 2017)	
21	*Sclerococcum constrictum* P.R. Johnst.	On decorticated wood	(Johnston, 2022)	
22	*Sclerococcum crassum* (Sarrión & Hafellner) Ertz & Diederich	*Juniperus oxycedrus*, *Parmelia*	(Sarrión et al., 2002; Diederich et al., 2018)	= *Dactylospora crassa* Sarrión & Hafellner

Table 2.95 (continued)

	Species name	Host	References	Remarks
23	*Sclerococcum davidii* (Hafellner & H. Mayrhofer) Ertz & Diederich	*Podocarpus totara*	(Hafellner & Mayrhofer; 2007;; Diederich et al., 2018)	= *Dactylospora davidii* Hafellner & H. Mayrhofer
24	*Sclerococcum deminutum* (Th. Fr.) Ertz & Diederich	on various lichens	(Triebel, 1989; Diederich et al., 2018)	= *Lecidea parasitica* ß *deminuta* Th. Fr.
25	*Sclerococcum dendriscostictae* Y. Joshi	*Sticta nylanderiana*	(Joshi, 2021b)	
26	*Sclerococcum dobrowolskii* (Olech & Alstrup) Ertz & Diederich	*Caloplaca saxicola*	(Olech et al., 1996; Diederich et al., 2018)	= *Dactylospora dobrowolskii* Olech & Alstrup
27	*Sclerococcum epimyces* (Tobisch) Olariaga, Teres, J.M. Martín, M. Prieto & Baral		(Tobisch, 1934; Hafellner, 1979; Olariaga et al., 2019)	Fungicolous = *Karschia epimyces* Tobisch
28	*Sclerococcum epiphytorum* Diederich	*Pertusaria hemisphaerica*	(Diederich, 1990)	
29	*Sclerococcum ewersii* Elix, P.M. McCarthy & Hafellner	*Lepra corallina*	(Elix et al., 2019)	
30	*Sclerococcum fissurinae* Pérez-Ort.	*Fissurina isidiata*	(Spribille et al., 2020)	

Table 2.95 (continued)

	Species name	Host	References	Remarks
31	*Sclerococcum frigidum* (Hafellner) Ertz & Diederich	*Brigantiaea fuscolutea*	(Hafellner; 1985a; Diederich et al., 2018)	= *Dactylospora frigida* Hafellner
32	*Sclerococcum fusiforme* (Ekanayaka, E.B.G. Jones, Q. Zhao & K.D. Hyde) Haelew., Stallman & Aime	On dead stems	(Ekanayaka et al., 2019; Haelewaters et al., 2022)	= *Dactylospora fusiformis* Ekanayaka, E.B.G. Jones, Q. Zhao & K.D. Hyde
33	*Sclerococcum gelidarium* Etayo & F. Berger	*Placopsis gelida*	(Berger, 2000)	
34	*Sclerococcum glaucomarioides* (Willey ex Tuck.) Ertz & Diederich	*Ochrolechia*	(Hafellner, 1979; Diederich et al., 2018)	= *Buellia glaucomarioides* Willey ex Tuck.
35	*Sclerococcum gloeocapsae* Øvstedal, Broady & Fryday	*Gloeocapsa, Bryophyta*	(Øvstedal et al., 2021a)	
36	*Sclerococcum graniforme* (Wallr.) Rabenh.	On linen fibers	(Wallroth, 1833; Rabenhorst, 1863)	=*Ostracococcum graniforme* Wallr.
37	*Sclerococcum griseisporodochium* Etayo	*Opegrapha*	(Etayo, 1995b)	
38	*Sclerococcum hafellnerianum* (Sérus.) Ertz & Diederich	*Santessonia lagunebergii*	(Sérusiaux et al., 1984; Diederich et al., 2018)	= *Dactylospora hafellneriana* Sérus.

Table 2.95 (continued)

	Species name	Host	References	Remarks
39	*Sclerococcum haliotrephum* (Kohlm. & E. Kohlm.) Ertz & Diederich	On wood	(Kohlmeyer, 1965;; Diederich et al., 2018)	= *Buellia haliotrepha* Kohlm. & E. Kohlm.
40	*Sclerococcum heterodermiae* (Etayo) Ertz & Diederich	*Heterodermia*	(Etayo, 2017; Diederich et al., 2018)	= *Dactylospora heterodermiae* Etayo
41	*Sclerococcum homoclinellum* (Nyl.) Ertz & Diederich	*Lecanora* and *Tephromela*	(Nylander, 1872; Diederich et al., 2018)	= *Lecidea homoclinella* Nyl.
42	*Sclerococcum imperfectum* (Ellis) Olariaga, Teres, J.M. Martín, M. Prieto & Baral	On dead stalks	(Ellis, 1881; Olariaga et al., 2019)	= *Patellaria imperfecta* Ellis
43	*Sclerococcum inconspicuum* (Etayo) Ertz & Diederich	*Menegazzia cincinnata*, *Nothofagus pumilio*	(Etayo & Sancho, 2008; Diederich et al., 2018)	= *Dactylospora inconspicua* Etayo
44	*Sclerococcum inopinum* (Döbbeler & W.R. Buck) Olariaga, Teres, J.M. Martín, M. Prieto & Baral	*Radula magellanica*	(Döbbeler et al., 2017; Olariaga et al., 2019)	= *Dactylospora inopina* Döbbeler & W.R. Buck

Table 2.95 (continued)

	Species name	Host	References	Remarks
45	*Sclerococcum inquilinum* (Tuck.) Ertz & Diederich	corticolous *Pertusaria*	(Tuckerman, 1866; Hafellner, 1979;; Diederich et al., 2018)	= *Buellia inquilina* Tuck.
46	*Sclerococcum knudsenii* Zhurb	*Polycauliona bolacina*	(Zhurbenko, 2022c)	
47	*Sclerococcum leuckertii* Diederich & P. Scholz	*Buellia aethalea*	(Diederich & Scholz, 1994)	
48	*Sclerococcum lobariellum* (Nyl.) Ertz & Diederich	*Lobaria*, *Ricasolia*, also *Pseudocyphellaria*	(Hawksworth, 1975a; Diederich, Lawrey, et al., 2018)	= *Lecidea lobariella* Nyl.
49	*Sclerococcum luridum* (Hafellner) Olariaga, Teres, J.M. Martín, M. Prieto & Baral	On dead wood	(Hafellner; 1979; Olariaga et al., 2019)	= *Dactylospora lurida* Hafellner
50	*Sclerococcum mangrovei* (E.B.G. Jones, Alias, Abdel-Wahab & S.Y. Hsieh) Ertz & Diederich	On wood	(Jones et al., 1999; Diederich et al., 2018)	= *Dactylospora mangrovei* E.B.G. Jones, Alias, Abdel-Wahab & S.Y. Hsieh
51	*Sclerococcum martynii* (Wakef.) Haelew., Stallman & Aime	On rotten wood	(Wakefield, 1934; Haelewaters et al., 2022)	= *Polydiscidium martynii* Wakef.

Table 2.95 (continued)

	Species name	Host	References	Remarks
52	*Sclerococcum mediterraneum* (Sarrión & Hafellner) Olariaga, Teres, J.M. Martín, M. Prieto & Baral	On bark	(Sarrión et al., 2002; Olariaga et al., 2019)	= *Dactylospora mediterranea* Sarrión & Hafellner
53	*Sclerococcum microsporum* (Etayo) Ertz & Diederich	*Catinaria atropurpurea*	(Etayo, 1991; Diederich et al., 2018)	= *Dactylospora microspora* Etayo
54	*Sclerococcum montagnei* Hafellner	*Lecanora rupicola*	(Hafellner, 1998a)	
55	*Sclerococcum olivaceum* Etayo & F. Berger	*Flavoparmelia soredians*	(Etayo et al., 2002)	
56	*Sclerococcum ophthalmizae* Coppins	*Pertusaria ophthalmiza*, *Betula*	(Diederich et al., 2018)	
57	*Sclerococcum orygmaeum* (Delise ex Nyl.) Ertz & Diederich	*Pseudocyphellaria berberina*	(Nylander, 1869; Kondratyuk, 1995; Diederich et al., 2018)	= *Lecidea orygmaea* Delise ex Nyl.
58	*Sclerococcum parasitaster* (Nyl.) Ertz & Diederich	*Biatora sphaeroides* and *Thelenella muscorum*	(Nylander, 1875a; Diederich et al., 2018)	= *Lecidea parasitaster* Nyl.
59	*Sclerococcum parasiticum* (Flörke) Ertz & Diederich	*Lepra*, *Ochrolechia* and *Pertusaria*	(Flörke, 1819; Diederich et al., 2018)	= *Lecidea parasitica* Flörke

Table 2.95 (continued)

	Species name	Host	References	Remarks
60	*Sclerococcum parellarium* (Nyl.) Ertz & Diederich	*Ochrolechia parella*	(Nylander, 1876; Diederich et al., 2018)	= *Lecidea parellaria* Nyl.
61	*Sclerococcum parmotrematis* Etayo & Paz-Berm.	*Parmotrema carballalianum*	(Paz-Bermúdez et al., 2023)	
62	*Sclerococcum pertusariicola* (Willey ex Tuck.) Ertz & Diederich	saxicolous *Pertusaria*	(Tuckerman, 1888;; Diederich et al., 2018)	= *Buellia pertusariicola* Willey ex Tuck.
63	*Sclerococcum phaeophysciae* Diederich & van den Boom	*Phaeophyscia orbicularis*	(Diederich & Boom; 2017)	
64	*Sclerococcum phyllobaeis* Etayo	*Phyllobaeis*	(Etayo, 2017)	
65	*Sclerococcum physciae* Y. Joshi	*Physcia*	(Joshi, 2021b)	
66	*Sclerococcum pleiospermum* (Triebel) Ertz & Diederich	*Lecanora caesiorubella* subsp. *merrillii*, *Heteromeles arbutifolia*	(Hafellner et al., 2002; Diederich et al., 2018)	= *Dactylospora pleiosperma* Triebel
67	*Sclerococcum polysporum* (Triebel) Ertz & Diederich	*Protoparmelia petraeoides*	(Triebel, 1989; Diederich et al., 2018)	= *Dactylospora polyspora* Triebel

Table 2.95 (continued)

	Species name	Host	References	Remarks
68	*Sclerococcum porphyreum* (Hafellner & Kalb) Ertz & Diederich	*Brigantiaea leucoxantha*	(Hafellner, 1985a; Diederich et al., 2018)	= *Dactylospora porphyrea* Hafellner & Kalb
69	*Sclerococcum protothallinum* (Anzi) Ertz & Diederich	*Fuscopannaria* and *Parmeliella*	(Anzi, 1860;; Diederich et al., 2018)	= *Abrothallus protothallinus* Anzi
70	*Sclerococcum pseudobactrodesmium* J. Ma & Y.Z. Lu	On decaying wood	(Ma et al., 2023)	
71	*Sclerococcum pseudosipmanii* Zhurb. & Diederich	*Parmotrema*	(Zhurbenko et al., 2020)	
72	*Sclerococcum pseudourceolatum* (Sarrión & Hafellner) Olariaga, Teres, J.M. Martín, M. Prieto & Baral	On plant	(Sarrión et al., 2002; Olariaga et al., 2019)	= *Dactylospora pseudourceolata* Sarrión & Hafellner
73	*Sclerococcum punctisapidum* P.R. Johnst.	On dead fronds of *Rhopalostylis sapida*	(Johnston, 2022)	
74	*Sclerococcum purpurascens* (Etayo) Ertz & Diederich	*Amygdalaria pelobotryon*, *Pilophorus* and *Porpidia*	(Triebel, 1989; Diederich et al., 2018)	= *Dactylospora purpurascens* Triebel

Subclass SORDARIOMYCETIDAE O.E. Erikss. & Winka

Class Eurotiomycetes familia incertae sedis

Family Rhynchostomataceae Winka & O.E. Erikss.

Rhynchomeliola Speg. (1-8)

Index Fungorum 4728, Facesoffungi, MycoBank, GenBank

Classification: Rhynchostomataceae, Eurotiomycetes familia incertae sedis, Sordariomycetidae, Eurotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Rhynchomeliola pulchella* Speg.

Accepted lichenicolous species:

Rhynchomeliola lichenicola Henssen & Kantvilas, on *Wawea fruticulose* (Henssen et al., 1985)

Class LABOULBENIOMYCETES Engl.

Subclass Laboulbeniomycetidae Alexop.

Order Pyxidiophorales P.F. Cannon

Family Pyxidiophoraceae G.R.W. Arnold

Gliocephalis Matr. (1-2)

Index Fungorum 8339, Facesoffungi, MycoBank, GenBank

Classification: Pyxidiophoraceae, Pyxidiophorales, Laboulbeniomycetidae, Laboulbeniomycetes, Pezizomycotina, Ascomycota, Fungi

Gliocephalis was introduced by Matruchot (1899) to accommodate the type species *G. hyaline*, which features a sporiferous head that bears a drop of hyaline mucilage. The genus is closely related to *Gliocladium*, which also has mucilage enveloping its spores, marking a significant difference from *Penicillium*. Hawksworth (1979) transferred a second species, *Gliocephalis pulchella*, from *Gliocladium pulchellum*, originally described as growing on lichen thallus. According to the lichenicolous list by Diederich (2018), this species was recorded growing on *Sticta* and placed within Laboulbeniales genus incertae sedis. In the phylogenetic analysis based

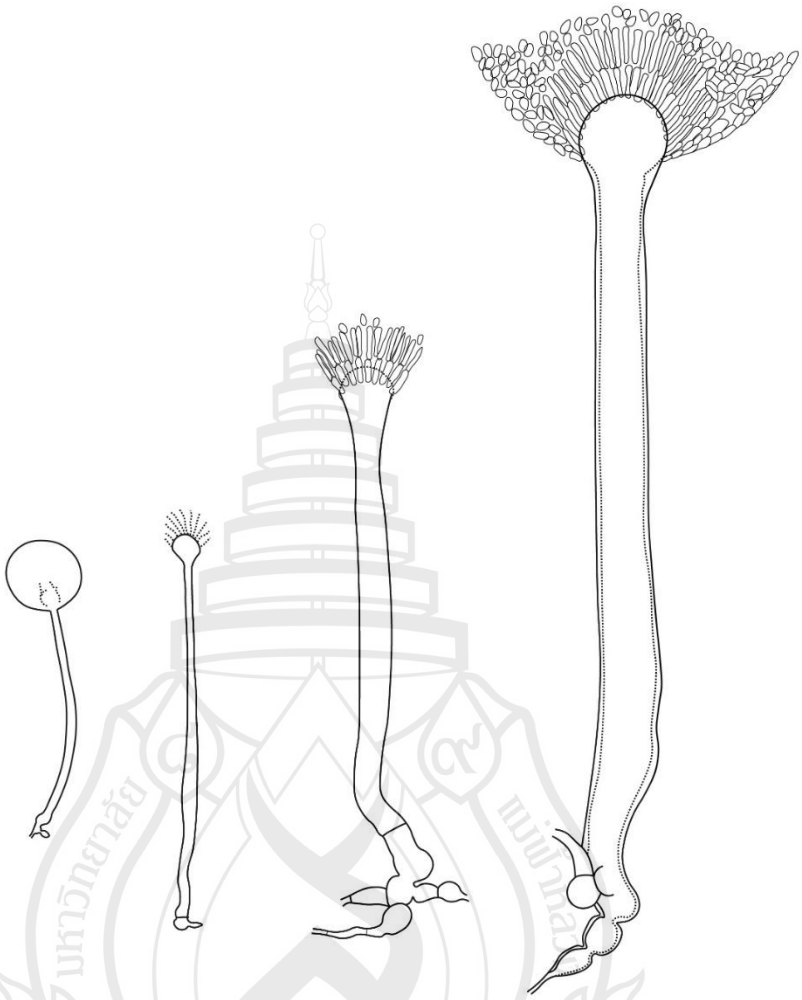
on SSU rDNA sequence conducted by Haelewaters et al. (2021), *Gliocephalis hyaline* was cluster in Pyxidiophorales clade. Consequently, Wijayawardene (2022) placed *Gliocephalis* within the family Pyxidiophoraceae, formally established by Arnold (1971).

Type species: *Gliocephalis hyalina* Matr.

Accepted lichenicolous species:

Gliocephalis pulchella (Penz. & Sacc.) D. Hawksw., on *Sticta* (Hawksworth 1979a)

= *Gliocladium pulchellum* Penz. & Sacc. (Penzig et al., 1902)



Source Redrawn from Matruchot (1899)

Figure 2.78 *Gliocephalis hyalina*

Class LECANOROMYCETES O.E. Erikss. & Winka

SubClass ACAROSPOROMYCETIDAE V. Reeb, Lutzoni & Cl. Roux

Order Acarosporales V. Reeb, Lutzoni & Cl. Roux

Family Acarosporaceae Zahlbr.

Acarospora A. Massal. (25-200+)

Index Fungorum 28, Facesoffungi, MycoBank, GenBank

Classification: Acarosporaceae, Acarosporales, Acarosporomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Acarospora schleicheri* (Ach.) A. Massal.

= *Urceolaria schleicheri* Ach.

Table 2.96 Accepted lichenicolous species of *Acarospora*

	Species name	Host	References	Remarks
1	*Acarospora anatolica* H. Magn.	*Dimelaena*	(Magnusson, 1929)	Lichenicolous lichen
2	*Acarospora brevilobata* H. Magn.	*Rhizocarpon*	(Magnusson, 1940)	Lichenicolous lichen
3	*Acarospora epiaspicilia* Cl. Roux & M. Bertrand	*Aspicilia* spp.	(Roux et al., 2019)	Lichenicolous lichen
4	*Acarospora episulphurata* Cl. Roux & S. Poumarat	*Acarospora sulphurata*	(Roux et al., 2019)	Lichenicolous lichen
5	*Acarospora epithallina* H. Magn.	*Acarospora* and *Caloplaca*	(Magnusson, 1929)	Lichenicolous lichen
6	*Acarospora freyi* H. Magn.	*Aspicilia*	(Magnusson, 1924b)	Lichenicolous lichen
7	*Acarospora heufleriana* Körb.	*Lecanora valesiaca*	(Körber, 1865b)	Lichenicolous lichen

Table 2.96 (continued)

	Species name	Host	References	Remarks
8	*Acarospora hospitans* H. Magn.	*Aspicilia, Bellemerea, Leanora, Lecidea* and *Tremolecia*	(Magnusson, 1924a)	Lichenicolous lichen
9	*Acarospora imbricatula* H. Magn.	*Aspicilia*	(Magnusson, 1954)	Lichenicolous lichen
10	*Acarospora impressula* Th. Fr.	*Aspicilia*	(Fries, 1871)	Lichenicolous lichen
11	*Acarospora insignis* H. Magn.	*Aspicilia*	(Magnusson, 1924b)	Lichenicolous lichen
12	*Acarospora insolata* H. Magn.	*Immersaria* and *Rhizocarpon*	(Magnusson, 1924a)	Lichenicolous lichen
13	*Acarospora interjecta* H. Magn.	*Acarospora novomexicana*	(Magnusson, 1930)	Lichenicolous lichen
14	*Acarospora invadens* H. Magn.	*Aspicilia* and *Dimelaena*	(Magnusson, 1940)	Lichenicolous lichen
15	*Acarospora jenisejensis* H. Magn.	*Buellia, Dimelaena* and *Lecanora*	(Magnusson, 1936)	Lichenicolous lichen
16	*Acarospora mayrhoferi* K. Knudsen & Kocourk.	*Dimelaena oreina*	(Knudsen et al., 2018)	Lichenicolous lichen
17	*Acarospora microcarpa* (Nyl.) Wedd.	*Acarospora* and *Dimelaena*	(Weddell, 1874)	Lichenicolous lichen = *Lecanora schleicheri* var. *microcarpa* Nyl.

Table 2.96 (continued)

	Species name	Host	References	Remarks
18	*Acarospora nashii* K. Knudsen	*Dimelaena* and *Pleopsidium*	(Knudsen, 2011)	Lichenicolous lichen
19	*Acarospora pulvinata* H. Magn.	*Aspicilia*	(Magnusson, 1940)	Lichenicolous lichen
20	*Acarospora sphaerospora* H. Magn.	*Aspicilia*	(Magnusson, 1924b)	Lichenicolous lichen
21	*Acarospora stapfiana* (Müll. Arg.) Hue	*Caloplaca* and *Xanthoria elegans*	(Hue, 1909)	Lichenicolous lichen
22	*Acarospora strigata* (Nyl.) Jatta	*Aspicilia*	(Jatta, 1906)	Lichenicolous lichen = *Lecanora strigata* Nyl.
23	*Acarospora succedens* H. Magn.	*Dimelaena oreina*	(Magnusson, 1930)	Lichenicolous lichen
24	*Acarospora superans* H. Magn.	*Aspicilia* and *Dimelaena*	(Magnusson, 1940)	Lichenicolous lichen
25	*Acarospora suprasedens* H. Magn.	*Aspicilia* and *Lecanora*	(Magnusson, 1944)	Lichenicolous lichen
26	*Acarospora tominiana* H. Magn.	*Aspicilia*	(Magnusson, 1929)	Lichenicolous lichen
27	*Acarospora umbrina* H. Magn.	*Lecanora*	(Magnusson, 1940)	Lichenicolous lichen

Myriospora Nägeli ex Uloth (2-12)

Index Fungorum 539621, Facesoffungi, MycoBank, GenBank

Classification: Acarosporaceae, Acarosporales, Acarosporomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Myriospora smaragdula* (Wahlenb. ex Ach.) Nägeli ex Uloth

= *Endocarpon smaragdulum* Wahlenb. ex Ach.

Table 2.97 Accepted lichenicolous species of *Myriospora*

	Species name	Host	References	Remarks
1	*Myriospora bullata* K. Knudsen, Kocourk. & Hodková	*Lecidea inops*	(Knudsen et al., 2021)	
2	*Myriospora hassei* (Herre) K. Knudsen & Arcadia	*Acarospora socialis*	(Arcadia et al., 2012)	= *Acarospora hassei* Herre

Myriospora Nägeli ex Uloth (3-9)

Index Fungorum 539621, Facesoffungi, MycoBank, GenBank

Classification: Acarosporaceae, Acarosporales, Acarosporomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Myriospora smaragdula* (Wahlenb. ex Ach.) Nägeli ex Uloth

= *Endocarpon smaragdulum* Wahlenb. ex Ach.

Table 2.98 Accepted lichenicolous species of *Polysporina*

	Species name	Host	References	Remarks
1	*Polysporina arenacea* (H. Magn.) K. Knudsen & Kocourk.	on crustose lichens	(Knudsen et al., 2008)	= *Acarospora arenacea* H. Magn.

Table 2.98 (continued)

	Species name	Host	References	Remarks
2	*Polysporina pusilla* (Anzi) Nimis	*Acarospora, Caloplaca, Protoblastenia*	(Nimis, 1993)	= *Sarcogyne pusilla* Anzi
3	*Polysporina subfuscescens* (Nyl.) K. Knudsen & Kocourk.	*Acarospora, Buellia, Caloplaca, Candelariella, Lecidea*	(Knudsen et al., 2008)	= *Lecanora subfuscescens* Nyl.

SubClass LECANOROMYCETIDAE P.M. Kirk, P.F. Cannon, J.C. David & Stalpers ex Miądl., Lutzoni & Lumbsch

Order Caliciales Bessey

Family Caliciaceae Chevall.

Acolium (Ach.) Gray (3-21)

Index Fungorum 43, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Acolium sessile* (Pers.) Arnold

= *Calicium sessile* Pers.

Table 2.99 Accepted lichenicolous species of *Acolium*

	Species name	Host	References	Remarks
1	*Acolium corallinum* (Hepp) Körb.	*Zeora sordida* and *Pertusaria ocehlata*	(Körber, 1865a)	= *Cyphelium corallinum* Hepp

Table 2.99 (continued)

	Species name	Host	References	Remarks
2	*Acolium marcianum* (B. de Lesd.) M. Prieto & Wedin	*Pertusaria pseudocorallina*	(Bouly de Lesdain, 1908; Prieto et al., 2017)	= *Cyphelium marcianum* B. de Lesd.
3	*Acolium sessile* (Pers.) Arnold	*Pertusaria coccodes* and other corticolous *Pertusaria*	(Persoon, 1797; Arnold, 1885; Prieto et al., 2017)	*Calicium sessile* Pers.

Amandinea M. Choisy ex Scheid. & H. Mayrhofer (2-95)

Index Fungorum 27699, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Amandinea coniops* (Wahlenb.) M. Choisy ex Scheid. & H. Mayrhofer

= *Lecidea coniops* Wahlenb.

Table 2. 100 Accepted lichenicolous species of *Amandinea*

	Species name	Host	References	Remarks
1	*Amandinea adjuncta* (Th. Fr.) Hafellner	*Lecanora stramine*	(Fries, 1866; Hafellner, 2004b)	= *Buellia adjuncta* Th. Fr.
2	*Amandinea deminuta* Hafellner	*Caloplaca felipponei*	(Hafellner, 2004b)	

Buellia De Not. (14-249)

Index Fungorum 674, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Buellia disciformis* (Fr.) Mudd

= *Lecidea parasema* var. *disciformis* Fr.

Table 2.101 Accepted lichenicolous species of *Buellia*

	Species name	Host	References	Remarks
1	*Buellia albulella* Elix	*Buellia albula*	(Elix et al., 2017)	
2	*Buellia caloplacivora* Llimona & Egea	*Caloplaca*	(Fernández, 1984)	Lichenicolous lichen
3	*Buellia campbelliana* Elix	*Cladonia*	(Elix, 2018)	Lichenicolous lichen
4	*Buellia griseosquamulata* Scheid.	*Buellia tirolensis*	(Scheidegger, 1993)	Lichenicolous lichen
5	*Buellia imshaugii* Hafellner	*Dimelaena oreina*	(Hafellner, 1979)	Lichenicolous lichen
6	*Buellia insularis* Øvstedal	*Pannaria* and *Vestergrenopsis*	(Øvstedal et al., 2009)	Lichenicolous lichen
7	*Buellia miriquidica* Scheid.	*Schaereria fuscocinerea*	(Scheidegger, 1987)	Lichenicolous lichen
8	*Buellia servilosina* Elix & Kantvilas	*Xanthoparmelia mougeotina*	(Elix et al., 2017)	
9	*Buellia subad* Elix & Kantvilas	*Caloplaca lateritia*	(Elix et al., 2017)	

Table 2.101 (continued)

	Species name	Host	References	Remarks
10	*Buellia teloschistis* Vězda	*Teloschistes*	(Rambold et al., 1992)	
11	*Buellia uberior* (Nyl.) Anzi	*Schaereria fuscocinerea*	(Rambold et al., 1992)	Lichenicolous lichen = *Lecidea uberior Nyl.*
12	*Buellia uruguayensis* Etayo & Osorio	*Caloplaca felipponei*	(Etayo & Osorio, 2004)	
13	*Buellia uberiuscula* (Nyl.) Zahlbr.	*Acarospora fuscata*	(Zahlbruckner, 1931)	Lichenicolous lichen =*Lecidea uberiuscula Nyl.*
14	*Buellia vouauxii* Calat. & Barreno	*Rhizoplaca melanophthalma*	(Calatayud & Barreno, 1995)	

Caliciella Vain. (1-4)

Index Fungorum 729, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: not indicated

Accepted lichenicolous species:

Caliciella parasitica Räsänen, on *Chaenotheca furfuracea* (Clauzade et al., 1989, Kaufmann et al., 1998)

Calicium Pers. (1-41)

Index Fungorum 732, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Calicium viride* Pers.

Accepted lichenicolous species:

Calicium corynellum (Ach.) Ach., on *Haematomma ochroleucum* and other saxicolous lichens. (Acharius 1803)

Cratiria Marbach (1-28)

Index Fungorum 28410, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

= *Mannia* Trevis.

Type: *Mannia lauri-cassiae* (Fée) Trevis.

Type species: *Cratiria lauri-cassiae* (Fée) Marbach

= *Lecidea lauri-cassiae* Fée

Accepted lichenicolous species:

Cratiria cinnamomea Elix, on *Lecanora pangarangoensis* (Elix 2022)

Dimelaena Norman (1-12)

Index Fungorum 1573, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Dimelaena oreina* (Ach.) Norman

= *Lecanora straminea* var. *oreina* Ach.

Accepted lichenicolous species:

Dimelaena lichenicola K. Knudsen, Sheard, Kocourk. & H. Mayrhofer, juvenile lichenicolous on *Dimelaena oreina* and *D. thysanota* (Knudsen et al., 2013)

Diplotomma Flot. (7-14)

Index Fungorum 1629, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Diplotomma alboatrum* (Hoffm.) Flot.

= *Lichen alboater* Hoffm.

Table 2.102 Accepted lichenicolous species of *Diplotomma*

	Species name	Host	References	Remarks
1	*Diplotomma murorum* (A. Massal.) Coppins	*Caloplaca teicholyta*	(Massalongo, 1852; Hawksworth et al., 1980)	= *Diplotomma alboatrum* var. *murorum* A. Massal.
2	*Diplotomma nivale* (Bagl. & Carestia) Hafellner	*Xanthoria elegans, X. sorediata* and *Caloplaca Myriolecis* gr. *dispersa*	(Baglietto et al., 1864; Tauern, 1995)	= *Leciographa nivalis* Bagl. & Carestia
3	*Diplotomma parasiticum* (B. de Lesd.) Diederich, Cl. Roux et Van Haluwyn		(Bouly de Lesdain, 1910; Roux 2014)	= *Diplotomma epipolium* var. *parasiticum* B. de Lesd.
4	*Diplotomma renobalesii* Cl. Roux	*Myriolecis albescens*	(Roux, 2012)	
5	*Diplotomma scheideggerianum* (Bricaud & Cl. Roux) Nimis	*Caloplaca xantholyta*	(Bricaud, 1991; Nimis 1993)	= *Buellia scheideggeriana* Bricaud & Cl. Roux

Table 2.102 (continued)

	Species name	Host	References	Remarks
6	*Diplotomma venustum* Körb.	*Protoparmeliopsis versicolor*	(Körber, 1865b)	juvenile lichenicolous lichen
7	*Diplotomma vezdanum* (P. Scholz & Knoph) Coppins	*Caloplaca verruculifera*	(Scholz et al., 1995; Coppins, 2002)	= *Buellia vezdana* P. Scholz & Knoph

Endohyalina Marbach (4-11)

Index Fungorum 28411, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Endohyalina rappii* (Imshaug ex R.C. Harris) Marbach

= *Buellia rappii* Imshaug ex R.C. Harris

Table 2.103 Accepted lichenicolous species of *Endohyalina*

	Species name	Host	References	Remarks
1	*Endohyalina brandii* Giralt, van den Boom & Elix	*Aspicilia intermutans*	(Giralt et al., 2010)	
2	*Endohyalina diederichii* Giralt, van den Boom & Elix	*Ramalina bourgeana*	(Giralt et al., 2010)	
3	*Endohyalina insularis* (Arnold) Giralt, van den Boom & Elix	*Lecanora rupicola*	(Giralt et al., 2010)	= *Buellia saxatilis* f. *insularis* Arnold

Table 2.103 (continued)

	Species name	Host	References	Remarks
4	*Endohyalina parmotrematis* Ngangom, Shweta Sharma, S. Joseph & Nayaka	*Parmotrema austrosinense*	(Roshinikumar et al., 2022)	

Monerolechia Trevis. (6)

Index Fungorum 3248, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Monerolechia was intrudoced by Trevisan (1856) to accommodate the type species *M. bayrhofferi*, originally described as *Lecidea bayrhofferi*, which grows on *Parmelia fahlunensis*. This lichenicolous genus begins as a parasite on various lichens before becoming autonomous. It is characterized by circular, patelliform, entirely black apothecia that are sessile, with a flat disc and a thick, prominent margin that eventually becomes convex and swollen. The hypothecium merges with the exciple, forming a deep black, carbonaceous, and very thick layer. The eight-spored asci are of the Lecanora-type, surrounded by paraphyses, and the ascospores are *Buellia*-type: ovoid-oblong, slightly curved, bilocular, and dark brown to black. (Trevisan, 1856, Elix, 2015).

The phylogenetic status of *Monerolechia* remains uncertain due to the lack of molecular data. Lumbsch et al. (2007, 2010) placed the genus within Physciaceae (Teloschistales), while Wijayawardene et al. (2018, 2020, 2022) assigned it to Caliciaceae (Caliciales). For now, we tentatively accept its placement within Caliciaceae (Caliciales) pending further sequence data.

Type species: *Monerolechia bayrhofferi* (Schaer.) Trevis.

= *Lecidea bayrhofferi* Schaer.

Table 2.104 Accepted lichenicolous species of *Monerolechia*

	Species name	Host	References	Remarks
1	*Monerolechia badia* (Fr.) Kalb	Saxicolous lichens *Parmelia fahlunensis*	(Fries, 1825; Kalb, 2004) (Trevisan, 1856)	juvenile parasite = *Lecidea badia* Fr. = *Lecidea bayrhofferi* Schaer.
2	*Monerolechia bayrhofferi* (Schaer.) Trevis.			
3	*Monerolechia californica* (H. Magn.) Elix	juvenile parasite *Dimelaena radiata*	(Elix, 2015)	= *Rinodina californica* H. Magn.
4	*Monerolechia glomerulans* (Müll. Arg.) Elix	juvenile parasite *Xanthoparmelia*	(Eli,x 2015)	= *Catolechia glomerulans* Müll. Arg.
5	*Monerolechia norstictica* Elix	On *saxicolous Lecanora* or *Pertusaria,*	(Elix, 2015)	lichen, juvenile parasite
6	*Monerolechia papuensis* Elix	Associated *Parmotrema praesorediosum, Pertusaria Xanthodactylina* and *Pyxine sorediata*	(Elix, 2016)	lichen, juvenile parasite

Tetramelas Norman (3-37)

Index Fungorum 5383, faceoffungi, MycoBank, GenBank

Classification: Caliciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:*Tetramelas geophilus* Norman

Table 2.105 Accepted lichenicolous species of *Tetramelas*

	Species name	Host	References	Remarks
1	*Tetramelas concinnus* (Th. Fr.) Giralt	*Buellia, Melanelia, Parmelia, Physcia* and *Pseudephebe*	(Fries, 1861; Giralt et al., 2009)	Lichenicolous lichen = *Buellia concinna* Th. Fr.
2	*Tetramelas phaeophysciae* A. Nordin & Tibell	*Physconia,* also on *Anaptychia, Phaeophyscia endococcina* and *Physcia*	(Nordin et al., 2005)	
3	*Tetramelas pulverulentus* (Anzi) A. Nordin & Tibell	*Physconia,* also on *Anaptychia, Phaeophyscia* and *Physcia*	(Anzi, 1860; Nordin et al., 2005)	= *Abrothallus pulverulentus* Anzi

Family Physciaceae Zahlbr.

Oxnerella S.Y. Kondr., Lőkös & Hur (1-2)

Index Fungorum 9986, faceoffungi, MycoBank, GenBank

Classification: Physciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

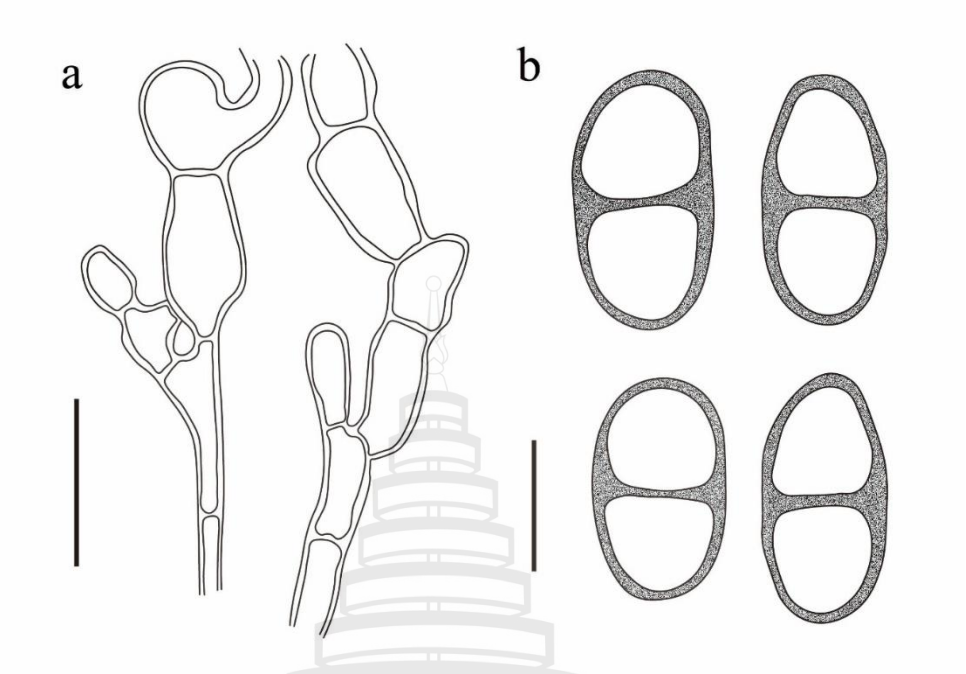
Oxnerella was introduced by Kondr., Lőkös & Hur (2014) to accommodate the lichen species *O. safavidiorum*. Subsequent phylogenetic analysis by Kondratyuk et al.

(2021), based on ITS and mtSSU sequences, revealed that *Oxnerella* forms part of the *Phaeophyscia* s. lat. subclade. As a result, the genus was placed within the family Physciaceae (Caliciales). The species *Oxnerella afghanica*, originally described as *Rinodina afghanica* (Steiner et al., 1987), was then designated as the type species, while the original type, *O. safavidiorum*, was transferred to *Lecania* (Kondratyuk et al., 2021). Additionally, *Oxnerella castanomelodes* was reclassified from *Rinodina castanomelodes* (Kondratyuk et al., 2021).

This genus is characterized by a crustose, areolate thallus that ranges in color from ochraceous to rusty brown. The hypothallus is concolorous with the thallus, also ochraceous. Apothecia are lecanorine, with convex, black or blackish discs. The cortical layer of the thalline exciple exhibits a palisade plectenchymatous structure, while the true exciple is paraplectenchymatous. The hymenium is dark and brownish, with a blackish, K– epihymenium. Paraphyses have swollen apical cells, and the subhymenium is hyaline. Asci are of the Biatora-type, and ascospores are 1-septate, constricted at the septum. There are two species recognized within this genus: one lichenicolous and one lichen-forming.

Type species: *Oxnerella afghanica* (M. Steiner & Poelt) S.Y. Kondr., Lőkös & Hur, on *Caloplaca polycarpoides*

= *Rinodina afghanica* M. Steiner & Poelt (Steiner et al., 1987, Kondratyuk et al., 2021)



Note a Paraphyses. b Ascospores. Scale bars: a–b = 10 µm.

Source Redrawn from Steiner et al. (1987)

Figure 2.79 *Oxnerella afghanica*

Rinodina (Ach.) Gray (10-138)

= *Lecanora* subdiv. *Rinodina* Ach.

Index Fungorum 4759, faceoffungi, MycoBank, GenBank

Classification: Physciaceae, Caliciales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Rinodina sophodes* (Ach.) A. Massal.

= *Lichen sophodes* Ach.

Table 2.106 Accepted lichenicolous species of *Rinodina*

	Species name	**Host**	**Remarks**
1	*Rinodina canariensis* Matzer, H. Mayrhofer & P. Clerc	*Saxicolous lichens*	lichenicolous lichen

Table 2.106 (continued)

	Species name	Host	Remarks
2	*Rinodina egedeana* (Linds.) Alstrup & D. Hawksw.	*Parmelia and Peltigera*	= *Lecidea egedeana* Linds.
3	*Rinodina epimilvina* H. Mayrhofer	*Rinodina milvina*	lichenicolous lichen
4	*Rinodina milvina* (Wahlenb.) Th. Fr.	*Saxicolous lichens*	lichenicolous lichen = *Parmelia milvina* Wahlenb. ex Ach.
5	*Rinodina milvinoides* H. Mayrhofer	*Aspicilia*	lichenicolous lichen
6	*Rinodina obnascens* (Nyl.) H. Olivier	*Aspicilia and Rhizocarpon*	lichenicolous lichen = *Lecanora obnascens* Nyl.
7	*Rinodina parasitica* H. Mayrhofer & Poelt	*Aspicilia, Lecanora and Lecidea*	lichenicolous lichen
8	*Rinodina santorinensis* J. Steiner	*Diploicia, Ochrolechia, Pertusaria, etc.*	lichenicolous lichen
9	*Rinodina superposita* H. Magn.	*Lecanora and Lecidea*	lichenicolous lichen

Order Lecanorales Nannf.

Family Catillariaceae Hafellner

Catillaria A. Massal. (5-53)

Index Fungorum 841, faceoffungi, MycoBank, GenBank

Classification: Catillariaceae, Lecanorales, Lecanoromycetidae,

Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Catillaria chalybeia* (Borrer) A. Massal.

= *Lecidea chalybeia* Borrer

Table 2.107 Accepted lichenicolous species of *Catillaria*

	Species name	Host	References	Remarks
1	*Catillaria japonica* Zhurb. & Hafellner	*Dibaeis sorediata*	(Zhurbenko & Ohmura, 2020)	
2	*Catillaria lobariicola* (Alstrup) Coppins & Aptroot	*Lobaria scrobiculata*	(Alstrup, 1997; Coppins et al., 2008)	= *Scutula lobariicola* Alstrup
3	*Catillaria mediterranea* Hafellner	*Anaptychia ciliaris* and *Niebla bourgaeana*	(Hafellner, 1982)	lichenicolous lichen
4	*Catillaria stereocaulorum* (Th. Fr.) H. Olivier	*Stereocaulon alpinum*	(Fries, 1861; Olivier, 1905)	= *Biatorina stereocaulorum* Th. Fr.
5	*Catillaria usneicola* Etayo	*Usnea*	(Etayo, 2000)	

Family Cladoniaceae Zenker.

Paralecia Brackel, Greiner, Peršoh & Rambold (1)

Index Fungorum 551012, faceoffungi, MycoBank, GenBank

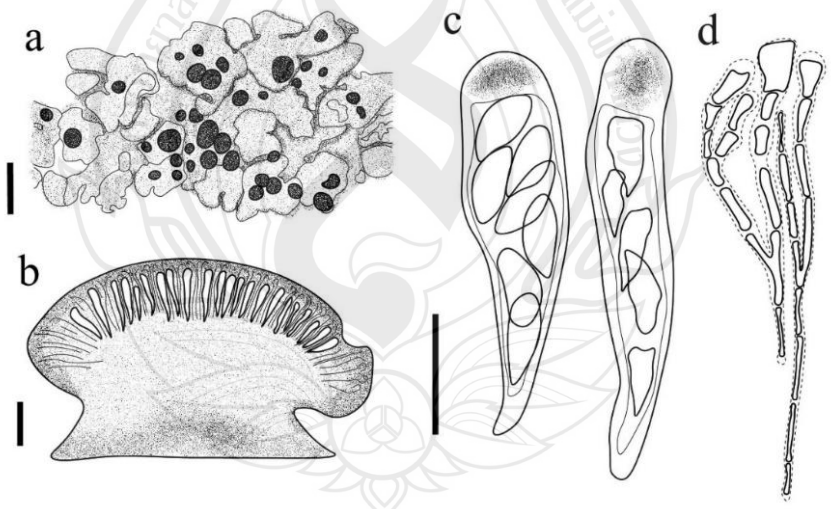
Classification: Cladoniaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Paralecia was introduced by Brackel, Greiner, Peršoh & Rambold (2015) to

accommodate the type species *P. pratorum*, which grows on *Protoparmeliopsis muralis*. The monotypic genus is characterized by its lichenicolous lifestyle, lecideine apothecia, clavate asci with an I+ blue, tube-like apical structure, and hyaline, simple ascospores. In the phylogenetic analysis by Liu et al. (2015), this genus is closely related to the lichenized genus *Squamarina* Poelt. Therefore, it was considered a member of the Squamarinaceae Hafellner (Liu et al., 2015). Diederich (2018) included *Paralecia* within the family Stereocaulaceae Chevall. Kraichak et al. (2018) conducted a revised classification of Leanoromycetes, synonymizing Squamarinaceae and Stereocaulaceae with Cladoniaceae (Kraichak et al., 2018). Consequently, *Paralecia* was included in the family Cladoniaceae (Wijayawardene et al., 2020; Wijayawardene et al., 2022).

Type species:

Paralecia pratorum Brackel, Greiner, Peršoh & Rambold, on *Protoparmeliopsis muralis*



Note a Ascomata of *P. pratorum* on young lobes of *Protoparmeliopsis muralis*. b Apothecium in longitudinal section. c Asci at different ontogenetical stages. d Paraphyses. Scale bars: a = 1 mm, b = 50 μm, c = 20 μm.

Source Redrawn from Liu et al. (2015)

Figure 2.80 *Paralecia pratorum*

Family Lecanoraceae Körb.

Carbonea (Hertel) Hertel (15-29)

Index Fungorum 25791, faceoffungi, MycoBank, GenBank

Classification: Lecanoraceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

= *Lecidea* subgen. *Carbonea* Hertel

Type species: *Carbonea atronivea* (Arnold) Hertel

= *Lecidea atronivea* Arnold

Table 2.108 Accepted lichenicolous species of *Carbonea*

	Species name	**Host**	**References**	**Remarks**
1	*Carbonea aggregantula* (Müll. Arg.) Diederich & Triebel	*Lecanora polytropa* & *Rhizoplaca*	(Müller, 1874b;; Cannon et al., 2022)	= *Lecidea aggregantula* Müll. Arg.
2	*Carbonea antarctica* (C.W. Dodge & G.E. Baker) D. Hawksw. & Iturr.	*Pseudephebe*	(Dodge et al., 1938; Hawksworth & Iturriaga, 2006)	= *Alectoria antarctica* C.W. Dodge & G.E. Baker
3	*Carbonea assimilis* (Hampe ex Körb.) Hafellner & Hertel	*Aspicilia, Lecanora, Lecidea, Pertusaria, Rhizocarpon* and *Tephromela* *Lecidella*	(Körber, 1861; Wirth, 1987; Cannon et al., 2022)	= *Lecidella assimilis* Hampe ex Körb.
4	*Carbonea atronivea* (Arnold) Hertel		(Arnold, 1870; Hertel, 1983)	= *Lecidea atronivea* Arnold

Table 2.108 (continued)

	Species name	Host	References	Remarks
5	*Carbonea degelii* Alstrup	*Lecanora intricata*	(Alstrup et al., 1994)	
6	*Carbonea halacsyi* (J. Steiner) Hafellner & Sancho	*Rhizocarpon*	(von Halácsy, 1894; Hafellner et al., 1990)	= *Lecidea halacsyi* J. Steiner
7	*Carbonea herteliana* Hafellner & Matzer	*Rhizocarpon umbilicatum*	(Hafellner, 1999b)	
8	*Carbonea intrudens* (H. Magn.) Hafellner	*Rhizocarpon*	(Magnusson, 1946; Hafellner, 2006)	= *Lecidea intrudens* H. Magn.
9	*Carbonea invadens* (H. Magn.) M.P. Andreev	*Rhizocarpon geographicum*	(Magnusson, 1927; Andreev, 2004)	juvenile lichenicolous = *Lecidea invadens* H. Magn.
10	*Carbonea neuropogonis* Etayo	*Usnea aurantiacoatra*	(Etayo & Sancho, 2008)	
11	*Carbonea superjecta* (Nyl.) Hertel	*Lecanora disjungenda*	(Hertel, 1984)	= *Lecidea superjecta* Nyl.
12	*Carbonea supersparsa* (Nyl.)	*Lecanora* (mainly *L.*	(Hertel, 1983)	= *Lecidea supersparsa* Nyl.

Table 2.108 (continued)

	Species name	Host	References	Remarks
	Hertel	*polytropa*)		
	Carbonea tephromelae M. Svensson & M. Westb.	*Tephromela atra*	(Svensson et al., 2021)	
13	*Carbonea vitellinaria* (Nyl.) Hertel & Rambold	*Candelariella*	(Hertel, 1983)	= *Lecidea vitellinaria* Nyl.
14	*Carbonea vorticosa* (Flörke) Hertel	*Physcia dubia*	(Hertel, 1983)	= *Lecidea sabuletorum* vorticosa Flörke

Lecanora Ach. (13-250+)

Index Fungorum 2687, faceoffungi, MycoBank, GenBank

Classification: Lecanoraceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Lecanora subfusca* (L.) Ach.

= *Lichen subfuscus* L.

Table 2.109 Accepted lichenicolous species of *Lecanora*

	Species name	Host	References	Remarks
1	*Lecanora epithallina* H. Magn.	*Vestergrenopsis isidiata*	(Magnusson, 1952)	
2	*Lecanora dispersa* f. *parasitans* (Wedd.) Harm.	*Dermatocarpon miniatum*	(Weddell, 1874)	= *Lecanora albescens* subvar. *parasitans* Wedd.

Table 2.109 (continued)

	Species name	Host	References	Remarks
3	*Lecanora gisleriana* Müll. Arg.	*Lecanora epanora, L. handelii* and *L. subaurea*	(Müller, 1874a; Cannon et al., 2022)	
4	*Lecanora gyrophorina* Poelt & Zhurb.	*Umbilicaria hyperborea*	(Poelt et al., 1997)	
5	*Lecanora lasalliae* Pérez-Ortega & Etayo	*Lasallia pustulata*	(Perez-Ortega et al., 2008)	
6	*Lecanora latro* Poelt	*Miriquidica nigroleprosa*	(Poelt, 1962)	
7	*Lecanora lecanoricola* (Alstrup, D. Hawksw. & R. Sant.) Rambold & Triebel	*Lecanora cenisia*	(Alstrup et al., 1990; Rambold et al., 1992)	= *Lecidella lecanoricola* Alstrup, D. Hawksw. & R. Sant.
8	*Lecanora mosigiicola* (Eitner) Hertel & Rambold	*Orphniospora mosigii*	(Eitner, 1911; Alstrup et al., 1990)	= *Biatora mosigiicola* Eitner
9	*Lecanora nohedensis* Roux & M. Barbero	*Placopyrenium breussii, Aspicilia calcitrapaeussii*	(Roux & Barbero, 2011)	
10	*Lecanora printzenii* Pérez-Ortega, Vivas & Hafellner	*Umbilicaria cylindrica*	(Lumbsch et al., 2011)	
11	*Lecanora thallophila* H. Magn.	*Dermatocarpon*		

Table 2.109 (continued)

	Species name	Host	References	Remarks
12	*Lecanora tolypodes* Poelt & Vezda	*Aspicilia* cf. *grisea*	(Poelt, 1970)	
13	*Lecanora usneicola* Etayo	*Usnea antarctica*	(Etayo & Sancho, 2006)	

Lecidella Körb. (3-80^{+})

Index Fungorum 2693, faceoffungi, MycoBank, GenBank

Classification: Lecanoraceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Lecidella viridans* (Flot.) Körb.

= *Lecidea sabuletorum* var. *viridans* Flot.

Table 2.110 Accepted lichenicolous species of *Lecidella*

	Species name	Host	References	Remarks
1	*Lecidella dimelaenophila* Hertel	*Dimelaena oreina*	(Hertel, 1977)	Juvenile lichenicolous
2	*Lecidella parasitica* Sanderson	*Pyrrhospora quernea*	(Cannon et al., 2022)	
3	*Lecidella vorax* Leuckert & Poelt	*Lecanora rupicola*	(Nimis et al., 1987)	

Miriquidica Hertel & Rambold (6-26)

Index Fungorum 25193, faceoffungi, MycoBank, GenBank

Classification: Lecanoraceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Miriquidica complanata* (Körb.) Hertel & Rambold

= *Lecanora complanata* Körb.

Table 2.111 Accepted lichenicolous species of *Miriquidica*

	Species name	Host	References	Remarks
1	*Miriquidica complanata* (Körb.) Hertel & Rambold	*Rhizocarpon* gr. *geographicum*	(Körber, 1859; Hertel et al., 1987)	= *Lecanora complanata* Körb.
2	*Miriquidica instrata* (Nyl.) Hertel & Rambold	*Aspicilia*	(Nylander, 1877; Hertel et al., 1987)	= *Lecidea instrata* Nyl.
3	*Miriquidica intrudens* (H. Magn.) Hertel & Rambold	*Rhizocarpon*	(Magnusson, 1942; Hertel et al., 1987)	= *Lecanora intrudens* H. Magn.
4	*Miriquidica invadens* Hafellner, Obermayer & Tretiach	*Sporastatia polyspora*	(Hafellner et al., 2014)	
5	*Miriquidica nigroleprosa* (Vain.) Hertel & Rambold	juvenile facultatively lichenicolous *Rhizocarpon*	(Vainio; 1883; Hertel et al., 1987)	= *Lecanora nigroleprosa* Vain.
6	*Miriquidica verrucariicola* (B.D. Ryan) K. Knudsen & Kocourk.	*Dimelaenaradiata* ,*Tephromela* and *Verrucaria subdivisa,*	(Nash et al., 2004; Knudsen et al., 2015)	= *Lecanora verrucariicola* B.D. Ryan

Myrionora R.C. Harris (1-5)

Index Fungorum 25230, faceoffungi, MycoBank, GenBank

Classification: Lecanoraceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Myrionora albidula* (Willey) R.C. Harris

= *Biatora albidula* Willey

Accepted lichenicolous species:

Myrionora pseudocyphellariae (Etayo) S. Ekman & Palice, on *Pseudocyphellaria* (Palice et al., 2013)

= *Scoliciosporum pseudocyphellariae* Etayo (Etayo & Sancho, 2008)

Family Parmeliaceae F. Berchtold & J. Presl

Nesolechia A. Massal. (21-22)

Index Fungorum 3499, faceoffungi, MycoBank, GenBank

Classification: Parmeliaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Nesolechia was intrudoced by Massalong (1856) to accommodate five species, with *N. oxyspora* designated as the type species, originally transferred from *Abrothallus oxysporus* Tul. The genus is characterized by punctiform, flattened to slightly swollen, circular to subelliptical, sessile apothecia that are lecideine in form and lack a distinct excipulum. The clavate asci are accompanied by agglutinated paraphyses with slightly thickened apices, containing eight elliptical to ovoid, transparent, unilocular spores.

Abrothallus oxysporus was initially recognized as a typical lichenicolous species before being reassigned to *Nesolechia* and later to *Phacopsis* (Tulasne, 1852; Massalongo, 1856). However, a six-locus phylogenetic analysis by Divakar et al. (2015) revealed that *N. oxyspora* is phylogenetically aligned with the *Punctelia* clade. Consequently, *Abrothallus oxysporus* was reclassified as *Punctelia oxyspora* by Divakar et al. (2017), though this reassignment was made without a comprehensive

morphological evaluation. As a result, *Nesolechia oxyspora* and *Phacopsis oxyspora* are now considered synonyms of *Punctelia oxyspora*.

Since the original type species of *Nesolechia* has been transferred to another genus and all five species originally described by Massalongo (1856) have been reassigned, it became necessary to designate a new type species. Among potential candidates, *Nesolechia cladoniaria* (Nyl.) Zopf and *N. oxysporella* (Nyl.) Rehm, both published in 1858, were considered. Due to the detailed description of *N. oxysporella* based on Massalongo's *Lich. exs.* 153, this species is proposed here as the neotype for the genus.

Nesolechia is defined solely by its ascocarps, asci, and spores, lacking a distinct thallus (Tulasne, 1852). In contrast, the classification of *Punctelia* is primarily based on the presence of pseudocyphellae on the thallus, which differentiates it from *Parmelia*, with only brief descriptions provided for its apothecia and spores (Krog, 1982). Due to the simplistic and vague morphological descriptions of spores in both *Abrothallus* and *Punctelia*, the reclassification of *Nesolechia oxyspora* into *Punctelia*, a genus with distinct phenotypic traits, based solely on genetic data, remains questionable. There is even concern that the phylogenetic analysis may have utilized sequences from a lichen rather than the correct sequences for *N. oxyspora*. As the type species, *Nesolechia oxyspora* embodies the key diagnostic traits of its genus. Therefore, a combined approach incorporating both phylogenetic and morphological analyses based on the type specimen would provide a more robust basis for taxonomic conclusions.

To date, *Nesolechia* comprises 22 recognized species, most of which are lichenicolous, with the exception of *N. imponens* Leight. ex Zopf, which may represent a lichen rather than a lichenicolous fungus. *Nesolechia* is a historically significant yet under-studied genus, with many of its species originating from transfers out of other genera. The most recent addition was made in the early 1900s, underscoring the need for further taxonomic investigation through integrated morphological and molecular

approaches.

Type species: *Nesolechia oxyspora* (Tul.) A. Massal.

= *Abrothallus oxysporus* Tul. Current name: *Punctelia oxyspora* (Tul.) Divakar, A. Crespo & Lumbsch

Neotype species:

Nesolechia oxysporella (Nyl.) Rehm, Massalongo's Lich. exs. 153

= *Lecidea oxysporella* Nyl.

Table 2.112 Accepted lichenicolous species of *Nesolechia*

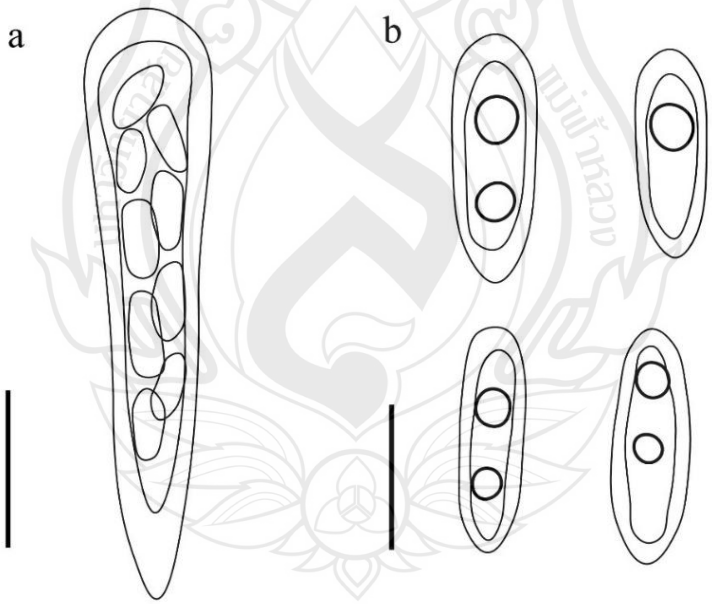
	Species name	**Host**	**References**	**Remarks**
1	*Nesolechia bruniana* Müll. Arg.	Parasitic on lichen	(Müller, 1875)	
2	*Nesolechia cladoniaria* (Nyl.) Zopf	*Cladonia uncialis*	(Zopf, 1896)	= *Lecidea cladoniaria* Nyl.
3	*Nesolechia cladoniscum* (Willey) Fink	*Cladonia papillaria*	(Fink, 1935)	= *Biatora cladoniscum* Willey (1892
4	*Nesolechia coccocarpiae* Müll. Arg.	*Coccocarpia aurantiacae*	(Müller, 1887b)	
5	*Nesolechia dispersula* (Arn.) Rehm	*Aspicilia polychroma f. candida*	(Dalla Torre et al., 1905)	= *Lecidea dispersula* Arn. (1891)
6	*Nesolechia diversispora* Grelet	*Lecanora*		a poorly known species
7	*Nesolechia doerfeltii* (Alstrup & P. Scholz) Diederich	*Arctoparmelia centrifuga*	(Diederic et al., 2018)	= *Phacopsis doerfeltii* Alstrup & P. Scholz (1998)

Table 2.112 (continued)

	Species name	Host	References	Remarks
8	*Nesolechia erichsenii* Räsänen	*Lecanora variae*	(Raesaenen, 1934)	
9	*Nesolechia falcispora* (Triebel & Rambold) Diederich	*Usnea maculata*	(Diederich et al., 2018)	*Phacopsis falcispora* Triebel & Rambold
10	*Nesolechia frigidella* (Nyl.) Vouaux	on lichen	(Vouaux, 1913b)	= *Lecidea frigidella* Nyl.
11	*Nesolechia fusca* (Triebel & Rambold) Pérez-Ort.	*Xanthoparmelia xanthomelaena*	(Spribille et al., 2010)	= *Phacopsis oxyspora var. fusca* Triebel & Rambold
12	*Nesolechia halacsyi* J. Steiner	*Rhizocarpon geographicum*	(Steiner, 1898)	
13	*Nesolechia intumescens* (Flörke ex Flot.) Sacc. & D. Sacc.	*Lecanora sordida*	(Saccardo et al., 1905)	*Lecidea petraea* var. *intumescens* Flörke ex Flot.
14	*Nesolechia koliensis* Räsänen	*Lecanora frustulosa*	(Räsänen, 1939)	
15	*Nesolechia moorei* Arnold	*Cladonia bellidiflora*	(Arnold, 1874b)	
16	*Nesolechia oxysporella* (Nyl.) Rehm	*Cladonia*	(Nylander, 1858a; Rehm 1889)	*Lecidea oxysporella* Nyl. (1858)
17	*Nesolechia oxysporiza* J. Steiner	*Lecidea polytropa*	(Steiner, 1898)	

Table 2.112 (continued)

	Species name	Host	References	Remarks
18	*Nesolechia papillariae* (Willey) Fink	*Cladonia papillaria*	(Fink, 1935)	= *Biatora papillariae* Willey (1892)
19	*Nesolechia perforans* (Stizenb.) Vouaux	*Parmelia perforata*	(Vouaux, 1913b)	= *Lecidea perforans* Stizenb. (1890)
20	*Nesolechia sarothamni* Velen.	Crustose lichen	(Velenovský, 1934)	
21	*Nesolechia vainioana* Räsänen	*Lecidea relanderi*	(Räsänen, 1939)	



Note a Asci. b Ascospores. Scale bars: a = 10 µm, b = 5 µm.

Source Redrawn from description of Nylander (1858a)

Figure 2.81 *Nesolechia oxysporella*

Phacopsis Tul. (13)

Index Fungorum 3876, faceoffungi, MycoBank, GenBank

Classification: Parmeliaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Phacopsis was originally described by Tulasne (1852) as a genus of parasitic lichens that exhibit a paradoxical, fungiform appearance, lacking a thallus and parasitizing various foliose, fruticose, and crustose species. The type species, *Phacopsis vulpina* Tul., was later designated by Clements et al. (1931). The genus is characterized by apothecia that initially develop hypophloeodally but eventually become exposed, innate-adnate to the substrate, and effuse, lacking distinct margins. The apothecia are black, manifesting as irregular, deformed patches. Asci are obovate, thick-walled, and contain 6–8 spores, which are oblong, sparsely septate, and pale. Spermogonia are embedded in the center of the apothecia, producing slender, straight, and short spermatia (Tulasne, 1852).

To date, 13 lichenicolous species are recognized within *Phacopsis*, as documented in Index Fungorum (2024) and MycoBank (2024). A phylogenetic analysis conducted by Peršoh et al. (2002) based on SSU sequences placed *Phacopsis* within the family Parmeliaceae (Lecanorales), a classification that has been widely accepted by subsequent researchers (Lumbsch et al., 2007; Wijayawardene et al., 2018; Wijayawardene et al., 2022).

Type species:

Phacopsis vulpina Tul.

Table 2.113 Accepted lichenicolous species of *Phacopsis*

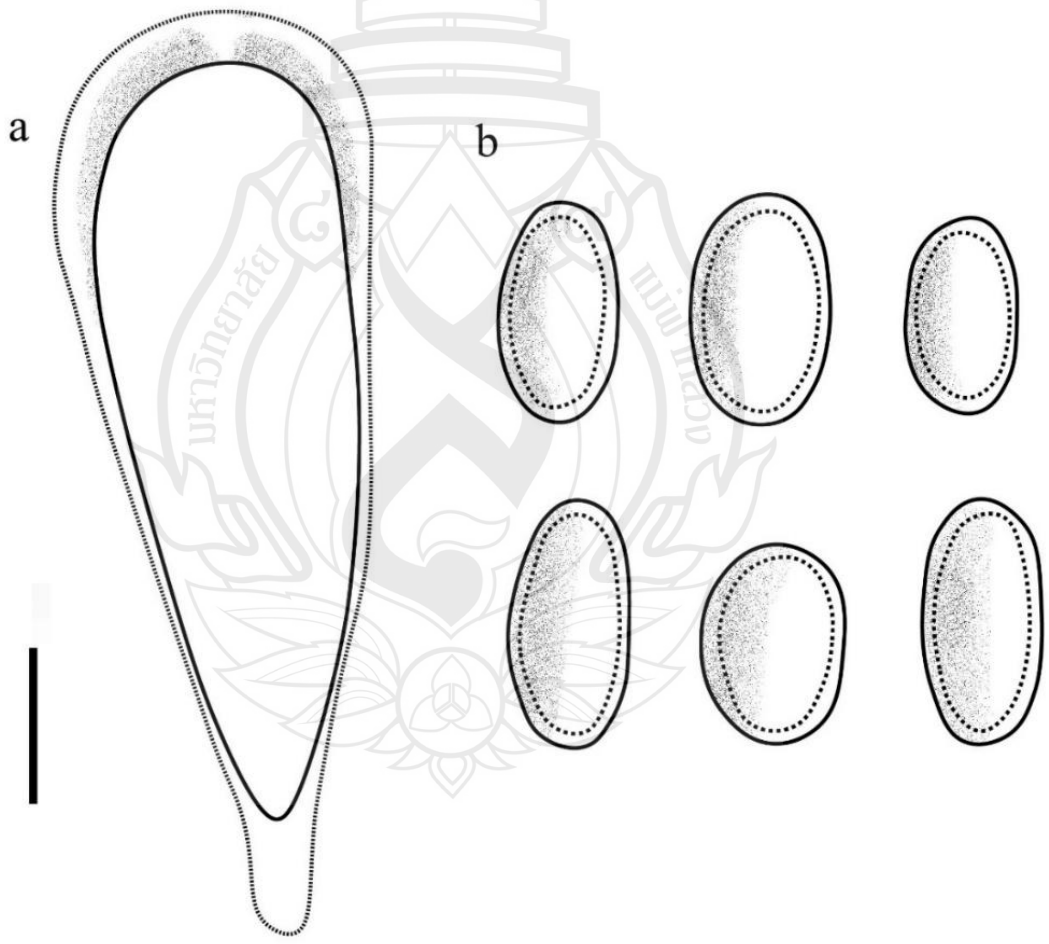
	Species name	Host	References	Remarks
1	*Phacopsis australis* Aptroot & Triebel	*Xanthoparmelia*	(Aptroot, 2002)	

Table 2.113 (continued)

	Species name	Host	References	Remarks
2	*Phacopsis cephalodioides* (Nyl.) Triebel & Rambold	*Hypogymnia physodes*	(Triebel et al., 1988)	=*Agyrium cephalodioides* Nyl.
3	*Phacopsis geographici* (J. Steiner) Keissl. Nesolechia geographici J. Steiner	*Rhizocarpon geographicum*	(Keissler, 1930)	= *Nesolechia geographici* J. Steiner
4	*Phacopsis lethariellae* Hafellner & Rambold	*Lethariella intricata*	(Triebel et al., 1995)	
5	*Phacopsis menegazziae* Triebel & Rambold	*Menegazzia terebrata*	(Triebel et al., 1995)	
6	*Phacopsis oroarcticae* Zhurb.	*Brodoa oroarctica*	(Zhurbenko, 2010a)	
7	*Phacopsis prolificans* (Müll. Arg.) Triebel & Rambold	*Cetraria collata, Platismatia interrupta*	(Rambold, 1992)	= *Nesolechia perforans* Müll. Arg.
8	*Phacopsis pulvinata Rodway*	dead trunk	(Rodway, 1924)	
9	*Phacopsis rufa* (Müll. Arg.) Triebel	*Cetrelia, Punctelia, Psoromatis*	(Rambold, 1992)	= *Nesolechia rufa* Müll. Arg.
10	*Phacopsis thallicola* (A. Massal.) Triebel & Rambold	*Parmelia caperata*	(Triebel et al., 1988)	= *Lecidea thallicola* A. Massal.

Table 2.113 (continued)

	Species name	Host	References	Remarks
11	*Phacopsis usneae* C.W. Dodge	*Usnea* subgen. *Neuropogon*	(Dodge, 1948)	
12	*Phacopsis vulpicidae* Zhurb. & Diederich	*Vulpicida juniperina*	(Zhurbenko et al., 2019)	
13	*Phacopsis vulpina* Tul.	*Letharia vulpina*	(Tulasne, 1852)	



Note a Asci. b Ascospores. Scale bar: a = 10 μm

Source Redrawn from Triebel et al. (1995)

Figure 2.82 *Phacopsis vulpina*

Protoparmelia M. Choisy (7-26)

Index Fungorum 4390, faceoffungi, MycoBank, GenBank

Classification: Parmeliaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Protoparmelia badia* (Hoffm.) Hafellner

= *Verrucaria badia* Hoffm.

Table 2.114 Accepted lichenicolous species of *Protoparmelia*

	Species name	Host	References	Remarks
1	*Protoparmelia atriseda* (Fr.) R.Sant. & V.Wirth	juvenile lichenicolous on *Rhizocarpon*	(Wirth, 1987)	= *Parmelia badia* var. *atriseda* Fr.
	Protoparmelia cupreobadia (Nyl.) Poelt	juvenile lichenicolous on *Rhizocarpon*	(Poelt et al., 1991)	= *Lecanora cupreobadia* Nyl.
2	*Protoparmelia hierrensis* van den Boom & Ertz	*Pertusaria*	(Van Den Boom & Ertz, 2012)	
3	*Protoparmelia leproloma* (R. Sant.) Rambold & Poelt	*Lecidea praenubila*	(Poelt et al., 1991)	= *Lecidea leproloma* R. Sant.
4	*Protoparmelia loricata* Poelt & Vězda	*Lecanora umbrosa*	(Vězda, 1989)	
5	*Protoparmelia phaeonesos* Poelt	*Aspicilia myrinii*	(Poelt et al., 1991)	

Raesaenenia D. Hawksw., Boluda & H. Lindgr. (2)

Index Fungorum 812847, faceoffungi, MycoBank, GenBank

Classification: Parmeliaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Raesaenenia was intrudoced by Divakar et al. (2015) based on phylogenetic analysis to accommodate the type species *Phacopsis huuskonenii* Räsänen, which parasitizes *Alectoria implexa*. In their phylogenetic tree, *Phacopsis huuskonenii* was found to be sister to *Protousnea* within the Anzioid clade of Parmeliaceae, but it was clearly distinct from the type species *Phacopsis vulpina* due to significant differences in ascospore morphology. However, Divakar et al. (2017) synonymized *Raesaenenia* with *Protousnea*, reclassifying *Raesaenenia huuskonenii* as *Protousnea huuskonenii*, leading to *Raesaenenia* as synonym of *Protousnea*. However, this change was not accepted by some authors (Diederich et al., 2018; Lücking 2019). Later, phylogenetic analysis by Etayo et al. (2023) indicated that *Phacopsis usneae* is more closely related to *Raesaenenia huuskonenii* than to *Protousnea vulpina*. Thus, a second species, *Phacopsis usneae*, was transferred to *Raesaenenia usneae*, and *Raesaenenia* was kept.

Raesaenenia is characterized by *Phacopsis*-like structures but distinguished by its subcylindrical ascospores with thickened caps of wall tissue at each end. The *Phacopsis*-like features include subimmersed, shiny brown to black apothecia; a colorless to blackish-brown excipulum and hypothecium; septate, unbranched paraphyses with dark-brown pigmented caps; broadly clavate, eight-spored, Lecanora-type asci; and colorless, nonseptate ascospores that can be ellipsoid, ovoid, fusiform, lemon-shaped, or falciform. (Hawksworth, 1978; Hafellner, 1987a; Triebel et al., 1988; Triebel et al., 1995).

Type species: *Raesaenenia huuskonenii* (Räsänen) D. Hawksw., C. Boluda & H. Lindgren

= *Phacopsis huuskonenii* Räsänen

Table 2.115 Accepted lichenicolous species of *Raesaenenia*

	Species name	Host	References	Remarks
1	*Raesaenenia huuskonenii* (Räsänen) D. Hawksw., Boluda & H. Lindgr.	*Alectoria implexa*	(Divakar et al., 2015)	= *Phacopsis huuskonenii* Räsänen
2	*Raesaenenia usneae* (C.W. Dodge) Etayo & Pino-Bodas	*Usnea trachycarpa*	(Etayo et al., 2023)	= *Phacopsis usneae* C.W. Dodge

Family Pilocarpaceae Zahlbr.

Fellhanera Vězda (1-50^{+})

Index Fungorum 25758, faceoffungi, MycoBank, GenBank

Classification: Pilocarpaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Fellhanera fuscatula* (Müll. Arg.) Vězda

= *Patellaria fuscatula* Müll. Arg.

Accepted lichenicolous species:

Fellhanera stictae Etayo, on *Sticta* (Etayo, 2017)

Micarea Fr. (9-100^{+})

Index Fungorum 3149, faceoffungi, MycoBank, GenBank

Classification: Parmeliaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Micarea prasina Fr.

Table 2.116 Accepted lichenicolous species of *Micarea*

	Species name	Host	References	Remarks
1	*Micarea amplissima* van den Boom & Etayo	*Ricasolia amplissima*	(Van Den Boom et al., 2023)	
2	*Micarea inquinans* (Tul.) Coppins	*Dibaeis baeomyces*	(Rambold et al., 1992)	*Abrothallus inquinans* Tul.
3	*Micarea kemmleri* Brackel	*Cladonia*	(Brackel, 2016)	
4	*Micarea novae-zelandiae* Zhurb.	*Bunodophoron ramuliferum*	(Zhurbenko, 2023c)	
5	*Micarea parasitica* van den Boom & Etayo	*Hypotrachyna*	(Van Den Boom et al., 2023)	
6	*Micarea peliocarpa* (Anzi) Coppins & R. Sant.	*Pertusaria*	(Coppins et al., 1979)	*Bilimbia peliocarpa* Anzi
7	*Micarea stereocaulorum* van den Boom & Etayo	*Stereocaulon*	(Etayo, 2017)	
8	*Micarea synotheoides* (Nyl.) Coppins	*Hypotrachyna* and *Parmotrema*	(Topham et al., 1982)	*Lecidea synotheoides* Nyl.
9	*Micarea usneae* van den Boom & Ertz	*Usnea*	(van den Boom & Damien, 2014)	

Family Psoraceae Zahlbr.

Glyphopeltis Brusse (1-2)

Index Fungorum 25717, faceoffungi, MycoBank, GenBank

Classification: Psoraceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

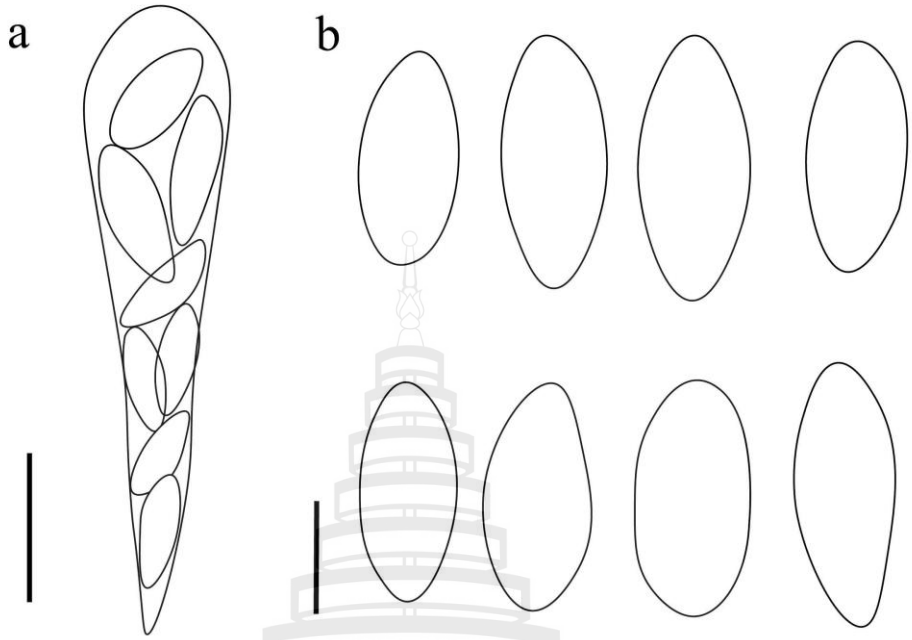
Glyphopeltis is a saxicolous lichen genus intrudoced by Brusse (1985) from southern Africa. It resembles *Glypholecia* in thallus form, texture, and surface fissuring, but differs in the presence of numerous black lecideine apothecia along the margins and fissures. Timdal (1988) combined the second species, *G. ligustica*, from *Psora ligustica* B. de Lesd., which is a lichen but a juvenile parasite on *Peltula*. Kistenich et al. (2018) conducted a phylogenetic analysis and revealed that this genus forms a single clade in Lecanorales (Kistenich et al., 2018)

Type species: *Glyphopeltis eburina* Brusse

Accepted lichenicolous species:

Glyphopeltis ligustica (B. de Lesd.) Timdal, on lichen, juvenile parasite on *Peltula* (Timdal, 1988)

= *Psora ligustica* B. de Lesd.



Note a Ascus. b Ascospores. Scale bars: a = 10 µm, b = 5 µm

Source Redrawn from Brusse (1985)

Figure 2.83 *Glyphopeltis eburina*

Psorula Gotth. Schneid. (1)

Index Fungorum 25717, faceoffungi, MycoBank, GenBank

Classification: Psoraceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Psorula was intrudoced by Schneider (1979) to accommodate two lichen species, *P. rufonigra* and *P. scotopholis*, originally combined from *Biatora*. *P. scotopholis* was later transferred to *Miriquidica scotopholis* (Nash et al., 2004). Rambold et al. (1992) reported that *P. rufonigra* is a lichenicolous lichen growing on *Spilonema* (Rambold et al., 1992), and this species was included in the lichenicolous list by Diederich (2018).

The type species is characterized by a squamosa, imbricate thallus that changes

from pale rufous to blackish. Its apothecia are adnate, plane, obtusely margined, atrorufous to black, and become convex over time. According to Schneider (1980), *Psorula* differs from *Psora* in the morphology of the apothecia, the scattered occurrences of algae in the squamules, the structure of the lower hymenium, and the different types of paraphyses (Timdal, 1984).

Type species: *Psorula rufonigra* (Tuck.) Gotth. Schneid., on *Spilonema* (Schneider, 1979)

= *Biatora rufonigra* Tuck.

Family Ramalinaceae C. Agardh

Bacidia De Not. (1-100^{+})

Index Fungorum 475, faceoffungi, MycoBank, GenBank

Classification: Ramalinaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Bacidia rosella* (Pers.) De Not.

Accepted lichenicolous species:

Bacidia killiasii (Hepp) D. Hawksw., on *Peltigera, Collema*. (Hawksworth, 1983)

= *Biatora killiasii* Hepp

Kiliasia Hafellner (2-10)

Index Fungorum 25646, faceoffungi, MycoBank, GenBank

Classification: Ramalinaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Kiliasia athallina (Hepp) Hafellner

= *Biatora athallina* Hepp

Table 2.117 Accepted lichenicolous species of *Kiliasia*

	Species name	Host	References	Remarks
1	*Kiliasia episema* (Nyl.) Hafellner	*Lecanoram saxicolam*	(Nylander, 1853;; Hafellner, 1984)	*Toninia episema* Nyl.
2	*Kiliasia nordlandica* (Th. Fr.) Kistenich, Timdal, Bendiksby & S. Ekman	*Placynthium* and other lichens with cyanobacteria	(Fries, 1874; Kistenich et al., 2018)	*Toninia nordlandica* Th. Fr.

Phyllopsora Müll. Arg. (1-100^{+})

Index Fungorum 4072, faceoffungi, MycoBank, GenBank

Classification: Ramalinaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Phyllopsora breviuscula* (Nyl.) Müll. Arg.

= *Lecidea breviuscula* Nyl.

Accepted lichenicolous species:

Phyllopsora phaeophysciae P. Maurya, G.K. Mishra & D.K. Upreti, on *Phaeophyscia hispidula* (Maurya et al., 2024)

Scutula Tul. (22-32)

Index Fungorum 4979, faceoffungi, MycoBank, GenBank

Classification: Ramalinaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Scutula was introduced by Tulasne (1852) and is characterized by very small, disc-shaped, slightly flat apothecia that are broadly attached to the substrate. Initially pale, later the apothecia become dark. The asci are clavate, somewhat truncated, and

composed of a thick membrane, containing 6–8 spores and densely packed with paraphyses. The spores are 4-celled, ovate to ellipsoidal, blunt at both ends, smooth, pale, and transparent, filled with homogeneous oil when mature. The asexual morph includes spherical, superficial, darkened spermagonia, which are filled with extremely slender, curved, linear spermatia. The pycnidia, similar in shape and position to the spermagonia but significantly thicker, also begin pale like the apothecia and darken later. The stylospores are elongated, blunt at both ends, straight or slightly curved, simple (rarely bilocular), smooth, with a thin, colorless, and transparent membrane, filled with oil or sparse protoplasm.

Diederich (2018) placed *Scutula* in the family Pilocarpaceae, but the phylogenetic analysis by Kistenich (2018) revealed that this genus clusters within the Ramalinaceae group. This view was accepted by Wijayawardene (2020, 2022), who placed *Scutula* in the family Ramalinaceae. To date, there are 32 accepted species according to Index Fungorum and MycoBank, 22 of which are lichenicolous fungi.

Type species: *Scutula wallrothii* Tul.

Table 2.118 Accepted lichenicolous species of *Scutula*

	Species name	**Host**	**References**	**Remarks**
1	*Scutula affinis* (A. Massal.) Zopf	*Peltigera canina*	(Zopf, 1896)	=*Spilodium affine* A. Massal.
2	*Scutula agardhiana* Flagey	*Lecanora agardhianoides*	(Flagey, 1896)	
3	*Scutula aggregata* Bagl. & Carestia	*Peltigera canina*	(Rehm, 1896a)	
4	*Scutula aspiciliae* (Müll. Arg.) Rehm	*Lecanora calcareae v. depressae*	(Rehm, 1896a)	= *Patellaria aspiciliae* Müll. Arg.

Table 2.118 (continued)

	Species name	Host	References	Remarks
5	*Scutula cladoniicola* Alstrup & D. Hawksw.	*Cladonia trassii*	(Alstrup et al., 1990)	
6	*Scutula curvispora* (D. Hawksw. & Miadl.) Diederich	*Peltigera degenii*	(Diederich et al., 2018)	= *Libertiella curvispora* D. Hawksw. & Miądl.
7	*Scutula dedicate* Triebel, Wedin & Rambold	*Peltigera didactyla*	(Triebel et al., 1997)	
8	*Scutula didymospora* (D. Hawksw. & Miadl.) Diederich	*Peltigera rufescens*	(Diederich et al., 2018)	= *Libertiella didymospora* D. Hawksw. & Miądl.
9	*Scutula epiblastematica* (Wallr.) Rehm	*Peltigera canina*	(Rehm, 1896a)	= *Peziza epiblastematica* Wallr.
10	*Scutula epigean* (Nyl.) Rehm	*Peltigera canina*	(Rehm, 1896a)	= *Lecidea epigena* Nyl.
11	*Scutula epiphylla* (G. Merr.) Vouaux	*Peltigera*	(Vouaux, 1913b)	= *Biatora epiphylla G. Merr.*
12	*Scutula heerii* Alstrup	*Peltigera*	(Karsten, 1885)	

Table 2.118 (continued)

	Species name	Host	References	Remarks
13	*Scutula krempelhuberi* Körb.	*Solorina saccata*	(Körber, 1865b)	
14	*Scutula leptogica* (Nyl.) Zopf	*Polychidium muscicola*	(Zopf, 1896)	
15	*Scutula leptogii* Dughi	*Leptogium*	(Dughi, 1936)	
16	*Scutula miliaris* (Wallr.) Trevis.	*Peltigera*	(Trevisan, 1853)	= *Peziza miliaris* Wallr.
17	*Scutula nephromatis* (Speg.) Etayo	*Nephroma antarcticum*	(Etayo & Rosato, 2008)	= *Patellea nephromatis* Speg.
18	*Scutula pseudocyphellariae* Etayo & Triebel	*Pseudocyphellaria*	(Etayo et al., 2010)	
19	*Scutula solorinaria* (Nyl.) P. Karst.	*Solorina bisporae*	(Karsten, 1885)	= *Lecidea solorinaria* Nyl.
20	*Scutula stereocaulorum* (Anzi) Körber	*Stereocaulon*	(Körber, 1865b)	= *Lecidea stereocaulorum* Anzi
21	*Scutula tuberculosa* (Th. Fr.) Rehm	*Peltigera*	(Saccardo et al., 1906)	= *Biatorina tuberculosa* Th. Fr.
22	*Scutula wallrothii* Tul.	*Peltigera canina*	(Tulasne, 1852)	

Thalloidima A. Massal. (2-59)

Index Fungorum 5393, faceoffungi, MycoBank, GenBank

Classification: Ramalinaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Thalloidima vesiculare* (Hoffm.) A. Massal.

= *Patellaria vesicularis* Hoffm.

Table 2.119 Accepted lichenicolous species of *Thalloidima*

	Species name	Host	References	Remarks
1	*Thalloidima collematicola* (Timdal) Timdal	*Collema multipartitum*	(Timdal, 1991; Kistenich et al., 2018)	*Toninia collematicola* Timdal
2	*Thalloidima leptogii* (Timdal) Timdal	*Collema* and *Leptogium*	(Timdal, 1991; Kistenich et al., 2018)	*Toninia leptogii* Timdal

Toninia A. Massal. (11-130^{+})

Index Fungorum 5495, faceoffungi, MycoBank, GenBank

Classification: Ramalinaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Toninia cinereovirens* (Schaer.) A. Massal.

= *Lecidea cinereovirens* Schaer.

Table 2.120 Accepted lichenicolous species of *Toninia*

	Species name	Host	References	Remarks
1	*Toninia lobothalliae* Y. Joshi	*Aspicilia almorensis* and *Lobothallia praeradiosa*	(Joshi, 2022c)	

Table 2.120 (continued)

	Species name	Host	References	Remarks
2	*Toninia nashii* Timdal	*Lecidella asema*	(Nash et al., 2002)	
3	*Toninia plumbina* (Anzi) Hafellner & Timdal	*Pannaria plumbea*	(Timdal, 1991)	= *Leciographa plumbina* Anzi
4	*Toninia poeltiana* S. Y. Kondr., L. Lőkös & J.-S. Hur	*Verrucaria fuscella*	(Kondratyuk et al., 2016)	
5	*Toninia subfuscae* (Arnold) Timdal	*Lecanora subfusca*, rarely on *Lecidella*	(Timdal, 1991)	*Celidium subfuscae* Arnold ex Zwackh
6	*Toninia subdispersa* (Hasse) K.Knudsen	*Lecania brunonis*	(Knudsen et al., 2007)	*Lecanora subdispersa* Nyl.
7	*Toninia subtalparum* van den Boom	*Lecania dudleyi*	(Nash et al., 2004)	
8	*Toninia tecta* C.A.Morse & Ladd	*Dermatocarpon*	(Ladd et al., 2018)	
9	*Toninia ualae* Etayo	*Pseudocyphellaria coriifolia* and *Nephroma antarcticum*	(Etayo & Sancho, 2008)	
10	*Toninia verrucariae* (Nyl.) Timdal	*Bagliettoa* and *Encephalographa elisae*	(Rambold et al., 1992)	*Lecidea verrucariae* Nyl.

Table 2.120 (continued)

	Species name	Host	References	Remarks
11	*Toninia verrucarioides* (Nyl.) Timdal	*Placynthium*	(Timdal, 1991)	*Lecidea aromatica* var. *verrucarioides* Nyl.

Family Ramboldiaceae S. Stenroos, Miądl. & Lutzoni

Ramboldia Kantvilas & Elix (1-42)

Index Fungorum 5393, faceoffungi, MycoBank, GenBank

Classification: Ramboldiaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Ramboldia stuartii* (Hampe) Kantvilas & Elix

= *Lecidea stuartii* Hampe

Accepted lichenicolous species:

Ramboldia insidiosa (Th. Fr.) Hafellner, on *Lecanora subfusca* and *L. varia*

= *Lecidea insidiosa* Th. Fr.

Family Scoliciosporaceae Hafellner

Scoliciosporum A. Massal. (2-15)

Index Fungorum 4959, faceoffungi, MycoBank, GenBank

Classification: Ramboldiaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Scoliciosporum holomelaenum* (Flörke) A. Massal.

= *Lecidea holomelaena* Flörke

Table 2.121 Accepted lichenicolous species of *Scoliciosporum*

	Species name	Host	References	Remarks
1	*Scoliciosporum intrusum* (Th. Fr.) Hafellner	*Rhizocarpon, Lecidea*	(Fries, 1867b; Hafellner, 2004c)	= *Lecidea intrusa* Th. Fr.
2	*Scoliciosporum vouauxii* (B. de Lesd.) Hafellner	*Ramalina webbii*	(De Lesdain, 1911; Hafellner, 2002b)	= *Bilimbia vouauxii* B. de Lesd.

Lecanorales Genera incertae sedis

Corticiruptor Wedin & Hafellner (2)

Index Fungorum 27820, faceoffungi, MycoBank, GenBank

Classification: Lecanorales genera incertae sedis, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Corticiruptor was introduced by Wedin & Hafellner (1998) to accommodate the type species *C. abeloneae*, originally described as *Arthonia abeloneae* P.M. Jørg., which grows on *Sticta*. A second species, *Corticiruptor corallinus*, was added by Etayo et al. (2008), found on *Pseudocyphellaria*.

Corticiruptor is characterized by small, pale apothecia that emerge from the upper cortex of the host thallus. The asci possess an amyloid tholus with tubes, which stains I+ blue in iodine, and dehisces rostrately. They are accompanied by branched paraphyses. The ascospores are hyaline, unicellular, and lack a distinct halo (Wedin et al., 1998). Based on the structure of the ascal wall, Wedin et al. (1998) classified this genus within the Lecanorales but did not assign it to a specific family. Two species are currently recognized in this genus, both of which are lichenicolous. However, no sequence data is available, leaving its precise familial placement uncertain.

Type species: *Corticiruptor abeloneae* (P.M. Jørg.) Wedin & Hafellner

Table 2.122 Accepted lichenicolous species of *Corticiruptor*

	Species name	Host	References	Remarks
1	*Corticiruptor abeloneae* (P.M. Jørg.) Wedin & Hafellner	*Sticta*	(Wedin et al., 1998)	= *Arthonia abeloneae* P. M. Jørg.
2	*Corticiruptor corallinus* Etayo	*Pseudocyphellaria*	(Etayo & Sancho, 2008)	

Lichenosticta Zopf (7)

Index Fungorum 8775, faceoffungi, MycoBank, GenBank

Classification: Lecanorales genera incertae sedis, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

The coelomycetous genus *Lichenosticta* was introduced by Zopf (1898) to accommodate the type species *L. podetiicola*, which parasitizes the podetia of *Cladonia gracilis* f. *hybrida*. It is characterized by small, subglobose to broadly pyriform, translucent brown to black pycnidia, with a diameter of about 60–150 μm. Due to the absence of sterigmata, the conidia are directly pinched from the wall of fruiting bodies. These conidia are variable in shape, broadly or narrowly elliptical, egg-shaped, or slightly curved, hyaline, aseptate, smooth-walled, and contain small oil droplets.

Pino-Bodas et al. (2017) conducted a phylogenetic analysis of the lichenicolous fungi associated with *Cladonia*, revealing that three strains of *Lichenosticta alcicorniaria* form a single clade closely related to *Gypsoplaca* within the Lecanorales (Pino-Bodas et al., 2017). Wijayawardene et al. (2020, 2022) accepted this viewpoint and placed *Lichenosticta* within the Lecanorales, as genera incertae sedis.

Following the introduction of the first species, Hawksworth et al. (1980)

transferred a second species, *Lichenosticta alcicornaria*, from *Microthelia alcicornaria* Linds., which grows on *Cladonia foliacea*. Zhurbenko et al. (2015) transferred another species, *L. lecanorae*, from *Dendrophoma lecanorae* Vouaux which grows on *Lecanora*. Additionally, four more species have been introduced and described in this genus (Zhurbenko, 2010b; Flakus et al., 2012; Zhurbenko et al., 2015; Zhurbenko & Pino-Bodas, 2015; Von Brackel & Wirth, 2023). Currently, seven species are accepted in this genus and six sequences of *Lichenosticta alcicornaria* are available in GenBank.

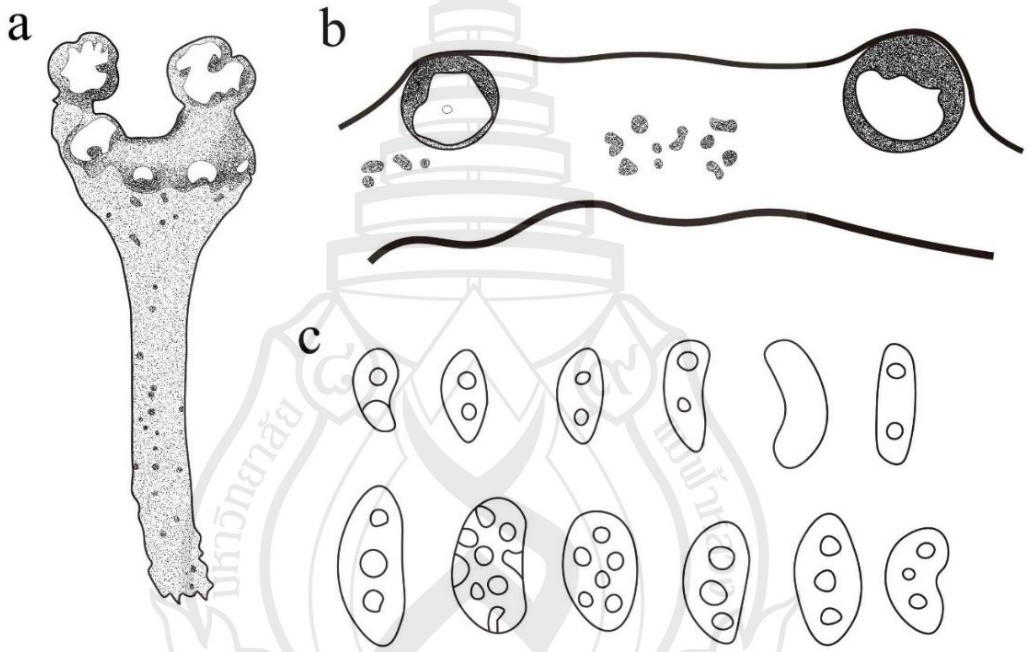
Type species: *Lichenosticta podetiicola* Zopf

Table 2.123 Accepted lichenicolous species of *Lichenosticta*

	Species name	**Host**	**References**	**Remarks**
1	*Lichenosticta alcicornaria* (Linds.) D. Hawksw.	*Cladonia foliacea*	(Hawksworth et al., 1980)	= *Microthelia alcicornaria* Linds.
2	*Lichenosticta dombrovskae* Zhurb.	*Phyllocladia* & *Stereocaulon alpinum*	(Zhurbenko, 2010b)	
3	*Lichenosticta hoegnabbae* Zhurb. & Pino-Bodas	*Cladia aggregata*	(Zhurbenko & Pino-Bodas, 2015)	
4	*Lichenosticta jurgae* Kukwa & Flakus	*Lecanora*	(Flakus et al., 2012)	
5	*Lichenosticta lecanorae* (Vouaux) Brackel & Zhurb.	*Lecanora glaucella* & *L. syringea*	(Zhurbenko et al., 2015)	= *Dendrophoma lecanorae* Vouaux

Table 2.123 (continued)

	Species name	Host	References	Remarks
6	*Lichenosticta podetiicola* Zopf	*Cladonia gracilis*	(Zopf, 1898)	
7	*Lichenosticta wirthii* Brackel	*Loxospora cismonica*	(Von Brackel & Wirth, 2023)	



Note a Host lichen *Cladonia*. b Section of apothecia. c Ascospores.

Source Redraw from Zopf (1898)

Figure 2.84 *Lichenosticta podetiicola*

Nimisiostella Calat., Barreno & O.E. Erikss. (1)

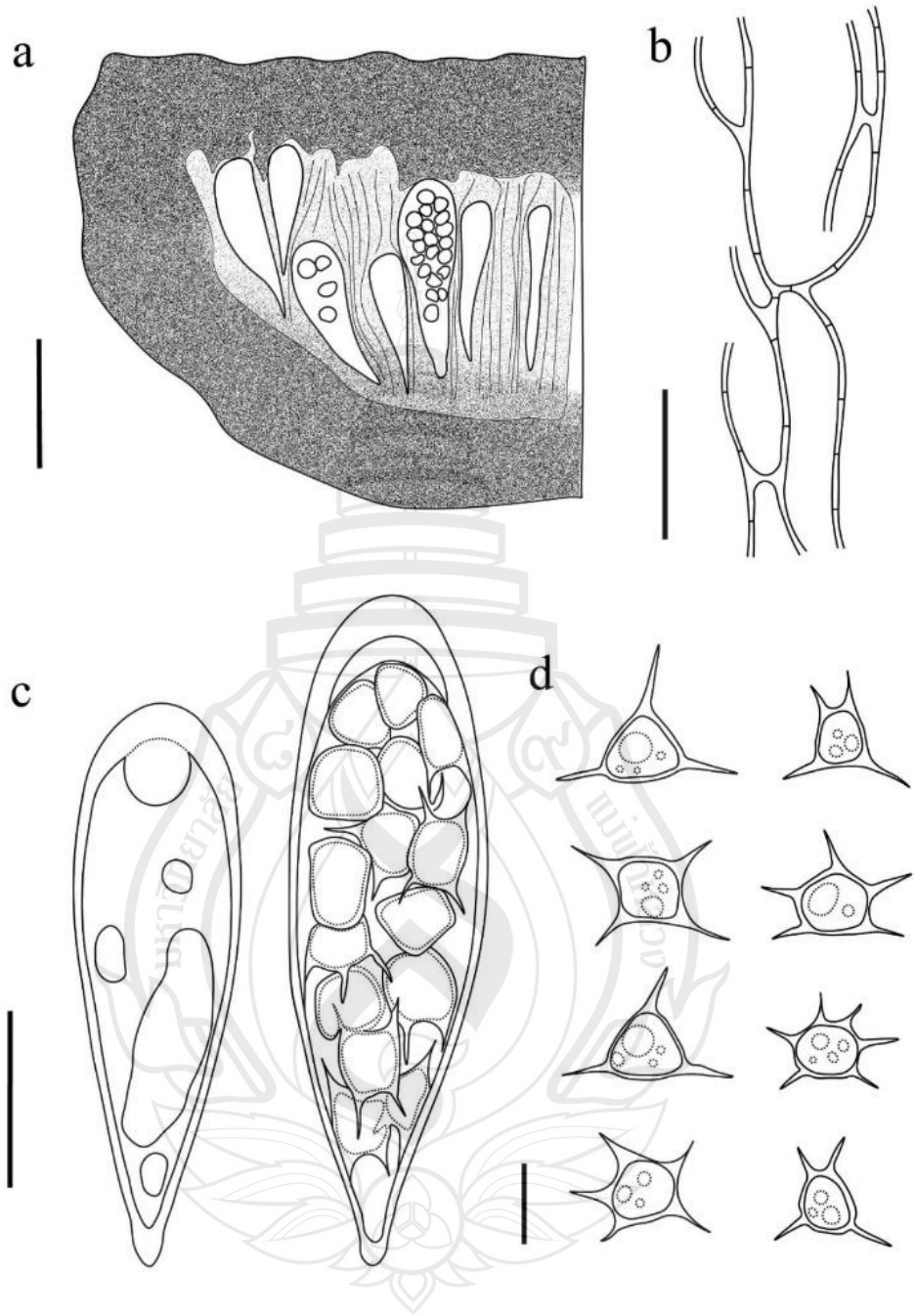
Index Fungorum 27824, faceoffungi, MycoBank, GenBank

Classification: Lecanorales genera incertae sedis, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

The monotypic genus *Nimisiostella* was introduced by Calatayud et al. (1997)

to accommodate the lichenicolous fungus *N. lichenicola*, which occurs on *Parmelia saxatilis* in Spain. The genus is characterized by sessile, rounded, black, apothecioid ascomata. Initially, the ascomata are closed and covered by a brown to dark brown layer that later disintegrates. The lecanoralean asci are clavate, apically thickened, and typically contain 16 to 24 stellate ascospores. The ascospores are simple, hyaline, and turn brownish in older specimens. They have a stellate shape, appearing subspherical or polyhedral, with thin, sharp, radiating projections extending in various directions. The phylogenetic position of *Nimisiostella* remains uncertain due to the lack of available sequence data (Calatayud et al., 1997).

Type species: *Nimisiostella lichenicola* Calat., Barreno & O.E. Erikss., on *Parmelia saxatilis* (Calatayud et al., 1997)



Note a Part of section of ascomata. b Paraphyses. c Asci. d Ascospores. Scale bars: a = 5 μm, b–c = 20 μm, d = 10 μm.

Source Redraw from Calatayud et al. (1997)

Figure 2.85 Sexual morph of *Nimisiostella lichenicola*

Umbilithecium Etayo (1)

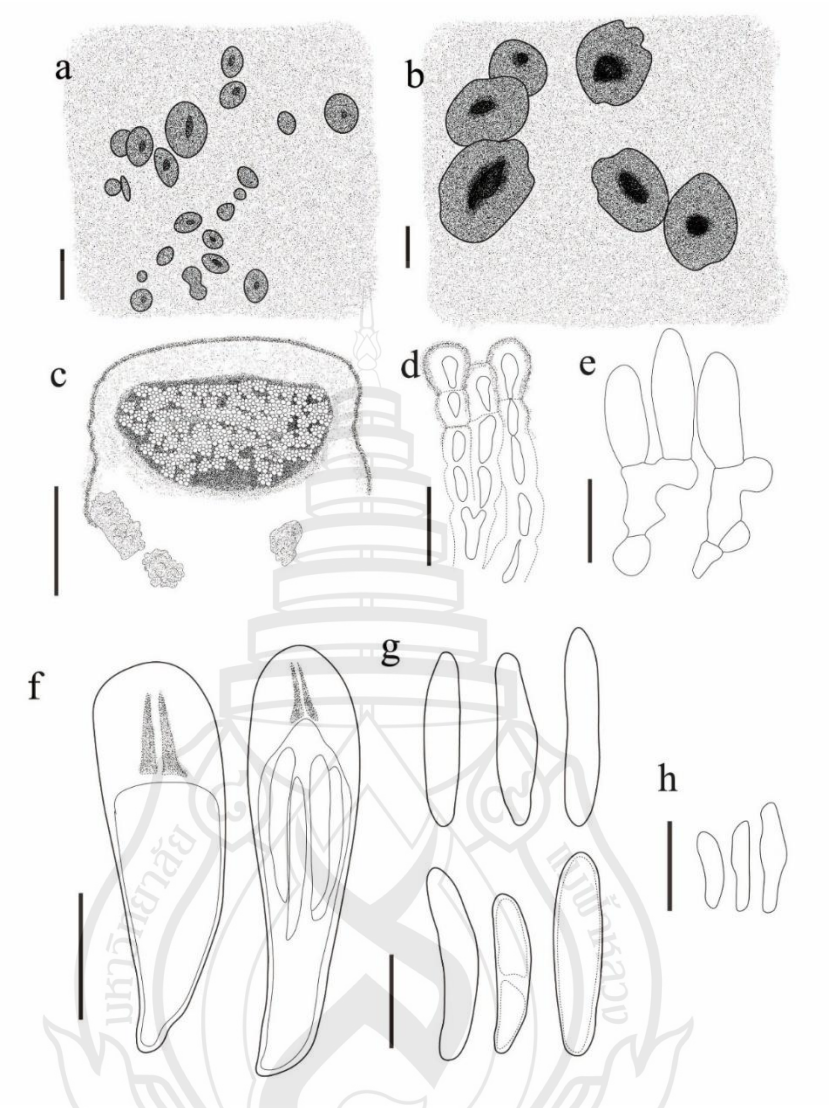
Index Fungorum 523870, faceoffungi, MycoBank, GenBank

Classification: Lecanorales genera incertae sedis, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Umbilithecium was introduced by Etayo et al. (2008) to accommodate the sole species *U. pseudocyphellariae*, which grows on *Pseudocyphellaria hellii*. The genus is characterized by apothecioid ascomata that are solitary or clustered, brown to black, and convex, with an excavated disc. The excipulum ranges from hyaline to brownish-orange, and the hymenium is hyaline, turning blue (I+) when treated with iodine. The epihymenium is gelatinous and brown, containing simple or branched paraphyses. The asci are clavate, containing 4–8 spores, and are of the *Porpidia* type. The ascospores are fusiform, hyaline, and simple (Etayo & Sancho, 2008). The phylogenetic position of *Umbilithecium* remains uncertain due to the lack of available sequence data.

Type species:

Umbilithecium pseudocyphellariae Etayo, on *Pseudocyphellaria hellii* (Etayo & Sancho, 2008)



Note a–b Ascomata on host. c Section of ascomata. d–e Paraphyses. f Asci. g Ascospores. h Conidia. Scale bars: a = 1mm, b = 0.5 mm, c = 100 μm, d–g = 10 μm, h = 5 μm.

Source Redrawn from Etayo et al. (2008)

Figure 2.86 *Umbilithecium pseudocyphellariae*

Umushamyces Etayo (2)

Index Fungorum 523871, faceoffungi, MycoBank, GenBank

Classification: Lecanorales genera incertae sedis, Lecanorales,

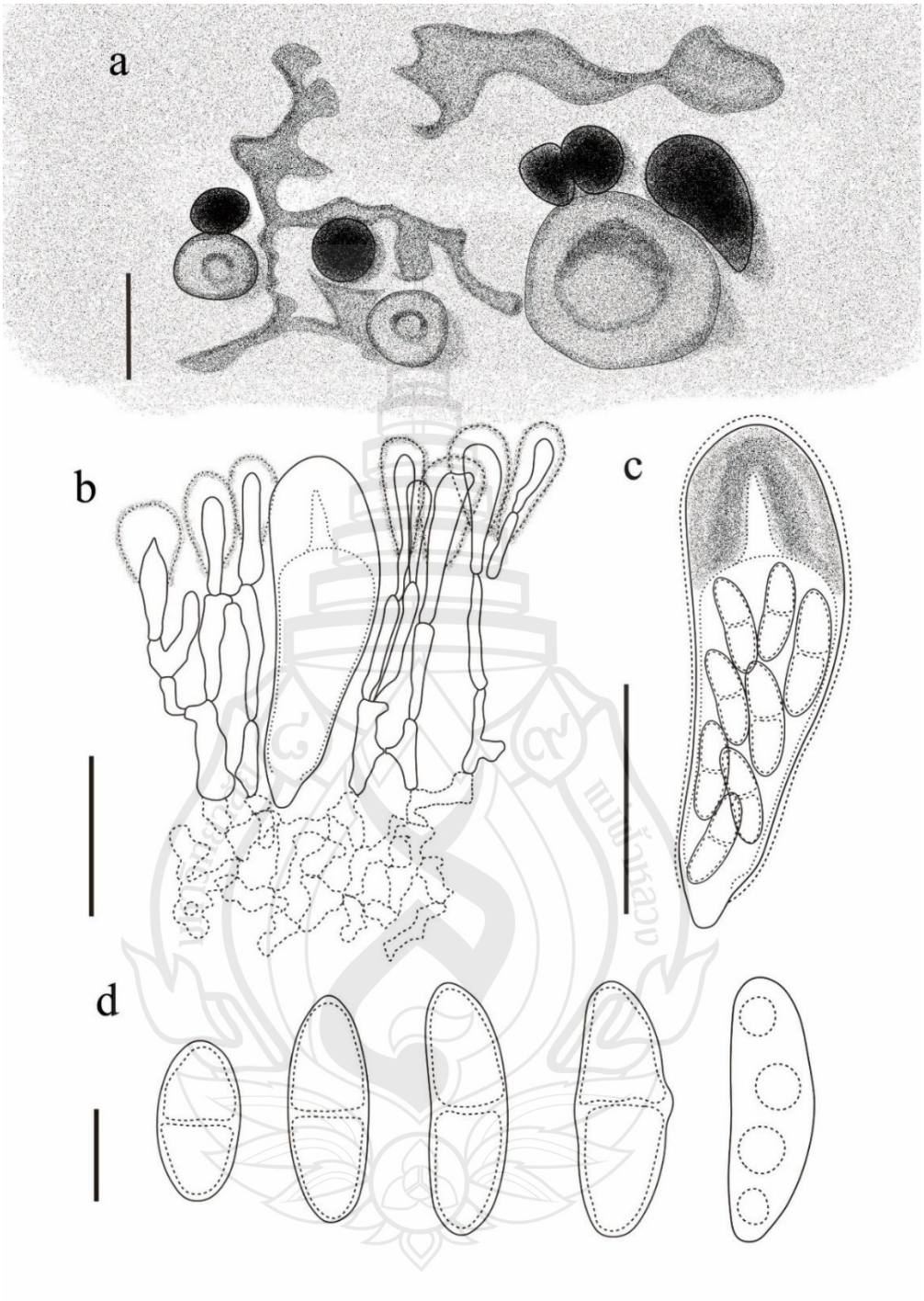
Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Umushamyces was introduced by Etayo et al. (2008) to accommodate the type species *U. kuturnus*, which grows on *Coccotrema cucurbitula*. The genus is characterized by simple or coalescent apothecia that are brown to black, convex to subspherical, and rounded or irregular when coalescent. The proper excipulum consists of branched, anastomosing, hyaline hyphae. The hymenium is hyaline or orange in its upper part, staining I+ brown and KI+ blue, with branched and anastomosing paraphyses. The asci are clavate, of the *Biatora* or *Bacidia* type, and eight-spored. The ascospores are hyaline, ellipsoidal, (0) 1-septate, straight or slightly curved, typically containing two oil droplets per cell. Zhurbenko (2023) introduced a second species, *Umushamyces wedinii*, which grows on *Bunodophoron ramuliferum*. Two species are recognized within this genus, but no sequence data are available in GenBank, leaving its phylogenetic status unclear.

Type species: *Umushamyces kuturnus* Etayo, on *Coccotrema cucurbitula*

Table 2.124 Accepted lichenicolous species of *Umushamyce*

	Species name	Host	References	Remarks
1	*Umushamyces kuturnum* Etayo	*Coccotrema cucurbitula*	(Etayo & Sancho, 2008)	
2	*Umushamyces wedinii* Zhurb. & Etayo	*Bunodophoron ramuliferum*	(Zhurbenko, 2023c)	



Note a Ascomata on host (black). b Paraphyses and ascus. c Ascus and ascospores. d Ascospores. Scale bars: a = 0.5 mm, b-c = 10 μm, d = 5 μm.

Source Redraw from Etayo et al. (2008)

Figure 2.87 *Umushamyces kuturnum*

Order Lecideales Vain.

Family Lecideaceae Chevall.

Cecidonia Triebel & Rambold (2)

Index Fungorum 25248, faceoffungi, MycoBank, GenBank

Classification: Lecideaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Cecidonia is introduced by Triebel & Rambold (1988) to accommodate two species, *C. umbonella* transferred from *Lecidea umbonella* Nyl. and *Cecidonia xenophana* transferred from *Phacographa xenophana* Körb. The two species were all lichenicolous on *Lecidea*, with *C. umbonella* assigned as the type species.

Type species:

Cecidonia umbonella (Nyl.) Triebel & Rambold

Table 2.125 Accepted lichenicolous species of *Cecidonia*

	Species name	Host	References	Remarks
1	*Cecidonia umbonella* (Nyl.) Triebel & Rambold	*Lecidea*	(Nylander, 1866a; Triebel et al., 1988)	= *Lecidea umbonella* Nyl.
2	*Cecidonia xenophana* (Körb.) Triebel & Rambold	*Lecidea contigua* and *Lecidea albocoerulescens*	(Körber, 1865b; Triebel et al., 1988)	= *Placographa xenophana* Körb.

Immersaria Rambold & Pietschm. (2-9)

Index Fungorum 25364, faceoffungi, MycoBank, GenBank

Classification: Lecideaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Immersaria athroocarpa* (Ach.) Rambold & Pietschm.

Table 2.126 Accepted lichenicolous species of *Immersaria*

	Species name	Host	References	Remarks
1	*Immersaria athroocarpa* (Ach.) Rambold & Pietschm.	juvenile facultatively lichenicolous on *Aspicila* and other lichens	(Rambold, 1989)	= *Lichen athroocarpus* Ach.
2	*Immersaria usbekica* (Hertel) M. Barbero, Nav.-Ros. & Cl. Roux	juvenile facultatively lichenicolous on *Aspicila* and other lichens	(Barbero et al., 1990)	= *Lecidea usbekica* Hertel

Lecidea Ach. (11-100^{+})

Index Fungorum 2692, faceoffungi, MycoBank, GenBank

Classification: Lecideaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Lecidea fuscoatra (L.) Ach.

= *Lichen fuscoater* L.

Table 2.127 Accepted lichenicolous species of *Lecidea*

	Species name	Host	References
1	*Lecidea acervata* Stizenb.	*Pseudoparmelia*	
2	*Lecidea buellielloides* S.Y. Kondr. & Hur	*Follmannia suborthoclada*	(Kondratyuk et al., 2020)
3	*Lecidea degeliana* Hertel	*Acarospora*	(Hertel, 1970a)

Table 2.127 (continued)

	Species name	Host	References	Remarks
4	*Lecidea diexcipula* D.Hawksw. & Alstrup	*Lecanora polytropa*	(Alstrup et al., 1990)	
5	*Lecidea grummannii* Hertel	*Acarospora*		
6	*Lecidea halacsyi* J. Steiner	*Rhizocarpon geographicum*	(von Halácsy, 1894)	
7	*Lecidea leprosolimbata* (Arnold) Poelt	*Bellemerea subcandida*	(Lettau, 1954)	= *Psora atrobrunnea* var. *leprosolimbata* Arnold
8	*Lecidea percutiens* Poelt	*Diploschistes scruposus*		
9	*Lecidea perforans* Stiz.	*Parmotrema*		
10	*Lecidea rapax* Hertel	*Aspicilia* and *Bellemerea*	(Hertel, 1970b)	
11	*Lecidea verruca* Poelt	*Aspicilia*	(Poelt, 1961)	

Poeltiaria Hertel (1-8)

Index Fungorum 25661, faceoffungi, MycoBank, GenBank

Classification: Lecideaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Poeltiaria turgescens* (Körb.) Hertel

= *Lecidella turgescens* Körb.

Accepted lichenicolous species:

Poeltiaria coromandelica (Zahlbr.) Rambold & Hertel, juvenile lichenicolous on *Parapordia leptocarpa* (Rambold, 1989)

= *Lecidea coromandelica* Zahlbr. (Zahlbruckner, 1941)

Order Leprocaulales Lendemer & B.P. Hodk.

Family Leprocaulaceae Lendemer & B.P. Hodk.

Halecania M. Mayrhofer (7-24)

Index Fungorum 25178, faceoffungi, MycoBank, GenBank

Classification: Leprocaulaceae, Leprocaulales, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Halecania alpivaga* (Th. Fr.) M. Mayrhofer

Table 2.128 Accepted lichenicolous species of *Halecania*

	Species name	Host	References	Remarks
1	*Halecania ahtii* Zhdanov	Crustose saxicolous lichens	(Zhdanov, 2020)	
2	*Halecania lobulata* van den Boom & Elix	*Hymenelia*	(van den Boom et al., 2005)	
3	*Halecania alpivaga* (Th. Fr.) M. Mayrhofer	*Physcia* and *Placynthium*	(Mayrhofer, 1987b)	= *Lecania alpivaga* Th. Fr.
4	*Halecania fuscopannariae* Etayo & van den Boom	*Fuscopannaria*	(van den Boom, 2009)	
5	*Halecania giraltiae* van den Boom & Etayo	Saxicolous lichens	(Van Den Boom et al., 2001)	
6	*Halecania parasitica* Aptroot & K.H. Moon	*Schaereria fuscocinerea*	(Aptroot et al., 2015)	

Table 2.128 (continued)

	Species name	Host	References	Remarks
7	*Halecania santessonii* M.P. Andreev	*Porpidia albocaerulescens*	(Andreev, 2010)	

Family Tephromelataceae Hafellner

Tephromela M. Choisy (4-50^{+})

Index Fungorum 5372, faceoffungi, MycoBank, GenBank

Classification: Lecideaceae, Lecanorales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Tephromela atra* (Huds.) Hafellner

= *Lichen ater* Huds.

Table 2.129 Accepted lichenicolous species of *Tephromela*

	Species name	Host	References	Remarks
1	*Tephromela campestricola* (Nyl.) Rambold & Triebel	*Lecanora pseudistera*	(Nylander, 1884; Rambold et al., 1992)	= *Lecidea campestricola* Nyl.
2	*Tephromela parasitica* Øvstedal & Søchting	*Lecidella*	(Sochting et al., 2004)	
3	*Tephromela cerasina* (Müll. Arg.) Rambold & Triebel	*Dirinaria, Physcia pictae*	(Durand, 1891; Rambold et al., 1992)	= *Nesolechia cerasina* Müll. Arg.
4	*Tephromela koliensis* (Räsänen) Rambold & Triebel	*Lecanora argopholis*	(Räsänen, 1939; Rambold et al., 1992)	= *Nesolechia koliensis* Räsänen

Order Rhizocarpales Miądl. & Lutzoni ex Miądl. & Lutzoni

Family Rhizocarpaceae M. Choisy ex Hafellner

Epilichen Clem. (3)

Index Fungorum 1864, faceoffungi, MycoBank, GenBank

Classification: Rhizocarpaceae, Rhizocarpales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Epilichen was introduced by Clements (1909) to accommodate the species *Epilichen scabrosus*, which was transferred from *Lecidea scabrosa* and is parasitic on the lichen *Baeomyces rupestris*. Hafellner (1978) later transferred another species, *Epilichen glauconigellus*, from *Lecidea glauconigella* Nyl., which also grows on *Baeomyces*. Triebel (1989) introduced a new species, *Epilichen stellatus*, which grows on *Lecidea cf. tessellata*. The genus is characterized by its round, superficial apothecia, 8-spored asci, and dark, elliptic to fusoid spores with a single septum. Marthinsen et al. (2019) published the available ITS sequence data for this genus, but no phylogenetic analysis was conducted. (Marthinsen et al., 2019). Here, we conducted a phylogenetic analysis, the result indicated that *Epilichen* is closely related to *Rhizocarpon* in Rhizocarpaceae (Rhizocarpales)

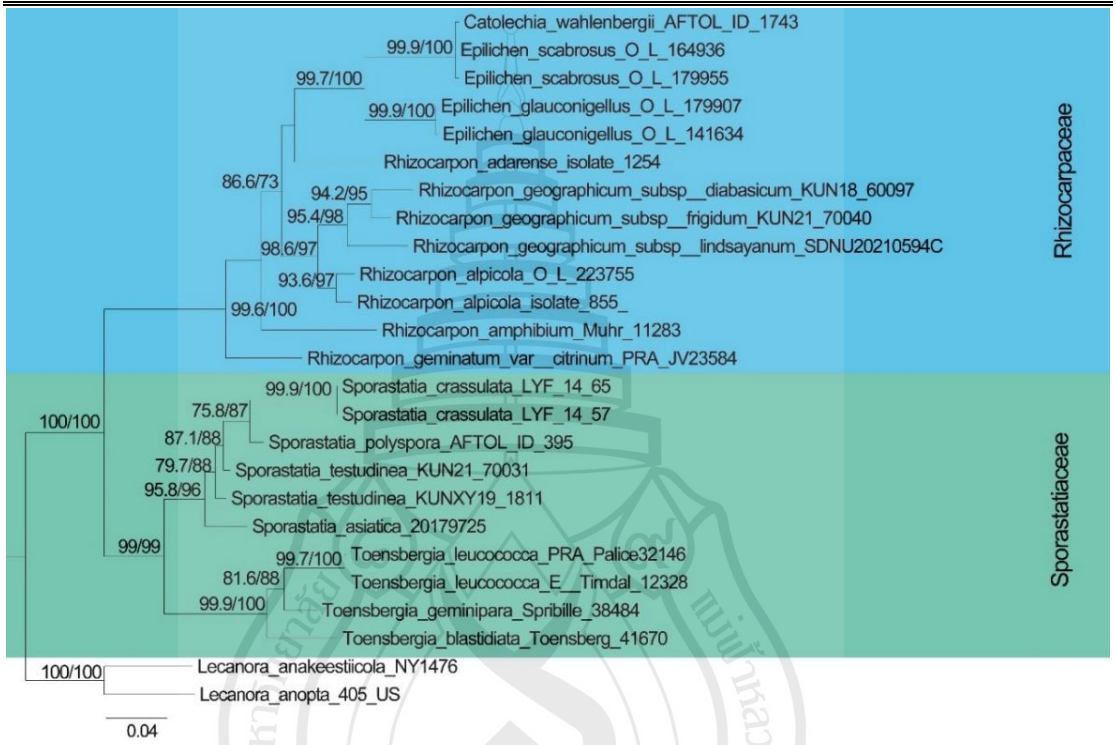
Type species: *Epilichen scabrosus* (Ach.) Clem.

Table 2.130 Accepted lichenicolous species of *Epilichen*

	Species name	Host	References	Remarks
1	*Epilichen glauconigellus* (Nyl.) Hafellner	*Baeomyces*	(Hafellner, 1978)	= *Lecidea glauconigella* Nyl.
2	*Epilichen scabrosus* (Ach.) Clements	*Baeomyces rupestris*	(Acharius, 1803; Clements, 1909)	= *Lecidea scabrosa* Ach.

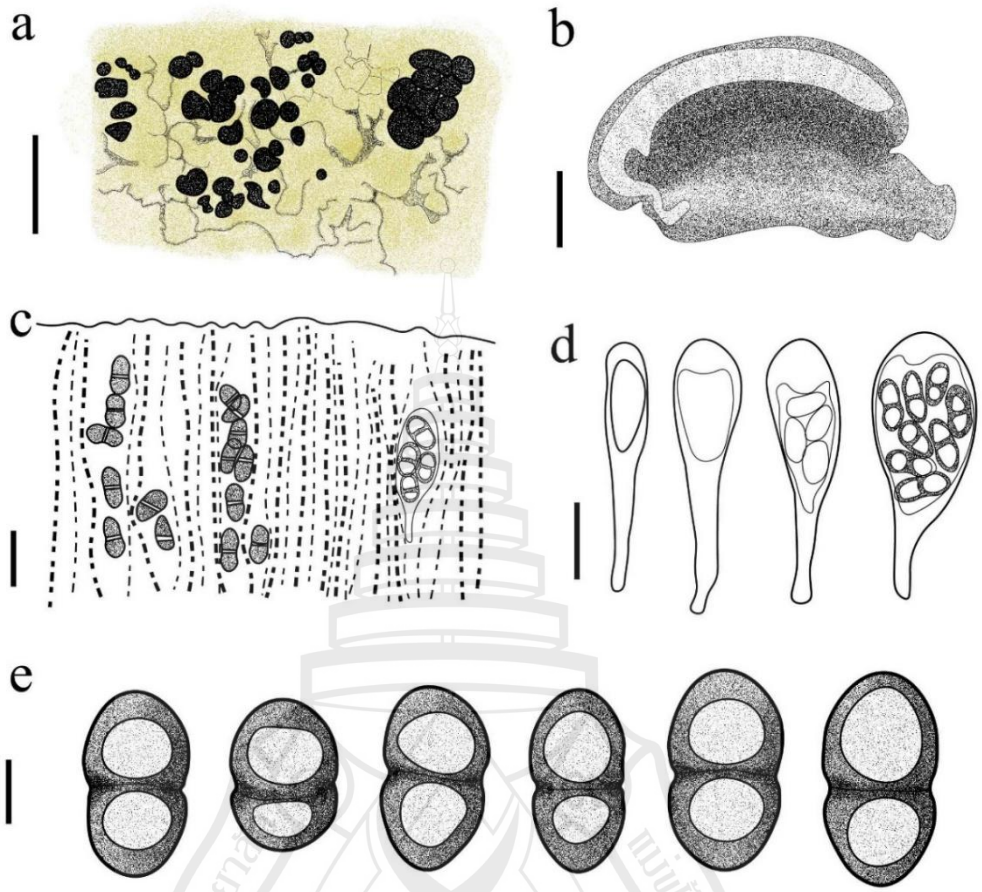
Table 2.130 (continued)

	Species name	Host	References	Remarks
3	*Epilichen stellatus* Triebel	*Lecidea cf. tessellata*	(Triebel, 1989)	



Note Bootstrap support values for maximum likelihood (ML ≥ 70%), and the Bayesian Posterior Probabilities (PP ≥ 0.90) are shown near the nodes as ML/PP. *Lecanora anakeestiicola* (NY1476) and *L. anopta* (405-US) were used as outgroups.

Figure 2.88 RAxML and MrBayes analysis of *Epilichen* based on the combined ITS and mtSSU sequence data.



Note a Ascomata on host. b Section of ascomata. c Part of the hymenium. d Asci. e Ascospores. Scale bars: a = 2 mm, b = 200 µm, c–d = 20 µm, e = 5 µm.

Source Redrawn from website: ITALIC 8.0 (2024) and Fungi of Great Britain and Ireland (2024)

Figure 2.89 *Epilichen scabrosus*

Rhizocarpon Ramond ex DC. (39-80)

Index Fungorum 4707, faceoffungi, MycoBank, GenBank

Classification: Rhizocarpaceae, Rhizocarpales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Rhizocarpon geographicum* (L.) DC.

= *Lichen geographicus* L.

Table 2.131 Accepted lichenicolous species of *Rhizocarpon*

	Species name	Host	References	Remarks
1	*Rhizocarpon advenulum* (Leight.) Hafellner & Poelt	*Pertusaria flavicans* and *P. rupicola*	(Hafellner et al., 1976)	= *Lecidea advenula* Leight.
2	*Rhizocarpon asiaticum* (Poelt) Poelt	*Sporastatia*	(Poelt, 1990)	= *Rhizocarpon pusillum* var. *asiaticum* Poelt
3	*Rhizocarpon aspiciliae* (Räsänen) D.Hawksw. & V.Atienza	*Hymenelia*	(Hawksworth et al., 1994)	= *Phaeocyrtis aspiciliae* Räsänen
4	*Rhizocarpon atrovirellum* (Nyl.) Zahlbr.	*Aspicilia*	(Zahlbruckner, 1926)	= *Lecidea atrovirella* Nyl.
5	*Rhizocarpon bryonthae* Poelt	*Pertusaria bryontha*	(Poelt, 1985)	
6	*Rhizocarpon cleptophilum* Alstrup &E.S.Hansen	*Acarospora picea*	(Alstrup et al., 2001)	
7	*Rhizocarpon captans* Poelt	*Aspicilia*	(Poelt, 1990)	

Table 2.131 (continued)

	Species name	Host	References	Remarks
8	*Rhizocarpon dahlii* Øvstedal	*Rhizocarpon geographicum*	(Øvstedal et al., 2009)	
9	*Rhizocarpon destructans* Alstrup	*Lecanora polytropa*	(Alstrup et al., 1990)	
10	*Rhizocarpon dimelaena* Timdal	*Dimelaena oreina*	(Nash et al., 2004)	
11	*Rhizocarpon dinothetes* Hertel & Leuckert	*Protoparmelia*	(Hertel et al., 1979)	
12	*Rhizocarpon diploschistidina* McCune	*Diploschistes muscorum*	(Lumbsch et al., 2011)	
13	*Rhizocarpon effiguratum* (Anzi) Th.Fr.	*Pleopsidium flavum*	(Fries, 1871)	= *Buellia effigurata* Anzi
14	*Rhizocarpon epispilum* (Nyl.) Zahlbr, s.lat.	*Pertusaria*	(Zahlbruckner, 1926)	= *Lecidea epispila* Nyl.
15	*Rhizocarpon fratricida* Poelt & Nimis	*Rhizocarpon*	(Nimis et al., 1987)	
16	*Rhizocarpon furax* Poelt & V. Wirth	*Lecidea*		

Table 2.131 (continued)

	Species name	Host	References	Remarks
17	*Rhizocarpon intermediellum* Räsänen	Other lichens	(Raesaenen, 1943)	juvenile lichenicolous
18	*Rhizocarpon inimicum* Poelt & Vězda	*Lecanora rupicola s.lat.*	(Poelt et al., 1984)	
19	*Rhizocarpon kakurgon* Poelt	*Aspicilia*	(Poelt, 1960)	
20	*Rhizocarpon kansuense* H. Magn.	*Aspicilia*		
21	*Rhizocarpon lusitanicum* (Nyl.) Arnold	*Lepra*	(Arnold, 1871)	= *Lecidea lusitanica* Nyl.
22	*Rhizocarpon malenconianum* (Llimona & Werner) Hafellner & Mayrhofer	*Diploschistes steppicus*	(Hafellner et al., 1977)	= *Leciographa malenconiana* Llimona & Werner
23	*Rhizocarpon mosigiae* Poelt &Obermayer	*Rimularia gibbosa*	(Poelt et al., 1995)	
24	*Rhizocarpon narssaqense* Alstrup	*Lecanora atromarginata*	(Alstrup et al., 1990)	

Table 2.131 (continued)

	Species name	Host	References	Remarks
25	*Rhizocarpon norvegicum* Räsänen	*Acarospora*	(Raesaenen, 1943)	juvenile lichenicolous
26	*Rhizocarpon ochrolechiae* (Poelt & Nimis) Hafellner	*Ochrolechia parella*	(Kalb et al., 1992)	
27	*Rhizocarpon parvum* Runem.	*Tremolecia atrata*	(Runemark, 1956)	juvenile lichenicolous
28	*Rhizocarpon pusillum* Runem.	*Sporastatia*	(Runemark, 1956)	
29	*Rhizocarpon rapax* V. Wirth & Poelt	*Acarospora, Aspicilia* and *Rimularia*		
30	*Rhizocarpon renneri* Poelt	*Dimelaena oreina*	(Poelt, 1958)	
31	*Rhizocarpon santessonii* Timdal	*Tremolecia atrata*	(Timdal, 1986)	
32	*Rhizocarpon subtile* Runem.	*Tremolecia*		juvenile lichenicolous
33	*Rhizocarpon superficiale* (Schaer.) Vain.	*Acarospora oxytona*	(Malme, 1914)	juvenile lichenicolous = *Lecidea superficialis* Schaer.

Table 2.131 (continued)

	Species name	Host	References	Remarks
34	*Rhizocarpon tephromelae* Øvstedal	*Tephromela atra*	(Øvstedal et al., 2009)	
35	*Rhizocarpon trapeliicola* Brand	*Trapelia*	(Sérusiaux et al., 1999)	
36	*Rhizocarpon schedomyces* Hafellner & Poelt	*saxicolous Pertusaria*	(Hafellner et al., 1976)	
37	*Rhizocarpon tungurahuae* Etayo & Palice	*Gyalidea*	(Etayo, 2017)	
38	*Rhizocarpon viridiatrum* (Wulf.) Koerb.	*Aspicilia, Lecidea, Tremolecia*	(Körber, 1855)	juvenile lichenicolous *=Lichen viridiater* Wulfen
39	*Rhizocarpon vorax* Poelt & Hafellner	*Ochrolechia parella and Pertusaria*	(Poelt et al., 1983)	

Order Teloschistales D. Hawksw. & O.E. Erikss.

Family Teloschistaceae Zahlbr.

subfamily Caloplacoideae Arup, Søchting & Frödén

Athallia Arup, Frödén & Søchting (1-11)

Index Fungorum 801992, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistales,

Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Athallia holocarpa* (Hoffm.) Arup, Frödén & Søchting

= *Verrucaria holocarpa* Hoffm.

Accepted lichenicolous species:

Athallia inconnexa (Nyl.) S.Y. Kondr. & Lőkös, on *Acarospora, Aspicilia* and *Caloplaca* (Kondratyuk et al., 2018)

= *Lecanora inconnexa* Nyl.

***Caloplaca* Th. Fr.** (19-150)

Index Fungorum 749, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Caloplaca cerina* (Hedw.) Th. Fr.

= *Lichen cerinus* Hedw.

Table 2.132 Accepted lichenicolous species of *Caloplaca*

	Species name	**Host**	**References**	**Remarks**
1	*Caloplaca anchon-phoeniceon* Poelt & Clauzade	*Aspicilia*	(Poelt, 1958)	
2	*Caloplaca adelphoparasitica* Nimis & Poelt	*Caloplaca* and other lichens	(Nimis et al., 1994)	
3	*Caloplaca cacuminum* Poelt	On saxicolous lichens		juvenile facultatively lichenicolous
4	*Caloplaca epitoninia* O. Breuss	*Toninia aromatica*	(Breuss, 1990)	

Table 2.132 (continued)

	Species name	Host	References	Remarks
	Caloplaca infestans H. Magn.	*Aspicilia, Caloplaca, Lecanora*		
5	*Caloplaca isidiigera* Vězda	On saxicolous lichen	(Vězda, 1978)	
6	*Caloplaca interna* Poelt & Nimis	*Aspicilia*	(Nimis et al., 1987)	
7	*Caloplaca lecanorae* F. C. Seavey & J. L. Seavey	*Lecanora leprosa*	(Seavey et al., 2012)	
8	*Caloplaca magni-filii* Poelt	*Miriquidica nigroleprosa*	(Poelt, 1958)	
9	*Caloplaca megalariicola* Øvstedal	*Megalaria grossa*	(Fryday et al., 2012)	
10	*Caloplaca necator* Clauz. & Poelt	*Aspicilia*	(Poelt, 1958)	
11	*Caloplaca nubigena* (Kremp.) Dalla Torre & Sarnth.	*Clauzadea immersa*	(Dalla Torre et al., 1900)	= *Callopisma ochraceum* var. *nubigenum* Kremp.
12	*Caloplaca pellodella* (Nyl.) Hasse	On saxicolous lichens		= *Lecanora pellodella* Nyl.

Table 2.132 (continued)

	Species name	Host	References	Remarks
13	*Caloplaca placidia* (A.Massa.) J.Steiner	*Pyrenodesmia chalybaea*		= *Callopisma aurantiacum* var. *placidium* A. Massal.
14	*Caloplaca psoromatis* Olech & Søchting	*Psoroma*	(Olech et al., 1993)	
15	*Caloplaca psoricida* Hansen, Poelt & Søchting	*Psora rubiformis*	(Hansen et al., 1987)	
16	*Caloplaca tenuatula* (Nyl.) Zahlbr.	*Bagliettoa calciseda*	(Zahlbruckner, 1931)	*Lecanora tenuatula* Nyl.
17	*Caloplaca tephromelae* Kantvilas, Suija & Motiej.	*Tephromela atra*	(Kantvilas et al., 2021)	
18	*Caloplaca rinodinae-albae* Poelt & Nimis	*Rinodina alba*	(Nimis et al., 1987)	

Erichansenia S.Y. Kondr., Kärnefelt & A. Thell (1-3)

Index Fungorum 834210, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Erichansenia epithallina (Lynge) S.Y. Kondr., Kärnefelt & A. Thell, on *Acarospora, Aspicila, Dimelaena, Lecanora, Melanelia, Pleopsidium, Psorinia, Rhizocarpon, Rhizoplaca, Stereocaulon, Tephromela, Umbilicaria*

= *Caloplaca epithallina* Lynge

Gyalolechia A. Massal. (1-20)

Index Fungorum 834210, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Gyalolechia aurea (Schaer.) A. Massal.

= *Lecidea aurea* Schaer.

Accepted lichenicolous species:

Gyalolechia epiplacynthium (Etayo) Diederich, on *Placynthium filiforme* (Diederich, Lawrey, et al., 2018)

= *Fulgensia epiplacynthium* Etayo (Etayo, 2010c)

Kuettlingeria Trevis. (3-14)

Index Fungorum 2597, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Kuettlingeria visianica (A. Massal.) Trevis.

= *Blastenia visianica* A. Massal.

Table 2.133 Accepted lichenicolous species of *Kuettlingeria*

	Species name	Host	References	Remarks
1	*Kuettlingeria emilii* (Vondrák, Khodos., Cl. Roux & V. Wirth) I.V. Frolov, Vondrák & Arup	on saxicolous lichens	(Frolov et al., 2021)	Juvenile lichenicolous = *Caloplaca emilii* Vondrák, Khodos., Cl. Roux & V. Wirth

Table 2.133 (contined)

	Species name	Host	References	Remarks
2	*Kuettlingeria erythrocarpa* (Pers.) I.V. Frolov, Vondrák & Arup	on *Aspicilia calcarea*	(Frolov et al., 2021)	Juvenile lichenicolous = *Patellaria erythrocarpa* Pers.
3	*Kuettlingeria furax* (Egea & Llimona) I.V. Frolov, Vondrák & Arup	on other lichens, especially *Aspicilia*	(Frolov et al., 2021)	Juvenile lichenicolous =*Caloplaca furax* Egea & Llimona

Pachypeltis Søchting, Arup & Frödén (2-7)

Index Fungorum 801999, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Pachypeltis castellana (Räsänen) Søchting, Frödén & Arup

= *Placodium castellanum* Räsänen

Table 2.134 Accepted lichenicolous species of *Pachypeltis*

	Species name	Host	References	Remarks
1	*Pachypeltis invadens* (Lynge) Søchting, Frödén & Arup	*Lecanora, Physcia caesia*	(Lynge, 1928;; Arup et al., 2013)	= *Caloplaca invadens* Lynge
2	*Pachypeltis insularis (Poelt) Vondrák & I.V. Frolov*	*Aspicilia*	(Poelt, 1958;; Vondrak et al., 2019)	= *Caloplaca insularis Poelt*

Pisutiella S.Y. Kondr., Lőkös & Farkas (1-6)

Index Fungorum 834212, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Pisutiella conversa* (Kremp.) S.Y. Kondr., Lőkös & Farkas

= *Callopisma conversum* Kremp.

Accepted lichenicolous species:

Pisutiella grimmiae (Nyl.) S.Y. Kondr., Lőkös & Farkas, on *Candelariella* (Kondratyuk et al., 2020)

= *Lecanora grimmiae* Nyl. (Nylander et al., 1886)

Variospora Arup, Søchting & Frödén (2-15)

Index Fungorum 802016, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Variospora velana* (A. Massal.) Arup, Søchting & Frödén

= *Callopisma aurantiacum* var. *velanum* A. Massal.

Table 2.135 Accepted lichenicolous species of *Variospora*

	Species name	Host	Remarks
1	*Variospora epierodens* (Cl. Roux & M. Bertrand) Cl. Roux & M. Bertrand	*Caloplaca velana*	= *Caloplaca epierodens* Cl. Roux & M. Bertrand
2	*Variospora velana* (A.Massal.) Arup, Søchting & Frödén	*Pyrenodesmia variabilis*	

Subfamily Teloschistoideae Arup, Søchting & Frödén

Catenarina **Søchting, Søgaard, Arup, Elvebakk & Elix (1-3)**

Index Fungorum 805510, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Catenarina desolata* Søchting, Søgaard & Elvebakk

Accepted lichenicolous species:

Catenarina desolata Søchting, Søgaard & Elvebakk, on *Aspicilia* (SØCHTING et al., 2014)

Elixjohnia S.Y. Kondr. & Hur (1-4)

Index Fungorum 819637, faceoffungi, MycoBank, GenBank

Classification: Teloschistoideae, Teloschistaceae, Teloschistineae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Elixjohnia jackelixii* (S.Y. Kondr., Kärnefelt & A. Thell) S.Y. Kondr. & Hur

= *Caloplaca jackelixii* S.Y. Kondr., Kärnefelt & A. Thell

Accepted lichenicolous species:

Elixjohnia ovis-atra (Søchting, Søgaard & Sancho) S.Y. Kondr., on *Hydropunctaria*

= *Sirenophila ovis-atra* Søchting, Søgaard & Sancho

Subfamily Xanthorioideae Arup, Søchting & Frödén

Flavoplaca Arup, Søchting & Frödén (4-30)

Index Fungorum 802017, faceoffungi, MycoBank, GenBank

Classification: Xanthorioideae, Teloschistaceae, Teloschistineae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Flavoplaca citrina* (Hoffm.) Arup, Frödén & Søchting

= *Verrucaria citrina* Hoffm.

Table 2.136 Accepted lichenicolous species of *Flavoplaca*

	Species name	Host	References	Remarks
1	*Flavoplaca coronata* (Körb.) J.Steiner	On saxicolous lichens	(Arup et al., 2013)	= *Callopisma aurantiacum* var. *coronatum* Kremp. ex Körb.
2	*Flavoplaca microthallina* (Wedd.) Zahlbr.	On saxicolous lichen	(Arup et al., 2013)	= *Lecanora microthallina* Wedd.
3	*Flavoplaca oasis* (A.Mas-sal.) Szatala	*Bagliettoa calciseda*	(Arup et al., 2013)	= *Callopisma aurantiacum* var. *oasis* A. Massal.
4	*Flavoplaca polycarpa* (A. Massal.) Arup, Frödén & Søchting	*Bagliettoa*	(Arup et al., 2013)	= *Callopisma aurantiacum* var. *polycarpum* A. Massal.

Shackletonia Søchting, Frödén & Arup (2-4)

Index Fungorum 802001, faceoffungi, MycoBank, GenBank

Classification: Xanthorioideae, Teloschistaceae, Teloschistineae, Teloschistales, Lecanoromycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Shackletonia hertelii* (Søchting, Øvstedal & Sancho) Søchting, Frödén & Arup

= *Caloplaca hertelii* Søchting, Øvstedal & Sancho

Table 2.137 Accepted lichenicolous species of *Shackletonia*

	Species name	Host	References	Remarks
1	*Shackletonia buelliae* (Olech & Søchting) Søchting, Frödén & Arup	*Buellia anisomera*	(Arup et al., 2013)	= *Caloplaca buelliae* Olech & Søchting

Table 2.137 (contined)

	Species name	Host	References	Remarks
2	*Shackletonia sauronii* (Søchting & Øvstedal) Søchting, Frödén & Arup	*Buellia*	(Arup et al., 2013)	= *Caloplaca sauronii* Søchting & Øvstedal

SubClass OSTROPOMYCETIDAE V. Reeb, Lutzoni & Cl. Roux

Order Baeomycetales Lumbsch, Huhndorf & Lutzoni.

Family Arthrorhaphidaceae Poelt & Hafellner

Arthrorhaphidaceae Poelt & Hafellner

Index Fungorum 80477, faceoffungi, MycoBank, GenBank

Classification: Baeomycetales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Arthrorhaphidaceae was introduced by Poelt & Hafellner (1976) to accommodate two genera, *Arthrorhaphis* Th. Fr. and *Neonorrlinia* Sydow., and *Arthrorhaphis* was designated as the type genus. Members of this family are lichenized fungi and partly parasitic, with a thallus that is either endothallic or superficial. The thallus is often wart-like or bullate, with poorly developed cortex, frequently containing rhizocarpic acid. The ascocarps are either disc-shaped and sessile or enclosed and embedded, with asci that are non-amyloid, slightly thickened at the apex, and contain septate, colorless spores. The paraphyses are branched and anastomosing. The ascocarps are colored olive in certain regions, such as the exciple, epihymenium, or ostiolar area (Poelt et al., 1976).

The type species of *Neonorrlinia*, *N. trypetheliza* was initially considered as a lichenized fungus, however, Hafellner et al. (1995) turn out that this is a lichenicolous fungus *Cercidospora* species on *Arthrorhaphis*. Then *Neonorrlinia* was treated as a synonym of *Cercidospora*, and Arthrorhaphidaceae becoming a monotypic family,

only composed of *Arthrorhaphis* (Hafellner et al., 1995).

Kraichak et al. (2018) revised the classification of orders and families in the two major subclasses of Lecanoromycetes, and Arthrorhaphidaceae was placed within Baeomycetales based on phylogenetic analysis. (Kraichak et al., 2018).

Type species: *Arthrorhaphis* Th. Fr.

Arthrorhaphis Th. Fr. (10-15)

Index Fungorum 336, faceoffungi, MycoBank, GenBank

Classification: Arthrorhaphidaceae, Baeomycetales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Arthrorhaphis was established by Fries (1861) to accommodate the type species *A. flavo-virescens*. This genus is morphologically and biologically diverse, comprising both lichenized and lichenicolous fungi. Of the 15 known species, seven are strictly lichenicolous, while three are facultative lichenicolous lichens. A phylogenetic study by Frisch et al. (2022) placed this genus within the family Arthrorhaphidaceae (Baeomycetales, Ostropomycetidae, Lecanoromycetes). (Frisch et al., 2022).

Arthrorhaphis anziana, not listed in Species Fungorum, is recognized in MycoBank as *Bacidia anziana* Lynge, but this name actually serves as the basionym of *A. anziana*. In Hawksworth's checklist (1972), it is noted to grow on other lichens, and thus we have included this species in our list. *Arthrorhaphis fuscoreagens* was transferred from *Lecidea fuscoreagens* Vain. by Poelt (1969). Although it is labeled as a synonym of *A. grisea* in Index Fungorum and MycoBank, we found no literature to support the reinstatement of the older species. *Arthrorhaphis viridescens* Rabenh., not listed in Species Fungorum, is still considered a valid name and should be included in the list. To date, 15 species are recognized in this genus: seven are strictly lichenicolous, three are facultative lichenicolous, and the rest are lichenized.

Type species: *Arthrorhaphis flavovirescens* (A. Massal.) Th. Fr.

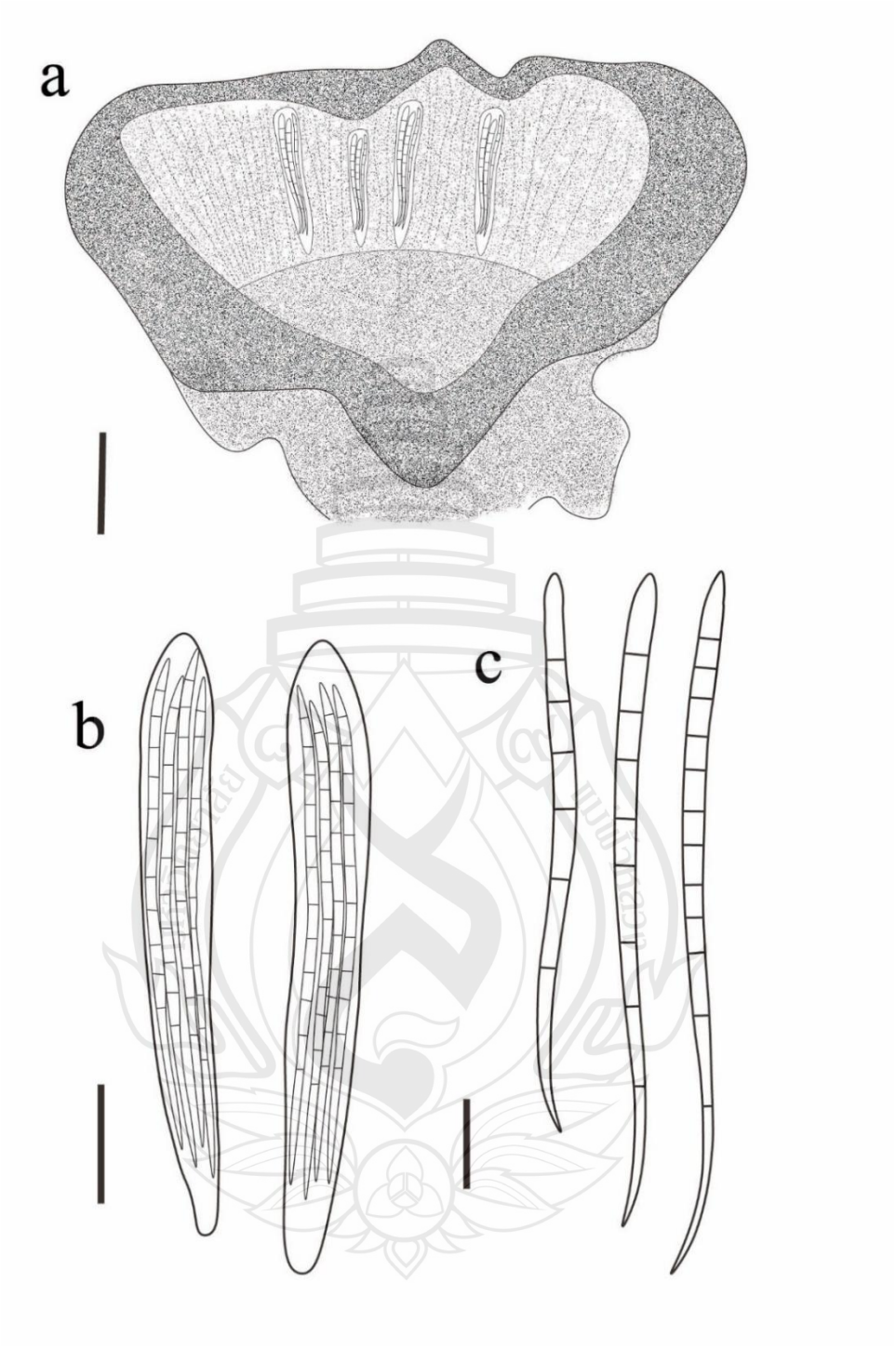
=*Catolechia flavovirescens* Flot.

Table 2.138 Accepted lichenicolous species of *Arthrorhaphis*

	Species name	Host	References	Remarks
1	*Arthrorhaphis aeruginosa* R. Sant. & Tønsberg	*Cladonia coniocraea*	(Santesson et al., 1994)	
2	*Arthrorhaphis alpina* (Schaer.) R. Sant.	on *Baeomyces rufus*	(Hawksworth et al., 1980)	Juvenile parasite lichenicolous = *Lecidea flavovirescens var. alpina* Schaer.
3	*Arthrorhaphis anziana* (Lynge) Poelt	On other lichens	(Hawksworth, 1972)	= *Bacidia anziana* Lynge
4	*Arthrorhaphis arctoparmeliae* Kocourk. & van den Boom	*Arctoparmelia incurva*	(Kocourková et al., 2005)	
5	*Arthrorhaphis citrinella* (Ach.) Poelt	on *Baeomyces rufus*	(Acharius, 1795; Poelt et al., 1969)	Juvenile parasite lichenicolous = *Lichen citrinellus* Ach.
6	*Arthrorhaphis grisea* Th. Fr.	*Baeomyces*	(Fries, 1861)	
7	*Arthrorhaphis muddii* Obermayer	*Baeomyces roseus*	(Obermayer, 1994)	

Table 2.138 (continued)

	Species name	Host	References	Remarks
8	*Arthrorhaphis olivaceae* R. Sant. & Tønsberg	*Melanelia olivacea*	(Santesson et al., 1994)	
9	*Arthrorhaphis phyllobaeis* Etayo & Palice	*Phyllobaeis imbricata*	(Etayo, 2017)	
10	*Arthrorhaphis vaccillans* Th. Fr. & Almq. ex Th. Fr.	on *Baeomyces*	(Fries, 1867c)	Juvenile parasite



Note a Section of ascomata. b Asci. c Ascospores. Scale bars: a = 100 μm, b = 20 μm, c = 10 μm.

Source Redrawn from Obermayer (1994) and Frisch et al. (2022)

Figure 2.90 *Arthrorhaphis citrinella*

Order Odontotrematales Lücking

Family Odontotremataceae D. Hawksw. & Sherwood

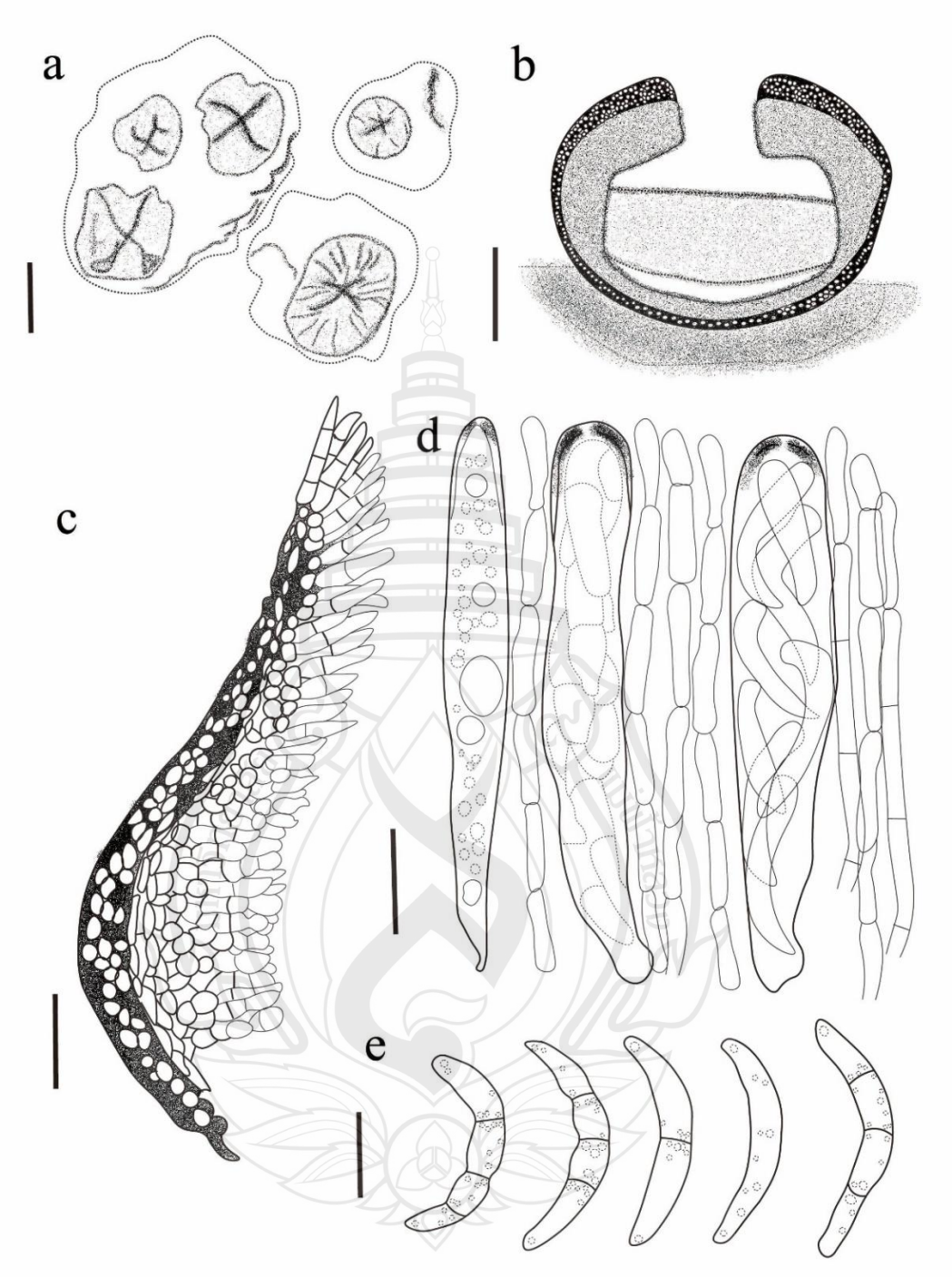
Paralethariicola Calat., Etayo & Diederich (1)

Index Fungorum 28545, faceoffungi, MycoBank, GenBank

Classification: Odontotremataceae, Odontotrematales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Paralethariicola was introduced by Calatayud, Etayo & Diederich (2001) to describe the single lichenicolous fungus *P. aspiciliae*, which grows on *Aspicilia* and has been recorded in continental Spain and Sardinia. This genus resembles *Lethariicola* and is characterized by excipular hairs, asci with a hemiamyloid apical ring and a more flattened apex, curved or slightly helicoid ascospores with ± pointed ends, and thicker paraphyses. *Paralethariicola* was originally classified in the family Odontotremataceae (Ostropales). Later, Lücking (2019) established the new order Odontotrematales to encompass Odontotremataceae. Due to the unavailability of sequence data, this genus has consistently been retained within Odontotremataceae (Odontotrematales).

Type species: *Paralethariicola aspiciliae* Calat., Etayo & Diederich, on *Aspicilia* (Calatayud et al., 2001)



Note a Ascomata. b Section of ascomata. c Part of the exciple. d Asci and paraphyses. e Ascospores. Scale bars: a = 250 µm, b = 50 µm, c = 20 µm, d–e = 10 µm.

Source Redrawn from Calatayud et al. (2001)

Figure 2.91 *Paralethariicola aspiciliae*

Order Ostropales Nannf.

Family Gomphillaceae Walt. Watson

Corticifraga D. Hawksw. & R. Sant. (11)

Index Fungorum 25504, faceoffungi, MycoBank, GenBank

Classification: Gomphillaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

The obligately lichenicolous genus *Corticifraga* was introduced by Hawksworth & Santesson (1990) to accommodate the type species *C. peltigera*, which primarily grows on *Peltigera* and occasionally on *Solorina* and *Pseudocyphellaria*. It is characterized by its lichenicolous, commensalistic, or parasitic lifestyle and is non-lichenized. The ascomata are initially nearly perithecioid or lens-shaped, breaking through the host cortex and eventually becoming apothecioid, concave to plane, fawn to black, occurring solitarily or in small groups, and are immersed. The exciple is hyaline to dark olivaceous brown, composed of irregular, subglobose to ± elongated pseudoparenchymatous cells. The paraphyses are filiform, simple or sparsely branched, and septate. The asci are broadly clavate with a short stalk, featuring two distinct wall layers, a truncated and thickened apex, and discharge through a short extension of the inner apical tissues without amyloid reactions, containing eight spores. The ascospores are hyaline, broadly fusiform to ellipsoid or soleiform, often tapered at the base, smooth, 1–3-septate, distichously arranged, and lack a perispore (Ertz, 2004).

Hawksworth & Santesson (1990) suggested that *Corticifraga* could belong to the order Ostropales due to its non-amyloid asci. However, Ertz (2004) proposed placing this genus within Lecanorales, though with some uncertainty. Lumbsch et al. (2007) classified this genus within *Lecanoromycetes* genera incertae sedis. It wasn't until Pino-Bodas et al. (2017) conducted a phylogenetic study on lichenicolous fungi associated with *Cladonia* and other genera that the type species *Corticifraga peltigerae* was sequenced and included in a phylogenetic analysis. This analysis placed the genus

within the order Ostropales, closely related to *Actinoplaca strigulacea* in the family Graphidaceae, subfamily Gomphilloideae, a classification later accepted by Wijayawardene et al. (2022).

Initially, *Corticifraga* was primarily found on *Peltigera*, with occasional occurrences on *Solorina* and *Pseudocyphellaria*. Zhurbenko (2007) introduced two additional species: *Corticifraga chugachiana*, which grows on *Lobaria*, and *Corticifraga santessonii*, which grows on *Nephroma occultum*. Most of the newly described species are found on foliose lichens, except for *Corticifraga ramalinae*, which grows on the fruticose lichen *Ramalina fraxinea* (Roux, 2022). To date, there are ten species in this genus, all of which are lichenicolous.

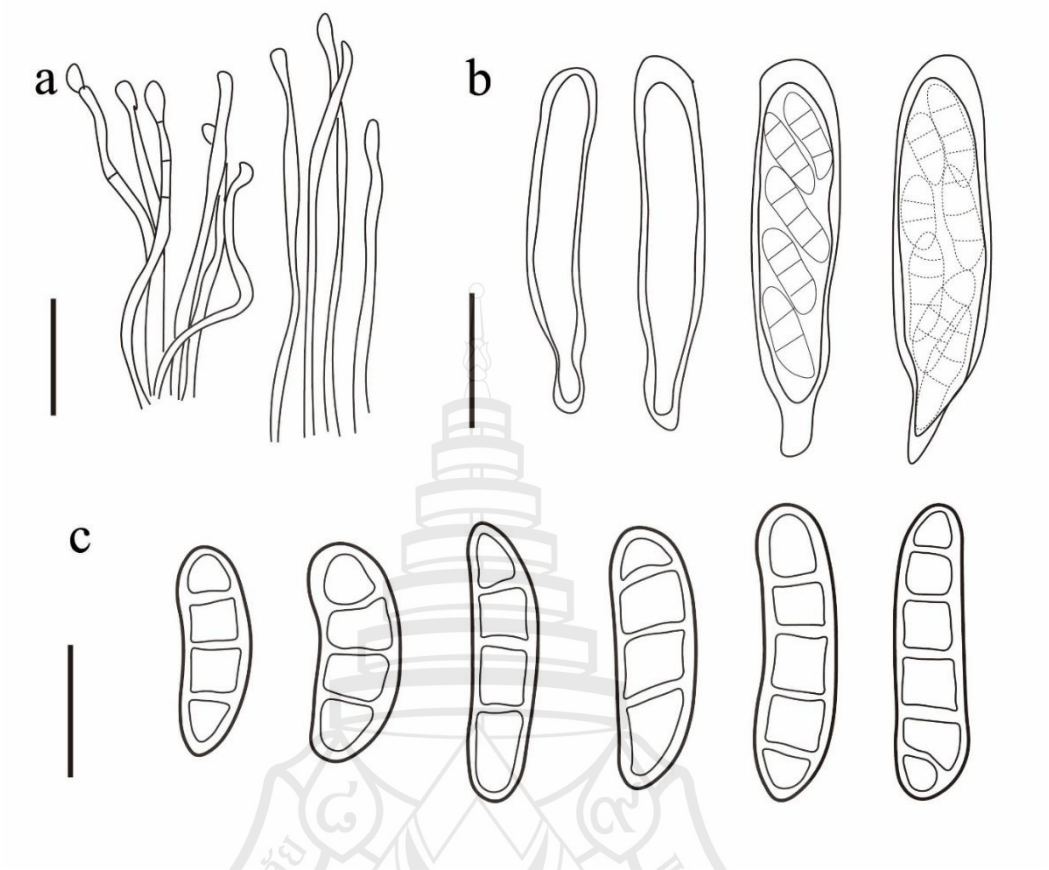
Type species: *Corticifraga peltigerae* (Fuckel) D. Hawksw. & R. Sant.

Table 2.139 Accepted lichenicolous species of *Corticifraga*

	Species name	Host	References	Remarks
1	*Corticifraga chugachiana* Zhurb.	*Lobaria oregana*	(Zhurbenko, 2007a)	
2	*Corticifraga fuckelii* (Rehm) D. Hawksw. & R. Sant.	*Peltigera canina*	(Rehm, 1888; Hawksworth et al., 1990)	= *Phragmonaevia fuckelii* Rehm
3	*Corticifraga fusispora* Zhurb.	*Peltigera leucophlebia,* exceptionally on *Solorina* and *Pseudocyphellaria*	(Zhurbenko, 2009c)	
4	*Corticifraga melanohaleae* P. Pinault et Cl. Roux	*Melanohalea exasperata*	(Roux, 2024a)	

Table 2.139 (continued)

	Species name	Host	References	Remarks
5	*Corticifraga microspora* Etayo & Flakus	*Lobariella pallida*	(Flakus et al., 2019b)	
6	*Corticifraga nephromatis* Pérez-Ort.	*Nephroma bellum*	(Spribille et al., 2020)	
7	*Corticifraga peltigerae* (Fuckel) D. Hawksw. & R. Sant.	*Peltigera,* exceptionally on *Solorina* and *Pseudocyphellaria*	(Fuckel, 1866; Hawksworth et al., 1990)	= *Peziza peltigerae* Fuckel
8	*Corticifraga pseudocyphellariae* Etayo	*Pseudocyphellaria freycinetii*	(Etayo & Sancho, 2008)	
9	*Corticifraga ramalinae* P. Pinault, Ertz & Cl. Roux	*Ramalina fraxinea*	(Roux, 2022)	
10	*Corticifraga santessonii* Zhurb. & Zavarzin	*Nephroma occultum*	(Zhurbenko, 2007a)	
11	*Corticifraga scrobiculatae* Perez-Ortega	*Lobaria scrobiculata*	(Spribille et al., 2010)	



Note a Paraphyses. b Asci. c Ascospores. Scale bars: a-b = 20 μm, c = 10 μm.

Source Redraw from Puolasmaa et al. (2012)

Figure 2.92 *Corticifraga peltigerae*

Gyalideopsis Vězda (5-50)

Index Fungorum 2162, faceoffungi, MycoBank, GenBank

Classification: Gomphillaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Gyalideopsis peruviana* G. Merr. ex Vězda

Table 2.140 Accepted lichenicolous species of *Gyalideopsis*

	Species name	Host	References
1	*Gyalideopsis cochlearifer* Lücking & Sérus.	*Gomphillaceae*	(Lücking et al., 1998)

Table 2.140 (continued)

	Species name	Host	References
2	*Gyalideopsis epithallina* R. Lücking	*Gyalideopsis vulgaris*	(Lücking, 1997)
3	*Gyalideopsis parvula* Kalb & Vězda	*Pilocarpaceae*	(Kalb et al., 1988)
4	*Gyalideopsis stipitata* Kalb & Vezda	*Dictyonema*	(Kalb et al., 1994)
5	*Gyalideopsis usneicola* Etayo	*Usnea*	(Etayo, 2017)

Paragyalideopsis Etayo (4)

Index Fungorum 818360, faceoffungi, MycoBank, GenBank

Classification: Gomphillaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

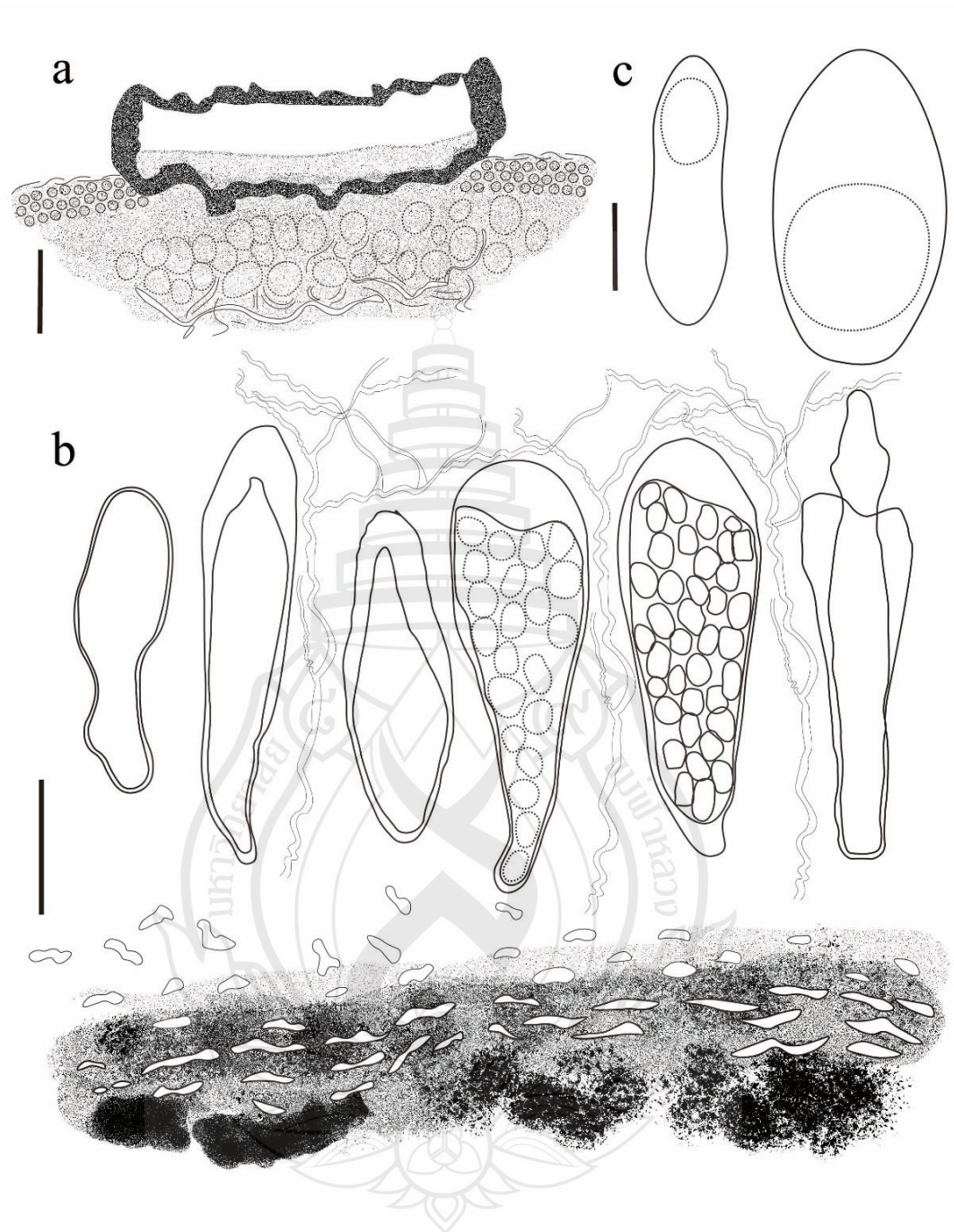
Paragyalideopsis was introduced by Etayo (2017) to accommodate four species that grow on non-foliicolous lichens, with *Paragyalideopsis floridae* (originally *Gyalideopsis floridae*) designated as the type species. This genus is distinguished by its lichenicolous habitat on non-epiphyllic species, the presence of a highly reduced thallus beneath the ascomata, the absence of hyphophores, and myriospored asci with small spores. Currently, no sequence data are available for this genus. Since *Paragyalideopsis* was separated from *Gyalideopsis*, it has been provisionally placed in the same family, Gomphillaceae (Ostropales). Its phylogenetic status will be further clarified once molecular data become available.

Type species:

Paragyalideopsis floridae (Etayo & Diederich) Etayo

Table 2.141 Accepted lichenicolous species of *Paragyalideopsis*

	Species name	Host	References	Remarks
1	*Paragyalideopsis breussii* Etayo	*Hypotrachyna*	(Etayo, 2017)	
	Paragyalideopsis floridae (Etayo & Diederich) Etayo	*Parmotrema rigidum*	(Etayo & Diederich, 2001; Etayo, 2017)	= *Gyalideopsis floridae* Etayo & Diederich
2	*Paragyalideopsis minuta* Etayo	*Trypethelium*	(Etayo, 2017)	
3	*Paragyalideopsis stereocaulicola* (Etayo) Etayo	*Stereocaulon*	(Etayo, 2010a & 2017)	= *Gyalideopsis stereocaulicola* Etayo



Note a Section of ascomata. b Asci, paraphyses. c Ascospores. Scale bars: a = 100 µm, b = 10 µm, c = 1 µm.

Source Redrawn from Etayo et al. (2001)

Figure 2.93 *Paragyalideopsis floridae*

Taitaia Suija, Kaasal., Kirika & Rikkinen (1)

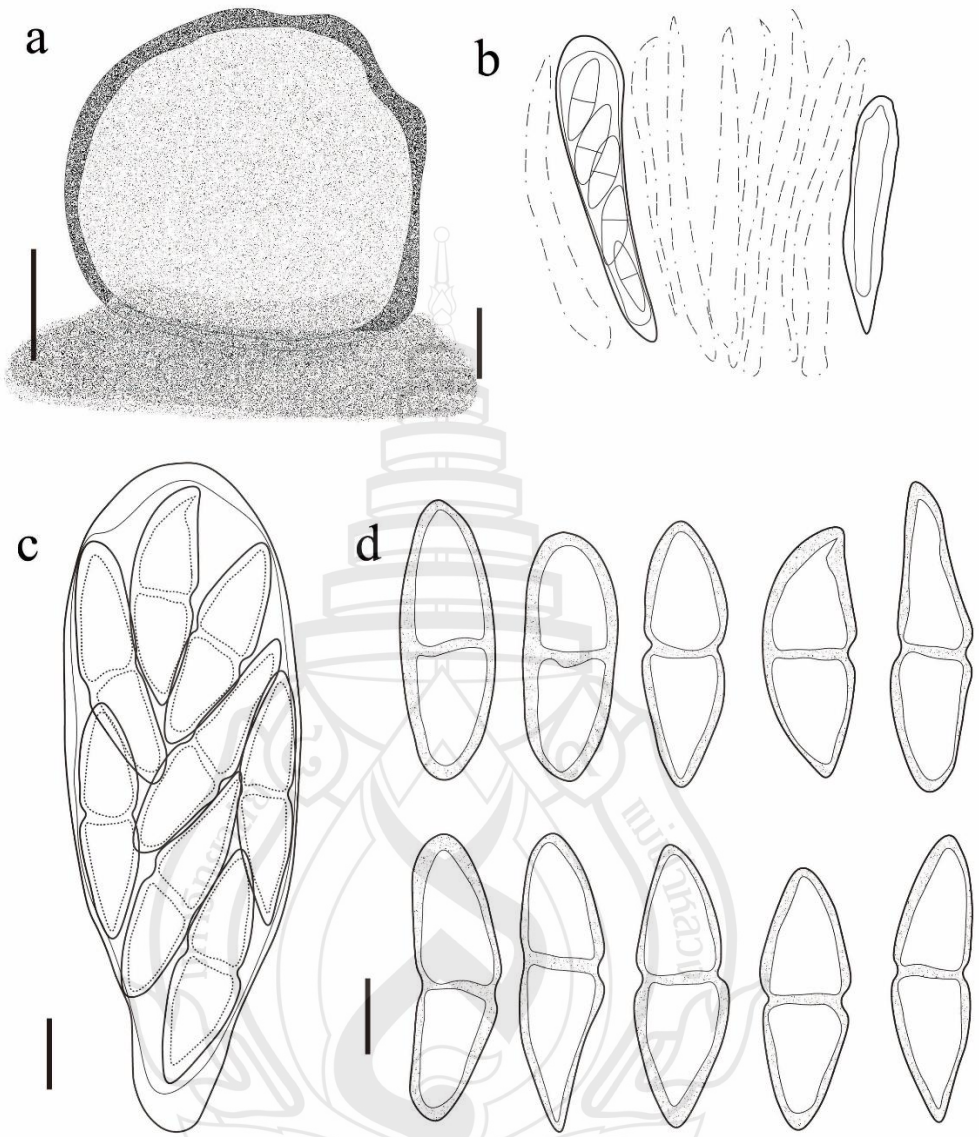
Index Fungorum 821739, faceoffungi, MycoBank, GenBank

Classification: Gomphillaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

The monotypic genus *Taitaia* was introduced by Suija et al. (2018) to accommodate the lichenicolous fungus *T. aurea*, which grows on the thalli of the epiphytic tripartite cyanolichen *Crocodia* cf. *clathrate*. Phylogenetic analysis revealed that this genus is closely related to *Gyalidea fritzei*, followed by *Corticifraga peltigerae*, supporting its placement within the family Gomphillaceae (Ostropales).

Taitaia is characterized by aggregated, apothecioid ascomata with yellow margins and salmon-red discs that develop from a single base. The hymenium is hyaline, lacks hymenial gel, and is filled with irregular, septate paraphyses. The asci are unitunicate and clavate, lacking a widened apex, and contain eight biseriate spores. The ascospores are two-celled, hyaline, fusiform, slightly or not constricted at the septum, symmetrical or occasionally asymmetrical, and surrounded by a perispore. (Suija et al., 2018).

Type species: *Taitaia aurea* Suija, Kaasalainen & Rikkinen, on *Crocodia* cf. *clathrate* (Suija et al., 2018)



Note a Section of ascomata. b Paraphyses and asci. c Ascus. d Ascospores. Scale bars: a = 20 µm, b = 10 µm, c–d = 5 µm.

Source Redraw from Suija et al. (2018)

Figure 2.94 *Taitaia aurea*

Family Graphidaceae Dumort.

Subfamily Graphidoideae Rivas Plata, Lücking & Lumbsch

Diploschistes Norman (4-30^{+})

Index Fungorum 1621, faceoffungi, MycoBank, GenBank

Classification: Graphidaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Diploschistes scruposus (Schreb.) Norman

= *Lichen scruposus* Schreb.

Table 2.142 Accepted lichenicolous species of *Diploschistes*

	Species name	Host	References	Remarks
1	*Diploschistes caesioplumbeus* (Nyl.) Vainio	on *Lecanora gangaleoides*	(Vainio, 1921a)	Juvenile lichenicolous = *Urceolaria actinostoma var. caesioplumbea Nyl.*
2	*Diploschistes euganeus* (A. Massal.) J. Steiner	*Ochrolechia parella*	(Steiner, 1919)	Facultatively = *Limboria euganea A. Massal.*
3	*Diploschistes muscorum* (Scop.) R. Sant.	*Cladonia* (rarely *Stereocaulon)*	(Hawksworth et al., 1980)	*Lichen muscorum Scop.*
4	*Diploschistes stereocaulorum* Lumbsch, C. Morris & McCune	*Stereocaulon sterile*	(Lumbsch et al., 2023)	

Family Protothelenellaceae Vězda, H. Mayrhofer & Poelt

Protothelenella Räsänen (6-14)

Index Fungorum 22316 faceoffungi, MycoBank, GenBank

Classification: Protothelenellaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Protothelenella reducta* (Th. Fr.) Räsänen

Table 2.143 Accepted lichenicolous species of *Protothelenella*

	Species name	Host	References	Remarks
1	*Protothelenella croceae* (Bagl. & Carestia) Hafellner & H. Mayrhofer	*Solorina crocea,* more rarely *Peltigera*	(Mayrhofer, 1987a)	= *Xenosphaeria croceae* Bagl. & Carestia
2	*Protothelenella leucothelia* (Nyl.) H. Mayrhofer & Poelt	on moribund lichens, especially *Cladonia*	(Mayrhofer et al., 1985)	facultatively lichenicolous =*Verrucaria leucothelia* Nyl
3	*Protothelenella pseudocyphellariae* Etayo	*Pseudocyphellaria freycinetii*	(Etayo & Sancho, 2008)	
4	*Protothelenella santessonii* H. Mayrhofer	*Cladonia squamosa*	(Etayo & Sancho, 2008)	
5	*Protothelenella sphinctrinoidella* (Nyl.) H. Mayrhofer & Poelt	*Cladonia, Peltigera* and *Stereocaulon*	(Mayrhofer et al., 1985)	Facultatively lichenicolous = *Verrucaria sphinctrinoidella* Nyl.

Table 2.143 (continued)

	Species name	Host	References	Remarks
6	*Protothelenella sphinctrinoides* (Nyl.) H. Mayrhofer & Poelt	*Peltigera* and *Solorina*	(Mayrhofer et al., 1985)	Facultatively lichenicolous = *Verrucaria sphinctrinoides* Nyl.

Family Spirographaceae Flakus, Etayo & Miadl.

Spirographaceae Flakus, Etayo & Miądl

Index Fungorum 833342, faceoffungi, MycoBank, GenBank

Classification: Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Spirographaceae was introduced by Flakus, Etayo & Miądl (2019) based on multilocus phylogenetic analysis to accommodate the sole genus *Spirographa* Zahlbr. This family represents an independent lineage within *Ostropales* and is sister to the clade containing *Fissurinaceae*, *Gomphillaceae*, and *Graphidaceae* (Flakus et al., 2019b).

The family is characterized by two reproductive stages. The sexual state features apothecioid or perithecioid, cleistohymenial ascomata that are immersed or sessile on the host thalli or hymenia. These ascomata may occur singly or in aggregates on a stroma, are pigmented brown or black, and possess a persistent exciple and a hymenium that reacts I– and K/I–. The paraphyses are simple to branched, and the asci are functionally unitunicate, containing 16–32 spores. The ascospores are 1-septate, hyaline, narrowly ellipsoidal to fusiform, and may be curved or sigmoid. The asexual state is characterized by immersed, pycnidial conidiomata that are hyaline to yellowish-brown or dark brown, with the top disintegrating irregularly to release conidia. The conidiophores are hyaline, septate, and branched, while the conidiogenous cells are

holoblastic and either synchronous or sympodial. The conidia are hyaline and exhibit diverse morphologies, including Y-shaped with a main axis and two diverging arms, triangular, or tetra- to polyhedral (Flakus et al., 2019b).

Type genus: *Spirographa* Zahlbr.

Spirographa Zahlbr. (22-24)

Index Fungorum 5151, faceoffungi, MycoBank, GenBank

Classification: Spirographaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

= *Asteroglobulus* Brackel, *Herzogia* 24(1): 69 (2011)

Type species: *Asteroglobulus giselae* Brackel

= *Cornutispora* Piroz., Mycologia 65(4): 763. 1973

Type species: *Cornutispora limaciformis* Piroz.

= *Graphinella* Zahlbr., Cat. Lich. Univers. 2: 285. 1923.

Type species: *Graphinella fusisporella* (Nyl.) Zahlbr.

= *Pleoscutula* Vouaux, Bull. Soc. Mycol. Fr. 29: 434. 1913.

Type species: *Pleoscutula arsenii* Vouaux

= *Pleospilis* Clem., Gen. Fung. (Minneapolis): 69. 1909.

Type species: *Pleospilis vermiformis* (Leight.) Clem.

= *Spilomela* (Sacc. & D. Sacc.) Keissl., Beih. Bot. Zbl., Abt. 2 37: 272. 1920

≡ *Melaspilea* subgen. *Spilomela* Sacc. & D. Sacc., Syll. Fung. (Abellini) 18: 179. 1906.

Type species: *Spilomela vermifera* (Leight.) Keissl.

= *Spirographomyces* Cif. & Tomas., Atti Ist. bot. Univ. Lab. Crittog. Pavia 10(1): 43, 69. 1953

Type species: *Spirographomyces spiralis* (Müll. Arg.) Cif. & Tomas.

Spirographa was established by Zahlbruckner in Engler (1907), is characterized by cleistohymenial, apothecioid or perithecioid ascomata, which may occur singly or

in stromatic aggregates, either immersed in the host or sessile. The disc, concave upon hymenial exposure at maturity, ranges from dark brown to black, sometimes lighter than the margin. The exciple is prominent, honey-brown to black, hairless, and composed of isodiametric cells. The hymenium is hyaline, while the epihymenium varies from honey-brown to orange-brown or black, containing granular pigments. Paraphyses are hyaline, simple, septate, occasionally branched at the apex, and typically thickened and pigmented at the tip. The asci are clavate to cylindrical, functionally unitunicate, with an unthickened apical wall and numerous spores. Ascospores are two-celled, hyaline, narrowly ellipsoidal to fusiform, often arranged spirally, with rounded or pointed ends, and may have prominent apical cilia. They are straight to curved or sigmoid, multiguttulate, smooth, and lack a perispore. (Engler et al., 1903; Flakus et al., 2019b).

Based on a phylogenetic analysis using four sequence datasets, Flakus et al. (2019) combined seven genera into *Spirographa*. The first of these is *Asteroglobulus*, introduced by von Brackel (2011) to describe the conidial fungi *A. giselae*, characterized by black conidiomata that form on darkened areas of *Ramalina farinacea* thalli and small, triangular to tetrahedral conidia. The type species *Asteroglobulus giselae* and an additional species, *A. pyramidalis*, were both transferred to *Spirographa* by Flakus et al. (2019).

The second genus combined into *Spirographa* is *Cornutispora*, established by Pirozynski (1973) with *C. limaciformis* as its type species. Subsequently, all ten species within *Cornutispora* were transferred to *Spirographa*. *Graphinella* is a monotypic genus introduced by Zahlbruckner (1923) to classify *G. fusisporella*, originally described as *Graphis fusisporella* (Nyl.). *Graphinella* was later transferred to *Spirographa* when *G. fusisporella* was reclassified as *Spirographa fusisporella* (Flakus et al., 2019b)..

Clements (1909) introduced *Pleospilis* with *P. vermifera* as the type species,

originally *Melaspilea vermiformis* (Leight.). A second species, *Pleospilis ascaridiella*, was transferred by Hawksworth (1983) from *Lecidea ascaridiella* (Nyl.), and both were moved to *Spirographa* by Flakus et al. (2019). Vouaux (1913) introduced the lichenicolous genus *Pleoscutula*, which included three species. The type species *Pl. arsenii* and *A. hypotrachynae* were subsequently transferred to *Spirographa* by Flakus et al. (2019), rendering *Pleoscutula* a synonym of *Spirographa*. Originally a subgenus of *Melaspilea*, *Spilomela* was elevated to genus level by Keissler (1920) and later, along with its two species, transferred to *Spirographa* by Flakus et al. (2019). The monotypic genus *Spirographomyces* was introduced by Ciferri et al. (1953) to accommodate *S. spiralis*, which was also transferred to *Spirographa* by Flakus et al. (2019).

To date, 24 species are recognized within *Spirographa*, 22of which are lichenicolous and three are lichens. Sequence data for eight of these species are available in GenBank.

Type species: *Spirographa fusisporella* (Nyl.) Zahlbr.

= *Graphis fusisporella* Nyl.

Table 2.144 Accepted lichenicolous species of *Spirographa*

	Species name	Host	References	Remarks
1	*Spirographa aggregata* Flakus, Etayo & Miądl.	*Polyblastidium corallophorum*	(Flakus et al., 2019b)	
2	*Spirographa arsenii* (Vouaux) Flakus, Etayo & Miądl.	*Physcia*	(Vouaux, 1913b; Flakus et al., 2019b)	= *Pleoscutula arsenii* Vouaux
3	*Spirographa ascaridiella* (Nyl.) Flakus, Etayo & Miądl.	*Porpidia*	(Nylander, 1868a; Flakus et al., 2019b)	= *Lecidea ascaridiella* Nyl.

Table 2.144 (continued)

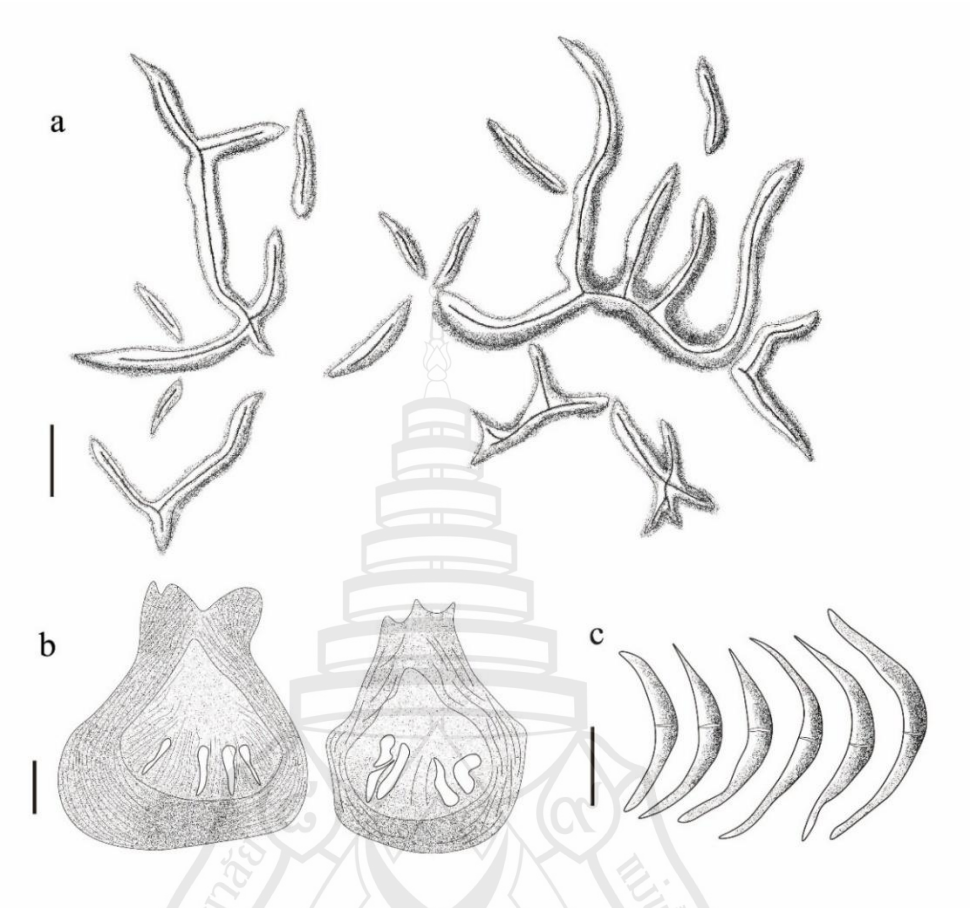
	Species name	Host	References	Remarks
4	*Spirographa bunodophoronis Zhurb.*	*Bunodophoron insigne*	(Zhurbenko, 2023c)	
5	*Spirographa ciliata* (Kalb) Flakus, Etayo & Miądl.	*Dibaeis cretacea*	(Gierl et al., 1993, Flakus et al., 2019b)	= *Cornutispora ciliata* Kalb
6	*Spirographa fusisporella* (Nyl.) Zahlbr.	*Graphidaceae*	(Nylander, 1866b; Engler et al., 1903)	= *Graphis fusisporella* Nyl. = *Opegrapha spiralis* Müll. Arg.
7	*Spirographa giselae* (Brackel) Flakus, Etayo & Miądl.	*Ramalina farinacea, R. fraxinea, Parmotrema crinitum,* and *P. reticulatum*	(von Brackel, 2011a; Flakus et al., 2019b)	= *Asteroglobulus giselae* Brackel
8	*Spirographa herteliana* (Knoph) Flakus, Etayo & Miądl.	*Lecidella elaeochroma*	(Knoph, 2004; Flakus et al., 2019b)	= *Cornutispora herteliana* Knoph
9	*Spirographa hypotrachynae* (Etayo) Flakus, Etayo & Miądl.	*Hypotrachyna*	(Etayo, 2002a; Flakus et al., 2019b)	= *Pleoscutula hypotrachynae* Etayo
10	*Spirographa intermedia* (Punith. & D. Hawksw.) Flakus, Etayo & Miądl.	*Ochrolechia*	(Punithalingam, 2003; Flakus et al., 2019b)	= *Cornutispora intermedia* Punith. & D. Hawksw.

Table 2.144 (continued)

	Species name	Host	References	Remarks
11	*Spirographa lichenicola* (D. Hawksw. & B. Sutton) Flakus, Etayo & Miądl.	*Parmelia sulcata*	(Hawksworth, 1976; Flakus et al., 2019b)	= *Cornutispora lichenicola* D. Hawksw. & B. Sutton
12	*Spirographa limaciformis* (Piroz.) Flakus, Etayo & Miądl.	*Therrya fuckelii*	(Pirozynski, 1973; Flakus et al., 2019b)	= *Cornutispora limaciformis* Piroz.
13	*Spirographa longispora* Etayo	*Sticta*	(Etayo, 2017)	
14	*Spirographa maroneae* Flakus, Etayo & Miądl.	*Maronea constans*	(Flakus et al., 2019b)	
15	*Spirographa ophiurospora* (Etayo) Flakus, Etayo & Miądl.	*Lobariella* cf. *pallida*	(Etayo, 2017; Flakus et al., 2019b)	*Cornutispora ophiurospora* Etayo
16	*Spirographa parmotrematis* Flakus, Etayo & Miądl.	*Parmotrema sancti-angelii*	(Flakus et al., 2019b)	
17	*Spirographa pittii* (D. Hawksw. & Punith.) Flakus, Etayo & Miądl.	*Hypotrachyna formosana*	(Punithalingam, 2003; Flakus et al., 2019b)	*Cornutispora pittii* D. Hawksw. & Punith.
18	*Spirographa pyramidalis* (Etayo) Flakus, Etayo & Miądl.	*Hypotrachyna revoluta*	(Etayo, 2010b; Flakus et al., 2019b)	*Cornutispora pyramidalis* Etayo

Table 2.144 (continued)

	Species name	Host	References	Remarks
19	*Spirographa triangularis* (Diederich & Etayo) Flakus, Etayo & Miądl.	*Pertusaria pertusa*	(Etayo et al., 1995; Flakus et al., 2019b)	*Cornutispora triangularis* Diederich & Etayo
20	*Spirographa tricupulata* (F. Berger & Er. Zimm.) Flakus, Etayo & Miądl.	*Physcia stellaris*	(Zimmermann et al., 2018; Flakus et al., 2019b)	*Cornutispora tricupulata* F. Berger & Er. Zimm.
21	*Spirographa usneae* Flakus, Kukwa & Etayo	*Usnea*	(Flakus et al., 2012)	
22	*Spirographa vermiformis* (Leight.) Flakus, Etayo & Miądl.	*Lepra albescens*	(Leighton, 1875; Flakus et al., 2019b)	*Melaspilea vermiformis* Leight.



Note a Ascomata. b Section of ascomata. c Ascospores. Scales: a = 500 µm, b = 50 µm, c = 10µm.

Source Redrawn from Flakus et al. (2019b)

Figure 2.95 *Spirographa fusisporella*

Family Stictidaceae Fr.

Cryptodiscus Corda (5-15)

Index Fungorum 1317 faceoffungi, MycoBank, GenBank

Classification: Stictidaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Cryptodiscus pallidus (Pers.) Corda

Table 2.145 Accepted lichenicolous species of *Cryptodiscus*

	Species name	Host	References	Remarks
1	*Cryptodiscus cladoniicola (D. Hawksw. & R. Sant.) Pino-Bodas, Zhurb. & S. Stenroos*	*Cladonia amaurocraea*	(Pino-Bodas et al., 2017)	*Lettauia cladoniicola D. Hawksw. & R. Sant.*
2	*Cryptodiscus epicladonia Zhurb. & Pino-Bodas*	*Cladonia*	(Pino-Bodas et al., 2017)	
3	*Cryptodiscus galaninae Zhurb. & Pino-Bodas*	*Cladonia*	(Pino-Bodas et al., 2017)	
4	*Cryptodiscus gassicurtiae Etayo & Aptroot*	*Gassicurtia coccinea*	(Etayo et al., 2020)	
5	*Cryptodiscus ihlenii Zhurb*	*Dibaeis arcuata*	(Zhurbenko & Ohmura, 2020)	

Ingvariella Guderley & Lumbsch (1)

Index Fungorum 27827 faceoffungi, MycoBank, GenBank

Classification: Stictidaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Ingvariella was introduced by Guderley & Lumbsch (1997) to accommodate the type species *I. bispora*, originally described as *Urceolaria bispora* and later transferred to *Diploschistes bisporus*. This species differs from other *Diploschistes*

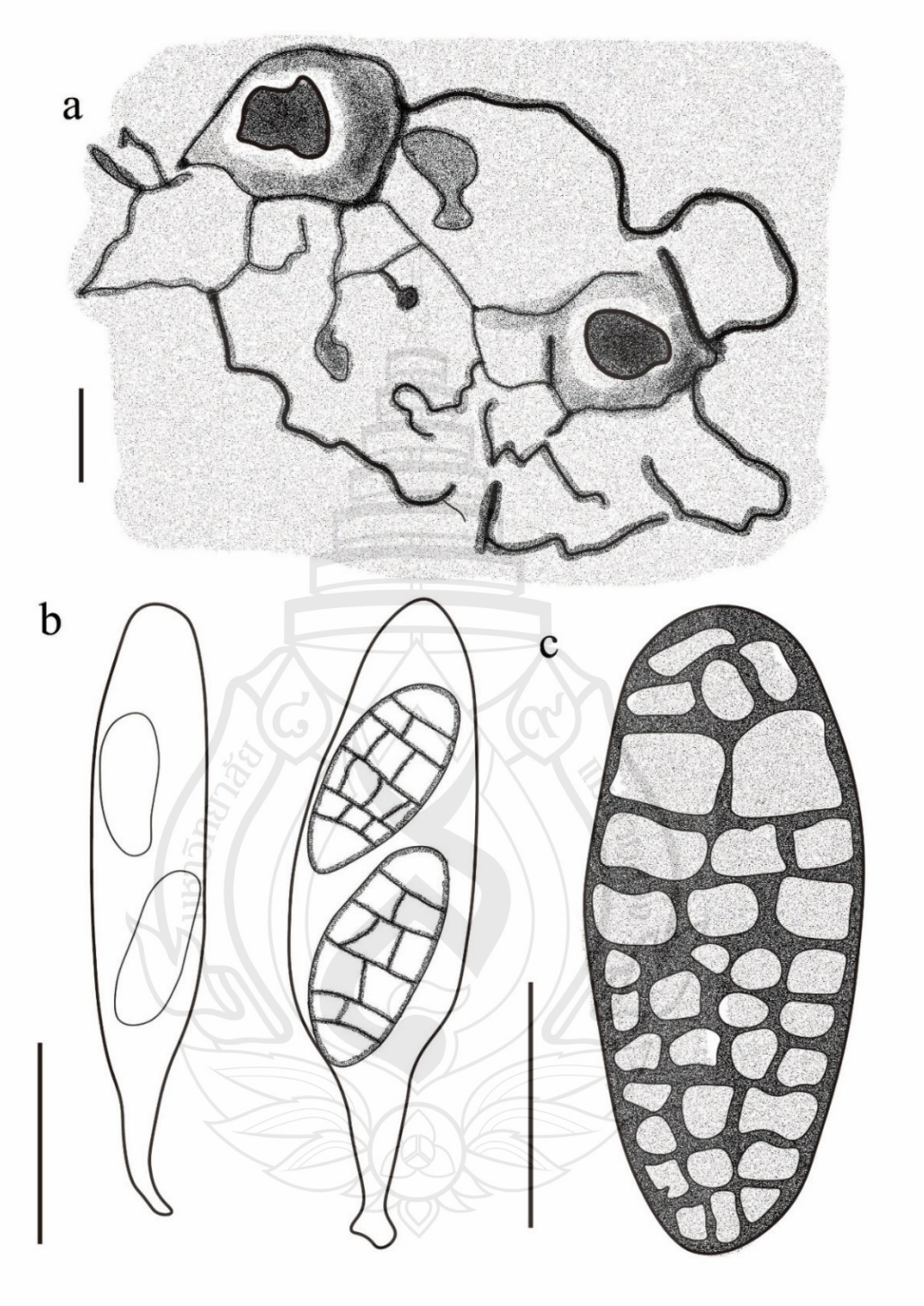
species in its lecideine apothecia, a pseudoexciple that formed from parts of the hymenium, and its degenerating, pigmented hymenial elements. Additionally, a new variety, *var. multispora*, featuring four spores per ascus, was also described. (Guderley et al., 1997).

Lumbsch (1989) conducted a monograph of *Diploschistes* and referred to *D. bisporus* growing on *Rhizocarpon geographicum*. Diederich (2018) included this species in the lichenicolous list of *Diploschstes* as a facultatively lichenicolous lichen.

Type species: *Ingvariella bispora* (Bagl.) Guderley & Lumbsch (Guderley et al., 1997)

= *Urceolaria bispora* Bagl. (Baglietto, 1871)

= *Diploschistes bisporus* (Bagl.) J. Steiner



Note a Apothecia on thallus. b Asci. c Ascospore. Scale bars: a = 1 mm, b = 20 μm, c = 10 μm.

Source Redrawn from Lumbsch (1989)

Figure 2.96 *Ingvariella bispora*

Lettauia D. Hawksw. & R. Sant. (3)

Index Fungorum 25515 faceoffungi, MycoBank, GenBank

Classification: Stictidaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Lettauia was introduced by Hawksw. & R. Sant. (1990) to accommodate the type species *L. cladoniicola*, which grows on *Cladonia amaurocraea*, and was initially placed within the family Fuscidiaceae. However, a phylogenetic analysis by Pino-Bodas et al. (2017) positioned this type species within *Cryptodiscus* (Stictaceae). Ihlen et al. (1996) later introduced a second species, *L. santessonii*, found on *Loxospora pustulata*, and Etayo (2002, 2017) added two more species: *L. hypotrachynae* on *Hypotrachyna* and *L. usneae* on *Usnea*. Currently, three species are recognized in this genus, though the type species has been combined.

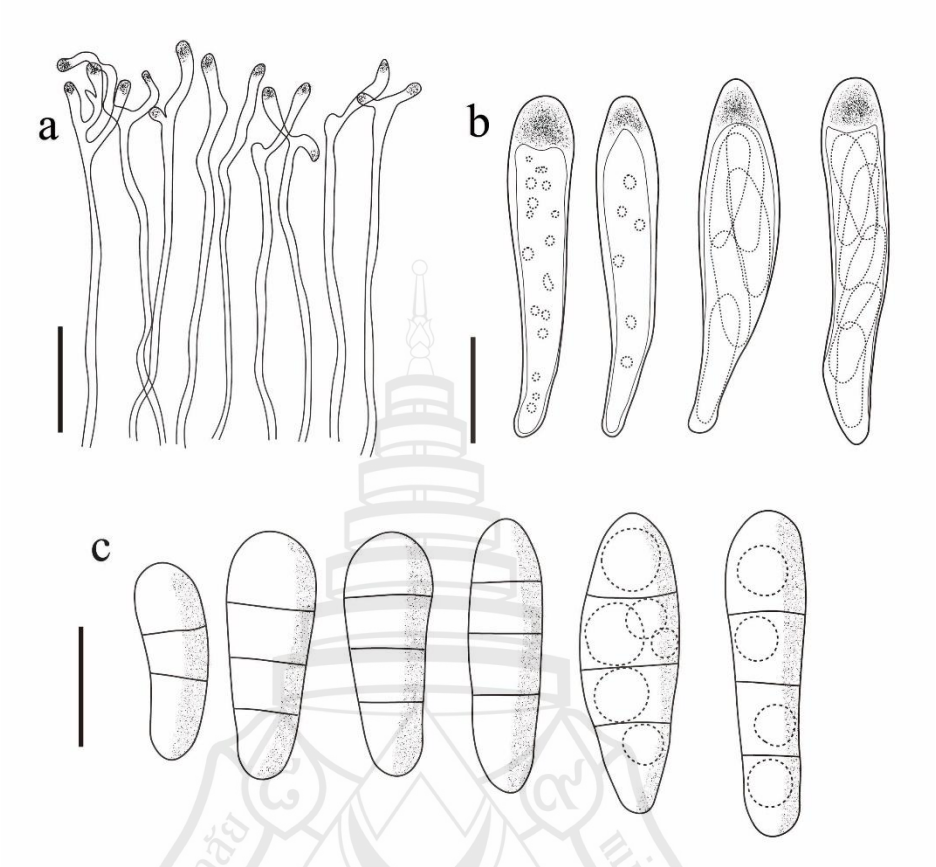
Although *Lettauia cladoniicola* was transferred to *Cryptodiscus* based on molecular data, the other three species lack sequence data. Further studies are needed to determine whether these species should be transferred to another genus or if a new type species should be designated once sequence data are available.

Type species: *Lettauia cladoniicola* D. Hawksw. & R. Sant. (Hawksworth et al., 1990)

Transferred to *Cryptodiscus cladoniicola* (D. Hawksw. & R. Sant.) Pino-Bodas, Zhurb. & S. Stenroos (Pino-Bodas et al., 2017)

Table 2.146 Accepted lichenicolous species of *Lettauia*

	Species name	**Host**	**References**
1	*Lettauia hypotrachynae* Etayo	*Hypotrachyna*	(Etayo, 2002a)
2	*Lettauia santessonii* Ihlen & Tønsberg	*Loxospora pustulata*	(Ihlen et al., 1996)
3	*Lettauia usneae* Etayo	*Usnea*	(Etayo, 2017)



Note a Paraphyses. b Asci. c Ascospores. Scale bars: a–b = 10 µm, c = 5 µm.

Source Redrawn from Etayo (2002a)

Figure 2.97 *Lettauia hypotrachynae*

Nanostictis M.S. Christ. (9)

Index Fungorum 3423 faceoffungi, MycoBank, GenBank

Classification: Stictidaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Nanostictis was introduced by Christ (1954) for a *Stictis*-like discomycete found on *Peltigera* thalli, with *N. peltigerae* (growing on *Peltigera polydactyla*) designated as the type species. This genus is characterized by immersed, whitish to yellowish ascomata, typically with a thick margin that opens by rupturing the host's cortex. The exciple structure is highly variable, ranging from paraplectenchymatous to

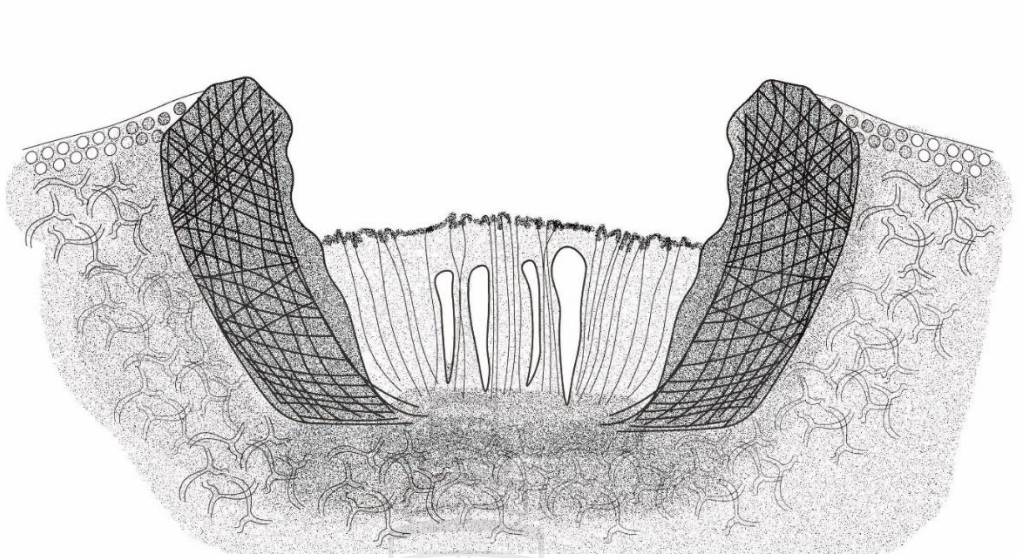
prosoplectenchymatous. The hymenium shows an I+ red and KI+ blue reaction. The asci are bitunicate, with an apical widening and a short ocular chamber, while the ascospores are filiform to fusiform and multiseptate (Etayo, 2017).

Due to its resemblance to *Stictis*, Sherwood (1977) placed *Nanostictis* in the order Ostropales. Lumbsch et al. (2007) further classified it within the family Stictidaceae (Ostropales), a position subsequently supported by later studies. Currently, nine recognized species are recognized in this genus, all lichenicolous and predominantly occurring on foliose lichen thalli. Sequence data for this genus is not yet available.

Type species: *Nanostictis peltigerae* M.S. Christ.

Table 2.147 Accepted lichenicolous species of *Nanostictis*

	Species name	**Host**	**References**
1	*Nanostictis caucasica* Zhurb.	*Parmelia sulcata*	(Zhurbenko, 2017)
2	*Nanostictis christiansenii* Etayo	*Lobaria pulmonaria*	(Etayo & Diederich, 1996b)
3	*Nanostictis confusa* Etayo	*Everniastrum* and *Hypotrachyna*	(Etayo, 2017)
4	*Nanostictis heterodermiae* Etayo	*Heterodermia*	(Etayo, 2017)
5	*Nanostictis nephromatis* Etayo	*Nephroma antarcticum*	(Etayo & Sancho, 2008)
6	*Nanostictis peltigerae* M.S. Christ.	*Peltigera polydactyla*	(Christiansen, 1954)
7	*Nanostictis pluriseptata* Etayo	*Lobaria subexornata*	(Etayo, 2002a)
8	*Nanostictis pseudocyphellariae* Sherwood	*Pseudocyphellaria*	(Sherwood-Pike, 1985)
9	*Nanostictis stictae* Etayo	*Sticta weigelii*	(Etayo, 2002a)



Source Redrawn from Etayo et al. (1996b).

Figure 2.98 The section of ascomata of *Nanostictis peltigerae*

Sphaeropezia Sacc. (16-35)

Index Fungorum 5106, faceoffungi, MycoBank, GenBank

Classification: Stictidaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Nanostictis peltigerae* M.S. Christ.

Table 2.148 Accepted lichenicolous species of *Sphaeropezia*

	Species name	Host	References	Remarks
	Sphaeropezia alpina (Sacc.) Sacc.	on leaves	(Saccardo, 1884)	= *Heterosphaeria alpina* Sacc.
1	*Sphaeropezia bryoriae* (Diederich & Etayo) Baloch & Wedin	*Bryoria fremontii*	(Baloch et al., 2013)	= *Odontotrema bryoriae* Diederich & Etayo
2	*Sphaeropezia cucularis* (Norman) Baloch & Wedin	*Parmeliopsis*	(Baloch et al., 2013)	= *Limboria cucularis* Norman

Table 2.148 (continued)

	Species name	Host	References	Remarks
3	*Sphaeropezia figulina* (Norman) Baloch & Wedin	*Lecanora polytropa*	(Baloch et al., 2013)	= *Limboria figulina* Norman
4	*Sphaeropezia intermedia* (Diederich, Zhurb. & Etayo) Baloch & Wedin	*Thamnolia vermicularis*	(Baloch et al., 2013)	=*Odontotrema intermedium* Diederich, Zhurb. & Etayo
5	*Sphaeropezia japewiae* (Zhurb. & Diederich) Baloch & Wedin	*Japewia tornoënsis*	(Baloch et al., 2013)	=*Odontotrema japewiae* Zhurb. & Diederich
6	*Sphaeropezia lecanorae* (Diederich & Marson) Baloch & Wedin	*Lecanora*	(Baloch et al., 2013)	=*Odontotrema lecanorae* Diederich & G. Marson
7	*Sphaeropezia melaneliae* (Diederich & Zhurb.) Baloch, Gilenstam & Wedin	*Melanelia hepatizon* and *Melanohalea olivacea*	(Baloch et al., 2013)	= *Odontotrema melaneliae* Diederich & Zhurb.
8	*Sphaeropezia mycoblasti* Diederich, Baloch & Wedin	*Mycoblastus saguinarius*	(Baloch et al., 2013)	
9	*Sphaeropezia navarinoi* (Etayo) Baloch & Wedin	*Micarea magellanica*	(Baloch et al., 2013)	= *Odontotrema navarinoi* Etayo

Table 2.148 (continued)

	Species name	Host	References	Remarks
10	*Sphaeropezia neuropogonis* Etayo & Pino-Bodas	*Raesaenenia usneae and Usnea antarctica*	(Johnston et al., 2019; Etayo et al., 2023)	
11	*Sphaeropezia ochrolechiae* (Diederich, Holien & Zhurb.) Baloch & Wedin	*Ochrolechia*	(Baloch et al., 2013)	=*Odontotrema ochrolechiae* Diederich, Holien & Zhurb.
12	*Sphaeropezia pertusariae* (Etayo, Diederich & Coppins) Baloch & Wedin	*Pertusaria hymenea*	(Baloch et al., 2013)	=*Odontotrema pertusariae* Etayo, Diederich & Coppins
13	*Sphaeropezia rhizocarpicola* (Zhurb., Diederich & Himelbrant) Baloch & Wedin	*Rhizocarpon geographicum*	(Baloch et al., 2013)	=*Odontotrema rhizocarpicola* Zhurb., Diederich & Himelbr.
14	*Sphaeropezia santessonii* (Zhurb., Etayo & Diederich) Baloch & Wedin	*Thamnolia vermicularis*	(Baloch et al., 2013)	= *Odontotrema santessonii* Zhurb., Etayo & Diederich
15	*Sphaeropezia sipei* (Grummann) Baloch & Wedin	*Letharia vulpina*	(Baloch et al., 2013)	= *Lethariicola sipei* Grummann

Table 2.148 (continued)

	Species name	Host	References	Remarks
16	*Sphaeropezia thamnoliae* (Zhurb., Diederich & Etayo) Baloch & Wedin	*Thamnolia*	(Baloch et al., 2013)	=*Odontotrema thamnoliae* Zhurb., Diederich & Etayo

Stictis Pers. (1-40)

Index Fungorum 5236 faceoffungi, MycoBank, GenBank

Classification: Stictidaceae, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Stictis radiata* (L.) Pers.

= *Lycoperdon radiatum* L.

Accepted lichenicolous species:

Schmitzomia cladoniae Rehm, on *Cladonia*. (Rehm 1882)

Ostropales Genera incertae sedis

Aabaarnia Diederich (1)

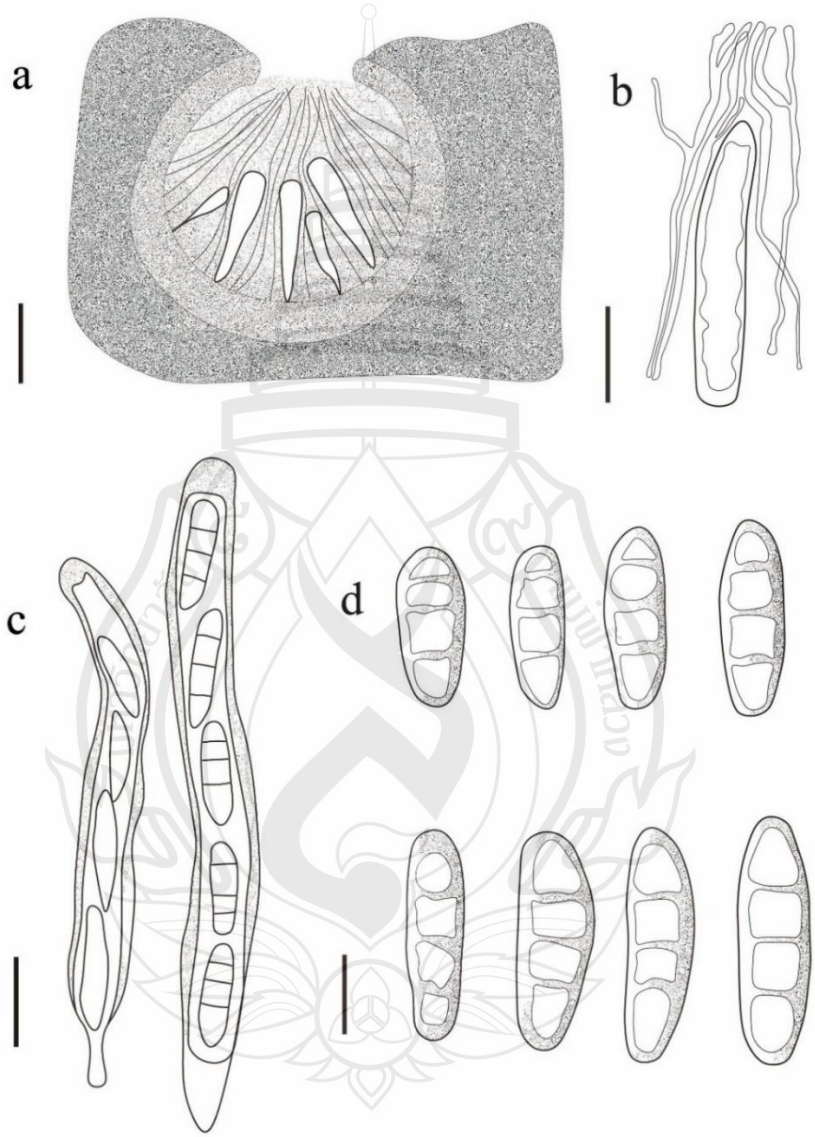
Index Fungorum 810083, faceoffungi, MycoBank, GenBank

Classification: Ostropales Genera incertae sedis, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Aabaarnia was introduced by Diederich (2014) to classify a lichenicolous, gall-inducing ascomycete found on *Siphula decumbens* in Australia and New Zealand. This genus is characterized by pale, immersed, cleistohymenial ascomata; an ascomatal wall lacking crystals; the absence of periphysoids; a hymenium with a KI+ blue reaction; subcylindrical asci containing 4–6 spores and featuring a prominent apical cap; and oval to short-cylindrical, 3-septate ascospores (Diederich, 2014). Currently, only a single species is recognized within this genus, and no sequence data are available.

Aabaarnia has been provisionally placed within *Ostropales* as genera incertae sedis until molecular data become available.

Type species: *Aabaarnia siphulicola* Diederich, on *Siphula decumbens* (Diederich, 2014)



Note a Section of ascomata. b Paraphyses and immature ascus. c Asci. d Ascospores. Scale bars: a = 50 µm, b–c = 20 µm, d = 10 µm.

Source Redrawn from Diederich (2014)

Figure 2.99 *Aabaarnia siphulicola*

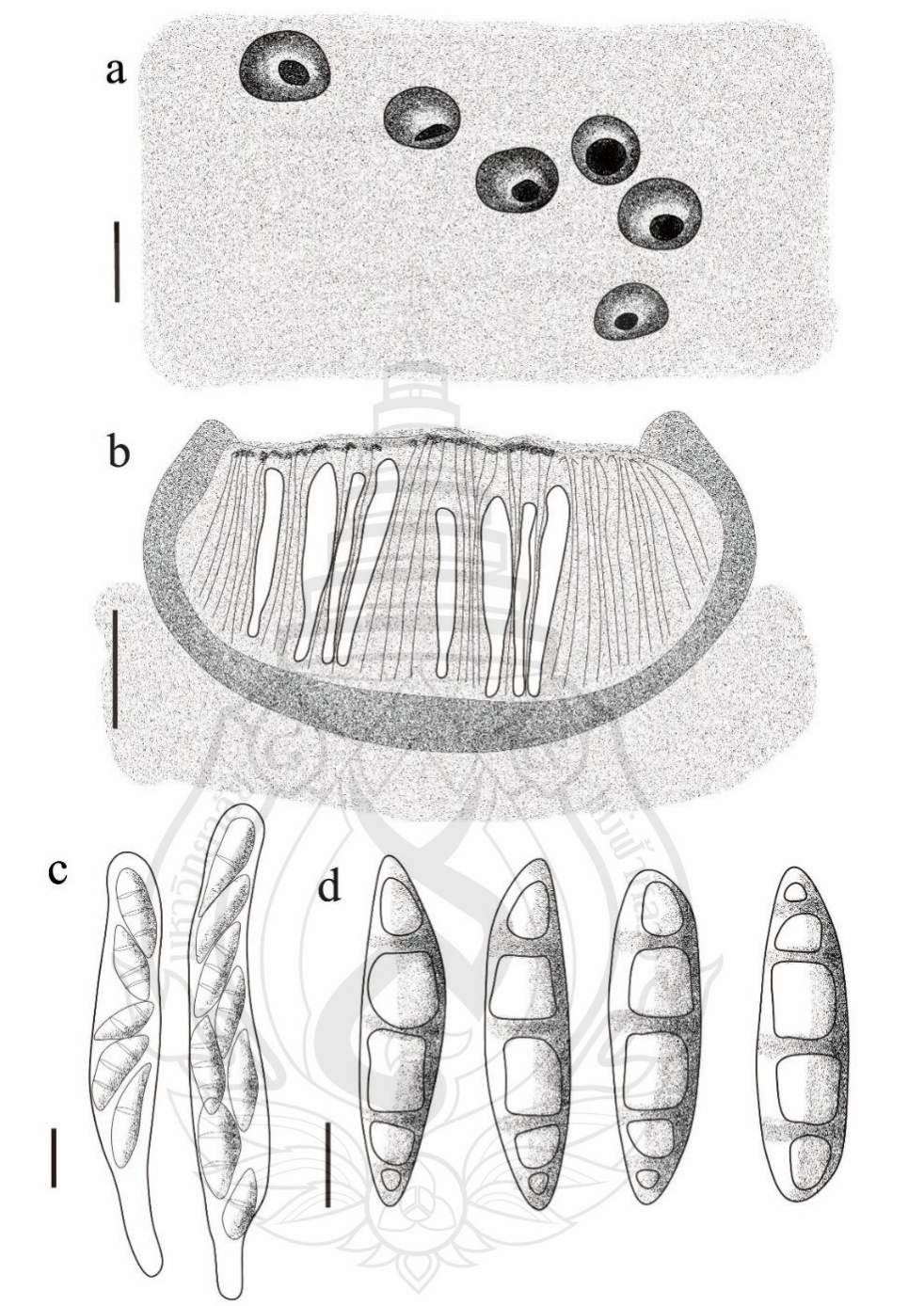
Biazrovia Zhurb. & Etayo (1)

Index Fungorum 802980, faceoffungi, MycoBank, GenBank

Classification: Ostropales Genera incertae sedis, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Biazrovia was introduced by Zhurb. & Etayo (2013) to accommodate the type species *B. stereocaulicola*, which grows on *StereoAcaulon* species. This genus is characterized by its lichenicolous habit, orange-brown apothecia that become urceolate, a cupulate, non-hairy exciple, a hyaline hymenium that is I- and KI-, filiform paraphyses with apical swelling, 8-spored asci with an apically thickened wall lacking a distinct ocular chamber, and hyaline, trans-septate, smooth-walled ascospores that are non-halonate (Zhurbenko & Etayo, 2013). Due to the absence of sequence data, Biazrovia has been provisionally placed within Ostropales as genera incertae sedis.

Type species: *Biazrovia stereocaulicola* Zhurb. & Etayo, on *Stereocaulon glareosum* (Zhurbenko & Etayo, 2013)



Note a Ascomata on thallus. b Section of ascomata. c Asci. d Ascospores. Scale bars: a = 200 μm, b = 50 μm, c = 10 μm, d = 5 μm.

Source Redrawn from Zhurbenko et al. (2013)

Figure 2.100 *Biazrovia stereocaulicola*

Normanogalla Diederich (1)

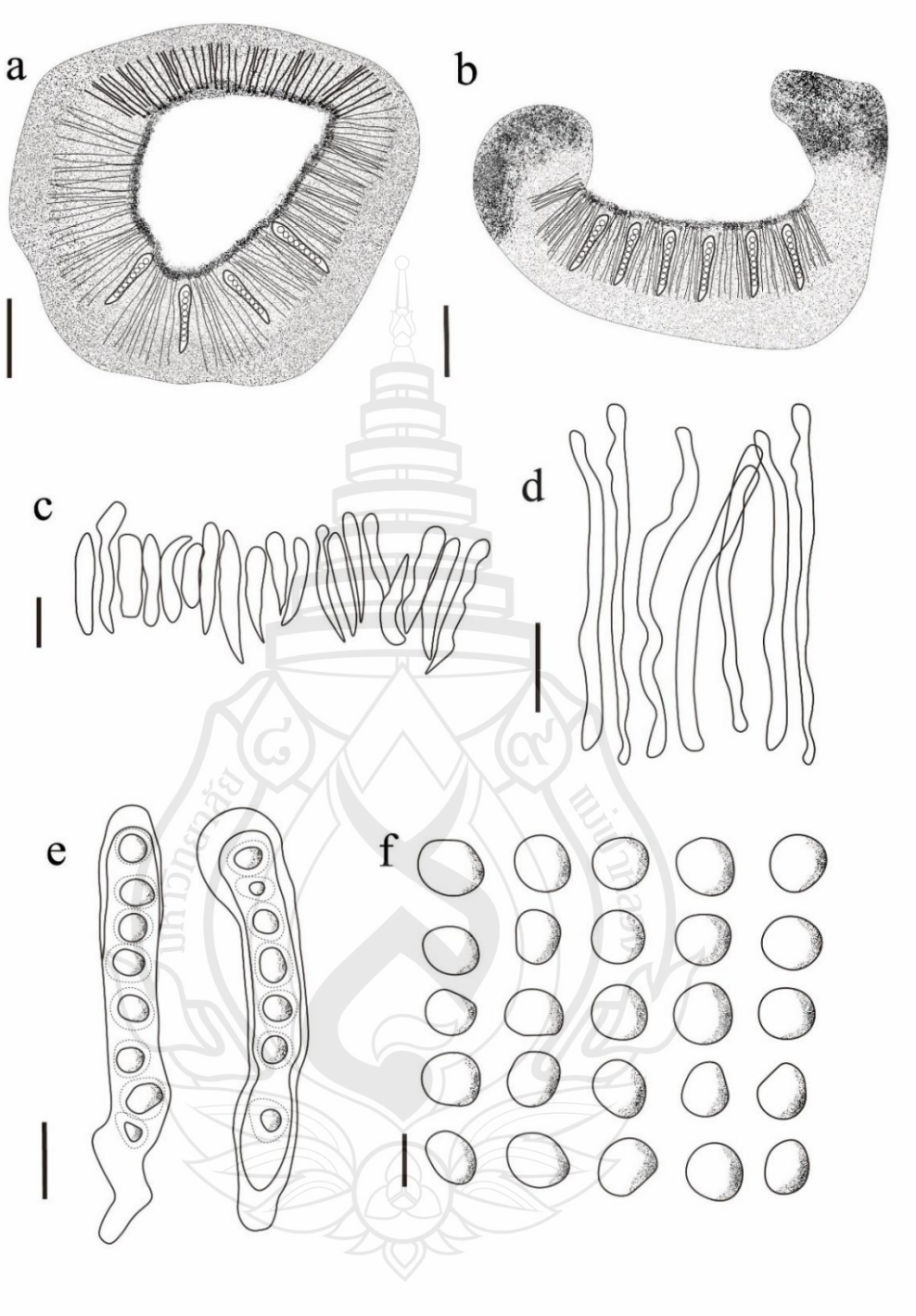
Index Fungorum 810085, faceoffungi, MycoBank, GenBank

Classification: Ostropales Genera incertae sedis, Ostropales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Normanogalla was introduced by Diederich (2014) to classify the lichenicolous, gall-inducing species *N. cribriformis*, formerly known as *Lecanora cribriformis* Norman, which grows on terricolous *Pertusaria* in Scandinavia and Greenland. This genus is characterized by pale, immersed, cleistohymenial ascomata; an ascomatal wall lacking crystals; abundant periphysoids; a KI- hymenium; subcylindrical, 8-spored asci with an unthickened or slightly thickened apical wall; and subspherical, aseptate ascospores. Currently, *N. cribriformis* is the sole member of this genus, and no sequence data are available. *Normanogalla* has been provisionally placed within *Ostropales* as genera incertae sedis.

Type species: *Normanogalla cribriformis* (Norman) Diederich, on *Pertusaria* (Diederich, 2014)

= *Lecanora cribriformis* Norman



Note a Section through closed ascoma. b Section through opened ascoma. c Periphysoids. d Paraphyses. e Asci. f Ascospores. Scale bars: a–b = 50 µm, c–e = 10 µm, f = 5 µm.

Source Redrawn from Diederich (2014)

Figure 2.101 *Normanogalla cribriformis*

Order Pertusariales M. Choisy ex D. Hawksw. & O.E. Erikss.

Family Megasporaceae Lumbsch

Aspicilia A. Massal. (1-85)

Index Fungorum 392, faceoffungi, MycoBank, GenBank

Classification: Megasporaceae, Pertusariales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Aspicilia cinerea* (L.) Körb.

= *Lichen cinereus* L.

Accepted lichenicolous species: :

Aspicilia parasitica B. de Lesd., lichenicolous lichen on saxicolous, crustose lichens (Diederich et al., 2018)

Family Microcaliciaceae Tibell

Microcalicium Vain. (3-6)

Index Fungorum 3154, faceoffungi, MycoBank, GenBank

Classification: Microcaliciaceae, Pertusariales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Microcalicium was introduced by Vainio in 1927 to accommodate the type species *M. disseminatum*, which was originally classified as *Cyphelium disseminatum* Ach. Initially described as a fungus growing on fallen *Abies* trunks, it was later noted by Clauzade et al. (1989) that *M. arenarium* occurs on the thallus of *Psilolechia*, while *M. conversum* and *M. disseminatum* are found on various species of *Caliciales*. These three species were subsequently included in the list of lichenicolous fungi by Diederich et al. (2018). The remaining three species in this genus are all found on wood.

Lumbsch (2007) placed *Microcalicium* within *Ascomycota* as families incertae sedis. Prieto et al. (2013) conducted a phylogenetic analysis, finding that *Microcalicium* is closely related to three *Pertusaria* species, forming a clade within the order *Agyriales* (Ostropomycetidae), though they raised questions regarding the clarity of *Agyriales*.

Wijayawardene et al. (2018) placed *Microcalicium* in the order *Taphrinales*, later reassigning it to *Pertusariales* in 2020. This placement has since been confirmed by subsequent phylogenetic analyses by Holien et al. (2022) and Vondrák et al. (2022).

Type species:

Microcalicium disseminatum (Ach.) Vain.

=*Cyphelium disseminatum* Ach.

Table 2.149 Accepted lichenicolous species of *Microcalicium*

	Species name	Host	References	Remarks
1	*Microcalicium arenarium* (Hampe ex A. Massal.) Tibel*l*	*Psilolechia*	(Tibell, 1978)	= *Cyphelium arenarium* Hampe ex A. Massal.
2	*Microcalicium conversum* Tibell	*Calicium* and *Chaenotheca*	(Tibell, 1978)	
3	*Microcalicium disseminatum* (Ach.) Vain.	*Calicium* and *Chaenotheca*	(Acharius, 1817; Vainio, 1927)	= *Cyphelium disseminatum* Ach.

Order Sarrameanales B.P. Hodk. & Lendemer

Family Schaereriaceae M. Choisy ex Hafellner

Schaereria Körb. (1-10)

Index Fungorum 4882, faceoffungi, MycoBank, GenBank

Classification: Schaereriaceae, Sarrameanales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Schaereria lugubris (Sommerf.) Körb.

= *Lecidea lugubris* Sommerf.

Accepted lichenicolous species:

Aspicilia parasitica B. de Lesd., lichenicolous lichen on saxicolous, crustose lichens (Diederich et al., 2018)

Order Trapeliales B.P. Hodk. & Lendemer

Family Xylographaceae Tuck.

Lambiella Hertel (1-15)

Index Fungorum 25647, faceoffungi, MycoBank, GenBank

Classification: Xylographaceae, Trapeliales, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Lambiella psephota (Tuck.) Hertel

= *Lecidea psephota* Tuck.

Accepted lichenicolous species: :

Schaereria parasemella (Nyl.) Lumbsch, lichenicolous lichen on *Biatora vernalis* (Lumbsch, 1997; Diederich et al., 2018)

= *Lecidea parasemella* Nyl. (Nylander, 1868b)

Ostropomycetidae family incertae sedis

Family Epigloeaceae Zahlbr.

Epigloea Zukal (1-10)

Index Fungorum 1862, faceoffungi, MycoBank, GenBank

Classification: Epigloeaceae, Ostropomycetidae family incertae sedis, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Epigloea bactrospora Zukal

Accepted lichenicolous species of

Epigloea urosperma Döbbeler, on *Placynthiella* (Döbbeler 1994)

Ostropomycetidae genera incertae sedis

Bachmanniomyces D. Hawksw. (7-8)

Index Fungorum 7303, faceoffungi, MycoBank, GenBank

Classification: Genera incetae sedis, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Bachmanniomyces was established by Hawksworth (1981) to accommodate the type species *B. uncialicola*, which grows on *Cladonia uncialis* f. *biuncialis* and was initially classified as *Phyllosticta uncialicola* Zopf. Hawksworth (1981) placed the genus in the order *Sphaeropsidales* within *Coelomycetes*. However, phylogenetic analyses by Pino-Bodas et al. (2017) and Diederich et al. (2018) have since clustered *Bachmanniomyces* within the subclass *Ostropomycetidae*, though relationships within this subclass remain unresolved. Diederich et al. (2018) proposed that *Bachmanniomyces uncialicola* represents the asexual stage of *Phaeopyxis punctum*, suggesting that *Phaeopyxis* be synonymized with *Bachmanniomyces* due to the latter's earlier naming.

Bachmanniomyces is characterized by its asexual morph, featuring solitary, unilocular, globose to subglobose conidiomata that are immersed and hyaline, with orange or brown ostioles. The conidiogenous cells are holoblastic, acrogenous, elongate-ampulliform, proliferative, annellate, and hyaline. The conidia are broadly fusiform to pyriform, mostly asymmetric, hyaline, simple, smooth, and embedded in mucilage (Hawksworth, 1981b).

To date, eight species are recognized within *Bachmanniomyces*, seven of which are lichenicolous. The only exception is *B. carniolicus*, a lichen found on bark that was transferred from *Biatora carniolica* Arnold.

Type species: *Bachmanniomyces uncialicola* (Zopf) D. Hawksw.

= *Phyllosticta uncialicola* Zopf

Table 2.150 Accepted lichenicolous species of *Bachmanniomyces*

	Species name	Host	References	Remarks
1	*Bachmanniomyces australis* (Rambold & Triebel) Diederich & Pino-Bodas	*Paraporpidia*	(Rambold et al., 1990; Diederich et al., 2018)	= *Phaeopyxis australis* Rambold & Triebel
2	*Bachmanniomyces muscigenae* (Alstrup & E.S. Hansen) Diederich & Pino-Bodas	*Physconia muscigena*	(Alstrup et al., 2001; Diederich et al., 2018)	= *Phaeopyxis muscigenae* Alstrup & E.S. Hansen
3	*Bachmanniomyces pseudocyphellariae* Etayo	*Pseudocyphellaria hillii*	(Etayo & Sancho, 2008)	
4	*Bachmanniomyces punctum* (A. Massal.) Diederich & Pino-Bodas	*Cladonia*	(Massalongo, 1855; Diederich et al., 2018)	= *Nesolechia punctum* A. Massal.
5	*Bachmanniomyces santessonii* Etayo	*Sticta weigelia*	(Etayo, 2010a)	
6	*Bachmanniomyces uncialicola* (Zopf) D. Hawksw.	*Cladonia uncialis*	(Zopf, 1896; Hawksworth, 1981b; Diederich et al., 2018)	= *Phyllosticta uncialicola* Zopf
7	*Bachmanniomyces varius* (Coppins, Rambold & Triebel) Diederich & Pino-Bodas	*Trapeliopsis gelatinosa*	(Rambold et al., 1990; Diederich et al., 2018)	= *Phaeopyxis varia* Coppins, Rambold & Triebel

Piccolia A. Massal. (1-10)

Index Fungorum 4093, faceoffungi, MycoBank, GenBank

Classification: Genera incetae sedis, Ostropomycetidae, Lecanoromycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Piccolia crocea* (Spreng.) A. Massal.

= *Patellaria crocea* Spreng.

Accepted lichenicolous species: :

Piccolia nannaria (Tuck.) Lendemer & Beeching, facultatively lichenicolous on *Pyrrhospora varians*. (Knudsen et al., 2007)

= *Heterothecium nannarium* Tuck.(Tuckerman, 1872)

Class LEOTIOMYCETES O.E. Erikss. & Winka

Subclass Leotiomycetidae O.E. Erikss. & Winka

Order Chaetomellales Crous & Denman

Family Chaetomellaceae Baral, P.R. Johnst. & Rossman

Hainesia Ellis & Sacc. (4-25)

Index Fungorum 8420, faceoffungi, MycoBank, GenBank

Classification: Chaetomellaceae, Chaetomellales, Leotiomycetidae, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Hainesia rhoina* (Sacc.) Ellis & Sacc.

= *Gloeosporium rhoinum* Sacc.

Table 2.151 Accepted lichenicolous species of *Hainesia*

	Species name	**Host**	**References**
1	*Hainesia aeruginascens* Brackel	*Platismatia glauca*	(Brackel, 2014)
2	*Hainesia bryonorae* Zhurb.	*Bryonora castanea*	(Zhurbenko & Brackel, 2013)
3	*Hainesia lecanorae* Brackel	*Lecanora muralis*	(Brackel, 2014)

Table 2.151 (continued)

	Species name	Host	References
4	*Hainesia peltigerae* Zhurbenko, M.	*Peltigera rufescens*	(Zhurbenko, 2013a)

Order Helotiales Nannf.

Family Cordieritidaceae Sacc.

Diplolaeviopsis Giralt & D. Hawksw. (4)

Index Fungorum 11272, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Diplolaeviopsis was established by Giralt & Hawksworth (1991) to describe a pycnidial fungus ranging from commensalistic to pathogenic on the apothecia and thalli of *Lecanora strobilina*. This genus is characterized by pycnidial conidiomata that are solitary, unilocular, immersed but erupting, subglobose to cup-shaped, dark brown to black, and ostiolate, with an angular texture composed of olive-brown, pseudoparenchymatous cells. The conidiophores are subglobose to subcylindrical, simple or sparsely branched, somewhat hyaline, or sometimes absent. The conidiogenous cells are acrogenous, subcylindrical, occasionally with enteroblastic proliferations, and hyaline. The conidia are holoblastic, solitary, elongate-soleiform to frog-shaped, hyaline, 1(–2)-septate, constricted at the septum, and smooth (Giralt et al., 1991).

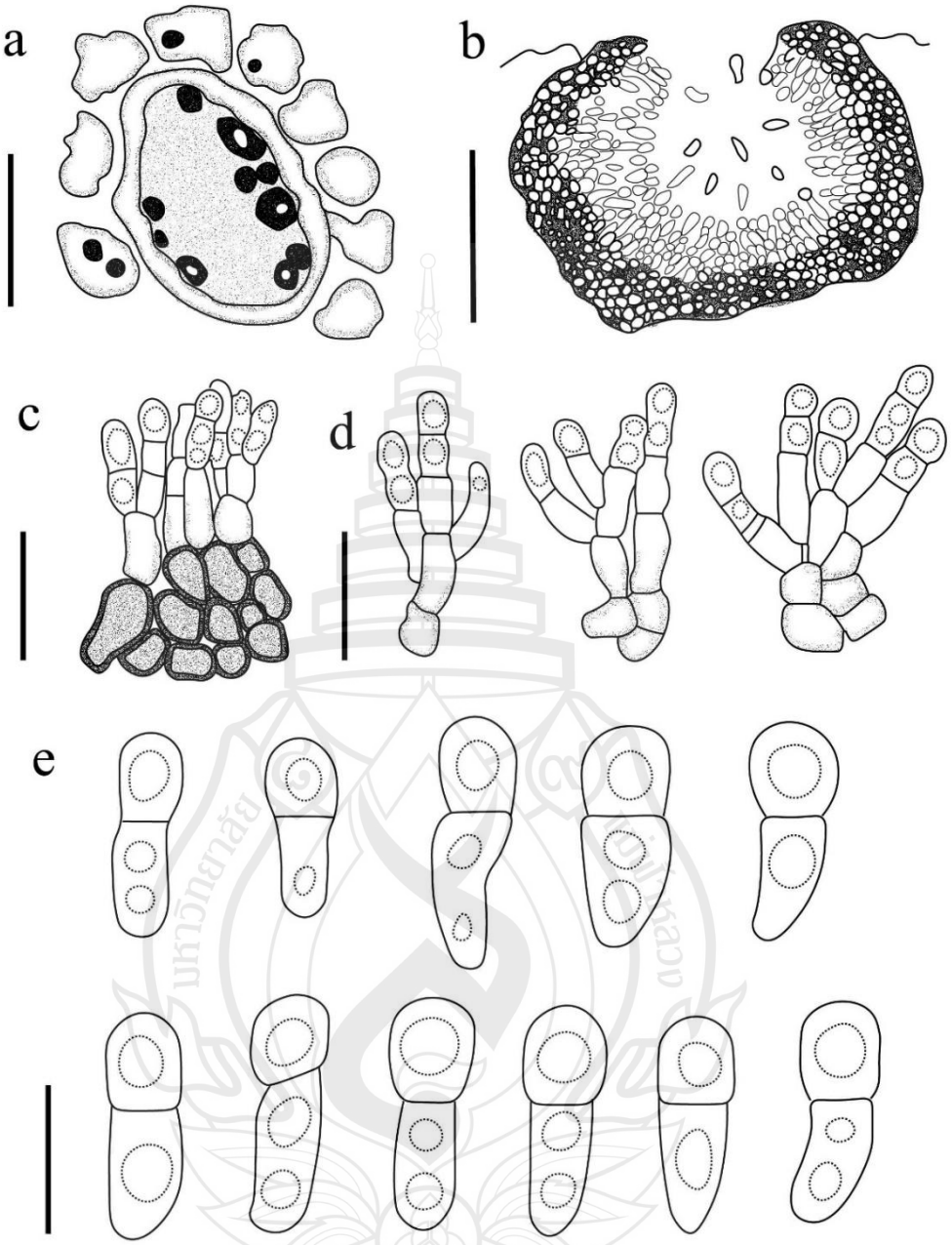
Phylogenetic analyses by Etayo et al. (2015) and Suija et al. (2015) revealed that *Diplolaeviopsis* clusters within the *Helotiales* clade. Further analysis by Pärtel et al. (2017) confirmed the genus's placement within the family *Cordieritidaceae* (Helotiales), as also supported by Wijayawardene (2018). Since its establishment, three

additional species have been introduced, resulting in four recognized species to date. Of these, only *Diplolaeviopsis ranula* has sequence data available in GenBank. (Etayo et al., 2015b & a; Suija et al., 2015; Pärtel et al., 2017).

Type species: *Diplolaeviopsis ranula* Giralt & D. Hawksw.

Table 2.152 Accepted lichenicolous species of *Diplolaeviopsis*

	Species name	**Host**	**References**	**Remarks**
1	*Diplolaeviopsis japonica* Zhurb. & Diederich	*Gyalolechia flavorubescens*	(Zhurbenko et al., 2015)	
2	*Diplolaeviopsis ranula* Giralt & D. Hawksw.	*Lecanora strobilina*, *L. strobilinoides, Lecanora strobilina* and *L. strobilinoides*	(Giralt et al., 1991)	
3	*Diplolaeviopsis symmictae* Diederich & Coppins	*Lecanora symmicta*	(Diederich & Coppins, 2014)	
4	*Diplolaeviopsis vietnamensis* Diederich & Ertz	*Bathelium*	(Zhurbenko et al., 2020)	



Note a Infected apothecium of *Lecanora* strobilina. b Vertical section of conidioma. c Vertical section of wall of conidioma. d Conidiogenolls cells and conidiophores. e Conidia. Scale bars: a = 250 µm, b = 50 µm, c–d = 10 µm, e = 5 µm.

Source Redrawn from Giralt et al. (1991)

Figure 2.102 *Diplolaeviopsis ranula*

Lawreyella Etayo, Kukwa & Rodr. Flakus (1)

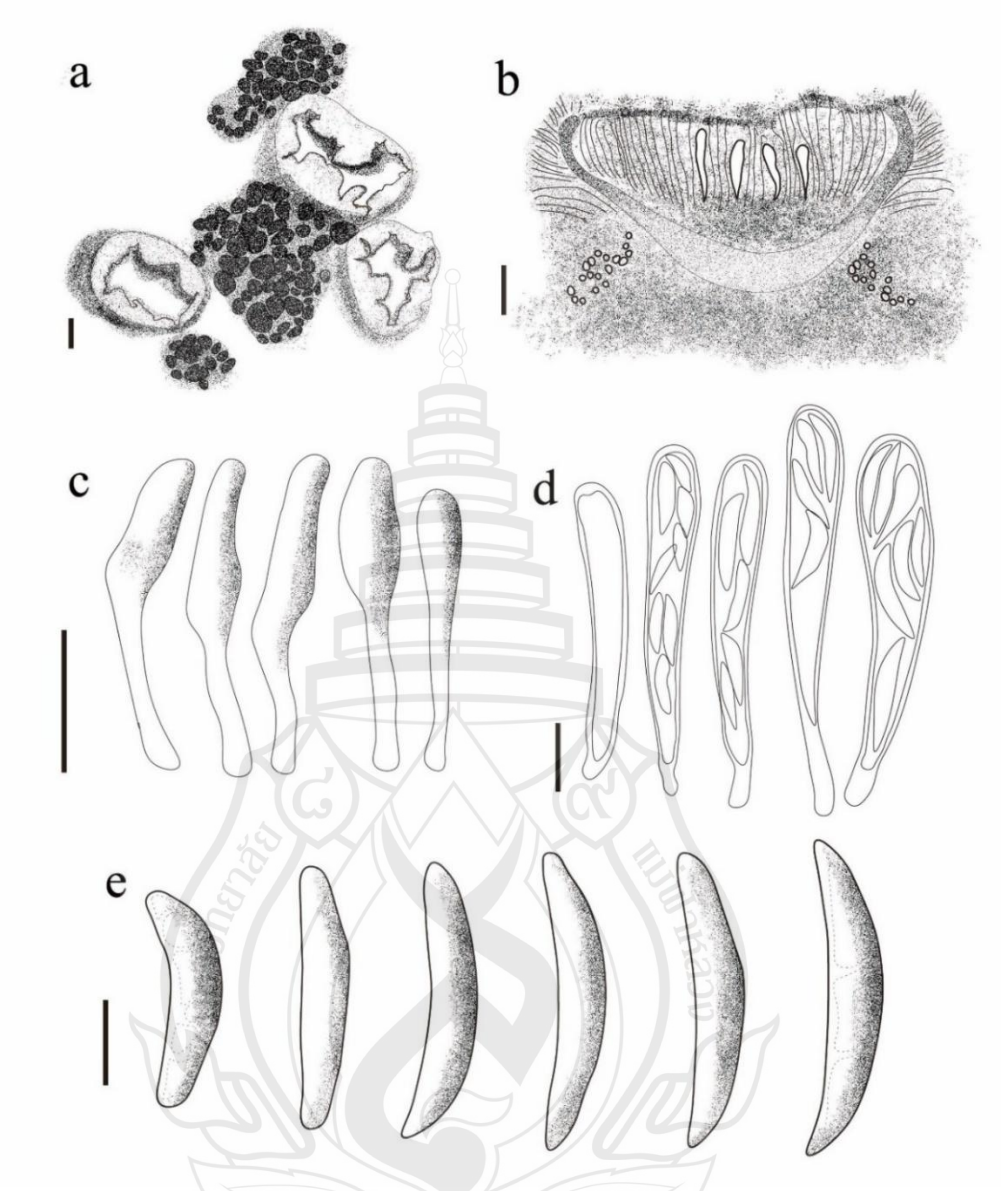
Index Fungorum 8833332, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Lawreyella was established by Flakus, Etayo, Kukwa & Rodr. Flakus (2019) to accommodate *L. lobariella*, originally described as *Unguiculariopsis lobariella*, which grows on the thallus of *Lobaria erosa*. Phylogenetic analyses placed this genus within *Cordieritidaceae* (Helotiales). The genus is characterized by black, aggregate ascomata with a greenish pigment in the hymeniu and an additional orange-brown pigment in the exciple and epithecium. It possesses short, aseptate, acute excipular hairs. The asci are 8-spored, functionally unitunicate, clavate with a long stalk, and have a slightly thickened apical wall. The ascospores are hyaline, simple, straight to curved, narrowly ellipsoidal with acute ends, and lack a perispore.

Type species: *Lawreyella lobariella* (S.Y. Kondr. & D.J. Galloway) Flakus, Etayo, Kukwa & Rodr. Flakus, on *Lobaria erosa* (Flakus et al., 2019b)

= *Unguiculariopsis lobariella* S.Y. Kondr. & D.J. Galloway (Kondratyuk et al., 1995a)



Note a Aggregated apothecial ascomata on the host thallus. b Section of ascomata. c Enlarged apical cells of paraphyses. d Asci. e Ascospores. Scale bars: a = 500 µm, b = 50 µm, c–d = 10 µm, e = 5 µm.

Source Redrawn from Flakus et al. (2019b)

Figure 2.103 *Lawreyella lobariella*

Llimoniella Hafellner & Nav.-Ros. (22)

Index Fungorum 26472, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Llimoniella was established by Hafellner (1993) to accommodate two lichenicolous species, *L. scabridula* and *L. adnate*. The type species, *L. scabridula*, was transferred from *Lecidea scabridula* Müll. Arg., growing on *Acarospora nodulosa* and *A. placodiiformis*. This genus is characterized by black, sessile to eruptive, marginate apothecia. The excipulum has a globular to angular texture and ranges from reddish-brown to dark brown. Asci are functionally unitunicate, cylindrical to slightly clavate, with walls unthickened at the apex and typically eight-spored. The paraphyses are septate, sparsely branched, with pigmented, clavate tips. The ascospores are hyaline, unicellular, elliptical, and lack a halo. (Hafellner, 1993a).

Vondrák et al. (2013) were the first to obtain ITS sequence data for *Llimoniella* and conducted a phylogenetic analysis, placing the genus within *Leotiomycetes* (Vondrak et al., 2013). A subsequent analysis by Suija et al. (2015), based on three gene loci, situated *Llimoniella* in the subfamily *Encoelioideae* of *Helotiaceae* (*Helotiales*, *Leotiomycetes*) (Suija et al., 2015). However, Pärtel et al. (2017) suggested a placement within the family *Cordieritidaceae* (*Helotiales*, *Leotiomycetes*) based on a five-locus phylogenetic analysis. (Pärtel et al., 2017). This classification was supported by Wijayawardene et al. (2018), who formally placed the genus in *Cordieritidaceae*. *Llimoniella fuscoatrae* Hafellner was reclassified as *Rhymbocarpus fuscoatrae* by Diederich & Etayo (2000), although this update is not recorded in Index Fungorum (Diederich & Etayo, 2000). Currently, all 22 recognized species in this genus are lichenicolous.

Type species: *Llimoniella scabridula* (Müll. Arg.) Nav.-Ros. & Hafellner

= *Lecidea scabridula* Müll. Arg., on *Placodium nodulosum*

Table 2.153 Accepted lichenicolous species of *Llimoniella*

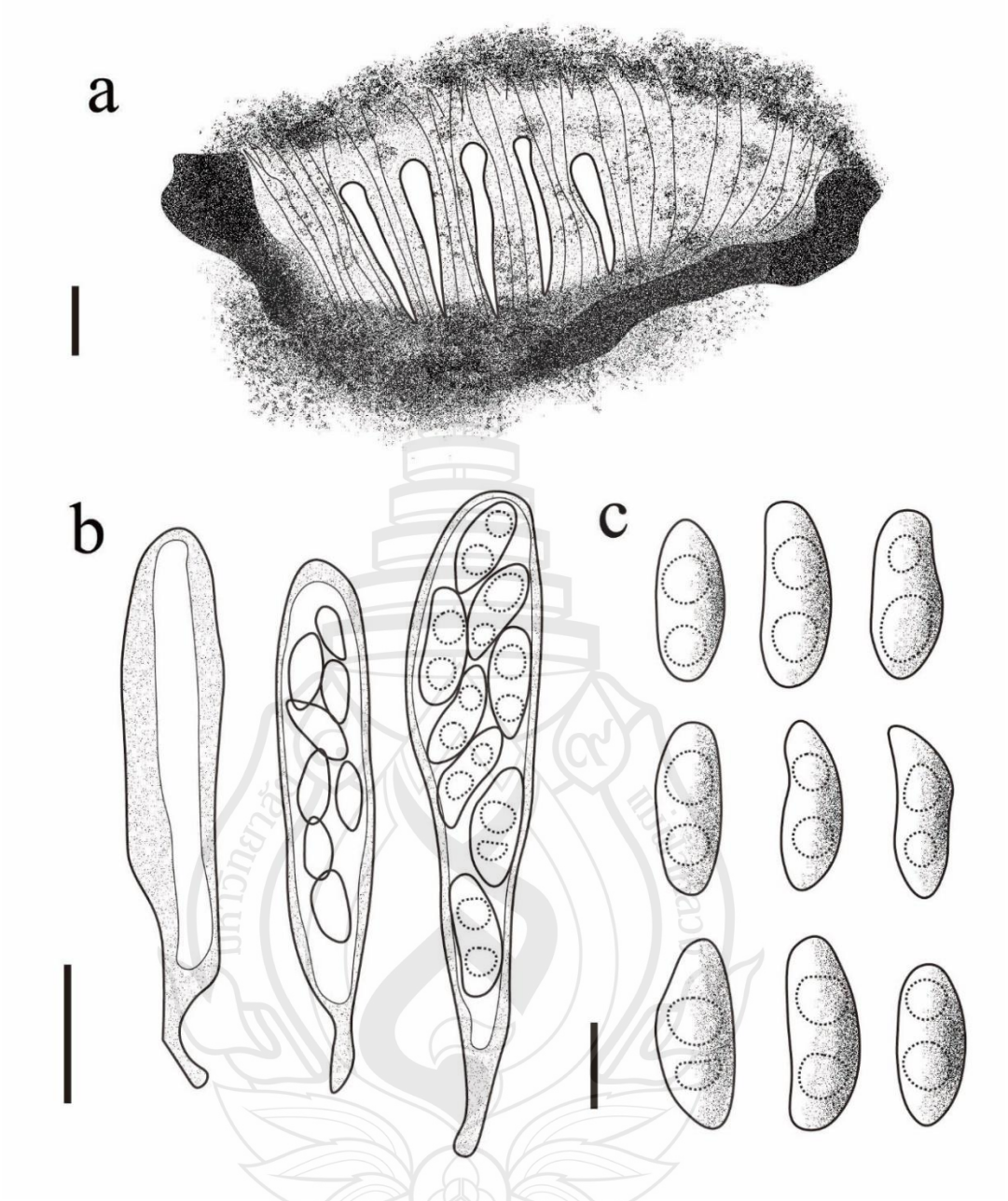
	Species name	Host	References	Remarks
1	*Llimoniella acarosporicola* (Kocourk. & K. Knudsen) Diederich & Ertz	*Acarospora socialis*	(Diederich et al., 2010)	= *Gelatinopsis acarosporicola* Kocourk. & K. Knudsen
2	*Llimoniella adnata* Hafellner & Nav.-Ros.	*Catapyrenium squamulosum, Placidium*	(Hafellner, 1993a)	
3	*Llimoniella bergeriana* Etayo	*Punctelia*	(Etayo, 2017)	
4	*Llimoniella bryonthae* Zhurb. & Diederich	*Pertusaria bryontha*	(Zhurbenko, 2021e)	
5	*Llimoniella caloplacae* S.Y. Kondr. & Khodos.	*Caloplaca borysthenica*	(Kondratyuk et al., 2006)	
6	*Llimoniella catapyrenii* Zhurb., Kukwa & Flakus	*Catapyrenium cinereum*	(Zhurbenko, 2013b)	
7	*Llimoniella chilensis* Zhurb	*Dibaeis*	(Zhurbenko & Ohmura, 2020)	
8	*Llimoniella cinnabarinae* Pérez-Ortega, Etayo & T. Sprib.	*Ramboldia cinnabarina*	(Pérez-Ortega et al., 2011)	

Table 2.153 (continued)

	Species name	Host	References	Remarks
9	*Llimoniella fuscatae* Hafellner & Obermayer	*Acarospora fuscata*	(Hafellner & Obermayer, 2007)	
10	*Llimoniella gregorellae* Kocourk. & Vondrák	*Gregorella humida*	(Vondrak et al., 2013)	
11	*Llimoniella heppiae* (Nav.-Ros., Hladun & Llimona) Diederich & Ertz	*Heppia despreauxii*	(Diederich et al., 2010)	= *Gelatinopsis heppiae* Nav.-Ros., Hladun & Llimona
12	*Llimoniella muralicola* Halıcı	*Protoparmeliopsis muralis*	(Halıcı, 2008)	
13	*Llimoniella parmotrematis* Etayo	*Parmotrema*	(Etayo, 2017)	
14	*Llimoniella pertusariae* Diederich & Etayo	*Pertusaria ophthalmiza, Pertusaria glaucomela* and *Lepra ophthalmiza*	(Diederich & Etayo, 2000)	
15	*Llimoniella phaeophysciae* Diederich, Ertz & Etayo	*Phaeophyscia hirsute*	(Diederich et al., 2010)	

Table 2.153 (continued)

	Species name	Host	References	Remarks
16	*Llimoniella placomaroneae* Etayo & Diederich	*Placomaronea candelarioides*	(Etayo, 2010a)	
17	*Llimoniella placopsidis* Diederich & Fryday	*Placopsis elixii*	(Diederich et al., 2010)	
18	*Llimoniella pyrenulae* Diederich & Etayo	*Pyrenula*	(Diederich & Etayo, 2000)	
19	*Llimoniella ramalinae* (Müll. Arg.) Etayo & Diederich	*Ramalina ecklonii, R. celastri* and *R. unilateralis*	(Diederich & Etayo, 2000)	= *Patellaria ramalinae* Müll. Arg.
20	*Llimoniella scabridula* (Müll. Arg.) Nav.-Ros. & Hafellner	*Acarospora nodulosa and A. placodiiformis*	(Hafellner, 1993a)	= *Lecidea scabridula* Müll. Arg.
21	*Llimoniella terricola* (Arnold) M. Schultz, Diederich & Ertz	*Leptogium byssinum*	(Diederich et al., 2010)	= *Physma terricola* Arnold
22	*Llimoniella vinosa* (Holien & Triebel) Diederich & Etayo	*Ochrolechia pallescens* and *Lepra cf. borealis*	(Diederich & Etayo, 2000)	= *Spirographa vinosa* Holien & Triebel



Note a Section of ascocmata. b Asci. c Ascospores. Scale bars: a = 50 μm, b = 10 μm, c = 5 μm.

Source Redrawn from Hafellner (1993a)

Figure 2.104 *Llimoniella scabridula*

Macroskyttea Etayo, Flakus, Suija & Kukwa (1)

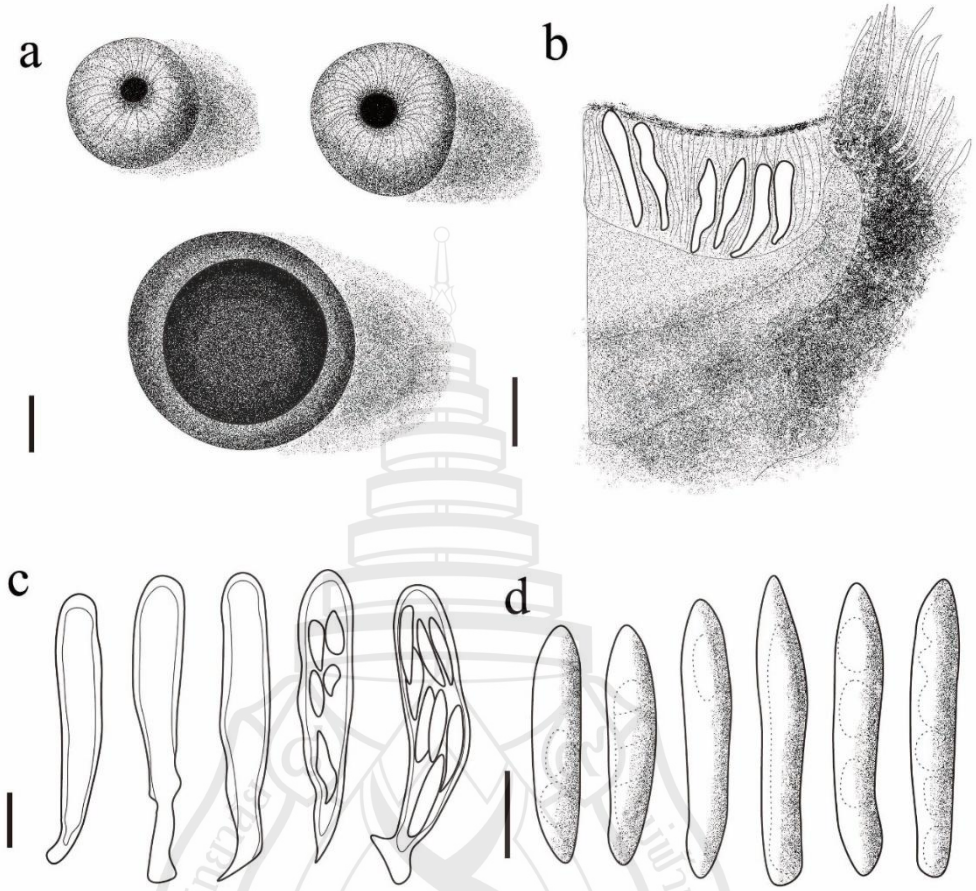
Index Fungorum 812780, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Macroskyttea was introduced by Etayo et al. (2015) to describe the lichenicolous fungus *M. parmotrematis*, which inhabits the thalli of *Parmotrema aberrans* and *P. ultralucens*. Phylogenetic analysis based on three loci suggests that *Macroskyttea* belongs to the order *Helotiales* and is closely related to *Diplolaeviopsis* within the *Cordieritidaceae* clade. To date, only one recognized species exists in this genus, with three sequence datasets available in GenBank.

Characteristic features of *Macroskyttea* include apothecioid ascomata that develop either dispersedly on the thallus or in groups of 3–4. Initially immersed, the ascomata become superficial to stipitate over time and turn black, with the upper part of the exciple appearing greyish due to the presence of hyaline hairs. The discs are black, initially obscured by the margin when young but widely exposed at maturity. The paraphyses are hyaline, surrounded by a hyaline gel, septate, and not constricted at the septa. The asci are eight-spored, cylindrical to narrowly clavate, with an apically thickened tholus containing a narrow ocular chamber and a characteristic widening at the apex. The ascospores are hyaline, narrowly ellipsoidal to fusiform, sometimes slightly curved, smooth, without a perispore, and typically contain four small oil guttules (Etayo et al., 2015a).

Type species: *Macroskyttea parmotrematis* Etayo, Flakus & Kukwa (Etayo et al., 2015a)



Note a Ascomata. b Part of section of ascomata. c Asci. d Ascospores. Scale bars: a = 250 µm, b = 25 µm, c = 10 µm, d = 5 µm.

Source Redrawn from Etayo et al. (2015a)

Figure 2.105 *Macroskyttea parmotrematis*

Protounguicularia Raitv. & R. Galán (4-8)

Index Fungorum 25773, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Protounguicularia was introduced by Raitviir & Galán (1986) to include three species characterized by long, cylindrical, blunt, and septate hairs. Shortly after,

Huhtinen (1987) transferred two of these species to *Arachnopeziza* due to the absence of glassy material in their excipular hairs. *Protounguicularia* is distinct for its septate ascomatal hairs with swollen bases and narrow, curved glassy apices, which may or may not contain a lumen.

Initially, Lumbsch et al. (2007) tentatively placed *Protounguicularia* in the family *Hyaloscyphaceae* (Helotiales), although this placement was marked as uncertain. This assignment remained for several years until Flakus et al. (2019) conducted a phylogenetic analysis, placing *Protounguicularia* within the family *Cordieritidaceae* (Helotiales). Currently, eight species are recognized in this genus, four of which are lichenicolous fungi, though only *P. nephromatis* has available sequence data in GenBank. (Lumbsch et al., 2007; Flakus et al., 2019a).

Type species: *Protounguicularia brevicapitata* Raitv. & R. Galán

Table 2.154 Accepted lichenicolous species of *Protounguicularia*

	Species name	**Host**	**References**	**Remarks**
1	*Protounguicularia fasciculata* (Etayo) Etayo	*Ramalina stenospora*	(Etayo, 2010a)	= *Unguiculariopsis fasciculata* Etayo
2	*Protounguicularia hispidula* (Etayo) Etayo	*Psoroma hispidulum*	(Etayo, 2017)	= *Unguiculariopsis hispidula* Etayo
3	*Protounguicularia nephromatis* (Zhurb. & Zavarzin) Huhtinen, D. Hawksw. & Ihlen	*Nephroma resupinatum*	(Huhtinen et al., 2008)	= *Unguiculariopsis nephromatis* Zhurb. & Zavarzin
4	*Protounguicularia usneae* Etayo	*Usnea*	(Etayo, 2017)	

Rhymbocarpus Zopf (14)

Index Fungorum 4726, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Rhymbocarpus was first mentioned by Zopf (1896) with the description of *Rh. punctiformis*, later designated as the type species of the genus. This type species is characterized by very small, sunken black apothecia. The epithecium is olive-green, while the hypothecium is colorless. The asci are eight-spored, and the spores are colorless, single-celled, ellipsoid to oblong or bean-shaped, measuring 10.7–12.5 × 3.6–5.4 μm.

Phylogenetic analysis based on three loci by Suija et al. (2015) placed *Rhymbocarpus* within the subfamily *Encoelioideae* of *Helotiaceae* (Helotiales). However, Pärtel et al. (2017), through a phylogenetic analysis using five gene loci, proposed that the genus belongs to the family *Cordieritidaceae* (Helotiales, Leotiomycetes), a view subsequently accepted by Wijayawardene et al. (2018).

Since the introduction of the first species in the 19th century, 15 species have been introduced or transferred from other genera. For example, *Rhymbocarpus geographici* was transferred from *Nesolechia geographici* J. Steiner by Vouaux (1913), and later to *Phacopsis geographici* by Keissler (1930). This species is excluded from the accepted list as it was not recorded in Index Fungorum or MycoBank. Currently, 15 species are recognized within this genus, with only one species having sequence data available. (Vouaux, 1913b; Keissler, 1930).

Type species:

Rhymbocarpus punctiformis Zopf

Table 2.155 Accepted lichenicolous species of *Rhymbocarpus*

	Species name	Host	References	Remarks
1	*Rhymbocarpus aggregatus* Etayo & Diederich	*Buellia griseovirens*	(Etayo et al., 2011)	
2	*Rhymbocarpus boomii* Etayo & Diederich	*Dirina ceratoniae*	(Diederich & Etayo, 2000)	
3	*Rhymbocarpus cruciatus* (Sherwood, D. Hawksw. & Coppins) Etayo & Diederich	*Diploicia canescens*	(Diederich & Etayo, 2000)	= *Skyttea cruciata* Sherwood, D. Hawksw. & Coppins
4	*Rhymbocarpus ericetorum* (Körb.) Etayo, Diederich & Ertz	*Baeomyces roseus* and *Sphyridium byssoides*	(Diederich et al., 2010)	= *Nesolechia ericetorum* Flot. ex Körb.
5	*Rhymbocarpus fuscoatrae* (Hafellner) Diederich & Etayo	*Lecidea fuscoatra*	(Diederich & Etayo, 2000)	= *Llimoniella fuscoatrae* Hafellner
6	*Rhymbocarpus gregarius* (Sherwood, D. Hawksw. & Coppins) Triebel	*Mycoblastus sterilis*	(Triebel, 1989)	= *Skyttea gregaria* Sherwood, D. Hawksw. & Coppins
7	*Rhymbocarpus makarovae* Diederich & Etayo	*Porpidia*	(Diederich & Etayo, 2000)	

Table 2.155 (continued)

	Species name	Host	References	Remarks
8	*Rhymbocarpus neglectus* (Vain.) Diederich & Etayo	*Lepraria neglecta* group	(Diederich & Etayo, 2000)	= *Nesolechia neglecta* Vain.
9	*Rhymbocarpus nitschkei* (Körb.) Triebel	*Thelotrema lepadinum*	(Triebel, 1989)	= *Nesolechia nitschkei* Körb.
10	*Rhymbocarpus pertusariae* Diederich, Zhurb. & Etayo	*Penusaria panyrga*	(Diederich & Etayo, 2000)	
11	*Rhymbocarpus pubescens* (Etayo & Diederich) Diederich & Etayo	*Pertusaria panyrga, Lepraria lobificans*	(Diederich & Etayo, 2000)	= *Llimoniella pubescens* Etayo & Diederich
12	*Rhymbocarpus punctiformis* Zopf	*Rhizocarpon geographicum*	(Zopf, 1896)	
13	*Rhymbocarpus roccellae* (Etayo, Paz-Bermúdez & Diederich) Etayo, Diederich & Ertz	*Roccella phycopsis*	(Diederich et al., 2010)	= *Gelatinopsis roccellae* Etayo, Paz-Berm. & Diederich
14	*Rhymbocarpus stereocaulorum* (Alstrup & D. Hawksw.) Etayo & Diederich	*Stereocaulon*	(Diederich & Etayo, 2000)	= *Geltingia stereocaulorum* Alstrup & D. Hawksw.

Skyttea Sherwood, D. Hawksw. & Coppins (31)

Index Fungorum 5043, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Skyttea was introduced by Sherwood et al. (1980) to accommodate lichenicolous fungus *S. nitschkei*, originally described as *Nesolechia nitschkei* Körb., which grows on *Thelotrema lepadinum*. The genus is characterized by lichenicolous ascocarps that are initially immersed in the host and later erupt through it, starting as closed structures and eventually opening with a broad pore. The ascocarps are deeply urn-shaped, featuring an olive or brown pseudoparenchymatous excipulum, often adorned with smooth hairs at the apex. The filiform paraphyses are simple or occasionally branched and septate. The asci are thick-walled, eight-spored, with an apically thickened wall, while the ascospores are hyaline, oval to narrowly ellipsoidal, and 0–1-septate.

Skyttea tephromelarum Kalb & Hafellner has been synonymized with *Skyttea elachistophora* (Nyl.) Sherwood & D. Hawksw. Similarly, *Skyttea heterochroae* was designated by Navarro-Rosinés et al. (2009) as a replacement name for *Lecidea pertusariicola* Jatta, since *Skyttea pertusariicola* had already been introduced by Diederich & Etayo (2004) for a different species. Currently, the genus includes 31 recognized species, all of which are lichenicolous, with sequence data for nine species available in GenBank.

A phylogenetic analysis by Suija et al. (2015) placed *Skyttea* within the order *Helotiales* (Leotiomycetes). Further analysis using five gene loci by Pärtel et al. (2017) assigned *Skyttea* to the family *Cordieritidaceae* (Helotiales, Leotiomycetes), a classification later endorsed by Wijayawardene (2018).

Type species: *Skyttea nitschkei* (Körb.) Sherwood, D. Hawksw. & Coppins

= *Nesolechia nitschkei* Körb.

Table 2.156 Accepted lichenicolous species of *Skyttea*

	Species name	Host	References	Remarks
1	*Skyttea anziae* Etayo & Diederich	*Anzia*	(Etayo, 2002a)	
2	*Skyttea arenicola* Alstrup & E. S. Hansen	*Cladonia pocillum*	(Alstrup et al., 2001)	
3	*Skyttea buelliae* Sherwood, D. Hawksw. & Coppins	*Buellia punctata*	(Sherwood et al., 1980)	
4	*Skyttea bumyoungsungii* S.Y.Kondr. & J.-S.Hur	Unidentified epilithic lichen thallus (*Gyalidea* or *Porpidia*?)	(Kondratyuk et al., 2018)	
5	*Skyttea caesii* Diederich & Etayo	*Mycoblastus caesius*	(Diederich & Etayo, 2000)	
6	*Skyttea carbonea* Diederich & Etayo	*Carbonea montevidensis*	(Diederich & Etayo, 2000)	
7	*Skyttea cismonicae* Hafellner	*Loxospora*	(Hafellner, 2000)	
8	*Skyttea dacampiae* Zhurb.	*Dacampia hookeri*	(Zhurbenko, 2007b)	
9	*Skyttea elachistophora* (Nyl.) Sherwood & D. Hawksw.	*Tylothallis biformigera*	(Sherwood et al., 1980)	= *Verrucaria elachistophora* Nyl.

Table 2.156 (continued)

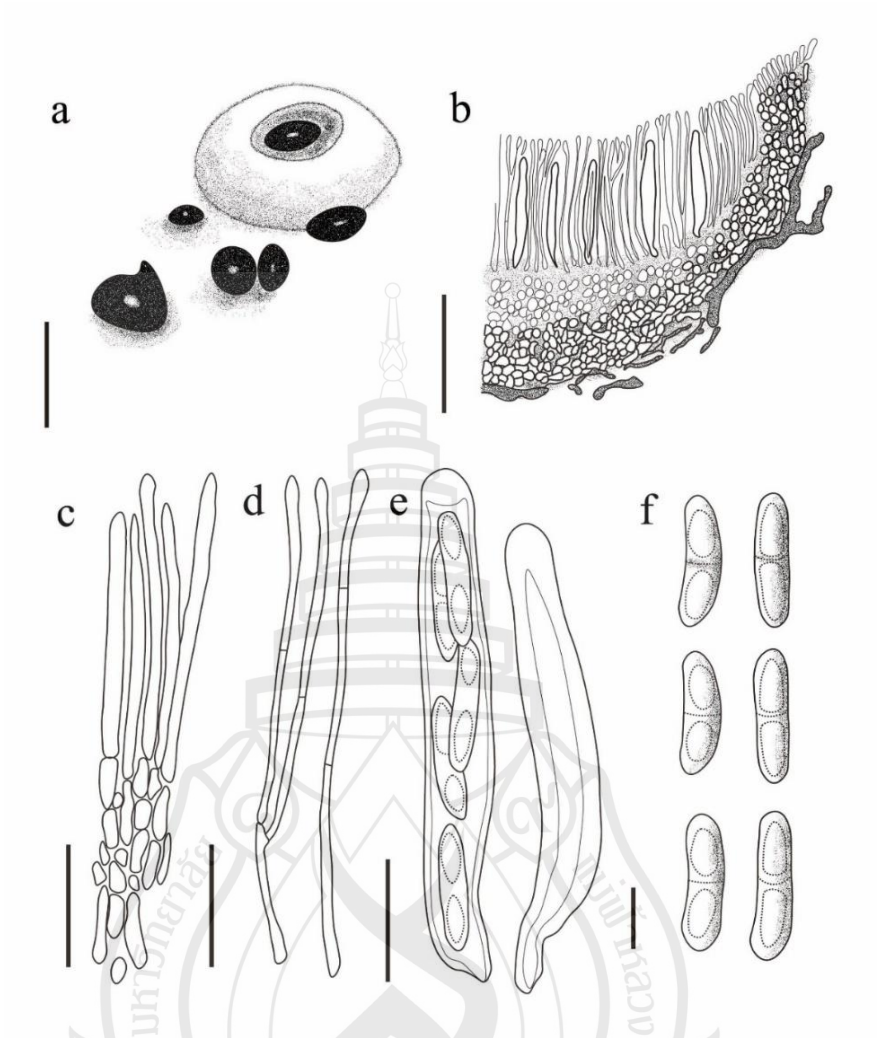
	Species name	Host	References	Remarks
10	*Skyttea fusispora* Sherwood, D. Hawksw. & Coppins	*Ochrolechia rosella*	(Sherwood et al., 1980)	
11	*Skyttea gossypina* Etayo	*Phlyctis argena*	(Etayo, 2010c)	
12	*Skyttea graphidicola* Diederich, Common & Suija	*Graphis* spp.	(Diederich et al., 2019)	
13	*Skyttea gregaria* Sherwood, D. Hawksw. & Coppins	*Mycoblastus sterilis, Mycoblastus fucatus*	(Sherwood et al., 1980)	
14	*Skyttea hawksworthii* Diederich	*Verrucaria*	(Diederich, 1986)	
15	*Skyttea heterochroae* (Jatta) Nav.-Ros. & Muñiz	*Pertusaria heterochroa*	(Navarro-Rosinés & Pérez, 2009)	≡ *Lecidea pertusariicola* Jatta
16	*Skyttea insignis* Driscoll, S. R. Clayden & R. C. Harris	*Lecanora insignis*	(Driscoll et al., 2016)	
17	*Skyttea lecanorae* Diederich & Etayo	*Lecanora*	(Diederich & Etayo, 2000)	
18	*Skyttea mayrhoferi* Diederich & Etayo	*Pertusaria melanospora*	(Diederich & Etayo, 2000)	

Table 2.156 (continued)

	Species name	Host	References	Remarks
19	*Skyttea megalosporae* Etayo & Diederich	*Megalospora tuberculosa*	(Etayo & Diederich, 1998)	
20	*Skyttea nitschkei* (Körb.) Sherwood, D. Hawksw. & Coppins	*Thelotrema lepadinum*	(Sherwood et al., 1980)	= *Nesolechia nitschkei* Körb.
21	*Skyttea ochrolechiae* Zhurb.	*Ochrolechia trochophore*	(Zhurbenk et al., 2015)	
22	*Skyttea pertusariicola* Diederich & Etayo	*Pertusaria*	(Nash et al., 2004)	
23	*Skyttea pyrenulae* Diederich, Etayo & Coppins	*Pyrenula occidentalis*	(Diederich & Etayo, 2000)	
24	*Skyttea radiatilis* (Tuck.) R. Sant., Etayo & Diederich	*Loxospora pustulata*	(Diederich & Etayo, 2000)	= *Gyalecta radiatilis* Tuck.
25	*Skyttea recognita* Etayo & Diederich	On sterile thallus	(Etayo, 2017)	
26	*Skyttea richardsonii* Iturr. & D. Hawksw.	Epiphytic crustaceous lichens	(Iturriaga et al., 2004)	
27	*Skyttea spinosa* D. Hawksw. & Coppins	*Verrucaria nigrescens*	(Hawksworth, 1982c)	
28	*Skyttea tavaresae* R. Sant., Etayo & Diederich	*Pyrrhospora quernea*	(Diederich & Etayo, 2000)	

Table 2.156 (continued)

	Species name	Host	References	Remarks
29	*Skyttea thelotrematis* Diederich & Etayo *Skyttea violacea* Etayo	*Thelotrema lepadinum* *Tephromela*	(Diederich & Etayo, 2000) (Etayo & Sancho, 2008)	
30	*Skyttea viridis* D. Hawksw. & Coppins	*Micarea denigrate*	(Hawksworth, 1982c)	



Note a Ascomata. b Vertical section of ascomata. c Marginal hairs. d Paraphyses. e Asci. f Ascospores. Scale bars: a = 500 µm, b = 50 µm, c–e = 10 µm, f = 5 µm.

Source Redrawn from Sherwood et al. (1980)

Figure 2.106 *Skyttea nitschkei*

Skyttella D. Hawksw. & R. Sant. (2)

Index Fungorum 25271, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Skyttella was established by Hawksworth et al. (1988) to accommodate the type species *S. mulleri*, which colonizes the thalli of *Peltigera*. This genus is characterized

by translucent, waxy, yellowish to yellow-orange ascomata with an arthonioid structure, and either a poorly developed or absent exciple. The paraphyses are branched, cylindrical, broad, and occasionally septate, with non-capitate apices. The asci are elongated, clavate, functionally unitunicate with a thickened pore, and the ascospores are simple, hyaline, ellipsoidal, and possess smooth walls (Etayo, 2017).

A second species, *Skyttella stictae*, described by Etayo (2017), grows on the apothecial discs of *Sticta*. It differs from *S. mulleri* by having a small exciple and by parasitizing *Sticta* apothecia rather than *Peltigera* thalli. Additionally, *S. stictae* is considerably smaller and lighter in color than *S. mulleri*.

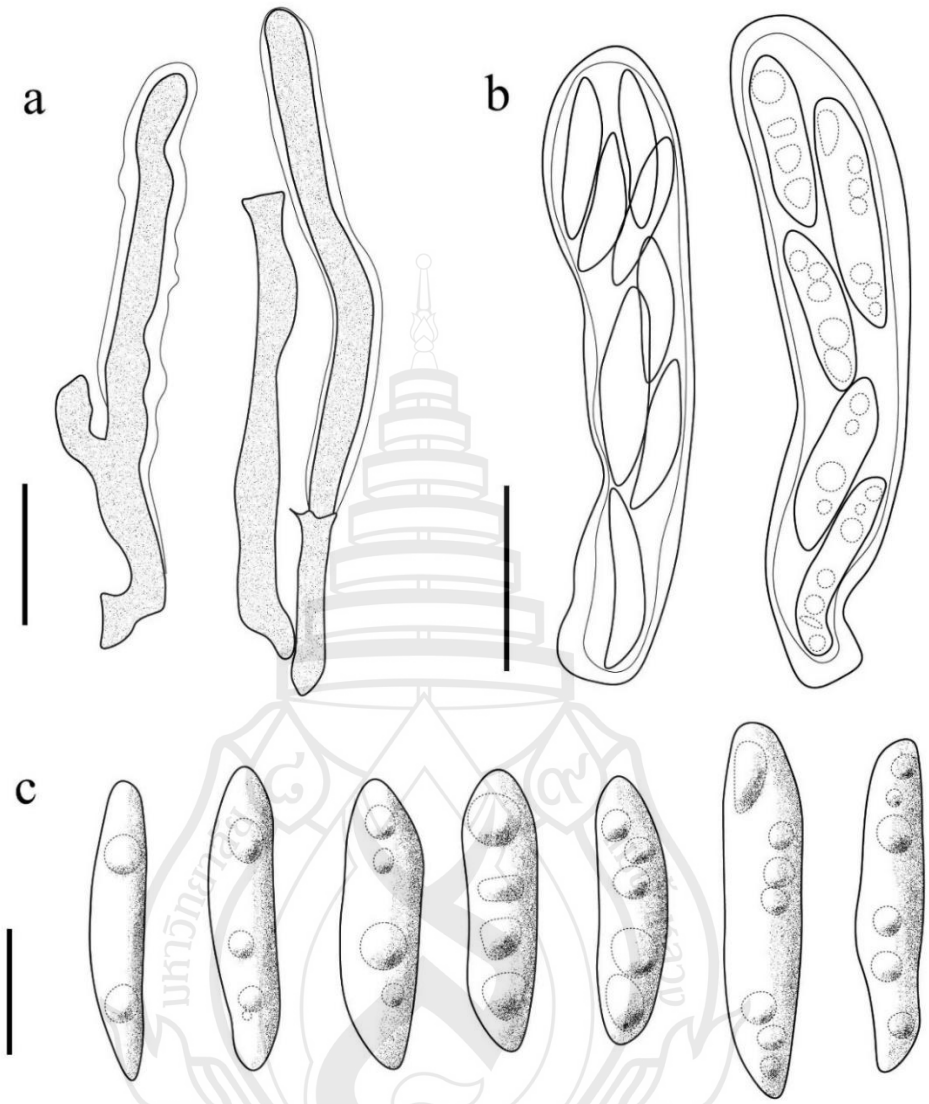
Lumbsch et al. (2007, 2010) classified *Skyttella* within Helotiales as a genus incertae sedis, while Wijayawardene (2018) assigned it to the family Cordieritidaceae, albeit without molecular evidence. Moriyama et al. (2024) provided the first sequence data for the type species *S. mulleri* from a Japanese specimen. Their phylogenetic analysis confirmed its placement in Cordieritidaceae (Moriyama et al., 2024). The genus comprises only two recognized species, with a single LSU sequence for the type species available in GenBank.

Type species: *Skyttella mulleri* (Willey) D. Hawksw. & R. Sant., on *Peltigera*. (Hawksworth & Santesson 1988)

= *Phacopsis mulleri* Willey

Table 2.157 Accepted lichenicolous species of *Skyttella*

	Species name	**Host**	**References**	**Remarks**
1	*Skyttella mulleri* (Willey) D. Hawksw. & R. Sant.	*Peltigera*	(Hawksworth & Santesson, 1988)	= *Phacopsis mulleri* Willey
2	*Skyttella stictae* Etayo	*Sticta*	(Etayo, 2017)	



Note a Paraphyses. b Asci. c Ascospores. Scales: a–b = 10 µm, C = 5 µm.

Source Redrawn from Moriyama et al. (2024)

Figure 2.107 *Skyttella mulleri*

Thamnogalla D. Hawksw. (2)

Index Fungorum 5398, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Thamnogalla was introduced by Hawksworth (1980) to accommodate the type

species *Thamnogalla crombiei*, which forms galls on *Thamnolia vermicularis*. Initially, *T. crombiei* was thought to be a fruiting body of the lichen itself, but Arnold (1874) clarified that it was a lichenicolous fungus and named it *Nesolechia vermicularis*. Earlier, Mudd (1865) had described a fungus on *Thamnolia* as *Endocarpon crombiei*. Based on Massalongo's original description, Hawksworth concluded that *Endocarpon crombiei* and *Nesolechia vermicularis* were the same species. Consequently, *Nesolechia vermicularis* was deemed invalid, and *Endocarpon crombiei* was transferred to *Thamnogalla crombiei*, designating it as the type species of *Thamnogalla*. More recently, Zhurbenko (2021) introduced a second species, *Thamnogalla episolorina*, which parasitizes *Solorina saccata*. Currently, the genus comprises two recognized species, with sequence data available for the type species in GenBank.

The genus is characterized by perithecia that are immersed, pale olive to nearly colorless, and have an ostiole. The paraphyses are filiform, unbranched, and septate. The asci are unitunicate, cylindrical to elongate-clavate, and eight-spored. The ascospores are ellipsoid, non-septate, hyaline, typically guttulate, smooth, and lack a gelatinous sheath.

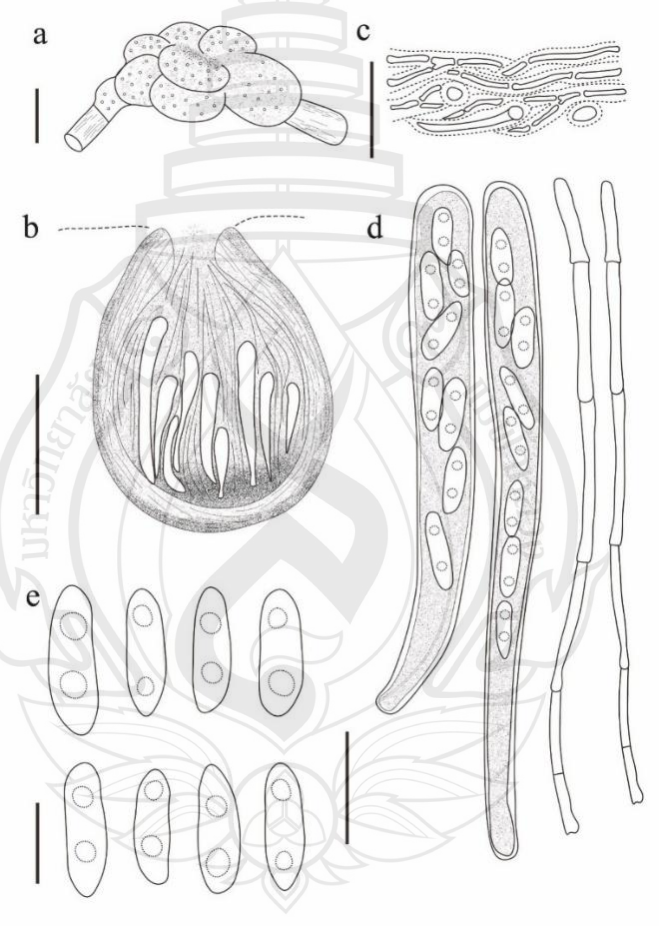
Initially, *Thamnogalla* was placed in the order *Sphaeriales* and tentatively assigned to the family *Physosporellaceae* by Hawksworth (1980). However, phylogenetic analysis by Suija et al. (2015) later placed it within the order *Helotiales* (Leotiomycetes). Further analysis using five gene loci by Pärtel et al. (2017) classified the genus within the family *Cordieritidaceae* (Helotiales, Leotiomycetes), a placement subsequently confirmed by Wijayawardene (2018).

Type species: *Thamnogalla crombiei* (Mudd) D. Hawksw.

= *Endocarpon crombiei* Mudd

Table 2.158 Accepted lichenicolous species of *Thamnogalla*

	Species name	Host	References	Remarks
1	*Thamnogalla crombiei* (Mudd) D. Hawksw.	*Thamnolia*	(Hawksworth, 1980a)	= *Endocarpon crombiei* Mudd
2	*Thamnogalla episolorina* Zhurb.	*Solorina saccate*	(Zhurbenko, 2021d)	



Note a Galls on *Thamnolia vermicularis*. b Vertical section of ascomata. c Vertical section of ascomatal wall. d Asci and paraphyses. e Ascospores. Scale bars: a = 1 mm, b = 50 µm, c–d = 10 µm, e = 5 µm.

Source Redrawn from Hawksworth (1980a)

Figure 2.108 *Thamnogalla crombiei*

Unguiculariopsis Rehm (14-31)

Index Fungorum 5676, faceoffungi, MycoBank, GenBank

Classification: Cordieritidaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Unguiculariopsis ilicincola* (Berk. & Broome) Rehm

= *Peziza ilicincola* Berk. & Broome

Table 2.159 Accepted lichenicolous species of *Unguiculariopsis*

	Species name	Host	References	Remarks
1	*Unguiculariopsis acrocordiae* (Diederich) Diederich & Etayo	*Acrocordia gemmate*	(Diederich & Etayo, 2000)	= *Skyttea acrocordiae* Diederich
2	*Unguiculariopsis ahtii* D. Hawksw., D. J. Galloway & S. Y. Kondr.	*Pseudocyphellaria*	(Kondratyuk et al., 1994)	
3	*Unguiculariopsis damingshanica* W. Y. Zhuang	On lichen thallus	(Zhuang, 2000)	
4	*Unguiculariopsis groenlandiae* (Alstrup & D. Hawksw.) Etayo & Diederich	*Caloplaca citrina*	(Diederich & Etayo, 2000)	= *Geltingia groenlandiae* Alstrup & D. Hawksw.
5	*Unguiculariopsis helmutii* S. Y. Kondr., Lőkös & Hur	*Rinodina sophorodes*	(Kondratyuk et al., 2016)	

Table 2.159 (continued)

	Species name	Host	References	Remarks
6	*Unguiculariopsis lesdainii* (Vouaux) Etayo & Diederich	*Lecanora saligna*	(Diederich & Etayo, 2000)	= *Nesolechia lesdainii* Vouaux
7	*Unguiculariopsis lettaui* (Grummann) Coppins	*Evernia prunastri*	(Rambold et al., 1990)	= *Pyrenopeziza lettaui* Grummann
8	*Unguiculariopsis lucaniae* Brackel	*Lecidella elaeochroma*	(von Brackel, 2011a)	
9	*Unguiculariopsis macrocarpa* Etayo	*Pseudocyphellaria crocata*	(Etayo & Sancho, 2008)	
10	*Unguiculariopsis manriquei* Etayo	*Lobaria pulmonaria*	(Etayo & Diederich, 1996b)	
11	*Unguiculariopsis peltigericola* Etayo	*Peltigera*	(Etayo, 2017)	
12	*Unguiculariopsis refractiva* (Coppins) Coppins	*Toninia lobulate*	(Rambold et al., 1990)	= *Skyttea refractiva* Coppins
13	*Unguiculariopsis thallophila* (P. Karst) W. Y. Zhuang	*Lecanora*	(Zhuang, 1988)	*Trochila thallophila* P. Karst.
14	*Unguiculariopsis triregia* S. Y. Kondr. & D. J. Galloway	*Sticta squamata*	(Kondratyuk et al., 1995b)	

Family Dermateaceae Fr.

Laetinaevia Nannf. (1-22)

Index Fungorum 2623, faceoffungi, MycoBank, GenBank

Classification: Dermateaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Laetinaevia lapponica* (Nannf.) Nannf.

= *Naevia lapponica* Nannf.

Accepted lichenicolous species:

Laetinaevia epithallina (W. Phillips & Plowr.) Baral, on *Peltigera canina* (Baral et al., 2020)

= *Peziza epithallina* W. Phillips & Plowr. (Johnston, 2022)

Family Helotiaceae Rehm

Bryoscyphus Spooner (1-10)

Index Fungorum 25788, faceoffungi, MycoBank, GenBank

Classification: Helotiaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Bryoscyphus conocephali (Boyd) Spooner

= *Helotium marchantiae* var. *conocephali* Boyd

Accepted lichenicolous species:

Bryoscyphus lichenicola Alstrup & M. S. Cole, on *Cladonia* cf. *pyxidata*

Family Hyaloscyphaceae Nannf.

Hyalopeziza Fuckel (2-25)

Index Fungorum 2390, faceoffungi, MycoBank, GenBank

Classification: Hyaloscyphaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Hyalopeziza patula (Pers.) Fuckel

= *Peziza patula* Pers.

Table 2.160 Accepted lichenicolous species of *Hyalopeziza*

	Species name	Host	References	Remarks
1	*Hyalopeziza heterodermiae* Etayo	*Heterodermia*	(Etayo, 2017)	
2	*Hyalopeziza rapax* Huhtinen	*Pseudocyphellaria crocata*	(Huhtinen et al., 2008)	

Polydesmia Boud. (1-7)

Index Fungorum 4313, faceoffungi, MycoBank, GenBank

Classification: Hyaloscyphaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Polydesmia pruinosa* (Jerdon ex Berk. & Broome) Boud.

= *Helotium pruinosum* Jerdon ex Berk. & Broome

Accepted lichenicolous species:

Polydesmia lichenis Huhtinen & R. Sant., on *Peltigera aphthosa* (Huhtinen et al., 1997)

Family Hyphodiscaceae Ekanayaka & K.D. Hyde

Hyphodiscus Kirschst. (1-14)

Index Fungorum 2421, faceoffungi, MycoBank, GenBank

Classification: Hyphodiscaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Hyphodiscus gregarius* Kirschst.

Accepted lichenicolous species:

Hyphodiscus ucrainicus (S.Y. Kondr.) Suija, Tsurykau & Diederich *Cladonia phyllophora* (Suija et al., 2018)

= *Pezizella ucrainica* S.Y. Kondr. (Kondratyuk et al., 1995a)

Family Lachnaceae Raitv.

Solenopezia Sacc. (1-10)

Index Fungorum 5050, faceoffungi, MycoBank, GenBank

Classification: Lachnaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Solenopezia solenia* Sacc.

Transferred to *Belonidium solenia* (Sacc.) Raitv.

Accepted lichenicolous species:

Solenopezia tetraspora P. Henn., on *Physcia integrate* (Engler, 1895)

Family Mollisiaceae Rehm

Niptera Fr. (1-75)

Index Fungorum 3513, faceoffungi, MycoBank, GenBank

Classification: Mollisiaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Niptera lacustris* (Fr.) Fr.

= *Peziza lacustris* Fr.

Accepted lichenicolous species:

Niptera lichenicola (Speg.) Sacc., on *Parmelia caperata* (Saccardo, 1889)

= *Pyrenopeziza lichenicola* Speg. (Spegazzini, 1879)

Trimmatostroma Corda (16-40)

Index Fungorum 10312, faceoffungi, MycoBank, GenBank

Classification: Mollisiaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Trimmatostroma salicis Corda

Table 2.161 Accepted lichenicolous species of *Trimmatostroma*

	Species name	Host	References	Remarks
1	*Trimmatostroma acetabuli* Diederich	*Pleurosticta acetabulum*	(Diederich, 2021)	
2	*Trimmatostroma aptrootii* Diederich	*Neobrownliella holochracea*	(Diederich et al., 2024)	
3	*Trimmatostroma cetrariae* Brackel	*Cetraria islandica*	(Zhurbenko & Brackel, 2013)	
4	*Trimmatostroma dendrographae* Diederich, Ertz,U.Braun & Heuchert	*Dendrographa*	(Diederich et al., 2010)	
5	*Trimmatostroma denigrans* Diederich	*Lecanora horiza*	(Diederich, 2021)	
6	*Trimmatostroma harrisii* Diederich	On a sterile, sorediate lichen	(Diederich et al., 2024)	= *Coniothecium eriodictyonis* Dearn. & Barthol.
7	*Trimmatostroma lecanoricola* Diederich,Etayo, U.Braun & Heuchert	*Lecanora*	(Diederic et al., 2010)	

Table 2.161 (continued)

	Species name	Host	References	Remarks
8	*Trimmatostroma lecideicola* Diederich & Schiefelbein	*Lecidea inops*	(Diederich et al., 2024)	
9	*Trimmatostroma physciae* Diederich & van den Boom	*Physcia tenella*	(Diederich et al., 2024)	
10	*Trimmatostroma rhizocarpivorum* Diederich & Ertz	*Rhizocarpon geographicum*	(Diederich et al., 2024)	
11	*Trimmatostroma roccellacearum* Diederich, Ertz, F. Berger & Millanes	*Lecanactis abietina*, *Roccella fuciformis* and *R. phycopsis*	(Diederich et al., 2024)	
12	*Trimmatostroma quercicola* Diederich, U.Braun & Heuchert	Sterile, corticolous, crustose lichens	(Diederich et al., 2010)	Facultative lichenicolous
13	*Trimmatostroma rouxii* Diederich, Tehler & van den Boom	*Opegrapha durieui*	(Diederich, 2021)	
14	*Trimmatostroma umbilicariicola* Heuchert & U.Braun	*Umbilicaria*	(Heuchert & Braun, 2015)	
15	*Trimmatostroma vandenboomii* Diederich	*Myriolecis albescens*	(Diederich, 2021)	

Table 2.161 (continued)

	Species name	Host	References	Remarks
16	*Trimmatostroma varicellariae* Heuchert & U.Braun	*Varicellaria rhodocarpa*	(Heuchert & Braun, 2015)	

Family Pezizellaceae Velen.

Calycina Nees ex Gray (1-25)

Index Fungorum 770, faceoffungi, MycoBank, GenBank

Classification: Pezizellaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Calycina herbarum (Pers.) Gray

= *Peziza herbarum* Pers.

Accepted lichenicolous species:

Calycina alstrupii Suija & Motiejūnaitė, on *Lobaria pulmonaria* (Suija & MotieJūnaitė, 2017)

Chalara (Corda) Rabenh. (4-100)

Index Fungorum 7601, faceoffungi, MycoBank, GenBank

Classification: Pezizellaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

= *Torula* subgen. *Chalara* Corda

Type species:

Chalara fusidioides (Corda) Rabenh.

= *Torula fusidioides* Corda

Table 2.162 Accepted lichenicolous species of *Chalara*

	Species name	Host	References
1	*Chalara lichenicola* M. S. Christ.	*Cladonia gracilis*	(Christiansen, 1993)
2	*Chalara lobariae* Etayo	*Lobaria pulmonaria*	(Etayo & Diederich, 1996b)
	Chalara ochrolechiae Brackel & Zhurb.	*Ochrolechia,*	(Diederich et al., 2024)
3	*Chalara pseudocyphellariae* Etayo	*Pseudocyphellaria faveolata*	(Etayo & Sancho, 2008)

Pezizella Fuckel (1-178)

Index Fungorum 3861, faceoffungi, MycoBank, GenBank

Classification: Mollisiaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Pezizella pulchella* Fuckel

Accepted lichenicolous species of *Pezizella*

Pezizella collematis Boud., on *Collema* (Keissler, 1930)

Family Sclerotiniaceae Whetzel

Acarosporium Bubák & Vleugel ex Bubák (1-5)

Index Fungorum 7010, faceoffungi, MycoBank, GenBank

Classification: Sclerotiniaceae, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Transferred to *Pycnopeziza* W.L. White & Whetzel

Type species: *Acarosporium sympodiale* Bubák & Vleugel ex Bubák

Accepted lichenicolous species:

Acarosporium lichenicola Ihlen *& Tønsberg*, on *Icmadophila* (Ihlen, 1998)

Helotiales genera incertae sedis

Brackelia Zhurb. (1)

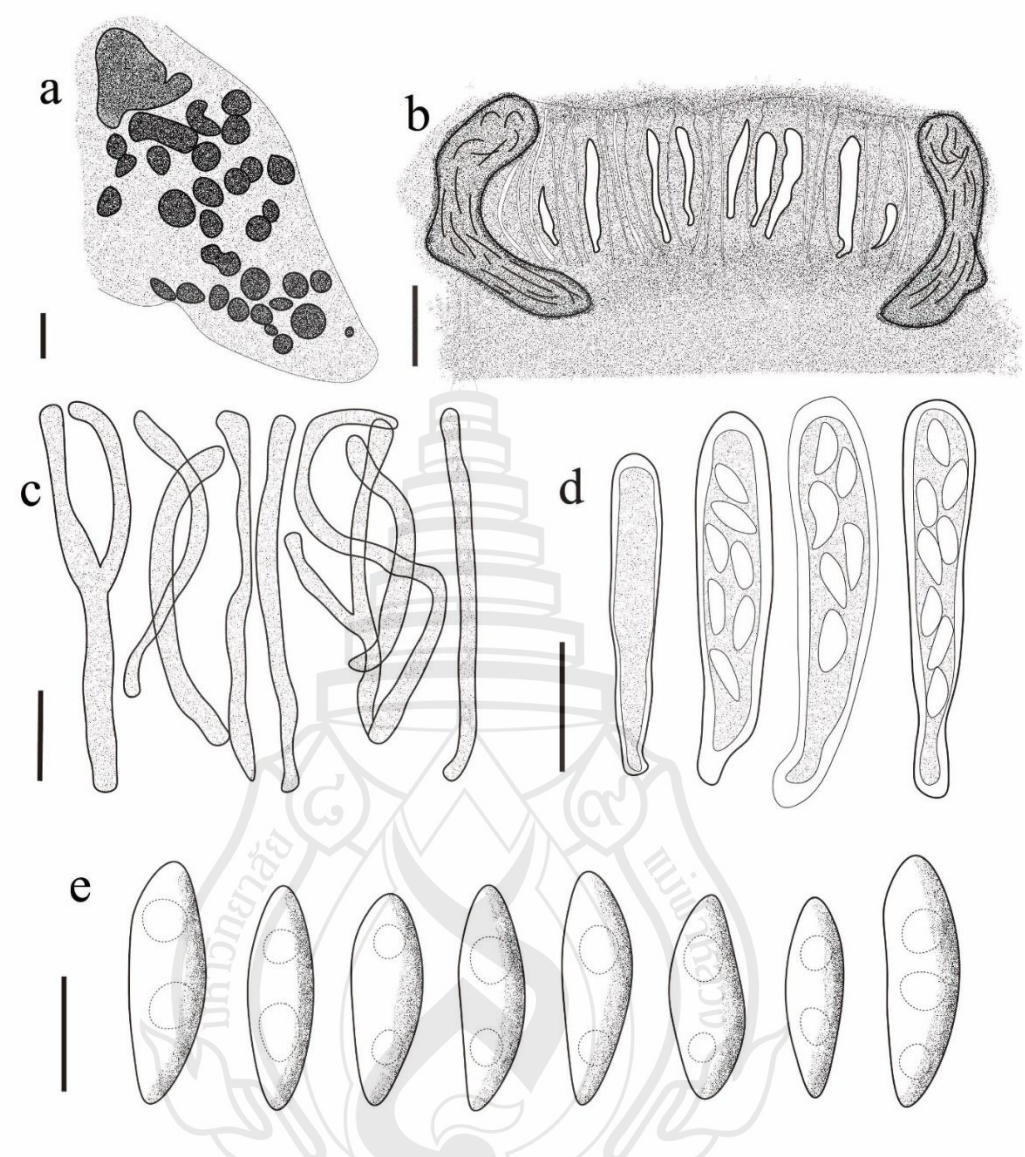
Index Fungorum 819555, faceoffungi, MycoBank, GenBank

Classification: Helotiales genera incertae sedis, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Brackelia was introduced by Zhurbenko et al. (2017) to accommodate the type species *B. lunkei*, which colonizes *Cladonia amaurocraea*. This genus is distinguished by its dark brown to nearly black, glossy, epruinose apothecia, which are superficial, rounded, and feature a flat disc with occasionally raised margins. The exciple is non-radiating, hairless, and brownish-orange laterally, transitioning to subhyaline at the base. The paraphyses are hyaline to light or medium brown, sometimes brownish-orange, filiform, and occasionally slightly clavate near the apex. They may branch below, are remotely septate, and do not constrict at the septa. Paraphyses dissociate readily in KOH. The asci are non-fissitunicate, narrowly clavate with a rounded apex and thickened apical wall, containing eight ascospores. The ascospores are hyaline, ellipsoid to very narrowly obovate, 0(–1)-septate, guttulate, with a smooth wall and no gelatinous sheath. They are arranged diagonally uniseriate to irregularly biseriate within the ascus (Zhurbenko & Pino-Bodas, 2017).

Due to its morphological features, *Brackelia* closely resembles species in *Llimoniella* (Helotiales). Consequently, Zhurbenko et al. (2017) tentatively placed the genus within *Helotiales*. However, its systematic position remains uncertain and will require further clarification once molecular sequence data become available.

Type species: *Brackelia lunkei* Zhurb., On hymenium of *Cladonia amaurocraea* (Zhurbenko & Pino-Bodas, 2017)



Note a Apothecia. b Section of apothecium. c Paraphyses. d Asci. e Ascospores. Scale bars: a = 100 µm, b = 20 µm, c–d = 10 µm, e = 2.5 µm.

Source Redrawn from Zhurbenko et al. (2017)

Figure 2.109 *Brackelia lunkei*

Cecidioskyttea Etayo (1)

Index Fungorum 511460, faceoffungi, MycoBank, GenBank

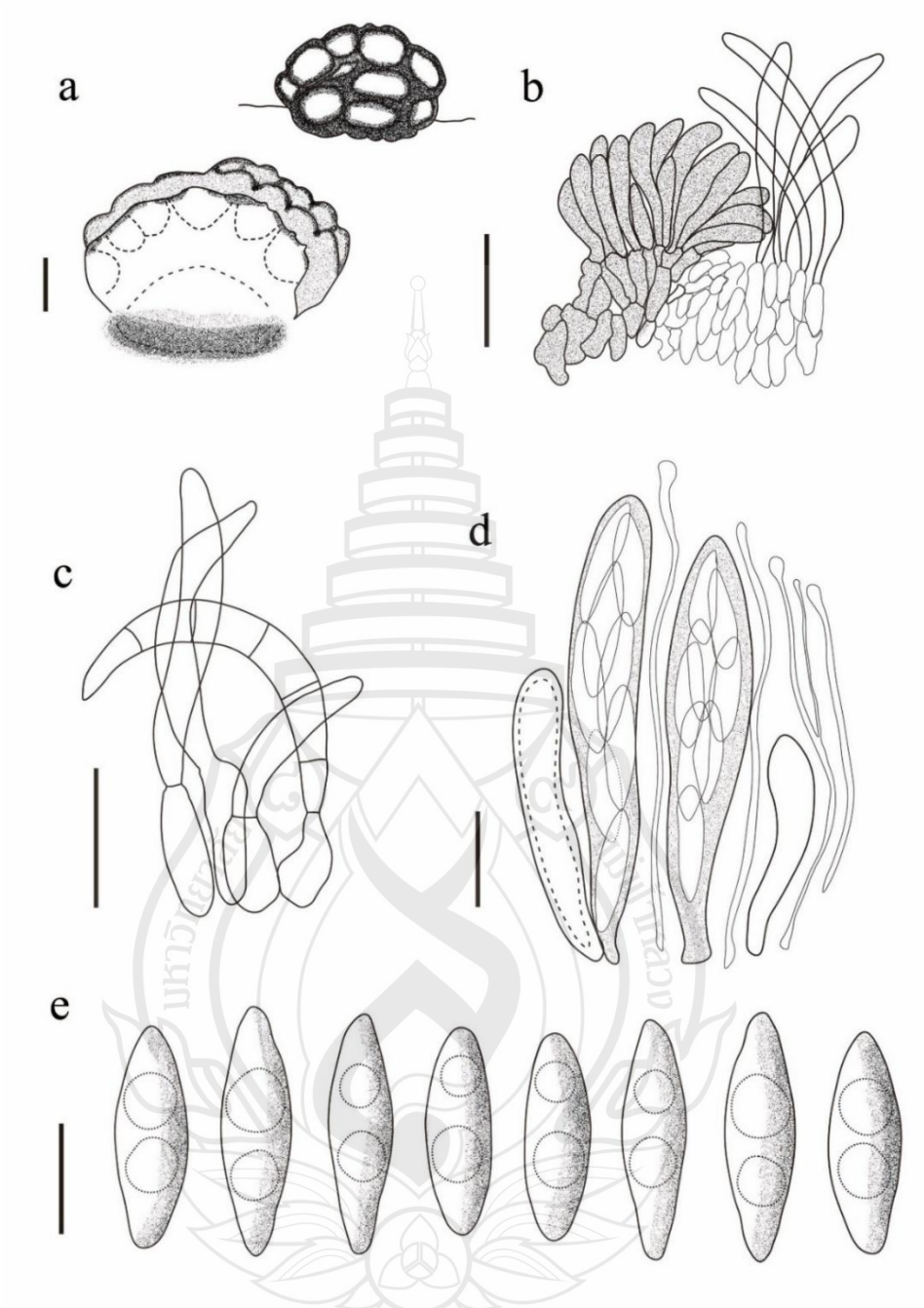
Classification: Helotiales genera incertae sedis, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Cecidioskyttea was introduced by Etayo et al. (2004) to accommodate the type species *Cecidioskyttea osorioi*, which induces gall formation on the thallus of *Concamerella fistulata*. These lichenicolous galls are black, superficial, convex, and warty, with a constricted base. The apothecia are immersed within the galls, closed, and feature a hyaline excipulum covered with olive-colored hairs. The paraphyses are filiform, simple, and septate. The asci are thin-walled, ellipsoidal to subcylindrical, eight-spored, and non-reactive to iodine (KI-negative). The ascospores are hyaline, ellipsoidal to fusiform, non-septate, and contain two guttules. Pycnidia are also immersed and occur interspersed with the apothecia. The conidiogenous cells are holoblastic, producing curved or sigmoidal, hyaline, smooth-walled conidia with 0–5 septa (Etayo & Osorio, 2004).

Etayo et al. (2004) placed *Cecidioskyttea* within the order *Helotiales* based on several characteristics: its non-cleistohymenial apothecia, exciple with setae, hymenium with simple paraphyses, thin-walled unitunicate asci that are KI-negative, and simple ascospores. Morphologically, *Cecidioskyttea* shares similarities with *Rhymbocarpus* Zopf, another genus with perithecioid, immersed apothecia (Diederich & Etayo, 2000). However, *Cecidioskyttea* is differentiated by its unique gall formation, the coexistence of ascomata and conidiomata, and distinct conidia that set it apart from *Rhymbocarpus* (Etayo & Osorio, 2004).

Currently, *Cecidioskyttea* includes only one recognized species, and no molecular sequence data are available in GenBank.

Type species: *Cecidioskyttea osorioi* Etayo, on *Concamerella fistulata* (Etayo & Osorio, 2004)



Note a Two black galls on the thallus of *Concamerella*. b Sections of a conidioma with the excipular setae covering the disc and the conidial structure. c Conidia and conidial cells. d Asci and paraphyses. **e** Ascospores. Scales: a = 100 µm, b = 20 µm, c–d = 10 µm, e = 5 µm.

Source Redrawn from Etayo (2004)

Figure 2.110 *Cecidioskyttea osorioi*

Chloroepilichen Etayo (1)

Index Fungorum 565883, faceoffungi, MycoBank, GenBank

Classification: Helotiales genera incertae sedis, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Chloroepilichen was introduced by Etayo et al. (2010) to accommodate the types species *Chloroepilichen rolfii*, which grows on the thallus of *Lobaria peltigera* from Peru.

Currently, only one species is recognized in *Cecidioskyttea*, and no sequence data is available in GenBank.

Type species: *Chloroepilichen rolfii* Etayo, on *Lobaria peltigera* (Etayo, 2010a)

Kukwaea Suija, Motiej. & Zhurb. (1)

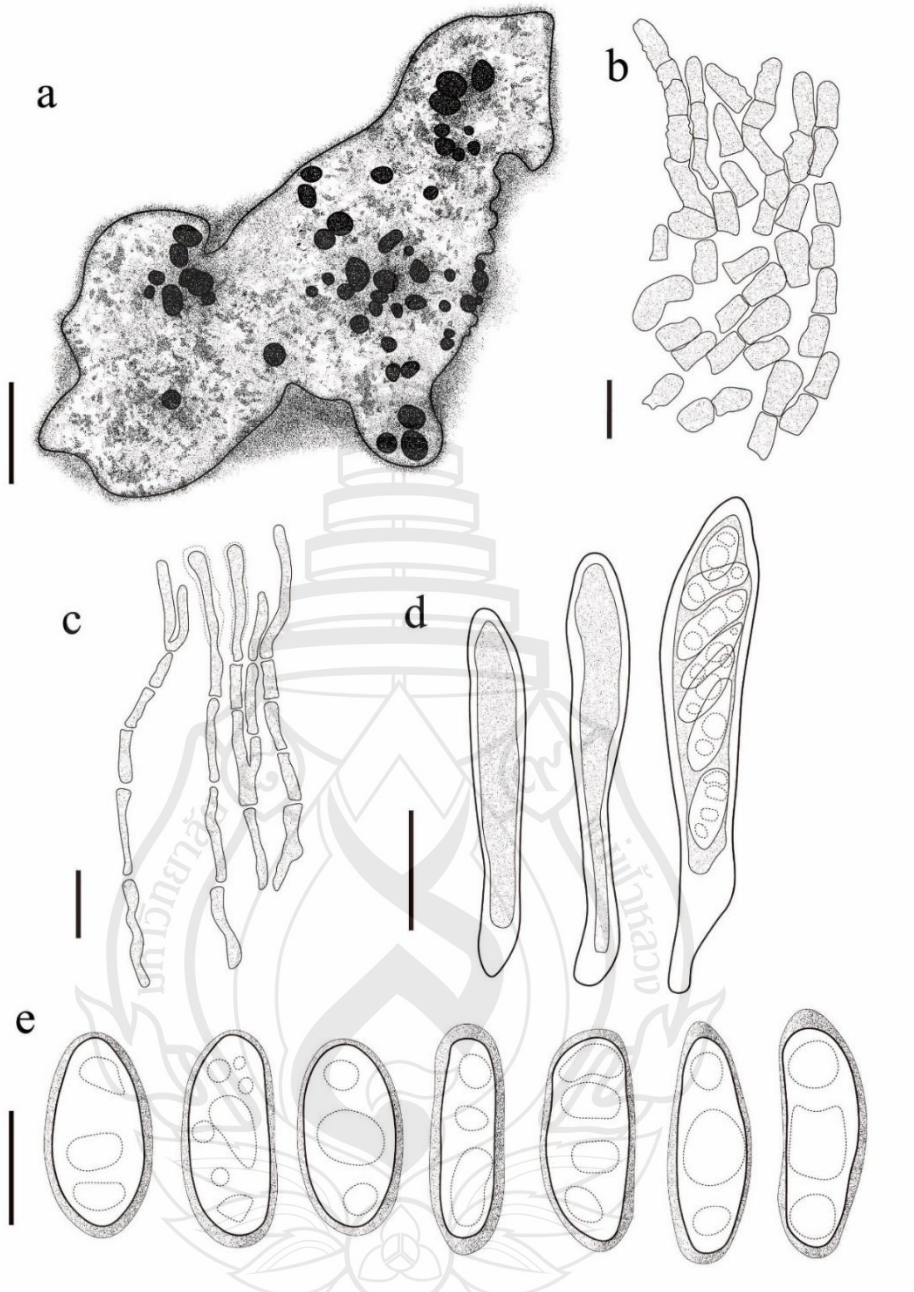
Index Fungorum 836107, faceoffungi, MycoBank, GenBank

Classification: Helotiales genera incertae sedis, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Kukwaea was introduced by Suija, Motiejūnait & Zhurbrenko (2020) to describe a lichenicolous fungus found on *Cetraria islandica* in coniferous forests across the European and Asian regions of Russia. This genus is distinguished by its cupulate, brown ascomata with a gray to blackish disc surrounded by brownish-gray, granulose hairs. The exciple is of the *textura angularis* type, containing crystals in its lower part, and features obtuse-tipped hairs. Other diagnostic traits include simple to forked paraphyses, *Calycina*-type asci, and hyaline, aseptate ascospores (Suija et al., 2020).

The type species, *Kukwaea pubescens*, is currently the sole species recognized within the genus. Although molecular data have confirmed its placement within the order *Helotiales*, its precise familial affiliation remains unresolved.

Type species: *Kukwaea pubescens* Motiej. & Zhurb., on *Cetraria islandica* (Suija et al., 2020)



Note a Ascomata on the thallus of *Cetraria islandica*. b Structure of ectal exciple. c Septate paraphyses. d Asci. e Ascospores. Scale bars: a = 500 µm, b–d = 10 µm, e = 5 µm.

Source Redrawn from Suija et al. (2020)

Figure 2.111 *Kukwaea pubescens*

Neoechinodiscus Molinari & R. Sierra (2)

= *Echinodiscus* Etayo & Diederich

Index Fungorum 837745, faceoffungi, MycoBank, GenBank

Classification: Helotiales genera incertae sedis, Helotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Neoechinodiscus was provided by Molinari & R. Sierra (2020) as a replacement for *Echinodiscus* Etayo & Diederich, introduced by Etayo et al. (2010) to accommodate the lichenicolous species *Echinodiscus lesdainii*, found on the thallus of *Lobaria peltigera*. Although *Echinodiscus* was validly published, Diederich et al. (2018) later recognized it as illegitimate due to nomenclatural conflicts. The name *Echinodiscus* was a later homonym of the diatom genus *Echinodiscus* A. Mann and the legume genus *Echinodiscus* Bentham. Additionally, the name had been used earlier by Leske (1778) for a genus of sand dollars in the family Astriclypeidae (Sierra et al., 2020).

Neoechinodiscus lesdainii was designated as the type species of *Neoechinodiscus*, characterized by its apothecioid ascomata. The discs are plane to convex, blackish, and slightly furfuraceous. The exciple is reduced, with a *textura prismatica* structure and lateral violet pigment reacting K+ bluish gray and N+ reddish orange. It features large, hyaline, simple hairs. The paraphyses are simple, septate, apically untapered, and intermixed with hairs similar to those arising from the exciple. The asci are clavate with a prominent stalk, uniformly thin-walled, not apically thickened, and the ascospores are hyaline, simple, and ellipsoid (Etayo et al., 2000).

Since the description of the first species, Zhurbenko (2009) introduced a second species, *E. kozhevnikovii*, which grows on *Cetraria islandica*. Both species were transferred to *Neoechinodiscus*, and the genus currently comprises these two recognized species. However, no sequence data are available in GenBank.

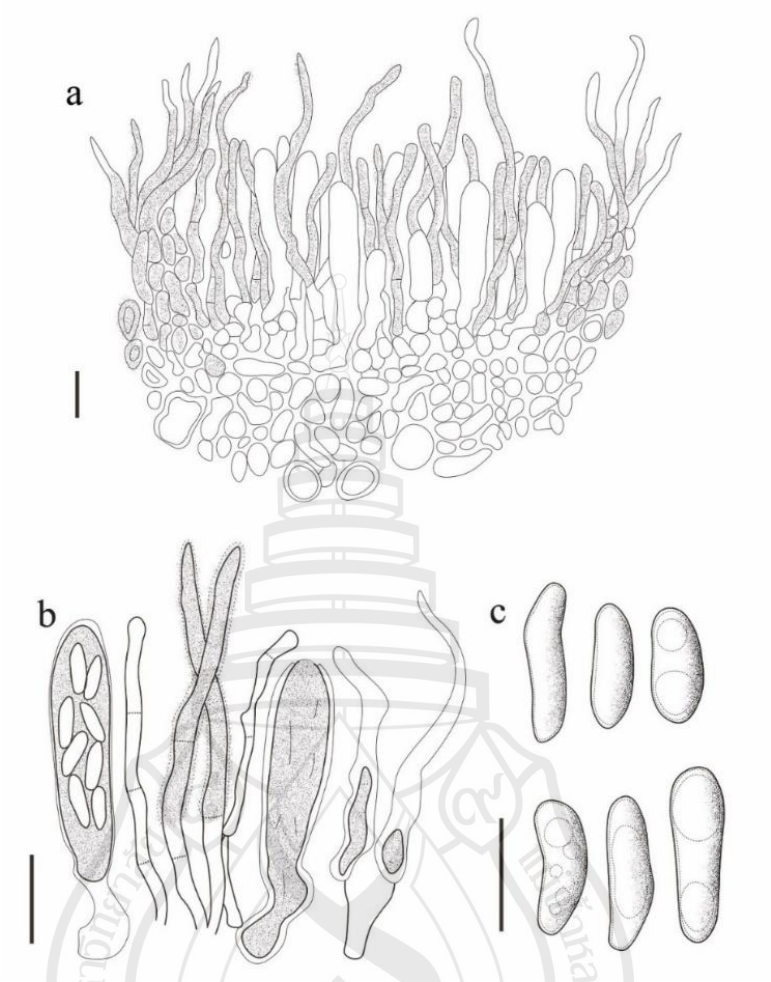
Type species: *Neoechinodiscus lesdainii* (Vouaux) R. Sierra & Molinari (Sierra et al., 2020)

= *Echinodiscus lesdainii* (Vouaux) Etayo & Diederich (Etayo et al., 2000)

= *Phacopsis lesdainii* Vouaux (Vouaux, 1914)

Table 2.163 Accepted lichenicolous species of *Neoechinodiscus*

	Species name	**Host**	**References**	**Remarks**
1	*Neoechinodiscus lesdainii* (Vouaux) R. Sierra & Molinari	*Lobaria peltigera*	(Vouaux, 1914) (Etayo et al., 2000; Sierra et al., 2020)	= *Phacopsis lesdainii* Vouaux
2	*Neoechinodiscus kozhevnikovii* (Zhurb.) Molinari & R. Sierra	*Cetraria islandica*	(Zhurbenko, 2009d)	= *Echinodiscus kozhevnikovii* Zhurb.



Note a Section through apothecium. b Asci, paraphyses, hymenial and excipular hairs. c Ascospores. Scales: a–b = 10 μm, c = 5 μm.

Source Redrawn from Etayo et al. (2000)

Figure 2.112 *Neoechinodiscus lesdainii*

Order Leotiales Korf & Lizon

Family Mniaeciaceae Baral

Epithamnolia Zhurb. (9)

Index Fungorum 563053, faceoffungi, MycoBank, GenBank

Classification: Mniaeciaceae, Leotiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Epithamnolia was introduced by Zhurb. (2012) based on morphological characteristics to describe the type species, *E. karatyginii*, which grows on *Thamnolia vermicularis* var. *subuliformis*. This genus is characterized by blackish, rugose, irregularly subglobose pycnidial conidiomata that become cupuliform with age. Initially almost closed, the conidiomata later develop an irregular opening, transitioning from a subimmersed state within the thallus of *Thamnolia* species to a more superficial position, where they appear singly and are dispersed. The conidiogenous cells lining the pycnidial cavity are enteroblastic and phialidic, with an indistinct collarette and periclinal thickening. They are non-proliferative, hyaline, lageniform to narrowly elliptic, and smooth-walled. The conidia are acrogenous, forming singly rather than in chains. They are hyaline, cylindrical with obtuse or occasionally slightly truncated ends, 0(1–2)-septate, not constricted at the septum, smooth-walled, and may exhibit sparse, inconspicuous guttules (Zhurbenko, 2012).

Initially, *Epithamnolia* was placed within Coelomycetes by Zhurb. (2012). However, a phylogenetic analysis by Suija et al. (2017) revealed that the genus clusters within Phacidiales (Leotiomycetidae, Leotiomycetes) as a genus incertae sedis, a position later accepted by Diederich (2018). Wijayawardene (2020) subsequently assigned the genus to Lichinodiales as a genus incertae sedis, and in 2022, he transferred it to the family Mniaeciaceae (Leotiales). Due to morphological similarities to *Hainesia* species—particularly the cupulate conidiomata and hyaline, cylindrical, septate conidia—Suija et al. (2017) proposed transferring four *Hainesia* species to *Epithamnolia* and introducing one new species to the genus. Following this, Diederich et al. (2018) transferred *Hainesia atrolazulina* to *Epithamnolia*. In 2019, Flakus et al., introduced *Epithamnolia rugosopycnidiata*, which grows on *Lobariella*. Currently, nine species are recognized within this genus, all of which are lichenicolous.

Type species: *Epithamnolia karatyginii* Zhurb.

Table 2.164 Accepted lichenicolous species of *Epithamnolia*

	Species name	Host	References	Remarks
1	*Epithamnolia atrolazulina* (Etayo) Diederich	*Hypotrachyna*	(Diederich et al., 2018)	= *Hainesia atrolazulina* Etayo
2	*Epithamnolia brevicladoniae* (Diederich & van den Boom) Diederich & Suija	*Cladonia*	(Suija et al., 2017)	= *Hainesia brevicladoniae* Diederich & van den Boom
3	*Epithamnolia karatyginii* Zhurb	*Thamnolia*	(Zhurbenko, 2012)	
4	*Epithamnolia khersonica* Darmostuk & Suija	*Cladonia foliacea*	(Diederich et al., 2024)	
5	*Epithamnolia longicladoniae* (Diederich & van den Boom) Diederich & Suija	*Cladonia*	(Suija et al., 2017)	= *Hainesia longicladoniae* Diederich & van den Boom
6	*Epithamnolia pertusariae* (Etayo & Diederich) Diederich & Suija	*Bryonora, Cladonia, Peltigera* and *Pertusaria*	(Suija et al., 2017)	= *Hainesia pertusariae* Etayo & Diederich

Table 2.164 (continued)

	Species name	Host	References	Remarks
7	*Epithamnolia rangiferinae* E. Zimm., Diederich & Suija	*Cladonia rangiferina*	(Suija et al., 2017)	
8	*Epithamnolia rugosopycnidiata* Etayo & Flakus	*Lobariella*	(Flakus et al., 2019b)	
9	*Epithamnolia xanthoriae* (Brackel) Diederich & Suija	*Candelaria, Hypogymnia, Lecanora, Melanohalea, Parmelia, Phaeophyscia, Physcia, Platismatia, Polycauliona, Protoparmeliopsis, Pseudevernia, Punctelia, Rusavskia* and *Xanthoria*	(Suija et al., 2017)	= *Hainesia xanthoriae* Brackel

Order Lichinodiales M. Prieto, M. Schultz, Olariaga & Wedin

Family Lichinodiaceae M. Prieto, M. Schultz, Olariaga & Wedin

Lichinodium Nyl. (1-4)

Index Fungorum 2860, faceoffungi, MycoBank, GenBank

Classification: Lichinodiaceae, Lichinodiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Lichinodium sirosiphoideum* Nyl., on thallus of *Parmelia saxatilis* (Nylander, 1875b)

Order Phacidiales C.E. Bessey

Family Helicogoniaceae Baral

Geltingia Alstrup & D. Hawksw. (1)

Index Fungorum 25362, faceoffungi, MycoBank, GenBank

Classification: Helicogoniaceae, Phacidiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Geltingia was introduced by Alstrup & D. Hawksw (1990) to accommodate the type species *G. associata*, along with *G. groenlandiae* and *G. stereocaulorum*. However, the latter two species were subsequently transferred to other genera, leaving the type species as the sole member of *Geltingia* (Alstrup et al., 1990; Diederich & Etayo, 2000). *Geltingia* is characterized by black ascomata, which are either solitary or loosely aggregated. These ascomata are initially immersed and perithecioid, becoming erumpent and often superficial and apothecioid at maturity. The exciple is persistent, brown, and consists of elongated to subglobose, parallel rows of pseudoparenchymatous cells. The asci are elongate-clavate to narrowly cylindrical, stalked, with a single functional wall layer that is not or only slightly thickened at the apex. Asci discharge by rupture at the ascus tip and contain eight spores, which are arranged monostichously, distichously, or somewhat helicoidally. The ascospores are subglobose to ellipsoid or cylindrical to almost fusiform, simple, guttulate, hyaline, and smooth (Alstrup et al., 1990).

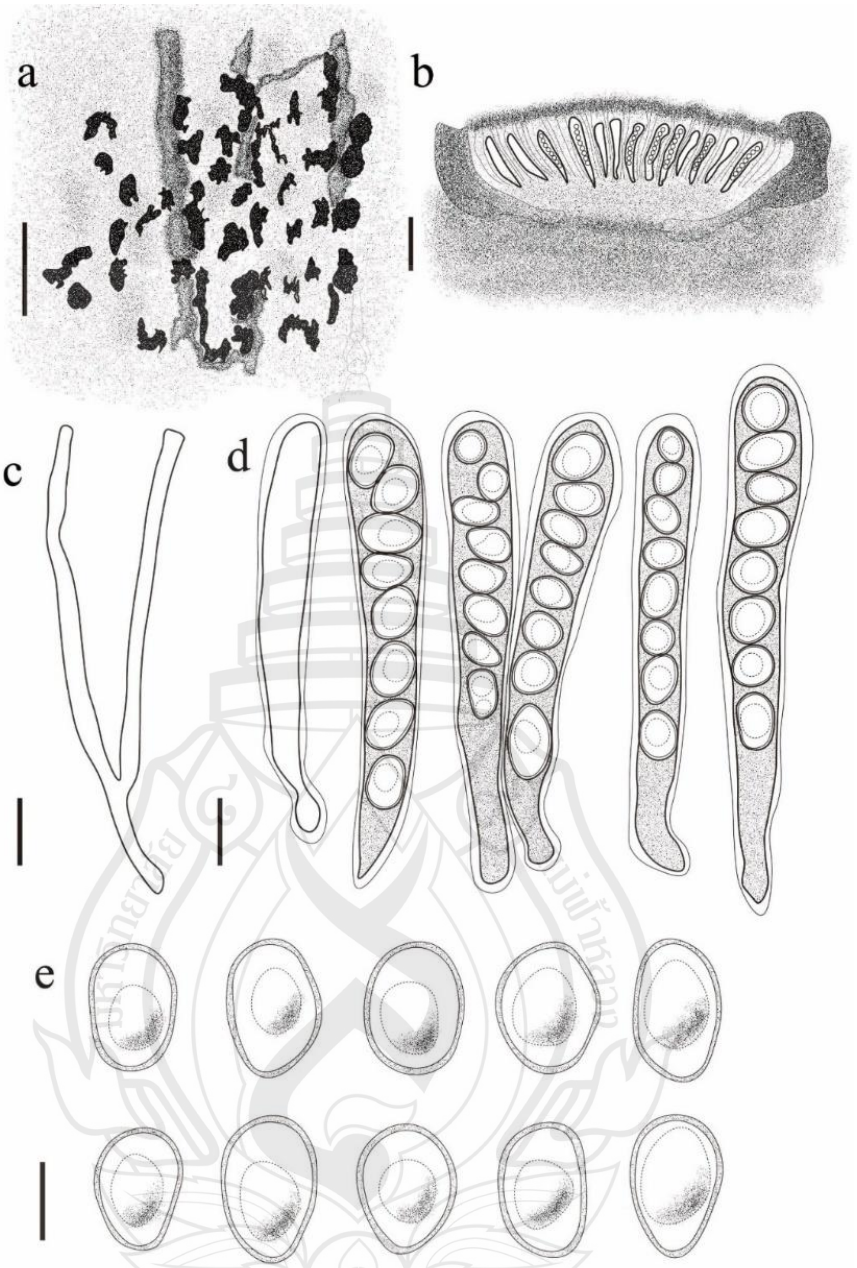
Initially, *Geltingia* was thought to belong to the family Odontotremataceae (Ostropales) due to its ascomata development. However, the presence of thin-walled

asci without apical thickening suggested a placement within *Helotiales*. Rambold et al. (1990) subsequently transferred *Geltingia* to *Helotiales* based on ascomata characteristics, a view later confirmed by Diederich et al. (2010). Phylogenetic analysis by Suija et al. (2015) showed that *Geltingia* clusters with *Eleutheromyces* outside the *Helotiales* clade. In the same year, Baral established the family Helicogoniaceae (Baral, 2015) and included *Geltingia* in this family, a placement that was accepted by Wijayawardene (2018).

Type species:

Geltingia associata (Th. Fr.) Alstrup & D. Hawksw. (Alstrup et al., 1990)

= *Lecidea associata* Th. Fr. (Fries, 1867a), on *Thamnolia vermicularis*, *Ochrolechia* sp. and *Pertusaria* spp.



Note a Ascomata on on *Thamnolia*. b Vertical section of ascomata. c Paraphysis. d Asci. e Ascospores. Scale bars: a = 1 mm, b = 50 µm, c–d = 10 µm, e = 5 µm.

Source Redrawn from Diederich et al. (2010) and Suija et al. (2015)

Figure 2.113 *Geltingia associata*

Gelatinopsis Rambold & Triebel (1-8)

Index Fungorum 25361, faceoffungi, MycoBank, GenBank

Classification: Helicogoniaceae, Phacidiales, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Gelatinopsis geoglossi (Ellis & Everh.) Rambold & Triebel

= *Lecidea associata* Th. Fr. (Fries, 1867a), on *Thamnolia vermicularis*, *Ochrolechia* sp. and *Pertusaria* spp.

Accepted lichenicolous species:

Gelatinopsis leptogii Ertz & Diederich, on *Leptogium byssinum* (Damien et al., 2006)

LEOTIOMYCETES Genera incertae sedis

Epicladonia D. Hawksw. (4)

Index Fungorum 8186, faceoffungi, MycoBank, GenBank

Classification: Leotiomycetes genera incertae sedis, Leotiomycetes, Pezizomycotina, Ascomycota, Fungi

Epicladonia was intrudoced by Hawksworth (1981) to accommodate three lichenicolous species found exclusively on *Cladonia*, often forming galls. The species *E. sandstedei*, originally described as *Diplodina sandstedei* by Zopf, was designated as the type species following its recombination by Hawksworth (1981). *Epicladonia* was initially placed within the Sphaeropsidales (Coelomycetes) and is characterized by solitary, unilocular, subglobose to cupuliform, dark brown conidiomata that are immersed or erumpent. Its conidiogenous cells are holoblastic, acrogenous, subcylindrical to elongate-ampulliform, proliferating, annellate, unbranched, and hyaline. The conidia are subcylindrical to narrowly ellipsoid or cymbiform, hyaline, and 0–1-septate. In Hawksworth's (1981) key, the three species were primarily distinguished by pycnidial diameter and the number of septa in their conidia.

Ihlen et al. (2005) introduced *Epicladonia lapponica*, which grows on *Pleopsidium chlorophanum*. However, this species was later transferred to

Phacographa lapponica (Ihlen) by Frisch & Ihlen (2022) based on phylogenetic analysis. Another species, *E. heterodermiae*, was introduced by Joshi et al. (2017) from *Heterodermia*, though its classification was based solely on morphological characteristics.

Currently, four species are accepted within this genus, with three having available sequences in GenBank. In the phylogenetic analysis by Pino-Bodas et al. (2017), three species were included. The results revealed that *Epicladonia* is polyphyletic, with *E. sandstedei* belonging to Leotiomycetes, while *E. simplex* and *E. stenospora* align with *Lecanorales* (Lecanoromycetidae, Lecanoromycetes). Unlike *E. sandstedei*, which often induces gall formation and typically has septate conidia, *E. simplex* and *E. stenospora* rarely induce galls, and their conidia are generally aseptate (Hawksworth 1981b; Zhurbenko & Pino-Bodas, 2017). The distinctions in gall-like structures and conidial septation between these groups suggest significant morphological differences, though Pino-Bodas et al. (2017) did not propose a formal revision of the genus. Diederich (2018) divided the five species into two groups in the checklist of lichenicolous fungi, and Wijayawardene (2018, 2022) placed *Epicladonia* within Leotiomycetes as genera incertae sedis.

Type species: *Epicladonia sandstedei* (Zopf) D. Hawksw.

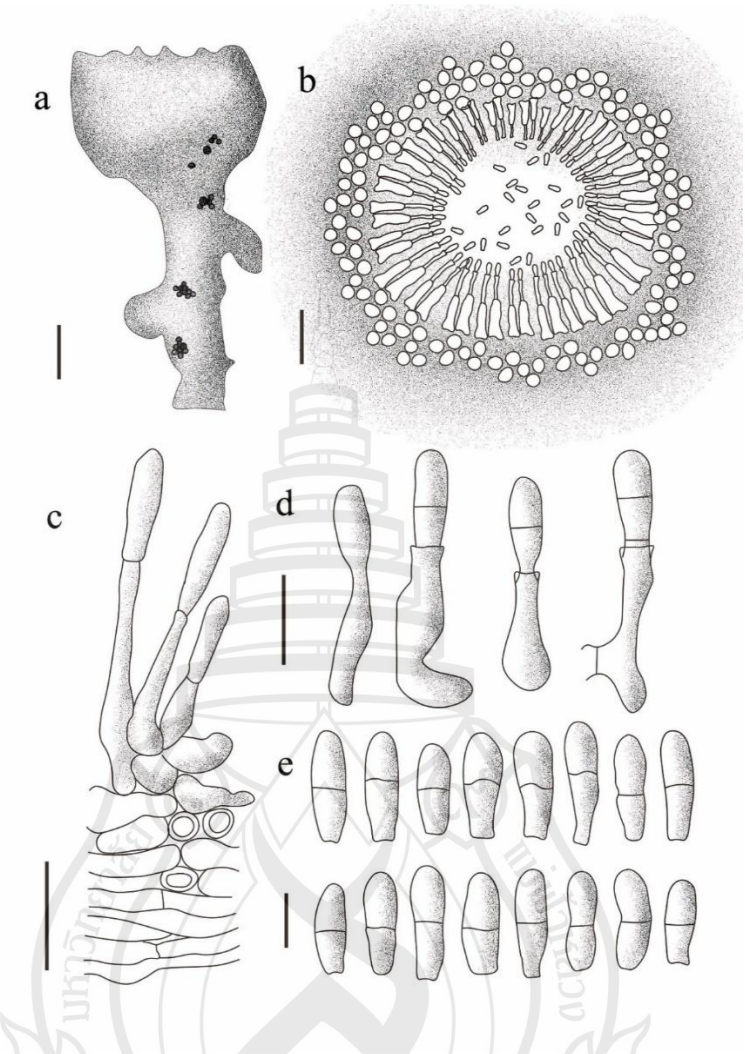
= *Diplodina sandstedei* Zopf

Table 2.165 Accepted lichenicolous species of *Epicladonia*

	Species name	Host	References	Remarks
1	*Epicladonia heterodermiae* Y.Joshi, Falswal & R.Joshi	*Heterodermia*	(Joshi et al., 2017)	

Table 2.165 (continued)

	Species name	Host	References	Remarks
2	*Epicladonia sandstedei* (Zopf) D. Hawksw.	*Cladonia caespiticia*	(Hawksworth, 1981b)	= *Diplodina sandstedei* Zopf
3	*Epicladonia simplex* D. Hawksw.	*Cladonia bacilliformis*	(Hawksworth, 1981b)	
4	*Epicladonia stenospora* (Harm.) D. Hawksw.	*Cladonia*	(Hawksworth, 1981b)	= *Aposphaeria stenospora* Harm.



Note a Infected podetium with galls. b Vertical section of pycnidium. c Vertical section of pycnidial wall. d Conidiogenous cells. e Conidia. Scale bars: a = 2 mm, b = 50 μm, c–d = 10 μm, e = 5 μm.

Source Redrawn from Hawksworth (1981b)

Figure 2.114 *Epicladonia sandstedei*

Class LICHINOMYCETES V. Reeb, Lutzoni & Cl. Roux

Order Lichinales Henssen & Büdel

Family Lichinaceae Nyl.

Phylliscum Nyl. (1-20)

Index Fungorum 4056, faceoffungi, MycoBank, GenBank

Classification: Lichinaceae, Lichinales, Lichinomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Phylliscum demangeonii* (Moug. & Mont.) Nyl., on *Ochrolechia frigida* (Nylander, 1855)

= *Collema demangeonii* Moug. & Mont. (Montagne, 1849)

Class Pezizomycetes O.E. Erikss. & Winka

SubClass Pezizomycetidae Locq.

Order Pezizales J. Schröt.

Family Ascodesmidaceae J. Schröt.

Ascodesmis Tiegh. (1-10)

Index Fungorum 356, faceoffungi, MycoBank, GenBank

Classification: Ascodesmidaceae, Pezizales, Pezizomycetidae, Pezizomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Ascodesmis nigricans* Tiegh.

Accepted lichenicolous species:

Ascodesmis microscopica (P. Crouan & H. Crouan) Le Gal, on *Lecide uliginosa* (Le Gal 1949)

= *Lecidea microscopica* P. Crouan & H. Crouan (Crouan et al., 1867a)

Class SORDARIOMYCETES O.E. Erikss. & Winka

SubClass DIAPORTHOMYCETIDAE Senan., Maharachch. & K.D. Hyde

Familia incertae sedis

Sporidesmium Link (3-200)

Index Fungorum 10024, faceoffungi, MycoBank, GenBank

Classification: Familia incertae sedis, Diaporthomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species:

Sporidesmium altum (Preuss) M.B. Ellis

= *Helminthosporium altum* Preuss

Table 2.166 Accepted lichenicolous species of *Sporidesmium*

	Species name	Host	References	Remarks
1	*Sporidesmium bacidiicola* Alstrup	*Bacidia rubella*	(Alstrup, 1991)	
2	*Sporidesmium lichenicola* Iturr., D. Hawksw. & J. L. Crane	*Leptogium*	(Iturriaga et al., 2008)	
3	*Sporidesmium usneae* Etayo	*Usnea*	(Etayo, 2017)	

Trichosphaeria Fuckel (1-45)

Index Fungorum 5588, faceoffungi, MycoBank, GenBank

Classification: Familia incertae sedis, Diaporthomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Trichosphaeria pilosa* (Pers.) Fuckel

= *Sphaeria pilosa* Pers.

Accepted lichenicolous species:

Trichosphaeria lichenum P. Karst. & Hariot, on *Peltigera canina* (Karsten et al., 1890)

SubClass HYPOCREOMYCETIDAE O.E. Erikss. & Winka

Order Coronophorales Nannf.

Family Nitschkiaceae Nannf.

Acanthonitschkea Speg. （1-9）

Index Fungorum 12, faceoffungi, MycoBank, GenBank

Classification: Nitschkiaceae, Coronophorales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Acanthonitschkea argentinensis* Speg.

Accepted lichenicolous species:

Acanthonitschkea peltigericola (Alstrup & Olech) O. E. Erikss. & R. Sant., on *Peltigera* (Eriksson et al., 1995)

= *Hystrix peltigericola* Alstrup & Olech (Alstrup, 1993c)

Lasiosphaeriopsis D. Hawksw. & Sivan. (7)

Index Fungorum 2658, faceoffungi, MycoBank, GenBank

Classification: Nitschkiaceae, Coronophorales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

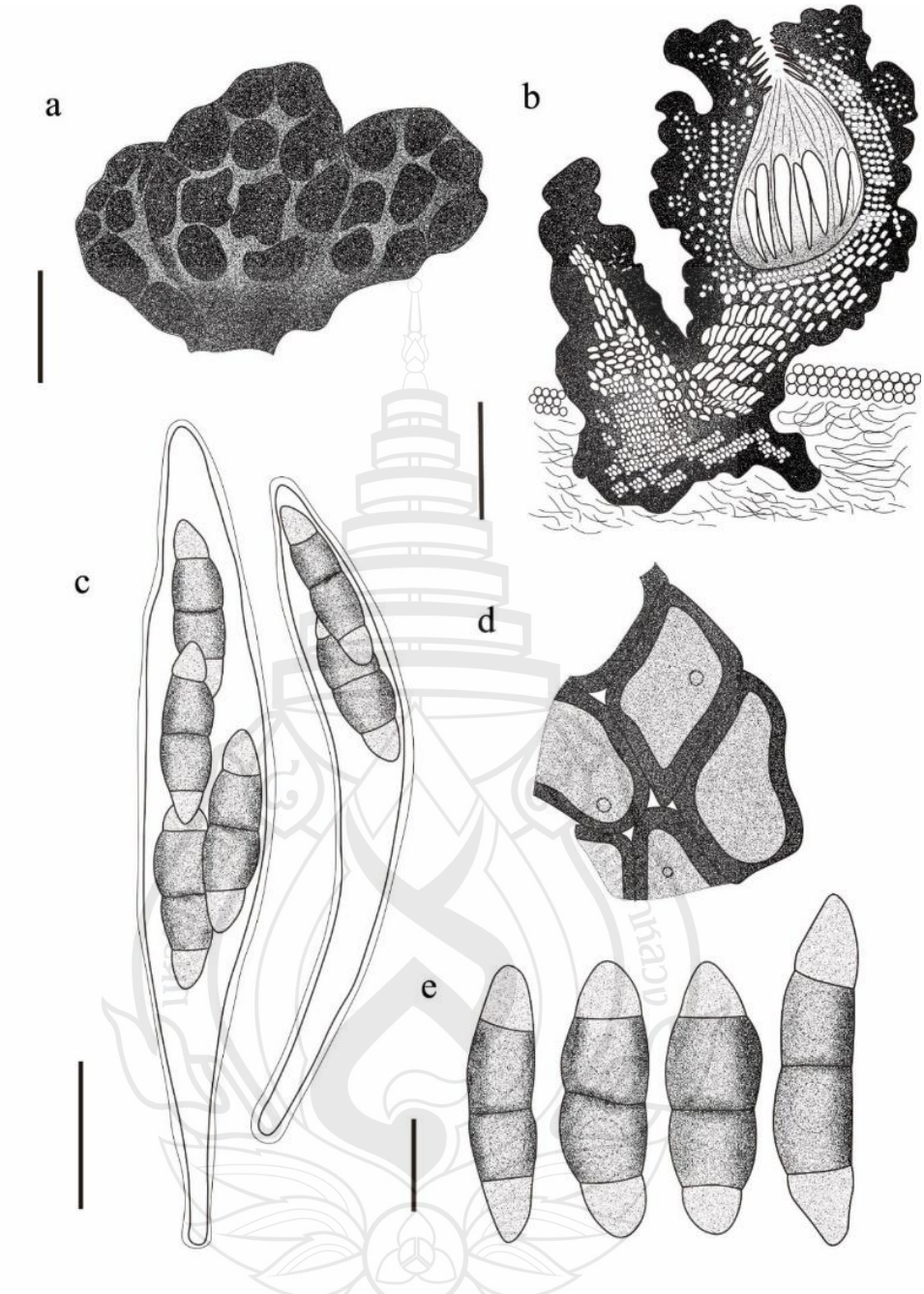
Lasiosphaeriopsis was introduced by Hawksworth (1980) to accommodate the type species *L. salisburyi*, which grows on *Peltigera rufescens*. This genus is characterized by superficial, carbonaceous, black stromata that are 1- to multiloculate, aggregated, irregularly obovoid, short-stalked, and coarsely warted, with ostioles containing periphyses. The asci are elongate-clavate, long-stalked, and unitunicate, lacking a discernible apical apparatus, and are 2- to 4-spored. The ascospores are broadly fusiform, 3- to 4-septate, brown with subhyaline terminal cells, smooth-walled, and lacking a gelatinous sheath (Hawksworth, 1980b).

Originally, *Lasiosphaeriopsis* was assigned to the family Nitschkiaceae (Coronophorales) by Hawksworth (1980) based on its morphological characteristics. However, in the absence of molecular data, its phylogenetic placement remains uncertain, although this classification is widely accepted. Since the initial description of the type species, three additional species have been transferred to *Lasiosphaeriopsis* from other genera (Eriksson & Santesson, 1986; Triebel, 1989; Alstrup et al., 1994), and three new species have been described (Alstrup et al., 1990; Zhurbenko & Triebel, 2005; Pérez-Ortega et al., 2008). Currently, seven species are recognized within this genus, all of which exhibit lichenicolous lifestyles.

Type species: *Lasiosphaeriopsis salisburyi* D. Hawksw. & Sivan.

Table 2.167 Accepted lichenicolous species of *Lasiosphaeriopsis*

	Species name	Host	References	Remarks
1	*Lasiosphaeriopsis cephalodiorum* (Rostr.) Alstrup	*Placopsis*	(Rostrup, 1870; Alstrup et al., 1994)	= *Sphaeria cephalodiorum* Rostr.
2	*Lasiosphaeriopsis christiansenii* Alstrup & D. Hawksw.	*Porpidia tuberculosa*	(Alstrup et al., 1990)	
3	*Lasiosphaeriopsis lecanorae* Pérez-Ortega & Halıcı	*Lecanora polytropa*	(Pérez-Ortega et al., 2008)	
4	*Lasiosphaeriopsis pilophori* Zhurb. & Triebel	*Pilophorus dovrensis*	(Zhurbenko & Triebel, 2005)	
5	*Lasiosphaeriopsis salisburyi* D. Hawksw. & Sivan.	*Peltigera rufescens*	(Hawksworth, 1980b)	
6	*Lasiosphaeriopsis stereocaulicola* (Linds.) O. E. Erikss. & R. Sant.	*Stereoculon alpinum*	(Lindsay, 1869; Eriksson & Santesson, 1986)	= *Sphaeria stereocaulicola* Th. Fr. ex Linds.
7	*Lasiosphaeriopsis supersparsa* (Zopf) Triebel	*Porpidia*	(Triebel, 1989)	= *Phaeospora supersparsa* Arnold



Note a Group of ascornata. b Vertical section through a stroma. c Asci. d Cells from the stroma. e Ascospores. Scale bars: a = 300 µm, b = 200 µm, c = 25 µm, e = 10 µm.

Source Redrawn from Hawksworth (1980b)

Figure 2.115 *Lasiosphaeriopsis salisburyi*

Rhagadostomella Etayo (2)

Index Fungorum 28689, faceoffungi, MycoBank, GenBank

Classification: Nitschkiaceae, Coronophorales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

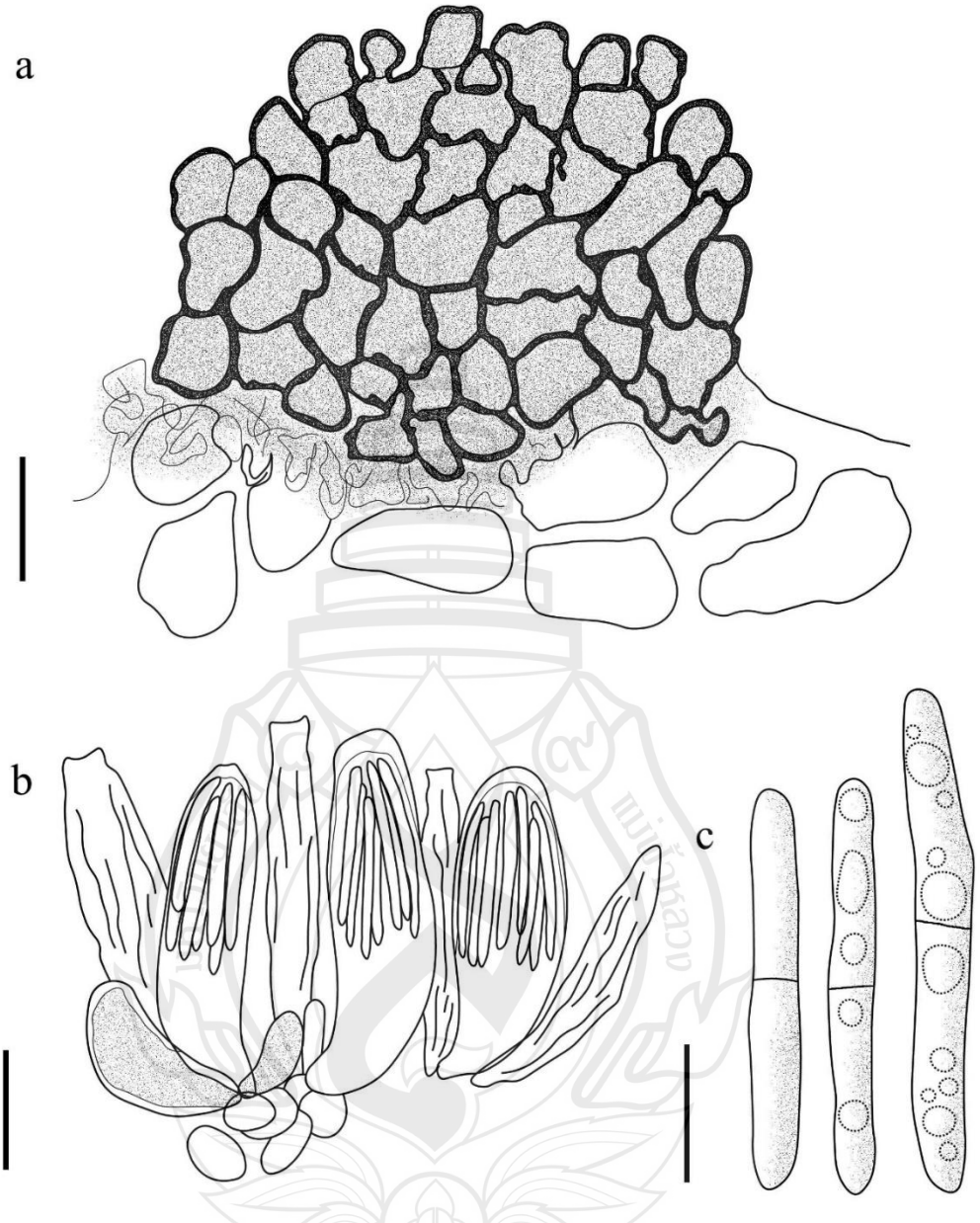
Rhagadostomella was introduced by Etayo (2002) to accommodate the type species *Rh. gregaria*, which grows on *Sticta weigelii*. It is characterized by its tiny ascomata with a rough surface, grouped together to form circular black patches. The ascoma wall consists of large, brown, subglobose cells. The asci are clavate, only slightly swollen at the apex, with spores positioned in the upuper part, leaving the lower half mostly empty. The dehiscence of the asci appears to be poricidal, and the ascospores are cylindrical, very narrow and one septate. *Rhagadostomella* was proposed to be placed within the family Nitschkiaceae based on its morphological characteristics by Etayo (2002). However, due to the lack of the molecular data, its phylogenetic status remains uncertain.

Since the establishment of *Rhagadostomella*, Flakus et al. (2019) introduced the second species, *Rh. hypolobariella*, which grows on foliose lichen *Lobariella pallida*. Currently, only two species are recognized within this genus, both of which are lichenicolous.

Type species: *Rhagadostomella gregaria* Etayo

Table 2.168 Accepted lichenicolous species of *Rhagadostomella*

	Species name	**Host**	**References**	**Remarks**
1	*Rhagadostomella gregaria* Etayo	*Sticta weigelii*	(Etayo, 2002a)	
2	*Rhagadostomella hypolobariella* Etayo & Flakus	*Lobariella pallida*	(Flakus et al., 2019b)	



Note a Ascomatal wall. b Asci. c Ascospores. Scale bars: a–b = 10 µm, c = 5 µm.

Source Redrawn from Etayo (2002a)

Figure 2.116 *Rhagadostomella gregaria*

Order Hypocreales Lindau

Family Bionectriaceae Samuels & Rossman

Acremonium Link (8-100)

Index Fungorum 7028, faceoffungi, MycoBank, GenBank

Classification: Bionectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Acremonium alternatum* Link

Table 2.169 Accepted lichenicolous species of *Acremonium*

	Species name	Host	References	Remarks
1	*Acremonium antarcticum* (Speg.) D. Hawksw.	*Teloschistes* facultatively lichenicolous	(Hawksworth, 1979a)	= *Sporotrichum antarcticum* Speg.
2	*Acremonium bavaricum* Brackel	*Melanelixia glabratula*	(Brackel et al., 2012)	
3	*Acremonium hypholomatis* (Boedijn) D. Hawksw.	Facultatively lichenicolous *Physcia stellaris*	(Boedijn, 1929; Brackel et al., 2012)	= *Cephalosporium hypholomatis* Boedijn
4	*Acremonium persicinum* (Nicot) W. Gams	Facultatively lichenicolous	(Gams, 1971)	= *Paecilomyces persicinus* Nicot
5	*Acremonium pertusariae* Brackel & Etayo	*Lepra* and *Pertusaria*	(Brackel et al., 2012)	
6	*Acremonium psychrophilum* C. Möller & W. Gams	*Turgidosculum complicatulum*	(Möller et al., 1993)	Probably lichenicolous

Table 2.169 (continued)

	Species name	Host	References	Remarks
7	*Acremonium spegazzinii* D. Hawksw.	*Leptogium*	(Hawksworth, 1979a)	
8	*Acremonium subeffusum* (Ellis & Galw.) Etayo & Brackel	*Physcia millegrana*	(Brackel et al., 2012)	= *Dendrodochium subeffusum* Ellis & Galloway
9	*Acremonium vanderkolkii* Boers & Diederich	*Lecanora* sp.	(Diederich et al., 2024)	

Nectriopsis Maire (27-73)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Bionectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Nectriopsis violacea* (J.C. Schmidt ex Fr.) Maire

Table 2.170 Accepted lichenicolous species of *Nectriopsis*

	Species name	Host	References	Remarks
1	*Nectriopsis albida* Etayo	*Sticta*	(Etayo, 2017)	
2	*Nectriopsis bacidinae* van den Boom	*Bacidia*	(Boom, 2021)	
3	*Nectriopsis cariosae* Brackel & D. G. Zimmermann	*Cladonia*	(von Brackel & Zimmermann, 2010)	

Table 2.170 (continued)

	Species name	Host	References	Remarks
4	*Nectriopsis cladoniicola* M. S. Cole & D. Hawksw.	*Cladonia*	(Cole et al., 2001)	
5	*Nectriopsis collematis* Diederich	*Collema*	(Aptroot et al., 1997)	
6	*Nectriopsis curtiseta* Etayo	*Sticta*	(Etayo, 2017)	
7	*Nectriopsis frangospora* Brackel	*Lepra albescens* and *Pertusaria rubefacta*	(Brackel, 2010a)	
8	*Nectriopsis gangwondoensis* S.Y. Kondr., Lőkös & Hur	*Phaeophyscia adiastola*	(Kondratyuk et al., 2018)	
9	*Nectriopsis guamuesii* Etayo	*Sticta*	(Etayo, 2002a)	
10	*Nectriopsis heterodermiae* Etayo	*Heterodermia*	(Etayo, 2002a)	
11	*Nectriopsis hirta* Etayo	*Pertusaria*	(Etayo, 2010b)	
12	*Nectriopsis indigens* (Arnold) Diederich & Schroers	Perithecioid lichens	(Sérusiaux et al., 1999)	= *Secoliga indigens* Arnold
13	*Nectriopsis lecanodes* (Ces.) Diederich & Schroers	*Lobaria, Peltigera, Pseudocyphellaria,* also on *Collema* and *Leptogium*	(Sérusiaux et al., 1999)	= *Sphaeria lecanodes* Ces.

Table 2.170 (continued)

	Species name	Host	References	Remarks
14	*Nectriopsis leptogii* Diederich	*Leptogium*	(Aptroot et al., 1997)	
15	*Nectriopsis lichenophila* (Speg.) Etayo	*Heterodermia*	(Etayo, 2002a)	= *Nectria lichenophila* Speg.
16	*Nectriopsis melongenoidea* Etayo	*Gomphillus*	(Etayo, 2017)	
17	*Nectriopsis micareae* Diederich, van den Boom & Ernst	*Micarea*	(Sérusiaux et al., 1999)	
18	*Nectriopsis mindoensis* (Petr.) Samuels	*Coenogonium*	(Samuels, 1988)	= *Nectria mindoensis* Petr.
19	*Nectriopsis perpusilla* (Mont.) Samuels	*Hypoxylon allantoideum*	(Samuels, 1988)	= *Hypocrea perpusilla* Mont.
20	*Nectriopsis peruvianus* Etayo & R. Sant.	*Dictyonema and Coccocarpia*	(Etayo, 2010a)	
21	*Nectriopsis physciicola* D. Hawksw. & Earl.-Benn.	*Physcia stellaris*	(Earland-Bennett et al., 2006)	
22	*Nectriopsis porinicola* Samuels	*Porina*	(Samuels, 1988)	

Table 2.170 (continued)

	Species name	Host	References	Remarks
23	*Nectriopsis silvaustralis* Etayo	*Pseudocyphellaria*	(Etayo & Sancho, 2008)	
24	*Nectriopsis tatrensis* (Alstrup) Lisická & Alstrup	*Thelidium*	(Lisická, 2005)	= *Nectria tatrensis* Alstrup
25	*Nectriopsis verseghyklarae* S. Y. Kondr., L. Lőkös & J.-S. Hur	*Verseghya klarae*	(Kondratyu et al., 2016)	
26	*Nectriopsis vinosa* Etayo	*Usnea*	(Etayo, 2017)	
27	*Nectriopsis vivida* Etayo & Sipman	*Elaeagia obovata*	(Etayo, 2017)	

Ovicuculispora Etayo (2)

Index Fungorum 565893, Faceoffungi, MycoBank, GenBank

Classification: Bionectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Ovicuculispora was established by Etayo (2010) and is characterized by producing two types of ascospores within a single ascus: macrospores and microspores. The type species, *Ovicuculispora parmeliae*, was transferred from *Diplodia parmeliae* Berk. & M.A. Curtis. This species is distinguished by its globose to subglobose ascomata, which are pink to red with a brighter papilla and a long-haired surface. The asci are clavate and contain one macrospore and four microspores. The ascospores are ellipsoid to narrowly ellipsoid, rounded at the apices, hyaline, and constricted at the

septum. Macrospores measure 29.7–47.7 × 12.0–22.1 µm, while microspores are 6.6–11.2 × 3.1–5.9 µm (Flakus et al., 2019b; Tadome et al., 2021). *O. parmeliae* exhibits significant variation in macrospore size and has been documented on multiple hosts (Lawrey et al., 1994; Cole et al., 2001; Diederich, 2003; Flakus et al., 2006; Etayo, 2010a).

Currently, only two species are recognized within the genus, both of which are lichenicolous. Although Telfer et al. (2015) submitted an ITS sequence labeled as *Ovicuculispora parmeliae* to GenBank, no phylogenetic analysis has yet incorporated this molecular data.

Type species: *Ovicuculispora parmeliae* (Berk. & M.A. Curtis) Etayo (Etayo, 2010a)

= *Diplodia parmeliae* Berk. & M.A. Curtis (Berkeley, 1875)

Table 2.171 Accepted lichenicolous species of *Ovicuculispora*

	Species name	Host	References	Remarks
1	*Ovicuculispora macrospora* Etayo	On sterile saxicolous crustose lichens	(Etayo, 2010a)	
2	*Ovicuculispora parmeliae* (Berk. & Curt.) Etayo	On various lichens	(Berkeley, 1875; Etayo, 2010a; Tadome et al., 2021)	= *Diplodia parmeliae* Berk. & M.A. Curtis

Paranectria Sacc**.** (4-16)

Index Fungorum 3707, Faceoffungi, MycoBank, GenBank

Classification: Bionectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Paranectria affinis* Sacc.

Table 2.172 Accepted lichenicolous species of *Paranectria*

	Species name	Host	References	Remarks
1	*Paranectria affinis* Sacc.	*Ephebe pubescens*	(Saccardo, 1878)	
2	*Paranectria alstrupii* Zhurb.	*Psoroma hypnorum*	(Zhurbenko, 2009a)	
	Paranectria oropensis (Rabenh.) D. Hawksw. & Piroz.	*Biatora*	(Hawksworth et al., 1977)	= *Sphaeria oropensis* Ces.
3	*Paranectria superba* D. Hawksw.	*Peltigera rufescens*	(Hawksworth, 1982c)	

Pronectria Clem. (49)

Index Fungorum 4370, Faceoffungi, MycoBank, GenBank

Classification: Bionectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Pronectria was established by Clements et al. (1931) with the type species *Pronectria lichenicola*, which was transferred from *Cryptodiscus lichenicola* Ces. (= *Nectria lichenicola* (Ces.) Sacc.). The genus was distinguished from *Nectriella* based on unique ascomatal features and its lichenicolous lifestyle. It is characterized by superficial, glabrous perithecia that grow on lichens, eight-spored unitunicate asci, and two-celled, hyaline or subhyaline ascospores (Clements et al., 1931). *Nectriella robergei* (Mont. & Desmaz.) Weese was classified as a species of *P. lichenicola* by Lowen (1990), a viewpoint accepted by Diederich (2018). Perera et al. (2023) gave a detailed description and illustration to the genus and the isotype *P. robergei*.

Since its establishment, Lowen (1990) transferred 12 species from other genera

to *Pronectria*, although four were later excluded or reclassified. Lowen (1990, 1995) also described three new species: *Pronectria terrestris* on *Thrombium*, *P. xanthoriae* on *Xanthoria parietina*, and *P. oligospora* on *Parmelia rudecta*. Further additions by Etayo et al., from the late 20th century included 15 species, and the transfer of *Pronectria dealbans* from *Sphaerella dealbans* Müll. Arg. (Etayo & Breuss, 1996; Etayo, 1998b; Etayo, 2001 & 2002a; Etayo & Sancho, 2008; Etayo, 2010a & c; Etayo et al., 2010; Etayo, 2017; Etayo et al., 2024). Von Brackel et al. (2010, 2013) described four species, while Zhurbenko et al., contributed five additional species between 2004 and 2018. (Zhurbenko et al., 2004; Zhurbenko et al., 2005; Zhurbenko, 2009a; von Brackel & Etayo, 2010; von Brackel, 2013; Zhurbenko et al., 2018). Khodosovtsev et al. (2012) introduced three species, and recent work by Darmostu et al. (2021) and Senanayake et al. (2023) has expanded the genus by two more species.

Currently, *Pronectria* comprises 49 recognized species, with molecular data available in GenBank for three sequences across two species. Initially placed in the family Bionectriaceae, this classification was later confirmed through phylogenetic analyses (Flakus et al., 2019b).

Type species: *Pronectria lichenicola* (Ces.) Clem.

= *Cryptodiscus lichenicola* Ces.

= *Pronectria robergei* (Mont. & Desm.) Lowen

= *Nectria robergei* Mont. & Desm.

Table 2.173 Accepted lichenicolous species of *Pronectria*

	Species name	Host	References	Remarks
1	*Pronectria algicola* Vondrák, Naumovich & Khodos	*Sarcosagium* or *Steinia*	(Khodosovtsev et al., 2012)	

Table 2.173 (continued)

	Species name	Host	References	Remarks
2	*Pronectria anisospora* (Lowen) Lowen	*Hypogymnia physodes*	(Lowen, 1990)	= *Nectriella anisospora* Lowen = *Acremonium pedatum* Lowen (Anamorph)
3	*Pronectria biglobosa* Etayo	*Hypotrachyna*	(Etayo, 2017)	
4	*Pronectria caloplacae* Khodos., Vondrák & Naumovich	*Caloplaca austrocitrina*	(Khodosovtsev et al., 2012)	
5	*Pronectria casaresii* Etayo	*Evernia prunastri*	(Etayo, 1998b)	
6	*Pronectria collematis* Etayo & Brackel	*Collema undulatum*	(von Brackel & Etayo, 2010)	
7	*Pronectria dealbans* (Müll. Arg.) Etayo & Breuss	*Endocarpon*	(Etayo & Breuss, 1996)	= *Sphaerella dealbans* Müll. Arg.
8	*Pronectria dillmaniae* Zhurb.	*Catapyrenium cinereum*	(Zhurbenko et al., 2005)	

Table 2.173 (continued)

	Species name	Host	References	Remarks
9	*Pronectria diplococca* Kocourk., Khodos., Naumovich, Vondrák & Motiej.	*Collema*	(Khodosovtsev et al., 2012)	
10	*Pronectria echinulata* Lowen	*Physcia aipolia*	(Rossman et al., 1999)	
11	*Pronectria erythrinella* (Nyl.) Lowen	*Peltigera*	(Lowen, 1990)	= *Sphaeria erythrinella* Nyl.
12	*Pronectria etayoi* E. Zimm. & F. Berger	*Physcia stellaris*	(Berger et al., 2020)	
13	*Pronectria fragmospora* Etayo	*Usnea*	(Etayo & Sancho, 2008)	
14	*Pronectria gromakovae* Darmostuk	*Lecanora populicola*	(Darmostuk, 2021a)	
15	*Pronectria hymeniicola Etayo*	*Collema glaucophthalmum*	(Etayo, 2010a)	
16	*Pronectria invisibilis Etayo*	*Nephroma antarcticum*	(Etayo & Sancho, 2008)	
17	*Pronectria japonica* Zhurb., Tadome & Y. Ohmura	*Ochrolechia*	(Zhurbenko et al., 2018)	

Table 2.173 (continued)

	Species name	Host	References	Remarks
18	*Pronectria lecideicola* Zhurb.	*Lecidea ramulosa*	(Zhurbenko, 2009a)	
19	*Pronectria leptaleae* (J. Steiner) Lowen	*Physcia leptalea*	(Lowen, 1990)	= *Pharcidia leptaleae* J. Steiner
20	*Pronectria leptogii* Etayo	*Leptogium*	(Etayo, 2002a)	
21	*Pronectria lichenicola* (Ces.) Clem.	*Peltigera canina*	(Clements et al., 1931)	= *Cryptodiscus lichenicola* Ces.
22	*Pronectria loweniae* Flakus, Etayo, Rodr. Flakus & Zhurb.	*Solorina saccata*	(Senanayake et al., 2023)	
23	*Pronectria microspora* Etayo	*Lobaria pallida*	(Etayo, 2002a)	
24	*Pronectria minuta* Motiej. & Kukwa	*Cladonia stellaris*	(Motiejūnaitė et al., 2008)	
25	*Pronectria neofissuriprodiens* F. Berger & E. Zimm.	*Lobaria pulmonaria* f. *papillaris*	(Berger et al., 2016)	
26	*Pronectria occulta* Etayo	*Usnea*	(Etayo & Sancho, 2008)	

Table 2.173 (continued)

	Species name	Host	References	Remarks
27	*Pronectria oligospora* Lowen & Rogersen	*Parmelia rudecta*	(Lowen, 1995)	
28	*Pronectria parmotrematis* Etayo	*Parmotrema*	(Etayo, 2001)	
29	*Pronectria pedemontana* Brackel	*Collema auriforme*	(von Brackel, 2013)	
30	*Pronectria pertusariicola* Lowen	*Lepra* and *Pertusaria pertusa*	(Rossman et al., 1999)	
31	*Pronectria pilosa* Etayo & López Silanes	*Collema furfuraceum*	(de Silanes et al., 2009)	
32	*Pronectria pycnidioidea* Etayo	*Heterodermia*	(Etayo, 2017)	
33	*Pronectria rhizocarpicola* Brackel	*Rhizocarpon geographicum*	(Brackel, 2013)	
34	*Pronectria robergei* (Mont. & Desm.) Lowen	*Peltigera*	(Lowen, 1990)	= *Nectria robergei* Mont. & Desm.
35	*Pronectria rolfiana* Etayo	*Solorina*	(Etayo et al., 2010)	

Table 2.173 (continued)

	Species name	Host	References	Remarks
36	*Pronectria roseopunctata* Etayo	*Hypotrachyna*	(Etayo, 2002a)	
37	*Pronectria santessonii* (Lowen & D. Hawksw.) Lowen	*Anaptychia runcinata*	(Lowen, 1990)	= *Nectriella santessonii* Lowen & D. Hawksw.
38	*Pronectria scrobiculatae* Etayo & López de Silanes	*Lobarina scrobiculata*	(Etayo et al., 2024)	
39	*Pronectria sticticola* Etayo	*Sticta weigelii*	(Etayo, 2002a)	
40	*Pronectria tenacis* (Vouaux) Lowen	*Collema tenax*	(Lowen, 1990)	= *Pharcidia mammillula* f. *tenacis* Vouaux
41	*Pronectria tenuispora* (D. Hawksw.) Lowen	*Peltigera polydactyla*	(Lowen, 1990)	= *Nectriella tenuispora* D. Hawksw.
42	*Pronectria terrestris* Lowen & Diederich	*Thrombium epigaeum*	(Lowen et al., 1990)	
43	*Pronectria tibellii* Zhurb.	*Cladonia pocillum*	(Zhurbenko et al., 2004)	

Table 2.173 (continued)

	Species name	Host	References	Remarks
44	*Pronectria tincta* (Fuckel) Lowen	*Anaptychia ciliaris*	(Lowen, 1990)	= *Cryptodiscus tinctus* Fuckel
45	*Pronectria toniniae* Etayo	*Toninia sedifolia*	(Etayo, 2010c)	
46	*Pronectria verrucariae* (Vouaux) Lowen	*Verrucaria integra*	(Lowen, 1990)	= *Nectria verrucariae* Vouaux
47	*Pronectria walkerorum* Zhurb.	*Ochrolechia*	(Zhurbenko et al., 2005)	
48	*Pronectria xanthoriae* Lowen & Diederich	*Xanthoria parietina*	(Lowen et al., 1990)	
49	*Pronectria zhurbenkoi* Brackel	*Peltigera praetextata*	(Brackel, 2015)	

Trichonectria Kirschst. (16-24)

Index Fungorum 5563, Faceoffungi, MycoBank, GenBank

Classification: Bionectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Trichonectria was established by Kirschstein (1906) to include the type species *Trichonectria aculeata*. However, as the original type specimen of *T. aculeata* was apparently lost, Hawksworth (1978) neotypified the genus based on *T. hirta*, which had been transferred from *Nectria hirta* A. Bloxam. This neotypification confirmed the synonymy between *T. aculeata* and *T. hirta*.

The genus is characterized by its superficial, non-stromatic ascomata, which are

scattered and vary in color from light yellowish and orange to brownish. The asci are unitunicate, clavate to subcylindrical, and the ascospores are hyaline with smooth walls. In the type species, ascospores range from uniseptate and ellipsoidal to multiseptate and elongate-cylindrical (Currey, 1863; Hawksworth, 1978; Etayo, 2017). Samuels (1988) distinguished *Trichonectria* from *Nectriopsis* by the presence of thick-walled hairs or setae on the ascomata and the production of phragmospores (multiseptate spores). He emphasized the diagnostic value of the ascomatal hairs and the Cephalosporiopsis-type anamorphs, describing several species with uniseptate spores.

Since its establishment, seven species of *Trichonectria* have been found to occur on mosses, fungi, or other plants. Currently, 24 species are recognized within the genus, 16 of which are lichenicolous. Although sequences from nine species are available in GenBank, no phylogenetic analysis has been conducted to clarify its systematic position. Consequently, *Trichonectria* remains assigned to the family Bionectriaceae.

Type species: *Trichonectria hirta* (A. Bolxam) Petch

= *Nectria hirta* A. Bloxam

Table 2.174 Accepted lichenicolous species of *Trichonectria*

	Species name	Host	References	Remarks
1	*Trichonectria apiculata* Etayo	*Usnea*	(Etayo, 2017)	
2	*Trichonectria australis* Etayo	*Usnea*	(Etayo & Sancho, 2008)	
3	*Trichonectria calopadiicola* Farkas & Flakus	*Calopadia* cf. *puiggari*	(Farkas et al., 2016)	

Table 2.174 (continued)

	Species name	Host	References	Remarks
4	*Trichonectria cladoniicola* (Alstrup & Svane) Alstrup	*Cladonia stygia*	(Alstrup et al., 2004)	= *Nectria cladoniicola* Alstrup & Svane
5	*Trichonectria epimegalosporae* Darmostuk, Etayo & Flakus	*Megalospora sulphurata* var. *sulphurata*	(Crous et al., 2023)	
6	*Trichonectria furcatosetosa* Brackel	*Melanelixia, Parmelia, Physcia* and *Candelariella*	(Brackel, 2014)	
7	*Trichonectria hirta* (A. Bolxam) Petch	*Corticolous lichens*	(Currey, 1863; Petch, 1937)	= *Nectria hirta* A. Bloxam
8	*Trichonectria hypotrachynae* Etayo	*Hypotrachyna*	(Etayo, 2002a)	
9	*Trichonectria intermedia* Etayo	*Parmotrema*	(Etayo, 2017)	
10	*Trichonectria leptogiicola* Etayo	*Leptogium phyllocarpum*	(Etayo, 2001)	
11	*Trichonectria parmeliellae* Etayo	*Parmeliella testacea*	(Etayo et al., 2024)	
12	*Trichonectria pertusariae* Etayo & van den Boom	*Pertusaria ophthalmiza*	(Etayo & Boom, 2005)	

Table 2.174 (continued)

	Species name	Host	References	Remarks
13	*Trichonectria puncteliae* Darmostuk, Etayo & Flakus	*Punctelia borreri*	(Crous et al., 2023)	
14	*Trichonectria pyrenaica* Gardiennet & Lechat	*Usnea*	(Gardiennet et al., 2011)	
15	*Trichonectria setadpressa* Etayo	*Lobaria pallida*	(Etayo, 2002a)	
16	*Trichonectria usneicola* Etayo	*Usnea*	(Etayo, 2002a)	

Family Clavicipitaceae Rogerson

Neobarya Lowen (4-11)

Index Fungorum 25587, Faceoffungi, MycoBank, GenBank

Classification: Clavicipitaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Neobarya parasitica* (Fuckel) Lowen

= *Barya parasitica* Fuckel

Table 2.175 Accepted lichenicolous species of *Neobarya ciliaris*

	Species name	Host	References	Remarks
1	*Neobarya ciliaris* Etayo	*Heterodermia lutescens*	(Etayo, 2002a)	
2	*Neobarya darwiniana* Etayo	*Nephroma antarcticum*	(Etayo & Sancho, 2008)	

Table 2.175

	Species name	Host	References	Remarks
3	*Neobarya lichenophila* (Ferd. & Winge) Lowen & Samuels	On rotten thallus of *Cladonia*	(Candoussau et al., 2007)	= *Barya lichenophila* Ferd. & Winge
4	*Neobarya peltigerae* Lowen, Boqueras & Gomez-Bolea	*Peltigera membranacea*	(Candoussau et al., 2007)	

Family Cordycipitaceae Kreisel ex G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora

Neobaryopsis Flakus, Etayo, Kukwa & Rodr. Flakus (1)

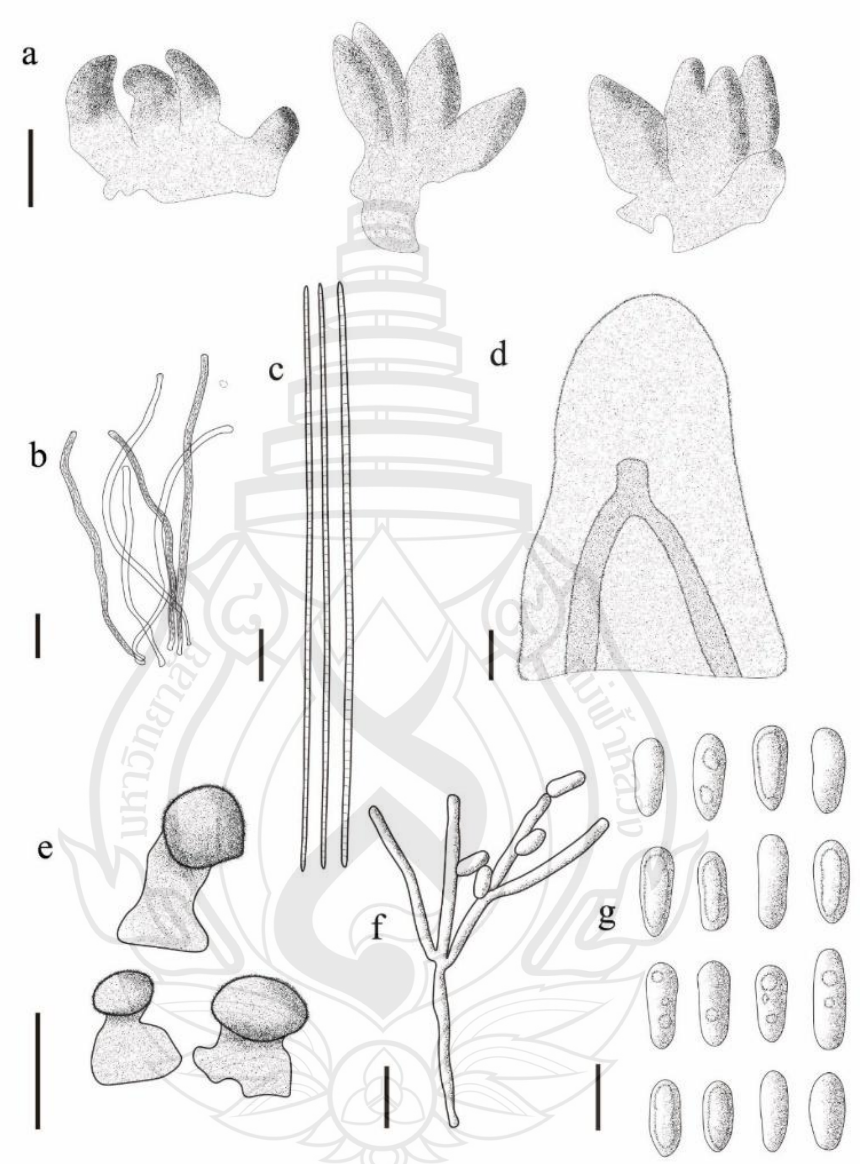
Index Fungorum 833335, Faceoffungi, MycoBank, GenBank

Classification: Cordycipitaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Neobaryopsis was introduced by Flaks et al. (2019) based on a phylogenetic analysis of SSU, LSU, RPB1, RPB2, and TEF1 sequence data. The analysis strongly supported the placement of this genus within the family Cordycipitaceae, distinguishing it as a unique group among lichenicolous fungi similar to *Neobarya*. The type species, *Neobaryopsis andensis*, is currently the sole member of the genus and is found on the thallus of *Lobariella*.

Neobaryopsis andensis is characterized by narrowly pyriform, yellowish to orange perithecioid ascomata that develop on a reduced, white, arachnoid subiculum. The ascospores are large, needle-shaped, and contain 50–90 septa. The asexual morph produces a hyaline to pink or yellowish-orange conidial mass with a white stipe. The conidiophores are branched, bearing large phialides, and the conidia are hyaline, ranging from ellipsoidal to obovoid in shape.

Type species: *Neobaryopsis andensis* Flakus, Etayo, Kukwa & Rodr. Flakus, on *Lobariella* (Flakus et al., 2019b)



Note a Perithecioid ascomata. b Asci. c Ascospores. d Section of the apical part of peridium. e Capitate synnemata. f Conidiogenous cells. g Conidia. Scale bars: a, e = 250 µm, b = 50 µm, c, f = 10 µm, d = 25 µm, g = 5 µm.

Source Redrawn from Flakus et al. (2019b)

Figure 2.117 *Neobaryopsis andensis*

Syspastospora P.F. Cannon & D. Hawksw. (1-4)

Index Fungorum 5354, Faceoffungi, MycoBank, GenBank

Classification: Cordycipitaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Syspastospora parasitica* (Tul.) P.F. Cannon & D. Hawksw.

= *Sphaeronaema parasiticum* Tul.

Accepted lichenicolous species:

Syspastospora cladoniae Etayo, on *Cladonia convolute* (Etayo, 2008)

Family Hypocreaceae De Not.

Hypomyces (Fr.) Tul. & C. Tul. (1-100)

Index Fungorum 2446, Faceoffungi, MycoBank, GenBank

Classification: Hypocreaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

= *Hypocrea* subgen. *Hypomyces* Fr.

Type species: *Hypomyces lactifluorum* (Schwein.) Tul. & C. Tul.

= *Sphaeria lactifluorum* Schwein.

Accepted lichenicolous species:

Hypomyces peltigericola Lechat & Gardiennet, on *Peltigera canina* (Lechat et al., 2017)

Lichenobarya Etayo, Diederich & Lawrey (1)

Index Fungorum 811832, Faceoffungi, MycoBank, GenBank

Classification: Hypocreaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

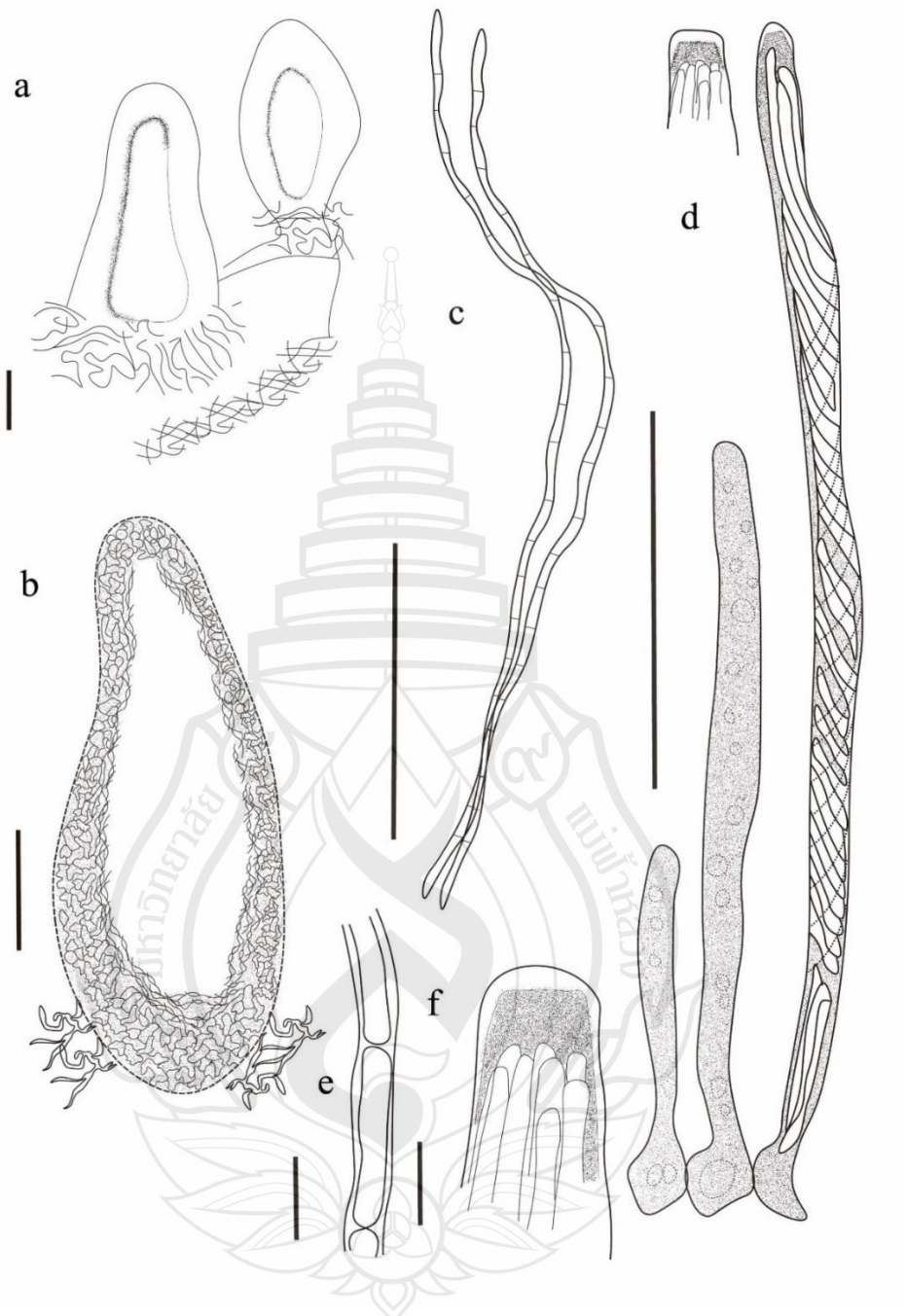
Lichenobarya was introduced by Etayo, Diederich and Lawrey (2015) based on molecular evidence to accommodate the type species *Lichenobarya usneae*, which parasitizes *Usnea rubicunda*. Initially, *L. usneae* was described as *Neobarya usneae* by Etayo in 2002, owing to its similarities with *Neobarya ciliaris*, including spore shape,

the presence of basal hyphae in the thallus, and a KI+ blue reaction in the ascomatal wall. However, a phylogenetic analysis by Lawrey et al. (2015) using ITS and nrLSU sequence data revealed that *N. usneae* is not closely related to the type species of *Neobarya* within the family Clavicipitaceae but instead belongs to the family Hypocreaceae. As a result, *Lichenobarya* was established as a new genus within Hypocreaceae (Hypocreales).

This genus is characterized by superficial, obpyriform, brown perithecioid ascomata that are immersed in a poorly developed, often indistinct subiculum. The asci are elongate, with a non- or only slightly thickened apex, and the ascospores are long, filiform, and multiseptated (Etayo, 2002a). Currently, *Lichenobarya usneae* remains the only recognized species in this genus, with one LSU and three ITS sequences available in GenBank.

Type species: *Lichenobarya usneae* (Etayo) Etayo, Diederich & Lawrey (Lawrey et al., 2015)

= *Neobarya usneae* Etayo (Etayo, 2002a)



Note a Ascomata. b Cross-section of ascomata. c Hyphae of the subiculum. d Asci at different stages. e Detail of a hyphae of subiculum. f Apex of ascus. Scale bars: a–b = 100 µm, c–e = 10 µm, f = 2 µm.

Source Redrawn from *Neobarya usneae* Etayo (2002a)

Figure 2.118 *Lichenobarya usneae*

Family Myrotheciomycetaceae Crous

Trichothecium Link (1-25)

Index Fungorum 10303, Faceoffungi, MycoBank, GenBank

Classification: Hypocreales genera incertae sedis, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Trichothecium roseum* (Pers.) Link

= *Trichoderma roseum* Pers.

Accepted lichenicolous species:

Trichothecium roseum (Pers. ex Fr.) Link ex Fr. Facultative lichenicolous (Link 1809)

= *Trichoderma roseum* Pers. (Persoon, 1794a)

Family Nectriaceae Tul. & C. Tul.

Cylindromonium Crous (5-7)

Index Fungorum 832900, Faceoffungi, MycoBank, GenBank

Classification: Nectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

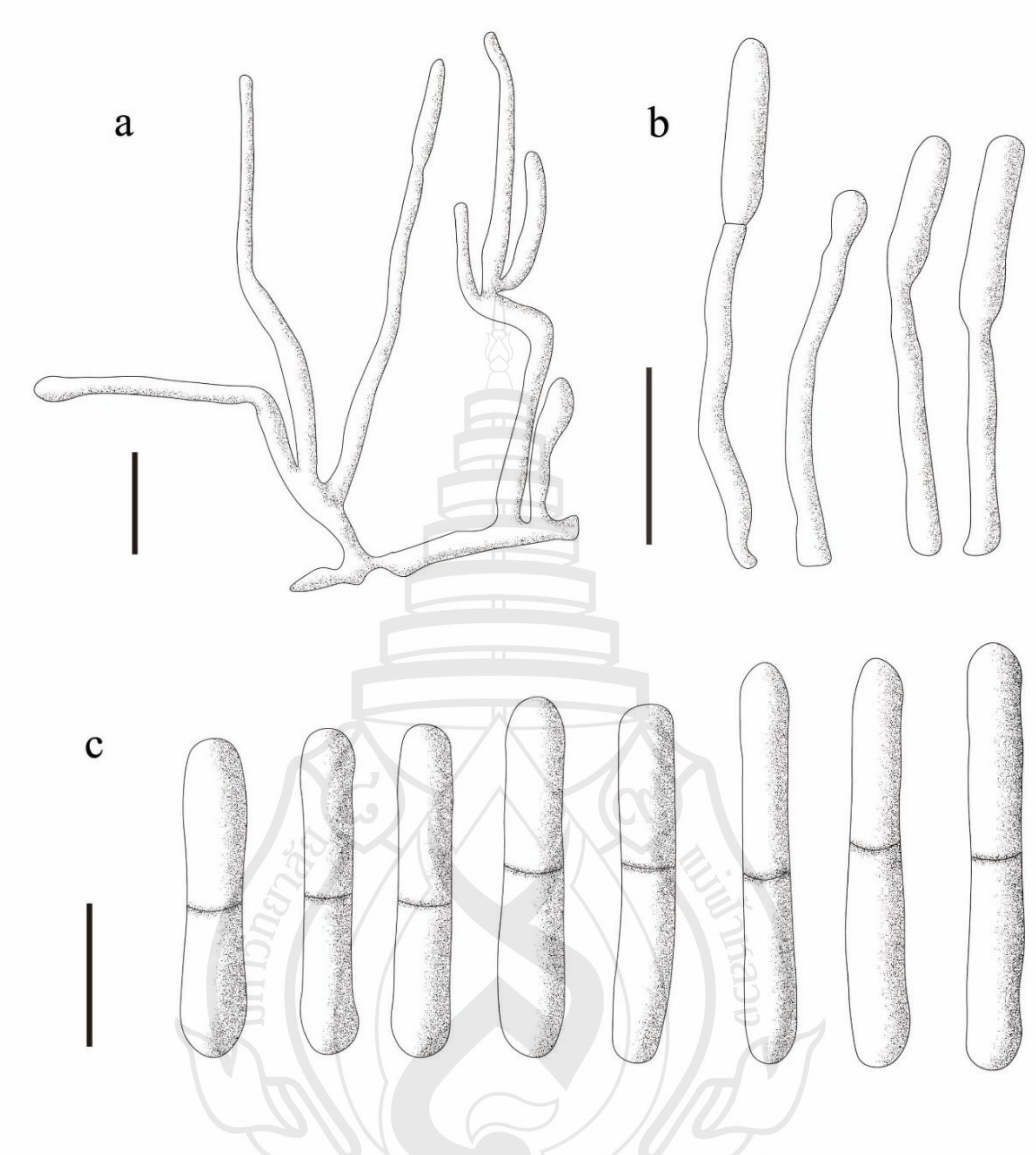
Cylindromonium was introduced by Crous et al. (2019) based on molecular analysis to accommodate *C. eugeniicola*, a new species found on leaf litter, along with two lichenicolous species, *C. lichenicola* and *C. rhabdosporum*, which were transferred from *Acremonium lichenicola* and *Acremonium rhabdosporum*, respectively. These species were found on *Parmelia* and *Cladonia*. Subsequently, Crous et al. (2020) added *C. alloxyli*, a species found on leaves, and Crous et al. (2021, 2023) further expanded the genus with two additional lichenicolous species: *C. everniae* on *Evernia prunastri* and *C. lichenophilum* on *Parmelina tiliacea*. Most recently, Ohmaki et al. (2023) described *C. dirinariae*, a lichenicolous species found on *Dirinaria applanata*. Currently, *Cylindromonium* comprises seven recognized species, five of which are lichenicolous.

This genus is characterized by hyaline, smooth, septate, and branched mycelium. Conidiophores are also hyaline and smooth, appearing either as individual unbranched conidiophores with a terminal phialide or as complex structures with a basal cylindrical cell that produces 2–4 phialides. The basal cell is subcylindrical, hyaline, smooth, and septate. Conidiogenous cells are phialidic, subcylindrical, and tapered apically with a flared collarette. Conidia are solitary or grouped in mucoid packets, cylindrical with obtuse ends, hyaline, smooth, granular, and typically 1-septate at the median (Crous et al., 2019).

Type species: *Cylindromonium eugeniicola* Crous

Table 2.176 Accepted lichenicolous species of *Cylindromonium*

	Species name	**Host**	**References**	**Remarks**
1	*Cylindromonium dirinariae* Ohmaki, Okane, Crous & Verkley	*Dirinaria applanata*	(Ohmaki et al., 2023)	
2	*Cylindromonium everniae* Crous & Boers	*Evernia prunastri*	(Crous et al., 2021)	
3	*Cylindromonium lichenicola* (W. Gams) Crous	on lichens and other substrata	(Gams, 1971; Crous et al., 2019)	= *Acremonium lichenicola* W. Gams
4	*Cylindromonium lichenophilum* Crous	*Parmelina tiliacea*	(Crous et al., 2023)	
5	*Cylindromonium rhabdosporum* (W. Gams) Crous	*Parmelia*, also from *Cladonia*	(Gams, 1971; Crous et al., 2019)	= *Acremonium rhabdosporum* W. Gams



Note a Conidiophores with conidiogenous cells. b Conidiogenous cells. c Conidia.

Scale bars: ab = 10 μm, c = 5 μm.

Source Redrawn from Crous et al. (2019)

Figure 2.119 *Cylindromonium eugeniicola*

Globonectria Etayo (1)

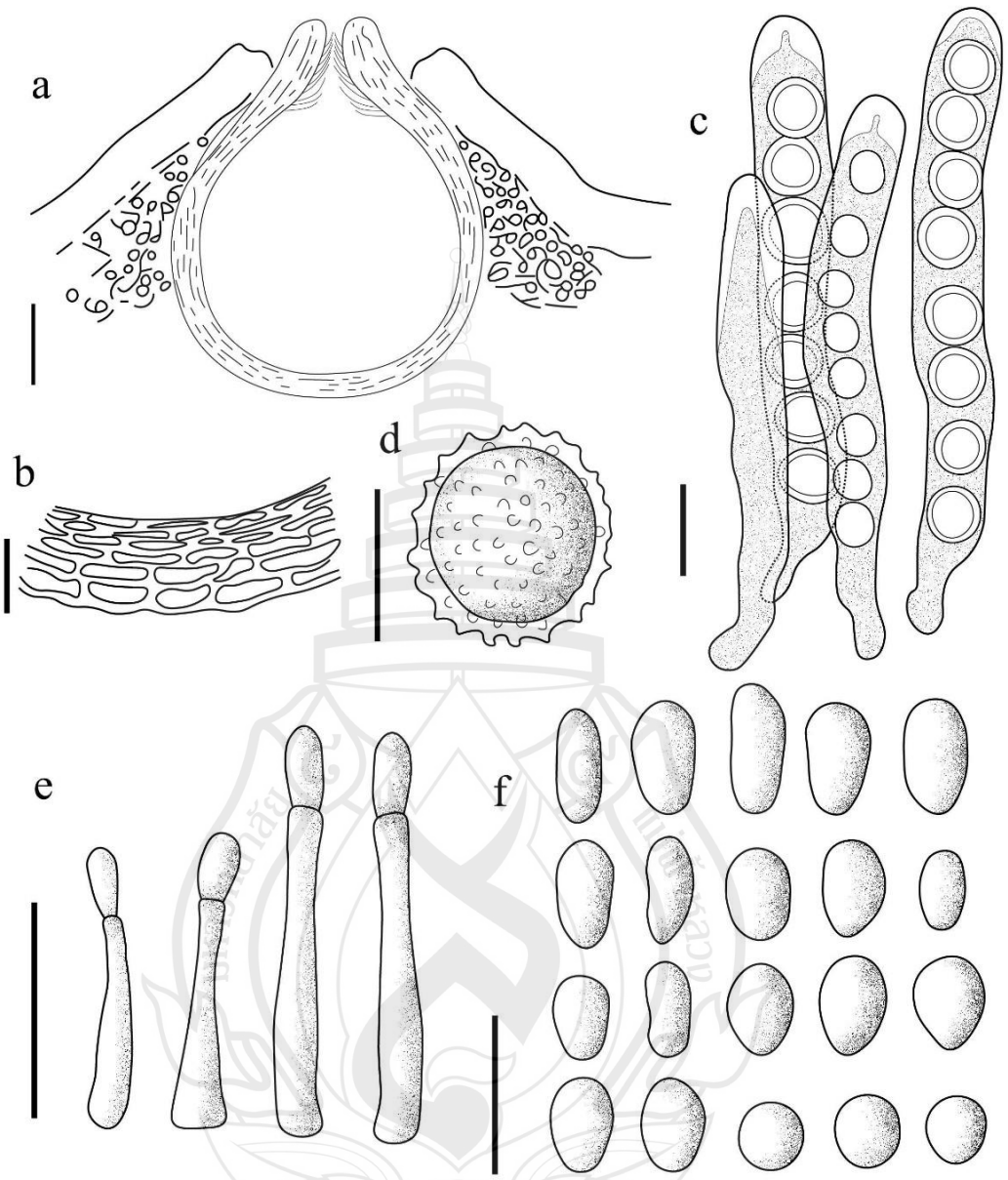
Index Fungorum 28686, Faceoffungi, MycoBank, GenBank

Classification: Nectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

The monotypic genus *Globonectria* was described by Etayo (2002) and is distinguished by its immersed or erumpent, orbicular perithecia that grow on the thalli of foliose lichens, cylindrical asci with 8 uniseriate spores and a non-amyloid tholus. The ascospores are hyaline, orbicular, ornamented. In 2019, Flakus et al., identified an *Acremonium*-like anamorph associated with the type species, *G. cochensis*, confirmed through phylogenetic analysis to represent the species' asexual state. This asexual morph is characterized by sporodochia-like clusters of conidiophores, hyaline, aseptate conidiogenous cells, and hyaline, aseptate, subglobose to broadly ellipsoidal conidia.

Initially, Etayo (2002) placed *Globonectria* within the order Hypocreales, noting its similarity to genera in the families Bionectriaceae and Hypocreaceae. Lumbsch et al. (2007) subsequently assigned it to Bionectriaceae, a placement widely accepted in subsequent studies (Lumbsch et al., 2007; Lumbsch et al., 2010; Wijayawardene et al., 2020; Wijayawardene et al., 2022). However, new sequence data and phylogenetic analysis by Flakus et al. (2019) revealed that *Globonectria* forms a monophyletic group within the Nectriaceae clade. As a result, the genus is now placed within the family Nectriaceae (Hypocreales).

Type species: *Globonectria cochensis* Etayo, on *Lobaria pallida* (Etayo 2002a)



Note a Section of ascoma. b Section of the ascomatal wall. c Asci. d Ascospore. e Conidiogenous cells. f Conida. Scale bars: a = 50 µm, b = 20 µm, c, e = 10 µm, d, f = 5 µm.

Source Redrawn from Etayo (2002a) and Flakus et al. (2019b)

Figure 2.120 *Globonectria cochensis*

Nectria (Fr.) Fr. (2-300)

Index Fungorum 3431, Faceoffungi, MycoBank, GenBank

Classification: Nectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

= *Hypocrea* sect. *Nectria* Fr.

Type species: *Nectria cinnabarina* (Tode) Fr.

= *Sphaeria cinnabarina* Tode

Table 2.177 Accepted lichenicolous species of *Nectria*

	Species name	Host	References	Remarks
1	*Nectria brutia* Diederich & Puntillo	*Collema*	(Diederich & Puntillo, 1995)	
2	*Nectria byssophila* Rossman	*Pannaria, Peltigera, Pseudocyphellaria* and *Psoroma*	(Rossman, 1979)	

Scolecofusarium L. Lombard, Sand.-Den. & Crous (1)

Index Fungorum 838676, Faceoffungi, MycoBank, GenBank

Classification: Nectriaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

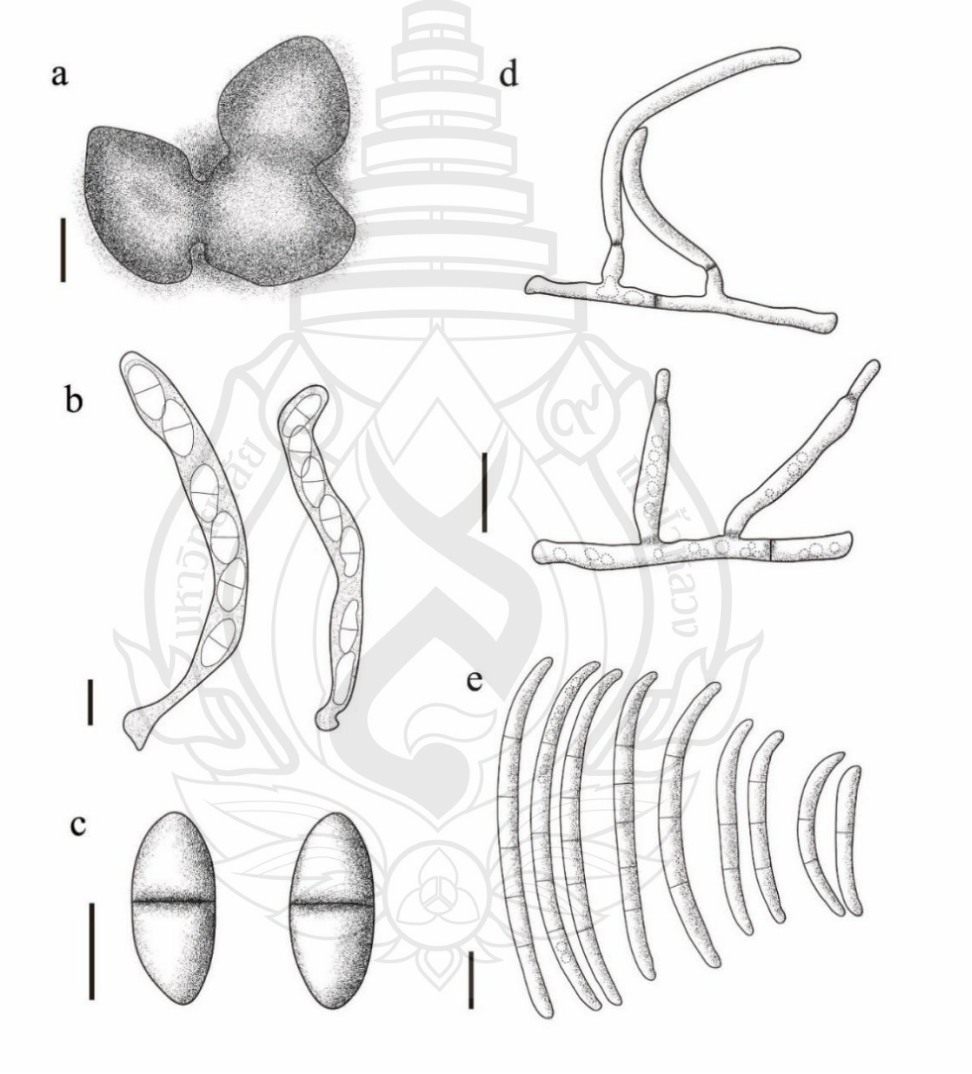
Scolecofusarium was introduced by Lombard, Sand.-Den. & Crous (2021) to accommodate *S. ciliatum*, a species originally described as *Tubercularia ciliata* by von Albertini & Schweinitz in 1805. (von Albertini et al., 1805). The lichenicolous species *Fusarium peltigerae* Westend., found on *Peltigera*, was later synonymized with *S. ciliatum* (Westendorp et al., 1849). This genus is characterized by red perithecia that produce cylindrical asci containing ellipsoidal, 1-septate, finely spinulose ascospores. Its asexual morph exhibits fusarioid features, with monophialides producing slender, nearly cylindrical macroconidia from aerial conidiophores and pink to salmon-colored

sporodochia. Notably, *Scolecofusarium* lacks both microconidia and chlamydospores (Crous, Lombard, et al., 2021).

Type species: *Scolecofusarium ciliatum* (Alb. & Schwein.) L. Lombard, Sand.-Den. & Crous (Crous et al., 2021)

= *Tubercularia ciliata* Alb. & Schwein.

= *Fusarium peltigerae* Westend., on *Peltigera*



Note a Ascomata. b Asci. c Ascospores. d Conidiophores and conidiogenous cells. e Conida. Scale bars: a = 100 µm, b, d, e = 10 µm, c = 5 µm.

Source Redrawn from Crous et al. (2021)

Figure 2.121 *Scolecofusarium ciliatum*

Xenonectriella Weese (21)

Index Fungorum 5822, Faceoffungi, MycoBank, GenBank

Classification: Nectriaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Xenonectriella was introduced by Weese (1919) to accommodate the type species *Xenonectriella lutescens*, originally described as *Nectria lutescens* by Arnold (1883). Rehm initially classified this species within *Pleonectria* based on spore characteristics. However, upon re-examining the original specimen, Weese (1919) determined that the spores were not truly muriform. Consequently, Weese established *Xenonectriella* as a distinct genus.

This genus is characterized by simple, subimmersed perithecia with a soft, nectriaceous context. The asci are predominantly 2-spored, although 3- to 5-spored asci may also occur. The ascospores are elliptical to oblong, initially two-celled but later developing into pseudo-multiseptate, muriform structures. They are hyaline to brown with a verrucose surface (Weese, 1919).

Since its establishment, numerous species have been added to *Xenonectriella* through transfers and new descriptions. Rossman (1999) transferred three species from *Nectriella* and *Pronectria*, while Etayo et al. (2008–2017) introduced eight new species and transferred four more from *Nectria* and *Pronectria*. Subsequently, Berger et al. (2020) introduced two new species and transferred another from *Pronectria*, with additional species described by Brackel (2014, 2016) and Pérez-Ort (2020).

To date, 21 species are recognized within *Xenonectriella*, all of which are lichenicolous. However, the phylogenetic status of *Xenonectriella* remains uncertain due to the absence of sequence data in GenBank. Its classification within the family Nectriaceae awaits confirmation pending the availability of molecular data.

Type species: *Xenonectriella lutescens* (Arnold) Weese

= *Nectria lutescens* Arnold ex Rehm

Table 2.178 Accepted lichenicolous species of *Xenonectriella*

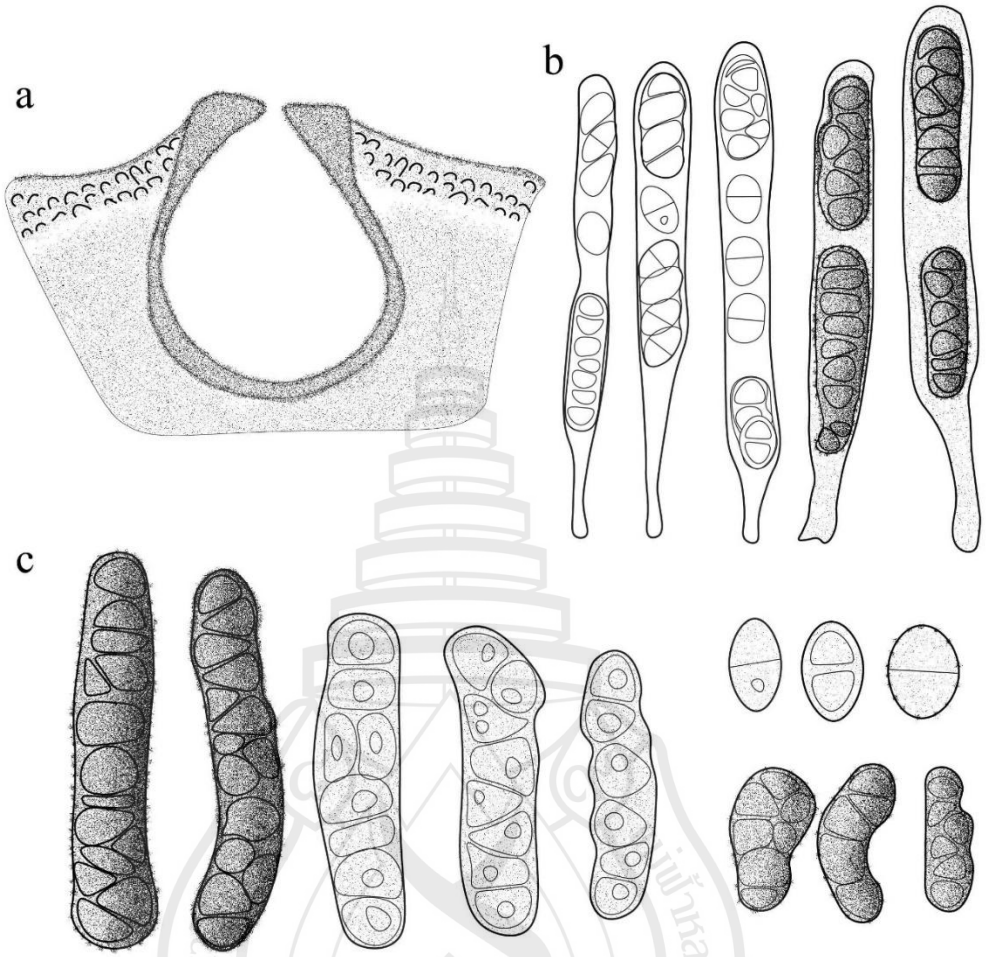
	Species name	Host	References	Remarks
1	*Xenonectriella angulospora* (Etayo) F. Berger	*Heterodermia obscurata*	(Etayo, 1998b; Berger et al., 2020)	= *Pronectria angulospora* Etayo
2	*Xenonectriella aurantiaca* Etayo	*Pseudocyphellaria*	(Etayo & Sancho, 2008)	
3	*Xenonectriella calabrica* Brackel & Puntillo	*Pertusaria pertusa*	(Brackel et al., 2016)	
4	*Xenonectriella coppinsiana* Etayo	*Yoshimuriella subdissecta*	(Etayo, 2017)	
5	*Xenonectriella dirinariae* Etayo & van den Boom	*Dirinaria*	(Etayo & van den Boom, 2013)	
6	*Xenonectriella fissuriprodiens* (Etayo) Etayo	*Lobaria pulmonaria*	(Etayo & Diederich, 1996b; Etayo 2017)	= *Pronectria fissuriprodiens* Etayo
7	*Xenonectriella humilis* Etayo	*Pseudocyphellaria freycinetii*	(Etayo & Sancho, 2008)	
8	*Xenonectriella leptaleae* (J. Steiner) Rossman & Lowen	*Physcia leptalea and Physconia*	(Fritsch, 1900; Rossman et al., 1999)	= *Pharcidia leptaleae* J. Steiner

Table 2.178 (continued)

	Species name	Host	References	Remarks
9	*Xenonectriella leptaleoides* (Etayo) Etayo	*Leptogium phyllocarpum*	(Etayo, 2002a; Etayo & Sancho, 2008)	= *Pronectria leptaleoides* Etayo
10	*Xenonectriella lutescens* (Rehm) Weese	*Solorina saccata*	(Rehm, 1883; Weese, 1919)	= *Nectria lutescens* Arnold ex Rehm
11	*Xenonectriella nephromatis* Pérez-Ort.	*Nephroma bellum*	(Spribille et al., 2020)	
12	*Xenonectriella ornamentata* (D. Hawksw.) Rossman	*Peltigera*	(Hawksworth, 1982b; Rossman et al., 1999)	= *Nectriella ornamentata* D. Hawksw.
13	*Xenonectriella physciacearum* F. Berger, E. Zimm. & Brackel	*Physconia venusta*	(Berger et al., 2020)	
14	*Xenonectriella protopannariae* (Zhurb.) Brackel	*Protopannaria pezizoides,* associated with *Cercidospora punctillata*	(Zhurbenko, 2007b; Brackel, 2014)	= *Pronectria protopannariae* Zhurb.
15	*Xenonectriella rosea* Etayo	*Pannaria farinosa*	(Etayo & Sancho, 2008)	

Table 2.178 (continued)

	Species name	Host	References	Remarks
16	*Xenonectriella rugulatispora* Etayo	*Lobariella*	(Etayo, 2017)	
17	*Xenonectriella septemseptata* (Etayo) Etayo & van den Boom	*Melanelia glabratula*	(Etayo, 1998b; Van den Boom & Etayo, 2014)	= *Pronectria septemseptata* Etayo
18	*Xenonectriella streimannii* (S. Y. Kondr., Coppins & D. J. Galloway) Rossman	*Lobaria* and *Sticta cyphellulata*	(Kondratyuk, 1996; Rossman et al., 1999)	= *Pronectria streimannii* S.Y. Kondr., Coppins & D.J. Galloway
19	*Xenonectriella subimperspicua* (Speg.) Etayo	*Ricasolia casarettiana*	(Spegazzini, 1899; Etayo, 2017)	= *Nectria subimperspicua* Speg.
20	*Xenonectriella vertebrata* Etayo	*Heterodermia*	(Etayo, 2017)	
21	*Xenonectriella zimmermannii* F. Berger & Brackel	*Physcia tenella*	(Berger et al., 2020)	



Note a Section of ascoma. b Immature and mature asci. c Mature and immature ascospores.

Source Redrawn from Weese (1919)

Figure 2.122 *Xenonectriella lutescens*

Family Niessliaceae Kirschst.

Atronectria Etayo (3)

Index Fungorum 532866, Faceoffungi, MycoBank, GenBank

Classification: Niessliaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Atronectria was introduced by Etayo (2008) to accommodate A. magellanica, a

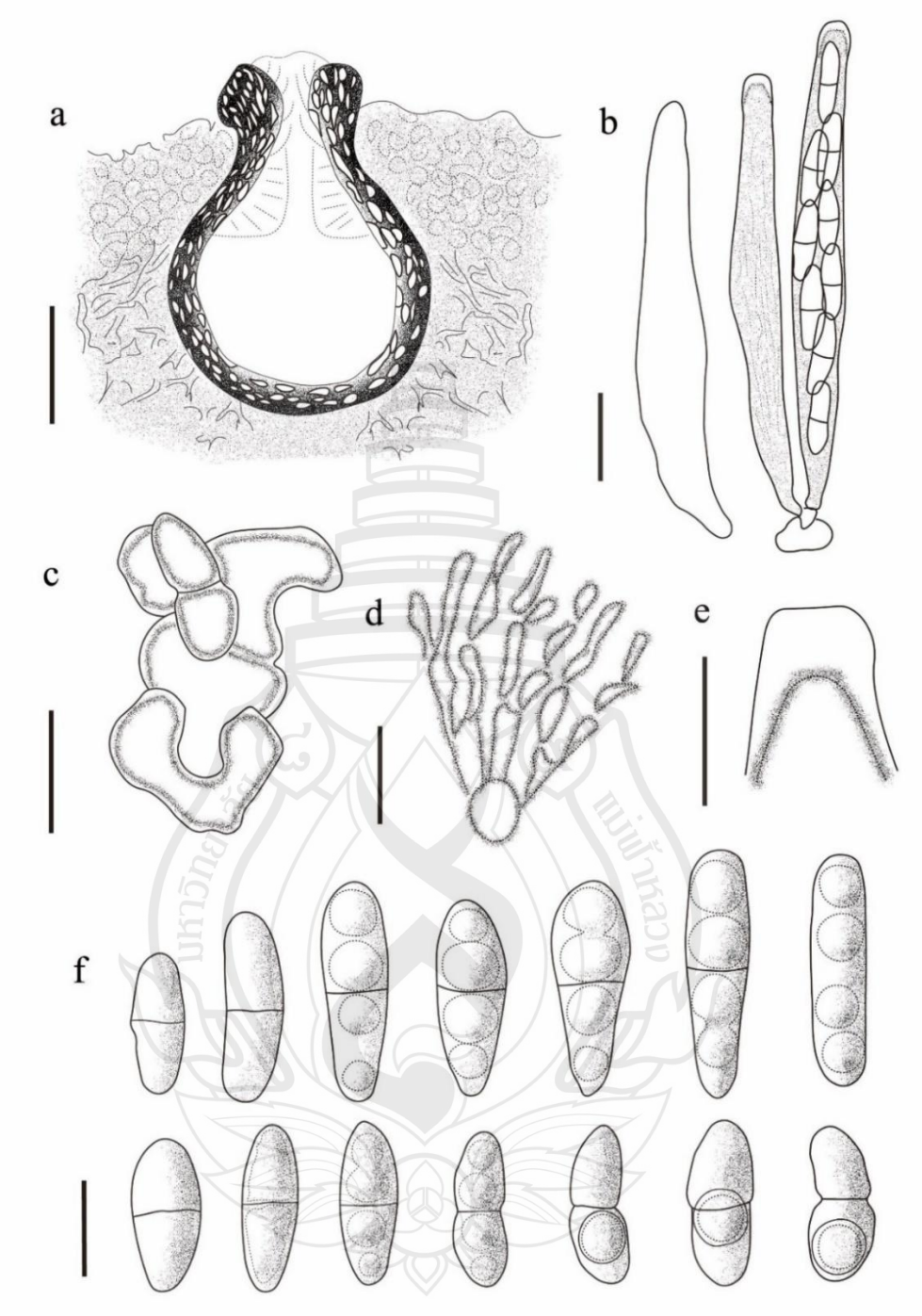
species parasitizing the thalli of Pseudocyphellaria coriifolia and Nephroma antarcticum. The type species is characterized by immersed or erumpent, subglobose, papillate, black perithecia with a brownish wall. The asci are cylindrical to long-clavate, unitunicate, and eight-spored. Ascospores are biseriate, ellipsoidal, hyaline, and uniseptate. Atronectria resembles Pronectria but differs in its darker brown perithecial wall (Etayo & Sancho, 2008).

Flakus et al. (2019) described a second species, *Atronectria lobariellae*, distinguished by its smaller ascomata, presence of oil guttules, and ecological specificity, as it grows on the apothecial hymenia of *Lobariella crenulata*. Subsequently, Zhurbenko (2022) introduced a third species, *A. thelotrematis*, which grows on the thalli of *Thelotrema lepadinum*, based on distinct chemical reactions and broader ascospores. To date, three species are recognized in this genus, all of which are lichenicolous, with no sequence data available in GenBank.

Type species: *Atronectria magellanica* Etayo

Table 2.179 Accepted lichenicolous species of *Atronectria*

	Species name	Host	References	Remarks
1	*Atronectria lobariellae* Etayo & Flakus	*Lobariella crenulata*	(Flakus et al., 2019b)	
2	*Atronectria magellanica* Etayo	*Pseudocyphellaria coriifolia* & *Nephroma antarcticum*	(Etayo & Sancho, 2008)	
3	*Atronectria thelotrematis* Zhurb	*Thelotrema lepadinum, Rhaphithamnus*	(Zhurbenko, 2022a)	



Note a Section of ascoma. b Asci. c Wall with epidermoid texture. d Branched periphysoids. e Ascal apex. f Ascospores. Scale bars: a = 50 µm, b–c = 10 µm, d–f = 5 µm.

Source Redrawn from Etayo et al. (2008)

Figure 2.123 *Atronectria magellanica*

Melanopsamma Niessl (1-40)

Index Fungorum 3079, Faceoffungi, MycoBank, GenBank

Classification: Niessliaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Melanopsamma pomiformis* (Pers.) Sacc.

= *Sphaeria pomiformis* Pers.

Accepted lichenicolous species:

Melanopsamma lettauiana (Keissl.) Vouaux, on saxicolous, crustose lichens (Vouaux 1912b)

= *Didymella lettauiana* Keissl.

Niesslia Auersw. (19-100)

Index Fungorum 3506, Faceoffungi, MycoBank, GenBank

Classification: Niessliaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Niesslia chaetomium* (Ces. & De Not.) Auersw.

= *Venturia chaetomium* Ces. & De Not.

Table 2.180 Accepted lichenicolous species of *Niesslia*

	Species name	Host	References	Remarks
1	*Niesslia cladoniicola* D. Hawksw. & W. Gams	*Cladonia rangiformis*	(Hawksworth, 1975a)	
2	*Niesslia coarctatae* (S.Y. Kondr., Lőkös & Hur) S.Y. Kondr., Lőkös & Hur	*Trapelia coarctata*	(Kondratyuk et al., 2016; Kondratyuk et al., 2019)	= *Stigmidium coarctatae* S.Y. Kondr., Lőkös & Hur

Table 2.180 (continued)

	Species name	Host	References	Remarks
3	*Niesslia coenogonii* van den Boom	*Coenogonium*	(Van Den Boom et al., 2017)	
4	*Niesslia echinoides* Etayo, Flakus & Kukwa	*Erioderma barbellatum*	(Etayo et al., 2013b)	
5	*Niesslia evae* Etayo	*Erioderma*	(Etayo, 2017)	
6	*Niesslia globospora* Etayo	*Dictyonema glabratum*	(Etayo, 2002a)	
7	*Niesslia keissleri* Zhurb	*Cladia* and *Cladonia*	(Zhurbenko & Pino-Bodas, 2017)	
8	*Niesslia kununguakii* Alstrup & E. S. Hansen	*Arthrorhaphis alpina*	(Alstrup et al., 2001)	
9	*Niesslia lobariae* Etayo & Diederich	*Lobaria pulmonaria*	(Etayo & Diederich, 1996b)	
10	*Niesslia parviseta* Darmostuk, Etayo & Flakus	*Erioderma barbellatum*	(Crous et al., 2023)	
11	*Niesslia peltigerae* Pérez-Ort.	*Peltigera kristinssonii*	(Spribille et al., 2020)	
12	*Niesslia peltigericola* (D. Hawksw.) Etayo	*Peltigera leucophlebia*	(Hawksworth, 1980b; Etayo & Sancho, 2008)	= *Wentiomyces peltigericola* D. Hawksw.
13	*Niesslia pseudocyphellariae* Etayo & Diederich	*Pseudocyphellaria beccarii*	(Etayo, 2000)	

Table 2.180 (continued)

	Species name	Host	References	Remarks
14	*Niesslia robusta* Tretiach	*Tephromela grumosa*	(Tretiach, 2002)	
15	*Niesslia schyzospora* Etayo	*Hypotrachyna*	(Etayo, 2002a)	
16	*Niesslia stictarum* (Nannf. & R. Sant.) R. Sant. & Tretiach	*Sticta ambavillaria*	(Nannfeldt et al., 1975; Tretiach, 2002)	= *Nitschkiopsis stictarum* Nannf. & R. Sant.
17	*Niesslia tatjanae* (S. Y. Kondr.) Etayo	*Pseudocyphellaria*	(Kondratyuk, 1996; Etayo & Sancho, 2008)	= *Wentiomyces tatjanae* S.Y. Kondr.
18	*Niesslia tetrahedrospora* Etayo	*Dichosporidium nigrocinctum*	(Etayo, 2002a)	
19	*Niesslia yaganae* Etayo	*Nephroma antarcticum*	(Etayo & Sancho, 2008)	

Trichosphaerella E. Bommer, M. Rousseau & Sacc. (1-7)

Index Fungorum 5587, Faceoffungi, MycoBank, GenBank

Classification: Niessliaceae, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Trichosphaerella decipiens* E. Bommer, M. Rousseau & Sacc.

Accepted lichenicolous species:

Trichosphaerella buckii R. C. Harris & Lendemer, on *Punctelia rudecta*

Family Sarocladiaceae L. Lombard

Sarocladium W. Gams & D. Hawksw. (1-30)

Index Fungorum 9790, faceoffungi, MycoBank, GenBank

Classification: Sarocladiaceae, Hypocreales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Sarocladium oryzae* (Sawada) W. Gams & D. Hawksw.

= *Acrocylindrium oryzae* Sawada

Accepted lichenicolous species:

Sarocladium strictum (W. Gams) Summerb. (Summerbell et al., 2011)

=*Acremonium strictum* W. Gams, facultatively lichenicolous (Gams, 1971; Diederich et al., 2018)

Hypocreales Genera incertae sedis

Cephalosporiopsis Peyronel (1-7)

Index Fungorum 7524, Faceoffungi, MycoBank, GenBank

Classification: Hypocreales genera incertae sedis, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Cephalosporiopsis alpina* (Peyronel) Peyronel

= *Cephalothecium alpinum* Peyronel

Accepted lichenicolous species:

Cephalosporiopsis epiparasitaster Alstrup, on *Chaenothecopsis parasitaste* (Alstrup, 1997)

Chondronectria Etayo, Flakus & Kukwa (1)

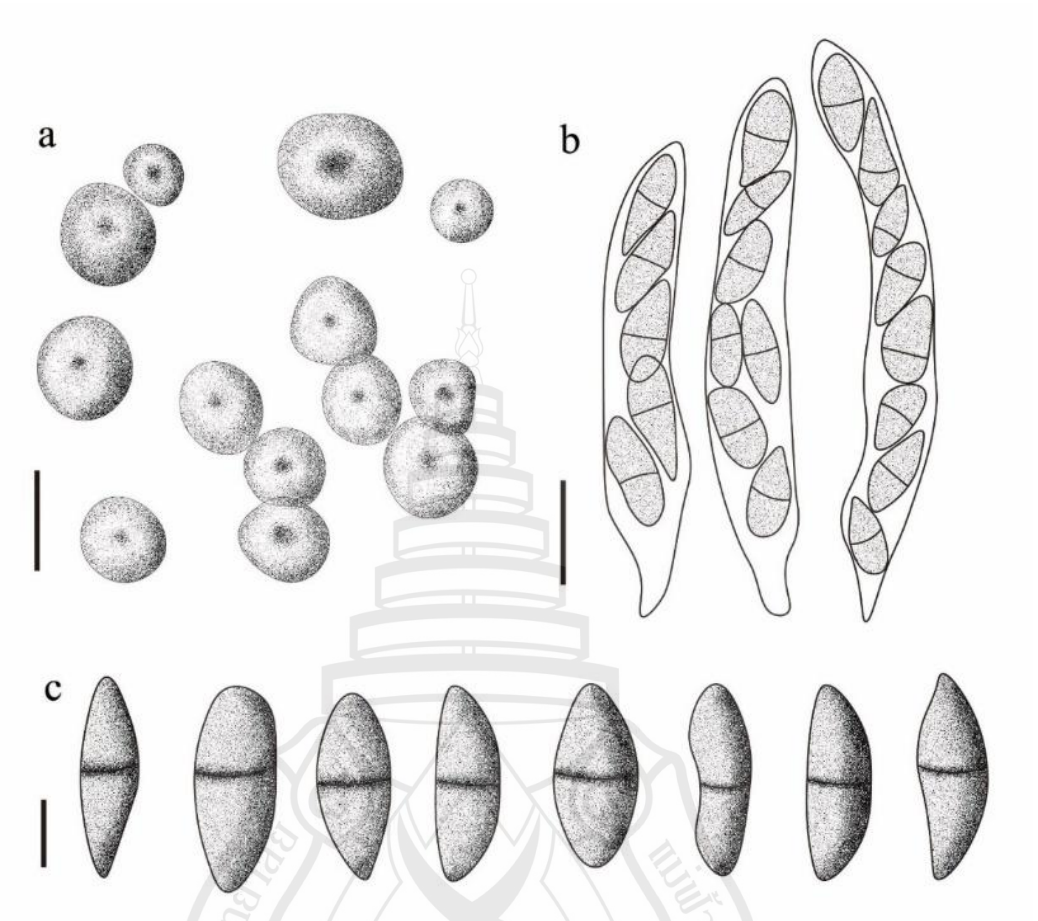
Index Fungorum 818310, Faceoffungi, MycoBank, GenBank

Classification: Hypocreales genera incertae sedis, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

The monotypic genus *Chondronectria* was established by Etayo, Flakus, and

Kukwa (2017) to accommodate *Ch. eriodermaticola*, a species that parasitizes *Erioderma cf. verruculosum*. This genus resembles *Nectriopsis* and *Trichonectria*, characterized by its lichenicolous nature, subglobose orange to brown ascomata, and chondroid excipulum, which contains thick-walled cells with small lumina and orange oil droplets. The asci are cylindrical, unitunicate, and octosporous, producing ellipsoid, hyaline, uniseptate spores. Originally placed in the family Bionectriaceae by Etayo (2017), *Chondronectria* was later reclassified by Wijayawardene et al. (2020, 2022) under *Hypocreales* genera incertae sedis. Due to the absence of molecular data, its phylogenetic position remains to be further clarified.

Type species: *Chondronectria eriodermaticola* Etayo, Flakus & Kukwa (Etayo, 2017)



Note a Ascomata. b Asci. c Ascospores. Scale bars: a = 200 μm, b = 10 μm, c = 5 μm.

Source Redraw from Etayo (2017)

Figure 2.124 *Chondronectria eriodermaticola*

Cylindronectria Etayo (1)

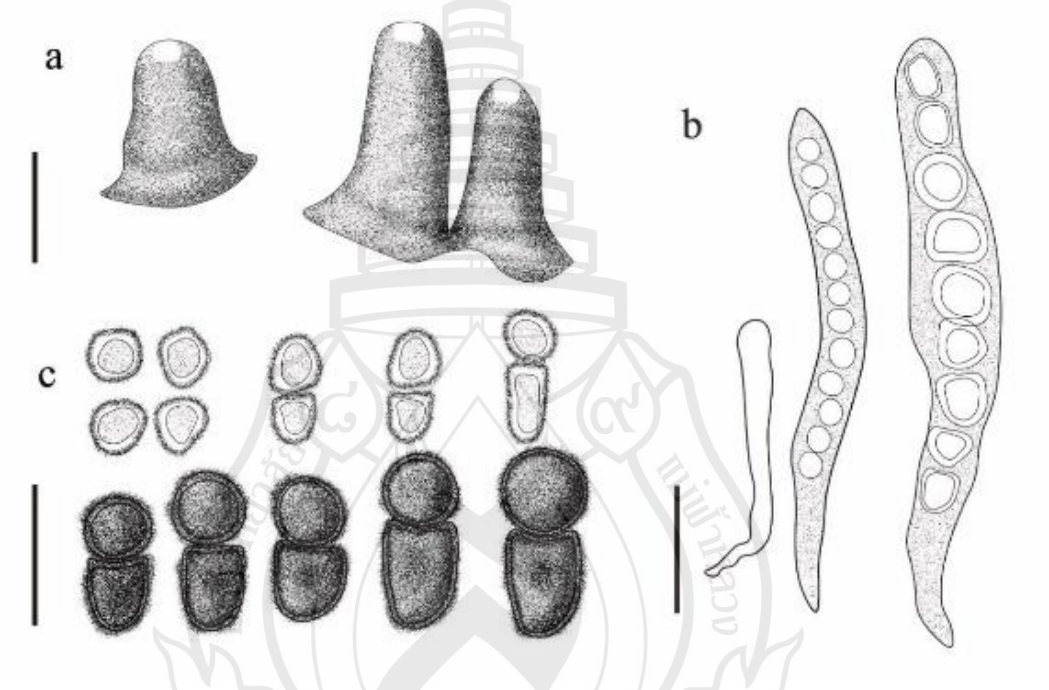
Index Fungorum 818315, Faceoffungi, MycoBank, GenBank

Classification: Hypocreales genera incertae sedis, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Cylindronectria was introduced by Etayo (2017) based on its morphological characteristics to accommodate the single species *C. cyanobactericola*, which grows on *Hypotrachyma* sp. in Ecuador. This genus is distinguished by its subcylindrical ascomata with a widened ostiole formed by apex breakdown, and a multi-layered

perithecial wall. The asci are cylindrical, unitunicate, and 8-spored, exhibiting a KI+ blue reaction in the wall. The ascospores are uniseriate, hyaline to yellowish, subspherical to polygonal, and verruculose. Etayo (2017) placed *Cylindronectria* within *Hypocreales*. However, no sequence data is available, and its phylogenetic status remains unconfirmed, pending further studies.

Type species: *Cylindronectria cyanobacteriicola* Etayo (Etayo, 2017)



Note a Ascomata. b Immature asci. c immature and mature ascospores. Scale bars: a = 100 µm, b–c = 10 µm.

Source Redrawn from Etayo (2017)

Figure 2.125 *Cylindronectria cyanobacteriicola*

Illosporiopsis D. Hawksw. (1)

Index Fungorum 28491, Faceoffungi, MycoBank, GenBank

Classification: Hypocreales genera incertae sedis, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Illosporiopsis was introduced by Hawksworth (2001) based on a phylogenetic

analysis using SSU, ITS, and mtSSU sequences to accommodate the type species *I. christiansenii*, which was transferred from *Hobsonia christiansenii* B.L. Brady & D. Hawksw., found on the thalli of *Candelariella* and *Physcia*. This lichenicolous genus is characterized by sporodochial, vividly pink, erumpent colonies; micronematous conidiophores; monoblastic, integrated conidiogenous cells; and solitary, hyaline, coiled, twisted, helically septate, smooth conidia. In the phylogenetic analysis by Sikaroodi et al. (2001), *I. christiansenii* clusters within the Hypocrealean clade, alongside *Illosporium* and a species of *Fusarium*. Consequently, *Illosporiopsis* was tentatively placed within Hypocreales as genera incertae sedis, pending further phylogenetic studies.

Type species: *Illosporiopsis christiansenii* (B.L. Brady & D. Hawksw.) D. Hawksw. (Sikaroodi et al., 2001)

= *Hobsonia christiansenii* B.L. Brady & D. Hawksw. (Lowen et al., 1986)

Illosporium Mart. (1-15)

Index Fungorum 8626, Faceoffungi, MycoBank, GenBank

Classification: Hypocreales genera incertae sedis, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Illosporium roseum* Mart.

Accepted lichenicolous species:

Illosporium carneum Fr., on *Peltigera canina* (Fries, 1829; Tadome et al., 2021)

Leptobarya Etayo (2)

Index Fungorum 818327, Faceoffungi, MycoBank, GenBank

Classification: Hypocreales genera incertae sedis, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

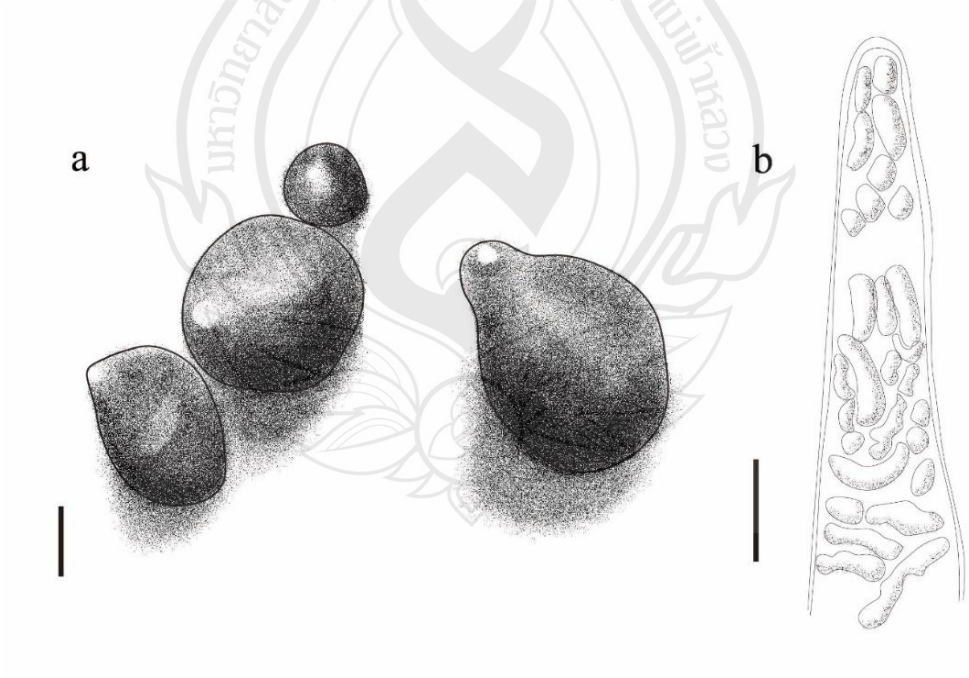
Leptobarya was introduced by Etayo (2017) to accommodate two species resembling *Neobarya* but differing in several critical features. *Leptobarya* is distinguished by its well-developed, persistent paraphyses with free apices;

ampulliform, unitunicate, polysporous asci with a small apical thickening; and vermiform, spiraled, curved, unicellular ascospores that fragment within the ascus. Although Etayo (2017) did not assign this genus to a specific taxonomic group, he highlighted the need to clarify its relationship to *Lichenobarya* or *Neobarya*, both within the order Hypocreales. Consequently, *Leptobarya* was provisionally placed in Hypocreales as genera incertae sedis, pending molecular data.

Type species: *Leptobarya nigra* Etayo

Table 2.181 Accepted lichenicolous species of *Leptobarya*

	Species name	Host	References	Remarks
1	*Leptobarya aurantiicarpa* Etayo	*Leptogium*	(Etayo, 2017)	
2	*Leptobarya nigra* Etayo	*Leptogium*	(Etayo, 2017)	



Note a Ascomata. b Part of ascus with ascospores. Scale bars: a = 200 μm, b = 10 μm.

Source Redrawn from Etayo (2017)

Figure 2.126 *Leptobarya nigra*

Roselliniella Vain. (21)

Index Fungorum 4786, Faceoffungi, MycoBank, GenBank

Classification: Hypocreales genera incertae sedis, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

The name *Roselliniella* first appeared in Vainio (1921), where it was referenced as a comparison to *Rosellinia* Sect. *Lichenicolae* Sacc., but without specifying any species. Initially, *Roselliniella* was treated as a later synonym of *Adelococcus* by Theissen and Sydow (1918) until Hafellner (1985) revived it as a distinct genus. Matzer et al. (1990) later revised *Roselliniella*, adding six new species and three additional combinations, and designated *R. nephromatis* as the type species, transferring it from *Sphaeria nephromatis* P. Crouan & H. Crouan

This genus is characterized by lichenicolous, perithecial, black ascomata with unitunicate asci that are cylindrical to club-shaped, long-stalked, and rounded or tapering at the apex, with thin walls. Each ascus contains 2 to 8 uniseriate ascospores, which can be 1–5-celled, not constricted at the septa, and vary in shape—elliptical, oval, lemon-shaped, spindle-shaped, or potato-shaped. Young ascospores are hyaline, while mature ones are brown and smooth-walled (Matzer et al., 1990).

Since Matzer et al (1990), eleven new species have been described by many researchers, bringing the total to 21 recognized species in *Roselliniella* (Index Fungorum). Initially, this genus was placed within the *Sordariales* based on its asci, ascospores, and interascal filaments (Hoffmann et al., 2000). However, subsequent phylogenetic analysis by Hawksworth et al. (2010), based on 28S rDNA sequences from *Roselliniella atlantica* and *R. euparmeliicola*, repositioned the genus within the *Hypocreales*.

Type species: *Roselliniella nephromatis* (P. Crouan & H. Crouan) Matzer & Hafellner (Matzer et al., 1990)

= *Sphaeria nephromatis* P. Crouan & H. Crouan (Crouan et al., 1867b)

Table 2.182 Accepted lichenicolous species of *Roselliniella*

	Species name	Host	References	Remarks
1	*Roselliniella africana* Diederich	*Usnea*	(Aptroot et al., 1997)	
2	*Roselliniella atlantica* Matzer & Hafellner	*Xanthoparmelia, Hypotrachyna* and *Platismatia*	(Matzer et al., 1990)	
3	*Roselliniella cladoniae* (Anzi) Matzer & Hafellner	*Cladonia deformis*	(Matzer et al., 1990)	= *Sordaria cladoniae* Anzi
4	*Roselliniella coccocarpiae* (Pat.) Matzer & R. Sant.	*Coccocarpia gayana*	(Matzer et al., 1990)	= *Laestadia coccocarpiae* Pat.
5	*Roselliniella epiphylla* Matzer & Hafellner	*Sporopodium*	(Matzer et al., 1990)	
6	*Roselliniella eriodermicola* Matzer & R. Sant.	*Erioderma tomentosum*	(Matzer et al., 1990)	
7	*Roselliniella euparmeliicola* Millanes & D. Hawksw.	*Parmelia* s. str.	(Hawksworth et al., 2010)	
8	*Roselliniella heterodeae* Matzer & Hafellner	*Cladia muelleri*	(Matzer et al., 1990)	

Table 2.182 (continued)

	Species name	Host	References	Remarks
9	*Roselliniella javkhlanae* Zhurb	*Rinodina turfacea* var. *ecrustacea*	(Zhurbenko et al., 2019)	
10	*Roselliniella lecideae* Darmostuk, Khodos. & Naumovich	*Lecidea fuscoatra*	(Darmostuk et al., 2018)	
11	*Roselliniella microthelia* (Wallr.) Nik. Hoffm. & Hafellner	*Trapelia*	(Hoffmann et al., 2000)	= *Verrucaria microthelia* Wallr.
12	*Roselliniella muralis* van den Boom	*Protoparmeliopsis muralis*	(van den Boom, 2015)	
13	*Roselliniella nephromatis* (Crouan) Matzer & Hafellner	*Nephroma*	(Matzer et al., 1990)	= *Sphaeria nephromatis* P. Crouan & H. Crouan
14	*Roselliniella oxyspora* Matzer & R. Sant.	*Coccocarpia erythroxyli*	(Matzer et al., 1990)	
15	*Roselliniella pannariae* Matzer & Hafellner	*Protopannaria pzizoides*	(Matzer et al., 1990)	
16	*Roselliniella papuana* Diederich	*Usnea*	(Aptroot et al., 1997)	
17	*Roselliniella peltigericola D.* Hawksw. & Miadl.	*Peltigera spuriella*	(Hawksworth & Miądlikowska, 1997)	
18	*Roselliniella ramirezii* Etayo	*Lobaria subexornata*	(Etayo, 2002a)	

Table 2.182 (continued)

	Species name	Host	References	Remarks
19	*Roselliniella silvae-gabretae* Brackel	*Lecanora polytropa*	(Brackel, 2021b)	
20	*Roselliniella stereocaulorum* Zhurb., Kukwa & Oset	*Stereo Sticta weigelii caulon*	(Zhurbenko et al., 2009)	
21	*Roselliniella stictae* Etayo	*Sticta weigelii*	(Etayo, 2002a)	

Stilbella Lindau (2-50)

Index Fungorum 10110, Faceoffungi, MycoBank, GenBank

Classification: Hypocreales genera incertae sedis, Hypocreales, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Stilbella erythrocephala* (Ditmar) Lindau

= *Stilbum erythrocephalum* Ditmar

Table 2.183 Accepted lichenicolous species of *Stilbella*

	Species name	Host	References	Remarks
1	*Stilbella eichlerae* Brackel	*Cetraria islandica*	(von Brackel, 2019)	
2	*Stilbella helmingeri Diederich*	*Cladonia pocillum*	(Diederich et al., 2024)	

Order Microascales Luttr. ex Benny & R.K. Benj.

Family Graphiaceae Z.W. de Beer, Seifert & M.J. Wingf. ex Mapook, Boonmee & K.D. Hyde

Graphium Corda (2-50)

Index Fungorum 8398, faceoffungi, MycoBank, GenBank

Classification: Graphiaceae, Microascales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Graphium penicillioides* Corda

Table 2.184 Accepted lichenicolous species of *Graphium*

	Species name	Host	References	Remarks
1	*Graphium aphthosae* Alstrup & D. Hawksw.	*Peltigera*	(Alstrup et al., 1990)	
2	*Graphium samogiticum* Motiej. & Alstrup	*Verrucaria bryoctona*	(Motiejūnaitė et al., 2006)	

Family Halosphaeriaceae E. Müll. & Arx ex Kohlm.

Cirrenalia (2-15)

Index Fungorum 7668, faceoffungi, MycoBank, GenBank

Classification: Halosphaeriaceae, Microascales, Hypocreomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Cirrenalia macrocephala* (Kohlm.) Meyers & R.T. Moore

Table 2.185 Accepted lichenicolous species of *Cirrenalia*

	Species name	Host	References	Remarks
1	*Cirrenalia lichenicola* Pérez-Ort.	*Mycoblastus caesius*	(Spribille et al., 2020)	
2	*Cirrenalia pertusariicola* Diederich & W. R. Buck	*Pertusaria pustulata*	(Diederich et al., 2024)	

SubClass SORDARIOMYCETIDAE O.E. Erikss. & Winka

Order Chaetosphaeriales Huhndorf, A.N. Mill. & F.A. Fernández

Family Chaetosphaeriaceae Réblová, M.E. Barr & Samuels

Dinemasporium Lév. (1-45)

Index Fungorum 8040, faceoffungi, MycoBank, GenBank

Classification: Chaetosphaeriaceae, Chaetosphaeriales, Sordariomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Dinemasporium graminum* (Lib.) Lév.

= *Vermicularia graminum* Lib.

Accepted lichenicolous species:

Dinemasporium strigosum (Pers.) Sacc., facultatively lichenicolous on *Peltigera* (Saccardo 1881)

= *Dematium aureum* var. *strigosum* Pers. (Persoon, 1797)

Order Diaporthales Nannf.

Family Cryphonectriaceae Gryzenh. & M.J. Wingf.

Endothia Fr. (1-9)

Index Fungorum 1810, Faceoffungi, MycoBank, GenBank

Classification: Cryphonectriaceae, Diaporthales, Sordariomycetidae, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Endothia gyrosa* (Schwein.) Fuckel

= *Sphaeria gyrosa* Schwein.

Accepted lichenicolous species:

Endothia paraguayensis (Speg.) Höhn., facultatively lichenicolous on lichens (Höhnel et al., 1910)

= *Nectria paraguayensis* Speg. (Spegazzini, 1885)

Order Phyllachorales M.E. Barr

Family Phyllachoraceae Theiss. & P. Syd.

Lichenochora Hafellner (48)

Index Fungorum 25318, Faceoffungi, MycoBank, GenBank

Classification: Phyllachoraceae, Phyllachorales, Sordariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Lichenochora was introduced by Hafellner (1989) to include three newly described species and three additional combinations. This genus is characterized by its lichenicolous perithecia, which frequently form galls on their hosts. The perithecia are gregarious and pyriform, typically immersed within well- or poorly-developed galls, with only the ostioles exposed. The peridium is brown, and the hamathecium contains broad, sparsely branched filaments, along with distinct periphyses in the ostiolar region. The asci are functionally unitunicate, bearing 4 to 8 spores with internal oily droplets. The ascospores are uniseptate, hyaline to slightly brownish, and consist of equally sized cells with broadly rounded apices.

Hafellner (1989) placed *Lichenochora* within the Phyllachoraceae (Phyllachorales) based on features like sunken perithecia with ostioles lined by periphyses, unitunicate asci, paraphyses, and brightly colored ascospores. He also noted that *Lichenochora* shows a specialized radiation on Physciaceae hosts with leaf-like thalli. However, species have also been described on crustose lichens, including *Lichenochora chimaerica*, *L. coarctatae*, *L. gahavisukae*, *L. thorii*, and *L. verrucariae* (Aptroot et al., 1997; Hafellner et al., 2000; Hoffmann et al., 2000; Zhurbenko, 2008a; Etayo, 2017). To date, 48 lichenicolous species of *Lichenochora* are recognized. However, as no molecular data is currently available in GenBank, further phylogenetic analysis is needed in the future.

Type species: *Lichenochora thallina* (Cooke) Hafellner (Hafellner, 1989)

= *Sphaerella thallina* Cooke (Cooke 1879)

Table 2.186 Accepted lichenicolous species of *Lichenochora*

	Species name	Host	References	Remarks
1	*Lichenochora acutispora* Etayo	*Fuscopannaria magellanica*	(Etayo & Sancho, 2008)	
2	*Lichenochora aipoliae* Etayo, Nav.-Ros. & Coppins	*Physcia aipolia*	(Etayo & Navarro-Rosinés, 2008)	
3	*Lichenochora ajaysinghii* Y. Joshi	*Caloplaca saxicola*	(Joshi et al., 2020)	
4	*Lichenochora alaskana* Zhurb.	*Fuscopannaria viridescens*	(Zhurbenko, 2023b)	
5	*Lichenochora aprica* Hafellner & Nik. Hoffm.	*Aspicilia*	(Hoffmann et al., 2000)	
6	*Lichenochora arctica* Zhurb.	*Candelariella canadensis* and *Rinodina terrestris*	(Zhurbenko, 2013b)	
7	*Lichenochora atrans* Halıcı, K. Knudsen & Candan	*Psora decipiens*	(Halici et al., 2009)	
8	*Lichenochora bacidiispora* Etayo	*Parmotrema*	(Etayo, 2017)	
9	*Lichenochora bellemerei* Nav.-Ros., Cl. Roux & Diederich	*Menegazzia*	(Navarro-Rosinés et al., 1998)	

Table 2.186 (continued)

	Species name	Host	References	Remarks
10	*Lichenochora caloplacae* Zhurb.	*Caloplaca tetraspora*	(Zhurbenko & Brackel, 2013)	
11	*Lichenochora chimaerica* Etayo	*Pertusaria*	(Etayo, 2017)	
12	*Lichenochora clauzadei* Nav.-Ros., Cl. Roux & Llimona	*Squamarina lentigera*	(Navarro-Rosinés et al., 1994)	
13	*Lichenochora coarctatae* (B. de Lesd.) Hafellner & F. Berger	*Lecidea coarctata*	(Hafellner et al., 2000)	= *Didymella coarctatae* B. de Lesd.
14	*Lichenochora collematum* Nik. Hoffm. & Hafellner	*Collema ceraniscum*	(Hoffmann et al., 2000)	
15	*Lichenochora constrictella* (Müll. Arg.) Hafellner	*Fulgensia bracteata*	(Hafellner, 1989)	= *Sagedia constrictella* Müll. Arg.
16	*Lichenochora coppinsii* Etayo & Nav.-Ros.	*Protopannaria pezizoides*	(Etayo & Navarro-Rosinés, 2008)	
17	*Lichenochora elegantis* Hafellner	*Xanthoria elegans*	(Hafellner et al., 2008)	
18	*Lichenochora epidesertorum* Nav.-Ros.	*Fulgensia desertorum*	(Navarro-Rosinés et al., 1998)	
19	*Lichenochora epifulgens* Nav.-Ros. & Cl. Roux	*Fulgensia fulgens*	(Navarro-Rosinés et al., 1998)	
20	*Lichenochora epimarmorata* Nav.-Ros.	*Caloplaca marmorata*	(Navarro-Rosinés et al., 1998)	

Table 2.186 (continued)

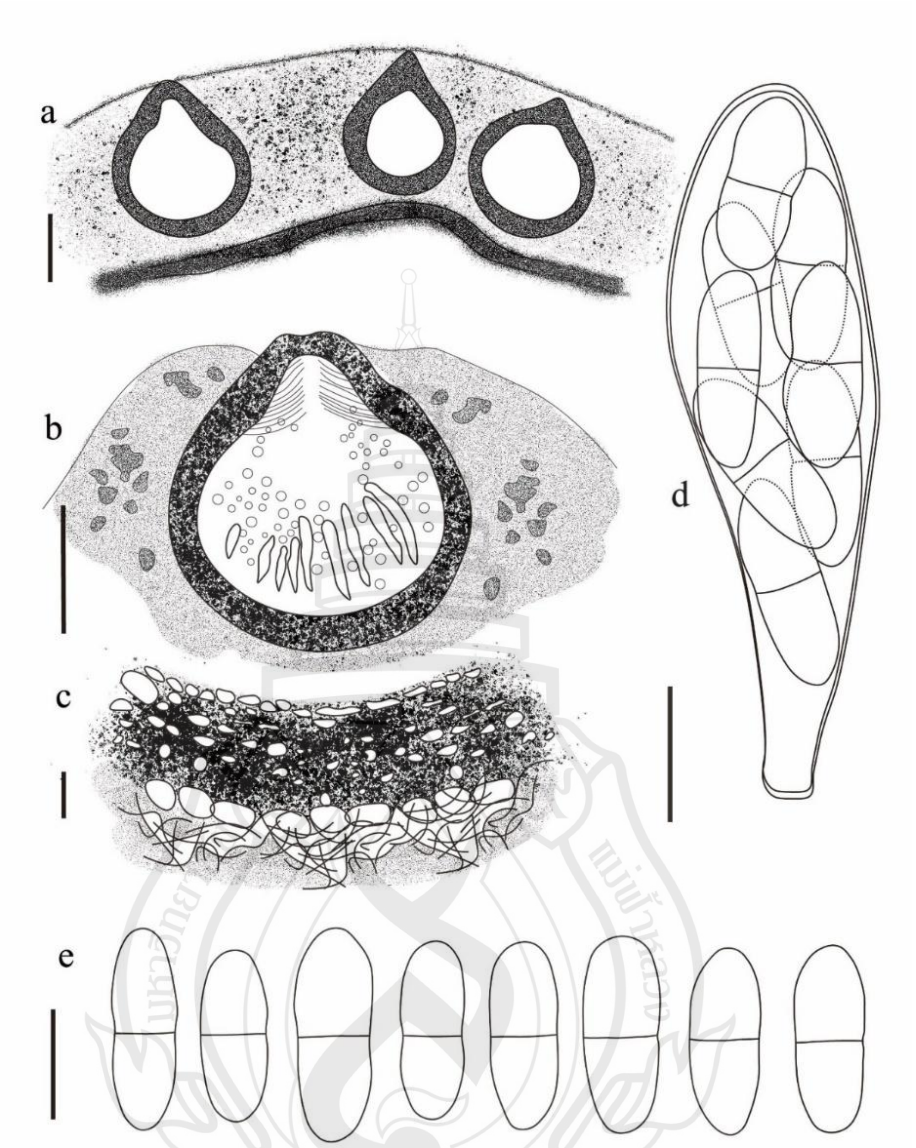
	Species name	Host	References	Remarks
21	*Lichenochora epinashii* Nav.-Ros. & Etayo	*Caloplaca nashii*	(Navarro-Rosinés et al., 2001)	
22	*Lichenochora gahavisukae* Diederich	*Graphis*	(Aptroot et al., 1997)	
23	*Lichenochora galligena* R. Sant. & Hafellner	*Physcia*	(Hafellner, 1989)	
24	*Lichenochora haematommatum* R. C. Harris & Lendemer	*Haematomma personii*	(Lendemer et al., 2016)	
25	*Lichenochora heppiae* Cl. Roux	*Heppia lutosa*	(Roux & Triebel, 1994)	
26	*Lichenochora hypanica* S. Y. Kondr., L. Lõkös & J.-S. Hur	*Endocarpon*	(Kondratyuk et al., 2014)	
27	*Lichenochora hyperphysciae* Etayo	*Hyperphyscia adglutinata*	(Etayo, 2011)	
28	*Lichenochora inconspicua* Hafellner	*Mycobilimbia berengeriana*	(Hafellner, 1989)	
29	*Lichenochora lecidellae* Boqueras & Nav.-Ros.	*Lecidella elaeochroma*	(Navarro-Rosinés et al., 1998)	
30	*Lichenochora lepidiotae* (Anzi) Etayo & Nav.-Ros.	*Fuscopannaria praetermissa*	(Etayo & Navarro-Rosinés, 2008)	= *Sphaerella lepidiotae* Anzi
31	*Lichenochora makareviczae* S. Y. Kondr.	*Lecanora* aff. *campestris*	(Kondratyuk et al., 2015)	

Table 2.186 (continued)

	Species name	Host	References	Remarks
32	*Lichenochora mediterraneae* Calat., Nav.-Ros. & E. Calvo	*Fuscopannaria mediterranea*	(Calatayud et al., 2000)	
33	*Lichenochora monegrina* Etayo	*Polyblastia*	(Etayo, 2010c)	
34	*Lichenochora obscuroides* (Linds.) Triebel & Rambold	*Physcia*	(Rambold et al., 1992)	= *Lecidea obscuroides* Linds.
35	*Lichenochora paucispora* Etayo & Nav.-Ros.	*Bilimbia sabuletorum*	(Etayo & Navarro-Rosinés, 2008)	
36	*Lichenochora physciicola* (Ihlen & R. Sant.) Hafellner	*Physcia dubia*	(Hafellner et al., 2012)	= *Telogalla physciicola* Ihlen & R. Sant.
37	*Lichenochora polycoccoides* Hafellner & R. Sant.	*Physcia tribacia*	(Hafellner, 1989)	
38	*Lichenochora pyrenodesmiae* Nav.-Ros. & Cl. Roux	*Caloplaca variabilis*	(Navarro-Rosinés et al., 1998)	
39	*Lichenochora rinodinae Zhurb.*	*Rinodina mniaraea*	(Zhurbenko, 2013b)	
40	*Lichenochora sedelnikoviorum* Zhurb.	*Rostania ceranisca*	(Zhurbenko, 2021c)	

Table 2.186 (continued)

	Species name	Host	References	Remarks
41	*Lichenochora sinapispermae* Etayo & Nav.-Ros.	*Caloplaca sinapisperma*	(Navarro-Rosinés et al., 2001)	
42	*Lichenochora tertia* Etayo, Flakus & Rodr. Flakus	*Xanthoria elegans*	(Etayo et al., 2013)	
43	*Lichenochora thallina* (Cooke) Hafellner	*Physcia obscura*	(Hafellner, 1989)	= *Sphaerella thallina* Cooke
44	*Lichenochora thorii* Zhurb.	*Aspicilia moenium*	(Zhurbenko, 2008a)	
45	*Lichenochora verrucariae* van der Kolk	*Verrucaria viridula*	(Hoffmann et al., 2000)	
46	*Lichenochora wasseri* S.Y. Kondr.	*Caloplaca citrina*	(Navrotskaya et al., 1996)	
47	*Lichenochora weillii* (Werner) Hafellner & R. Sant.	*Physcia leucoleiptes*	(Hafellner, 1989)	= *Didymella weillii* Werner
48	*Lichenochora xanthoriae* Triebel & Rambold	*Xanthoria*	(Triebel et al., 1991)	



Note a–b Section of ascomata. c Part of section of ascomatal wall. d Ascus. e Ascospores. Scale bars: a = 100 µm, b = 50 µm, c–e = 10 µm.

Source Redrawn from Hafellner (1989)

Figure 2.127 *Lichenochora thallina*

Order Sordariales Chadef. ex D. Hawksw. & O.E. Erikss.

Family Helminthosphaeriaceae Samuels, Cand. & Magni

Endophragmiella B. Sutton (3-100)

Index Fungorum 8167, Faceoffungi, MycoBank, GenBank

Classification: Helminthosphaeriaceae, Sordariales, Sordariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Endophragmiella pallescens* B. Sutton

Table 2.187 Accepted lichenicolous species of *Endophragmiella*

	Species name	Host	References	Remarks
1	*Endophragmiella franconica* Brackel & Markovsk.	*Platismatia glauca*	(Brackel et al., 2009)	
2	*Endophragmiella hughesii* D. Hawksw.	*Lobaria pulmonaria*	(Hawksworth, 1979a)	
3	*Endophragmiella stordeuriana* U. Braun, Zhurb., Diederich, Tsurykau & Heuchert	*Cladonia*	(Zhurbenko et al., 2015)	

Sordariales genera incertae sedis

Globosphaeria D. Hawksw. (1)

Index Fungorum 25444, Faceoffungi, MycoBank, GenBank

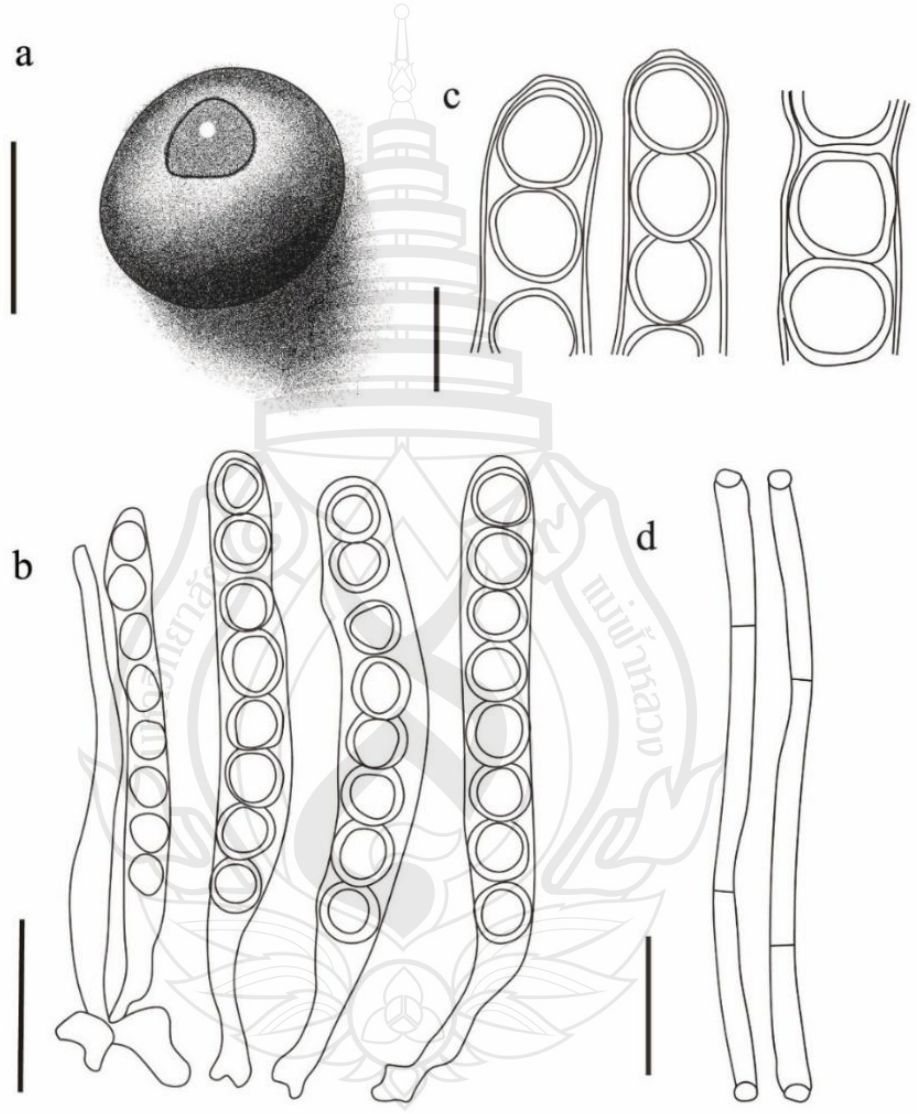
Classification: Sordariales genera incertae sedis, Sordariales, Sordariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Globosphaeria was introduced by Hawksworth (1990) to accommodate a single species, *G. jamesii*, which grows on the squamules of *Normandina pulchella*. This genus is characterized by its perithecioid, subglobose ascomata that are brownish-black and ostiolate, with slender, septate paraphyses. The asci are thin-walled, cylindrical, and contain eight uniseriate, thick-walled, globose, hyaline ascospores, each with a distinct germ pore (Hawksworth, 1990a).

Initially, Hawksworth (1990) placed *Globosphaeria* in Xylariales based on the presence of filiform paraphyses and the germ pore on its ascospores. However,

Lumbsch et al. (2007) later reclassified it under Sordariales as *incertae sedis*. To confirm its phylogenetic placement, additional molecular data will be essential.

Type species: *Globosphaeria jamesii* D. Hawksw. on *Normandina pulchella* (Hawksworth 1990a)



Note a Ascoma. b Asci. c Ascus apices with included ascospores and angularly compressed ascospores. d Portion of paraphyses. Scale bars: a = 200 µm, b = 25 µm, c–d = 10 µm.

Source Redrawn from Hawksworth (1990a)

Figure 2.128 *Globosphaeria jamesii*

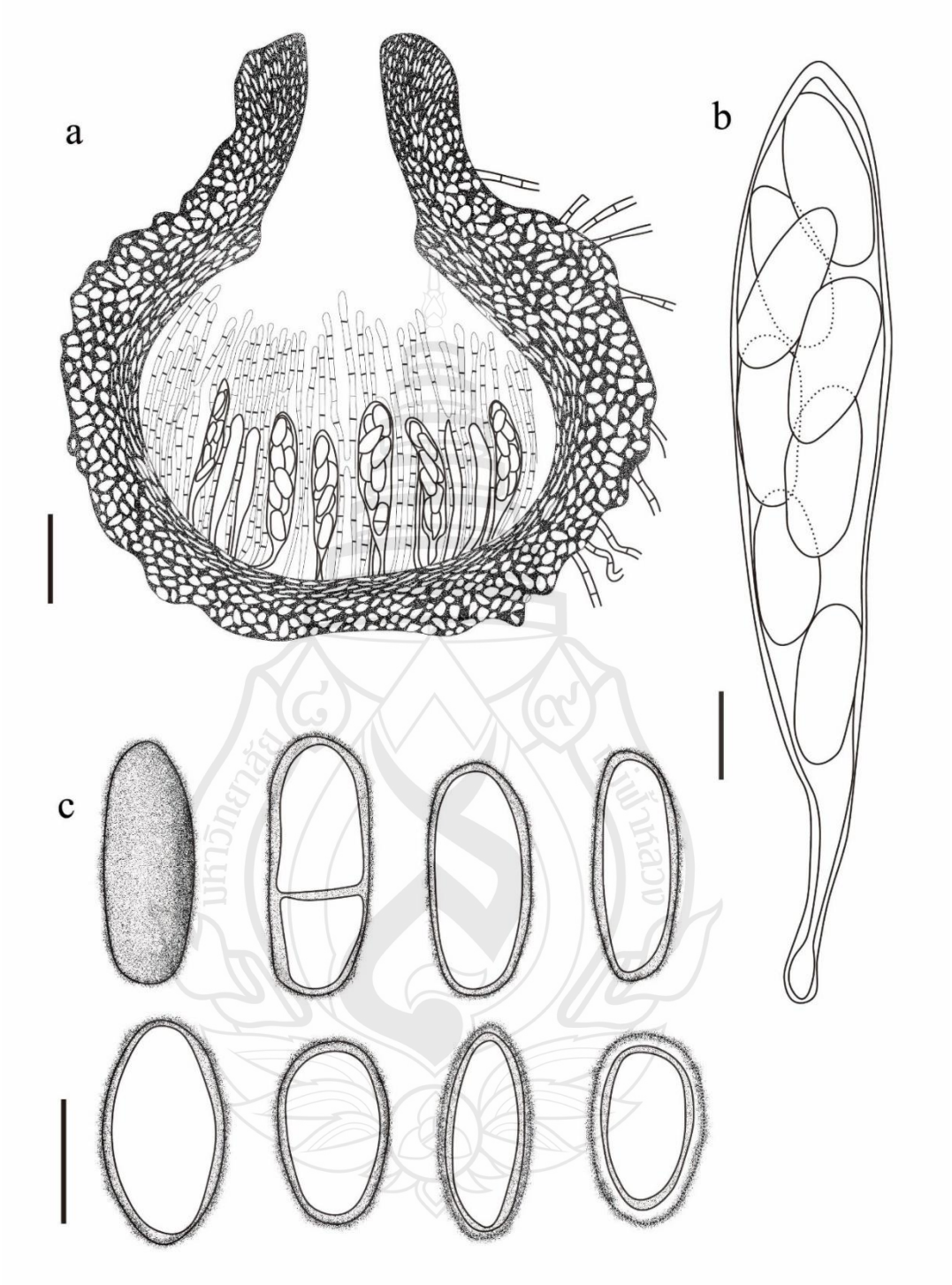
Reconditella Matzer & Hafellner (1)

Index Fungorum 25462, Faceoffungi, MycoBank, GenBank

Classification: Sordariales genera incertae sedis, Sordariales, Sordariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Reconditella was introduced by Matzer & Hafellner (1990) to accommodate the species *R. physconiarum*, which grows on *Physconia distorta*. This genus is characterized by superficial, non-setose perithecia with a dark brown peridium. It has distinct, septate, unbranched paraphyses, along with simple, septate periphyses. The asci are functionally unitunicate, cylindrical to slightly clavate or ventricose, eight-spored, with thin walls and blunt apices. Ascospores are initially haloed, unicellular (occasionally uniseptate), becoming pale brown and verruculose upon maturity. Although originally affiliated with Sordariales, *Reconditella* is currently placed as *incertae sedis* within Sordariales due to the absence of molecular data, awaiting further phylogenetic analysis (Matzer et al., 1990).

Type species: *Reconditella physconiarum* Hafellner & Matzer (Matzer et al., 1990)



Note a Section of ascoma. b Ascus. c Ascospores. Scale bars: a = 50 μm, b = 10 μm.

Source Redrawn from Matzer et al. (1990)

Figure 2.129 *Reconditella physconiarum*

Roselliniomyces Matzer & Hafellner (2)

Index Fungorum 25464, Faceoffungi, MycoBank, GenBank

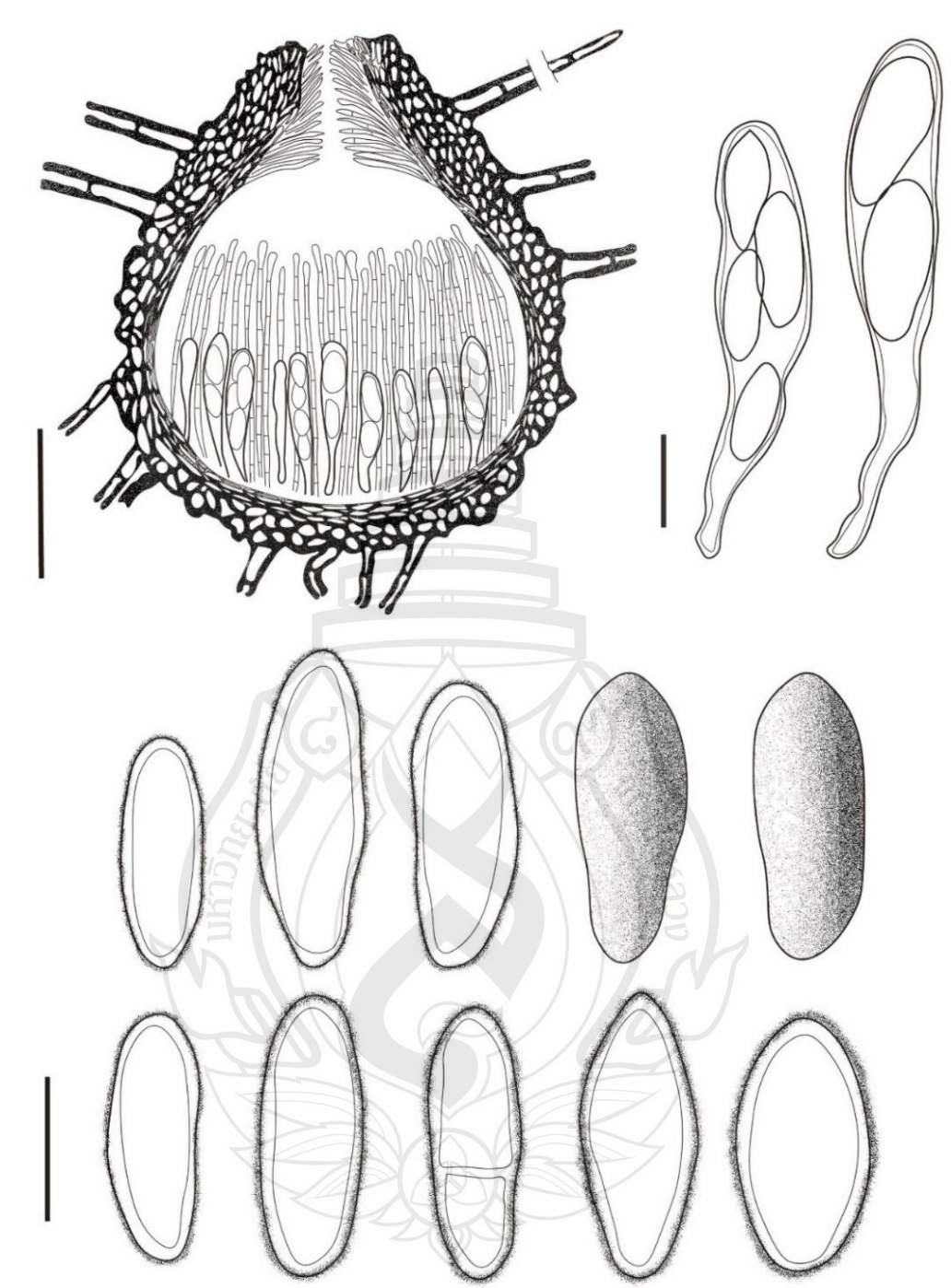
Classification: Sordariales genera incertae sedis, Sordariales, Sordariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Roselliniomyces was introduced by Matzer & Hafellner (1990) to accommodate *R. trichotheliorum*, which grows on *Trichothelium epiphyllum*. This genus is distinguished by its black, non-setose, spherical, superficial perithecia, which have a brown pseudoparenchymatous wall and brown, septate, unbranched setae on the upper surface. The paraphyses and periphyses are elongated, septate, and simple. The asci are cylindrical to slightly clavate, unitunicate, with thin walls. The ascospores are primarily unicellular, ellipsoidal, initially hyaline with a halo, becoming pale brown and verruculose upon maturity. This genus differs from *Reconditella* by having well-developed setae and is currently placed as *incertae sedis* within Sordariales due to the lack of molecular data (Matzer et al., 1990). Etayo (2017) introduced a second species, *R. erinaceus*, which differs from *R. trichotheliorum* by its larger ascomata, larger asci, and larger ascospores with one or two septa. To date, only two species are recognized in this genus.

Type species: *Roselliniomyces trichotheliorum* Matzer & Hafellner (Matzer et al., 1990)

Table 2.188 Accepted lichenicolous species of *Roselliniomyces*

	Species name	Host	References	Remarks
1	*Roselliniomyces erinaceus* Etayo	*Sticta* sp.	(Etayo, 2017)	
2	*Roselliniomyces trichotheliorum* Matzer & Hafellner	*Trichothelium epiphyllum*	(Matzer et al., 1990)	



Note a Section of ascoma. b Asci. c Ascospores. Scale bars: a = 50 μm, b–c = 10 μm.

Source Redrawn from Matzer et al. (1990)

Figure 2.130 *Roselliniomyces trichotheliorum*

Roselliniopsis Matzer & Hafellner (7-8)

Index Fungorum 25465, Faceoffungi, MycoBank, GenBank

Classification: Sordariales genera incertae sedis, Sordariales, Sordariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Roselliniopsis was introduced by Matzer et al. (1990) to accommodate two species: *R. groedensis*, transferred from *Rosellinia groedensis* Zopf, and *R. tropica*. Due to the poor preservation of *R. groedensis* specimens, *R. tropica* was designated as the neotype. Both species are associated with lichen hosts: *R. groedensis* occurs on *Ochrolechia lactea* in Europe, while *R. tropica* grows on a corticolous crustose lichen, likely *Ochrolechia*, in Africa (Matzer et al., 1990).

This genus is characterized by black, aggregated perithecia on a subiculum, egg-shaped peridium with a brown wall, and the absence of setae, though free hyphae on the substrate may support the upper part. The asci are unitunicate, narrowly cylindrical, stalked, without apical thickening, thin-walled, and contain 4-8 spores. The uniseriate ascospores are 1- to 3-celled, broadly ellipsoid, brown, and have round germ pores (Matzer et al., 1990). *Roselliniopsis* currently has nine records in Index Fungorum, seven of which are lichenicolous. The genus is placed within Sordariales as *incertae sedis*, pending molecular data for phylogenetic analysis to further confirm its taxonomic position.

Lecotype:

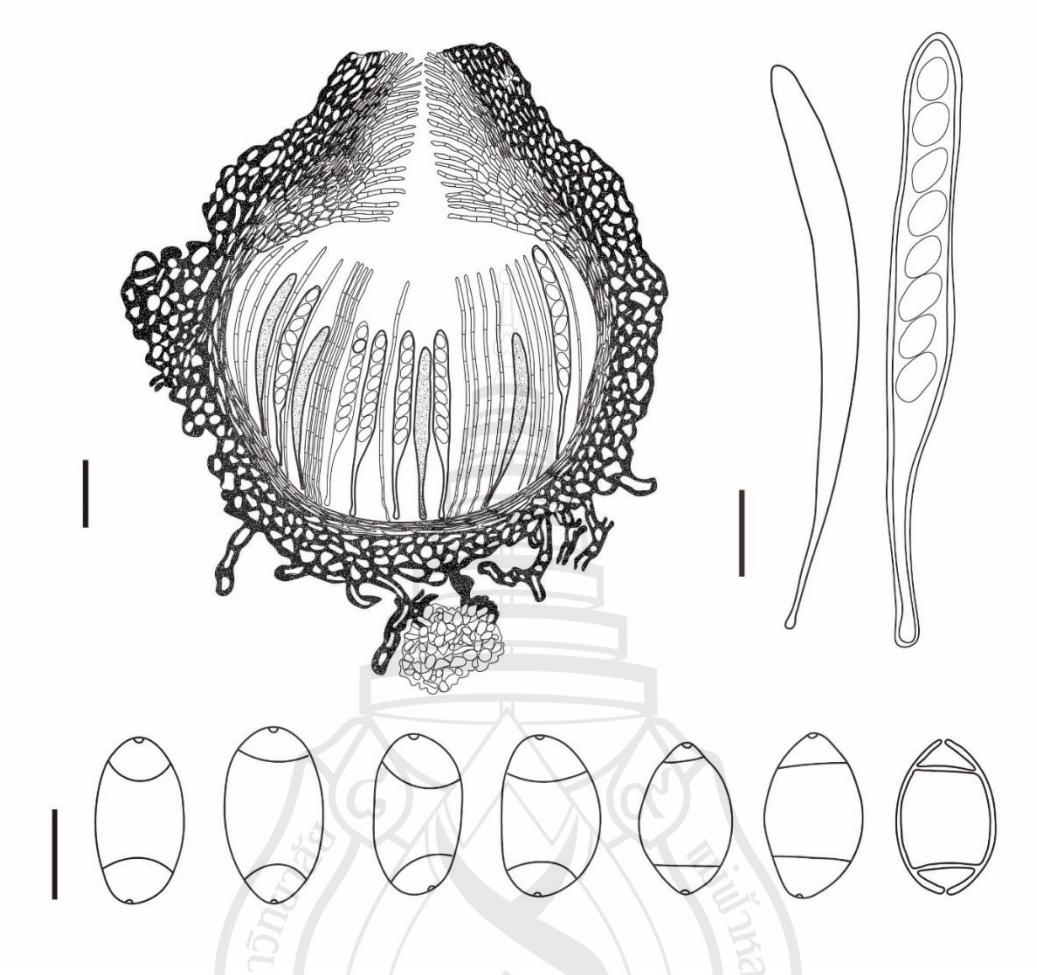
Roselliniopsis groedensis (Zopf) Matzer & Hafellner (Matzer et al., 1990)

= *Rosellinia groedensis* Zopf (Zopf, 1896)

Neotype: *Roselliniopsis tropica* Matzer & R. Sant.

Table 2.189 Accepted lichenicolous species of *Roselliniopsis*

	Species name	Host	References	Remarks
1	*Roselliniopsis gelidaria* (Mudd) Matzer	*Squamaria gelida*	(Matzer, 1993)	= *Sphaeria gelidaria* Mudd
2	*Roselliniopsis groedensis* (Zopf) Matzer & Hafellner	*Ochrolechia lactea*, *Pertusaria sulphurella* var. *variolosa*	(Matzer et al., 1990)	= *Rosellinia groedensis* Zopf
3	*Roselliniopsis palicei* Etayo	*Placopsis gelida*	(Etayo, 2002c)	
4	*Roselliniopsis phaeophysciae* S.Y. Kondr., Lőkös & Hur	*Phaeophyscia adiastola*	(Kondratyuk et al., 2013)	
5	*Roselliniopsis tartaricola* (Nyl. ex Leight.) Matzer	*Lecanora tartarea*	(Matzer, 1993)	= *Sphaeria tartaricola* Nyl. ex Leight.
6	*Roselliniopsis tropica* Matzer & R. Sant.	*Plumeria acutifolia*	(Matzer et al., 1990)	
7	*Roselliniopsis ventosa* (Rostr.) Alstrup	*Squamaria gelida*	(Alstrup et al., 1994)	= *Sphaeria ventosa* Rostr.



Note a Section of ascoma. b Asci. c Ascospores. Scale bars: a = 50 µm, b = 20 µm, c = 10 µm.

Source Redraw from Matzer et al. (1990)

Figure 2.131 *Roselliniopsis tropica*

SubClass XYLARIOMYCETIDAE O.E. Erikss. & Winka

Order Xylariales Nannf.

Family Hyponectriaceae Petr.

Charonectria Sacc. (1-3)

Index Fungorum 986, Faceoffungi, MycoBank, GenBank

Classification: Hyponectriaceae, Xylariales, Xylariomycetidae,

Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Charonectria consolationis* Sacc.

Accepted lichenicolous species:

Charonectria amabilis Lowen & D. Hawksw., on *Phaeorrhiza sphaerocarpa* (Rossman et al., 1999)

Physalospora Niessl (2-100)

Index Fungorum 4079, Faceoffungi, MycoBank, GenBank

Classification: Hyponectriaceae, Xylariales, Xylariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Physalospora alpestris* Niessl

Table 2.190 Accepted lichenicolous species of *Physalospora*

	Species name	Host	References	Remarks
1	*Physalospora collematis* (Stein) G. Winter	*Collema*	(Winter, 1886)	= *Thrombium collematis* Stein
2	*Physalospora ionaspidis* (Stein) Vouaux	*Ionaspis chrysophana*	(Vouaux, 1913a)	=*Thrombium ionaspidis* Stein

Family Hypoxylaceae DC.

Hypoxylon Bull. (1-200^{+})

Index Fungorum 2456, Faceoffungi, MycoBank, GenBank

Classification: Hypoxylaceae, Xylariales, Xylariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Hypoxylon coccineum* Bull.

Accepted lichenicolous species:

Sphaeria sociella Nyl., on *Trapelia coarctata*

Family Requienellaceae Boise

Lacrymospora Aptroot (1)

Index Fungorum 25383, Faceoffungi, MycoBank, GenBank

Classification: Requienellaceae, Xylariales, Xylariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Lacrymospora was introduced by Aptroot (1991) to accommodate the single lichenicolous species *L. parasitica*, which parasitizes the thallus of a lichenized ascomycete. This genus is distinguished by hemispherical, exposed ascocarps with a fully carbonized wall and a black, obconical ostiole. The hamathecium is gelatinized and contains oil droplets. The asci are elongate, possess a rounded ocular chamber, and are eight-spored. Ascospores are uniseriate, brown, bicolored, ellipsoidal with rounded ends, and asymmetrically distoseptate. The asexual morph includes black pycnidia with a carbonized wall in the upper part, producing acro-pleurogenous, filiform conidia. When *Lacrymospora* was established, Aptroot (1991) assigned it to the family Requienellaceae. However, without available molecular data, its phylogenetic placement remains uncertain and requires further study for confirmation.

Type species: *Lacrymospora parasitica* Aptroot, on *Myriotrema* (Aptroot, 1991)

Parapyrenis Aptroot (1-8)

Index Fungorum 26301, Faceoffungi, MycoBank, GenBank

Classification: Requienellaceae, Xylariales, Xylariomycetidae, Dothideomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Parapyrenis aurora* (Zahlbr.) Aptroot

= *Microthelia aurora* Zahlbr.

Accepted lichenicolous species:

Parapyrenis lichenicola Aptroot & Diederich, on *Pertusaria* (Aptroot et al., 1997)

SORDARIOMYCETES genera incertae sedis

Biciliopsis Diederich (2)

Index Fungorum, faceoffungi, MycoBank, GenBank

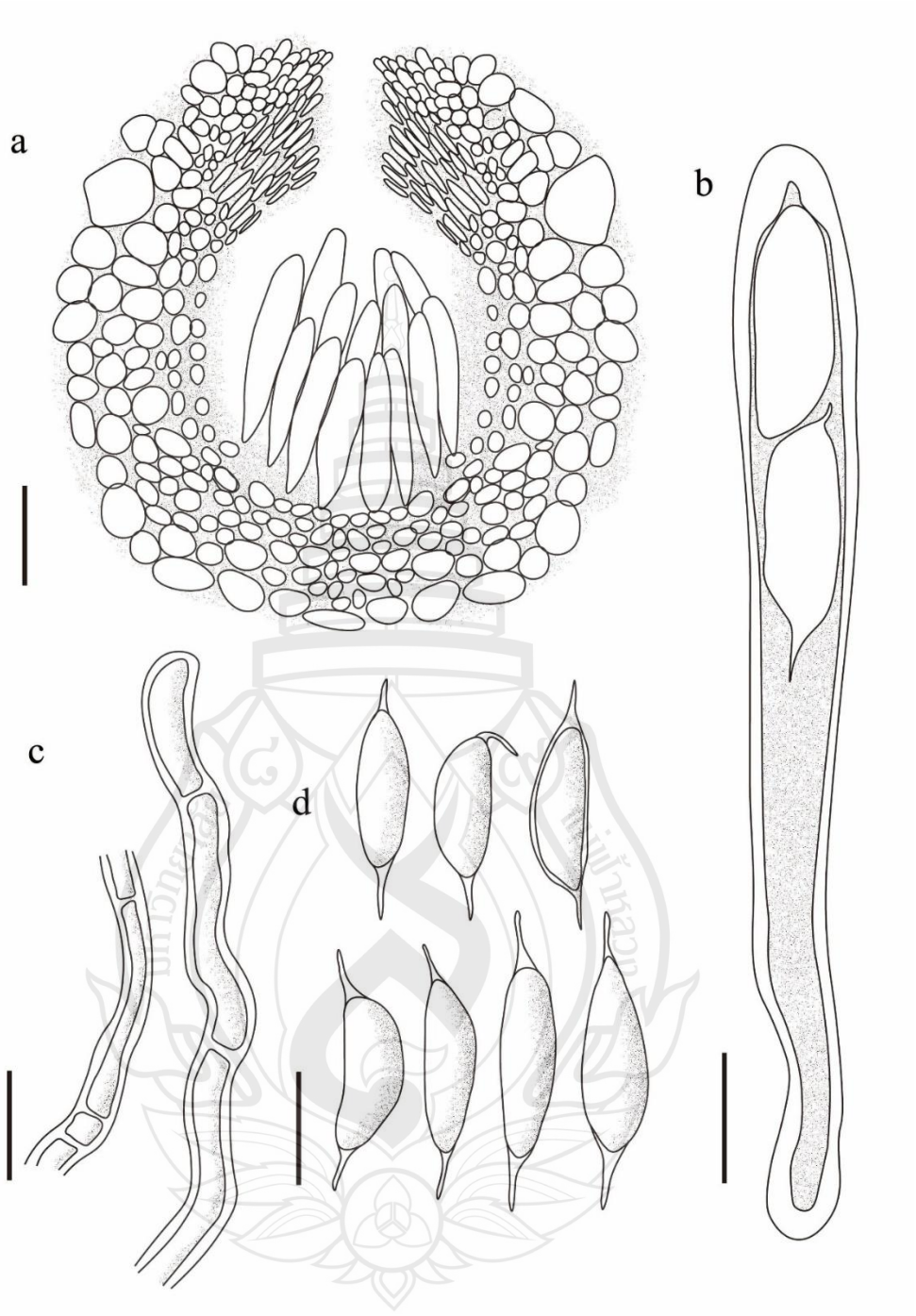
Classification: Sordariomycetes genera incertae sedis, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Biciliopsis was established by Diederich in Aptroot et al. (1997) to accommodate the type species *B. leptogiicola*, which is found on the cyanobacsterial lichen *Leptogium*. The genus is defined by its superficial ascomata, aggregated on a black stroma, with hyphae arising from the outer wall and two-spored asci. Initially, *Biciliopsis* was placed in *Dothideomycetes* genera incertae sedis (Lumbsch et al., 2007, Lumbsch et al., 2010, Wijayawardene et al., 2014). However, Wijayawardene et al. (2018) reclassified it within *Sordariomycetes* genera incertae sedis. Zhurbenko & Pino-Bodas (2017) later introduced a second species, *Biciliopsis cladoniae*, which occurs on *Cladonia ceratophylla* and is similar to *B. leptogiicola*, differing primarily by the absence of a stroma and the presence of erumpent ascomata with setae.

Type species: *Biciliopsis leptogiicola* Diederich

Table 2.191 Accepted lichenicolous species of *Biciliopsis*

	Species name	Host	References	Remarks
1	*Biciliopsis cladoniae* Zhurb., Pino-Bodas & Diederich	*Cladonia*	(Zhurbenko & Pino-Bodas, 2017)	
2	*Biciliopsis leptogiicola* Diederich	*Leptogium*	(Aptroot et al., 1997)	



Note a Section through ascoma. b Ascus. c Hyphae arising from the outer wall of the ascoma. d Ascospores. Scale bars: a = 40 µm, b = 10 µm, c–d = 20 µm.

Source Redraw from Aptroot et al. (1997)

Figure 2.132 *Biciliopsis leptogiicola*

Ellisembia Subram. (1-69)

Index Fungorum, faceoffungi, MycoBank, GenBank

Classification: Sordariomycetes genera incertae sedis, Sordariomycetes, Pezizomycotina, Ascomycota, Fungi

Type species: *Ellisembia coronata* (Fuckel) Subram.

Accepted lichenicolous species:

Ellisembia lichenicola Heuchert & U. Braun, on *Pertusaria and Physconia* (HeucHert et al., 2006)

Pezizomycotina Ordo incertae sedis

Order Thelocarpales Lücking & Lumbsch

Family Thelocarpaceae Zukal

Thelocarpon Nyl. (3-52)

Index Fungorum 5430, faceoffungi, MycoBank, GenBank

Classification: Thelocarpaceae, Thelocarpales, Pezizomycotina Ordo incertae sedis, Pezizomycotina, Ascomycota, Fungi

= *Sphaeropsis* Flot.

Type species: *Thelocarpon laureri* (Flot.) Nyl.

= *Sphaeropsis laureri* Flot.

Table 2.192 Accepted lichenicolous species of *Thelocarpon*

	Species name	Host	References	Remarks
1	*Thelocarpon cyaneum* Olech & Alstrup	*Polyblastia*	(Olech et al., 1990)	
2	*Thelocarpon epibolum* Nyl.	*Solorina crocea*	(Nylander, 1866c)	
3	*Thelocarpon lichenicola* (Fuckel) Poelt & Hafellner	*Baeomyces rufus*	(Poelt et al., 1975)	= *Ahlesia lichenicola* Fuckel

Pezizomycotina Familiae incertae sedis

Family Myxotrichaceae Locq. ex Currah

Thelocarpon Nyl. (1-17)

Index Fungorum 3405, faceoffungi, MycoBank, GenBank

Classification: Myxotrichaceae, Pezizomycotina Familiae incertae sedis, Pezizomycotina, Ascomycota, Fungi

Type species: *Myxotrichum chartarum* Kunze

Accepted lichenicolous species:

Myxotrichum bicolor (Ehrenb.) Fr., on *Usnea* (Fries, 1832)

= *Campsotrichum bicolor* Ehrenb.

Family Obryzaceae Körb.

Obryzaceae Körb.

Index Fungorum 3537, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina families incertae sedis, Pezizomycotina, Ascomycota, Fungi

Obryzaceae was introduced by Körber (1855) to accommodate the lichenized genus *Obryzum* Wallr. Although Hawksworth et al. (1988) deemed the family name *Obryzaceae* invalid, it has been widely accepted (Lumbsch et al., 2007; Wijayawardene et al., 2022; Liu et al., 2024). The initial description of this family focused on the characteristics of the lichen (Körber, 1855). Leighton (1879) later clarified that the perithecia of the type species *O. corniculatum* actually belonged to a lichenicolous fungus parasitic on the thallus of *Leptogium microscopicum*.

The family is characterized by astromatic, perithecial ascomata that are immersed, pyriform, ostiolate, and possess a periphysate ostiolar region. The asci are 4–8-spored, unitunicate, clavate, narrowly ellipsoid to ovoid, thin-walled, short-pedicellate, and evanescent, with no apparent apical ring. The ascospores are aseptate, hyaline, smooth-walled, lacking appendages, and without a gelatinous sheath

(Maharachchikumbura et al., 2016).

Due to the lack of molecular data, the phylogenetic position of Obryzaceae remains uncertain. Hawksworth et al. (1988) proposed rejecting the name Obryzaceae to conserve Gnomoniaceae, as they considered the two families to be synonymous. Subsequently, Lumbsch et al. (2010) placed *Obryzaceae* within *Sordariomycetes* families incertae sedis. However, Maharachchikumbura et al. (2016) argued that *Obryzaceae* is distinct from *Gnomoniaceae* based on morphological differences and habitat preferences and suggested that the family should be excluded from *Sordariomycetes*.

Diederich et al. (2018) placed *Obryzaceae* within *Pezizomycotina* ordo incertae sedis, while Hyde et al. (2024) placed it back within *Sordariomycetes* families incertae sedis. Further molecular studies are needed to resolve its phylogenetic position.

Type genus: *Obryzum* Wallr.

Obryzum Wallr. (4-6)

Index Fungorum 3537, Faceoffungi, MycoBank, GenBank

Classification: Obryzaceae, Pezizomycotina family incertae sedis, Pezizomycotina, Ascomycota, Fungi

Obryzum was introduced by Wallroth (1825) for a presumed pyrenocarpous gelatinous lichen, *O. corniculatum*. Initially, this species was mistakenly interpreted as a sterile *Leptogium* infected by a lichenicolous fungus. The host lichen was identified as *Collema corniculatum* Hoffm., leading to confusion because the fungus and its host shared the same name. Leighton (1879) clarified that the perithecia actually belonged to a lichenicolous fungus parasitic on the thallus of *Leptogium microscopicum*. The lichenicolous fungus was identified as *Verrucaria corniculate*, and described as having small, immersed, tuberculate, endocarpoid apothecia; eight-spored asci; and colorless, short-fusiform, corniculate ascospores with seven septa.

Later, Eriksson (1981), Santesson (1993), and Hoffmann & Hafellner (2000)

proposed that *O. corniculatum* should exclusively refer to the lichenicolous fungus originally described by Wallroth (1825). However, because Wallroth's classification was based on *Collema corniculatum*, the type species of *Obryzum* technically remained *C. corniculatum*. To resolve this taxonomic conflict, Lücking et al. (2017) proposed conserving the names *Obryzum corniculatum* Wallr. and *Obryzum* Wallr. to maintain stability in nomenclature.

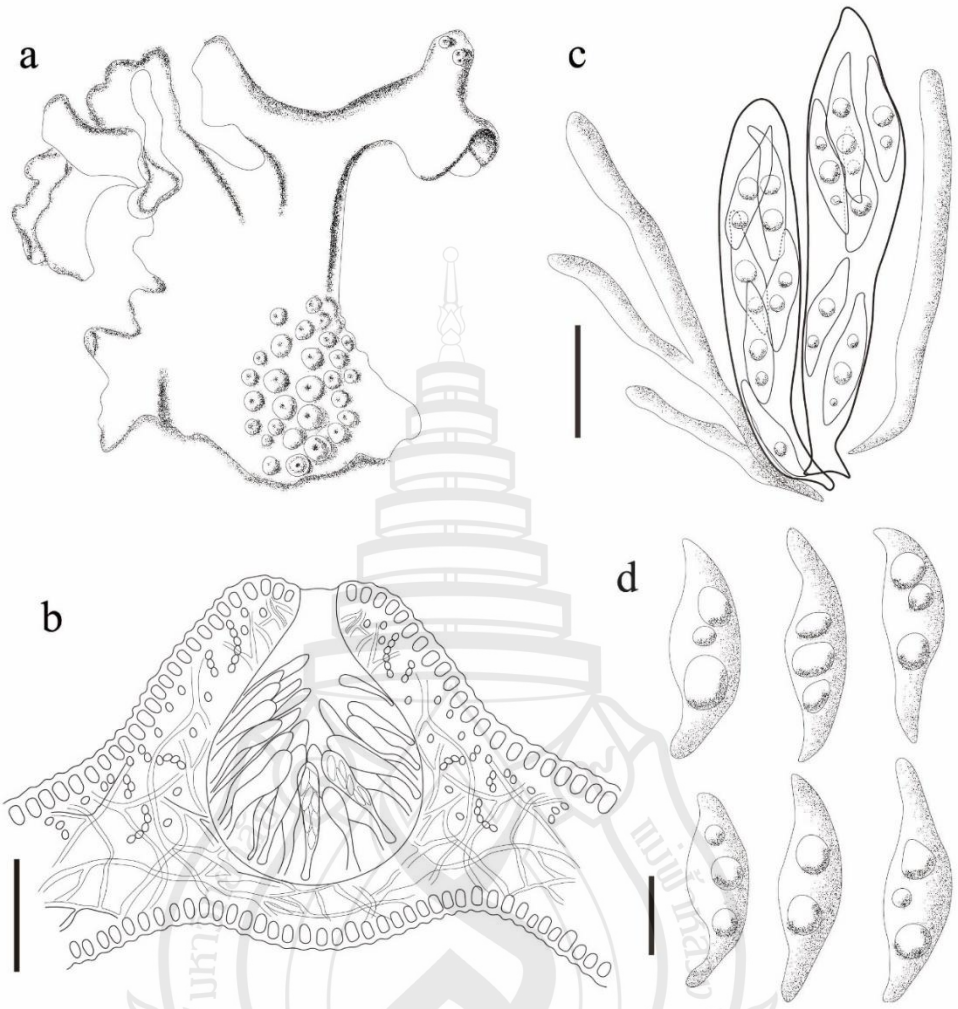
Körber (1855) had previously introduced the provisional family *Obryzaceae* to accommodate *Obryzum*, but Hawksworth et al. (1988) later deemed the family name invalid. To date, six species are recognized in *Obryzum* (Index Fungorum and MycoBank), four of which are lichenicolous. The genus is currently placed in *Pezizomycotina* as genera incertae sedis, pending further molecular studies to clarify its phylogenetic position.

Type species: *Obryzum corniculatum* (Hoffm.) Wallr.

= *Collema corniculatum* Hoffm.

Table 2.193 Accepted lichenicolous species of *Obryzum*

	Species name	**Host**	**References**	**Remarks**
1	*Obryzum corniculatum* (Hoffm.) Wallr.	*Scytinium*	(Wallroth, 1825)	= *Collema corniculatum* Hoffm.
2	*Obryzum friesii* (Keissl.) Nik. Hoffm. & Hafellner	*Leptogium*	(Hoffmann et al., 2000)	= *Physalospora friesii* Keissl.
3	*Obryzum scabrosum* Stirt.	On thallus of unknown lichen	(Stirton, 1881)	
4	*Obryzum striguloides* Aptroot & Sipman	*Agonimia vouauxii*	(Aptroot et al., 2001)	



Note a Ascomata on host. b Seciton of ascoma. c Asci and paraphyses. d Ascospores. Scale bars: b = 50 µm, c = 20 µm, d = 10 µm.

Source Redraw from Tulasne (1852) and Maharachchikumbura et al. (2016).

Figure 2.133 *Obryzum corniculatum*

Ascomycota Genera incertae sedis

Acaroconium Kocourk. & D. Hawksw. (2)

Index Fungorum 511401, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

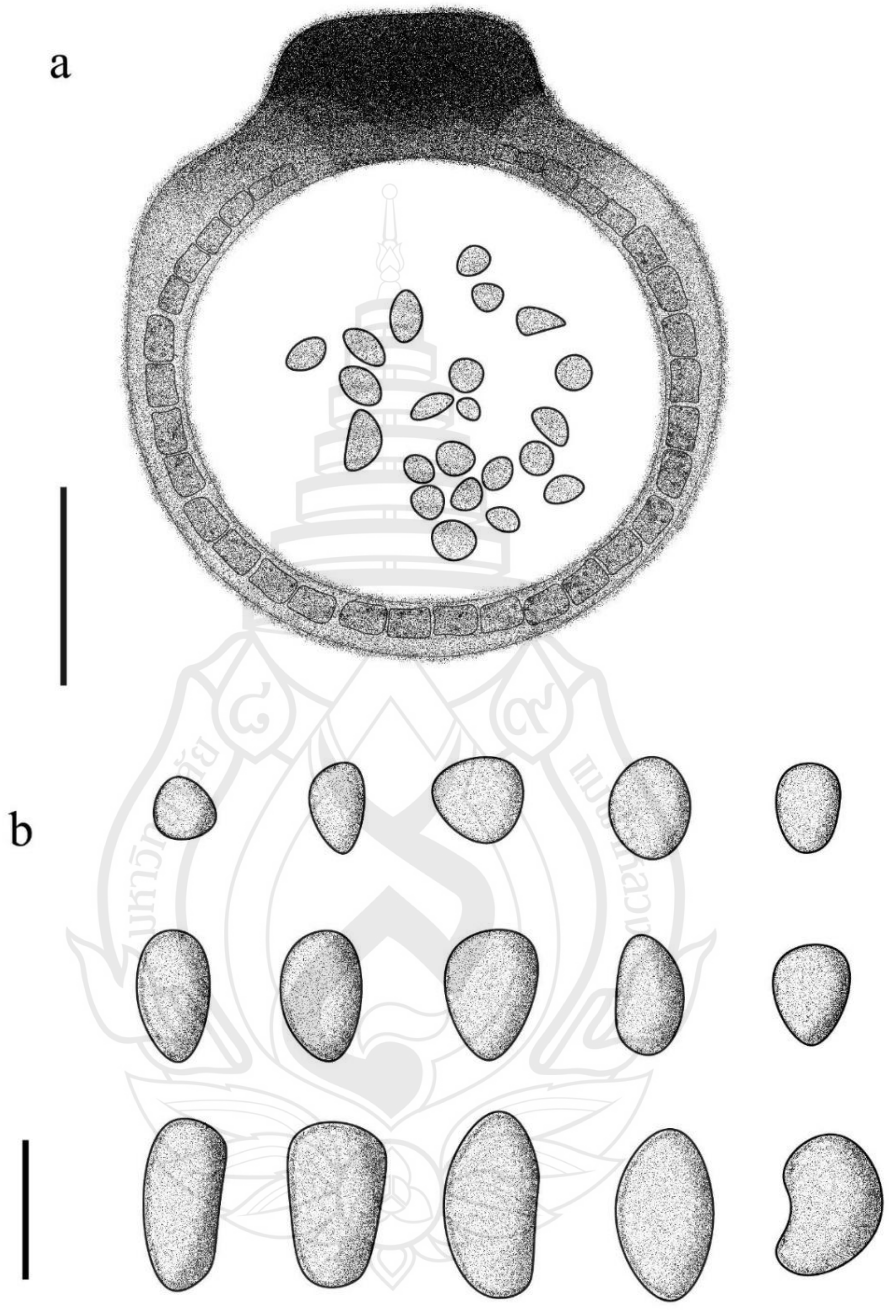
Acaroconium was introduced by Kocourk. & D. Hawksw. (2008) to accommodate the coelomycete *A. punctiforme*, which was discovered on *Acarospora macrospora*. This genus is distinguished by its black, subglobose pycnidia with a prominent thickened ostiolar collar and hyaline, broadly ampulliform conidiogenous cells. The conidia are simple, brown, ellipsoid, and non-septate, differing from *Lichenoconium* by their enteroblastic and non-ornamented nature (Kocourkov et al., 2008).

Zhurbenko (2021) later added *A. lavrinenkoae*, which is characterized by pale orange pycnidia and longer conidia. With only two species recognized to date and no molecular data available, the genus remains within *Pezizomycotina* as genera incertae sedis.

Type species: *Acaroconium punctiforme* Kocourk. & D. Hawksw.

Table 2.194 Accepted lichenicolous species of *Acaroconium*

	Species name	Host	References	Remarks
1	*Acaroconium lavrinenkoae* Zhurb.	*Solorina saccata*	(Zhurbenko, 2021d)	
2	*Acaroconium punctiforme* Kocourk. & D. Hawksw.	*Acarospora macrospora*	(Kocourkov et al., 2008)	



Note a Section of pycnidia. b Conida. Scale bars: a = 20 μm, b = 5 μm.

Source Redrawn from Kocourkov et al. (2008)

Figure 2.134 *Acaroconium punctiforme*

Acremoniula G. Arnaud ex Cif. (1-8)

Index Fungorum 7027, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Type species: *Acremoniula suprameliola* Cif.

Accepted lichenicolous species:

Acremoniula cladoniae Boers, van der Kolk & Diederich, on *Cladonia furcata*. (Diederich et al., 2024)

Anthostomaria (Sacc. & D. Sacc.) Theiss. & Syd. (1-100)

Index Fungorum 225, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

= *Anthostomella* subgen. *Anthostomaria* Sacc. & D. Sacc.

Type species: *Anthostomaria apogyra* (Nyl.) Theiss. & Syd., on *Gyrophorae polyphyllae*, *Umbilicaria* (Theissen et al., 1918b)

= *Melanotheca apogyra* Nyl.

Arborillus Munt.-Cvetk. & Gómez-Bolea (1)

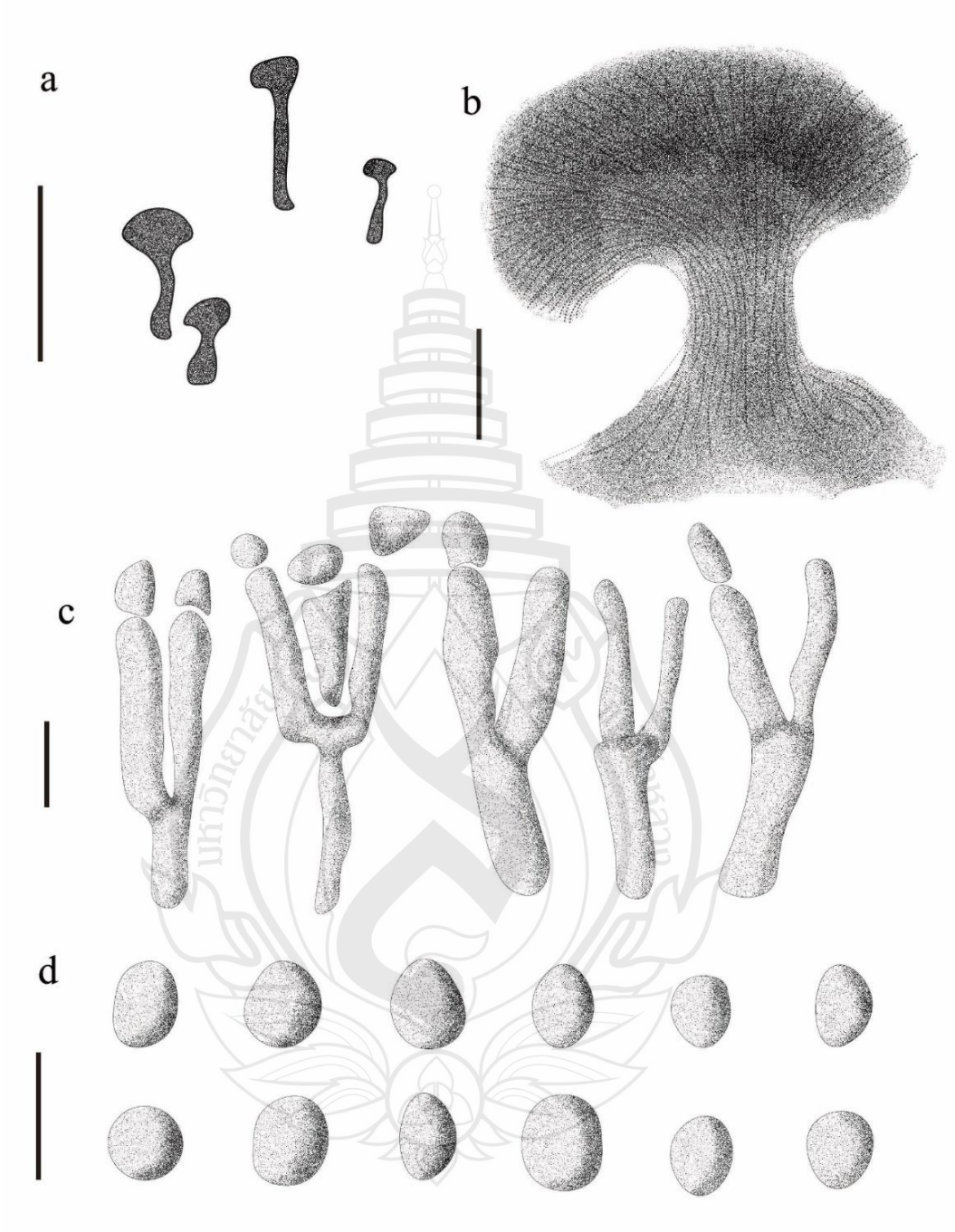
Index Fungorum 27876, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

The hyphomycetous genus *Arborillus* was introduced by Munt.-Cvetk. & Gómez-Bolea (1998) to accommodate the type species *A. llimonae*, discovered on the lichen *Diploschistes diacapsis*. This genus is characterized by brown, macronematous, erect synnemata with expanded, capitate apices. The conidiogenous cells are terminally integrated, monophialidic, penicillate, and verrucose. The conidia are dry, non-septate, verrucose, and catenate, with truncate poles resembling a broad pore. In the absence of molecular data, the phylogenetic position of *Arborillus* remains unresolved (Muntañola-Cvetković et al., 1998).

Type species: *Arborillus llimonae* Munt.-Cvetk. & Gómez-Bolea, on

Diploschistes diacapsis (Muntañola-Cvetković et al., 1998)



Note a Synnemata. b Section of synnemata. c Penicillate conidiogenous cells. d Conida. Scale bars: a = 1 mm, b = 100 µm, c–d = 5 µm.

Source Redraw from Muntañola-Cvetković et al. (1998).

Figure 2.135 *Arborillus llimonae*

Asterophoma D. Hawksw. (1)

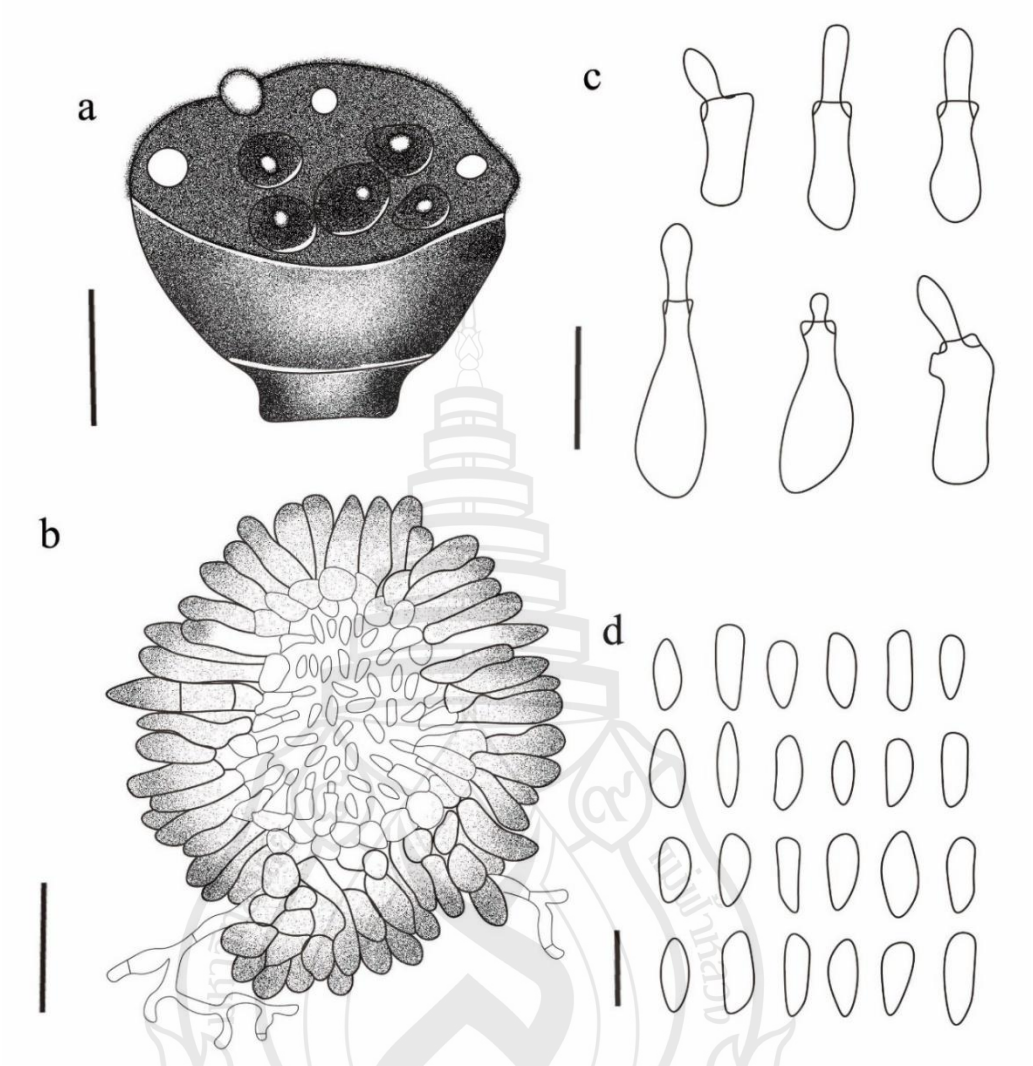
Index Fungorum 7266, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Asterophoma was established by Hawksworth (1981) with the type species *A. mazaediicola*, discovered on *Calicium trabinellum*. The genus is characterized by solitary, uniloculate, globose pycnidia that are dark brown to black and ostiolate. Its conidiogenous cells are enteroblastic, acrogenous, narrowly ampulliform to broadly subcylindrical, phialidic, occasionally biphialidic, and hyaline. The conidia are minute, smooth-walled, subcylindrical, hyaline, and simple, aggregating into a slimy mass that is extruded through the ostiole as a whitish drop (Hawksworth, 1981b).

Initially, Hawksworth (1981) placed *Asterophoma* within Sphaeropsidales. Subsequently, Diederich (2018) transferred it to *Pezizomycotina* as genera incertae sedis, pending further phylogenetic confirmation based on molecular data.

Type species: *Asterophoma mazaediicola* D. Hawksw., on *Calicium trabinellum* (Hawksworth, 1981b)



Note a Infected mazaedium with pycnidia extruding conidia in mucilaginous drops. b Vertical section of pycnidium. c Conidiogenous cells. d Conida. Scale bars: a = 100 μm, b–c = 10 μm, d = 5 μm.

Source Redrawn from Hawksworth (1981b)

Figure 2.136 *Asterophoma mazaediicola*

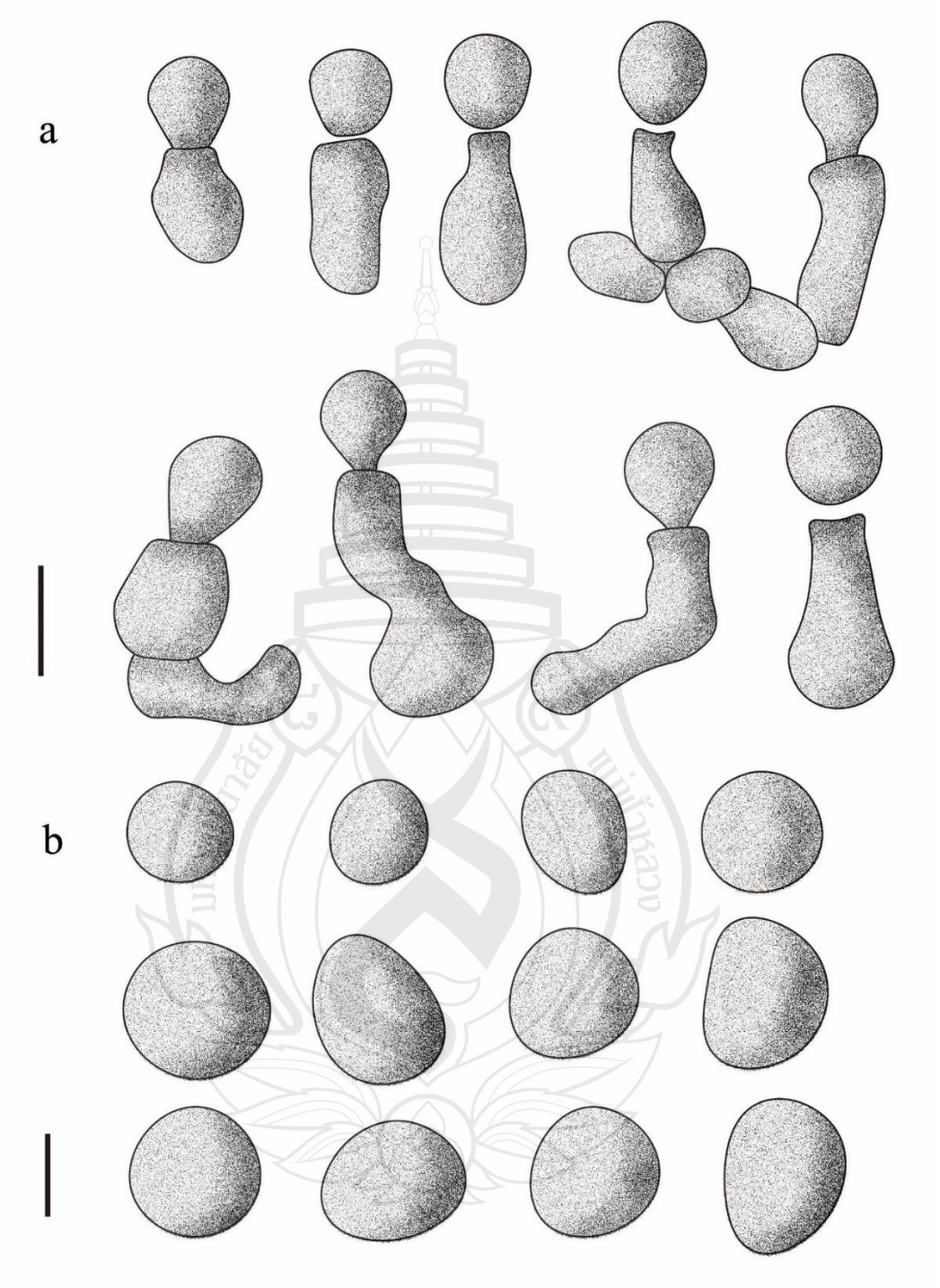
Baliomyces Zhurb. & Diederich (1)

Index Fungorum 853862, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Baliomyces was introduced by Zhurb. & Diederich (2024) to describe the type species *B. taimyricus*, a parasite of *Amygdalaria elegantior*. This genus is characterized by the absence of conidiomata, with conidiophores reduced to conidiogenous cells that form colonies of blackish conidia on the host surface. The conidiogenous cells are brown, percurrently proliferating with up to five annellations, and exhibit variable shapes ranging from lageniform to ampulliform, occasionally subcylindrical, and either straight or curved. The conidia are acrogenous, solitary, and brown, with forms that are primarily subglobose but can also be obovoid to pyriform, truncate at the base with a relatively narrow scar. Less commonly, they may be ellipsoidal or oblong. They are aseptate, smooth-walled, or occasionally roughened in older conidia, typically containing numerous small guttules (Zhurbenko et al., 2024). In the absence of molecular data, the phylogenetic position of *Baliomyces* remains uncertain, and it is tentatively placed within *Pezizomycotina* as genera incertae sedis.

Type species: *Baliomyces taimyricus* Zhurb. & Diederich (Zhurbenko et al., 2024)



Note a Conidiogenous cells. b Conida. Scale bars: ab = 10 μm

Source Redraw from Zhurbenko et al. (2024)

Figure 2.137 *Baliomyces taimyricus*

Bicoloromyces Heuchert, U. Braun & D. Hawksw. (1)

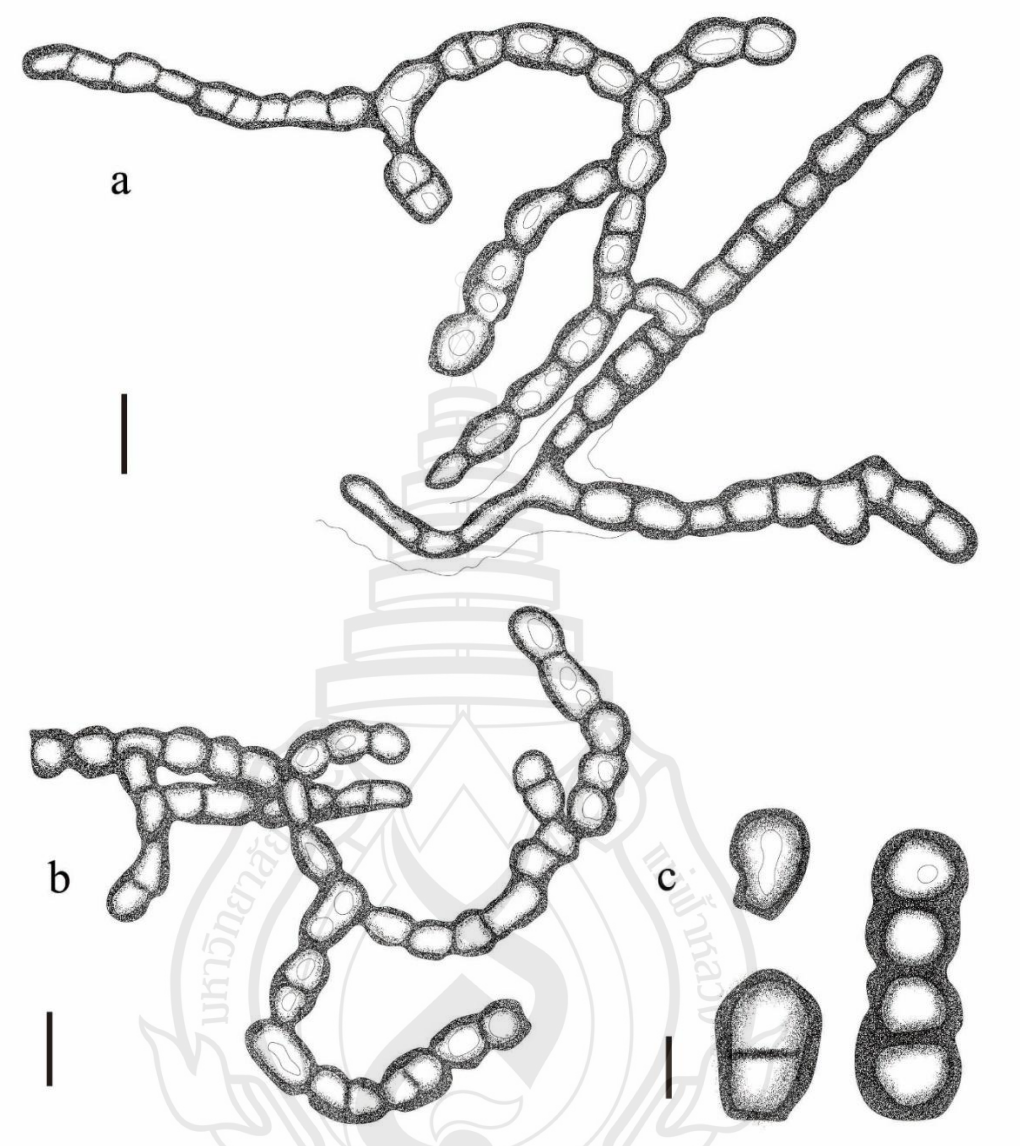
Index Fungorum 811365, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Bicoloromyces was introduced by Heuchert, U. Braun & D. Hawksw. (2015) to describe *B. kyffinensis*, a species discovered on a sterile crustose lichen. This genus is characterized by black, effuse, caespitose fungal colonies composed of branched, septate hyphae that are smooth or slightly rugose, subhyaline to pale brown, and often encrusted with crystalline structures. The stromata are cushion-like, formed from swollen hyphal cells, or composed of subglobose to elongated stromatic cells that range from brown to dark brown. The conidiophores are immersed, aseptate, unbranched, and either subcylindrical or doliiform, producing conidia in basipetal chains. The conidia vary in color from pale aeruginous to blackish, and their morphology is diverse: they can be straight or curved, erect to decumbent, 0–1-septate, and range in shape from subglobose to ellipsoid or subcylindrical. They are also distoseptate (Heuchert et al., 2015).

In the absence of molecular data, the phylogenetic status of *Bicoloromyces* remains unresolved, highlighting the need for further studies to determine its placement.

Type species: *Bicoloromyces kyffinensis* Heuchert, U. Braun & D. Hawksw.(Heuchert et al., 2015)



Note a Branched chains of conidia adhering at basal hyphae. b Conidial chain resembling monilioid hyphae. c Conidia. Scale bars: a–b = 10 μm, c = 5 μm.

Source Redrawn from Heuchert et al. (2015)

Figure 2.138 *Bicoloromyces kyffinensis*

Caeruleoconidia Zhurb. & Diederich (3)

Index Fungorum 819620, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Caeruleoconidia was first introduced by Zhurb. & Diederich (2015) to accommodate the type species *C. ochrolechiae*, which grows on the thallus and apothecia of *Ochrolechia pseudopallescens* (Zhurbenko et al., 2015). However, its nomenclature was not formally validated until Zhurbenko et al. (2017) reintroduced the genus.

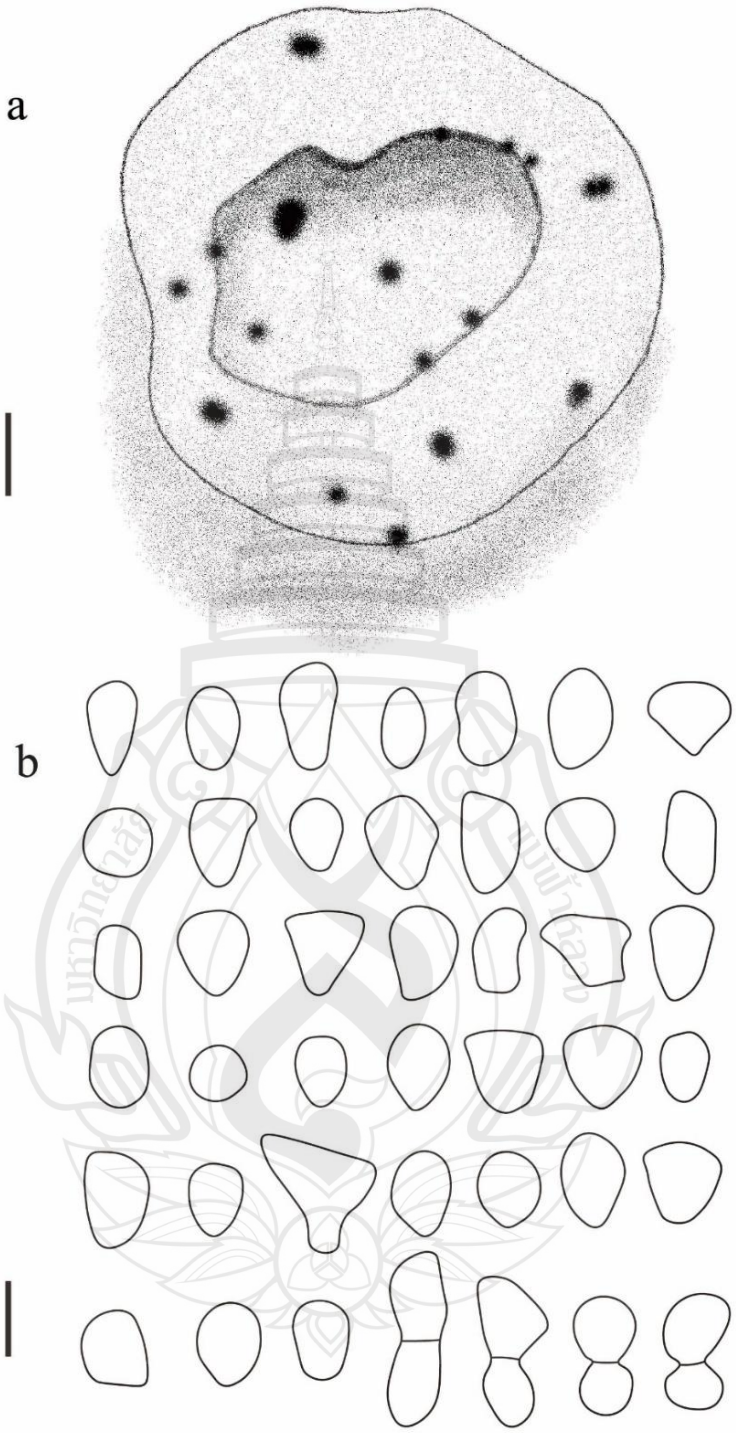
This genus is characterized by pycnidioid or sporodochioid, pulvinate conidiomata, often accompanied by a lateral, ring-like rudimentary wall. The conidiomata are blackish and stromatic in structure. Conidiophores are hyaline to bluish-green, composed of vertically elongated cells, and densely aggregated. The conidia are holoblastic, bluish-green, subglobose, smooth-walled, and 0–1-septate (Zhurbenko et al., 2015).

To date, three species are recognized in this genus. Due to the lack of molecular data, the phylogenetic placement of *Caeruleoconidia* remains unresolved.

Type species: *Caeruleoconidia ochrolechiae* Zhurb. & Diederich

Table 2.195 Accepted lichenicolous species of *Caeruleoconidia*

	Species name	Host	References	Remarks
1	*Caeruleoconidia biazrovii* Zhurb. & Diederich	*Cladonia stellaris*	(Zhurbenko & Pino-Bodas, 2017)	
2	*Caeruleoconidia ochrolechiae* Zhurb. & Diederich	*Ochrolechia pseudopallescens*	(Zhurbenko et al., 2015; Zhurbenko & Pino-Bodas, 2017)	
3	*Caeruleoconidia roccellae* E. Zimm. & Diederich	*Roccella fuciformis*	(Diederich et al., 2024)	



Note a Conidiomata on host. b Conidia. Scale bars: a = 200 μm, b = 5 μm.

Source Redraw from Zhurbenko et al. (2015)

Figure 2.139 *Caeruleoconidia ochrolechiae*

Calongeomyces D. Hawksw. & Etayo (1)

Index Fungorum 519339, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

= *Calongia* D. Hawksw. & Etayo, Lichenologist 42(4): 355 (2010)

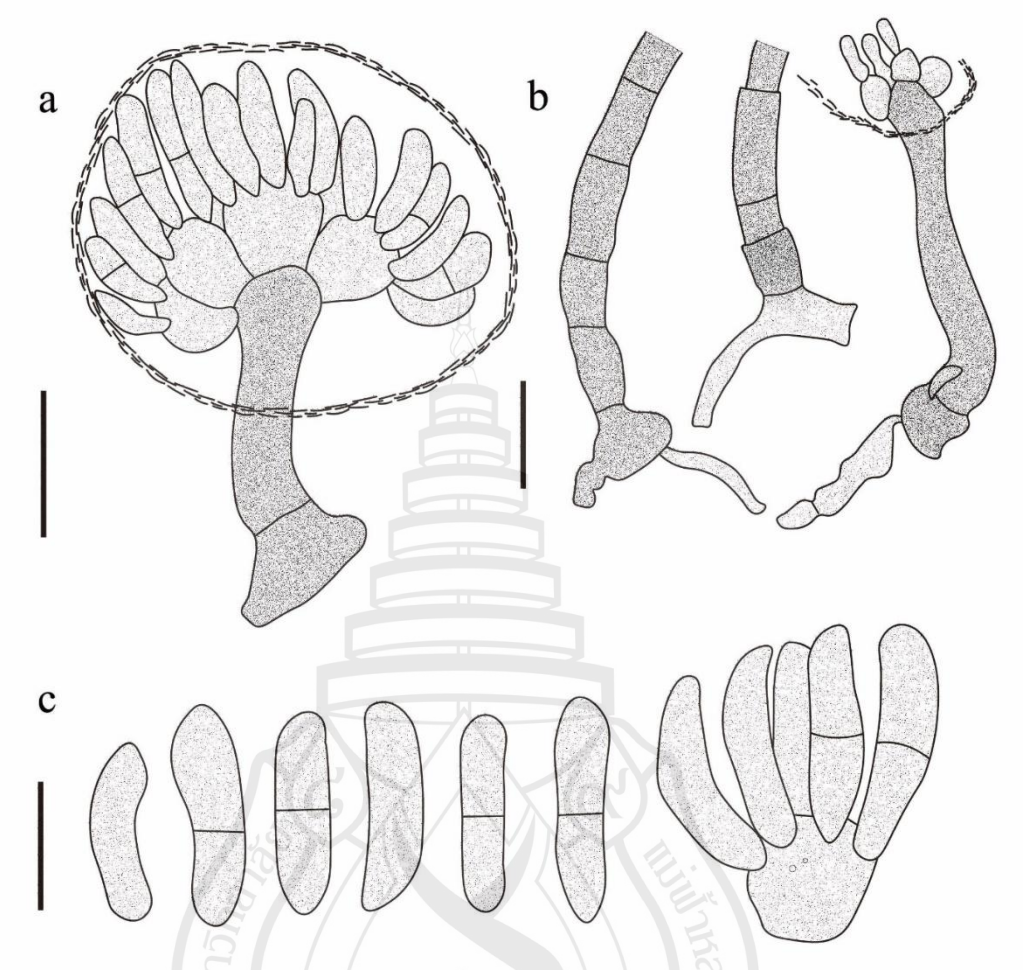
Type: *Calongia gibelluloides* D. Hawksw. & Etayo

Calongeomyces was introduced by Hawksworth & Etayo (2011) to reclassify the species *C. gibelluloides*, originally described as *Calongia gibelluloides*. This species is found growing on the thalli of *Flavoparmelia caperata* and discolored squamules of *Cladonia* species. *Calongia* was deemed invalid and subsequently synonymized with *Calongeomyces*. The genus is distinguished by macronematous, mononematous conidiophores that arise singly or in small groups from a single red-brown rhomboidal basal cell. The conidiophores are unbranched, rigid, and either septate or non-septate, with a swollen apical region enclosed in a membranous sheath. Polyblastic, brown conidiogenous cells emerge from the expanded apex; these cells are subglobose to ampulliform and bear several conidiogenous loci. The conidia are solitary, narrowly ellipsoid to elongate, 0–1-septate, smooth-walled, greyish-brown, and leave circular scars upon detachment (Hawksworth & Etayo, 2010).

The genus is tentatively placed within *Pezizomycotina* as genera incertae sedis, with its phylogenetic position remaining uncertain due to the lack of molecular data.

Type species: *Calongeomyces gibelluloides* (D. Hawksw. & Etayo) D. Hawksw. & Etayo (Hawksworth et al., 2011)

= *Calongia gibelluloides* D. Hawksw. & Etayo (Hawksworth & Etayo 2010)



Note a Conidiophore with the enclosing vesicular membranous sheath intact. b Conidiophores with basal part and conidia discharged. c Conidia and conidiogenous cells with scars. Scale bars: a–b = 10 μm, c = 5 μm.

Source Redraw from Hawksworth et al. (2010)

Figure 2.140 *Calongeomyces gibelluloides*

Carnegieispora Etayo & F. Berger (1)

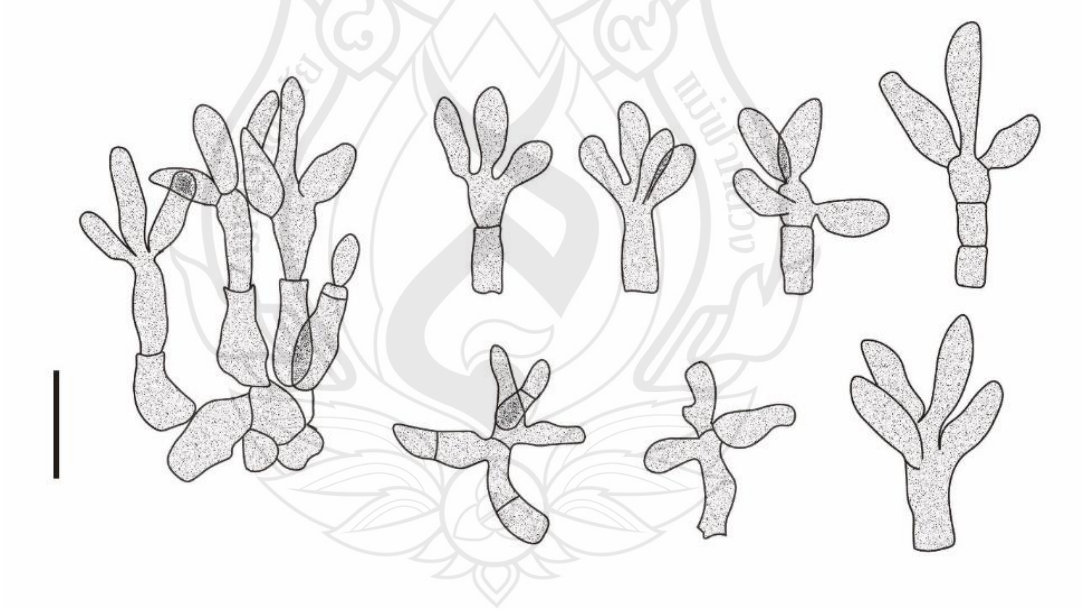
Index Fungorum 515391, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Carnegieispora was introduced by Etayo & Berger (2009) to describe its sole

species, *C. rimeliae*, which grows on the bleached thalli of *Parmotrema reticulatum* (Taylor) M. Choisy. The genus is characterized by black, immersed conidiomata that initially appear pycnidial, but later fissure through the host thallus, resembling acervuli. The conidiophores arise from a subhyaline to brownish paraplechtenchyma and can be either subspherical or elongate. Conidiogenous cells are holoblastic, gray, elongate-cylindrical, annellidic, and produce 1–2 percurrent proliferations. Conidia are irregularly branched, dry, acrogenous, gray, and have a truncate base (Etayo & Berger, 2009). Due to the absence of molecular data, the phylogenetic placement of *C. rimeliae* remains uncertain and is tentatively assigned to the Pezizomycotina genera incertae sedis.

Type species: *Carnegieispora rimeliae* Etayo & F. Berger, on *Parmotrema reticulatum* (Etayo & Berger, 2009)



Note Conidiophores, conidiogenous cells and conidia. Scale bar = 10 μm.

Source Redraw from Etayo et al. (2009)

Figure 2.141 *Carnegieispora rimeliae*

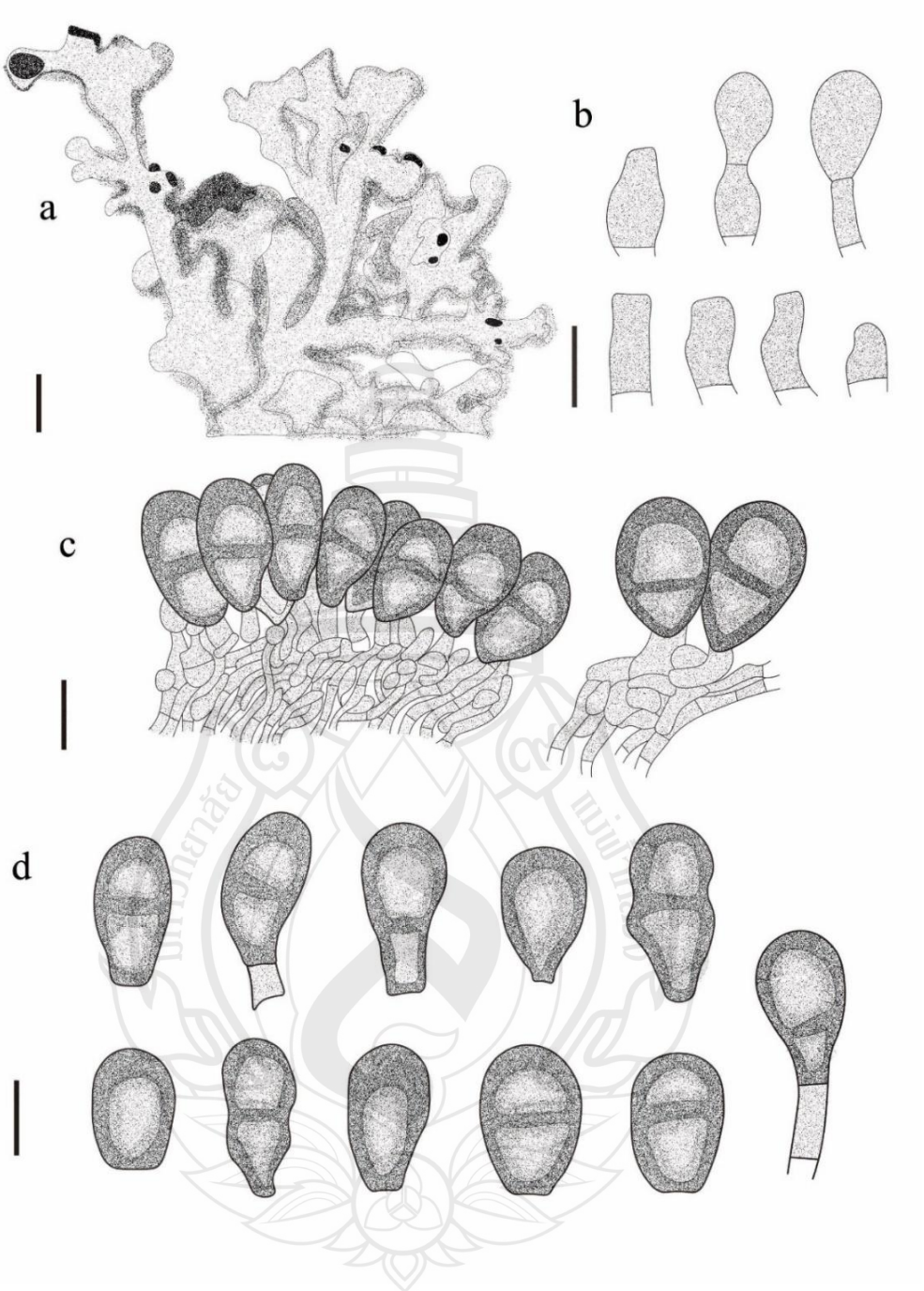
Cecidiomyces U. Braun & Zhurb. (1)

Index Fungorum 800818, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Cecidiomyces was introduced by Braun & Zhurbenko (2012) to accommodate its sole species, *C. santessonii*, which was discovered on *Stereocaulon argus*. This genus is characterized by its lichenicolous habit, gall formation, and caespitose to sporodochial colony structure. The conidiophores are semi-macronematous, monoblastic, and determinate, being reduced to conidiogenous cells. The conidia are solitary, subglobose to obovoid or obpyriform, with a broadly rounded apex, and are 0–1-septate and pigmented. The phylogenetic placement of *Cecidiomyces* remains unresolved due to the lack of molecular data (Zhurbenko & Braun, 2012).

Type species: *Cecidiomyces santessonii* U. Braun & Zhurb., on *Stereocaulon argus*



Note a Habitus. b Conidiophores reduced to conidiogenous cells. c Portions of colonies. d Conidia. Scale bars: a = 1 mm, b–d = 10 μm.

Source Redrawn from Zhurbenko et al. (2012)

Figure 2.142 *Cecidiomyces santessonii*

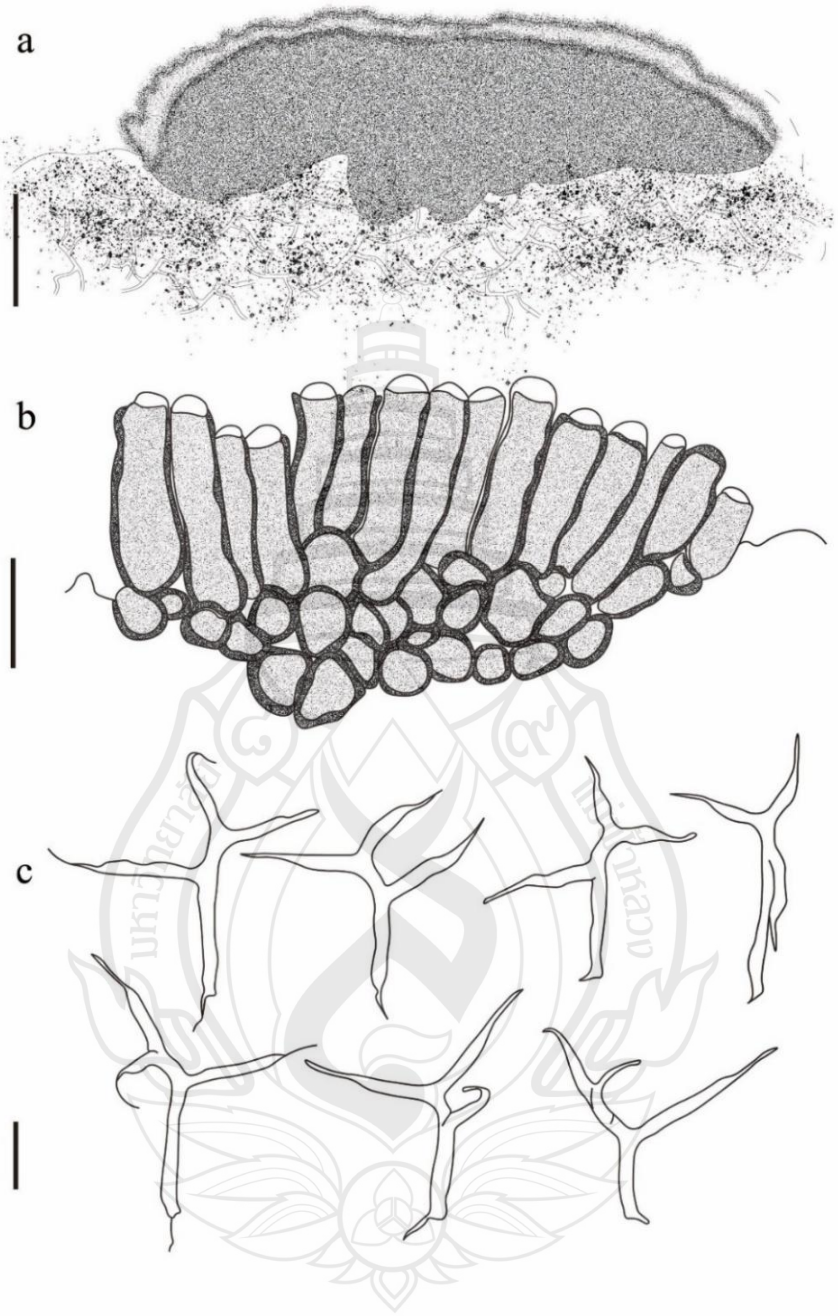
Choreospora Constant. & R. Sant. (1)

Index Fungorum 25027, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Choreospora was introduced by Constant. & R. Sant. (1987) to describe the sole hyphomycete, *C. tibellii*, which was found on a sterile foliicolous lichen thallus of *Echinoplaca* sp. The genus is characterized by sporodochial conidiomata with a reduced, black, round to irregular-shaped stroma. The phialides, which function as conidiogenous cells, are brown, cylindrical, and annellidic. The conidia are pale olivaceous, tetraradiate, non-septate, and feature whip-like extensions on their arms (Constantinescu et al., 1987). Due to the lack of molecular data, the phylogenetic status of *Choreospora* remains uncertain and requires further investigation in the future.

Type species: *Choreospora tibellii* Constant. & R. Sant.



Note a Vertical section of conidioma. b Section of conidiomata. c Conidia. Scale bars: a = 15 μm, b–c = 10 μm.

Source Redrawn from Constantinescu et al. (1987)

Figure 2.143 *Choreospora tibellii*

Cladoniicola Diederich, van den Boom & Aptroot (2)

Index Fungorum 28920, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

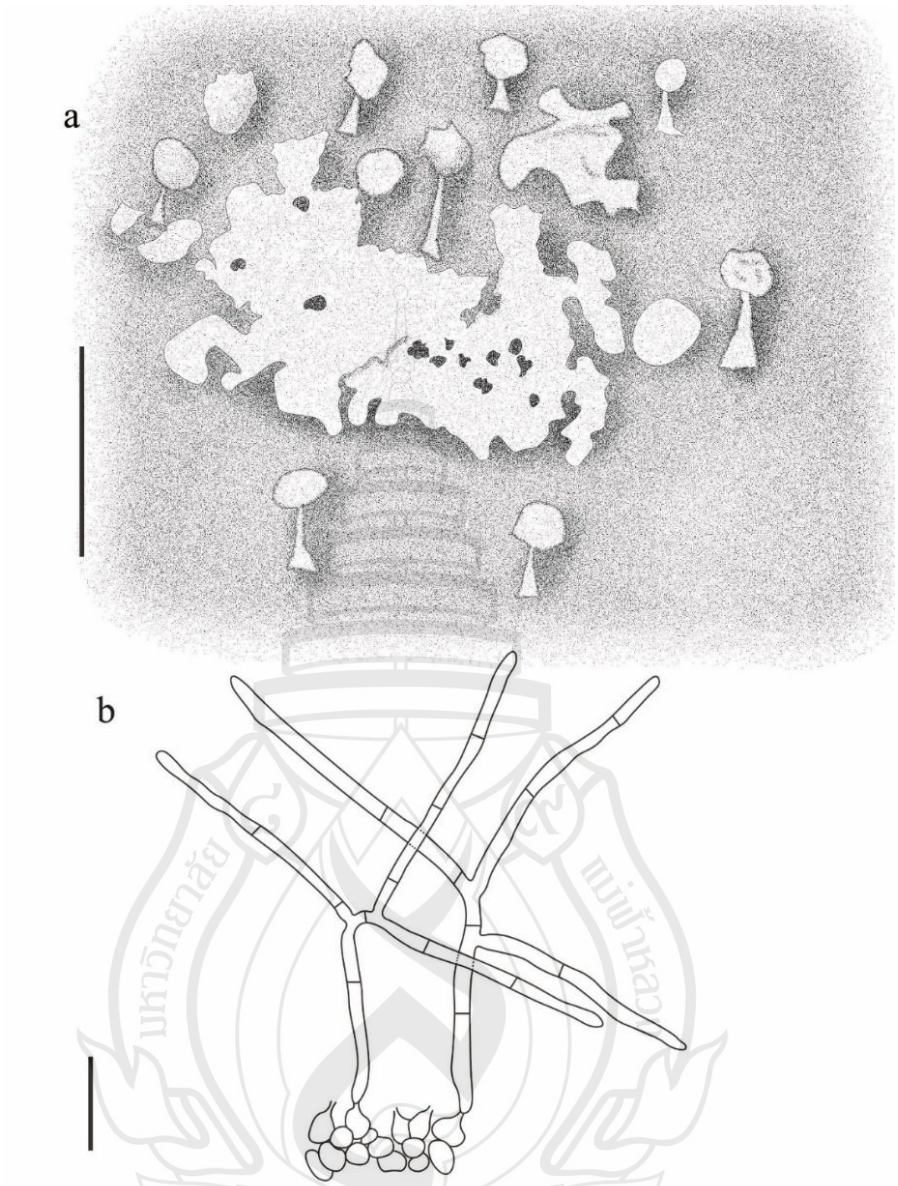
Cladoniicola was introduced by Diederich et al. (2001) to describe the lichenicolous coelomycete *C. staurospora*, which grows on the primary thallus of *Cladonia*. This genus is characterized by dark brown, subglobose, pycnidial, stromatic conidiomata that open irregularly without a defined ostiole. It lacks conidiophores, with conidiogenous cells arising from the inner pycnidial wall, lining the pycnidial cavity. These cells are hyaline, non-septate, ellipsoidal, ampulliform, or irregular in shape, tapering towards the apex, and holoblastic. The conidia are hyaline, smooth, and thin-walled, basally slightly attenuated, elongate, with one main straight axis and four cylindrical arms (Diederich et al., 2001).

Etayo (2010) introduced a second species, *C. irregularis*, which grows on the thallus of *Diploschistes diacapsis*. This species differs from *C. staurospora* by having larger conidiomata, larger conidiogenous cells, and more irregular and larger conidia. To date, two species are recognized in this genus, and no molecular data are available. As such, its phylogenetic status remains uncertain and requires further investigation when sequence data become available.

Type species: *Cladoniicola staurospora* Diederich, van den Boom & Aptroot

Table 2.196 Accepted lichenicolous species of *Cladoniicola*

	Species name	Host	References	Remarks
1	*Cladoniicola irregularis* Etayo	*Diploschistes diacapsis*	(Etayo, 2010c)	
2	*Cladoniicola staurospora* Diederich, van den Boom & Aptroot	*Cladonia humilis*	(Diederich et al., 2001)	



Note a Black pycnidia growing on decolourized squamules of Cladonia humilis. b Conidiogenous cells and conidia. Scale bars: a = 1 mm, b = 10 μm.

Source Redrawn from Diederich et al. (2001)

Figure 2.144 *Cladoniicola staurospora*

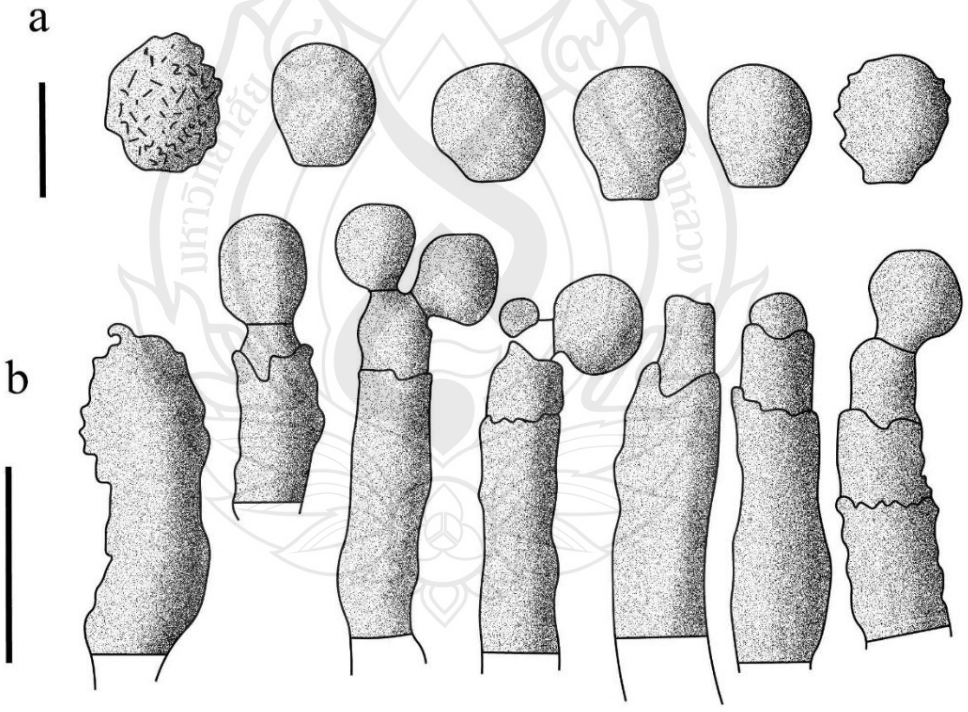
Clauzadeomyces Diederich (1)

Index Fungorum 28920, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Cladoniicola was introduced by Diederich (1994) to describe *C. verrucosus*, a hyphomycete found forming sporodochia on the thallus of the crustose lichen *Placopsis lambii*. This species is characterized by macronematous, mononematous, septate conidiophores, brown, verrucose, annellidic conidiogenous cells, and brown, subglobose, solitary, simple, verrucose conidia with a truncate base (Diederich, 1994). Currently, *C. verrucosus* is the only species recognized in the genus. Due to the absence of molecular data, its phylogenetic position remains uncertain, and it is tentatively placed within *Pezizomycotina* genera incertae sedis.

Type species: *Clauzadeomyces verrucosus* Diederich, on *Placopsis lambii*



Note a Conida. b Conidiogenous cells and conidia. Scale bars: a = 5 μm, b = 10 μm.

Source Redrawn from Diederich (1994)

Figure 2.145 *Clauzadeomyces verrucosus*

Codonmyces Calat. & Etayo (3)

Index Fungorum 28397, Faceoffungi, MycoBank, GenBank

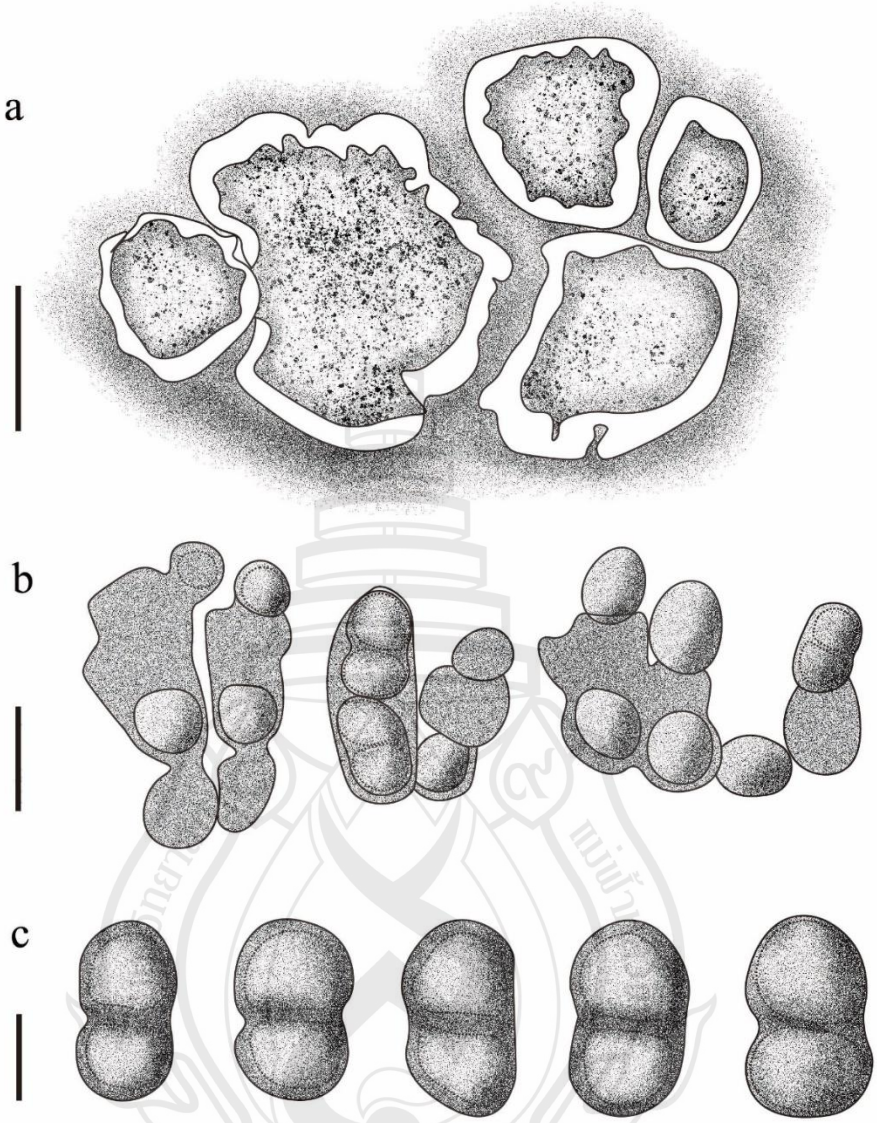
Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Codonmyces was introduced by Calat. & Etayo (1999) to describe the conidial fungus *C. lecanorae*, which occurs on *Lecanora valesiaca*. This genus is characterized by its black, powdery, effuse colonies; macronematous, mononematous, and irregularly branched conidiophores; and campanulate, monoblastic conidiogenous cells that are brown, discrete, and grouped, with several prominent flared annellations. The conidia are brown, 1-septate, and feature coarse, flattened warts (Calatayud & Etayo, 1999a). Zhurbenko et al. (2024) and Diederich et al. (2024) described two new species separately, leading to three known species in this genus. Due to the lack of molecular data available, the phylogenetic status of this genus remains uncertain.

Type species: *Codonmyces lecanorae* Calat. & Etayo

Table 2.197 Accepted lichenicolous species of *Codonmyces*

	Species name	Host	References	Remarks
1	*Codonmyces canoparmeliae* Diederich	*Canoparmelia texana*	(Diederich et al., 2024)	
2	*Codonmyces lecanorae* Calat. & Etayo	*Lecanora valesiaca* and *Protoparmeliopsis muralis*	(Calatayud & Etayo, 1999a)	
3	*Codonmyces ochrolechiae* Zhurb. & Diederich	*Ochrolechia yasudae* and *Ochrolechia* sp.	(Zhurbenko et al., 2024)	



Note a Habitus. b Conidiogenous cells and conidia. c Conidia. Scale bars: a = 0.5 mm, b = 10 μm, c = 5 μm.

Source Redrawn from Calatayud et al. (1999a)

Figure 2.146 *Codonmyces lecanorae*

Coniambigua Etayo & Diederich (4)

Index Fungorum 27666, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina,

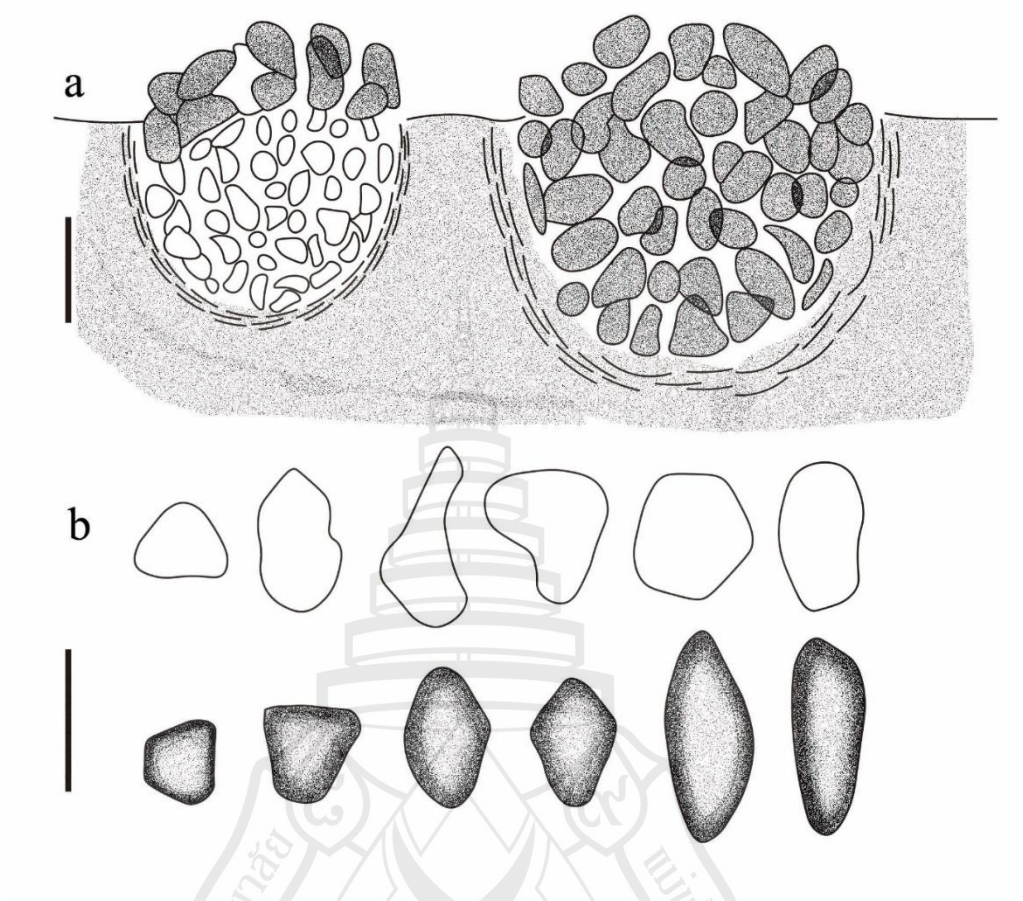
Ascomycota, Fungi

Coniambigua was introduced by Etayo & Diederich (1995) to describe the conidial species *C. phaeographidis*, which is found on *Phaeographis lyellii*. This genus is characterized by dark-colored, pycnidial conidiomata with irregular openings and hyaline walls. The holoblastic, terminal conidiogenous cells are integrated and hyaline. The conidia are dark brown, acrogenous, simple, and ornamented, with shapes ranging from rounded to cylindrical or polyhedral (Etayo et al., 1995). Diederich et al. (2024) introduced two new species and transferred one species from *Sclerococcum aptrootii*. Due to the lack of sequence data, the phylogenetic status of this genus remains uncertain and requires further investigation in the future.

Type species: *Coniambigua phaeographidis* Etayo & Diederich

Table 2.198 Accepted lichenicolous species of *Coniambigua*

	Species name	Host	References	Remarks
1	*Coniambigua aptrootii* (Diederich) Diederich	*Fissurina dumastii*	(Diederich, 2015; Diederich et al., 2024)	= *Sclerococcum aptrootii* Diederich
2	*Coniambigua graphidis* Kukwa & Diederich	*Graphis scripta*	(Diederich et al., 2024)	
3	*Coniambigua ochrolechiae* Diederich	*Ochrolechia*	(Diederich et al., 2024)	
4	*Coniambigua phaeographidis* Etayo & Diederich	*Phaeographis lyellii*	(Etayo et al., 1995)	



Note a Section through immersed conidiomata. b Conidia. Scale bars: a = 25 μm, b = 10 μm.

Source Redrawn from Etayo et al. (1995)

Figure 2.147 *Coniambigua phaeographidis*

Deichmannia Alstrup & D. Hawksw. (1)

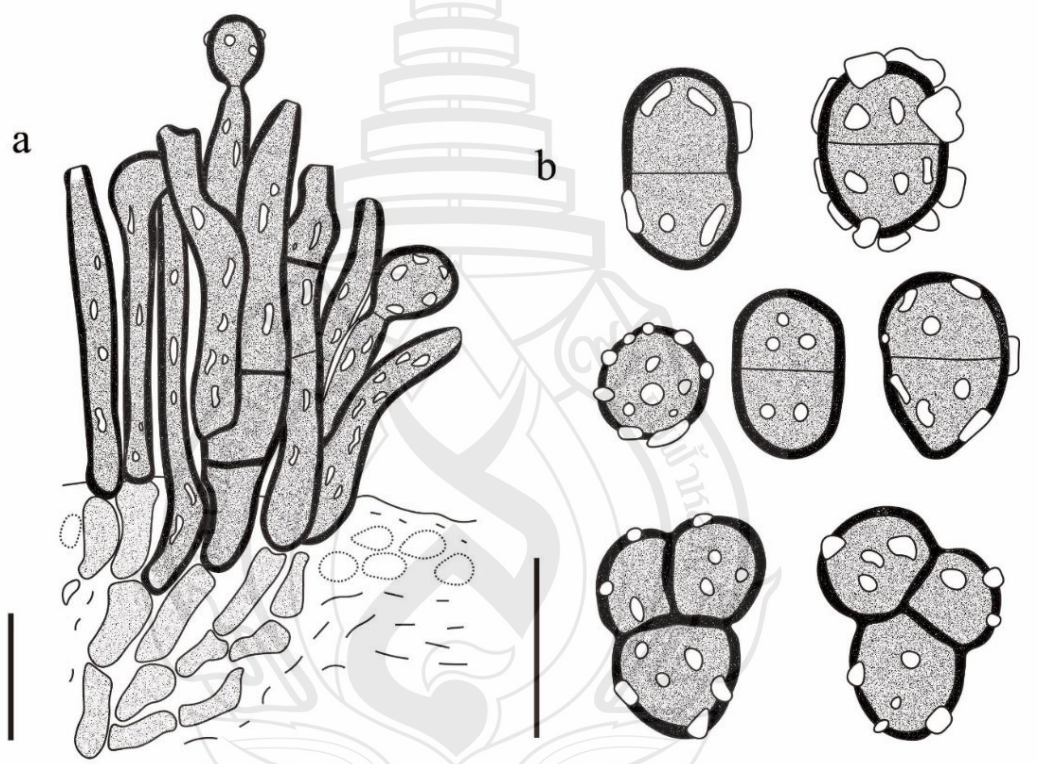
Index Fungorum 27666, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Deichmannia was introduced by Alstrup & Hawksworth (1990) to describe the lichenicolous hyphomycete *D. verrucispora*, found on *Diploschistes muscorum*. This monotypic genus is characterized by black, sporodochial colonies and brown, macronematous, aggregated, sparsely branched, subcylindrical conidiophores. The

genus also features monoblastic, integrated, terminal conidiogenous cells that are subcylindrical and brown. The conidia are brown, solitary, broadly ellipsoid, dry, 1–2-septate, and coarsely verrucose (Alstrup et al., 1990). Due to the lack of sequence data, the phylogenetic position of this genus remains uncertain and requires further investigation for clarification.

Type species: *Deichmannia verrucispora* Alstrup & D. Hawksw., on *Diploschistes muscorum*



Note a Conidiophores and conidiogenous cells. b Conidia. Scale bars: a–b = 10 μm.

Source Redrawn from Alstrup et al. (1990)

Figure 2.148 *Deichmannia verrucispora*

Dictyophrynella Bat. & Cavalc. (1)

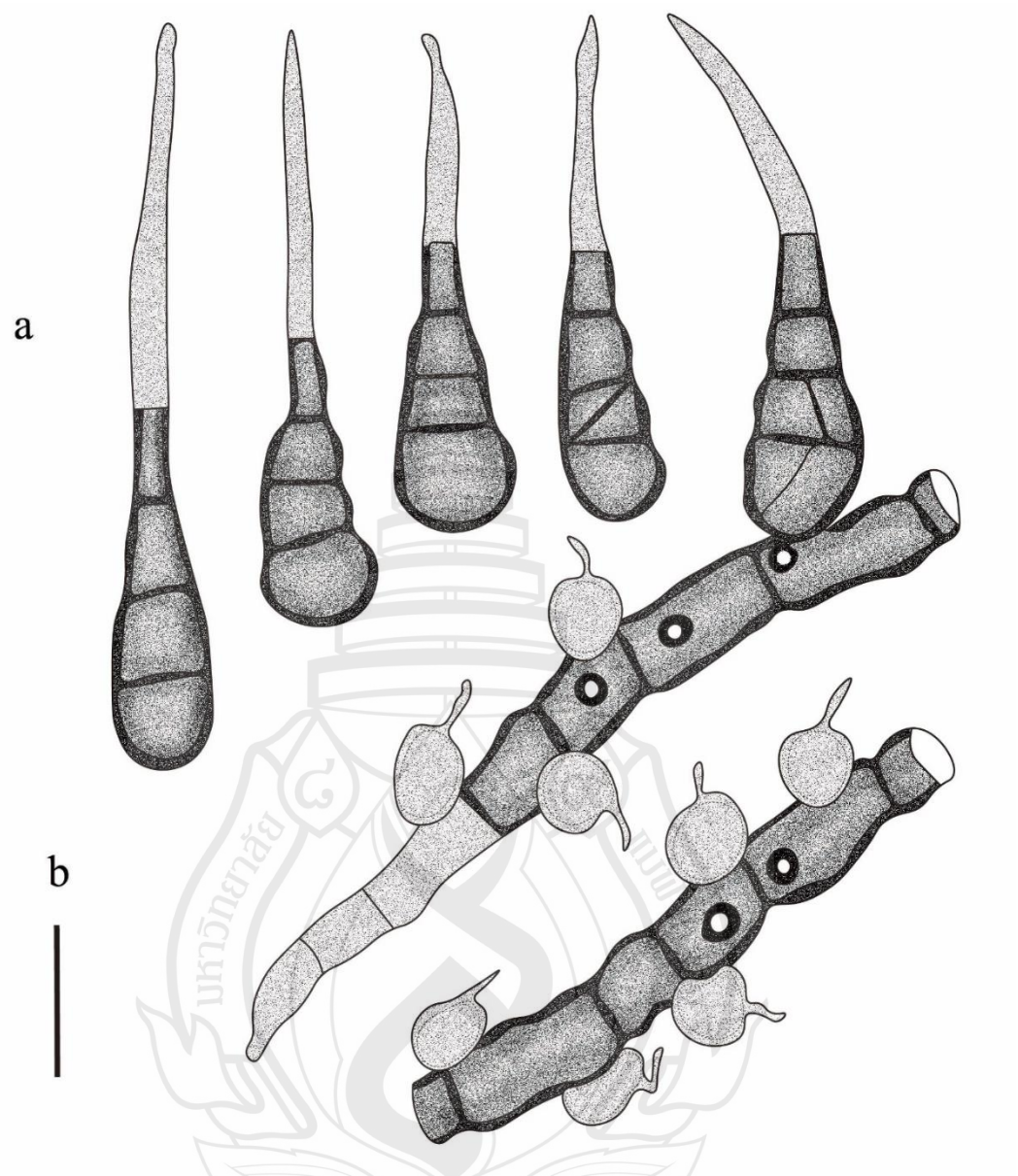
Index Fungorum 7998, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina,

Ascomycota, Fungi

The monotypic genus *Dictyophrynella* was introduced by Bat. & Cavalc. (1964) to describe the type species *D. bignoniacearum*, which is found on unidentified lichens on decomposing leaflets. This genus is characterized by dispersed, dark brown, superficial colonies on the surface of the host lichen. The pale brown mycelium branches at right angles and gradually thickens, becoming dark brown. Frequent, lateral hyphopodia are subglobose with mucronate necks. The conidiogenous cells are integrated and intercalary, resembling hyphae except for the attached conidia or scars. The conidia are solitary, obclavate, submuriform with 3–5 septa, dark brown with a pale, elongated apical cell. The length of the conidia varies between 25–45 µm (Hawksworth, 1979a). With only one known species and no molecular data available, the phylogenetic status of this genus remains uncertain.

Type species: *Dictyophrynella bignoniacearum* Bat. & Cavalc. (Batista et al., 1964; Monteiro, 2009)



Note a Conidia. b Conidiogenous cells. Scale bar = 10 μm.

Source Redrawn from Hawksworth (1979a)

Figure 2.149 *Dictyophrynella bignoniacearum*

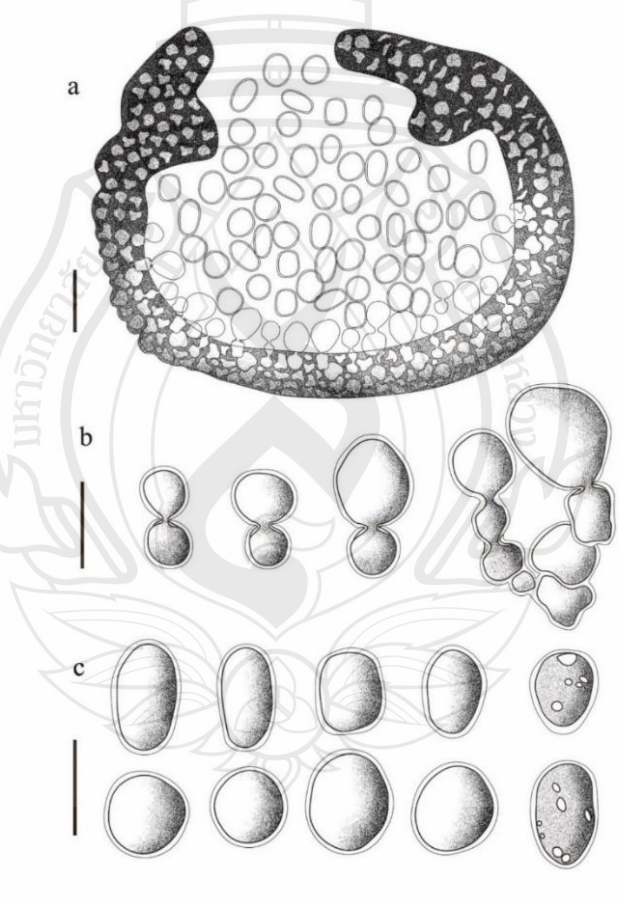
Epaphroconidia Calat. & V. Atienza (1)

Index Fungorum 27462, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Epaphroconidia was introduced by Calat. & V. Atienza (1995) to describe *E. hawksworthii*, a conidial fungus found on the thallus of *Pertusaria pertusa* in Spain. The genus is characterized by black conidiomata, which are initially subglobose but become cupulate with age. Conidiogenous cells emerge from the pycnidial wall and produce conidia enteroblastically through a minute pore. The conidia are holoblastic, large, globose, hyaline, and aseptate (Calatayud et al., 1995). With only one known species and no molecular data available, its phylogenetic placement remains uncertain.

Type species: *Epaphroconidia hawksworthii* Calat. & V. Atienza, on *Pertusaria pertusa*



Note a Section of conidioma. b Different stages of conidiogenous cells and conidia. c Conidia. Scale bars: a = 25 µm, bc = 20 µm.

Source Redrawn from Calatayud et al. (1995)

Figure 2.150 *Epaphroconidia hawksworthii*

Endosporoideus W.H. Ho, Yanna, K.D. Hyde & Goh (1-2)

Index Fungorum 28925, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Type species: *Endosporoideus pedicellatus* W.H. Ho, Yanna, K.D. Hyde & Goh

Accepted lichenicolous species:

Endosporoideus leprae Diederich, on *Lepra ventosa*. (Diederich et al., 2024)

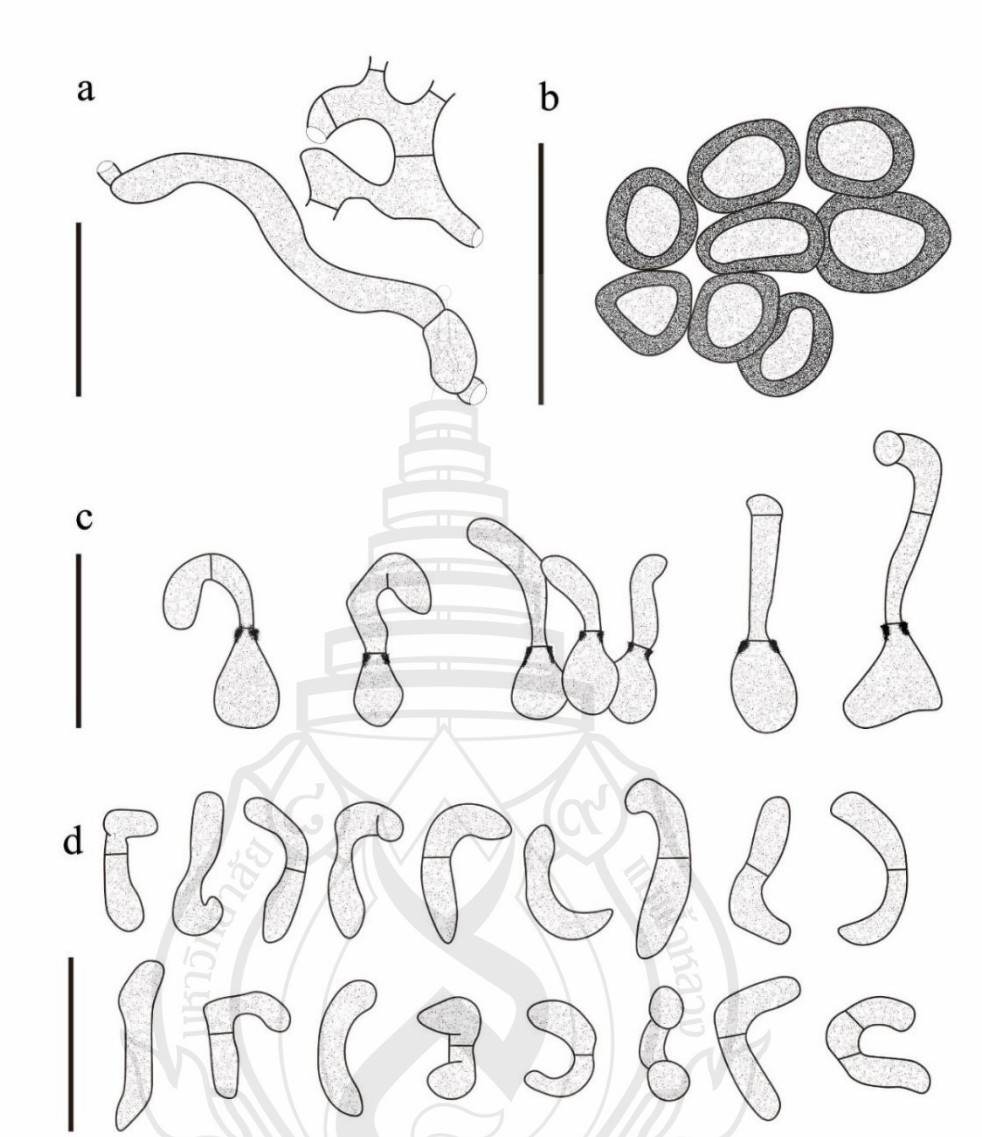
Everniicola D. Hawksw. (1)

Index Fungorum 8222, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Everniicola was introduced by Hawksworth (1982) to describe the lichenicolous coelomycete *E. flexispora*, which grows on *Evernia prunastri*. This genus is characterized by uniloculate, scattered, subglobose to cupuliform, immersed brown conidiomata with an ostiole. The conidiogenous cells are enteroblastic, acrogenous, subglobose or short ampulliform, phialidic, non-proliferating, and hyaline. The conidia are subcylindrical, often L-shaped, hyaline, 0–2-septate, and smooth. Originally placed in *Sphaeropsidales* by Hawksworth (1982), *Everniicola* is now considered *Ascomycota* incertae sedis due to insufficient molecular data, leaving its phylogenetic status uncertain. Further research is needed.

Type species: *Everniicola flexispora* D. Hawksw., on *Evernia prunastri* (Hawksworth, 1982c)



Note a Hyphae ramifying amongst host tissues. b Surface view of pycnidial wall cells. c Conidiogenous cells with attached conidia. d Conidia. Scale bar: a–d = 10 μm.

Source Redrawn from Hawksworth (1982c)

Figure 2.151 *Everniicola flexispora*

Feltgeniomyces Diederich (6)

Index Fungorum 25360, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Feltgeniomyces was introduced by Diederich (1990) to accommodate the type species *F. luxemburgensis*, which occurs on the thalli of *Lecidella conspurcatosorediosae*. This monotypic genus is characterized by semi-macronematous, rarely branched, pale brown, smooth-walled conidiophores that form sporodochia. The conidiogenous cells are enteroblastic, terminal, subcylindrical to narrowly ampulliform, with a short, wide collarette, and pale brown in color. The conidia are solitary, semi-endogenous or acrogenous, subspherical to ellipsoid, simple, smooth or finely verrucose, and brown (Diederich, 1990). Despite the recognition of six species, no molecular data are available, leaving the phylogenetic status unresolved. Further studies are necessary.

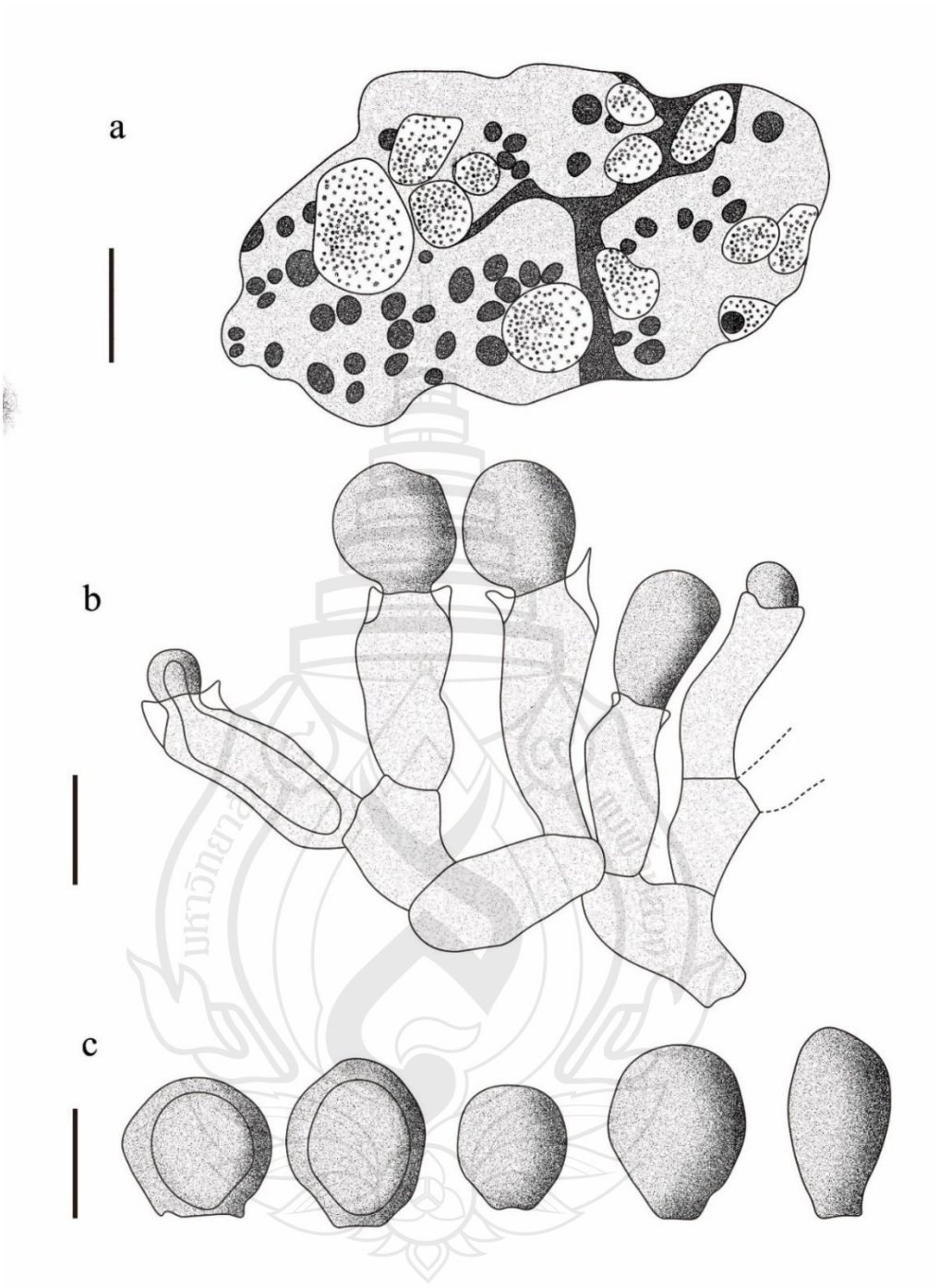
Type species: *Feltgeniomyces luxemburgensis* Diederich, on *Lecidella conspurcatosorediosa*

Table 2.199 Accepted lichenicolous species of *Feltgeniomyces*

	Species name	Host	References	Remarks
1	*Feltgeniomyces dichotomus* Etayo & Calat.	*Physcia biziana*, *Juniperus thurifera*	(Calatayud & Etayo, 2001)	
2	*Feltgeniomyces lecanorae* Zhurb.	*Lecanora chlarotera*	(Zhurbenko et al., 2020)	
3	*Feltgeniomyces luxemburgensis* Diederich	*Lecidella conspurcatosorediosa*	(Diederich, 1989 & 1990)	
4	*Feltgeniomyces mongolicus* Zhurb.	*Hypogymnia bitteri*	(Zhurbenko, et al., 2019)	

Table 2.199 (continued)

	Species name	Host	References	Remarks
5	*Feltgeniomyces physciae* Etayo & Breuss	*Physcia*	(Etayo & Breuss, 1998)	
6	*Feltgeniomyces uniseptatus* Diederich	*Hypotrachyna sinuosa*	(Aptroot et al., 1997)	



Note a Sporodochia on thallus of *Lecidella conspurcatosorediosa*. b Conidiophores, conidiogenous cells and conidia. c Conidia. Scale bars: a = 1 mm, b–c = 5 μm.

Source Redrawn from Diederich (1990)

Figure 2.152 *Feltgeniomyces luxemburgensis*

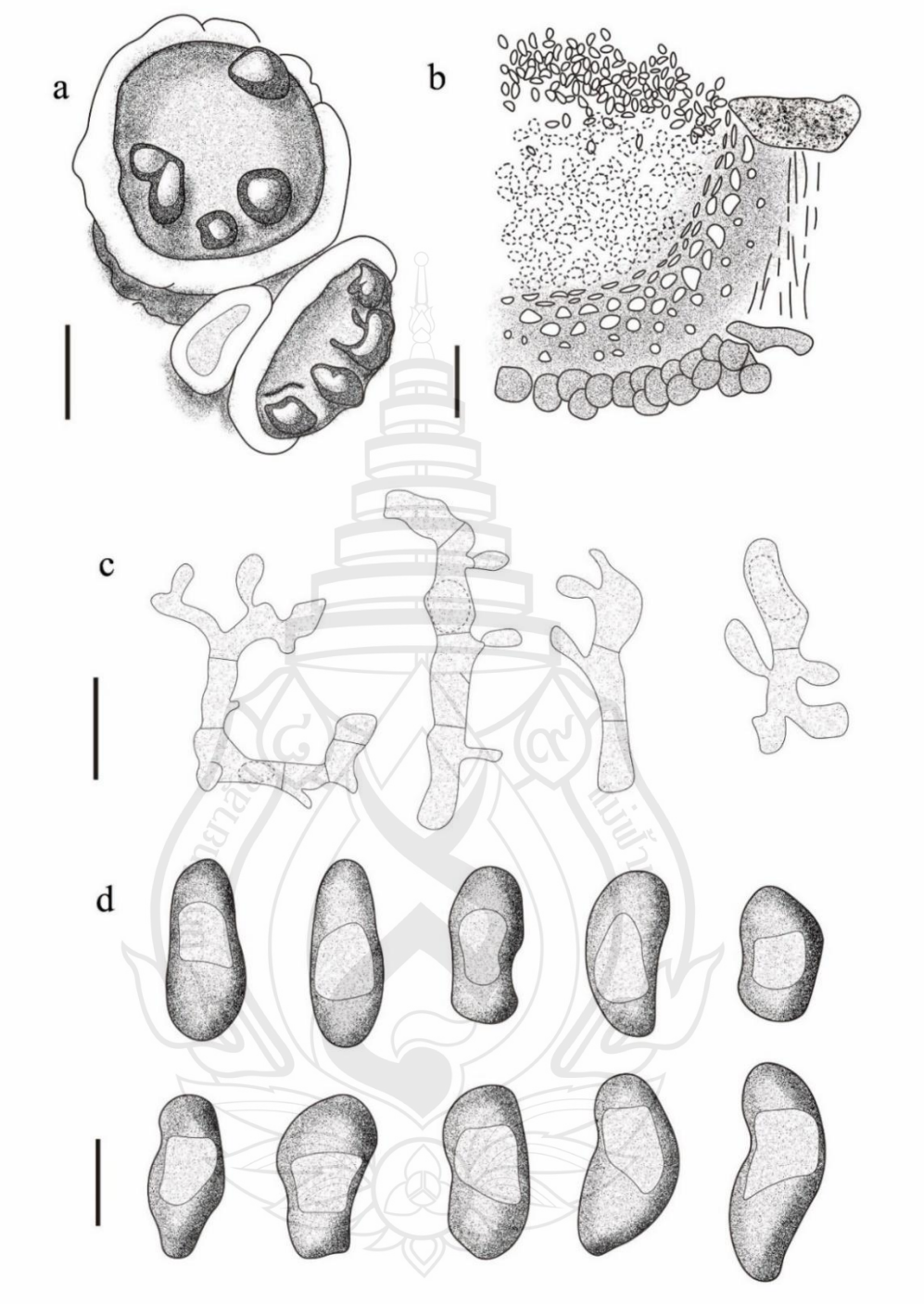
Fenestroconidia Calat. & Etayo (1)

Index Fungorum 28396, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Fenestroconidia was introduced by Calat. & Etayo (1999) to describe the lichenicolous species *F. caloplacae*, which occurs on the apothecial discs of *Caloplaca saxicola*. This genus is characterized by black, sporodochial conidiomata, hyaline, multi-septate, flexuous, irregularly branched conidiophores, and hyaline, enteroblastic conidiogenous cells arranged in irregularly branched chains. The conidia are pale brown, simple, and feature an oblong, subhyaline, guttule-like zone (Calatayud & Etayo 1999b). With only one known species and no molecular data available, the phylogenetic position of *Fenestroconidia* remains uncertain, and it is tentatively placed within Pezizomycotina genera incertae sedis.

Type species: *Fenestroconidia caloplacae* Calat. & Etayo, on *Caloplaca saxicola*



Note a Sporodochial conidiomata growing on the disc of *Caloplaca saxicola*. b Section of a conidioma. c Conidiophores and conidiogenous cells. d Conidia. Scale bars: a = 200 µm, b = 20 µm, c = 5 µm, d = 2.5 µm.

Source Redrawn from Calatayud et al. (1999b)

Figure 2.153 *Fenestroconidia caloplacae*

Galloea Alstrup & Søchting (1)

Index Fungorum 541667, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Galloea was introduced by Alstrup & Søchting (2009) to accommodate the fungus *Galloea cladoniicola* which grows in galls on thallus of *Cladonia chlorophaea*. This is a poorly known monotypic genus, distinguished by the abundant aerial hyphae, the reduced conidiophores, and the long, narrowly claviform conidia (Diederich et al., 2024).

Type species: *Galloea cladoniicola Alstrup & Søchting*, on *Cladonia*. (Alstrup et al., 2009)

Gyalectiphila Diederich & Cl. Roux (3)

Index Fungorum 856005, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Gyalectiphila, introduced by Diederich & Cl. Roux (2024), accommodates three combinations, and is distinguished from *Hawksworthiana* and *Refractohilum* by iits subcylindrical, septate conidiophores with numerous annellations along their length, septate conidia, and the absence of gall induction on the host thallus. It is characterized by effuse and hyaline colonies, arising from the surface of the host. The mycelium is immersed, consisting of branched, septate, hyaline, smooth-walled hyphae. Conidiophores are macronematous, mononematous, erect, unbranched, subcylindrical, hyaline, smooth- and thick-walled, and septate, originating directly from immersed hyphae. Conidiogenous cells are monoblastic, terminal, percurrently proliferating, with distinct annellations along the conidiophore, either appressed or flared. Conidia are solitary, dry, cymbiform, smooth-walled, hyaline, transversely septate, multiguttulate, with an obtuse apex and a truncate base featuring a slightly thickened hilum (Diederich et al., 2024).

Due to the lack of molecular data, this genus is tentatively placed Ascomycota

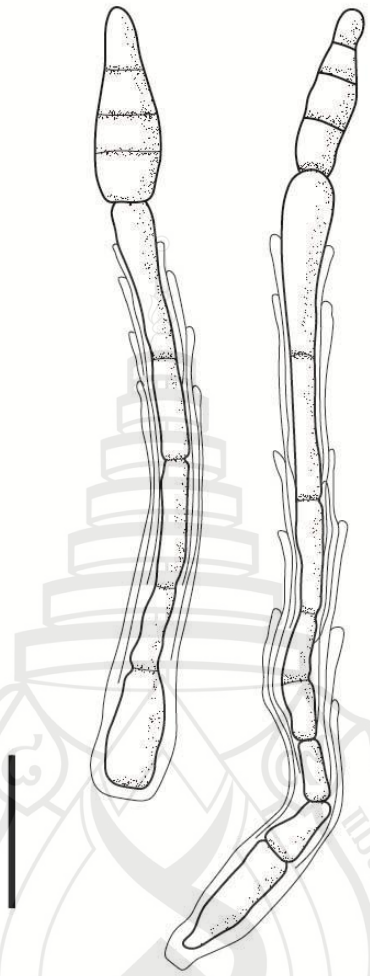
genera incertae sedis.

Type species: *Gyalectiphila achromatica* (B. Sutton) Cl. Roux & Diederich

=*Sporidesmium achromaticum* B. Sutton

Table 2.200 Accepted lichenicolous species of *Gyalectiphila*

	Species name	**Host**	**References**	**Remarks**
1	*Gyalectiphila achromatica* (B. Sutton) Cl. Roux & Diederich	On sterile, thin, greyish white lichen thalli with *Trentepohlia*, twice on fertile *Gyalecta fagicola*	(Sutton, 1973; Diederich et al., 2024)	= *Sporidesmium achromaticum* Sutton
2	*Gyalectiphila intermedia* (Cl. Roux & Etayo) Cl. Roux & Diederich	*Gyalecta carneola, G. arbuti, G. fagicola* and *G. truncigena,* or on sterile, thin, greyish white lichen thalli with *Trentepohlia.*	(Diederich et al., 2024)	= *Refractohilum intermedium* Cl. Roux & Etayo
3	*Gyalectiphila pluriseptata* (Etayo & Cl. Roux) Cl. Roux & Diederich	On the usually fertile thalli of *Anisomeridium polypori, Gyalecta carneola, G. fagicola, Strigula ziziphi* and *Thelopsis rubella*	(Diederich et al., 2024)	= *Refractohilum pluriseptatum* Etayo & Cl. Roux



Note Conidiophores, in LCB. Scale bar = 10 μm.

Source Redrawn from Roux et al. (1997) and Diederich et al. (2024).

Figure 2.154 *Gyrophthorus perforans*

Gyrophthorus Hafellner & Sancho (3)

Index Fungorum 25510, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

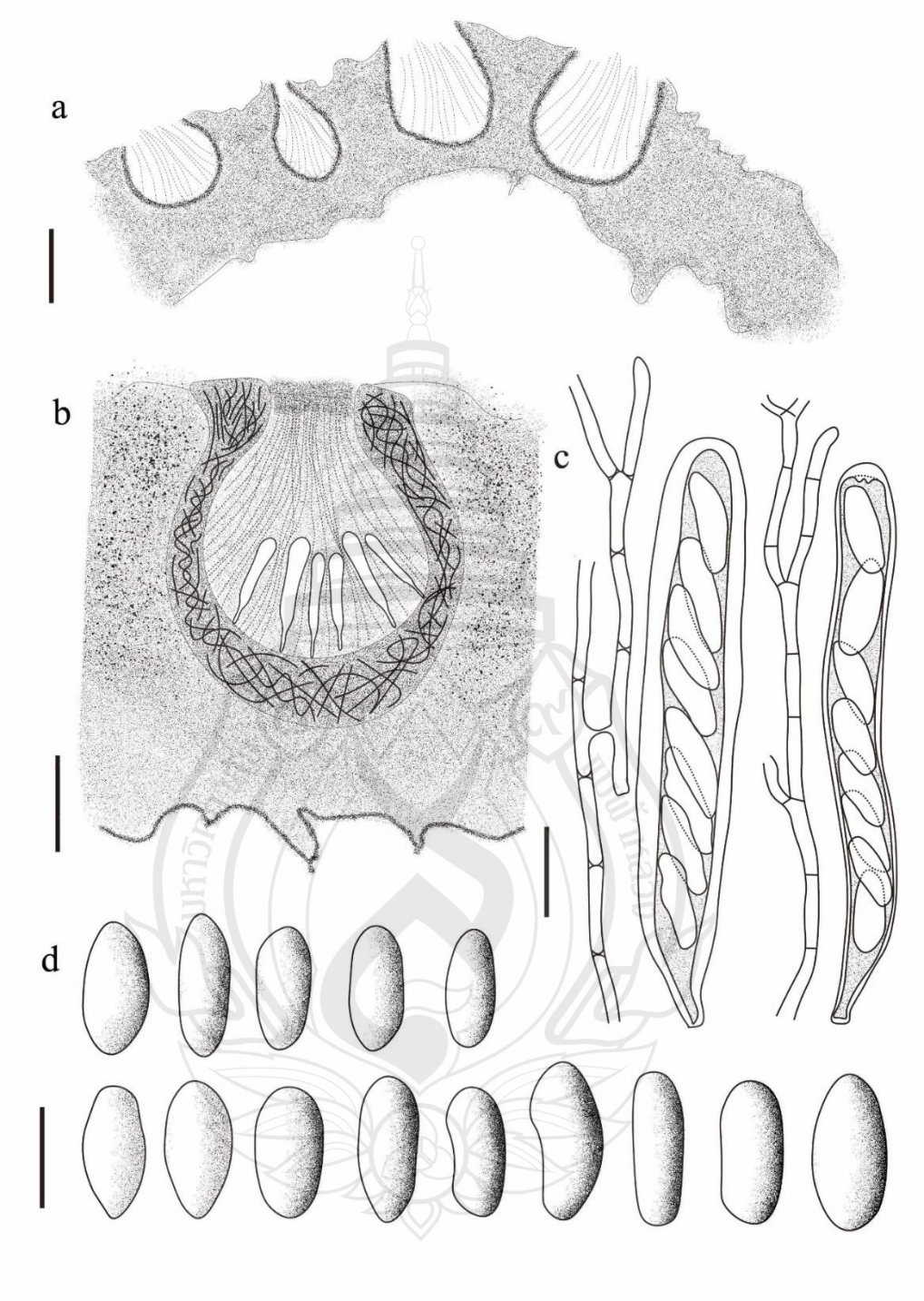
Gyrophthorus was introduced by Hafellner et al. (1990) to accommodate the lichenicolous species *G. perforans* and *G. crustulosae*, which grow on the thalli or

apothecia of *Umbilicaria*. These species are distinguished by their immersed perithecia that emerge through the ostioles. The peridium is dark but not carbonaceous, and the hamathecium consists of distinct, persistent, branched, and occasionally anastomosing filaments. Asci are functionally unitunicate, 8-spored, with thick lateral walls and slightly thinner apices. Ascospores are unicellular, hyaline, and elliptical (Hafellner et al., 1990). A third species, *G. gracilis*, was introduced by Hoffmann et al. (2000), found on *Umbilicaria vellea*. To date, three species are recognized in this genus, and in the absence of molecular data, its phylogenetic status remains uncertain, with its placement tentatively assigned to Pezizomycotina genera incertae sedis.

Type species: *Gyrophthorus perforans* Hafellner & Sancho, on *Umbilicaria vellea*

Table 2.201 Accepted lichenicolous species of *Gyrophthorus*

	Species name	Host	References	Remarks
1	*Gyrophthorus crustulosae* (Creveld) Hafellner & Sancho	*Umbilicaria crustulosa*	(Hafellner et al., 1990)	= *Phacopsis crustulosae* Creveld
2	*Gyrophthorus gracilis* Nik. Hoffm. & Hafellner	*Umbilicaria vellea*	(Hoffmann et al., 2000)	
3	*Gyrophthorus perforans* Hafellner & Sancho	*Umbilicaria vellea*	(Hafellner et al., 1990)	



Note a–b Section of ascoma. c Paraphyses and asci. d Ascospores. Scale bars: a = 100 µm, b = 50 µm, c–d = 10 µm.

Source Redrawn from Hafellner et al. (1990)

Figure 2.155 *Gyrophthorus perforans*

Hawksworthiana U. Braun (1)

Index Fungorum 11094, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

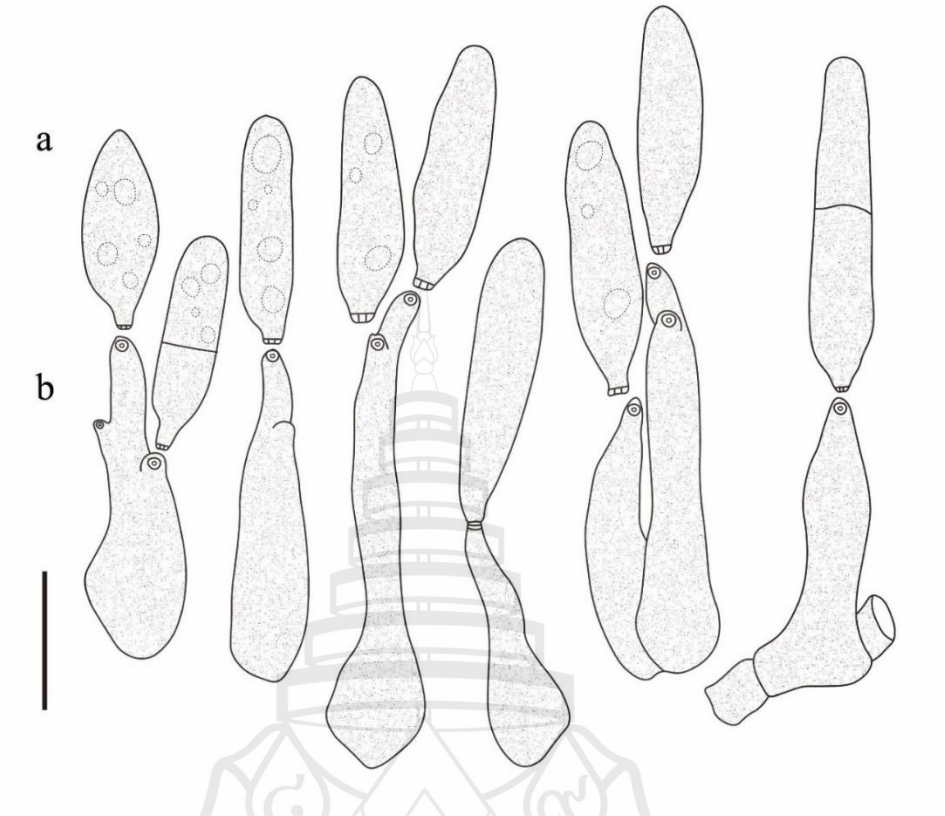
Hawksworthiana was established by Braun (1988) to accommodate the lichenicolous species *H. peltigericola*, originally described as *Ramularia peltigericola* by Hawksworth (1980). This species is characterized by its mycelium, which is immersed in convex, gall-like deformations on the host, cracking and becoming areolate with age. The conidiophores are micronematous and located beneath the surface of the gall, while the conidiogenous cells are ampulliform or subcylindrical. These cells emerge individually or in small groups, giving the surface a frosted appearance. The conidia are elongate-clavate to subcylindrical, hyaline, non-septate, and smooth-walled (Hawksworth, 1980a). The relationship to teleomorphic states in *Mycosphaerella* remains uncertain. Due to the absence of molecular data, the taxonomic placement of this species remains unclear. Further phylogenetic analysis, supported by the availability of sequence data, is necessary to clarify its position.

Type species: *Hawksworthiana peltigerae* (Keissl.) Diederich, On the thallus of *Peltigera polydactylon*, *P. rufescens*, *P. canina*, *P. collina*, *P. degenii*, *P. didactyla*, *P. evansiana*, *P. extenuata*, *P. fibrillosa*, *P. hymenina*, *P. leucophlebia*, *P. membranacea*, *P. neckeri*, *P. praetextata*, *P. soredians*, inducing galls concolorous with the host thallus. (Diederich et al., 2024)

= *Ovularia peltigerae* Keissl.

= *Hawksworthiana peltigericola* (D. Hawksw.) U. Braun (Braun 1988)

= *Ramularia peltigericola* D. Hawksw. (Hawksworth 1980a)



Note a Conidia. b Conidiogenous cells. Scale bar = 10 μm.

Source Redrawn from Hawksworth (1980a)

Figure 2.156 *Hawksworthiana peltigericola*

Henfellra Halıcı, D. Hawksw., Z. Kocakaya & Kocakaya (1)

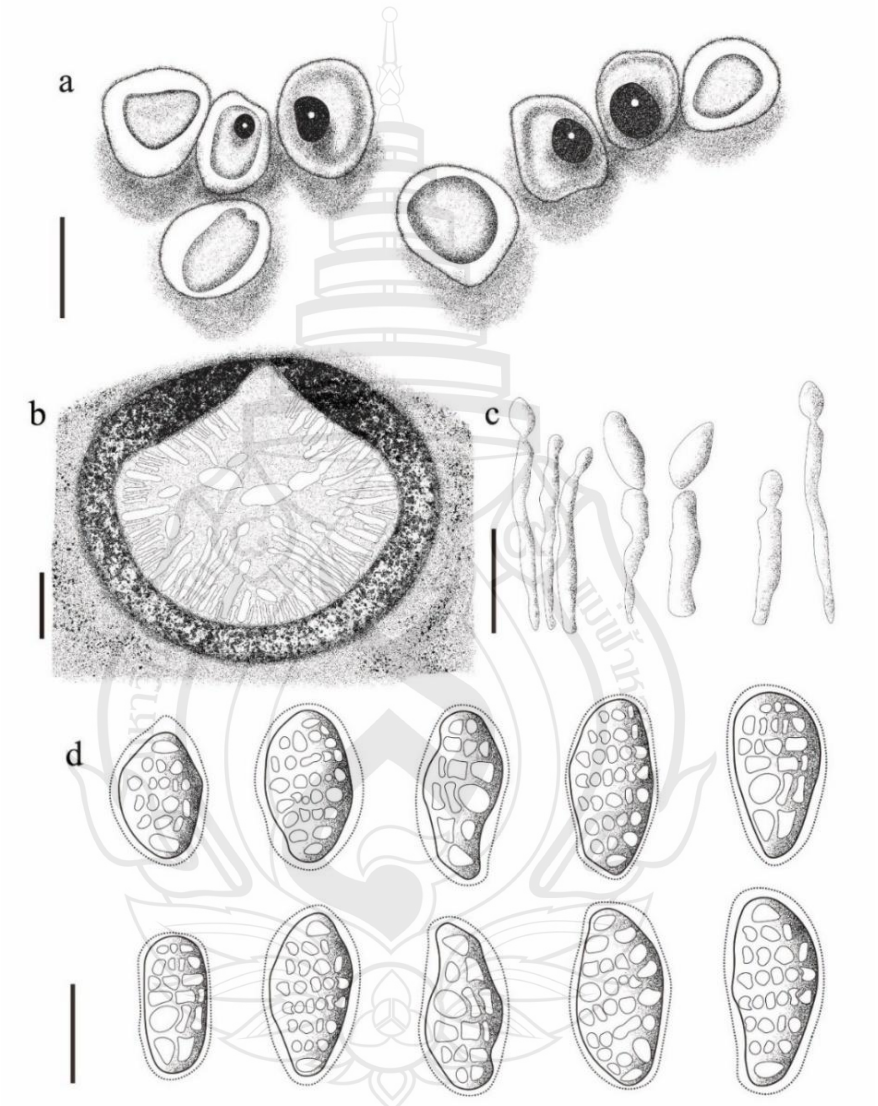
Index Fungorum 817289, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Henfellra was introduced by Hawksworth et al. (2016) for the species *H. muriformis*, found on the apothecia of *Candelariella antennaria*. This genus is characterized by black, erumpent, pycnidial conidiomata with an ostiole. The conidiogenous cells are enteroblastic, cylindrical, hyaline, and phialidic. Conidia are hyaline, thin-walled, ellipsoid, rounded at both ends, muriform, and enclosed in a gelatinous sheath (Hawksworth et al., 2016). With *H. muriformis* as the only species

and no molecular data available, its phylogenetic position remains uncertain, and it is tentatively placed within Pezizomycotina genera incertae sedis.

Type species: *Henfellra muriformis* Halıcı, D. Hawksw., Z. Kocak. & M. Kocak. (Hawksworth et al., 2016)



Note a Infected apothecial discs of the host lichen, *Candelariella antennaria*. b Section of pycnidial conidioma. c Conidiogenous cells. d Conidia. Scale bars: a = 200 µm, b–c = 20 µm, d = 10 µm.

Source Redrawn from Hawksworth et al. (2016)

Figure 2.157 *Henfellra muriformis*

Hymenobia Nyl. (1)

Index Fungorum 2413, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Hymenobia was first referenced by Nylander (1854) for a small parasitic fungus inhabiting the hymenium of *Lecidea jurana*, though no description or illustration was provided. Later, Triebel (1989) designated *Hymenobia insidiosa* Nyl. as the type species of the genus. Roux et al. (1991) discussed its systematic position and elaborated on its characteristics, including very thin-walled or absent perithecioid ascocarps with a dispersed hymenium within the host (*Lecidea*), branched paraphyses, unitunicate asci, and hyaline, thin-walled spores with 1–2 septa. The genus is tentatively placed within *Ascomycota* genera incertae sedis pending the availability of molecular data.

Type species: *Hymenobia insidiosa* Nyl. (Nylander, 1854; Triebel, 1989; Roux et al., 1991)

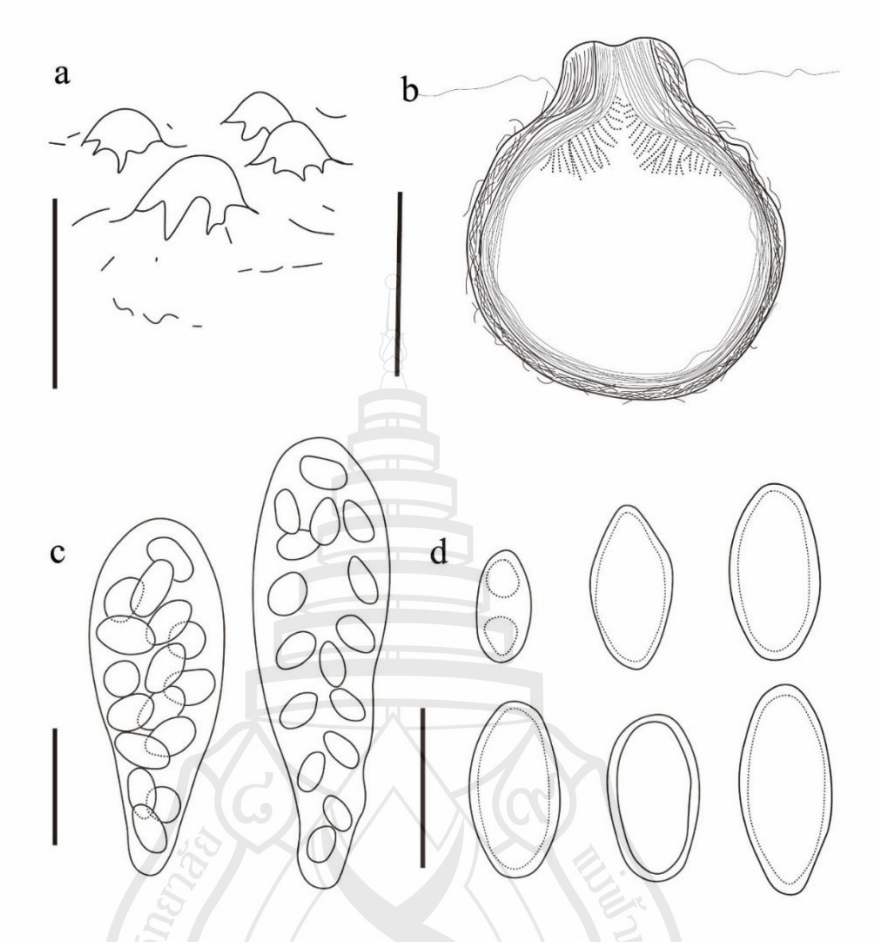
Hypotrachynicola Etayo (1)

Index Fungorum 28687, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Hypotrachynicola was introduced by Etayo (2002) to accommodate the parasitic fungus *H. rubra*, found on the foliose lichen *Hypotrachyna*. The genus is characterized by black, subglobose, aggregated, and immersed perithecioid ascomata with a brown, papillate ostiole. The perithecium wall exhibits an epidermoid texture, and periphyses are simple. The asci are unitunicate, clavate, thin-walled, and contain 16 hyaline, unseptate, ellipsoid spores (Etayo, 2002a). In the absence of molecular data, *Hypotrachynicola* has been tentatively placed within *Pezizomycotina* genera incertae sedis, pending further phylogenetic analysis.

Type species: *Hypotrachynicola rubra* Etayo, on *Hypotrachyna*. (Etayo, 2002a)



Note a Four sites on the stem of *Hypotrachyna* sp. b Cross section of an ascoma. c Asci. d Ascospores. Scale bars: a = 100 µm, b = 50 µm, c = 10 µm, d = 5 µm.

Source Redrawn from Etayo (2002a)

Figure 2.158 *Hymenobia insidiosa*

Intralichen D. Hawksw. & M.S. Cole (4)

Index Fungorum 28662, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Intralichen was introduced by Hawksw. & Cole (2002) to describe four dematiaceous hyphomycetes that grow within the thalli or apothecia of lichens, sporulating on their surface. The genus is characterized by micronematous

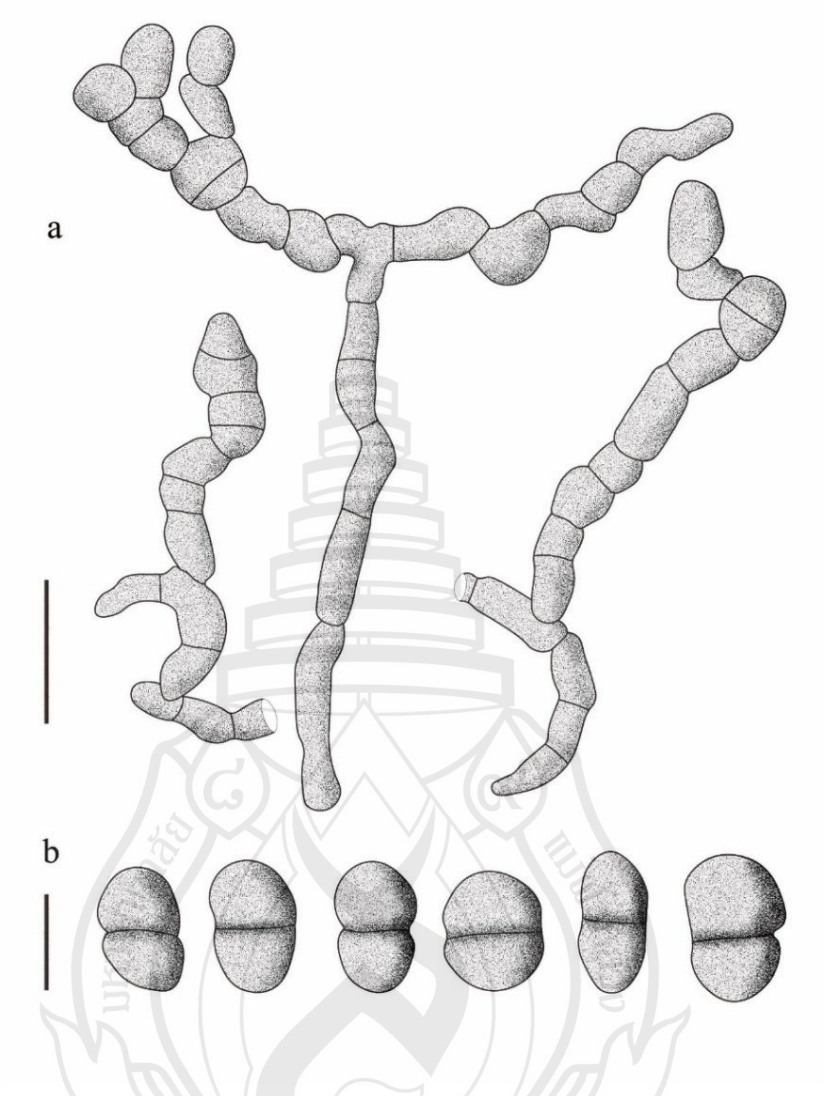
conidiophores composed of thick-walled, brown cells, and terminal, monoblastic conidiogenous cells. The conidia form in unbranched chains and are ellipsoid to subglobose, 0–1 septate, and vary from pale to dark brown (Hawksworth et al., 2002). Some species also produce multicellular structures. Due to the absence of molecular data, the phylogenetic placement of *Intralichen* remains uncertain and requires further investigation.

Type species: *Intralichen christiansenii* (D. Hawksw.) D. Hawksw. & M.S. Cole

= *Bispora christiansenii* D. Hawksw.

Table 2.202 Accepted lichenicolous species of *Intralichen*

	Species name	Host	References	Remarks
1	*Intralichen baccisporus* D. Hawksw. & M.S. Cole	*Caloplaca trachyphylla*	(Hawksworth et al., 2002)	
2	*Intralichen christiansenii* (D. Hawksw.) D. Hawksw. & M.S. Cole	*Candelariella vitellina*	(Hawksworth, 1979a; Hawksworth et al., 2002)	*Bispora christiansenii* D. Hawksw.
3	*Intralichen lichenicola* (M.S. Christ. & D. Hawksw.) D. Hawksw. & M.S. Cole	*Candelariella vitellina*	(Hawksworth, 1979a; Hawksworth et al., 2002)	*Trimmatostroma lichenicola* M.S. Christ. & D. Hawksw.
4	*Intralichen lichenum* (Diederich) D. Hawksw. & M.S. Cole	*Opegrapha atra*	(Diederich, 1990; Hawksworth et al., 2002)	*Bispora lichenum* Diederich



Note a Conidiophores and conidiogenous cells. b Conidia. Scale bars: a = 10 μm, b = 5 μm.

Source Redrawn from Hawksworth (1979a)

Figure 2.159 *Intralichen christiansenii*

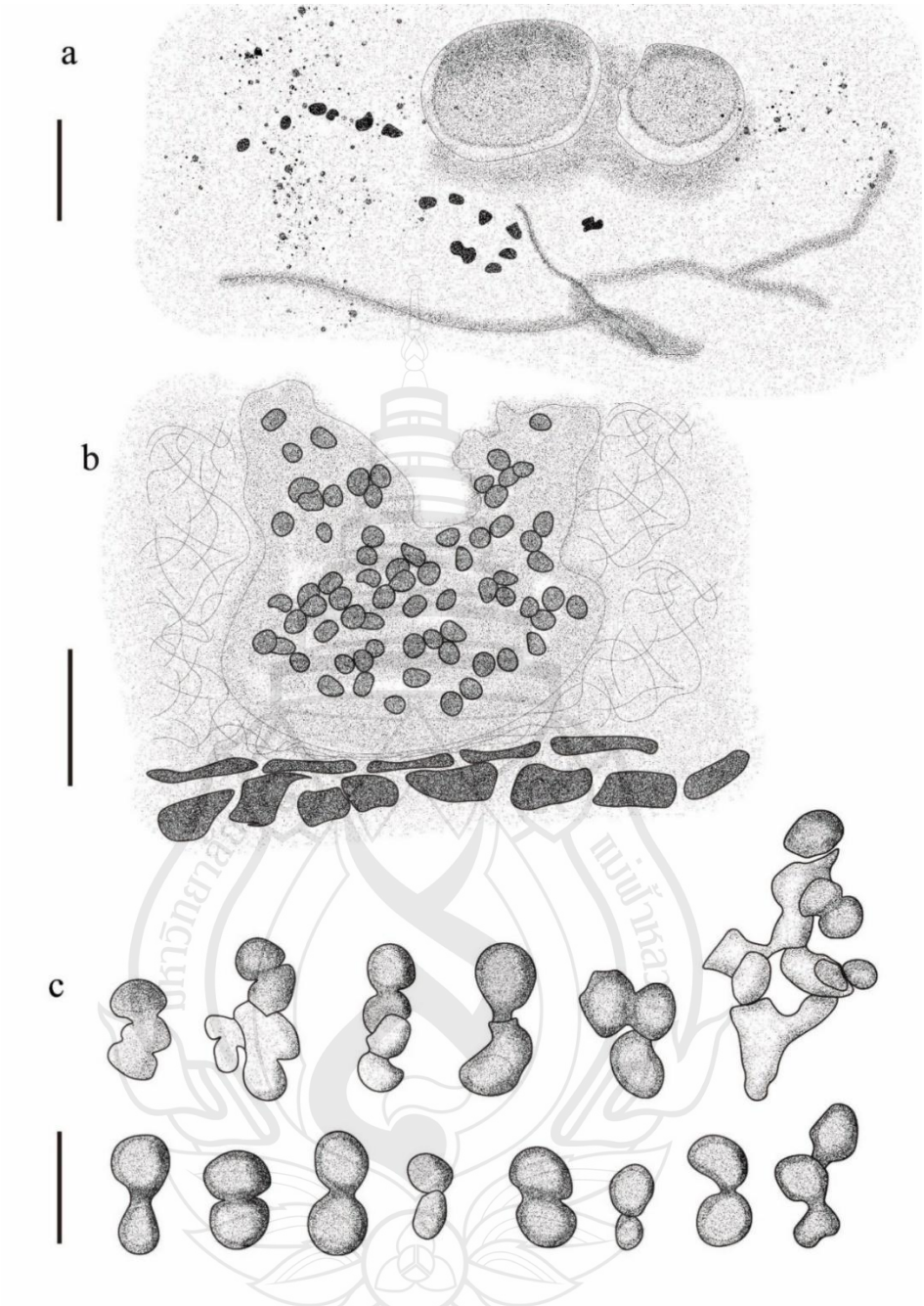
Isthmoconidium Etayo & Fr. Berger (1)

Index Fungorum 803515, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Isthmoconidium was introduced by Etayo & F. Berger (2013) to describe the type species *I. bacidiicola*, which grows on the thalli of the corticolous lichen *Bacidia heterochroa*. The genus is characterized by black, punctiform conidiomata that are initially immersed with a pycnidioid or pseudocupulate appearance, later becoming slightly erumpent. The conidiophores are hyaline to violaceous, irregularly branched, and multiseptate. Conidia are violaceous-brown, comprising 2 (rarely 3 or 4) inflated cells connected by a thin isthmus, and are smooth-walled (Etayo & Berger, 2013). Due to the lack of molecular data, *Isthmoconidium* has been tentatively placed within *Pezizomycotina* genera *incertae sedis*. Further phylogenetic studies are needed to clarify its systematic position.

Type species: *Isthmoconidium bacidiicola* Etayo & F. Berger (Etayo & Berger, 2013)



Note a The black sporodochia on the thallus of the host, *Bacidia heterochroa*. b Vertical section through a partially immersed sporodochium. c Conidiophores with conidiogenous cells and 2-celled conidia. Scale bars: a = 200 μm, b = 20 μm, c = 10 μm

Source Redrawn from Etayo et al. (2013)

Figure 2.160 *Isthmoconidium bacidiicola*

Kalchbrenneriella Diederich & M.S. Christ (1)**.**

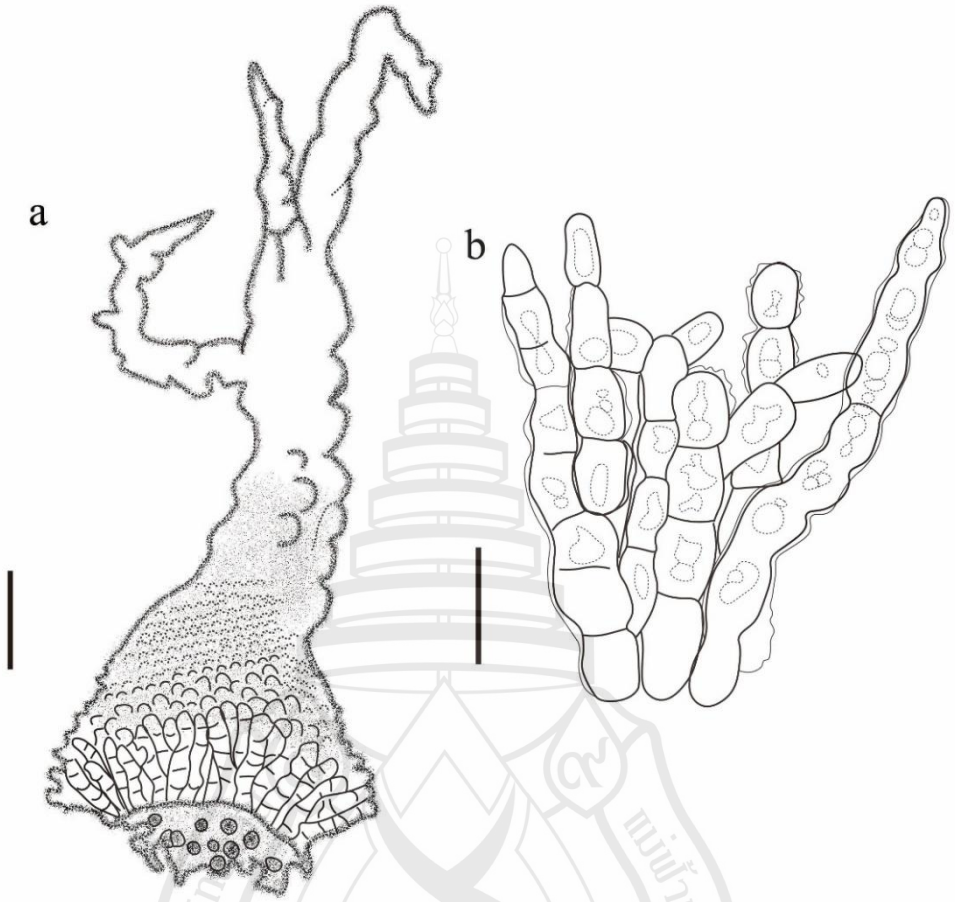
Index Fungorum 28656, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Kalchbrenneriella was introduced by Diederich (2002) to accommodate the lichenicolous hyphomycete *K. cyanescens*, originally described as *Torula cyanescens* Kalchbr., found growing on *Usnea* thalli. The genus is characterized by semi-macronematous, erect, hyaline, straight, wrinkled conidiophores; monoblastic, terminal, subcylindrical to ellipsoidal, hyaline conidiogenous cells; and acrogenic, aseptate, subcylindrical to ellipsoidal, wrinkled, hyaline conidia arranged in chains (Diederich, 2002). Due to the absence of molecular data, *Kalchbrenneriella* has been tentatively placed within *Pezizomycotina* genera *incertae sedis*. Further phylogenetic analysis is needed to confirm its taxonomic placement.

Type species: *Kalchbrenneriella cyanescens* (Kalchbr.) Diederich & M.S. Christ. (Diederich, 2002)

= *Torula cyanescens* Kalchbr.



Note a Infected *Usnea* thallus at varying magnification. b Conidiophores and conidia. Scale bars: a–b = 10 μm.

Source Redrawn from Diederich (2002)

Figure 2.161 *Kalchbrenneriella cyanescens*

Katherinomyces Khodos. (1)

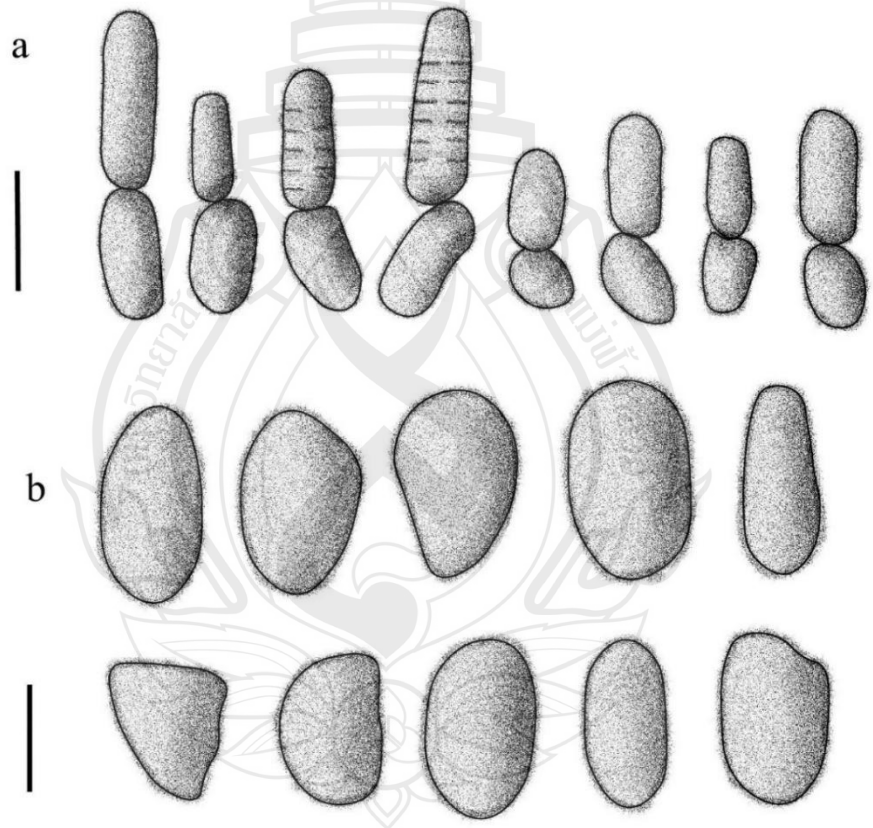
Index Fungorum 823932, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Katherinomyces was first introduced by Khodosovtsev (2016) to describe the lichenicolous species *K. ectrariae*, found on *Cetraria aculeata*. Initially, the genus

name was considered invalid until its formal publication in 2018. *Katherinomyces* is characterized by stromatic conidiomata, short, poorly developed brown conidiophores, and broadly ellipsoid, bacilliform, or polygonal brown conidiogenous cells. The conidia are holoblastic, aseptate, and exhibit variable shapes, ranging from bacilliform to ovoid (Khodosovtsev et al., 2018). Due to the absence of molecular data, *Katherinomyces* has been tentatively placed within *Pezizomycotina* genera *incertae sedis*. Further molecular studies are necessary to determine its phylogenetic position.

Type species: *Katherinomyces cetrariae* Khodos. (Khodosovtsev et al., 2018)



Note a Conidiogenous cells with bacilliform conidia. b Ellipsoid to rounded conidia. Scale bars: a–b = 10 μm.

Source Redraw from Khodosovtsev et al. (2016)

Figure 2.162 *Katherinomyces cetrariae*

Keissleriomyces D. Hawksw. (1)

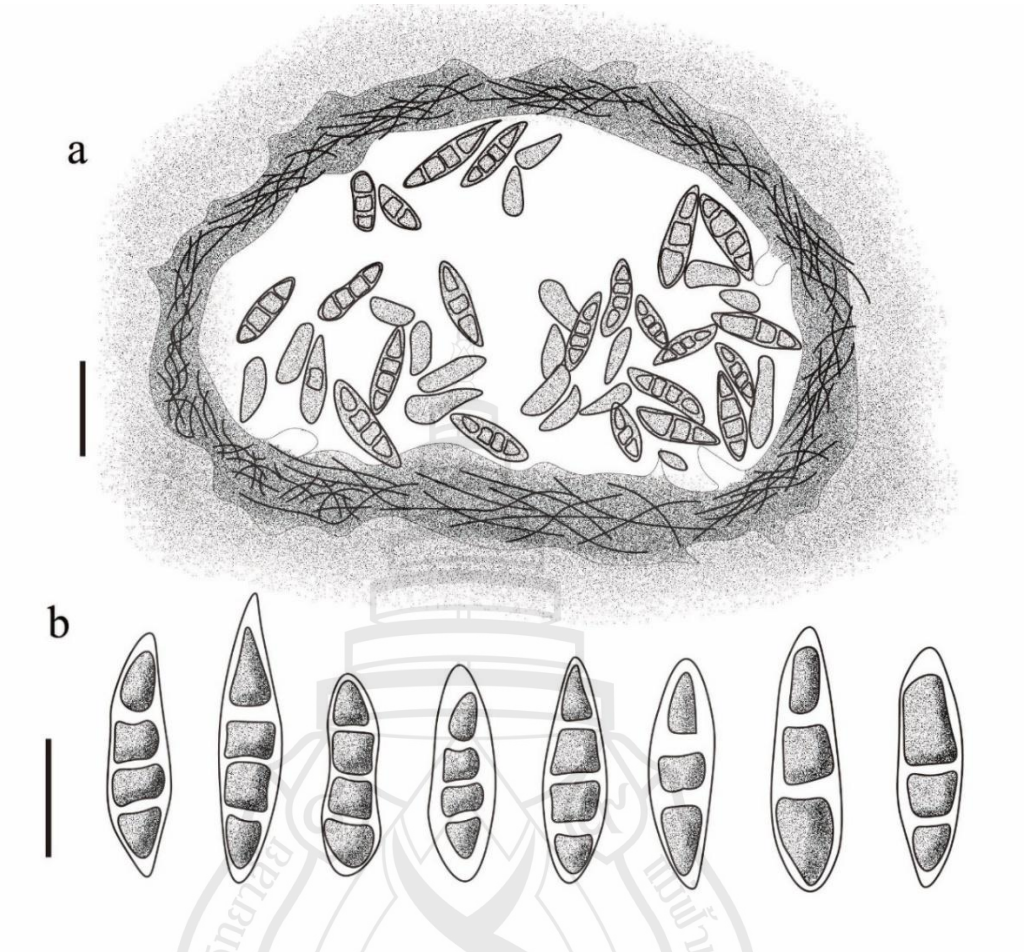
Index Fungorum 8667, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Keissleriomyces was introduced by Hawksworth (1981) to accommodate the type species *K. sandstedeanus*, originally described as *Stagonospora sandstedeana* by Keissler (1925). The genus is characterized by black, singular, immersed, subglobose, unilocular conidiomata with a distinct ostiole. The conidiogenous cells are enteroblastic, subglobose to short-ampulliform, and polyphialidic, capable of producing up to three conidia. The conidia are dry, broadly fusiform, slightly curved at the base, hyaline, 3-septate, and smooth-walled (Hawksworth, 1981b). Initially placed within *Sphaeropsidales*, *Keissleriomyces* was later tentatively assigned to *Pezizomycotina* genera *incertae sedis* due to the absence of molecular data. Further research is needed to clarify its phylogenetic position.

Type species: *Keissleriomyces sandstedeanus* (Keissl.) D. Hawksw. (Hawksworth, 1981b)

= *Stagonospora sandstedeana* Keissler (Keissler, 1925)



Note a Vertical section of pycnidium. b Conidia. Scale bars: a = 20 μm, b = 10 μm.

Source Redrawn from Hawksworth (1981b)

Figure 2.163 *Keissleriomyces sandstedeanus*

Lambinonia Sérus. & Diederich (1)

Index Fungorum 8667, Faceoffungi, MycoBank, GenBank

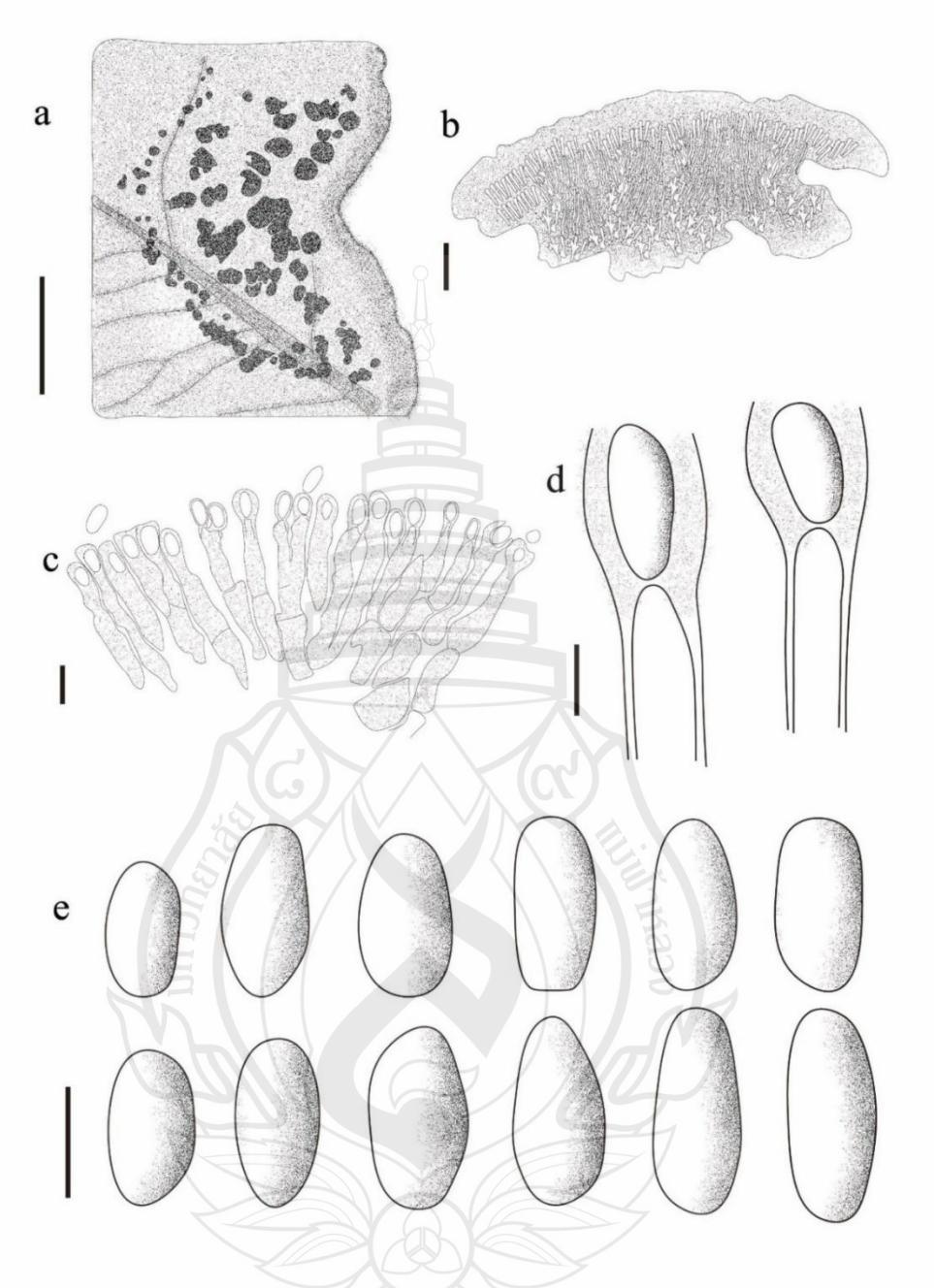
Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Lambinonia was introduced by Sérus. & Diederich (2005) to accommodate the lichenicolous hyphomycete *L. strigulae*, initially described as *Melanconium strigulae* by Elenkin & Woronin (1908), found growing on *Strigula nitidula*. The genus is characterized by pale greyish to black, roundish to elongate sporodochia. Its

conidiophores are macronematous, branched, and brown, forming dense tufts. The conidiogenous cells are enteroblastic, monophialidic, with broad collarettes, producing single, dry, aseptate, elongate-ellipsoid conidia that are hyaline and smooth-walled (Sérusiaux, 2005). Due to the absence of molecular data, *Lambinonia* has been tentatively placed within *Pezizomycotina* genera *incertae sedis*. Further research is required to resolve its phylogenetic placement.

Type species: *Lambinonia strigulae* (Elenkin & Woron.) Sérus. & Diederich (Sérusiaux, 2005)

= *Melanconium strigulae* Elenkin & Woron. (Elenkin et al., 1908)



Note a Thallus of *Strigula nitidula* with numerous concentrically arranged sporodochia. b–c Section through a blackish, slightly flattened sporodochium. d Conidiogenous cells. e Conidia. Scale bars: a = 1 mm, b = 20 µm, c = 10 µm, d–e = 2 µm.

Source Redrawn from Sérusiaux (2005)

Figure 2.164 *Lambinonia strigulae*

Lawalreea Diederich (2)

Index Fungorum 25369, Faceoffungi, MycoBank, GenBank

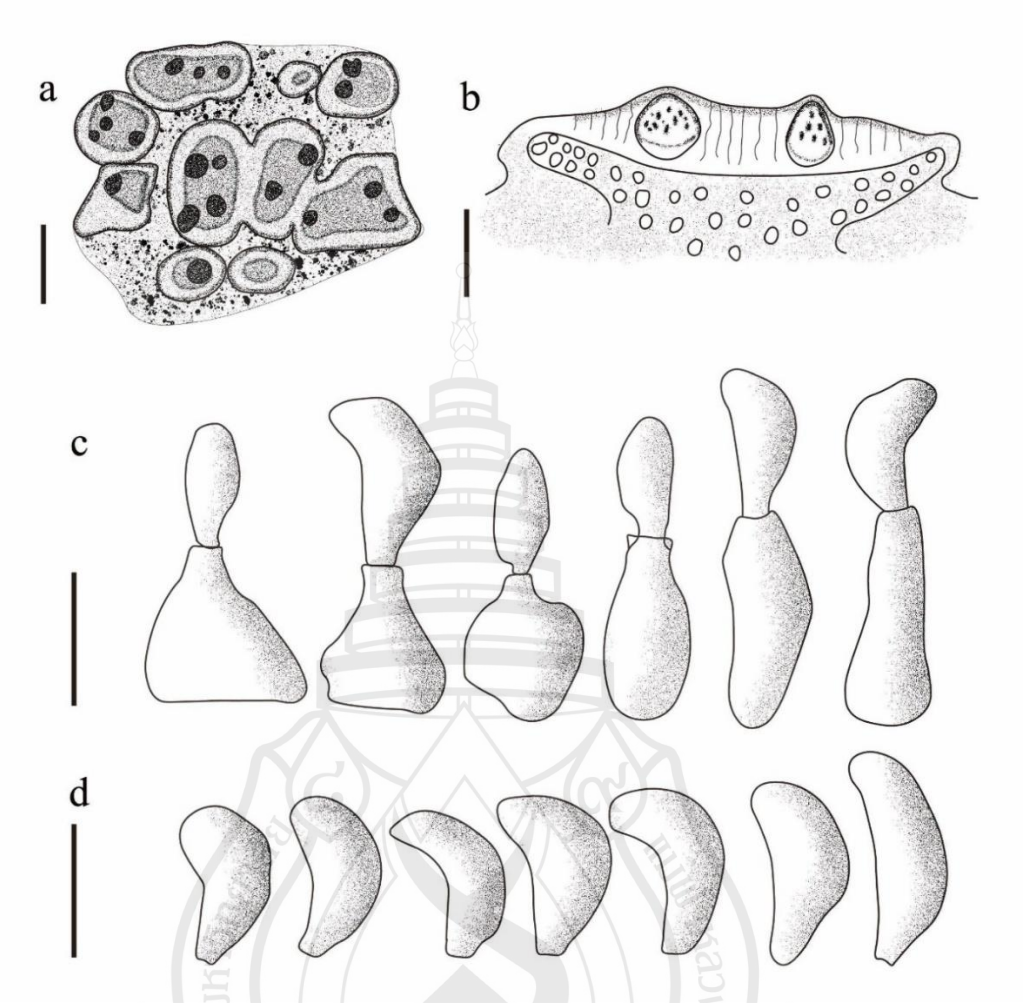
Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Lawalreea was introduced by Diederich (1990) to describe the lichenicolous species *L. lecanorae*, found on *Lecanora persimilis*. This genus is characterized by pycnidial conidiomata that are immersed or erumpent, subspherical to ellipsoid, dark, and lack an ostiole, instead opening irregularly at the apex. The conidiogenous cells are enteroblastic, ampulliform to ellipsoid, hyaline, and smooth-walled. The conidia are simple, hyaline, smooth-walled, falciform, with a rounded apex and a weakly truncated base (Diederich, 1990). In 2024, *Lawalreea burgaziana* was described by Etayo et al., occurring on *Platismatia glauca*, increasing the number of recognized species in the genus to two. Due to the absence of molecular data, *Lawalreea* remains tentatively placed within *Pezizomycotina* genera *incertae sedis*. Further phylogenetic studies are needed to clarify its systematic position.

Type species: *Lawalreea lecanorae* Diederich

Table 2.203 Accepted lichenicolous species of *Lawalreea*

	Species name	Host	References	Remarks
1	*Lawalreea burgaziana* Etayo & López de Silanes	*Platismatia glauca*	(Etayo et al., 2024)	
2	*Lawalreea lecanorae* Diederich	*Lecanora persimilis*	(Diederich, 1990)	



Note a Thallus and apothecia of *Lecanora persimilis* with pycnidia. b Vertical section through an apothecium of *L. persimilis* with two pycnidia. c Conidiogenous cells with conidia. d Conidia. Scale bars: a = 200 µm, b = 100 µm, c–d = 5 µm.

Source Redrawn from Diederich (1990)

Figure 2.165 *Lawalreea lecanorae*

Leightoniomyces D. Hawksw. & B. Sutton (2)

Index Fungorum 8723, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Leightoniomyces was introduced by Hawksworth & Sutton (1977) to describe

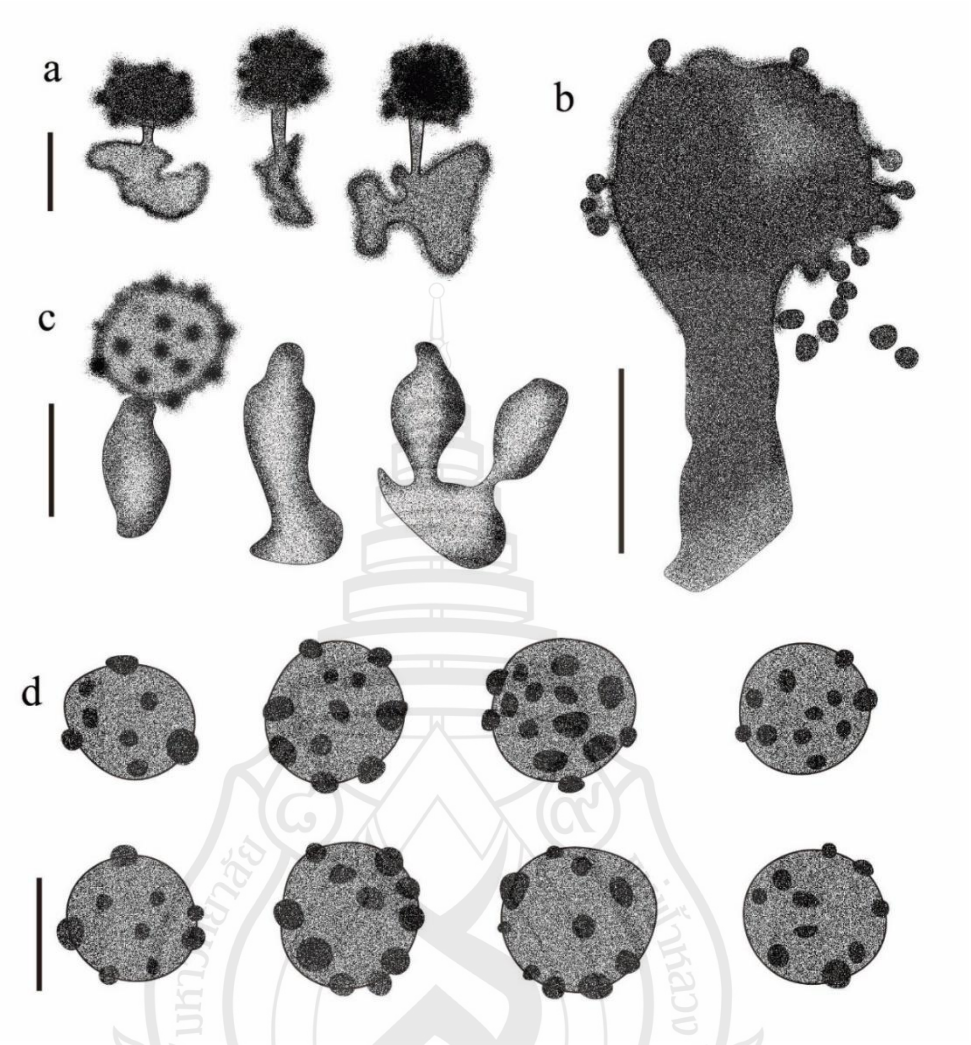
the lichenicolous or algicolous species *L. phillipsii*, originally described as *Periconia phillipsii* by Berkeley et al. (1875), found on *Thrombium epigaeum*. The genus is characterized by black, effuse colonies with an immersed mycelium, lacking stroma, setae, and hyphopodia. It features macronematous, synnematous conidiophores that are dark brown to black with capitate apices. Conidia are dark brown, globose, verrucose, and produced singly (Hawksworth, 1977b). Initially assigned to Dematiaceae, *Leightoniomyces* is now regarded as *Pezizomycotina* genera *incertae sedis* due to the absence of molecular data. Further phylogenetic studies are needed to resolve its taxonomic placement.

Type species: *Leightoniomyces phillipsii* (Berk. & Leight.) D. Hawksw. & B. Sutton

= *Periconia phillipsii* Berk. & Leight. (Berkeley et al., 1875)

Table 2.204 Accepted lichenicolous species of *Leightoniomyces*

	Species name	Host	References	Remarks
1	*Leightoniomyces canariensis* Etayo & Pérez-Vargas	On crustose lichen, volcanic rocks	(Pérez-Vargas et al., 2013)	
2	*Leightoniomyces phillipsii* (Berk. & Leight.) D. Hawksw. & B. Sutton	*Thrombium epigaeum*	(Berkeley et al., 1875; Hawksworth, 1977b)	*Periconia phillipsii* Berk. & Leight.



Note a Habit. b Vertical section of synnema and head. c Conidiogenous cells. d Conidia. Scale bars: a = 100 μm, b = 50 μm, c–d = 10 μm.

Source Redrawn from Hawksworth (1977b)

Figure 2.166 *Leightoniomyces phillipsii*

Lichenobactridium Diederich & Etayo (1)

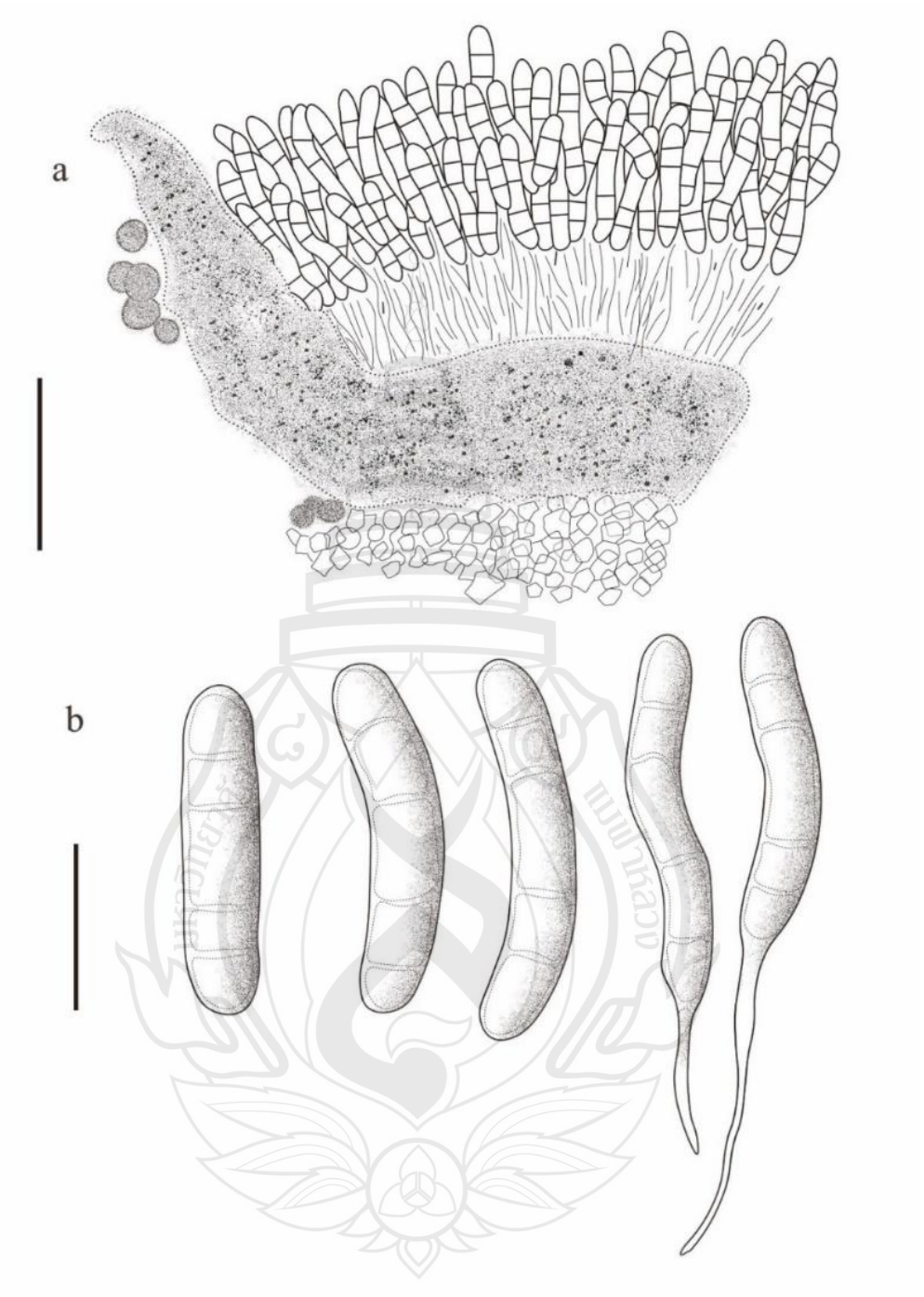
Index Fungorum 27675, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Lichenobactridium was introduced by Diederich & Etay (1995) to describe the lichenicolous species *L. pertusariae*, found on *Pertusaria pertusa*. The genus is

characterized by sporodochial conidiomata that are immersed to superficial, concave or flat, with a blackish-brown lower portion surrounded by a marginal, brownish granulose layer. The conidiophores are semi-macronematous, hyaline, and filiform, with holoblastic, terminal, filiform, smooth-walled conidiogenous cells. Conidia are solitary, dry, subcylindrical, septate, and hyaline (Etayo et al., 1995). Due to the absence of molecular data, *Lichenobactridium* is tentatively placed within *Pezizomycotina* genera *incertae sedis*. Further molecular studies are required for taxonomic clarification.

Type species: *Lichenobactridium pertusariae* Diederich & Etayo (Etayo et al., 1995)



Note a Section through a sporodochium. b Conidia, with parts of conidiogenous cells.

Scale bars: a = 50 μm, b = 10 μm.

Source Redrawn from Etayo et al. (1995)

Figure 2.167 *Lichenobactridium pertusariae*

Lichenohendersonia Calat. & Etayo (4)

Index Fungorum 28532, Faceoffungi, MycoBank, GenBank

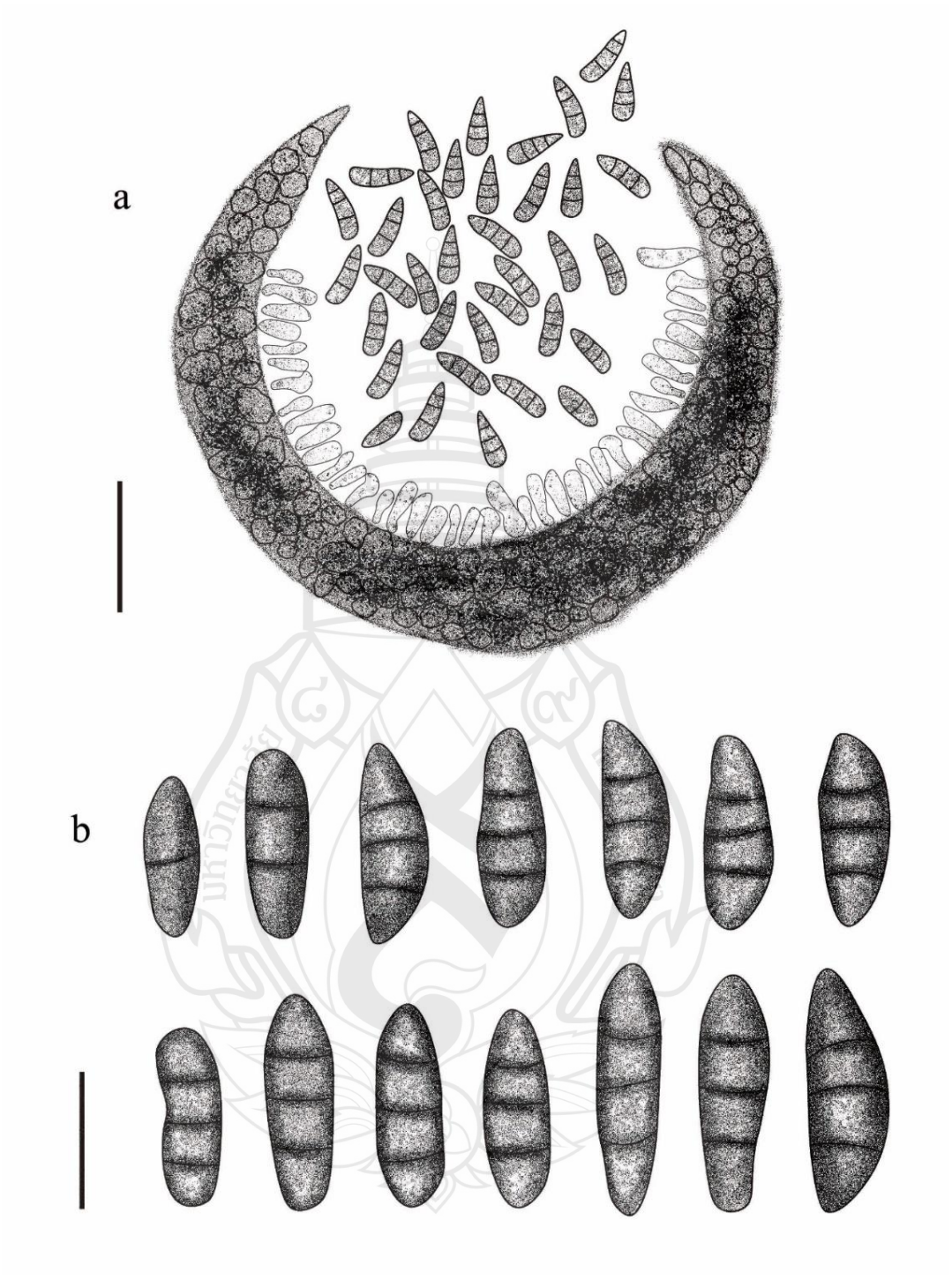
Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Lichenohendersonia was introduced by Calat. & Etayo (2001) to describe three lichenicolous species: *L. squamarinae*, *L. uniseptata*, and *L. varians*. The genus is characterized by pycnidial, unilocular, globose or subglobose, ostiolate conidiomata with pale to medium brown walls that may darken around the ostiole. The conidiogenous cells are holoblastic, ampulliform, and arise from the inner conidiomatal wall. Conidia are solitary, brown, ellipsoidal to oblong, and 1–3-septate. A second species, *L. physciicola*, was introduced by Berger et al. (2021), found on *Physcia tenella*. To date, four species are recognized. Due to a lack of molecular data, the phylogenetic status of this genus remains uncertain and is tentatively placed within *Pezizomycotina* genera incertae sedis.

Type species: *Lichenohendersonia squamarinae* Calat. & Etayo

Table 2.205 Accepted lichenicolous species of *Lichenohendersonia*

	Species name	Host	References
1	*Lichenohendersonia physciicola* F. Berger & Brackel	*Physcia tenella*	(Berger et al., 2021)
2	*Lichenohendersonia squamarinae* Calat. & Etayo	*Squamarina lentigera*	(Calatayud & Etayo, 2001)
3	*Lichenohendersonia uniseptata* Etayo & Calat.	*Parmelina tiliacea*	(Calatayud & Etayo, 2001)
4	*Lichenohendersonia varians* Calat. & Etayo	*Rhizoplaca chrysoleuca*	(Calatayud & Etayo, 2001)



Note a Section of conidioma. b Conidia. Scale bars: a = 25 μm, b = 10 μm.

Source Redrawn from Calatayud et al. (2001)

Figure 2.168 *Lichenohendersonia squamarinae*

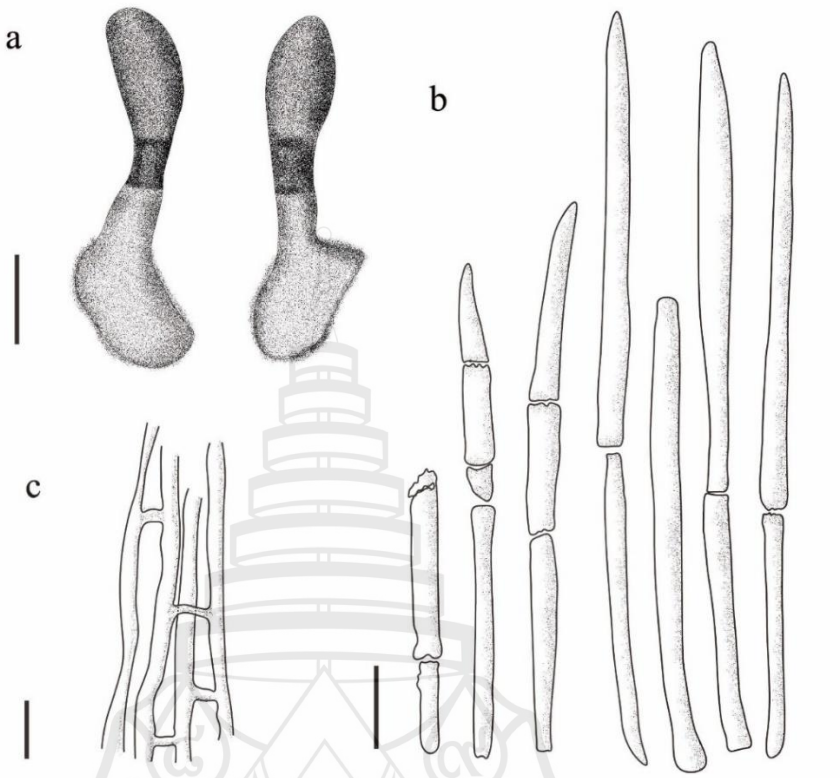
Lichenopenicillus Etayo (1)

Index Fungorum 818339, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

The monotypic genus *Lichenopenicillus* was introduced by Etayo (2017) to accommodate the type species *L. versicolor*, found on the thalli of *Sticta* species. The genus is characterized by pencil-shaped synnemata that are yellow, blackish, and purple at the base. The conidiophores are hyaline, branched and anastomosing, with cylindrical, terminal or lateral conidiogenous cells. The conidia are acicular, septate, dry, and hyaline, with holoblastic conidiogenesis and schizolytic secession (Etayo, 2017). Due to the lack of molecular data, *Lichenopenicillus* is tentatively placed within *Ascomycota* genera incertae sedis.

Type species: *Lichenopenicillus versicolor* Etayo (Etayo, 2017)



Note a Appearance of the synnemata. b Septate, Conidiogenous cells and acicular conidia. c Conidiophores. Scale bars: a = 100 μm, b = 10 μm, c = 5 μm.

Source Redrawn from Etayo (2017)

Figure 2.169 *Lichenopenicillus versicolor*

Lichenophoma Keissl.

Index Fungorum 8774, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Lichenophoma was introduced by Keissler (1911) for a presumed lichenicolous coelomycete, *L. haematommatis*, found on *Haematomma elatinum*. However, Hawksworth et al. (2006) reexamined Keissler's collections and determined that the species was not lichenicolous but rather a sorediate lichen species of *Cliostomum*. As a

result, the genus and its type species were synonymized with *Cliostomum haematommatis*. Additionally, *L. opegraphae* was reassigned to *Laeviomyces opegraphae* by Hawksworth (1981), while the third species, *L. arecae*, was invalid.

Type species: *Lichenophoma haematommatis* Keissl.

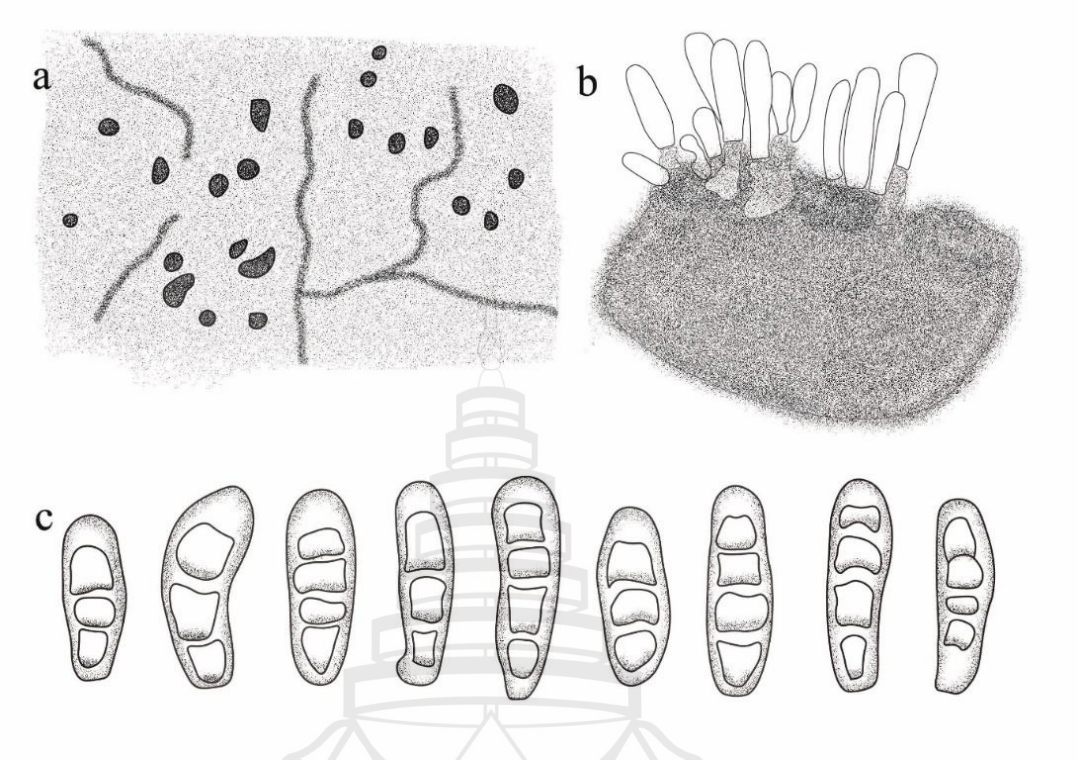
Lichenopuccinia D. Hawksw. & Hafellner (1)

Index Fungorum 11120, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Lichenopuccinia was introduced by Hawksworth & Hafellner (1984) to accommodate the sole lichenicolous hyphomycete *L. poeltii*, found on the thallus of *Parmelia sulcata*. The genus is characterized by discrete sporodochia with pseudoparenchymatous conidiomata, macronematous, cylindrical conidiophores, and monoblastic, terminal or sympodial, non-proliferating conidiogenous cells. The conidia are singly arising, elongate-clavate, with a truncate base, colourless, 3-5 distoseptate (Atienza et al., 1994). Due to the lack of molecular data, the genus is tentatively placed within Ascomycota genera incertae sedis.

Type species: *Lichenopuccinia poeltii* D. Hawksw. & Hafellner, on *Parmelia sulcata* (Hawksworth, 1984)



Note a Sporodochia of thallus of *Parmelia* sp. b Section of sporodochium. c Conidia.

Source Redrawn from website: Fungi Outer Hebrides (2024).

Figure 2.170 *Lichenopuccinia poeltii*

Lichenostella Calat. & Etayo (2)

Index Fungorum 11120, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

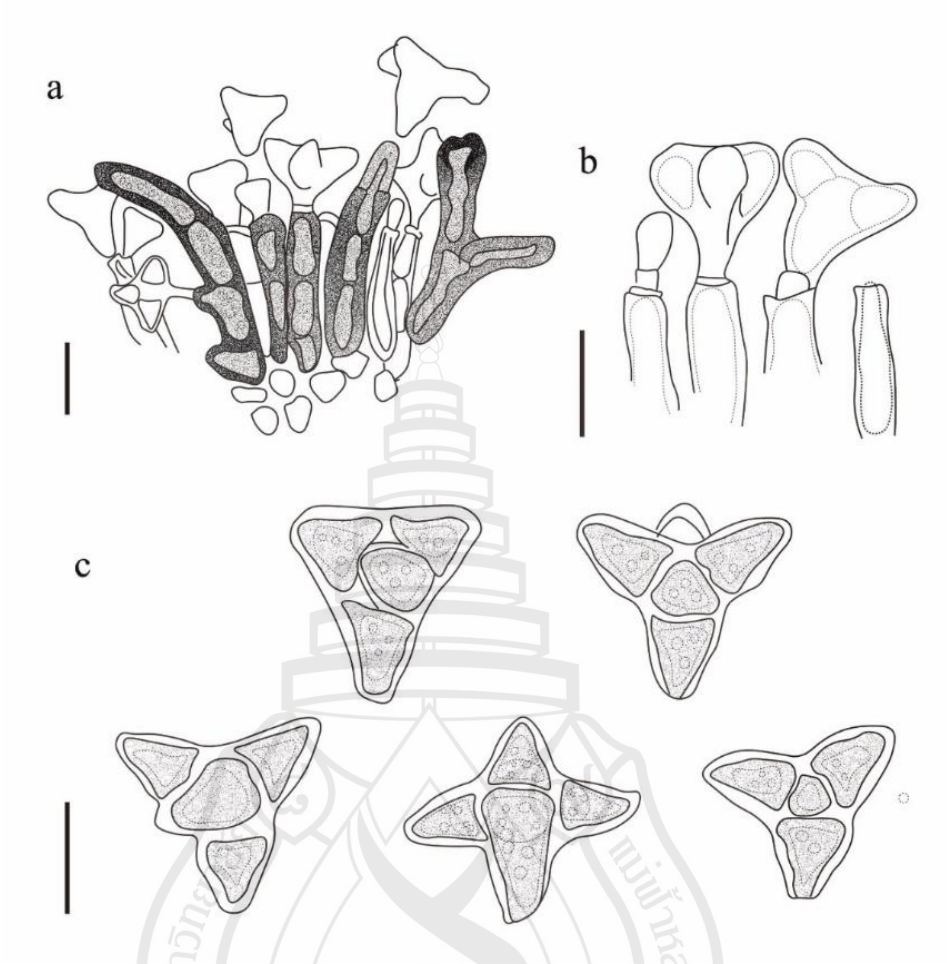
Lichenostella was introduced by Calatayud & Etayo (1999) to describe the conidial fungus *L. hypotrachynae*, found on *Hypotrachyna*. The genus is characterized by black, sporodochial colonies with macronematous, subcylindrical conidiophores that are hyaline to brown, straight, and simple or branched, often septate. Brown setae, which sometimes function as conidiophores, are also present. The conidiogenous cells are monoblastic, or rarely polyblastic, and can be terminal or intercalary. The conidia are dry, non-catenate, star-like (staurospores), with septate arms (Calatayud & Etayo, 1999a). Due to the lack of molecular data, *Lichenostella* is tentatively placed within

Ascomycota genera incertae sedis.

Type species: *Lichenostella hypotrachynae* Etayo & Calat. (Calatayud & Etayo, 1999a)

Table 2.206 Accepted lichenicolous species of *Lichenostella*

	Species name	Host	References	Remarks
1	*Lichenostella griseofusca* van der Kolk & Diederich	*Lecanora chlarotera*	(Diederich et al., 2024)	
2	*Lichenostella hypotrachynae* Etayo & Calat.	*Hypotrachyna*	(Calatayud & Etayo, 1999a)	



Note a Conidiophores, setae, and conidiogenous cells producing conidia. b Conidiogenous cells producing conidia. c Conidia. Scale bars: a–c = 10 μm.

Source Redrawn from Calatayud (1999a)

Figure 2.171 *Lichenostella hypotrachynae*

Llanorella Alstrup & Olech ex Diederich & Brackel (1)

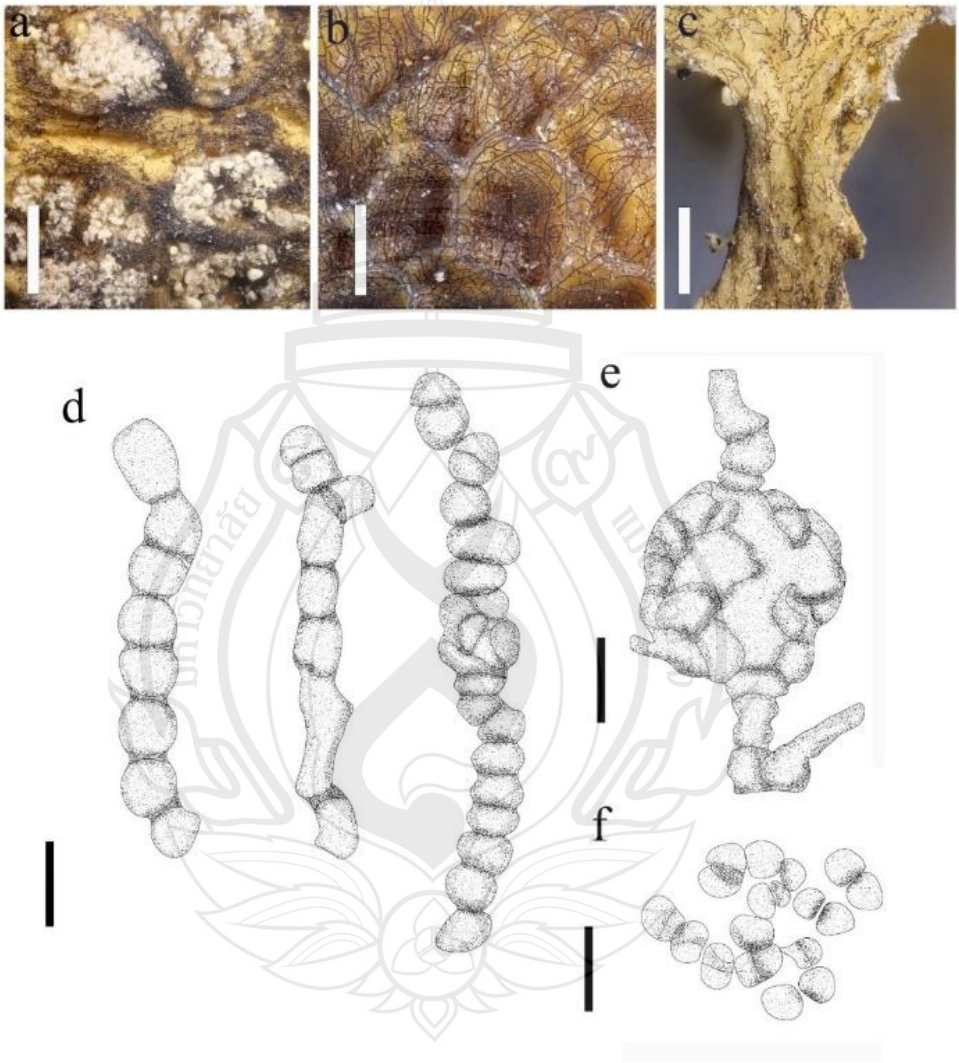
Index Fungorum 855970, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Llanorella was initially invalidly introduced by Alstrup et al. (2018) to accommodate the sole type species *Llanorella ramalinae*. Diederich & Brackel (2024) validly redescribed it. This genus is characterized by an often-sterile superficial net of

blackish hyphae that occasionally produces sterile globules, central agglomerations of dark brown conidia, or terminal conidia. Due to the lack of molecular data, *Llanorella* is tentatively placed within Ascomycota genera incertae sedis.

Type species: *Llanorella ramalinae* Alstrup & Olech ex Diederich & Brackel, on the thallus of *Ramalina*.



Note a–c Sterile colony over the thallus of *Ramalina* sp. d Sterile hyphae. e Sterile bulbils produced laterally on hyphae. f Sporodochium-like agglomerations of conidia. Scale bars: a–c = 500 μm, e–f = 10 μm.

Source Redrawn from Diederich et al. (2024)

Figure 2.172 *Llanorella ramalinae*

Milospium D. Hawksw. (3-4)

Index Fungorum 8949, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

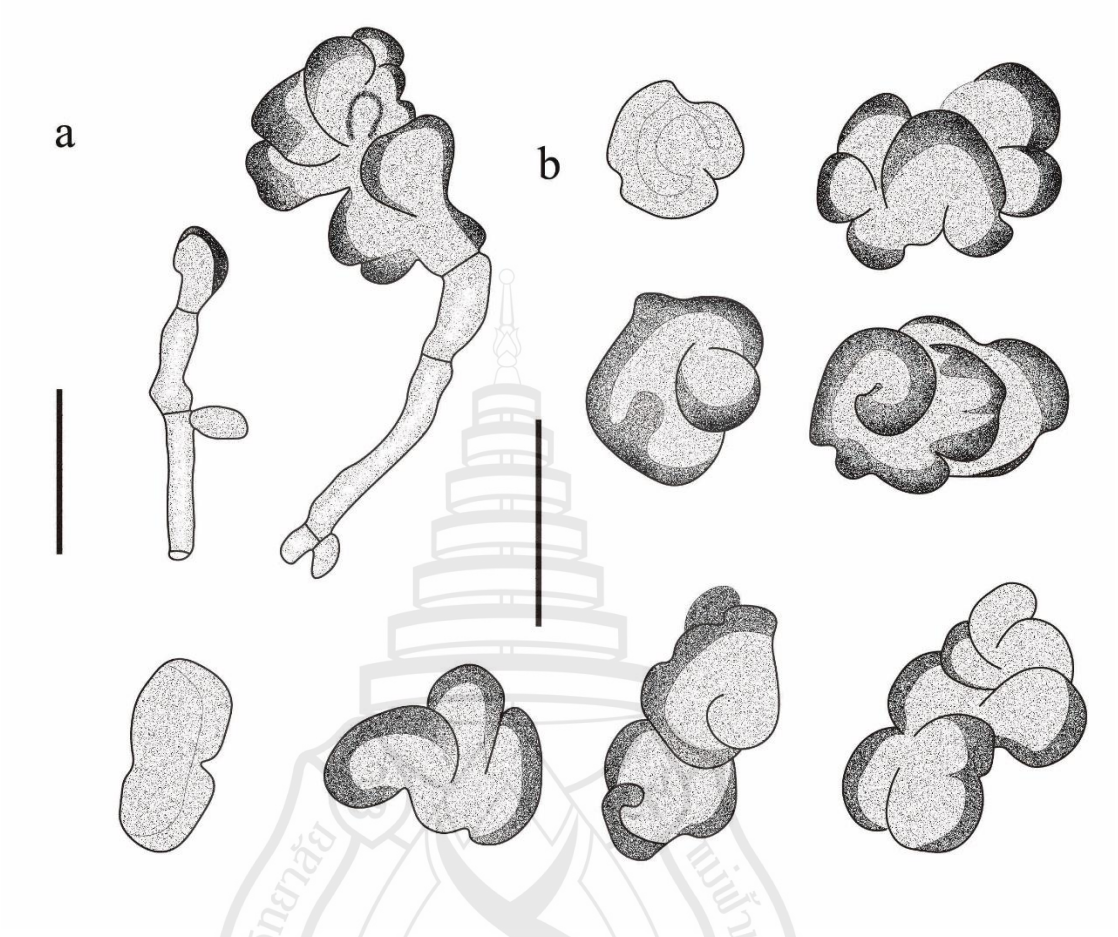
Milospium was introduced by Hawksworth (1975) to accommodate the lichenicolous hyphomycete *M. graphideorum*, which was transferred from *Spilomium graphideorum* Nyl., found on the thalli of *Opegrapha* species. The genus is characterized by dark brown to black colonies, micronematous to semi-macronematous conidiophores, and solitary, dry, acropleurogenous conidia that are irregularly subglobose to ellipsoid. Four species are recognized in this genus, three of which are lichenicolous. Although *Milospium* was originally placed in *Dematiaceae* by Hawksworth (1975), its phylogenetic status remains uncertain due to a lack of molecular data. It is tentatively placed within Pezizomycotina genera incertae sedis, pending the availability of sequence data (Hyde et al., 2024).

Type species: *Milospium graphideorum* (Nyl.) D. Hawksw. (Hawksworth 1975b)

= *Spilomium graphideorum* Nyl. (Nylander, 1857)

Table 2.207 Accepted lichenicolous species of *Milospium*

	Species name	Host	References	Remarks
1	*Milospium deslooveri* Diederich & Sérus.	*Opegrapha*	(Sérusiaux et al., 1999)	
2	*Milospium graphideorum* (Nyl.) D. Hawksw.	*Opegrapha*	(Hawksworth, 1975b)	= *Spilomium graphideorum* Nyl.
3	*Milospium lacoizquetae* Etayo & Diederich	*Cladonia parasitica*	(Etayo & Diederich, 1996a)	



Note a Conidiophores. b Conidia. Scale bars: a–b = 10 µm.

Source Redrawn from Hawksworth (1975b)

Figure 2.173 *Milospium graphideorum*

Minutophoma D. Hawksw. (1)

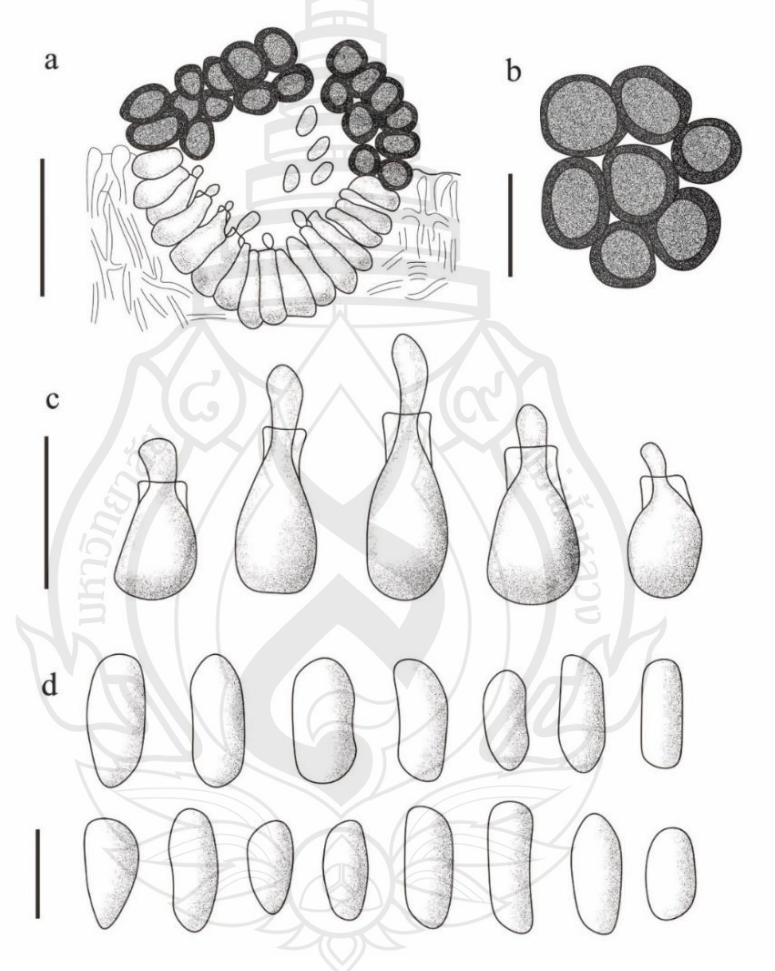
Index Fungorum 8953, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

The monotypic genus *Minutophoma* was introduced by Hawksworth (1981) to describe the lichenicolous coelomycete *M. chrysophthalmae*, which occurs on the apothecia of *Chrysothrix chrysophthalmae*. The genus is characterized by black, half-immersed, globose to subglobose pycnidia with walls composed of thick-walled, dark

brown cells that form a textura angularis. The upper cells disassociate, creating an irregular ostiole. The conidiogenous cells are ampulliform, phialidic, and hyaline, while the conidia are non-catenate, subcylindrical, hyaline, and minute (Hawksworth, 1981b). Although originally placed in *Sphaeropsidales*, its phylogenetic status remains uncertain pending molecular data.

Type species: *Minutophoma chrysophthalmae* D. Hawksw.



Note a Vertical section of pycnidium. b The upper part of the pycnidium. c Conidiogenous cells. d Conidia. Scale bars: a = 10 µm, b–c = 5 µm. d = 2 µm.

Source Redrawn from Hawksworth (1981b)

Figure 2.174 *Minutophoma chrysophthalmae*

Neolamya Theiss. & Syd. (3)

Index Fungorum 3465, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

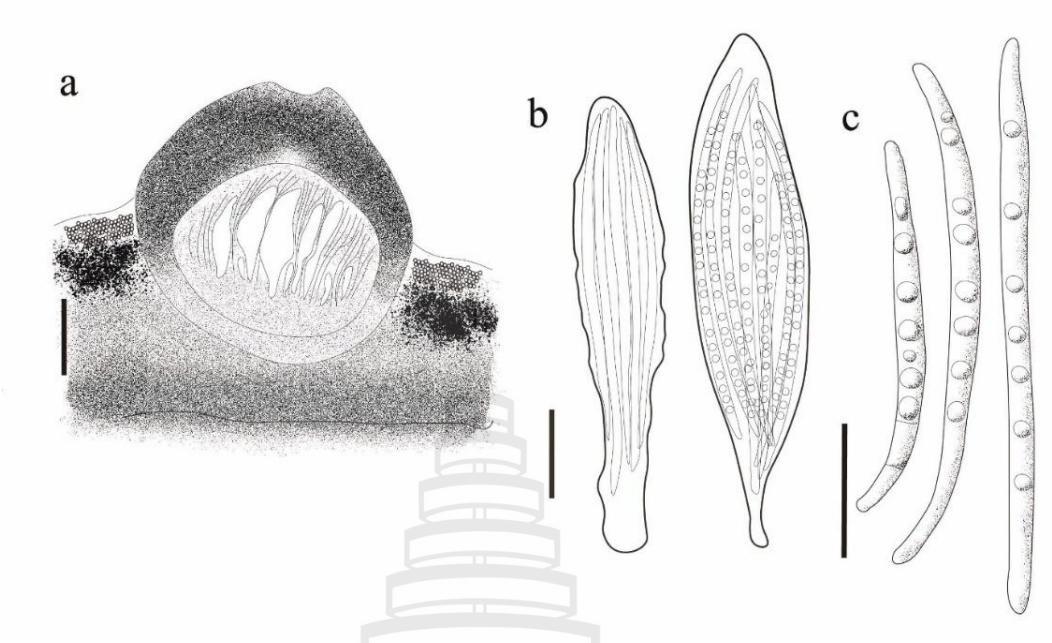
Neolamya was introduced by Theissen & Sydow (1918) to describe the lichenicolous fungus *N. peltigera*, originally described as *Sphaeria peltigerae* by Montagne (1845), which occurs on *Peltigera horizontalis*. The genus is characterized by small, erumpent, globose to ovate black perithecia that radially split the host thallus, and acicular ascospores (Theissen et al., 1918b). Kocourková (2009) added a second species, *N. xanthoparmeliae*, found on *Xanthoparmelia conspersa*, while the third species, *N. ahtii*, described by Zhurbenko et al. (2017), occurs on *Cladonia gracilis*. Currently, three species are recognized in the genus. However, due to the lack of molecular data, *Neolamya* remains tentatively placed in *Ascomycota* genera incertae sedis pending further phylogenetic analysis.

Type species: *Neolamya peltigerae* (Mont.) Theiss. & Syd. (Theissen et al., 1918b)

= *Sphaeria peltigerae* Mont. (Montagne, 1845)

Table 2.208 Accepted lichenicolous species of *Neolamya*

	Species name	Host	References	Remarks
1	*Neolamya ahtii* Zhurb.	*Cladonia gracilis*	(Zhurbenko & Pino-Bodas, 2017)	
2	*Neolamya peltigerae* (Mont.) Theiss. & Syd.	*Peltigera horizontalis*	(Montagne, 1845; Theissen et al., 1918b)	= *Sphaeria peltigerae* Mont.
3	*Neolamya xanthoparmeliae* Kocourk.	*Xanthoparmelia conspersa*	(Kocourková, 2009)	



Note a Section of ascoma. b Asci. c Ascospores. Scale bars: a = 50 μm, b–c = 20 μm.

Source Redrawn from Kocourková (2009)

Figure 2.175 *Neolamya peltigerae*

Nigromacula Etayo (2)

Index Fungorum 28688, Faceoffungi, MycoBank, GenBank

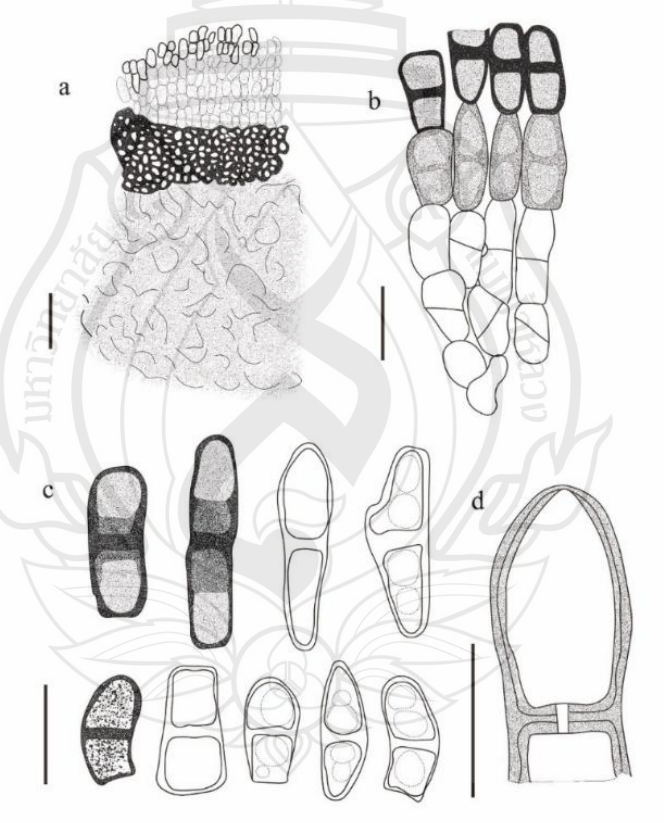
Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Nigromacula was introduced by Etayo (2002) to describe the type species *N. hypotrachynae*, which grows on the foliose lichen *Hypotrachyna*. The genus is characterized by black, superficial, plano-convex sporodochia, with monoblastic, integrated, terminal, ellipsoidal conidiogenous cells. The conidia are acrogenic, ellipsoidal to subcylindrical, ornamented, striate, and uniseptate (Etayo, 2002a). Hawksworth (2003) transferred *N. uniseptata* from *Vouauxiella uniseptata* D. Hawksw., a species found on *Parmelia laevigata*. The genus currently includes two recognized lichenicolous species. Due to the lack of molecular data, *Nigromacula* is tentatively placed within *Ascomycota* genera incertae sedis.

Type species: *Nigromacula hypotrachynae* Etayo

Table 2.209 Accepted lichenicolous species of *Nigromacula*

	Species name	Host	References	Remarks
1	*Nigromacula hypotrachynae* Etayo	*Hypotrachyna*	(Etayo, 2002a)	
2	*Nigromacula uniseptata* (D. Hawksw.) D. Hawksw.	*Parmelia laevigata*	(Hawksworth, 2003)	= *Vouauxiella uniseptata* D. Hawksw.



Note a Cross-section of a sporodochium. b Conidiophores and conidial cells. c Conidia. d Part of a conidium. Scale bars: a = 100 μm, b–c = 10 μm, d = 5 μm.

Source Redrawn from Etayo (2002a)

Figure 2.176 *Nigromacula hypotrachynae*

Nigropuncta D. Hawksw. (2)

Index Fungorum 9123, Faceoffungi, MycoBank, GenBank

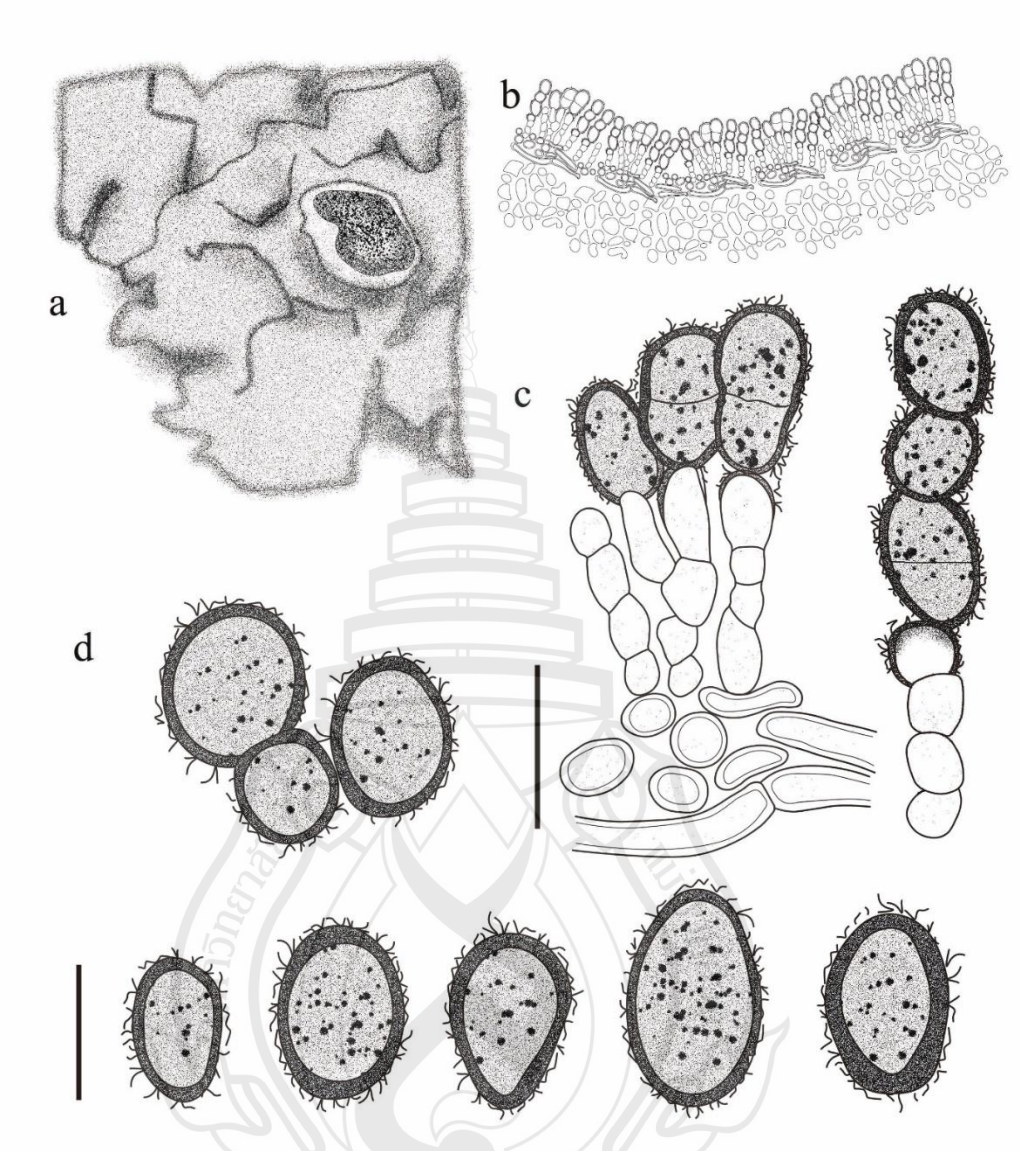
Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Nigropuncta was introduced by Hawksworth (1981) to describe the type species *N. rugulosa*, which grows on the thalli of saxicolous lichens. The genus is characterized by pycnidial conidiomata, which are initially subglobose but become cup-shaped with age, and are immersed in the host. The conidiomata are lined with a compact layer of conidiophores, and the conidiogenous cells are terminal, holothallic, and subglobose. The conidia are catenate, dark olivaceous to black, and rough-walled (Hawksworth, 1981b). Alstrup (1993) later described a second species, *N. groenlandica*, also found on crustose lichens. Due to the lack of molecular data, *Nigropuncta* is tentatively placed within *Ascomycota* genera incertae sedis, pending further molecular analysis.

Type species: *Nigropuncta rugulosa* D. Hawksw.

Table 2.210 Accepted lichenicolous species of *Nigropuncta*

	Species name	Host	References	Remarks
1	*Nigropuncta groenlandica* Alstrup	*Crustose lichen*	(Alstrup, 1993a)	
2	*Nigropuncta rugulosa* D. Hawksw.	*Lichen*	(Hawksworth, 1981b)	



Note a Infected areolae. b Vertical section of pycnidium (lower part). c Conidiogenous cells and detail of the pycnidial wall. **d** Conidia. Scale bars: c = 10 μm, d = 5 μm.

Source Redrawn from Hawksworth (1981b)

Figure 2.177 *Nigropuncta rugulosa*

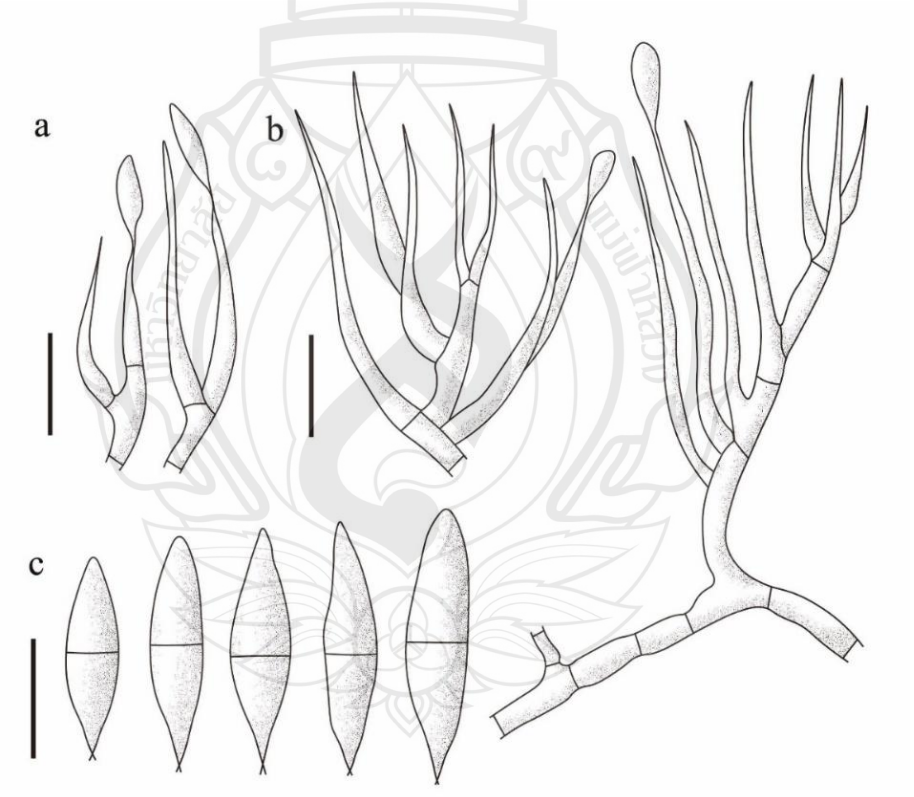
Patriciomyces D. Hawksw. (1)

Index Fungorum 28498, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Patriciomyces was introduced by Hawksworth (2001) to describe the lichenicolous species *P. valentinianus*, which grows on the thallus of *Physcia stellaris*. The genus is characterized by superficial, compact, pale orange sporodochia, measuring 0.4–0.6 mm in width and 0.2–0.4 mm in height. The conidiophores are macronematous, hyaline, and branched. The conidiogenous cells are terminal or lateral, holoblastic, subulate, and range from 30-55 μm in height. The conidia are hyaline, 1-septate, biconical, and measure 18-20 μm in length (Cole et al., 2001). Due to the lack of molecular data, *Patriciomyces* is tentatively placed within *Ascomycota* genera incertae sedis, with its phylogenetic status requiring further study.

Type species: *Patriciomyces valentinianus* D. Hawksw.



Note a Conidiophores. b Branching pattern of conidiophores. c Conidia. Scale bars: a, b = 20 μm, c = 10 μm.

Source Redrawn from Cole et al. (2001)

Figure 2.178 *Patriciomyces valentinianus*

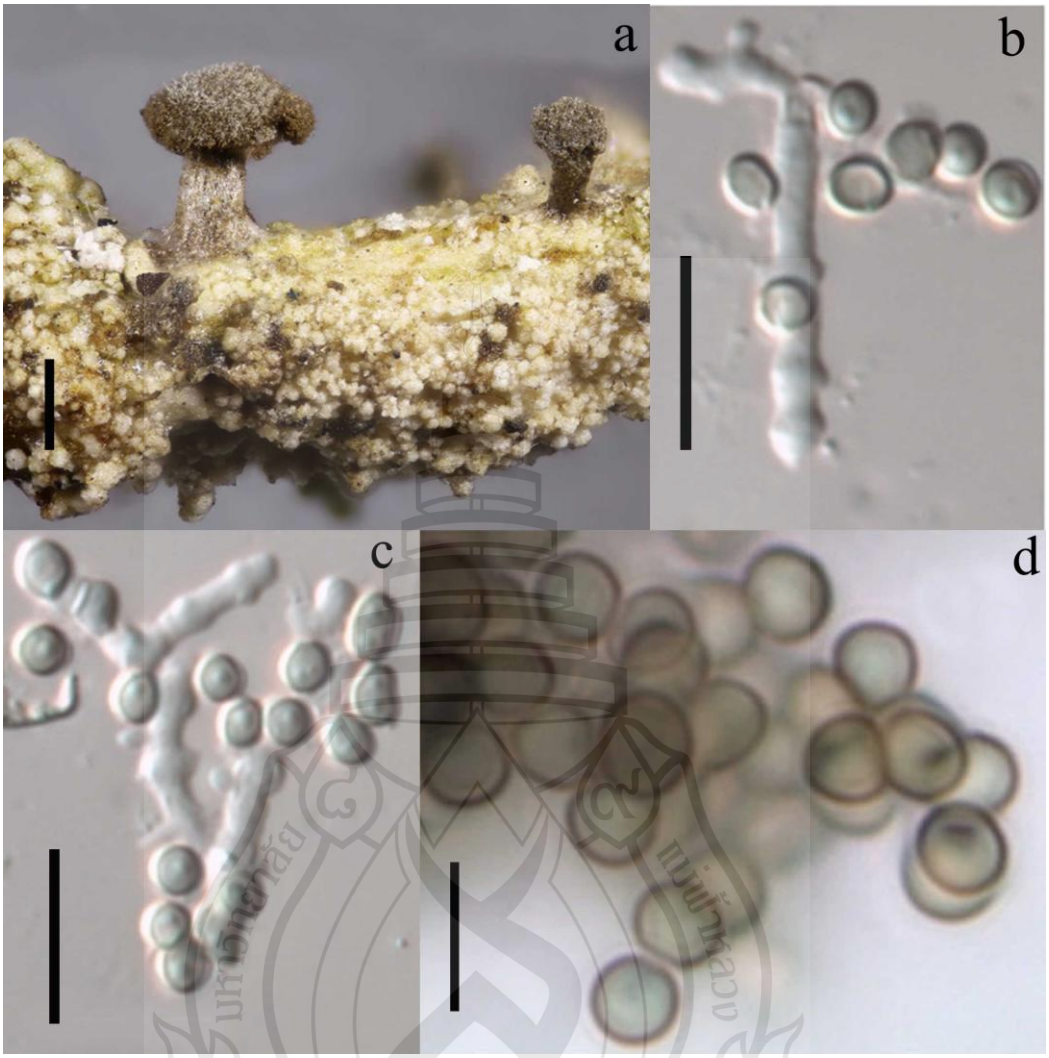
Pseudophaeoisaria Diederich & Giavarini (1)

Index Fungorum 855984, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Pseudophaeoisaria was introduced by Diederich & Giavarini (2024) to accommodate the type species *P. cladoniae*. The genus is characterized by synnematous, non-gelatinous conidiomata with a pale to medium greyish-brown stipe and a slightly velvety capitulum. Stipe hyphae are brown, K+ olivaceous, parallel, septate, and smooth. The mycelium is immersed, with conidiophores not distinct from stipe hyphae. Conidiogenous cells are integrated, terminal, hyaline, sometimes short-branched, sympodial, denticulate. Conidia are dry, aseptate, subspherical to short-ellipsoidal, often catenate in groups of 2–3, medium brown, K+ olivaceous brown and smooth walls. Due to the lack of molecular data, this genus is tentatively placed within Ascomycota genera incertae sedis.

Type species: *Pseudophaeoisaria cladoniae* Diederich & Giavarini, on *Cladonia polydactyla*. (Diederich et al., 2024)



Note a Synnemata over the thallus of *Cladonia polydactyla*. b–c Conidiophores and conidia. d Conidia. Scale bars: a = 500 µm, b–c = 10 µm, d = 5 µm.

Source Reedited from Diederich et al. (2024)

Figure 2.179 *Patriciomyces valentinianus*

Pygmaeosphaera Etayo & Diederich (3)

Index Fungorum 27671, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

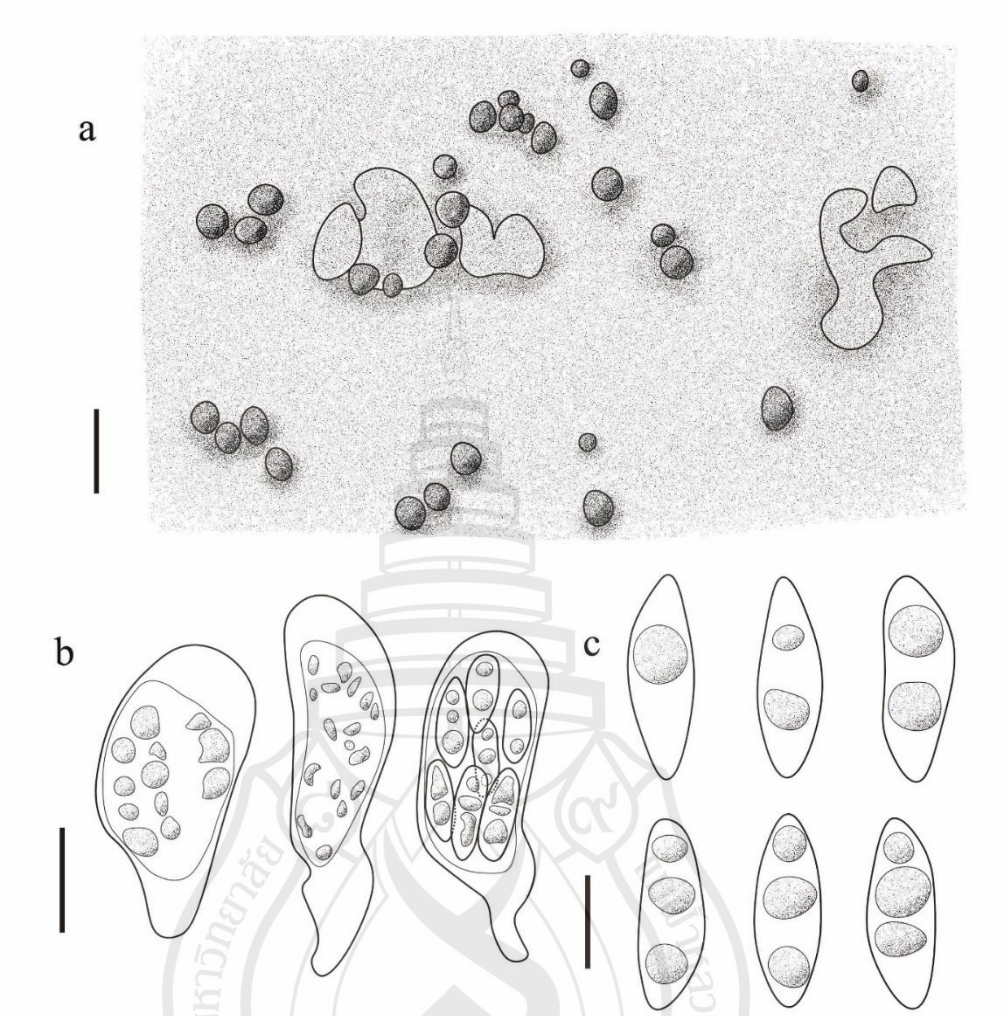
Pygmaeosphaera was introduced by Etayo & Diederich (2017) to encompass three lichenicolous species. The type species, *Pygmaeosphaera coccocarpiae*, was

transferred from *Nectriopsis coccocarpiae* Diederich and is associated with *Coccocarpia pellita*. The genus is distinguished by its very small, perithecioid ascomata, measuring less than 60 μm in diameter, with a thin ascomatal wall lacking a distinct cellular structure. Additional diagnostic features include hamathecial hyphae originating from the ascomatal wall, bitunicate, claviform asci that are both I- and KI-negative, and 1-septate, hyaline, smooth-walled ascospores (Etayo, 2017). Its phylogenetic placement remains uncertain due to the absence of molecular data, necessitating further study.

Type species: *Pygmaeosphaera coccocarpiae* (Diederich) Etayo & Diederich
= *Nectriopsis coccocarpiae* Diederich (Aptroot et al., 1997)

Table 2.211 Accepted lichenicolous species of *Pygmaeosphaera*

	Species name	**Host**	**References**	**Remarks**
1	*Pygmaeosphaera coccocarpiae* (Diederich) Etayo & Diederich	*Coccocarpia pellita*	(Aptroot et al., 1997; Etayo, 2017)	= *Nectriopsis coccocarpiae* Diederich
2	*Pygmaeosphaera epigraphis* Etayo & Sipman	*Graphis* cf. *angustata*	(Etayo, 2017)	
3	*Pygmaeosphaera sipmaniana* Etayo	*Parmeliella delicata*	(Etayo, 2017)	



Note a Tiny ascomata on *coccocarpia domingensis*. b Asci. c Ascospores. Scale bars: a = 100 μm, b = 10 μm, c = 5 μm.

Source Redrawn from Etayo (2017)

Figure 2.180 *Pygmaeosphaera coccocarpiae*

Randlanea Zhurb., Diederich & U. Braun (1)

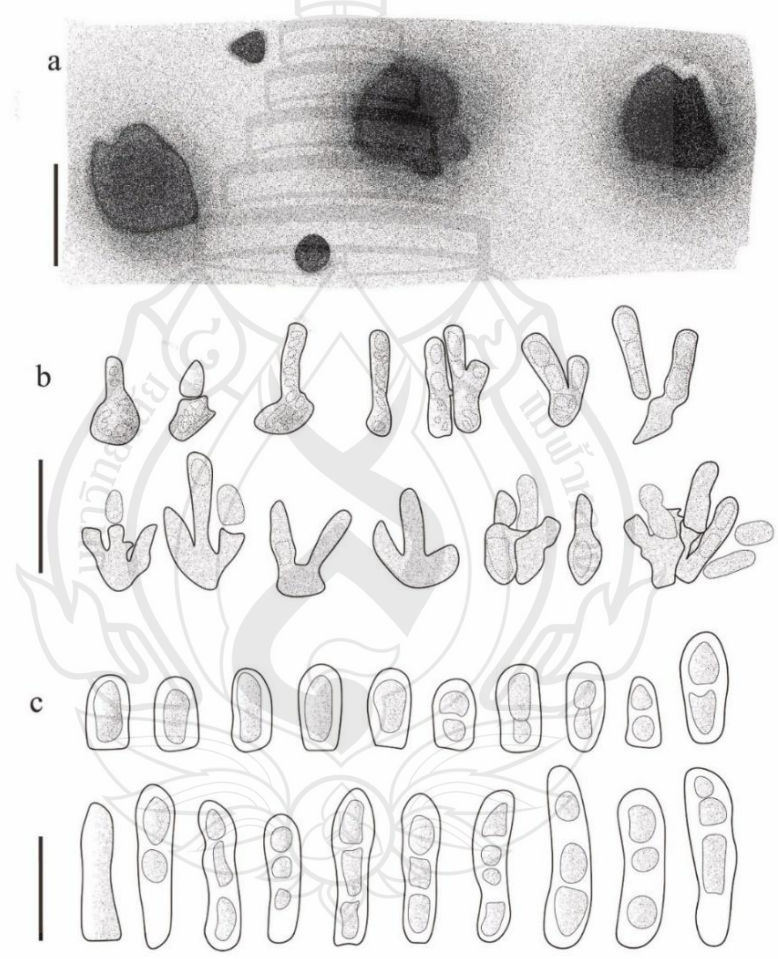
Index Fungorum 850398, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Randlanea was introduced by Zhurb., Diederich & U. Braun (2023) to describe the lichenicolous fungus *R. usneicola*, which is associated with *Usnea longissima*. The genus is characterized by phialidic conidiogenesis, multilocular conidiogenous cells

that are occasionally annellidic, and conidia that form in chains. These conidia are initially 1–2(–3)-septate but frequently fragment into aseptate sections (Zhurbenko et al., 2023). Due to the absence of molecular data, the phylogenetic placement of *Randlanea* remains uncertain, and it is tentatively assigned to *Ascomycota* genera incertae sedis.

Type species: *Randlanea usneicola* Zhurb., Diederich & U. Braun, on *Usnea longissima*.



Note a Conidiomata. b Conidiogenous cells. c Conidia. Scale bars: a = 50 µm, b = 10 µm, c = 5 µm.

Source Redrawn from Zhurbenko et al. (2023)

Figure 2.181 *Randlanea usneicola*

Refractohilum D. Hawksw. (4-5)

Index Fungorum 27671, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Refractohilum was introduced by Hawksworth (1977) to include three lichenicolous species: the newly described *R. galligenum* and two transferred species, *R. achromaticum* and *R. peltigerae*. The genus is characterized by lichenicolous fungi forming effuse, hair-like colonies, with predominantly immersed mycelium. The conidiophores are erect, unbranched, hyaline, and sparsely septate. Conidiogenous cells are terminal, exhibiting percurrent proliferation with distinctive annellations. Conidia are cymbiform, hyaline, smooth-walled, and non-catenate, featuring 0–3 septa, an obtuse apex, and a thick, refractive, truncate base (Hawksworth, 1977b).

Roux et al. (1997) described two additional species, *R. intermedium* and *R. pluriseptatum*, associated with *Pachyphiale carneola*. Subsequently, Castañeda Ruíz et al. (1998) introduced *R. mycophilum*, a fungicolous species found on the apothecia of *Xylaria*. In total, five species are currently recognized within the genus, four of which are lichenicolous. Initially placed in the family Moniliaceae (Deuteromycotina-Hyphomycetes), *Refractohilum* is now tentatively classified within *Ascomycota* genera incertae sedis due to the absence of molecular data.

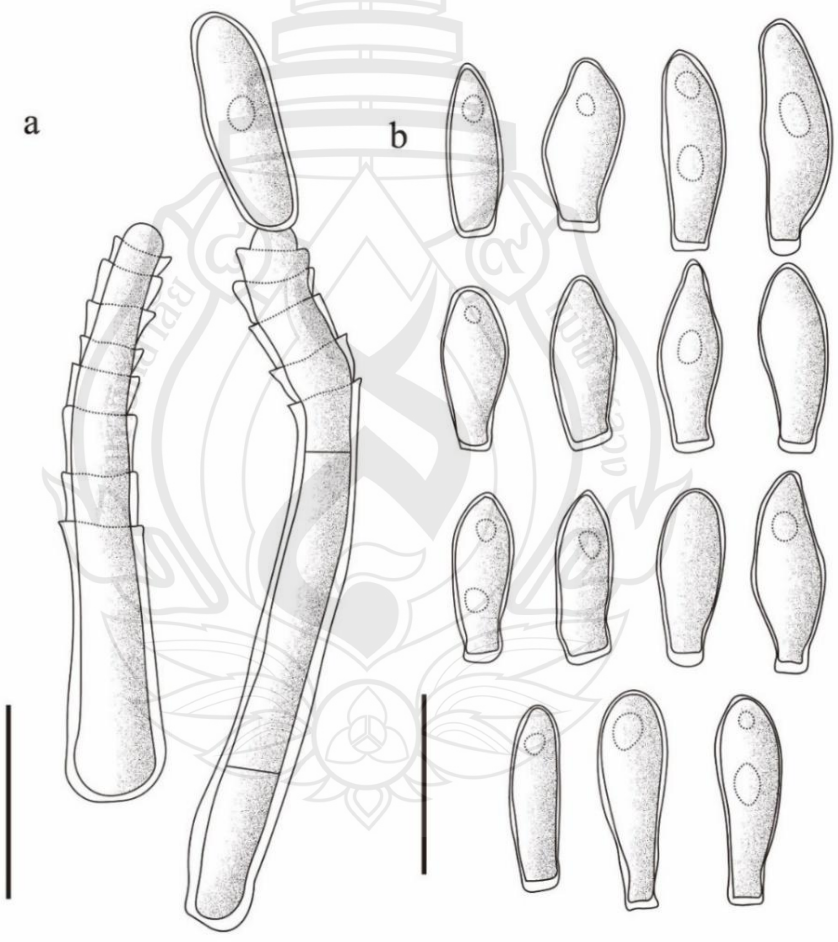
Type species: *Refractohilum galligenum* D. Hawksw.

Table 2.212 Accepted lichenicolous species of *Refractohilum*

	Species name	Host	References	Remarks
1	*Refractohilum achromaticum* (B. Sutton) D. Hawksw.	*Gyalecta*	(Hawksworth, 1977b)	= *Sporidesmium achromaticum* B. Sutton
2	*Refractohilum galligenum* D. Hawksw.	*Nephroma laevigatum*	(Hawksworth, 1977b)	

Table 2.212 (continued)

	Species name	Host	References	Remarks
3	*Refractohilum intermedium* Cl. Roux & Etayo	*Pachyphiale carneola, Gyalecta*	(Roux et al., 1997)	
4	*Refractohilum pluriseptatum* Etayo & Cl. Roux	*Pachyphiale carneola*	(Roux et al., 1997)	



Note a Conidiogenous cells. b Conidia. Scale bars: a–b = 10 μm.

Source Redrawn from Hawksworth (1977b)

Figure 2.182 *Refractohilum galligenum*

Sarcoexcipula Etayo (1)

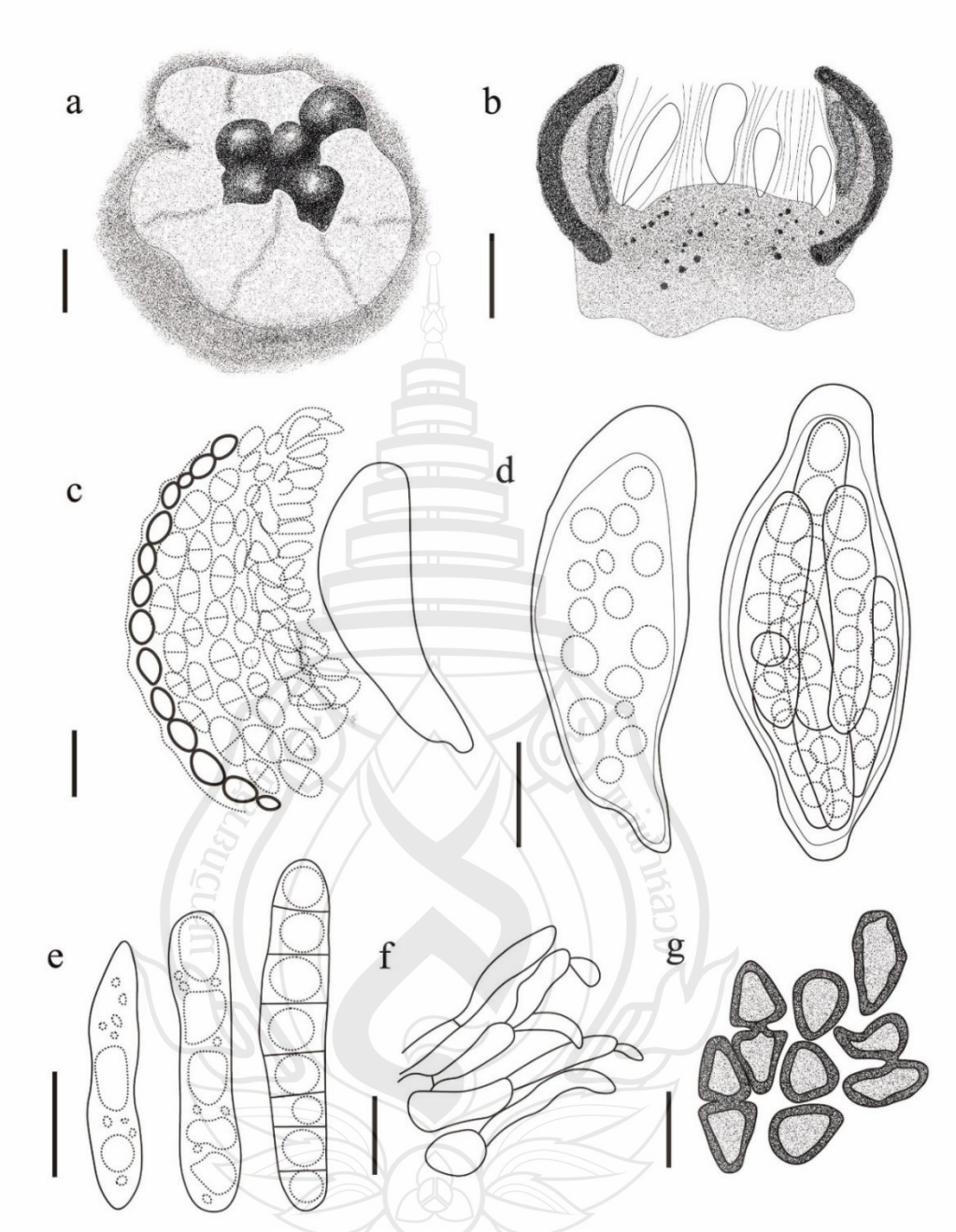
Index Fungorum 523869, Faceoffungi, MycoBank, GenBank

Classification: Pezizomycotina genera incertae sedis, Pezizomycotina, Ascomycota, Fungi

Sarcoexcipula was introduced by Etayo (2008) to describe the type species *S. pannariae*, which grows on the thalli and ascomata of the pale lichen *Pannaria pallida*. This genus is characterized as a lichenicolous fungus with black, sessile, subglobose perithecioid ascomata, measuring 100–150 µm in diameter and possessing a thick wall (50–65 µm). The hymenium displays distinctive reactions: I+ red-violet and KI+ blue. Asci are broadly clavate and bitunicate, producing cylindrical, hyaline ascospores with 0–7 septa (Etayo & Sancho, 2008).

The phylogenetic placement of *Sarcoexcipula* remains unresolved due to the absence of molecular data, necessitating further research for clarification.

Type species: *Sarcoexcipula pannariae* Etayo, on *Pannaria pallida*. (Etayo & Sancho, 2008)



Note a Ascomata grouped on the stem of pannaria pallida. b Cross section of ascoma. c Cross section of a part of the ascoma. d Asci. e Ascospores. f Periphyses. g Ascoma wall cells. Scale bars: a = 100 μm, b = 50 μm, c–e = 10 μm, f–g = 5 μm.

Source Redrawn from Etayo & Sancho (2008)

Figure 2.183 *Sarcoexcipula pannariae*

Sessiliospora D. Hawksw. (1)

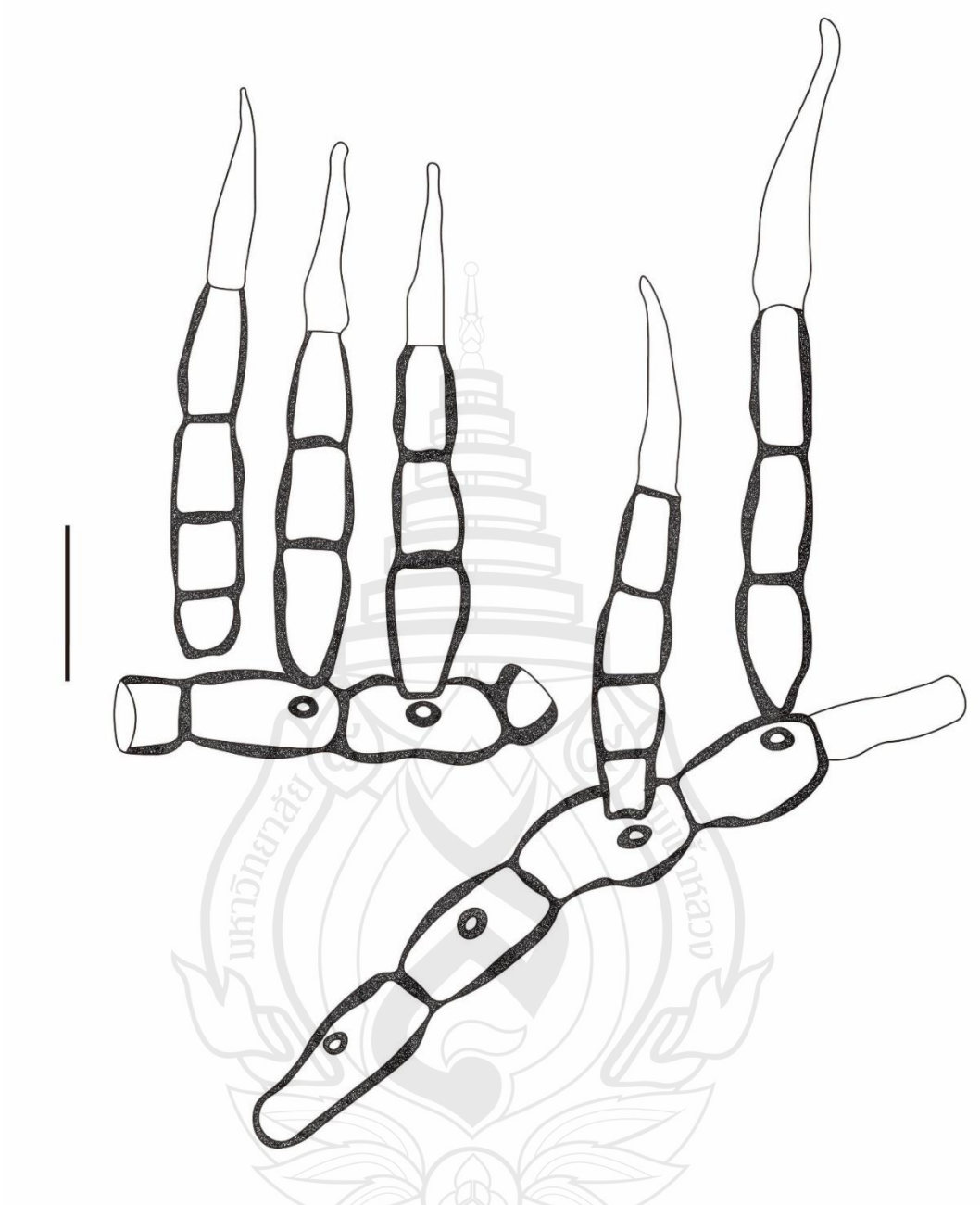
Index Fungorum 9907, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Sessiliospora was introduced by Hawksworth (1979) to describe the lichenicolous species *S. bicolor*, which occurs on the thallus of *Lasioloma arachnoideum*. The genus is characterized by effuse colonies with superficial, adpressed, branched mycelium. It lacks stroma, setae, and hyphopodia. Conidiophores are micronematous, mononematous, prostrate, simple or branched, and brown. Conidiogenous cells are monotretic, intercalary, and determinate, with dark brown walls and lateral scars. The conidia are elongate-obclavate, septate, with brown basal cells and subhyaline, beak-like apical cells (Hawksworth, 1979a).

Initially assigned to Dematiaceae, *Sessiliospora* remains tentatively placed in *Ascomycota* genera incertae sedis, as its phylogenetic position is unresolved due to the absence of molecular data (Hyde et al., 2024).

Type species: *Sessiliospora bicolor* D. Hawksw., on *Lasioloma arachnoideum*. (Hawksworth, 1979a)



Note Conidiogenous cells and conidia. Scale bar = 10 μm.

Source Redrawn from Hawksworth (1979a)

Figure 2.184 *Sessiliospora bicolor*

Stellifraga Alstrup & Olech (1)

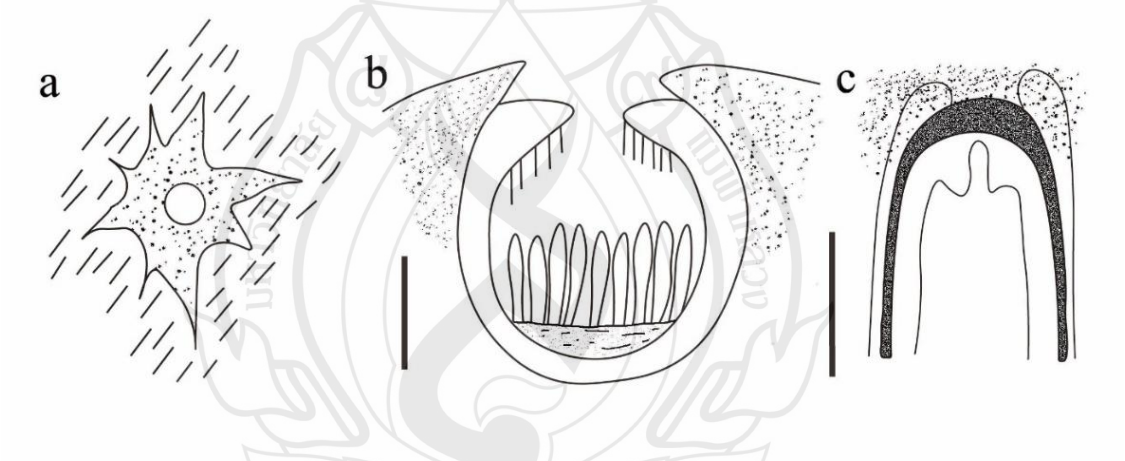
Index Fungorum 6200, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Stellifraga was introduced by Alstrup & Olech (1993) to describe the lichenicolous fungus *S. cladoniicola*, which occurs on *Cladonia gracilis*. The genus is characterized by immersed perithecia that rupture the host's cortex, subcylindrical asci with a distinctive tholus pierced by a *chambre oculaire*, and hamathecial filaments closely adherent to the asci. The apical part of the ascus wall and surrounding gel exhibit a blue reaction in Melzer's reagent. Ascospores are hyaline and septate (Alstrup, 1993c).

Due to the absence of molecular data, *Stellifraga* is tentatively placed within *Ascomycota* genera incertae sedis, pending further phylogenetic investigation (Hyde et al., 2024).

Type species: *Stellifraga cladoniicola* Alstrup & Olech, on *Cladonia gracilis*. (Alstrup, 1993c)



Note a Habitus seen from above. b Skematic section of host and fungus. c Apex of ascus surrounded by hamathecial, paraphysis-like, filaments. Scale bars: b = 50 μm, c = 10 μm.

Source Redrawn from Alstrup (1993c)

Figure 2.185 *Stellifraga cladoniicola*

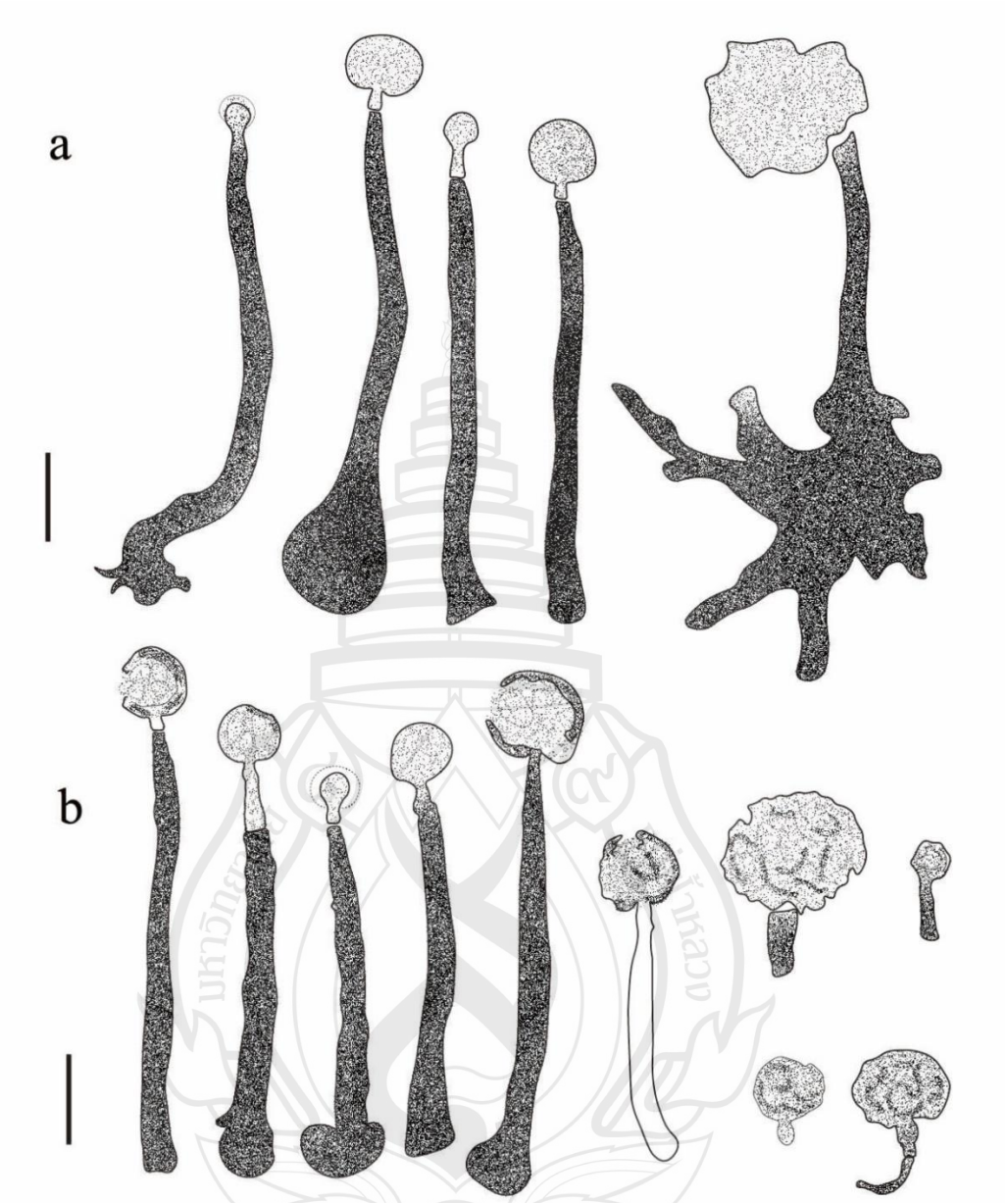
Stipititheca Diederich & Ertz (1)

Index Fungorum 855988, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Stipititheca was introduced by Diederich & Ertz (2024) to accommodate the type species *Stipititheca pyrenulae* which grows on *Pyrenula*. The genus is characterized by by its erect, blackish, mononematous, unbranched conidiophores, which are typically straight or slightly curved and have a broad foot cell arising from a blackish basal stroma. The conidiogenous cells are monoblastic, terminal, and integrated into the conidiophores, with indistinct annellations. Conidia initially appear unicellular with a thick, subhyaline sheath that gradually darkens, while the interior develops into brown, ellipsoidal cells that are eventually released collectively. Due to the lack of molecular data, this genus is tentatively placed within Ascomycota genera incertae sedis.

Type species: *Stipititheca pyrenulae* Diederich & Ertz, on *Pyrenula*. (Diederich et al., 2024)



Note a–b Conidiophores, conidiogenous cells and conidia. Scale bars: a–b = 10 μm.

Source Redrawn from Diederich et al. (2024)

Figure 2.186 *Stipititheca pyrenulae*

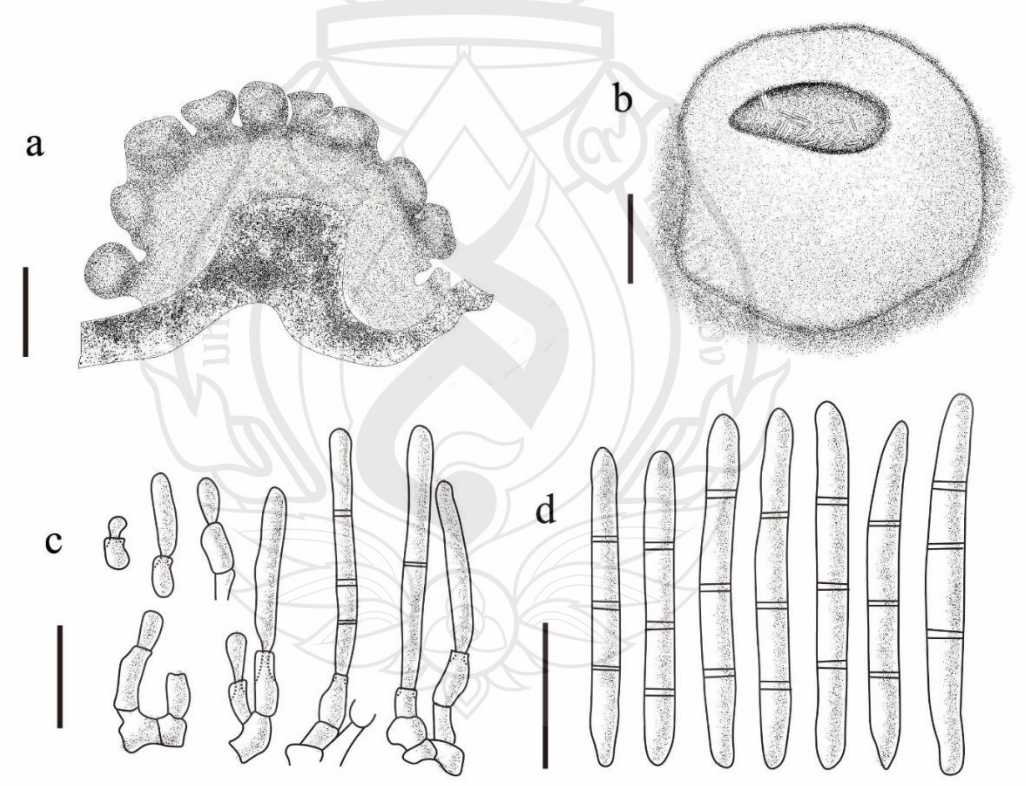
Stygiomyces Coppins & S.Y. Kondr. (1)

Index Fungorum 6271, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Stygiomyces was introduced by Coppins & Kondratyuk (1995) to describe the lichenicolous species *S. galliformis*, which grows on *Pseudocyphellaria faveolata*. The genus is characterized by pale pycnidial conidiomata with intricately textured walls. Conidiogenous cells are phialidic, short-cylindrical to ampulliform, and conidia are hyaline, long-bacilliform, and septate at maturity, with a more or less truncate proximal apex (Coppins et al., 1995). Due to the absence of molecular data, *Stygiomyces* is tentatively placed within *Ascomycota* genera incertae sedis, pending further phylogenetic analysis (Hyde et al., 2024).

Type species: *Stygiomyces galliformis* Coppins & S.Y. Kondr., on *Pseudocyphellaria faveolata*. (Coppins et al., 1995)



Note a Section of gall with pycnidia. b Pycnidia. c Conidiogenous cells and conidia. d Conidia. Scale bars: a = 200 μm, b = 50 μm, c–d = 10 μm.

Source Redrawn from Coppins et al. (1995)

Figure 2.187 *Stygiomyces galliformis*

Taeniolina M.B. Ellis (1-6)

Index Fungorum 10171, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Type species: *Taeniolina centaurii* (Fuckel) M.B. Ellis

= *Torula centaurii* Fuckel

Accepted lichenicolous species:

Taeniolina scripta (P. Karst.) P.M. Kirk, facultatively lichenicolous on corticolous lichens.

= *Hormiscium scriptum* P. Karst.

Talpapellis Alstrup & M.S. Cole (11-12)

Index Fungorum 27897, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

= *Ameroconium* U. Braun & Zhurb., Lichenologist 45(5): 583 (2013)

Type: *Ameroconium cladoniae* U. Braun & Zhurb.

Talpapellis was introduced by Alstrup & M.S. Cole (1998) to describe the type species *T. peltigerae*, which grows on *Peltigera venosa*. The genus is characterized as a parasymbiotic, lichenicolous hyphomycete with superficial to semi-immersed mycelium composed of elongated, smooth-walled cells. Its conidiophores are acroauxic, mononematous, rarely branched, and dark gray-brown. The conidiogenous cells are terminal, polytretic, and sympodial, while the conidia are dark brown, ellipsoid, non-septate, and truncate (Alstrup et al., 1998). Heuchert et al. (2014) revised and reassessed the genus *Talpapellis*, highlighting the prominent annellations associated with the formation of conidiogenous cells and the conidiation. These features are distinctive and represent significant differences when compared to *Taeniolella* (Heuchert et al., 2014).

Heuchert et al. (2018) transferred *Talpapellis beschiana* from *Taeniolella beschiana*. In addition, *Ameroconium cladoniae*, the type species of *Ameroconium*, was also treated as a synonym of *Talpapellis beschiana*. Diederich et al. (2024) introduced

four new species and combined one species, *Talpapellis pseudocyphellariae* from *Taeniolella*. The species, *Talpapellis mahensis*, was initially described as lichenicolous on an unidentified crustose lichen, then was regarded as a lichenized species with a whitish, sorediate thallus containing psoromic acid and norstictci acid, usually covered by a blackish hyphomycetous asexual stage. To date, tewlve species are recognized within the genus, eleven of which are lichenicolous. However, no molecular data are available, and its phylogenetic placement remains unclear, with *Talpapellis* tentatively classified within *Ascomycota* genera incertae sedis (Hyde et al., 2024).

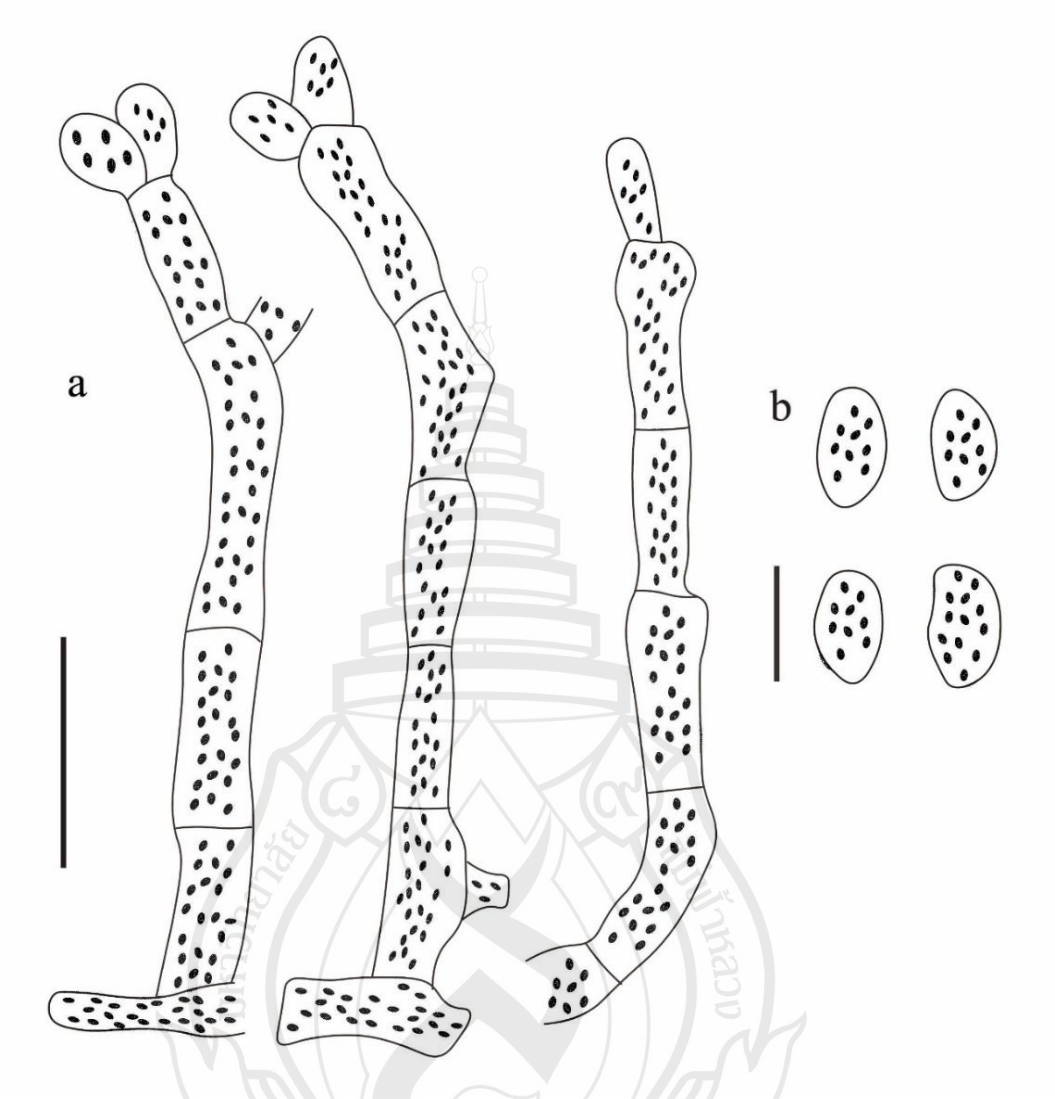
Type species: *Talpapellis peltigerae* Alstrup & M.S. Cole

Table 2.213 Accepted lichenicolous species of *Talpapellis*

	Species name	**Host**	**References**	**Remarks**
1	*Talpapellis beschiana* (Diederich) Zhurb., U. Braun, Diederich & Heuchert	*Cladonia chlorophaea*	(Heuchert et al., 2018)	= *Taeniolella beschiana* Diederich
2	*Talpapellis chlorinae* Ertz, Diederich & F. Berger	*Chrysothrix chlorina*	(Diederich et al., 2024)	
3	*Talpapellis dendrographae* Diederich & van den Boom	*Dendrographa decolorans*	(Diederich et al., 2024)	
4	*Talpapellis graphidis* Heuchert, Common, U. Braun & Diederich	*Phaeographis brasiliensis*	(Diederich et al., 2019)	
5	*Talpapellis lendemeri* Diederich	*Lecanora cyrtella*	(Diederich et al., 2024)	
6	*Talpapellis mahensis* Diederich, U. Braun & Ertz		(Diederich et al., 2017)	Lichen

Table 2.213 (continued)

	Species name	Host	References	Remarks
7	*Talpapellis pachnolepiae* Diederich & van den Boom	*Pachnolepia pruinata*	(Diederich et al., 2024)	
8	*Talpapellis peltigerae* Alstrup & M.S. Cole var. *peltigerae*	*Peltigera venosa*	(Alstrup et al., 1998)	
9	*Talpapellis peltigerae* Alstrup & M. S. Cole var. *rossica* Heuchert, Zhurb. & U. Braun	*Peltigera leucophlebia, P. aphthosa* and *P. venosa*	(Heuchert et al., 2014)	
10	*Talpapellis pseudocyphellariae* (Etayo) Diederich, U. Braun & Heuchert	*Nephroma antarcticum* and *Pseudocyphellaria hillii*	(Etayo & Sancho, 2008; Diederich et al., 2024)	= *Taeniolella pseudocyphellariae* Etayo
11	*Talpapellis psorulae* Zhurb. & U. Braun	*Psorula rufonigra*	(Zhurbenko et al., 2024)	
12	*Talpapellis solorinae* Zhurb., Heuchert & U. Braun	*Solorina crocea*	(Zhurbenko et al., 2015)	



Note a Conidiophores and conidia. b Conidia. Scale bars: a = 10 μm, b = 5 μm.

Source Redraw from Alstrup et al. (1998)

Figure 2.188 *Talpapellis peltigerae*

Teratosperma Syd. & P. Syd. (2-10)

Index Fungorum 10182, Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Type species: *Teratosperma singulare* Syd. & P. Syd.

Table 2.214 Accepted lichenicolous species of *Teratosperma*

	Species name	Host	References
1	*Teratosperma anacardii* Hansf.	on foliicolous lichens	(Hansford, 1943)
2	*Teratosperma lichenicola* D.Hawksw.	*Strigula elegans*	(Hawksworth, 1979a)

Teratosperma Syd. & P. Syd. (3-23)

Index Fungorum 10280 Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Type species: *Trichoconis caudata* (Appel & Strunk) Clem.

Table 2.215 Accepted lichenicolous species of *Trichoconis*

	Species name	Host	References	Remarks
1	*Trichoconis hafellneri* U. Braun, Khodos., Darmostuk & Diederich	*Xanthoria parietina*	(Braun et al., 2016)	
2	*Trichoconis lichenicola* D. Hawksw.	*Peltigera collina*	(Hawksworth, 1980b)	
3	*Trichoconis physciicola* Brackel	*Physcia adscendens, P. tenella* and *Prunus spinosa*	(Brackel, 2014)	

Vagnia D. Hawksw. & Miądl. (1)

Index Fungorum 27760, Faceoffungi, MycoBank, GenBank

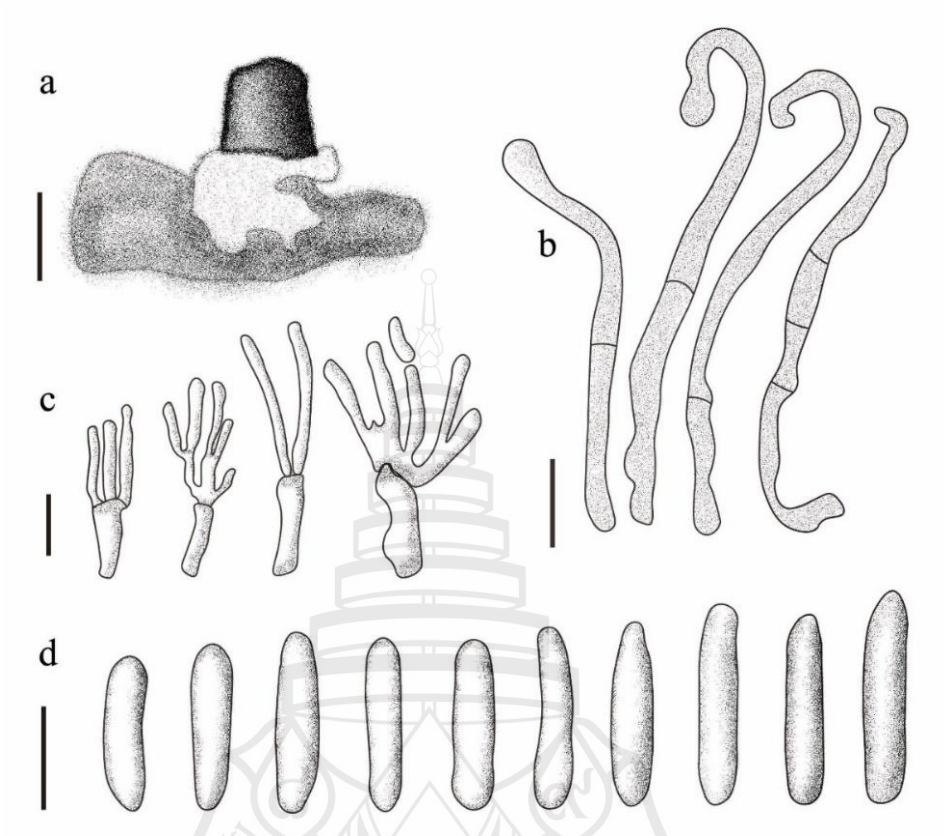
Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Vagnia was introduced by Hawksworth & Miadlikowska (1997) to describe the lichenicolous species *V. cirriformis*, which occurs on the thalli of *Peltigera*. The genus

is distinguished by its lichenicolous lifestyle and unique morphological characteristics. Its conidiomata are solitary, cupulate to doliiform, dark brown in color but appear white due to superficial hairs, and feature a conspicuous black, columnar cirrus of conidia extending above the structure. The conidiomatal wall is composed of irregularly interwoven brown hyphae, with 0–1-septate, flexuous hairs. Conidiophores are simple or 1–3-branched, hyaline, and give rise to cylindrical, hyaline conidiogenous cells. The conidia are enteroblastic, bacilliform, and hyaline, but they aggregate in the cirrus to appear olive to dark green or black (Hawksworth & Miadlikowska, 1997).

Due to the lack of molecular data, the phylogenetic position of *Vagnia* remains uncertain. It is currently classified within Ascomycota genera incertae sedis, pending further study.

Type species: *Vagnia cirriformis* D. Hawksw. & Miądl. (Hawksworth & Miadlikowska, 1997)



Note a Conidioma. b Hairs arising from the conidioma wall. c Conidiophores and conidiogenous cells. d Conidia. Scale bars: a = 50 μm, b = 20 μm, c = 10 μm, d = 5 μm.

Source Redrawn from Hawksworth et al. (1997)

Figure 2.189 *Vagnia cirriformis*

Viridiannula Etayo (1)

Index Fungorum 10391 Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Viridiannula was introduced by Etayo (2002) to accommodate the type species *V. pertusariae* which grows on *Pertusaria*. This genus is characterized by sessile conidiomata, 40–50(–70) μm diam. Conidiogenous cells are polyphialidic, with 1–4 proliferations, conidia are polymorphic, 6.5–10(–12) × 2.5–3(–3.5) μm (Etayo et al.,

2024). Due to the absence of molecular data, *Viridiannula* is tentatively placed within Ascomycota genera incertae sedis, pending further phylogenetic analysis (Hyde et al., 2024).

Type species: *Viridiannula pertusariae* Etayo, on *Pertusaria* (Etayo, 2002b)

Vouauxiella Petr. & Syd. (4)

Index Fungorum 281604 Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Vouauxiella was introduced by Petrak & Sydow (1927) to include two species, *V. verrucosa* and *V. lichenicola*, both originally classified under *Torula* and found on *Lecanora subfusca*. Sutton (1980) later added *V. pithospora*, transferred from *Alysia pithospora* Cavalc. & A.A. Silva, which occurs on foliicolous lichens. Alstrup (1993) described *V. caloplacae*, identified on *Caloplaca scopularis*. Currently, the genus comprises four recognized species (Table 1), although no molecular data are available in GenBank.

The genus is characterized by small, dispersed, roundish to oval fruit bodies primarily composed of the darkly pigmented tissue of the host. These fruit bodies are initially embedded in the host tissue and later rupture, becoming widely open at maturity, often resembling miniature cups. Conidiophores are robust, simple, occasionally forked, and located at the base and lower side walls of the fruit bodies. They are darkly pigmented, short-segmented, and produce chains of unicellular, darkly colored conidia. The conidia are elongated, ellipsoidal, or occasionally nearly spherical (Petrak et al., 1927).

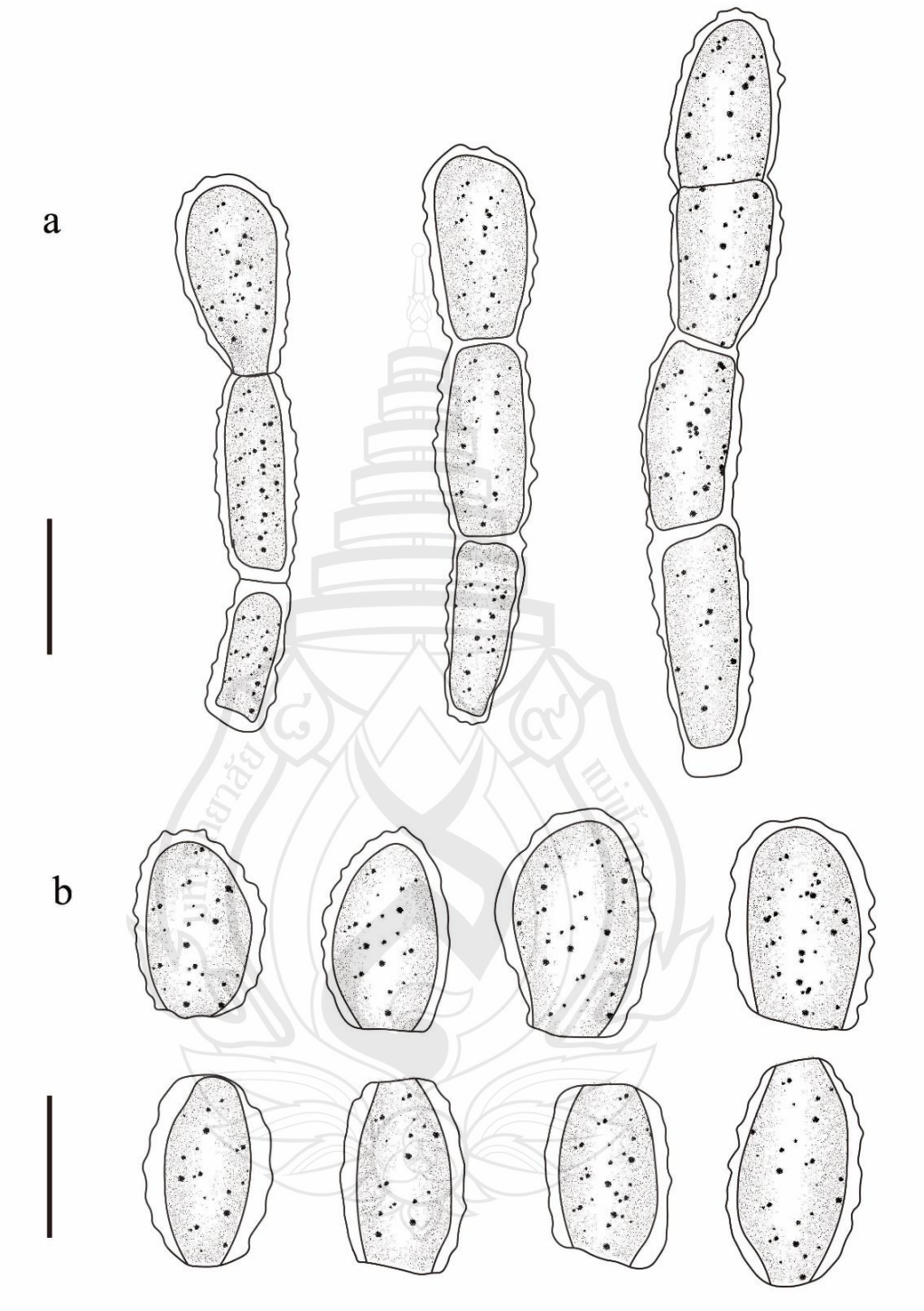
Type species:

Vouauxiella verrucosa (Vouaux) Petr. & Syd.

= *Torula verrucosa* Vouaux

Table 2.216 Accepted lichenicolous species of *Vouauxiella*

	Species name	Host	References	Remarks
1	*Vouauxiella caloplacae* Alstrup	*Caloplaca scopularis*	(Alstrup, 1993a)	
2	*Vouauxiella lichenicola* (Linds.) Petr. & Syd.	*Lecanora subfusca*	(Lindsay, 1869; Petrak et al., 1927)	*Torula lichenicola* Linds.
3	*Vouauxiella pithospora* (Cavalc. & A.A. Silva) B. Sutton	On foliicolous lichens	(Sutton, 1980)	*Alysia pithospora* Cavalc. & A.A. Silva
4	*Vouauxiella verrucosa* (Vouaux) Petr. & Syd.	*Lecanora subfusca*	(De Lesdain, 1907; Petrak et al., 1927)	*Torula verrucosa* Vouaux



Note a Conidiophores. b conidia. Scale bars: a–b = 5 μm

Source Redrawn from Hawksworth (1976)

Figure 2.190 *Vouauxiella verrucosa*

Xylohyphopsis W.A. Baker & Partr. (1-2)

Index Fungorum 28402, Faceoffungi, MycoBank, GenBan

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Type species: *Xylohyphopsis curta* (Corda) W.A. Baker & Partr.

Accepted lichenicolous species:

Xylohyphopsis xanthoriicola P. Pinault & Diederich, on *Xanthoria parietina* (Diederich et al., 2024)

Zevadia J.C. David & D. Hawksw. (1)

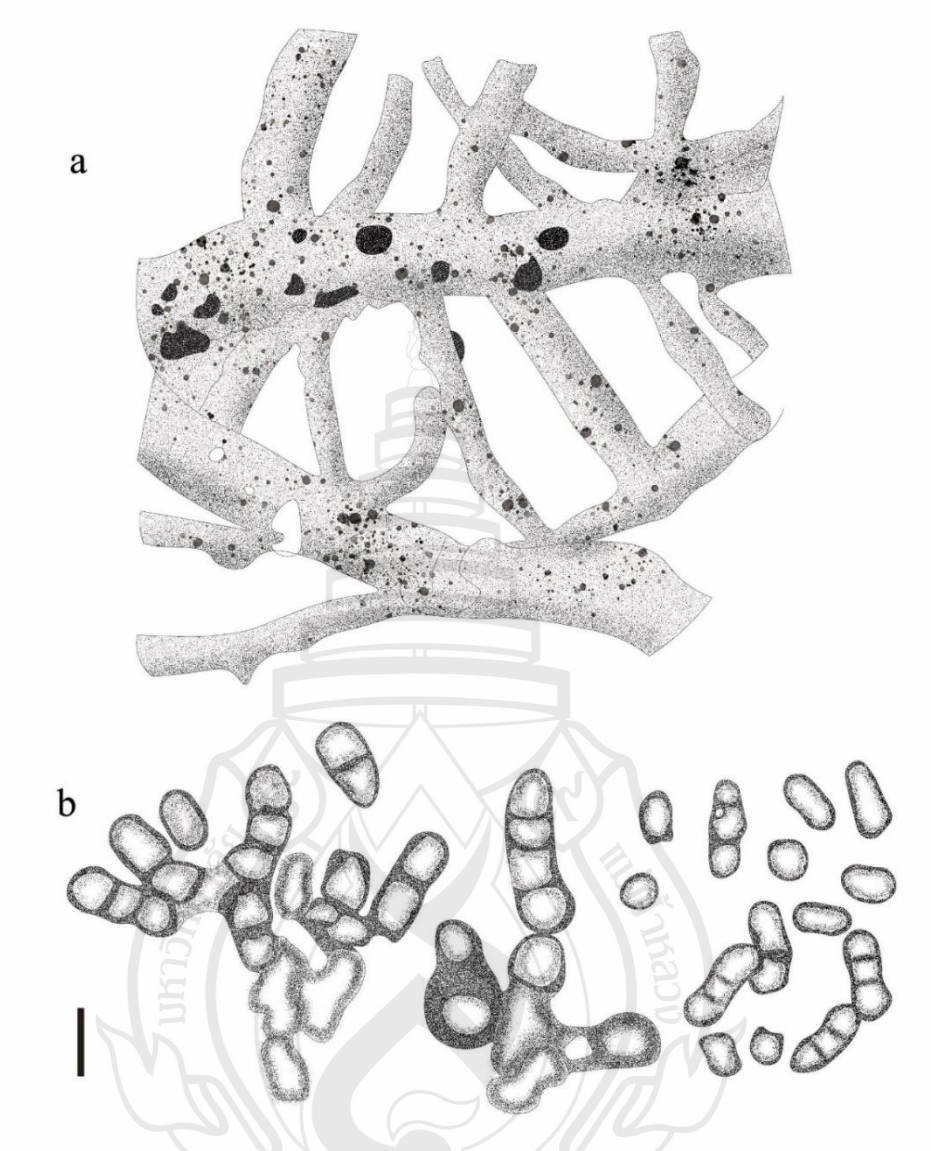
Index Fungorum 27650 Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Zevadia was introduced by David & Hawksworth (1995) to accommodate *Z. peroccidentalis*, discovered on *Usnea flammea*. The genus is characterized by stromatic conidiomata that are initially covered by a thin layer, which later ruptures to expose the conidia and conidiophores. The fruiting bodies are black, carbonaceous, and often coalesce into larger structures. The conidiophores are septate, pigmented, and branched, bearing cupulate conidiogenous cells. The conidia are dark brown, warty, and typically non-septate, forming in short basipetal chains (David & Hawksworth, 1995).

In the absence of molecular data, the phylogenetic position of *Zevadia* remains unresolved, and it is tentatively placed within *Ascomycota* as genera incertae sedis (Hyde et al., 2024).

Type species: *Zevadia peroccidentalis* J.C. David & D. Hawksw. (David & Hawksworth, 1995)



Note a Conidiomata on thallus of *Usnea flammea.* b Conidiogenous cells and conidia. Scale bar = 5 μm.

Source Redraw from the website: Fungi of Great Britain and Ireland (2024).

Figure 2.191 *Zevadia peroccidentalis*

Zwackhiomacromyces Etayo & van den Boom (2)

Index Fungorum 803963 Faceoffungi, MycoBank, GenBank

Classification: Ascomycota genera incertae sedis, Ascomycota, Fungi

Zwackhiomacromyces was introduced by Etayo & van den Boom (2014) to

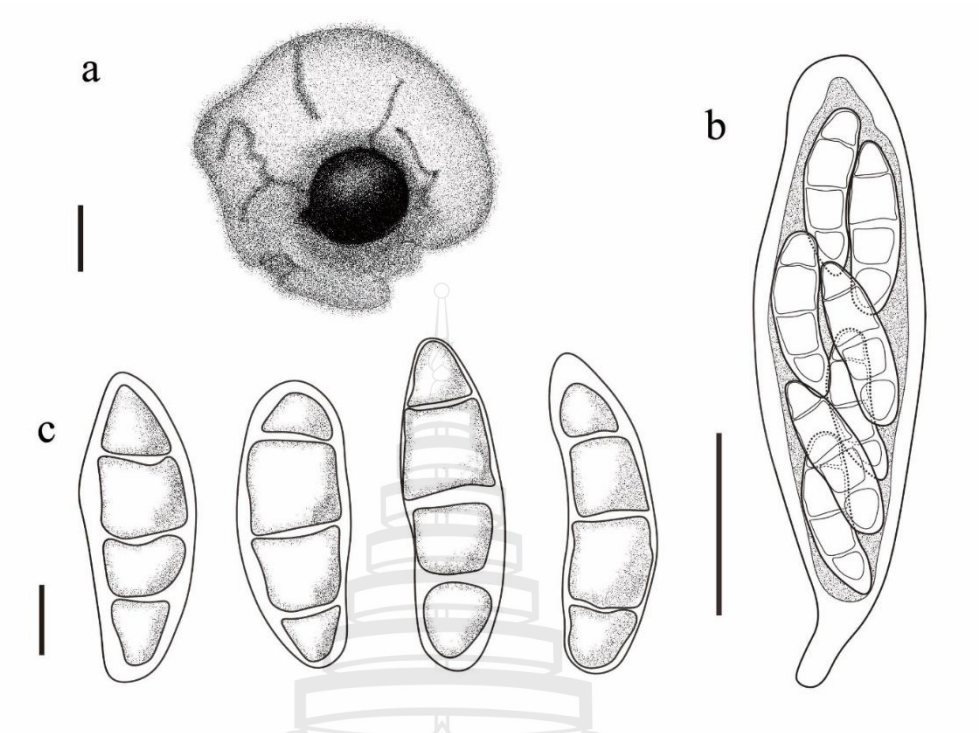
describe the lichenicolous fungus *Z. constrictocarpus*, which occurs on *Megalospora verrucosa*. This genus is distinguished by black, pyriform perithecioid ascomata with a papilliform ostiole that opens radially. The ascomatal wall is dark, pseudoparenchymatous, and contains extracellular pigment. The hamathecium is composed of branched pseudoparaphyses, while the asci are elongate-clavate with fissitunicate walls. The ascospores are ellipsoid, 3-septate, hyaline, and smooth-walled. Berger et al. (2016) added a second species, *Z. hyalosporus*, transferring it from *Pyrenidium hyalosporum* Alstrup, D. Hawksw. & R. Sant.

In the absence of molecular data, the phylogenetic placement of *Zwackhiomacromyces* remains uncertain, and it is tentatively assigned to Ascomycota as genera incertae sedis (Hyde et al., 2024).

Type species: *Zwackhiomacromyces constrictocarpus* Etayo & van den Boom

Table 2.217 Accepted lichenicolous species of *Zwackhiomacromyces*

	Species name	Host	References	Remarks
1	*Zwackhiomacromyces constrictocarpus* Etayo & van den Boom	*Megalospora verrucosa*	(Van den Boom & Etayo, 2014)	
2	*Zwackhiomacromyces hyalosporus* (Alstrup, D. Hawksw. & R. Sant.) Etayo & F. Berger	*Placopsis gelida*	(Alstrup et al., 1990, Berger et al., 2016)	= *Pyrenidium hyalosporum* Alstrup, D. Hawksw. & R. Sant.



Note a Perithecium. b Ascus. c Ascospores. Scale bars: a = 0.1 mm, b = 50 μm, c = 10 μm.

Source Redrawn from Van den Boom et al. (2014)

Figure 2.192 *Zwackhiomacromyces constrictocarpus*

Phylum BASIDIOMYCOTA R.T. Moore

Subphylum AGARICOMYCOTINA Doweld

Class AGARICOMYCETES Doweld

Order Agaricales Underw.

Family Hygrophoraceae Lotsy

Arrhenia Fr. (1-65)

Index Fungorum 17100, Faceoffungi, MycoBank, GenBank

Classification: Hygrophoraceae, Agaricales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Arrhenia auriscalpium* (Fr.) Fr.

= *Cantharellus auriscalpium* Fr.

Accepted lichenicolous species of

Arrhenia peltigerina (Peck) Redhead, Lutzoni, Moncalvo & Vilgalys, on *Peltigera* (Redhead, 2002)

= *Agaricus peltigerinus* Peck

Family Tricholomataceae R. Heim ex Pouzar

Gamundia Raithelh. (1-7)

Index Fungorum 17638, Faceoffungi, MycoBank, GenBank

Classification: Tricholomataceae, Agaricales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species:

Arrhenia auriscalpium (Fr.) Fr.

= *Cantharellus auriscalpium* Fr.

Accepted lichenicolous species of

Gamundia striatula (Kühner) Raithelh. facultatively lichenicolous on *Cladonia* and *Peltigera*

= *Rhodocybe striatula* Kühner

Order Atheliales Jülich

Family Atheliaceae Jülich

Athelia Pers. (1-37)

Index Fungorum 17118, Faceoffungi, MycoBank, GenBank

Classification: Atheliaceae, Atheliales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Athelia epiphylla* Pers.

Table 2.218 Accepted lichenicolous species of *Athelia*

	Species name	Host	References	Remarks
1	*Athelia alnicola* (Bourdot & Galzin) Jülich	facultatively lichenicolous	(Jülich, 1972)	= *Corticium centrifugum* subsp. *alnicola* Bourdot & Galzin
2	*Athelia arachnoidea* (Berk.) Jülich	on various lichens	(Jülich, 1972)	= *Corticium arachnoideum* Berk.
3	*Athelia epiphylla* Pers.	facultatively lichenicolous	(Persoon, 1818)	
4	*Athelia salicum* Pers.	facultatively lichenicolous	(Persoon, 1822)	

Order Boletales E.-J. Gilbert

Family Coniophoraceae Ulbr.

Penttilamyces Zmitr., Kalinovskaya & Myasnikov (1-3)

Index Fungorum 556847, Faceoffungi, MycoBank, GenBank

Classification: Coniophoraceae, Boletales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Penttilamyces romellii* (Ginns) Zmitr., Kalinovskaya & Myasnikov

= *Leucogyrophana romellii* Ginns

Accepted lichenicolous species of

Penttilamyces lichenicola (Thorn, Malloch & Ginns) Zmitr., Kalinovskaya & Myasnikov, on *Cladonia* (Zmitrovich et al., 2019)

= *Leucogyrophana lichenicola* Thorn, Malloch & Ginns (Thorn et al., 1998)

Order Cantharellales Gäum.

Family Ceratobasidiaceae G.W. Martin

Ceratobasidium D.P. Rogers (1-24)

Index Fungorum 17260, Faceoffungi, MycoBank, GenBank

Classification: Ceratobasidiaceae, Cantharellales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Ceratobasidium calosporum* D.P. Rogers

Accepted lichenicolous species of

Ceratobasidium bulbillifaciens Diederich & Lawrey, on *Physcia tenella*. (Diederich et al., 2014)

Family Hydnaceae Chevall.

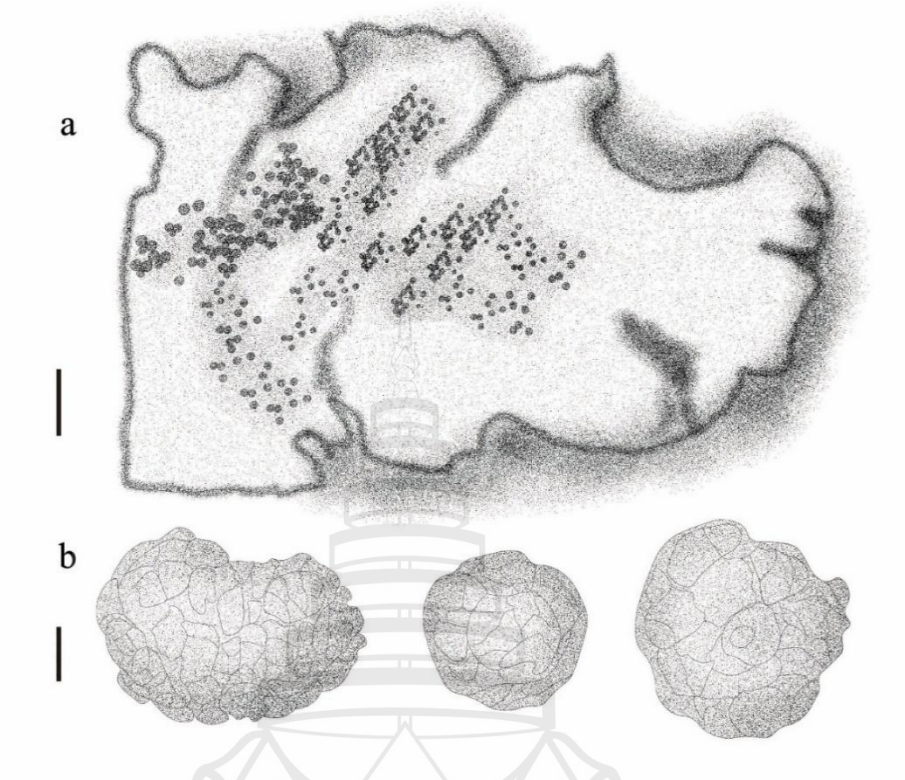
Bergerella Diederich & Lawrey (1)

Index Fungorum 835061, Faceoffungi, MycoBank, GenBank

Classification: Hydnaceae, Cantharellales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Bergerella was introduced by Diederich & Lawrey (2020) to describe the lichenicolous species *B.* atrofusca, which occurs on the thallus of *Physcia aipolia*. This genus is characterized by superficial, dark reddish-brown, shiny bulbils that are round to ellipsoid, measuring 25–35 µm in diameter and composed of thin-walled cells ranging from 6–15 µm in diameter (Lawrey et al., 2020). Hyde et al. (2024) placed *Bergerella* within Hydnaceae.

Type species: *Bergerella atrofusca* Diederich & Lawrey, on *Physcia aipolia*. (Lawrey et al., 2020)



Note a Bulbils on white necrosed thallus of *Physcia aipolia*. b Bulbils in water. Scale bars: a = 200 μm, b = 10 μm.

Source Redrawn from Lawrey et al. (2020)

Figure 2.193 *Bergerella atrofusca*

Bulbilla Diederich, Flakus & Etayo (1)

Index Fungorum 807650, Faceoffungi, MycoBank, GenBank

Classification: Hydnaceae, Cantharellales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

=*Adamflakia* Diederich & Lawrey, in Lawrey, Zimmermann, Sikaroodi & Diederich, Bryologist 119(4): 347 (2016)

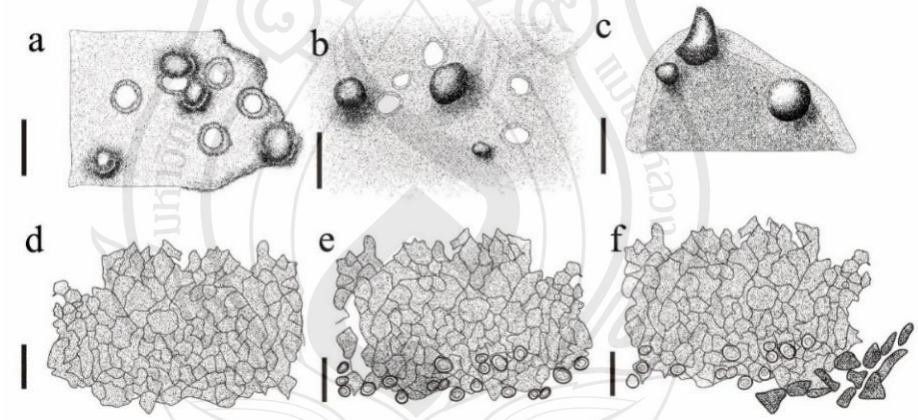
Type: *Adamflakia applanata* (Diederich, Flakus & Etayo) Diederich & Lawrey

Bulbilla was introduced by Diederich, Flakus & Etayo (2014) to describe *B. applanata*, a lichenicolous species found on the thalli of *Pseudocyphellaria* and *Sticta*. The genus is characterized by colonies forming as dispersed bulbils that are slightly to

distinctly immersed in the host thallus, leaving visible scars when removed. These bulbils are pale beige to greyish orange, translucent, round to ellipsoid, and can reach up to 700 µm in size. The cells composing the bulbils are polyhedral, smooth, and strongly adherent, with some specimens exhibiting surface agglomerations of small crystals (Diederich et al., 2014).

Lawrey et al. (2016) proposed the name *Adamflakia* as a replacement for *Bulbilla*, but since *Bulbilla* was already validly published and widely accepted, *Adamflakia* was subsequently treated as a synonym of *Bulbilla*. Based on the phylogenetic analysis conducted by Diederich, Flakus & Etayo (2014), *Bulbilla* was initially placed within *Cantharellales* as genera incertae sedis. Currently, this genus was placed within Hydnaceae by Hyde et al. (2024).

Type species: *Bulbilla applanata* Diederich, Flakus & Etayo



Note a On the thallus of *Pseudocyphellaria*. b On the thallus of *Sticta*. c On the apothecium of *Pseudocyphellaria faveolate*. d Polyhedral cells of the lower part of bulbil. e A mixture of polyhedral cells of bulbil and photobiont cells of host. f Polyhedral cells of bulbil, photobiont cells (arrows) and host hyphae. Scale bars: a–c = 500 µm, d–f = 20 µm.

Source Redrawn from Diederich, et al. (2014)

Figure 2.194 *Bulbilla applanata*

Burgella Diederich & Lawrey (2)

Index Fungorum 807650, Faceoffungi, MycoBank, GenBank

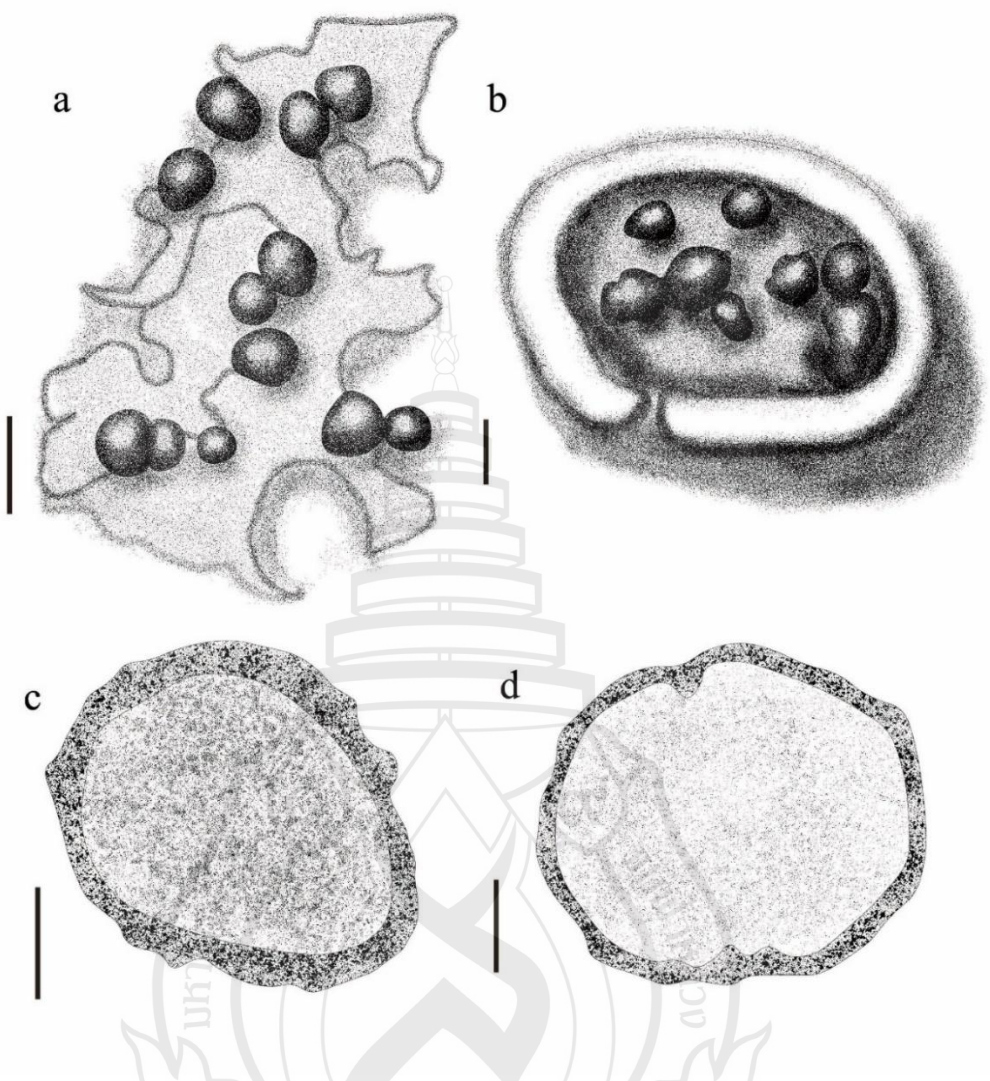
Classification: Hydnaceae, Cantharellales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Burgella was introduced by Diederich & Lawrey (2007) to describe the lichenicolous species *B. flavoparmeliae*, found on *Flavoparmelia baltimorensis*. This genus is characterized by colonies of dispersed or agglomerated, honey-colored, shiny bulbils that are roundish, ellipsoid, or irregular in shape and partially immersed in the substrate. The cells are strongly adherent, both externally and internally, without any specialized structural features. Diederich et al. (2014) later added *B. lutea*, which is distinguished by its yellow to orange bulbils. At present, two species are recognized within *Burgella*, and this genus was placed Hydnaceae (Cantharellales) by Hyde et al. (2024).

Type species: *Burgella flavoparmeliae* Diederich & Lawrey

Table 2.219 Accepted lichenicolous species of *Burgella*

	Species name	Host	References	Remarks
1	*Burgella flavoparmeliae* Diederich & Lawrey	*Flavoparmelia baltimorensis*	(Diederich et al., 2007)	
2	*Burgella lutea* Diederich, Capdet, A.I. Romero & Etayo	*Heterodermia, Pertusaria and Sticta weigelii*	(Diederich et al., 2014)	



Note a Bulbils on the thallus of *Flavoparmelia baltimorensis*. b Bulbils on apothecia of *Physcia aipolia*. c Bulbil in surface view. d Bulbil in the optical section. Scale bars: a–b = 200 µm, c–d = 50 µm.

Source Redraw from Diederich et al. (2007)

Figure 2.195 *Burgella flavoparmeliae*

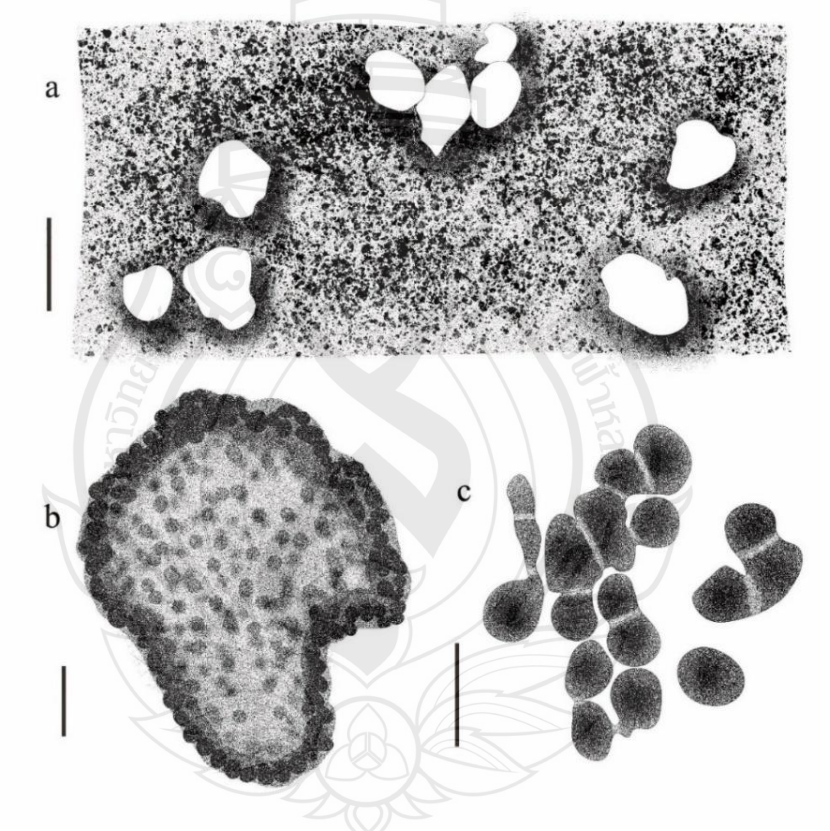
Burgellopsis Diederich & Lawrey (1)

Index Fungorum, Faceoffungi, MycoBank, GenBank

Classification: Hydnaceae, Cantharellales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Burgellopsis was introduced by Diederich & Lawrey (2014) to describe the type species *B. nivea*, which occurs on crustose lichens. This genus is characterized by superficial white bulbils that are round to ellipsoid, with a rough surface and convex cells visible under magnification. The bulbils lack specialized cells and are composed of polyhedral, indistinctly catenate cells. Neither oil droplets nor crystals are present. On agar plates, colonies produce white aerial hyphae (Diederich et al., 2014). Recently, the genus was placed within Hydnaceae by Hyde et al. (2024).

Type species: *Burgellopsis nivea* Diederich & Lawrey (Diederich et al., 2014)



Note a Over sterile, saxicolous lichen. b Bulbils in lactophenol cotton blue. c Bulbil after pressure on cover glass, separating inner cells. Scale bars: a = 200 µm, b = 50 µm, c = 20 µm.

Source Redrawn from Diederich, et al. (2014)

Figure 2.196 *Burgellopsis nivea*

Burgoa Goid. (1-10)

Index Fungorum 7457, Faceoffungi, MycoBank, GenBank

Classification: Hydnaceae, Cantharellales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Burgoa verzuoliana* Goid.

Accepted lichenicolous species of

Burgoa angulosa Diederich, Lawrey & Etayo, on *Physcia aipolia* (Diederich et al., 2007)

Minimedusa Weresub & P.M. LeClair (1-3)

Index Fungorum 18065, Faceoffungi, MycoBank, GenBank

Classification: Hydnaceae, Cantharellales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

=*Pneumatospora* B. Sutton, Kuthub. & Muid, Trans. Br. mycol. Soc. 83(3): 423 (1984)

Type: *Pneumatospora obcoronata* B. Sutton, Kuthub. & Muid

=*Tricellulortus* Matsush., Matsush. Mycol. Mem. 8: 39 (1995)

Type: *Tricellulortus peponiformis* Matsush.

Type species: *Minimedusa polyspora* (Hotson) Weresub & P.M. LeClair

= *Papulaspora polyspora* Hotson

Accepted lichenicolous species of

Minimedusa pubescens Diederich, Lawrey & Heylen, on *Scoliciosporum chlorococcum* (Diederich et al., 2007)

Neoburgoa Diederich, E. Zimm. & Lawrey (1)

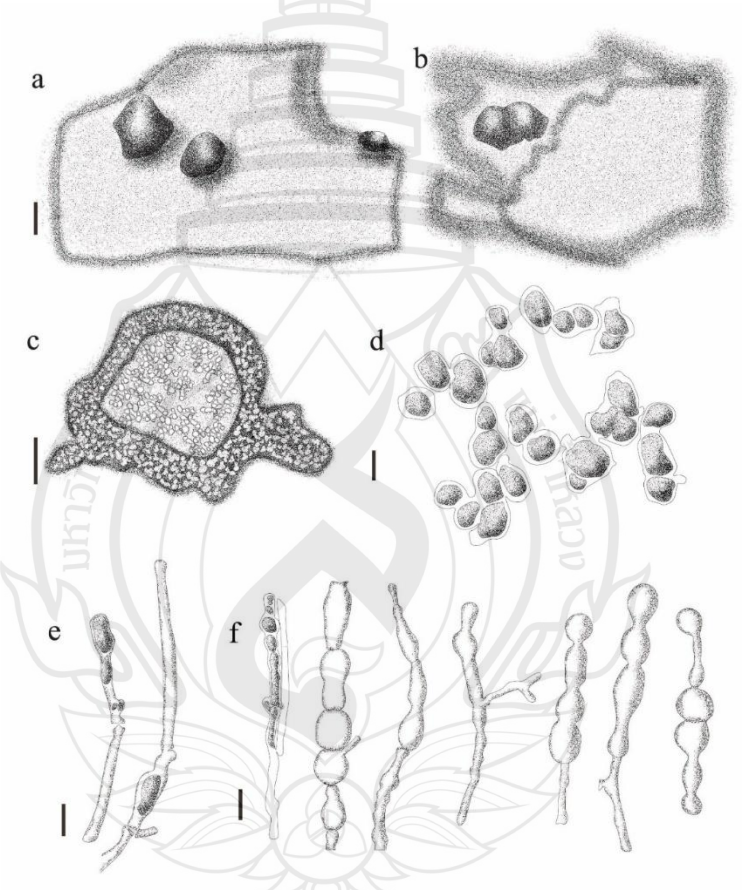
Index Fungorum 818611, Faceoffungi, MycoBank, GenBank

Classification: Hydnaceae, Cantharellales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Neoburgoa was introduced by Diederich, Zimmermann & Lawrey (2016) to

describe the type species *N. freyi*, found on *Cladonia rangiferina*. The genus is characterized by yellow to orange bulbils, either immersed or superficial, roundish to ellipsoid, and measuring 150–300(–700) µm in diameter. The bulbils consist of thick-walled, polyhedral cells (10–20 µm in diameter), and lack clamps within the bulbils, though they are present in culture. Hyde et al. (2024) placed *Neoburgoa* within the Hydnaceae (Cantharellales, Agaricomycetes).

Type species: *Neoburgoa freyi* Diederich, Zimmermann & Lawrey



Note a–b Bulbils on thallus of *Cladonia rangiferina*. c Section through bulbil. d Individual cells inside bulbil. e–f Hyphae producing chains of swollen cells. Scale bars: a = 200 µm, c = 50 µm, d–f = 10 µm.

Source Redrawn from Lawrey et al. (2016)

Figure 2.197 *Neoburgoa freyi*

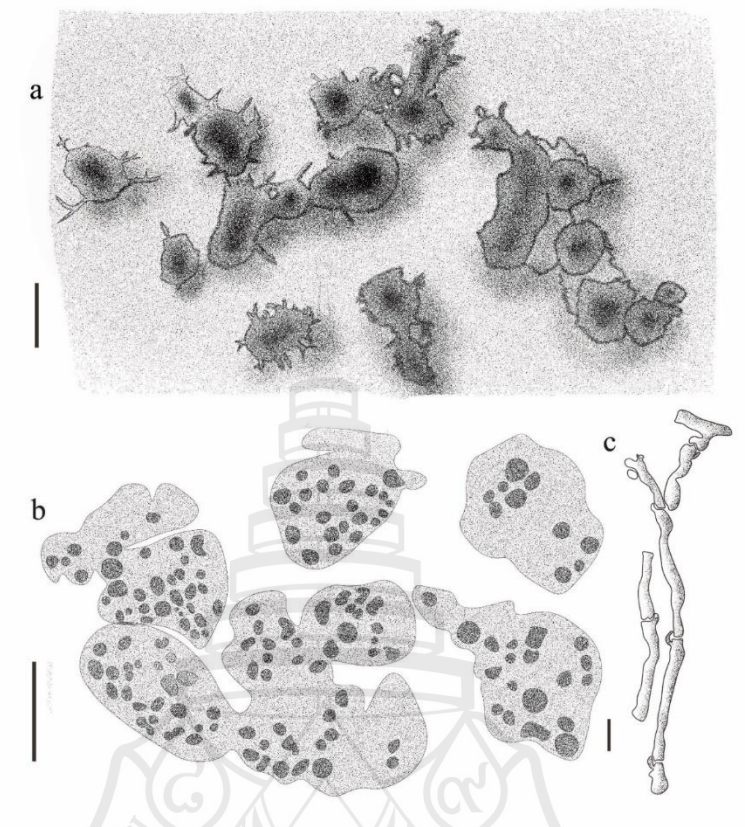
Parmeliicida Diederich, F. Berger, Etayo & Lawrey (1)

Index Fungorum 844615, Faceoffungi, MycoBank, GenBank

Classification: Hydnaceae, Cantharellales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Parmeliicida was introduced by Diederich et al. (2022) to describe the basidiomycete *P. pandemica*, which occurs on *Parmelia saxatilis* and *P. sulcata*. This genus is characterized by dark reddish-brown, superficial lichenicolous bulbils measuring 150–270 × 120–200 µm. The bulbils lack specialized external cells and are composed of round to ellipsoid internal cells, 8–17 µm in diameter. Phylogenetic analysis conducted by Diederich et al. (2022) indicated that Parmeliicida belong to Hydnaceae (Cantharellales).

Type species: *Parmeliicida pandemica* Diederich, F. Berger, Etayo & Lawrey



Note a Bulbils on the necrosed thallus of *Parmelia saxatilis*. **b** Squashed bulbil. **c** Hyphae with clamps. Scale bars: a = 200 µm, b–c = 10 µm.

Source Redrawn from Diederich et al. (2022)

Figure 2.198 *Parmeliicida pandemica*

Order Corticiales K.H. Larss.

Family Corticiaceae Herter

Corticium Pers. (1-75)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Corticiaceae, Corticiales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Corticium roseum* Pers.

Accepted lichenicolous species:

Corticium *silviae* Diederich, E. Zimm. & Lawrey, on *Thamnolia*

Erythricium J. Erikss. & Hjortstam. (1-5)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Corticiaceae, Corticiales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: Erythricium *laetum* (P. Karst.) J. Erikss. & Hjortstam

= Hyphoderma *laetum* P. Karst.

= Corticium *laetum* (P. Karst.) Bres.

Accepted lichenicolous species of

Erythricium *aurantiacum* Diederich, E. Zimm. & Lawrey, on *Thamnolia*

Laetisaria Burds. (2-10)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Corticiaceae, Corticiales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species:

Laetisaria fuciformis (Berk.) Burds.

Table 2.220 Accepted lichenicolous species of *Laetisaria*

	Species name	**Host**	**References**	**Remarks**
1	*Laetisaria buckii* (Diederich & Lawrey) Diederich, Lawrey & Ghobad-Nejhad	*Bacidia heterochroa*	(Diederich et al., 2018)	= *Marchandiomyces buckii* Diederich & Lawrey
2	*Laetisaria lichenicola* Diederich, Lawrey & Van den Broeck	*Physcia tenella* and *Physcia adscendens*	(Diederich et al., 2011)	

Marchandiomyces Diederich & D. Hawksw. (1-5)

Index Fungorum, Facesoffungi, MycoBank, GenBank

Classification: Corticiaceae, Corticiales, Agaricomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Marchandiomyces corallinus* (Roberge) Diederich & D. Hawksw. On *Physcia tenella*

Class TREMELLOMYCETES Doweld

Order Filobasidiales Jülich

Family Filobasidiaceae L. S. Olive

Zyzygomyces Diederich, Millanes & Wedin (8)

Index Fungorum 844617, Faceoffungi, MycoBank, GenBank

Classification: Filobasidiaceae, Filobasidiales, Tremellomycetes, Agaricomycotina, Basidiomycota, Fungi

Zyzygomyces was introduced by Diederich, Millanes & Wedin (2022) to accommodate eight lichenicolous species, with *Z. bachmannii* (transferred from *Syzygospora bachmannii* Diederich & M.S. Christ.) as the type. The genus is characterized by waxy to gelatinous, often gall-inducing basidiomata that are whitish to brown or blackish, ranging from applanate pulvinate to subspherical or tuberculate. Other key features include tremelloid haustoria, ellipsoid clamped probasidia (in some species), the absence of hyphidia and cystidia, aseptate cylindrical basidia with 2–4 subulate sterigmata that have a refractive apex, and ellipsoid, ovoid, or almost limoniform basidiospores obliquely attached to sterigmata. Phylogenetic analysis based on ITS and LSU sequences places the genus within Filobasidiaceae (Filobasidiales, Tremellomycetes) (Diederich et al., 2022a).

Type species: Zyzygomyces *bachmannii* (Diederich & M.S. Christ.) Diederich & Millanes

= Syzygospora *bachmannii* Diederich & M.S. Christ.

Table 2.221 Accepted lichenicolous species of *Zyzygomyces*

	Species name	Host	References	Remarks
1	*Zyzygomyces aipoliae* Diederich, Millanes, F. Berger & Ertz	*Physcia aipolia*	(Diederich et al., 2022a)	
2	*Zyzygomyces bachmannii* (Diederich & M.S. Christ.) Diederich & Millanes	*Cladonia subrangiformis*	(Diederich, 1996; Diederich et al., 2022a)	*Syzygospora bachmannii* Diederich & M.S. Christ.
3	*Zyzygomyces bunodophori* Diederich, Etayo & Palice	*Bunodophoron*	(Diederich et al., 2022a)	
4	*Zyzygomyces leucodermiae* Diederich, Millanes, Ertz, Etayo & Flakus	*Leucodermia leucomelos*	(Diederich et al., 2022a)	
5	*Zyzygomyces mobergii* Diederich & Millanes	*Polyblastidium japonicum*	(Diederich et al., 2022a)	
6	*Zyzygomyces physciacearum* (Diederich) Diederich, Millanes & Wedin	*Physcia dubia*	(Diederich, 1996; Diederich et al., 2022a)	*Syzygospora physciacearum* Diederich
7	*Zyzygomyces physconiae* Diederich, Millanes, P. Pinault & Brackel	*Physconia grisea*	(Diederich et al., 2022a)	
8	*Zyzygomyces polyblastidii* Diederich, Flakus, Etayo & Rodr. Flakus	*Polyblastidium japonicum*	(Diederich et al., 2022a)	

Syzygospora G.W. Martin (1-17)

Index Fungorum 18627, Faceoffungi, MycoBank, GenBank

Classification: Filobasidiaceae, Filobasidiales, Tremellomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Syzygospora alba* G.W. Martin

Table 2.222 Accepted lichenicolous species of *Syzygospora*

	Species name	Host	References	Remarks
1	*Syzygospora parmeliicola* Diederich	*Hypotrachyna bogotensis*	(Diederich, 1996)	
2	*Syzygospora septata* Diederich & Etayo	*Hypotrachyna*	(Diederich et al., 2022)	

Order Tremellales Fr.

Family Tremellaceae Fr.

Biatoropsis Räsänen (11)

Index Fungorum 22053, Faceoffungi, MycoBank, GenBank

Classification: Tremellaceae, Tremellales, Tremellomycetes, Agaricomycotina, Basidiomycota, Fungi

Biatoropsis was introduced by Raesaenen (1934) to describe *B. usnearum*, found on *Usnea* species. It is characterized by hyphae lacking clamps, tremelloid haustoria, and a hymenium with numerous probasidia. The mature basidia are transversely septate, and basidiospores are subglobose to ellipsoid with a lateral apiculus. An asexual stage with catenulate conidia is common, and lunate conidia have been observed (Raesaenen, 1934).

Millanes et al. (2016) introduced two species, *Biatoropsis hafellneri* on *Usnea cornuta* and *B. protousneae* on *Protousnea dusenii*. Subsequently, Diederich et al. (2020, 2022) described six additional species. In total, 11 species are now recognized

within *Biatoropsis*, which is phylogenetically placed in the family Tremellaceae (Tremellales, Tremellomycetes).

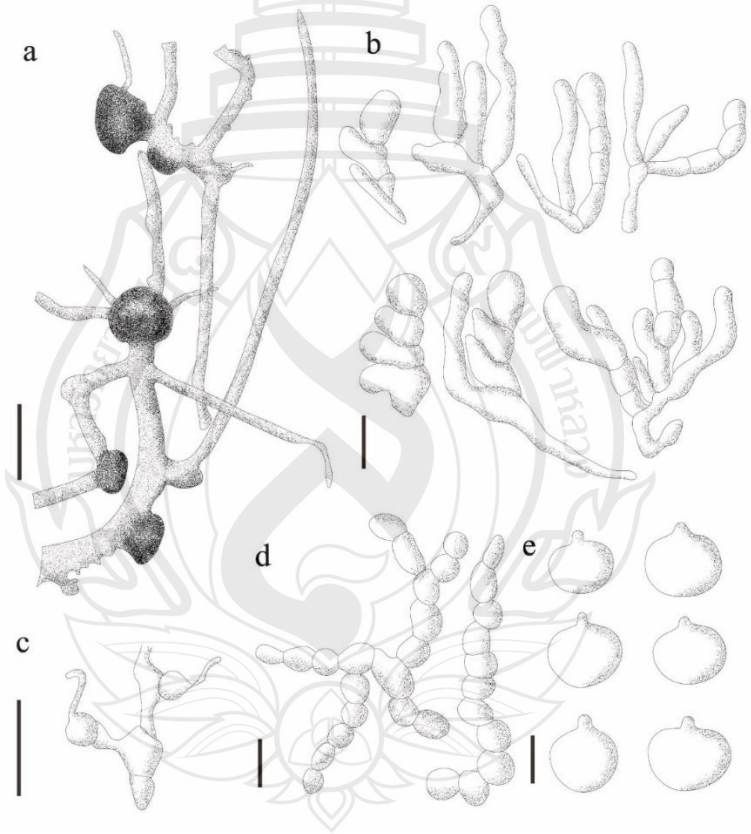
Type species: *Biatoropsis usnearum* Räsänen

Table 2.223 Accepted lichenicolous species of *Biatoropsis*

	Species name	**Host**	**References**
1	*Biatoropsis angulatae* Diederich & Millanes	*Usnea angulata*	(Diederich et al., 2022)
2	*Biatoropsis antarcticae* Diederich, Etayo & Millanes	*Usnea antarctica*	(Diederich et al., 2022)
3	*Biatoropsis hafellneri* Millanes, Diederich, M. Westb. & Wedin	*Usnea cornuta*	(Millanes et al., 2016)
4	*Biatoropsis hirtae* Diederich & Millanes	*Usnea hirta*	(Diederich et al., 2022)
5	*Biatoropsis macaronesica* Diederich & Millanes	*Usnea esperantiana*	(Diederich et al., 2022)
6	*Biatoropsis millanesiana* Diederich & Wedin	*Usnea exasperata*	(Diederich & Ertz, 2020)
7	*Biatoropsis minuta* Millanes, Diederich, M. Westb. & Wedin	*Usnea barbata*	(Millanes et al., 2016)
8	*Biatoropsis nigrescens* Diederich, Millanes & F. Berger	*Usnea capillacea*	(Diederich et al., 2022)
9	*Biatoropsis protousneae* Millanes, Diederich, M. Westb. & Wedin	*Protousnea dusenii*	(Millanes et al., 2016)

Table 2.223 (continued)

	Species name	Host	References
10	*Biatoropsis rubicundae* Diederich & Millanes	*Usnea rubicunda*	(Diederich et al., 2022)
11	*Biatoropsis usnearum* Räsänen	*Usnea comosa, Usnea similis* and *Usnea glabrescens*	(Raesaenen, 1934)



Note a Basidiomata on the thallus of *Usnea subfloridana*. **b** Basidia. **c** haustorial branches. **d** catenulate conidia. **e** basidiospores. Scale bars: a = 1 mm, b–c = 10 μm, d–e = 5 μm.

Source Redrawn from Diederich et al. (2022)

Figure 2.199 *Biatoropsis usnearum*

Heteroacanthella Oberw. (1-3)

Index Fungorum 25511, Faceoffungi, MycoBank, GenBank

Classification: Tremellaceae, Tremellales, Tremellomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Heteroacanthella variabilis* Oberw. & Langer

Accepted lichenicolous species:

Heteroacanthella ellipsospora J.C. Zamora, Pérez-Ort. & V.J. Rico, on *Lecanora carpinea*. (Zamora et al., 2014)

Hormomyces Bonord. (1-5)

Index Fungorum 8561, Faceoffungi, MycoBank, GenBank

Classification: Tremellaceae, Tremellales, Tremellomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Hormomyces aurantiacus* Bonord.

Accepted lichenicolous species of

Hormomyces physciicola P. Pinault & Diederich, on *Physcia aipolia*. (Diederich et al., 2024)

Tremella Pers. (122-300+)

Index Fungorum 92236, Faceoffungi, MycoBank, GenBank

Classification: Tremellaceae, Tremellales, Tremellomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Tremella mesenterica* (Schaeff.) Retz.

Table 2.224 Accepted lichenicolous species of *Tremella*

	Species name	Host	References	Remarks
1	*Tremella abrothalli* Diederich & Goward	*Abrothallus parmeliarum*	(Diederich et al., 2022b)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
2	*Tremella acarosporae* Diederich & Hollinger	*Acarospora* sp.	(Diederich et al., 2022b)	
3	*Tremella alectoriae* Diederich & Holien	*Alectoria sarmentosa*	(Diederich et al., 2022b)	
4	*Tremella altimontana* Brackel & V. Wirth	*Caloplaca cerina*	(Von Brackel & Wirth, 2023)	
5	*Tremella anaptychiae* J.C. Zamora & Diederich	*Anaptychia ciliaris*	(Diederich et al., 2022b)	
6	*Tremella aptrootii* Diederich & Common	*Astrothelium* sp.	(Diederich et al., 2022b)	
7	*Tremella aspiciliae* Diederich, Coppins & A. Fletcher	*Aspicilia caesiocinerea*	(Diederich et al., 2022b)	
8	*Tremella bretonica* Brackel	*Ramalina fastigiata*	(von Brackel, 2024)	
9	*Tremella brodoae* (P. Pinault & Cl. Roux) Diederich	*Brodoa intestiniformis*	(Diederich et al., 2022b)	= *Epicladonia brodoae* P. Pinault & Cl. Roux
10	*Tremella caloplacae* (Zahlbr.) Diederich	*Caloplaca callopisma*	(Sérusiaux et al., 2003)	= *Lindauopsis caloplacae* Zahlbr.
11	*Tremella candelariellae* Diederich & Etayo	*Candelariella vitellina*	(Diederich, 1996)	
12	*Tremella celata* Pérez-Ort., Millanes, V.J. Rico & J.C. Zamora	*Ramalina fraxinea*	(Zamora et al., 2016)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
13	*Tremella cephalodiicola* Diederich	*Psoroma pannarioides*	(Diederich, 1996)	
14	*Tremella cervina* Diederich & Millanes	*Cetraria ericetorum*	(Diederich et al., 2022b)	
15	*Tremella cetraculeata* Diederich, Millanes & Hollinger	*Cetraria aculeata*	(Diederic et al., 2022b)	
16	*Tremella cetrariae* Diederich, Millanes, F. Berger & Zamora	*Cetraria islandica*	(Diederich et al., 2022b)	
17	*Tremella cetrariellae* Millanes, Diederich, M. Westb., Pippola & Wedin	*Cetrariella delisei*	(Millanes et al., 2015)	
18	*Tremella cetrariicola* Diederich & Coppins	*Tuckermannopsis chlorophylla*	(Diederich, 1996)	
19	*Tremella christiansenii* Diederich	*Physcia tenella*	(Diederich, 1996)	
20	*Tremella cladoniae* Diederich & M.S. Christ.	*Cladonia* sp.	(Diederich, 1996)	
21	*Tremella coccocarpiae* Diederich	*Coccocarpia rottleri*	(Diederich, 1996)	
22	*Tremella confluens* Pippola, Diederich & Goward	*Usnea longissima*	(Diederich et al., 2022b)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
23	*Tremella conidioparmotrema* Diederich, Etayo & Millanes	*Parmotrema* sp.	(Diederich et al., 2022b)	
24	*Tremella conidiopunctelia* Diederich, Millanes, Lendemer, D. P. Waters & Giavarini	*Punctelia caseana*	(Diederich et al., 2022b)	
25	*Tremella coniocarpi* Diederich & Common	*Coniocarpon cinnabarinum*	(Diederich et al., 2022b)	
26	*Tremella coppinsii* Diederich & G. Marson	*Platismatia regenerans*	(Diederich et al., 1988)	
27	*Tremella dendrographae* Diederich & Tehler	*Dendrographa minor*	(Diederich, 1996)	
28	*Tremella diederichiana* Pérez-Ort., Millanes, V.J. Rico & J.C. Zamora	*Lecidea* aff. *eryt hrophaea*	(Zamora et al., 2016)	
29	*Tremella diploschistina* Millanes, M. Westb., Wedin & Diederich	*Diploschistes scruposus*	(Millanes et al., 2012)	
30	*Tremella dirinariae* Diederich, Millanes & Wedin	*Dirinaria aegialita*	(Ariyawansa et al., 2015)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
31	*Tremella elegantis* Freire-Rallo, Diederich, Millanes & Wedin	*Rusavskia elegans*	(Freire-Rallo et al., 2023)	
32	*Tremella emmanueliae* Diederich & Aptroot	*Emmanuelia* sp.	(Diederich et al., 2022b)	
33	*Tremella ertzii* Diederich	*Pertusaria* sp.	(Diederich et al., 2022b)	
34	*Tremella everniae* Diederich	*Evernia mesomorpha*	(Diederich, 1996)	
35	*Tremella flakusii* Diederich, Millanes, Rodr. Flakus & Aptroot	*Crocodia clathrata*	(Diederich et al., 2022b)	
36	*Tremella flavoparmeliae* Diederich, Hodkinson & Millanes	*Flavoparmelia caperata*	(Diederich et al., 2022b)	
37	*Tremella graphidastrae* Diederich	*Graphidastra multiformis*	(Diederich, 1996)	
38	*Tremella graphidicola* Diederich & Common	*Graphis* sp.	(Diederich et al., 2022b)	
39	*Tremella graphidis* Diederich, Millanes, Wedin & Common	*Graphis assimilis* and *G. caesiella*	(Ariyawansa et al., 2015)	
40	*Tremella haematommatis* Diederich	*Haematomma puniceum*	(Diederich, 1996)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
41	*Tremella harrisii* Diederich	*Polymeridium catapastum*	(Diederich, 1996)	
42	*Tremella herpothalli* Diederich, Flakus, Rodr. Flakus, Etayo & Palice	*Herpothallon* sp.	(Diederich et al., 2022b)	
43	*Tremella huuskonenii* Diederich, Myllys, Goward & H. Lindgr.	*Bryoria pikei, Pseudotsuga menziesii*	(Lindgren et al., 2015)	
44	*Tremella hypocenomycis* Diederich	*Hypocenomyce scalaris*	(Diederich, 1996)	
45	*Tremella hypogymniae* Diederich & M.S. Christ.	*Hypogymnia physodes*	(Diederich, 1996)	
46	*Tremella imshaugiae* Diederich, Coppins, R.C. Harris, Millanes & Wedin	*Imshaugia aleurites*	(Diederich et al., 2020)	
47	*Tremella lecidellae* Diederich & Brackel	*Lecidella elaeochroma*	(Diederich et al., 2022b)	
48	*Tremella leprae* Diederich & W. R. Buck	*Lepra oahuensis*	(Diederich et al., 2022b)	
49	*Tremella leprariae* Diederich	*Lepraria finkii*	(Diederich et al., 2022b)	
50	*Tremella leptogii* Diederich	*Leptogium* sp.	(Diederich, 1996)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
51	*Tremella lethariae* Diederich	*Letharia vulpina, Pseudotsuga menziesii*	(Diederich, 2003)	
52	*Tremella leucodermiae* Diederich, Etayo, Flakus & Millanes	*Leucodermia leucomelos*	(Diederich et al., 2022b)	
53	*Tremella lichenicola* Diederich	*Violella fucata*	(Diederich, 1986)	
54	*Tremella lobariacearum* Diederich & M.S. Christ	*Lobaria macaronesica*	(Diederich, 1996)	
55	*Tremella macrobasidiata* J.C. Zamora, Pérez-Ort. & V.J. Rico	*Lecanora chlarotera*	(Zamora et al., 2011)	
56	*Tremella macroceratis* Diederich & Hafellner	*Cladonia macroceras*	(Diederich, 1996)	
57	*Tremella mayrhoferi* J.C. Zamora, Millanes, Etayo & Wedin	*Lecanora allophana*	(Zamora et al., 2018)	
58	*Tremella microcarpa* Diederich	corticolous crustose lichen	(Diederich, 1996)	
59	*Tremella monospora* Diederich	*Leptogium*	(Diederich, 1996)	
60	*Tremella montis-wilhelmii* Diederich	*Normandina simodense*	(Diederich, 1996)	
61	*Tremella nashii* Diederich	*Usnea sorediifera*	(Diederich, 2007a)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
62	*Tremella nephromatis* Diederich	*Nephroma parile*	(Diederich, 1996)	
63	*Tremella nephromopsidis* Diederich	*Nephromopsis orbata*	(Diederich et al., 2022b)	
64	*Tremella nieblae* Diederich & van den Boom	*Niebla cephalota*	(Diederich, 2007a)	
65	*Tremella nimisiana* Freire-Rallo, Diederich, Millanes & Wedin	*Xanthocarpia marmorata*	(Freire-Rallo et al., 2023)	
66	*Tremella normandinae* Diederich	*Normandina pulchella*	(Diederich, 1996)	
67	*Tremella occultixanthoriae* Diederich, Geyselings & Millanes	*Xanthoria parietina*	(Diederich et al., 2022b)	
68	*Tremella octosporae* Diederich & Sérus.	*Agonimia octospora*	(Diederich et al., 2022b)	
69	*Tremella pacificae* Diederich & van den Boom	*Agonimia pacifica*	(Diederich et al., 2022b)	
70	*Tremella papuana* Diederich	*Hypogymnia pseudobitteriana*	(Diederich, 1996)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
71	*Tremella parmeliarum* Diederich	*Parmotrema reticulatum*	(Diederich, 1996)	
72	*Tremella parmeliellae* Diederich & Sérus.	*Parmeliella foliicola*	(Diederich, 1996)	
73	*Tremella parmogardneri* Diederich, Etayo & Millanes	*Parmotrema gardneri*	(Diederich et al., 2022b)	
74	*Tremella parmohypotropi* Diederich, Gockman & Millanes	*Parmotrema hypotropum*	(Diederich et al., 2022b)	
75	*Tremella parmoperforati* Diederich & Millanes	*Parmotrema perforatum*	(Diederich et al., 2022b)	
76	*Tremella pertuceracea* Diederich, Flakus & Rodr. Flakus	*Pertusaria* sp.	(Diederich et al., 2022b)	
77	*Tremella pertusae* Diederich, Millanes, Brackel & Etayo	*Pertusaria pertusa*	(Diederich et al., 2022b)	
78	*Tremella pertusariae* Diederich	*Pertusaria hymenea*	(Diederich, 1996)	
79	*Tremella pertusariicola* Diederich, Flakus, Etayo & Rodr. Flakus	*Pertusaria* cf. *rigida*	(Diederich et al., 2022b)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
80	*Tremella pertutexanae* Diederich, Millanes & Common	*Pertusaria texana*	(Diederich et al., 2022b)	
81	*Tremella pertuthalamiae* Diederich & Millanes	*Pertusaria tetrathalamia*	(Diederich et al., 2022b)	
82	*Tremella phaeographidis* Diederich, Coppins & Bandoni	*Phaeographis smithii*	(Diederich, 1996)	
83	*Tremella phaeographinae* Diederich & Aptroot	*Phaeographis* s. lat	(Diederich, 1996)	
84	*Tremella phaeophysciae* Diederich & M. S. Christ	*Phaeophyscia orbicularis*	(Diederich, 1996)	
85	*Tremella pinaultii* Diederich & Millanes	*Hypogymnia physodes*	(Diederich et al., 2022b)	
86	*Tremella pisutiellae* Diederich & W. R. Buck	*Pisutiella conversa*	(Diederich et al., 2022b)	
87	*Tremella placynthiellae* Diederich & W. R. Buck	*Placynthiella icmalea*	(Diederich et al., 2022b)	
88	*Tremella protoparmeliae* Diederich & Coppins	*Protoparmelia badia*	(Diederich, 1996)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
89	*Tremella pseudocyphellariae* Diederich, Millanes & Ertz	*Pseudocyphellaria desfontainii*	(Diederich et al., 2022b)	
90	*Tremella psoroglaenae* Diederich	*Psoroglaena* sp.	(Diederich, 1996)	
91	*Tremella psoromicola* Diederich	*Psoroma* sp.	(Diederich, 1996)	
92	*Tremella puncteliae* Diederich, Etayo & Millanes	*Punctelia borreri*	(Diederich et al., 2022b)	
93	*Tremella puncteliotegens* Diederich, Etayo & Millanes	*Punctelia borreri* s. lat.	(Diederich et al., 2022b)	
94	*Tremella purpurascentis* Diederich, Common & Millanes	*Dirinaria purpurascens*	(Diederich et al., 2022b)	
95	*Tremella pyrenaica* Diederich, Poumarat, Daval & Millanes	*Lecanora* gr. *polytropa*	(Diederich et al., 2022b)	
96	*Tremella pusillae* Freire-Rallo, Diederich, Millanes & Wedin	*Calogaya pusilla*	(Freire-Rallo et al., 2023)	
97	*Tremella pyrenulae* Diederich, Millanes, Wedin & Common	*Pyrenula ochraceoflavens*	(Ariyawansa et al., 2015)	
98	*Tremella ramalinae* Diederich	*Ramalina lacera*	(Diederich, 1996)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
99	*Tremella ramboldiae* Diederich & W. R. Buck	*Ramboldia haematites*	(Diederich et al., 2022b)	
100	*Tremella rhabdodisci* Diederich, Thor, Ertz & Millanes	*Rhabdodiscus inalbescens*	(Diederich et al., 2022b)	
101	*Tremella rhizocarpicola* Diederich, Millanes & Wedin	*Rhizocarpon lavatum*	(Millanes et al., 2014)	
102	*Tremella rinodinae* Diederich & M.S. Christ.	*Rinodina oleae*	(Diederich, 1996)	
103	*Tremella robusta* Diederich, Ertz, van den Boom & Millanes	*Dendrographa franciscana*	(Diederich et al., 2022b)	
104	*Tremella santessonii* Diederich	*Usnea*	(Diederich & Christianse, 1994)	
105	*Tremella sarcographae* Diederich & Aptroot	*Sarcographa medusulina*	(Diederich et al., 2022b)	
106	*Tremella sorediatae* Freire-Rallo, Diederich, Millanes & Wedin	*Rusavskia sorediata*	(Freire-Rallo et al., 2023)	
107	*Tremella stevensiana* Diederich	*Usnea confusa*	(Diederich & Christianse, 1994)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
108	*Tremella stictae* Diederich	*Sticta weigelii*	(Diederich, 1996)	
109	*Tremella strigulae* Diederich	*Strigula stigmatella*	(Diederich et al., 2022b)	
110	*Tremella sulcariae* Diederich & M.S. Christ.	*Sulcaria sulcata*	(Diederich, 1996)	
111	*Tremella synarthoniae* Diederich & Common	*Synarthonia inconspicua*	(Diederich et al., 2022b)	
112	*Tremella teloschistis* Diederich, Gockman, Walden & Millanes	*Teloschistes exilis*	(Diederich et al., 2022b)	
113	*Tremella tornabeae* Diederich, Etayo, Pérez-Ortega & Millanes	*Tornabea scutellifera*	(Diederich et al., 2022b)	
114	*Tremella tubulosae* Diederich, Coppins, J. C. Zamora,Millanes & Wedin	*Hypogymnia tubulosa*	(Diederich et al., 2020)	
115	*Tremella tuckerae* Diederich	*Ramalina sinensis*	(Diederich, 2007a)	
116	*Tremella umbilicariae* Diederich & Millanes	*Umbilicaria*	(Diederich et al., 2014)	

Table 2.224 (continued)

	Species name	Host	References	Remarks
117	*Tremella variae* Pérez-Ort., Millanes, V.J. Rico & J.C. Zamora	*Lecanora varia*	(Zamora et al., 2016)	
118	*Tremella wedinii* Diederich, Common & Millanes	*Glyphis scyphulifera*	(Diederich et al., 2019)	
119	*Tremella wirthii* Diederich	*Protoparmelia hypotremella*	(Diederich, 1996)	
120	*Tremella xanthomendozae* Diederich, C. A. Morse & Brinker	*Xanthomendoza weberi*	(Diederich et al., 2022b)	
121	*Tremella zamorae* Diederich & Millanes	*Lecanora louisianae*	(Diederich et al., 2022b)	

Tremellomycetes genera incertae sedis

Heteromycophaga P. Roberts (1-3)

Index Fungorum 27781, Faceoffungi, MycoBank, GenBank

Classification: Tremellomycetes genera incertae sedis, Tremellomycetes, Agaricomycotina, Basidiomycota, Fungi

Type species: *Heteromycophaga glandulosae* P. Roberts

Accepted lichenicolous species:

Heteromycophaga cladoniae Diederich, van den Boom & Kukwa, on *Cladonia cervicornis* (Diederich et al., 2024)

Subphylum PUCCINIOMYCOTINA R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw.

Class AGARICOSTILBOMYCETES R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw.

SubClass Agaricostilbomycetidae Bauer, Begerow, Oberw., M. Piepenbr. & Berbee

Order Agaricostilbales Oberw. & R. Bauer

Family Crittendeniaceae Millanes, Diederich & Wedin

Index Fungorum 842928, Faceoffungi, MycoBank, GenBank

Classification: Crittendeniaceae, Agaricostilbales, Agaricostilbomycetidae, Agaricostilbomycetes, Pucciniomycotina, Basidiomycota, Fungi

Crittendeniaceae was introduced by Millanes, Diederich & Wedin (2022) to accommodate *Crittendenia*. It is distinguished from *Chionosphaeraceae* by the presence of basidia with a basal clamp and its lichenicolous habitat. Phylogenetic analyses place this family within *Agaricostilbales* (Diederich et al., 2022).

The family is characterized by a thallus that typically spreads over the host thallus or is reduced. The thallus is flat or swollen to subspherical, hyaline to more commonly brownish, often darker than the host thallus, strongly gelatinous, and translucent.The basidiomata are stipitate-capitate, synnemata-like, fleshy-waxy, and vary in color from whitish to pale brownish, pinkish, or orangish, with a slightly translucent appearance. Basidia are apical, tubular, with the largest diameter near the apex, aseptate, and usually have basal clamps that may proliferate to form additional basidia. When immature, basidia are apically rounded; when mature, they bear (1–)4–8 short, inconspicuous sterigmata that collapse after spore detachment. Basidiospores are hyaline, aseptate, shortly to elongate ellipsoid or fusiform, without a distinct basal apiculus (but often slightly truncate at the base), not forcibly discharged, and frequently released in clusters of 3–8 spores. The spore walls are usually smooth and relatively

thin.Subspherical yeast-like cells, much smaller than basidiospores, are frequently present and abundant in the hymenium, on the basidiomatal stipe, or within the host thallus surrounding the basidiomata. However, their connection to *Crittendenia* has not yet been established (Diederich et al., 2022).

Type genus: *Crittendenia* Diederich, Millanes, M. Westb., Etayo, J.C. Zamora & Wedin

Crittendenia Diederich, Millanes, M. Westb., Etayo, J.C. Zamora & Wedin (18)

Index Fungorum 8835604, Faceoffungi, MycoBank, GenBank

Classification: Crittendeniaceae, Agaricostilbales, Agaricostilbomycetidae, Agaricostilbomycetes, Pucciniomycotina, Basidiomycota, Fungi

Crittendenia was introduced by Millanes et al. (2021) to accommodate two species, *C. coppinsii* and *C. lichenicola*, previously in *Chionosphaera*. The genus is characterized by basidiomata growing on lichens, which are fleshy-waxy, synnemata-like, and pale. Basidia are tubular, aseptate, with basal clamps, and collapse after spore detachment. *Crittendenia* species have hyaline, ellipsoid to fusiform basidiospores.

Diederich et al. (2022) revised the genus, introducing 16 species based on morphological characters and molecular data, bringing the total to 18 species. *Crittendenia* is placed within the family Crittendeniaceae (Agaricostilbales, Agaricostilbomycetes) based on phylogenetic analysis.

Type species: *Crittendenia coppinsii* (P. Roberts) Diederich, M. Westb., Millanes & Wedin

Table 2.225 Accepted lichenicolous species of *Crittendenia*

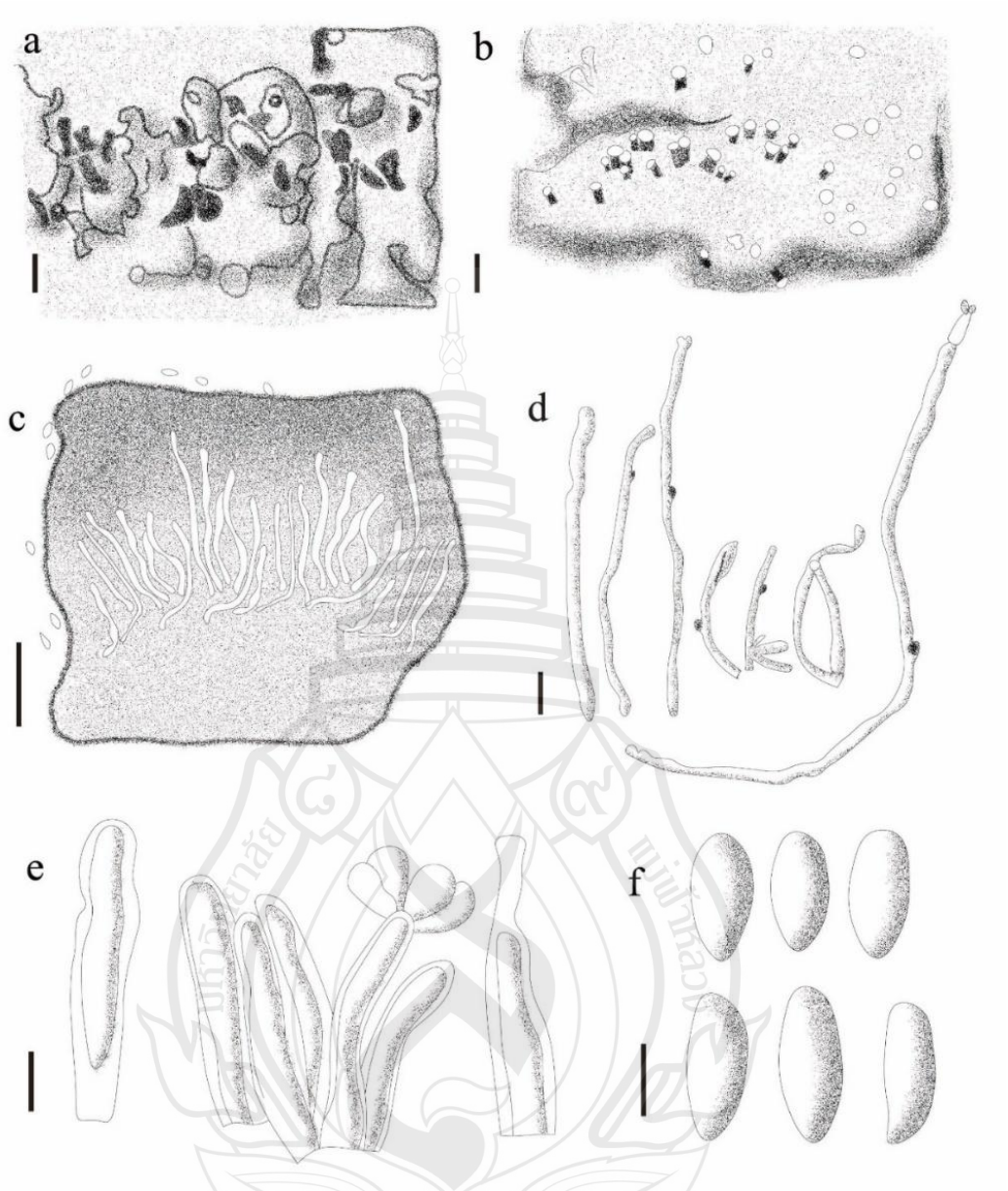
	Species name	Host	References	Remarks
1	*Crittendenia absistentis* Diederich, Coppins & Millanes	*Bacidia absistens,*	(Diederich et al., 2022)	

Table 2.225 (continued)

	Species name	Host	References	Remarks
2	*Crittendenia bacidinae* Diederich, van den Boom & Millanes	*Bacidina apiahica*	(Diederich et al., 2022)	
3	*Crittendenia bryostigmatis* Diederich & Tønsberg	*Bryostigma muscigenum*	(Diederich et al., 2022)	
4	*Crittendenia byssolomatis* Diederich, van den Boom & Millanes	*Bacidina maderense*	(Diederich et al., 2022)	
5	*Crittendenia coppinsii* (P. Roberts) Diederich, M. Westb., Millanes & Wedin	*Parmelia glabratula*	(Millanes et al., 2021)	= *Chionosphaera coppinsii* P. Roberts
6	*Crittendenia crassitunicata* Diederich & Etayo	*Melanohalea ushuaiensis*	(Diederich et al., 2022)	
7	*Crittendenia heterodermiae* Diederich, Etayo & Millanes	*Heterodermia comosa*	(Diederich et al., 2022)	
8	*Crittendenia hypotrachynae* Diederich, Etayo, van den Boom & Millanes	*Hypotrachyna endochlora*	(Diederich et al., 2022)	
9	*Crittendenia kakouettae* Diederich, van den Boom & Millanes	*Byssoloma kakouettae, Cryptomeria*	(Diederich et al., 2022)	
10	*Crittendenia lecanorae* Diederich & Etayo	*Lecanora, Rhizophora mangle* and *Avicennia*	(Diederich et al., 2022)	

Table 2.225 (continued)

	Species name	Host	References	Remarks
11	*Crittendenia lecidellae* Diederich, Etayo & Millanes	*Lecidella elaeochroma*	(Diederich et al., 2022)	
12	*Crittendenia lichenicola* (Alstrup, B. Sutton & Tønsberg) Diederich, Millanes & Wedin	*Micarea prasina*	(Millanes et al., 2021)	= *Chionosphaera lichenicola* Alstrup, B. Sutton & Tønsberg
13	*Crittendenia lopadii* Diederich, Holien & Tønsberg	*Lopadium disciforme*	(Diederich et al., 2022)	
14	*Crittendenia parvispora* Diederich, van den Boom & Millanes	*Bacidia laurocerasi*	(Diederich et al., 2022)	
15	*Crittendenia physciiphila* Diederich, Pinault, Etayo & Millanes	*Physcia adscendens*	(Diederich et al., 2022)	
16	*Crittendenia physconiae* Diederich, J.C. Zamora & Millanes	*Physconia distorta*	(Diederich et al., 2022)	
17	*Crittendenia stictae* Diederich, Etayo & Millanes	*Sticta fuliginosa*	(Diederich et al., 2022)	
18	*Crittendenia teloschistis* Diederich, Etayo, F. Berger & Millanes	*Teloschistes flavicans*	(Diederich et al., 2022)	



Note a Immature basidiomata on *Melanohalea exasperatula*. **b** Mature basidiomata on *Melanelixia glabratula*. **c** Entire basidioma. **d** Basidia with basal clamps. **e** Mature basidium with basidiospores. **f** Basidiospores.

Source Redrawn from Millanes et al. (2021)

Figure 2.200 *Crittendenia coppinsii*

Order Cyphobasidiales T. Sprib. & H. Mayrhofer

Family Cyphobasidiaceae T. Sprib. & H. Mayrhofer

Cyphobasidium Millanes, Diederich & Wedin (9)

Index Fungorum 815651, Faceoffungi, MycoBank, GenBank

Classification: Cyphobasidiaceae, Cyphobasidiales, Agaricostilbomycetidae, Agaricostilbomycetes, Pucciniomycotina, Basidiomycota, Fungi

Cyphobasidium was introduced by Millanes, Diederich & Wedin (2016) to accommodate *C. hypogymniicola* and *C. usneicola*, both transferred from *Cystobasidium*. The genus is characterized by basidiomata that induce conspicuous, convex galls with a constricted base on host lichen thalli, often becoming irregular in shape. Context hyphae may have clamps, but haustorial branches are unknown. Mature basidia consist of a thick-walled, ellipsoid to elongate lower part (probasidium) and a thin-walled, cylindrical, often bent, transversely 3-septate upper part (meiosporangium); the epibasidia are short and roughly perpendicular to the basidium. Basidiospores are ellipsoid to broadly fusiform, sometimes slightly curved, with a distinct refractive apiculus at the lower end and a rounded upper end. Initially placed in *Cystobasidiomycetes* based on phylogenetic analysis (Millanes et al., 2016). *Cyphobasidium* was later accommodated into the new family *Cyphobasidiaceae* and order *Cyphobasidiales* (Spribille et al., 2016). Diederich et al. (2022) expanded the genus with seven new species, bringing the total to nine recognized lichenicolous species.

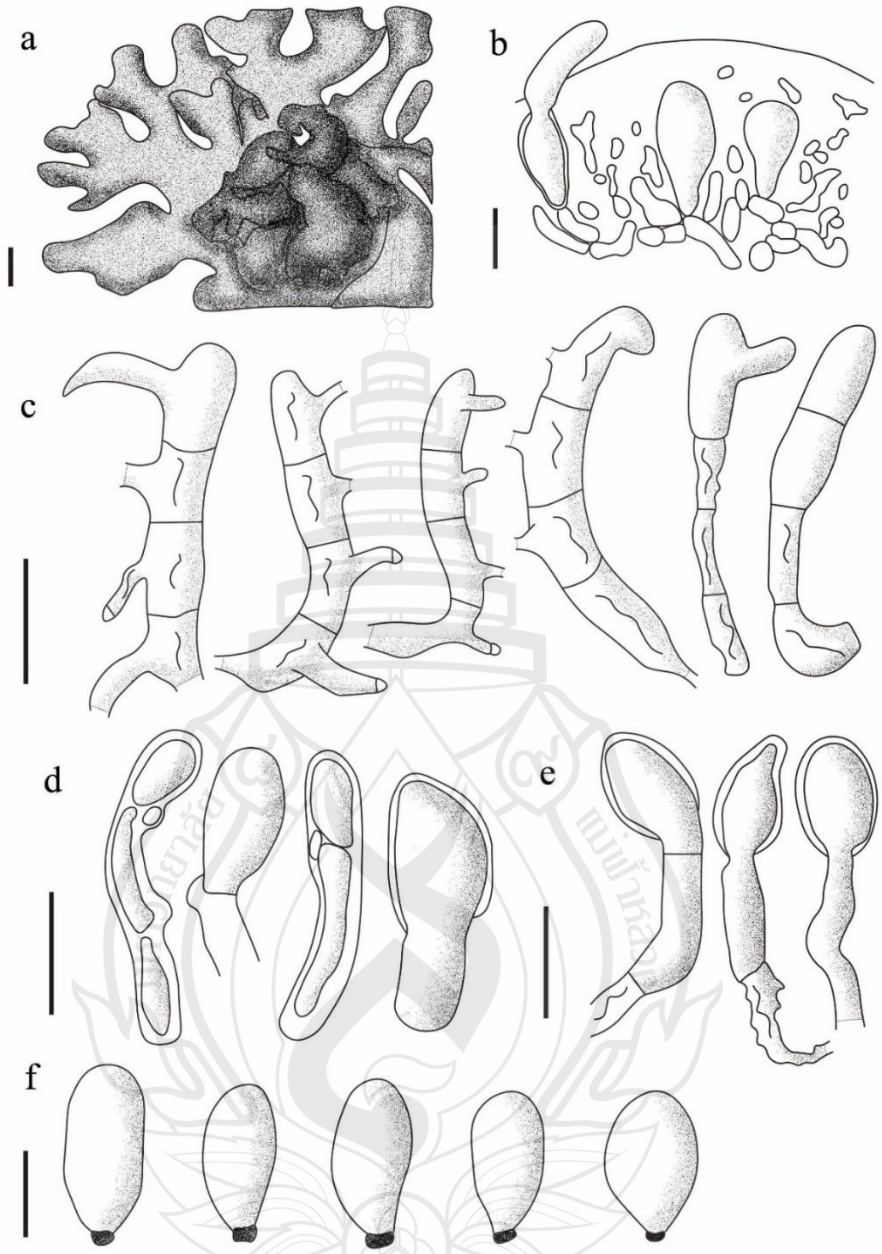
Type species:

Cyphobasidium hypogymniicola (Diederich & Ahti) Millanes, Diederich & Wedin

=*Cystobasidium hypogymniicola* Diederich & Ahti

Table 2.226 Accepted lichenicolous species of *Cyphobasidium*

	Species name	Host	References	Remarks
1	*Cyphobasidium buelliicola* Diederich & W.R. Buck	*Buellia stillingiana*	(Diederich et al., 2022)	
2	*Cyphobasidium crocodiicola* Diederich & W.R. Buck	*Crocodia rubella*	(Diederich et al., 2022)	
3	*Cyphobasidium enterographicola* Diederich, Ertz & Millanes	*Enterographa pallidella*	(Diederich et al., 2022)	
4	*Cyphobasidium hypogymniicola* (Diederich & Ahti) Millanes, Diederich & Wedin	*Hypogymnia physodes*	(Diederich, 1996; Millanes et al., 2016)	= *Cystobasidium hypogymniicola* Diederich & Ahti
5	*Cyphobasidium hypotrachynicola* Diederich, Flakus, Etayo & Rodr. Flakus	*Hypotrachyna*	(Diederich et al., 2022)	
6	*Cyphobasidium lecaniicola* Diederich, Ertz & Millanes	*Lecania naegelii*	(Diederich et al., 2022)	
7	*Cyphobasidium puncteliicola* Diederich & Millanes	*Punctelia graminicola*	(Diederich et al., 2022)	
8	*Cyphobasidium ramalinicola* P. Pinault & Diederich	*Ramalina fraxinea*	(Diederich et al., 2022)	
9	*Cyphobasidium usneicola* (Diederich & Alstrup) Millanes, Diederich & Wedin	*Usnea*	(Diederich, 1996; Millanes et al., 2016)	= *Cystobasidium usneicola* Diederich & Alstrup



Note a Basidiomatal galls on the thallus of *Hypogymnia physodes*. b Section through a basidioma. c Probasidia. d,e basidia. f basidiospores. Scale bars: a= 1 mm, b–e = 10 μm, f = 5 μm.

Source Redrawn from Diederich et al. (2022)

Figure 2.201 *Cyphobasidium hypogymniicola*

Class Microbotryomycetes R. Bauer, Begerow, J.P. Samp., M. Weiss & Oberw.

Order Kriegeriales Toome & Aime

Family Kriegeriaceae Toome & Aime

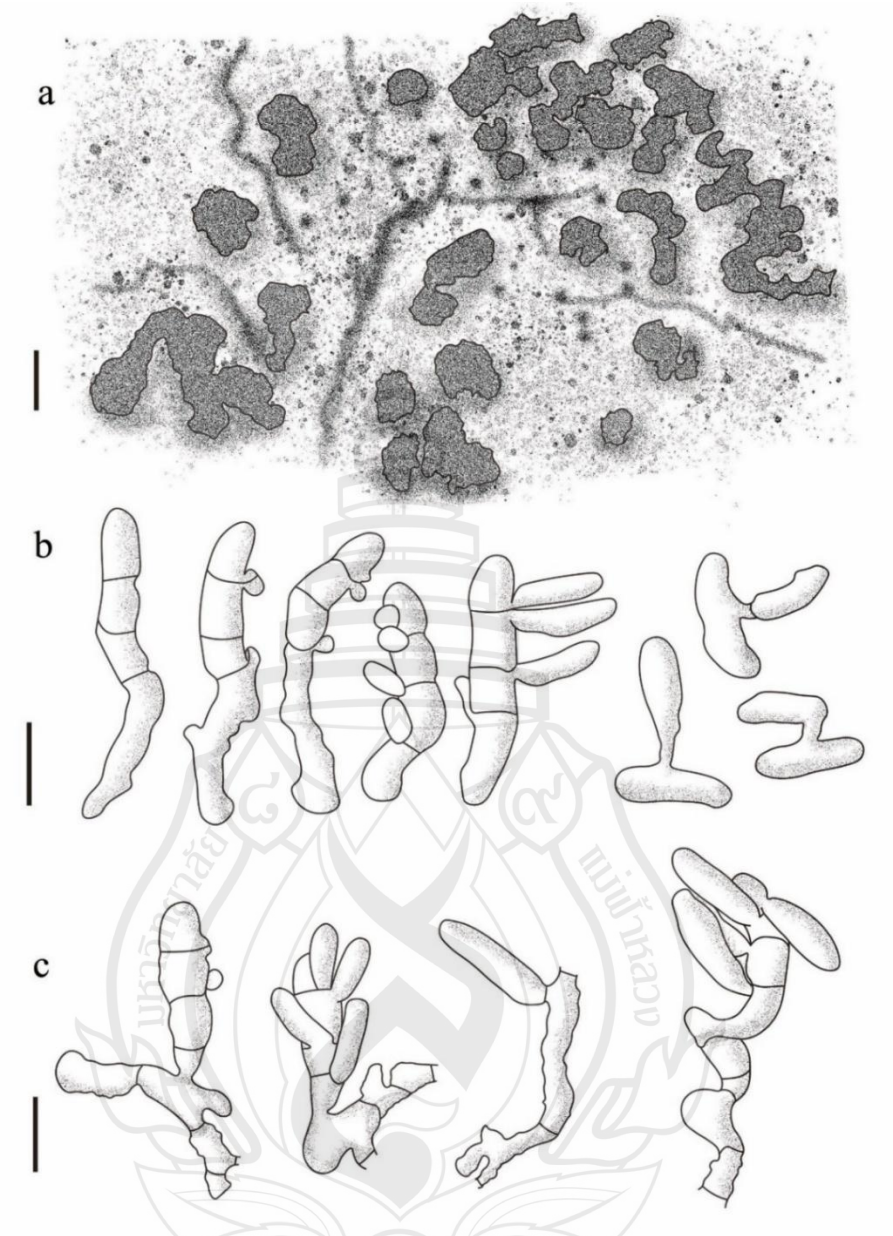
***Kriegeriopsis* Etayo, Diederich, Millanes & Wedin (1)**

Index Fungorum 844633, Faceoffungi, MycoBank, GenBank

Classification: Kriegeriaceae, Kriegeriales, Microbotryomycetes, Pucciniomycotina, Basidiomycota, Fungi

Kriegeriopsis was introduced by Etayo, Diederich, Millanes & Wedin (2022) to describe *K. livingstonensis*, which grows on *Tetramelas* aff. *graminicola*. The genus is characterized by lichenicolous, gall-inducing blackish basidiomata, the absence of clamps at all septa, and claviform to subcylindrical basidia with three transverse septa. Sporogenous loci form in the upper part of the three lower basidial cells and the lower part of the apical cell. The basidiospores are large, elongate-ellipsoid, aseptate, capable of germination to produce secondary spores, and may eventually become septate, acting as secondary basidia. Phylogenetic analysis by Diederich et al. (2022) placed this genus within *Kriegeriaceae* (Kriegeriales, Microbotryomycetes).

Type species: *Kriegeriopsis livingstonensis* Etayo, Diederich, Millanes & Wedin



Note a Blackish basidiomatal galls on the sterile thallus of *Tetramelas* aff. *Antarctica*. b Basidia and basidiospores development. **c** Old basidium remnants (two lower cells) with an enlarged attached basidiospore that may eventually develop into a secondary basidium. Scale bars: a = 200 µm, b–c = 10 µm.

Source Redrawn from Diederich et al. (2022)

Figure 2.202 *Kriegeriopsis livingstonensis*

CHAPTER 3

REASSESSING THE DIVERGENCE TIMES OF ABROTHALLALES AND ITS ADJACENT ORDERS, WITH THE DISCOVERY OF FIVE NEW LICHENICOLOUS SPECIES OF ABROTHALLUS (LICHENOCONIACEAE, ABROTHALLALES) FROM CHINA

3.1 Abstract

Lichens, as symbiotic associations of fungi and algae or cyanobacteria, play a crucial role in ecological diversity. Lichenicolous fungi, which parasitize or live commensally on lichens, directly influence the survival and growth of their hosts. However, phylogenetic studies of lichenicolous fungi remain limited due to frequent failures in obtaining pure DNA sequences from mixed fungal materials. Evolutionary studies targeting lichenicolous fungi are virtually nonexistent. The order Abrothallales, characterized by prominent spherical apothecia emerging from the lichen thallus, provides a unique opportunity for evolutionary research as its DNA can be extracted and sequenced with relative ease. Despite this, there are still taxonomic uncertainties within this order and discrepancies in divergence time estimates to better understand their evolution.

Over the past eight years, two studies have included Abrothallales in molecular clock analyses of Dothideomycetes, but their estimated divergence times of Abrothallales vary significantly due to poor taxon sampling in phylogeny and usage of calibration points. To refine these estimates, we expanded the sampling to include additional taxa of Abrothallales and used different calibration points. During a recent field survey, we also collected fresh specimens, successfully sequenced their DNA, and confirmed their placement in Abrothallales through morphological and phylogenetic

analyses. By incorporating these new samples and expanding the taxon sampling, and include 12 adjacent orders, we reconducted comprehensive analyses to estimate evolutionary rates and timescales.

Our phylogenetic results corroborate with previous findings but yield significantly different divergence times. The estimated crown age for Abrothallales is 98.82 Mya (71–132 Mya), and the stem age is 191.91 Mya (159–227 Mya), approximately 40 million years earlier than prior estimates. Among the other orders, the divergence times of eight orders are notably earlier, three fall within the range of previous estimates, and four are slightly later. These findings emphasize the importance of expanded sampling and taxonomic representation in molecular clock studies, as well as the critical role of selecting appropriate fossil calibration points for accurate divergence time estimation. This study not only sheds new light on the evolutionary history of Abrothallales but also lays a foundation for future research on the evolutionary analysis of other lichenicolous fungi.

Additionally, five species are described and illustrated, including four identified as new species based on the phylogenetic analyses and morphology. One species is reported in China for the first time, and a key to the species of *Abrothallus* is provided.

Key words: Dothideomycetes, Molecular clock, Multigene, Phylogeny, Taxonomy

3.2 Introduction

Lichenicolous fungi represent a kind of specialized group which grow on lichens and establish a parasitic, saprophytic or commensal relationship with them (Diederich et al., 2018). They play significant roles in shaping ecological interactions, driving evolutionary processes, and serving as indicators of environmental health (Lawrey et al., 2003). Due to their tiny size and the difficulty of isolating them from host tissues, obtaining pure DNA for further studies from lichenicolous fungi remains a significant challenge. These technical limitations have hindered the development of a robust, phylogenetically-based classification system and have led to inconsistencies in evolutionary estimates. As a result, the majority of

lichenicolous fungal species still lack DNA sequences data, and their classification continues to rely primarily on morphological characteristics (Bates et al., 2012).

Determining the time of origin and key diversification events in the phylogeny of Ascomycota remains one of the most critical aspects in advancing our understanding of fungal evolution. In molecular clock analysis, choosing correct calibration points and increasing taxon sampling can significantly influence molecular estimates of divergence times (Pollock et al., 2002; Zwickl et al., 2002). Prieto & Wedin, (2013) used data from 6 molecular markers and 121 extant taxa within Ascomycota, and various 'relaxed clock' scenarios to estimate the divergence times of most of the major groups of Ascomycota. However, Beimforde et al., (2014) used five fossils and 145 taxa representing most groups of the Ascomycota to estimate divergence times of Ascomycota lineages. Their results suggested that increased taxon sampling tends to yield earlier divergence time estimates compared to those reported by Prieto & Wedin (2013). Liu et al. (2017) and Hongsanan et al. (2020) both applied the fossil *Metacapnodium succinum* as a calibration point. However, their use of different sampling taxa to analyze the Dothideomycetes lineage led to noticeably different divergence time estimates for Capnodiales (216 Mya vs. 178 Mya), highlighting the notable impact of sampling taxa on time estimation. Furthermore, Zhang et al. (2019) reported an estimated divergence time for Capnodiales of 195 Mya when they sampled different taxa in their analyses and employed the fossil *Margaretbarromyces dictyosporus* to calibrate the crown of *Aigialus*. These findings imply the critical importance of both calibration points and sampling strategies in evolutionary analyses.

Fossils or ambers representing extant groups are often incorporated into molecular clock analyses as ingroups to serve as calibration points. Their crown ages are typically set based on the geological age of the fossils or ambers. Consequently, the selection of appropriate calibration points has a significant impact on molecular estimates of divergence times (Inoue et al., 2010; Hipsley et al., 2014). Rikkinen et al. (2003) described and illustrated the fossil *Metacapnodium succinum*, which was placed

within Metacapnodiaceae (Capnodiales, Dothideomycetes). Subsequently, Schmidt et al. (2014) and Beimforde et al. (2014) discussed the divergence time of Metacapnodiaceae, and this family was used as a calibration point in several studies, including Liu et al. (2017), Zhang et al. (2019), and Hongsanan et al. (2020a). Based on morphological similarities between extant capnodialean sooty molds and fossil specimens, Samarakoon et al. (2019) proposed a minimum crown age of 100 million years for Capnodiales. However, in a phylogenetic analysis conducted by Faezeh (2024), Metacapnodiaceae was placed within Eurotiomycetes Raising significant doubts about the accuracy of prior studies that relied on this fossil as a calibration point. As a result, *Metacapnodium succinum* is no longer proposed as a calibration point for Capnodiales. Instead, alternative fossils were selected to improve the accuracy of divergence time estimations in this study.

In addition to calibration points, taxon sampling is another critical factor influencing phylogenetic inference and divergence time estimates (Zwickl et al., 2002). This issue is particularly pronounced in molecular clock analyses at the class level. For instance, Liu et al. (2017) utilized four species to represent Abrothallales and two species to represent Lichenoconiales. Their analysis estimated the crown age of Abrothallales at 39 Mya (16–76 Mya) and Lichenoconiales at 9 Mya (1–27 Mya), with both orders sharing a stem age of 56 Mya (24–102 Mya). Hongsanan et al. (2020) conducted a molecular clock analysis using two species of *Abrothallus* and two species of *Lichenoconium*. Their results yielded a crown age of 7.7 Mya for *Abrothallus*, 12.8 Mya for *Lichenoconium*, and 58.84 Mya for Abrothallales as a whole, with the stem age of Abrothallales estimated at 204 Mya. These contrasting findings highlight the significant influence of taxon sampling on molecular clock analyses, highlighting the importance of carefully selecting taxa to achieve reliable phylogenetic and temporal estimates.

Abrothallus was initially described as a lichenized genus to accommodate the species, *A. bertianus*, however, doubts about whether it is a parasite was also proposed

by De Notaris (1846). Lindsay (1857) precisely confirmed the lichenicolous habit through critical microscopic studies (Lindsay, 1857). Suija et al. (2018) formally designated *A. bertianus* as the lectotype based on the examination of historical material and other materials deposited in the corresponding Herbarium. *Abrothallus* contains two reproductive structures, the sexual and the asexual morph. The sexual morph is characterized by black, convex to almost subglobose apothecioid ascomata, often with greenish pruina, bitunicate and fissitunicate asci with 4–8-spored, and 2–4-celled, brown, asymmetric, ornamented ascospores. Its asexual morph was firstly described under the genus *Vouauxiomyes*, characterized by dark brown pycnidium, ampulliform to lageniform conidiogenous cells, and hyaline to slightly yellowish conidia which are clavate to obpyriform or almost roundish, with 1–3 guttules, a rounded apex, and a truncate base (Hawksworth et al., 1979). The conidia holoblastic, smooth to slightly echinulate, often embedded in mucilage (Pérez-Ortega et al., 2014). To date, 52 lichenicolous species and two lichens are recognized in *Abrothallus* (Index Fungorum, 2024). Pérez-Ortega et al. (2014) introduced Abrothallaceae and Abrothallales based on phylogenic analysis to accommodate the *Abrothallus*.

Lichenoconium was established by Petrak & Syd (1927) to accommodate the type species *L. lichenicola*, which transferred from *Dactylium dendroides* subsp. *Lichenicola*. For a long time, the phylogenetic position of *Lichenoconium* remained uncertain due to the lack of molecular data. This uncertainty was resolved when Lawrey et al. (2011) successfully cultured four species and conducted a molecular phylogenetic analysis. Their results confirmed the monophyly of *Lichenoconium* and placed it within Dothideomycetes. However, no other recognized order was found to be closely related to this genus. To address this, Hyde et al. (2013) introduced a new order, Lichenoconiales, and a new family, Lichenoconiaceae, based on phylogenetic analysis to accommodate the genus *Lichenoconium*. The genus is characterized by coelomycetous, immersed to sessile, dark brown pycnidia with an undifferentiated ostiole, simple globose to ellipsoid conidia that are often truncate at the base, thick-

walled, brown, and commonly verrucose, and hyaline or poorly pigmented holoblastic conidiogenous cells that are elongate and annellidic (Lawrey et al., 2011; Hernández-Restrepo et al., 2020). According to Index Fungorum (2025), *Lichenoconium* currently includes 17 species

However, this classification scheme was revised and Diederich et al. (2018) synonymized Lichenoconiales with Abrothallales and tentatively Lichenoconiaceae with Abrothallaceae. Based on phylogenetic analysis, Hongsanan et al. (2020b) formally accepted the classification proposed by Diederich et al. (2018), and suggested retaining Lichenoconiaceae (2013) over Abrothallaceae (2014) due to Lichenoconiaceae being the older name.

Previous studies focusing on class-level divergence time estimation typically employed limited taxonomic sampling across orders, achieving methodological feasibility at the expense of precision. In contrast, our study specifically targets order-level divergence times. To minimize potential biases from restricted taxon representation, we implemented an enhanced sampling strategy incorporating multiple representative taxa per order while strategically excluding certain orders to maintain computational tractability. While this selective approach may reduce resolution at higher taxonomic levels, it significantly improves chronological accuracy at our target order-level classification. As part of this investigation, we included ten newly collected Abrothallales specimens obtained during recent microfungal surveys in Yunnan Province, China. These foliose lichen-lichenicolous fungi were identified through combined morphological examination and molecular phylogenetic analyses. To optimize divergence time estimation for Abrothallales, we integrated these novel sequence data with an expanded taxonomic framework encompassing twelve phylogenetically related orders, thereby substantially improving the robustness of our temporal reconstructions.

3.3 Materials and Methods

3.3.1 Specimen Collection, Examination and Isolation

The specimens were collected from three National Nature Reserves within Yunnan Province of China: Laojun, Meili, and Yulong Mountain. Morphological characteristics were observed and photographed using a compound microscope (Nikon Y-TV55) equipped with a digital camera (Nikon DS-Ri2), and a stereomicroscope (Olympus ZX-16) with a digital camera (Olympus SC180). Measurements were conducted using Image Frame Work software (Tarosoft (R), Version 0.9.7). The length, width, and length/width ratio (l/w) of asci and ascospores are provided (where $n \geq 10$) as: (min–) [X−SD]–[X+SD] (–max), where "min" and "max" represent the extreme observed values, X is the arithmetic mean, and SD is the standard deviation. The number of measurements (n) is indicated (Zhurbenko, 2023). Photo plates were processed using Adobe Photoshop CC 2019 software (Adobe Systems, USA). The holotype specimens are deposited in the Lichen Herbarium of Kunming Institute of Botany (KUN-L), Chinese Academy of Science, Yunnan, China.

3.3.2 DNA extraction, PCR amplification & sequencing

DNA extraction was conducted directly from the ascomata due to unsuccessful attempts at isolating fungal cultures. The lichenicolous apothecia were carefully cut from the surface of host lichens using a razor blade and a super-fine needle under a dissecting microscope, subsequently transferred to a 200 µl centrifuge tube, with a minimum requirement of five to ten apothecia depending on the apothecia size. It was imperative to promptly and thoroughly remove the tissue of host lichens. Total genomic DNA was extracted using the Forensic DNA Kit (Omega Bio-tek, Norcross, Georigia), following the manufacturers' instructions. Five genes were amplified and sequenced. The PCR amplifications were conducted on a Mastercycler (Bio-RAD T-100) in 25-µL reactions with 1.0 µL of DNA template, 12.5 µL of 2 × dNTPs Mix (Solarbio), 1.0 µL (10mM) of each primer and 9.5 µL of double-distilled water (ddH_2O). The primer pairs and PCR amplification parameters are displayed in Table 3.1. The PCR products were sequenced by Shanghai Sangon Company (Chengdu, Sichuan Province, China).

Table 3.1 Primer pairs and Parameters for PCR amplification.

Gene	Primer	Initial Denaturation	Denaturation	Annealing	Elongation	Final Extension	Hold	References
ITS	ITS1f/ ITS4	95°C/ 3 min	95°C/45 s	56°C/90s	72°C/1min	72°C/ 10min	4°C/+ ∞	(White et al., 1990, Gardes et al., 1993)
			34 cycles					
LSU	LR0R/ LR5	95°C/ 3 min	95°C/45 s	55°C/90s	72°C/1min	72°C/ 10min	4°C/+ ∞	(Vilgalys et al., 1990)
			34 cycles					
SSU	NS1/ NS4	95°C/ 3 min	95°C/45 s	53°C/90s	72°C/1min	72°C/ 10min	4°C/+ ∞	(White et al., 1990)
			34 cycles					
TEF1	983F/ 2218R	95°C/ 3 min	95°C/45 s	56°C/90s	72°C/1min	72°C/ 10min	4°C/+ ∞	(Rehner et al., 2005)
			34 cycles					
RBP2	fRPB2-5F/ fRPB2-7cR	95°C/ 3 min	95°C/45 s	52°C/90s	72°C/1min	72°C/ 10min	4°C/+ ∞	(Liu et al., 1999)
			34 cycles					

3.3.3 Molecular Cloning for Target Gene Isolation

The molecular cloning approach was specifically employed under the following conditions: (1) PCR amplification using specimen-derived DNA as template generated a distinct electrophoretic band, yet (2) Sequencing revealed superimposed peaks, necessitating targeted isolation of the desired gene.

(1) PCR Amplification and Product Purification

Initial PCR reactions were performed using standard protocols. The entire PCR products were subjected to agarose gel electrophoresis (1.5% gel, 120 V for 30 min). Upon confirmation of a single clear band, the target DNA fragment was excised under UV light (wavelength: 302 nm) and purified using the SanPrep Column DNA Gel Extraction Kit (Sangon Biotech, Shanghai), following the manufacturer's instructions.

(2) Ligation of PCR Product to Vector

The purified PCR product was ligated into the pMD19-T vector (TaKaRa, Clontech), a TA-cloning vector optimized for blunt-end ligation. Ligation reactions were performed using T4 DNA Ligase (Sangon Biotech, Cat. No. B500007) at a vector-to-insert molar ratio of 1:3 in 1× ligation buffer (16°C, 12 h). The ligation mixture was stored at –20°C for subsequent use.

(3) Preparation of *E. coli* Competent Cells

Chemically competent E. coli DH5α cells were prepared using the calcium chloride (CaCl2) method: A single colony of DH5α was inoculated into 5 mL LB broth and incubated overnight at 37°C with shaking (200 rpm). The culture was diluted 1:100 into 50 mL fresh LB and grown to mid-log phase (OD600 ≈ 0.4–0.6). Cells were harvested by centrifugation (4,000 ×g, 10 min, 4°C), gently resuspended in 10 mL ice-cold 0.1 M CaCl2, and incubated on ice for 30 min. After a final centrifugation (4,000 ×g, 10 min, 4°C), cells were resuspended in 1 mL ice-cold 0.1 M CaCl2 containing 15% glycerol and aliquoted into sterile tubes.

(4) Transformation and Colony Screening

A 10 μL aliquot of the ligation mixture was mixed with 100 μL competent cells and incubated on ice for 30 min. Heat shock was performed at 42°C for 45 sec, followed by immediate cooling on ice for 2 min. Recovery was achieved by adding 900 μL SOC medium (37°C, 1 h, 200 rpm). Antibiotic Resistance Screening: Transformed cells were plated on LB agar supplemented with 100 μg/mL ampicillin. Only colonies harboring the plasmid grew after 16–18 h at 37°C. Blue-White Screening (if applicable): For vectors containing the lacZα system, 40 μL X-gal (20 mg/mL) and 40 μL IPTG (24 mg/mL) were spread on plates. White colonies (indicating insert disruption of lacZα) were prioritized. Colony PCR Verification: Randomly selected colonies were suspended in 10 μL sterile water. PCR was performed using vector-specific primers (e.g., M13-F/R). Amplified products were analyzed by agarose gel electrophoresis (1.0%, 120 V, 20 min) to confirm insert size.

(5) Sequencing and Validation

Positive clones were selected for plasmid extraction (SanPrep Plasmid Mini Kit, Sangon Biotech). The insert DNA was sequenced by a commercial service (Sangon Biotech). Sequence homology was confirmed using NCBI BLAST (https://blast.ncbi.nlm.nih.gov), with ⩾99% identity to the expected target gene.

3.3.4 Phylogenetic Analyses

Table 3.2 Taxa name, voucher/culture and their GenBank accession numbers used in the phylogenetic analyses

Species	Culture/ voucher	GenBank accession numbers			References
		LSU	ITS	TEF1	
Abrothallus acetabuli	SPO308	KF816232	KF816165	NA	(Pérez-Ortega et al., 2014)
A. acetabuli	von Brackel 5661	NA	KP165100	NA	(Suija et al., 2015)
A. altoandinus	AF25948	NA	OR116440	NA	(Senanayake et al., 2023)
A. boomii	van den Boom 43228	NA	KP165092	KP165108	(Suija et al., 2015)
A. buellianus	SPO303	KF816234	KF816166	NA	(Pérez-Ortega et al., 2014)
A. caerulescens	SPOc80	NA	HQ702852	NA	(Pérez-Ortega et al., 2011)
A. canariensis	van den Boom 37849	NA	KP165087	KP165123	(Suija et al., 2015)

Table 3.2 (continued)

Species	Culture/ voucher	GenBank accession numbers			References
		LSU	ITS	TEF1	
A. doliiformis	S309	NA	KP165086	NA	(Suija et al., 2015)
A. cladoniae	AB53	KF816228	KF816173	NA	(Pérez-Ortega et al., 2014)
A. eriodermae	AB60^{T}	NA	NR_158312	KP165126	(Suija et al., 2015)
A. eriodermae	TU-65983	NA	NA	KP165117	(Suija et al., 2015)
A. ertzii	Ertz 12517	NA	KP165102	KP165127	(Suija et al., 2015)
A. etayoi	Perez-Ortega 2003^{T}	NA	NR_158309	KP165112	(Suija et al., 2015)
A. flavoparmeliae	KUN-L 88643 ml-112	PQ772187	PQ721324	PQ723767	This study
A. granulatae	Perez-Ortega 3166	NA	KP165094	KP165122	(Suija et al., 2015)
A. hypogymniaum	KUN-L 88540^{T} ljs-215	PQ772194	PQ721331	PQ723774	This study
A. hypogymniaum	KUN-L 88545 ljs-210	PQ772193	PQ721330	PQ723773	This study
A. hypotrachynae	SPO302	KF816233	KF816167	NA	(Pérez-Ortega et al., 2014)
A. kamchatica	S310	NA	KP165091	KP165107	(Suija et al., 2015)
A. kamchatica	SPO310	KF816235	KF816168	KF816187	(Pérez-Ortega et al., 2014)
A. macrosporus	A.F.25602	MT153971	NA	NA	(Flakus et al., 2019)
A. myelochroae	KUN-L 88665 ml-90T	PQ772186	PQ721323	PQ723766	This study

Table 3.2 (continued)

Species	Culture/ voucher	GenBank accession numbers			References
		LSU	ITS	TEF1	
A. nephromatis	Spribille 10581	NA	KP165088	KP165130	(Suija et al., 2015)
A. nephromatis	LE 260303	NA	KP165105	KP165119	(Suija et al., 2015)
A. nephromatis	Ertz 12514	NA	KP165103	KP165118	(Suija et al., 2015)
A. nephromatis	Perez-Ortega 3159	NA	KP165089	KP165115	(Suija et al., 2015)
A. nephromatis	2SP-2014	KF816230	KF816175	NA	(Pérez-Ortega et al., 2014)
A. parmeliarum	AB36	KF816229	KF816172	NA	(Pérez-Ortega et al., 2014)
A. parmeliarum	AB57	KF816227	KF816178	NA	(Pérez-Ortega et al., 2014)
A. parmelioidea	KUN-L 88638 ml-117-3T	PQ772188	PQ721325	PQ723768	This study
A. parmelioidea	KUN-L 88565 yl-190	PQ772190	PQ721327	PQ723770	This study
A. parmelioidea	KUN-L 88566 yl-189	NA	NA	PQ723769	This study
A. parmelioidea	KUN-L 88612 ml-143	PQ772189	PQ721326	NA	This study
A. parmelioidea	KUN-L 88551 ljs-204	PQ772192	PQ721329	PQ723772	This study
A. parmotrematis	AB1	KF816231	KF816176	NA	(Pérez-Ortega et al., 2014)
A. secedens	SPO305	KF816236	KF816169	NA	(Pérez-Ortega et al.,2014)

Table 3.2 (continued)

Species	Culture/ voucher	GenBank accession numbers			References
		LSU	ITS	TEF1	
A. secedens	Perez-Ortega 3158	NA	KP165098	KP165121	(Suija et al., 2015)
A. secedens	Perez-Ortega 3161	NA	KP165093	KP165110	(Suija et al., 2015)
A. secedens	Perez-Ortega 3162	NA	KP165097	NA	(Suija et al., 2015)
A. secedens	Perez-Ortega 3175	NA	KP165096	NA	(Suija et al., 2015)
A. subhalei	Etayo IX-6T	NG_06893 2	NR_184917	NA	(Flakus et al., 2019)
A. subhalei	J.E.IX-7	MT153974	NA	NA	(Flakus et al., 2019)
A. subhalei	J.E.44-1	MT153972	MT153945	NA	(Flakus et al., 2019)
A. subhalei	J.E.VII-7	NA	NA	NA	(Flakus et al., 2019)
A. tetrasporus	AF25621	OR133230	OR116442	NA	(Senanayake et al., 2023)
A. welwitschia	Perez-Ortega 3171	NA	NA	KP165131	(Suija et al., 2015)
A. welwitschia	AB61	NA	NA	KP165129	(Suija et al., 2015)
A. welwitschia	Ertz 1083	NA	NA	KP165128	(Suija et al., 2015)
A. welwitschia	Perez-Ortega 3169	NA	KP165090	KP165116	(Suija et al., 2015)

Table 3.2 (continued)

Species	Culture/ voucher	GenBank accession numbers			References
		LSU	ITS	TEF1	
A. welwitschia	Perez-Ortega 3168	NA	NA	KP165114	(Suija et al., 2015)
A. welwitschia	Spribille 24949	NA	NA	KP165109	(Suija et al., 2015)
A. yunnanensis	KUN-L 88552 ljs-203T	PQ772191	PQ721328	PQ723771	This study
Abrothallus sp.	Perez-Ortega 3155	NA	KP165099	KP165124	(Suija et al., 2015)
Abrothallus sp.	von Brackel 5491	NA	KP165106	KP165120	(Suija et al., 2015)
Lichenoconium aeruginosum	CBS 129239T	NG_06026 6	NR_160250	NA	(Vu et al., 2019)
L. aeruginosum	JL359-09	HQ174269	NA	NA	(Lawrey et al., 2011)
L. erodens	JL363-09	HQ174267	NA	NA	(Lawrey et al., 2011)
L. erodens	CBS 128704	MH876415	MH864965	NA	(Vu et al., 2019)
L. erodens	CBS 128028	MH876200	MH864759	NA	(Vu et al., 2019)
L. erodens	Flakus 26452	MW31519 7	NA	NA	(Wijayawardene et al., 2021)
L. hawksworthii	Flakus 27364	MW31519 8	MW315198	NA	(Wijayawardene et al., 2021)
L. lecanorae	JL382-10	HQ174263	NA	NA	(Lawrey et al., 2011)
L. usneae	JL352-09	HQ174265	NA	NA	(Lawrey et al., 2011)

Table 3.2 (continued)

Species	Culture/ voucher	GenBank accession numbers			References
		LSU	ITS	TEF1	
L. usneae	CBS 128708	MH876417	MH864967	NA	(Vu et al., 2019)
Patellaria chromolaenae	MFLUCC 17-1482	MT214475	MT214381	MT235796	(Mapook et al., 2020)
Patellaria guizhouensis	GZCC 19-0222	OR209665	OR225070	OR140428	(Zhang et al., 2023)

Note The newly generated sequences are shown in black bold font and "T" indicates holotype or ex-type strains. The absence of GeneBank accession numbers is shown by "NA".

3.3.5 Divergence Times Analyses

The divergence times analyses were estimated using BEAST package v2.7.5 (https://www.beast2.org/) (Vaughan, 2023). All the aligned sequence data set from phylogenetic analyses were partitioned separately for each ITS, LSU, SSU, RPB2 and TEF1 data set, and loaded in BEAUti 2 Standard (Bilderbeek et al., 2018) to construct an XML file. Clock and Site models were set to be unlinked (each gene partition was independently estimated), and the trees were set to be linked across partitions. An optimized relaxed clock model (Didelot et al., 2021) for each gene partition was used with mean clock rate = 1.0 (default value) for the analyses. The best-fit model for each gene partition was selected based on ModelFinder (Kalyaanamoorthy et al., 2017). The speciation of nodes in the topology was performed using Yule process tree prior with a randomly generated starting tree. Taxa sets were generated to add the calibration information, associated with the most recent common ancestor (MRCA). The MCMC chain length was set to 500,000,000, The tracelog, screenlog, and treelog were all set to 1000, with other parameters kept default values. Tracer v.1.6 (Rambaut et al., 2018) was used to verify whether the effective sample sizes (ESS) exceeded 200. The maximum clade credibility (MCC) tree was summarized using TreeAnnotator v.2.7.5,

with a burn-in of 20% and a posterior probability limit of 0.8 (Helfrich et al., 2018), and then visualized using FigTree V.1.4.4 (Rambaut, 2016). The MCC tree was edited using Adobe illustrator CC 2019.

Three fossils were selected as calibrations for molecular clock analysis (table 3.3). The first calibration is the minimum crown age of 145 Mya for the order Microthyriales which was determined based on the fossils of *Phragmothyrites* sp. & *Microthyriacites* sp. and the host divergence times of *Asterothyrites* (Krassilov, 1967; Martınez, 1968; Kalgutkar, 1985a; Axsmith et al., 1998; Samarakoon et al., 2019). 15 different genera from family Microthyriaceae were included in the taxa set. The second fossil, *Margaretbarromyces dictyosporus*, was utilized to calibrate the minimum crown age of the extant genus *Aigialus* as 34 Mya (Mindell et al., 2007; Phukhamsakda et al., 2016; Liu et al., 2018; Samarakoon et al., 2019). The third fossils, *Muyocopron mucoris* and *M. neyveliensis* were utilized to calibrate the minimum crown age of the genus *Muyocopron* as 54 Mya (Pitman et al., 2012; Mapook et al., 2016; Samarakoon et al., 2019). The crown age of the Dothideomycetes was calibrated as the secondary calibration (A2), with a normal distribution, mean = 290, SD = 30 and 97.5% of CI = 349 Mya following the references (Schmidt et al., 2014; Hongsanan et al., 2020). The GenBank accession numbers of extant species for calibrations in the MCC tree are listed in table 3.4 and the GenBank accession numbers of adjacent orders are listed in table 3.5.

Table 3.3 The list of the fossils used as calibration

Crown group	**Crown age (Mya)**	**Fossil and the geological periods**	**Reference**
Microthyriales	145	*Asterothyrites canadensis* Canada (late Paleocene–early Eocene, 58.7–40.4 Mya)	(Kalgutkar, 1985b)

Table 3.3 (continued)

Crown group	Crown age (Mya)	Fossil and the geological periods	Reference
		Asterothyrites dictyozamiticola Russia (early Cretaceous, 145.5–99.6 Mya)	(Krassilov, 1967; Kalgutkar et al., 2000)
		Asterothyrites edvensis India (Miocene, 23.03–5.33 Mya)	
		Asterothyrites konkanensis India (Neogene, 23.03–2.58 Mya)	(Rao et al., 1976)
		Asterothyrites menonii South India (Miocene, 23.03–5.33 Mya).	(Saxena et al., 1990)
		Asterothyrites minutus New South Wales (Midlate Cenozoic, 33.9–5.3 Mya)	(Kalgutkar et al., 2000)
		Asterothyrites podocarpi Russia (early Cretaceous, 145.5–99.6 Mya);	(Cookson, 1947)
		Asterothyrites spinulatus USA (early Eocene, 59–54 Mya)	(Krassilov, 1967)
		Asterothyrites tennesseensis USA (early Eocene, 59–54 Mya)	(Dilcher, 1965)
Muyocopron	54	*Muyocopron mucoris* (early Cenozoic, 59–54 Mya)	(Dilcher, 1965)
		Muyocopron neyveliensis India (Miocene, 23.03–5.33 Mya)	(Reddy et al., 1982)
Aigialus	34	*Margaretbarromyces dictyosporus* Canada (Eocene, 56–33.9 Mya)	(Mindell et al., 2007)
Asterina	54	*Asterina eocenica* USA (Paleocene 59–54 Mya)	(Dilcher, 1965)

Table 3.3 (continued)

Crown group	Crown age (Mya)	Fossil and the geological periods	Reference
		Asterina indodeightonii India (late Pliocene to early Pleistocene, 5.3–2.58 Mya)	(Vishnu et al., 2017)
		Asterina kosciuskensis Australia (early Miocene 23.03–15.97 Mya)	(Selkirk, 1975)
		Asterina mioconsobrina India (late Pliocene to early Pleistocene, 5.3–2.58 Mya)	(Vishnu et al., 2017)
		Asterina miosphaerelloides India (late Pliocene to early Pleistocene, 5.3–2.58 Mya)	(Vishnu et al., 2017)
		Asterina neocombreticola India (middle to late Miocene, 11.63–5.33 Mya)	(Vishnu et al., 2017)
		Asterina neoelaeocarpi India (middle to late Miocene, 11.63–5.33 Mya)	(Vishnu et al., 2017)
		Asterina nodosaria USA (Paleocene, 59–54 Mya)	(Dilcher, 1965)
		Asterina presaracae India (Pliocene, 5.33–2.58 Mya)	(Vishnu et al., 2017)

Table 3.4 Taxa used as the calibrations and the GenBank accession numbers of their extant species

Species	Culture/ voucher	LSU	SSU	ITS	TEF	RPB2	References
Aigialus grandis	BCC 20000	GU4797 75	NA	NA	NA	GU4798 14	(Suetrong et al., 2010)
Aigialus mangrovis	BCC 33563	GU4797 76	GU4797 41	NA	GU4798 40	GU4798 15	(Kohlmeyer et al., 2009)

Table 3.4 (continued)

Species	Culture/ voucher	LSU	SSU	ITS	TEF	RPB2	References
Aigialus parvus	PUFD45	MK026761	MK026763	MK028710	MN520611	MN520612	Devadatha 2018 Direct submission
Aigialus rhizophorae	BCC 33572	GU479780	GU479745	NA	GU479844	GU479819	(Kohlmeyer et al., 2009)
Delitschia chaetomioides	DSE871	MW209067	MW209047	MW209042	MW238837	MW238833	(Pintye et al., 2021)
Delitschia winteri	AFTOL-ID 1599	DQ678077	DQ678026	NA	DQ677922	DQ677975	(Schoch et al., 2006)
Fusculina eucalypti	CBS 120083	DQ923531	NA	DQ923531	NA	NA	(Summerbell et al., 2006)
Gordonomyces mucovaginatus	CBS 127273	NG_057941	NA	NR_157428	NA	NA	(Crous et al., 2011)
Massaria inquinas	WU 30527	HQ599402	HQ599444	HQ599402	HQ599342	HQ599460	(Voglmayr et al., 2011)
Massaria vomitoria	WU 30606	HQ599437	HQ599404	HQ599437	HQ599375	HQ599466	(Voglmayr et al., 2011)
Neomassaria fabacearum	MFLUCC 16-1875	KX524145	NG_061245	NA	KX524149	NA	(Sun et al., 2022)
Neocamarosporium phragmitis	MFLUCC 17-0756	NG_070431	NG_065736	MG844345	MG844351	NA	(Hyde et al., 2018)
Arxiella celtidis	MFLU 18-0093	NG_079559	NA	NR_174850	NA	NA	(Tennakoon et al., 2021)
Arxiella dolichandrae	CBS 138853	MH878643	NA	KP004449	MK495954	MK492710	(Vu et al., 2019)

Table 3.4 (continued)

Species	Culture/ voucher	LSU	SSU	ITS	TEF	RPB2	References
Arxiella longispora	SGSF 411	MW725533	NA	MN719073	MW883565	MW770762	(Xu et al., 2023)
Arxiella terrestris	SGSF 957	MW725535	MZ404939	MW725532	MW883563	MW770764	(Xu et al., 2023)
Leptodiscella africana	CBS 400.65	NG_064050	NA	NR_145359	MK495955	MK492711	(Vu et al., 2019)
Leptodiscella chlamydospora	MUCL 28859	FN869567	NA	FR745398	NA	NA	(Madrid et al., 2012)
Leptodiscella sexualis	MFLU 19-2783	NG_079560	NA	NR_174851	NA	NA	(Tennakoon et al., 2021)
Muyocopron alcornii	BRIP_43897	MK487708	NA	MK487735	MK495956	MK492712	(Hernãndez-Restrepo et al., 2019)
Muyocopron atromaculans	MUCL_34983	MK487709	NA	MK487736	MK495957	MK492713	(Hernãndez-Restrepo et al., 2019)
Muyocopron castanopsis	MFLUCC 14-1108	KU726965	KU726968	MT137784	MT136753	KY225778	(Mapook et al., 2020)
Muyocopron celtidis	MFLU 19-2740	MW063253	NG_077437	MW063194	NA	NA	(Mapook et al., 2020)
Muyocopron chromolaenae	MFLUCC 17-1513	NG_068700	NA	NR_168857	MT136756	MT136761	(Mapook et al., 2020)
Muyocopron chromolaenicola	MFLUCC 17-1470	MT137877	NG_070151	NR_168858	MT136757	NA	(Mapook et al., 2020)

Table 3.4 (continued)

Species	Culture/ voucher	LSU	SSU	ITS	TEF	RPB2	References
Muyocopron dipterocarpi	MFLUCC 14-1103	KU726966	KU726969	MT137785	MT136754	KY225779	(Mapook et al., 2016)
Muyocopron ficinum	MFLU 18-2515	MW063256	NG_077438	NR_174835	NA	NA	(Tennakoon et al., 2021)
Muyocopron garethjonesii	MFLU 21-0192	OL782055	OL780523	OL782139	NA	NA	(Senwanna et al., 2021)
Muyocopron geniculatum	CBS 721.95	NG_066266	NA	NR_164054	MK495959	MK492715	(Hernãndez-Restrepo et al., 2019)
Muyocopron heveae	MFLUCC 17-0066	NG_068599	NG_070118	MH986836	NA	NA	Senwanana, 2018, direct submission
Muyocopron karsti	GZCC 19-0273	OR209651	OR134420	NA	NA	NA	(Zhang et al., 2023)
Muyocopron laterale	CBS 141029	MK487712	NA	MK487738	MK495960	MK492716	(Hernãndez-Restrepo et al., 2019)
Muyocopron lithocarpi	MFLUCC 14-1106	KU726967	KU726970	MT137786	MT136755	NA	(Mapook et al., 2016)
Muyocopron thailandica	MFLU 18-1151	MT677920	NA	MT677922	NA	NA	(Hongsanan et al., 2020)
Muyocopron zamiae	CPC:37461	MW883818	NA	MW883424	MW890109	MW890064	(Crous et al., 2021)
Mycoleptodiscus alishanensis	MFLU 19-2721	NG_079546	NG_077439	NR_174836	NA	NA	(Tennakoon et al., 2021)

Table 3.4 (continued)

Species	Culture/ voucher	LSU	SSU	ITS	TEF	RPB2	References
Mycoleptodiscus endophyticus	MFLUCC 17-0545	NG_064487	NA	NR_158860	MG646985	NA	(Tibpromma et al., 2018)
Mycoleptodiscus indicus	UTHSCSA R-4334	GU220383	NA	GU220382	NA	NA	(Metry et al., 2010)
Mycoleptodiscus suttonii	CBS 276.72	MK487728	NA	NR_164056	MK495974	MK492732	(Hernãndez-Restrepo et al., 2019)
Mycoleptodiscus terrestris	CBS 231.53	MK487730	NA	NR_145373	MK495976	MK492734	(Hernãndez-Restrepo et al., 2019)
Neocochlearomyces chromolaenae	BCC 68250	NG_066431	NG_065766	NR_161151	MK047573	NA	(Crous et al., 2018)
Neomycoleptodiscus alishanense	MFLUCC 19-0390	ON024150	NA	ON024153	NA	NA	(Liu et al., 2024)
Neomycoleptodiscus venezuelense	CBS 100519	MK487732	NA	NR_164057	MK495978	MK492736	(Hernãndez-Restrepo et al., 2019)
Paramycoleptodiscus albizziae	CBS 141320	MH878220	NA	NR_145403	MK495979	MK492737	(Vu et al., 2019)
Pseudopalawania siamensis	MFLUCC 17-1476a	NA	MT137789	MT137782	MT136752	NA	(Mapook et al., 2020)
Quadrisporella heveae	MFLUCC 18-0308	NG_228919	NA	NR_185667	OL875101	OL828755	(Senwanna et al., 2021)

Table 3.4 (continued)

Species	Culture/ voucher	LSU	SSU	ITS	TEF	RPB2	References
Setoapiospora thailandica	MFLUCC 17-1426	NG_0689 14	NG_068 420	NR_168 229	MN6487 31	NA	(Mapook et al., 2023)
Zelosatchmopsis sacciformis	CBS 116.88	MH87381 2	NG_077 439	MH8621 22	NA	NA	(Vu et al., 2019)
Antidactylaria minifimbriata	YMF1.045 78	MK57780 8	MK5777 93	MK5695 06	MK5778 38	MK577823	(Qiao et al., 2021)
Chaetothyriothecium elegans	CPC 21375	NG_0588 61	NA	NA	NA	NA	(Hongsanan et al., 2014)
Hamatispora phuquocensis	VTCCF121 9	LC06407 3	NA	LC0640 74	NA	NA	(Le et al., 2018)
Heliocephala elegans	MUCL 39003	HQ33347 8	NA	HQ3334 78	NA	NA	(Abarca et al., 2011)
Heliocephala gracilis	MUCL 41200	HQ33347 9	NA	HQ3334 79	NA	NA	(Abarca et al., 2011)
Heliocephala natarajanii	MUCL 43745	HQ33348 0	NA	HQ3334 80	NA	NA	(Abarca et al., 2011)
Heliocephala zimbabweensis	MUCL 40019	HQ33348 1	NA	HQ3334 81	NA	NA	(Abarca et al., 2011)
Isthmomyces dissimilis	YMF1.046 04	MK57781 1	MK5777 96	NA	MK6071 71	MK577826	Guo 2019 Direct submission
Isthmomyces lanceatus	YMF1.045 14	MK57781 3	MK5777 98	MK5778 95	MK6071 73	MK577828	(Qiao et al., 2021)
Isthmomyces macrosporus	YMF 1.04518	MK57781 2	MK5777 97	MF7407 96	MK6071 72	MK577827	(Qiao et al., 2021)

Table 3.4 (continued)

Species	Culture/ voucher	LSU	SSU	ITS	TEF	RPB2	References
Isthmomyces oxysporus	YMF1.045 13	MK57781 0	MK5777 95	NA	MK6071 70	MK577825	(Qiao et al., 2021)
Keqinzhangia aquatica	YMF1.042 62	MK57780 9	MK5777 94	MK5695 07	MK5778 39	MK577824	(Qiao et al., 2021)
Microthyrium buxicola	MFLUCC 15-0213	KT30655 2	KT3065 50	NA	NA	NA	(Ariyawansaet al., 2015)
Microthyrium chinense	HKAS 92487	NG_2419 00	NA	NA	NA	NA	(Tennakoon et al., 2021)
Microthyrium ilicinum	VUL.315	MG84415 1	MG8441 44	NA	NA	NA	(Le Renard et al., 2020)
Microthyrium macrosporum	VUL 460	MG84415 9	MG8441 47	NA	NA	NA	(Le Renard et al., 2020)
Microthyrium propagulensis	IFRD 9037	NG_0603 39	NA	NA	NA	NA	(Wu et al., 2014)
Neoanungitea eucalyptorum	CPC 35763	NG_0683 13	NA	NR_166 310	NA	NA	(Crous et al., 2019)
Neoscolecobasidium agapanthi	CPC 28778	NG_0597 48	NA	NR_152 546	NA	NA	(Crous et al., 2016)
Nothoanungitopsis urophyllae	CBS 146799	NG_0767 15	NA	NR_173 015	NA	NA	(Crous et al., 2021)
Parazalerion indica	CBS 125443	MH87497 7	NA	MH8634 83	NA	NA	(Vu et al., 2019)
Pseudocoronospora hainanense	YMF1.045 17	MK57780 7	MK5777 92	NR_186 925	MK5778 37	MK577822	(Liu et al., 2023)

Table 3.4 (continued)

Species	Culture/ voucher	LSU	SSU	ITS	TEF	RPB2	References
Pseudomicrothyrium thailandicum	MFLU 14-0286	NG_081481	NG_081398	NA	NA	NA	(Hongsanan et al., 2020)
Pseudopenidiella gallaica	CBS 121796	LT984843	NA	LT984842	NA	NA	(Iturrieta-González et al., 2020)
Pseudopenidiella piceae	CBS 131453	NG_042681	NA	NR_111761	NA	NA	(Iturrieta-González et al., 2020)
Pseudopenidiella podocarpi	CPC 37092	NG_068336	NA	MN562140	NA	NA	(Crous et al., 2012)
Triscelophorus anisopteroideus	YMF1.04267	MK577818	MK577803	MK569511	NA	MK577833	(Crous et al., 2019)
Triscelophorus monosporus	CBS 440.54	MH868925	NA	NA	NA	NA	(Vu et al., 2019)
Triscelophorus sinensis	YMF1.04065	MK577820	MK577805	MK569513	MK607179	MK577835	(Qiao et al., 2021)
Tumidispora shoreae	MFLUCC 14-0574	KT314074	KT314076	NA	NA	NA	(Ariyawansa et al., 2015)
Tumidispora shoreae	MFLUCC 12-0409	KT314073	KT314075	NA	NA	NA	(Ariyawansa et al., 2015)
Tumidispora thailandica	NCYU 19-0090	ON751751	NA	ON751740	NA	NA	(Tennakoon et al., 2023)
Tumidispora thailandica	MFLU 19-2771	ON751750	NA	ON751739	NA	NA	(Tennakoon et al., 2023)

Note The absence of GeneBank accession numbers is shown by “NA”

Table 3.5 The GenBank accession numbers of the adjacent orders used in the molecular clock analysis

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Asterina cestricola	TH 591	GU586215	GU586209	NA	NA	NA
Asterina fuchsiae	TH 590	GU586216	GU586210	NA	NA	NA
Asterina magnoliae	MFLU 16-0071	MN629745	NA	NA	NA	NA
Asterina neomangifera	MFLU 21-0038	MZ225596	NA	NA	NA	NA
Asterina phenacis	TH 589	GU586217	GU586211	NA	NA	NA
Asterina siphocampyli	MP 1324	HQ701140	NA	NA	NA	NA
Asterina weinmanniae	TH 592	GU586218	GU586212	NA	NA	NA
Asterina zanthoxyli	TH 561	GU586219	GU586213	NA	NA	NA
Asterostomella grewiae	MFLU 13-0629	MN364645	MN364416	NA	NA	NA
Prillieuxina winteriana	URM 90232	OP221710	NA	NA	NA	NA
Asterotexis cucurbitacearum	VIC 42814	NG_057054	NA	NA	NA	NA
Cylindrohyalospora fici	NCYUCC 19-0330	MW063244	NA	NA	NA	NA
Hemigrapha atlantica	Ertz 14014	KP456151	NA	NA	NA	NA
Lembosia mimusopis	MFLU 19-1225	MN563123	NA	NA	NA	NA
Lembosia albersii		KM386982	NA	NA	NA	NA
Lembosia xyliae	MFLU 14-0004	NG_059589	NA	NA	NA	NA
Cirsosia mangiferae	MFLU 21-0039	NG_148995	NA	NR_182545	NA	NA
Melaspileella proximella	Vondrak14216	NA	NA	MG773655	NA	NA
Morenoina calamicola	MFLUCC 14-1162	NG_059779	NG_065667	NR_154210	NA	NA

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Morenoina palmicola	MFLUCC 15-0284	MK120272	MK120299	NA	NA	NA
Oblongohyalospora macarangae	MFLUCC 18-0552	MW063241	NA	NA	NA	NA
Buelliella physciicola	Ertz 19173	KP456148	NA	NA	NA	NA
Buelliella poetschii	Ertz 18116	KP456150	NA	NA	NA	NA
Buelliella minimula	Lendemer 42273	KX244961	NA	NA	NA	NA
Karschia cezannei	Ertz 19186	NG_060323	NA	NA	NA	NA
Karschia talcophila	Diederich 16749	KP456155	NA	NA	NA	NA
Melaspileopsis cf. diplasiospora	Ertz 16247	KP456164	NA	NA	NA	NA
Labrocarpon canariense	Ertz 16308	KP456157	NA	NA	NA	NA
Stictographa lentiginosa	Ertz 17570	KP456170	NA	NA	NA	NA
Discopycnothyrium palmae	SH-2014	KM386979	NA	NA	NA	NA
Inocyclus angularis	VIC 39747	NG_060316	NA	NR_154069	NA	NA
Pirozynskiella laurisilvatica	FMR_13133	KY853520	NA	KY853459	NA	NA
Pirozynskiella laurisilvatica	CBS 138109	NG_058462	NA	NR_153488	NA	NA
Aeminium ludgeri	E19	MG938293	NA	MG938060	NA	NA
Saxispiralis lemnorum	PL132_A	OR081765	NA	OR081767	NA	OR074926
Capnodium aciculiforme	CBS 892.73	GU301847	GU296176	NA	GU349045	GU371736
Capnodium alfenasii	CBS 146151	MN749165	NA	MN749233	MN829346	MN829260
Capnodium blackwelliae	CBS 133588	NA	NA	MN749235	NA	NA
Capnodium coartatum	CPC 17779	MN749167	NA	MN749236	MN829348	MN829262

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Capnodium coffeae	CBS 147.52	DQ247800	DQ247808	MH856967	NA	KT216519
Capnodium coffeicola	MFLUCC 15-0206	NG_068231	NA	KU358921	NA	NA
Capnodium gamsii	CBS 146154	MN749169	NA	MN749239	MN829350	MN829264
Capnodium gardeniarum	CPC 14327	GU301807	GU296143	NA	GU349054	GU371743
Capnodium neocoffeicola	CBS 139613	MN749173	NA	MN749243	MN829354	MN829268
Capnodium paracoartatum	MFLUCC 14-0282	NG_073832	NG_070334	NR_169716	NA	NA
Capnodium paracoffeicola	CBS 139615	MN749175	NA	MN749245	MN829356	MN829270
Capnodium salicinum	CBS 131.34	MH866941	DQ677997	MH855469	NA	NA
Chaetocapnodium insulare	CBS 146159	NG_068681	NA	NR_168830	MN829359	MN829274
Chaetocapnodium philippinense	MFLUCC 12-0110	KP744503	NA	NR_168831	MN829362	MN829277
Chaetocapnodium placitae	CBS 124758	MH874920	NA	MH863403	MN829363	MN829278
Chaetocapnodium siamensis	CBS 139815	MN749181	NA	MN749252	MN829364	MN829279
Chaetocapnodium summerellii	CBS 146157	MN749176	NA	NR_168829	MN829357	MN829271
Chaetocapnodium tanzanicum	CBS 145.79	MN749182	NA	NR_168832	MN829365	MN829280
Chaetocapnodium thailandense	CBS 139619	MN749183	NA	NR_168833	MN829366	MN829281
Conidiocarpus asiaticus	MFLUCC10-0062	JN832612	JN832597	NA	NA	NA
Conidiocarpus caucasicus	GUMH937	KC833050	KC833051	NA	NA	NA
Conidiocarpus fici-septicae	MFLUCC 19-0072	MW063206	NA	MW063143	NA	NA
Conidiocarpus siamensis	SICAUCC 23-0010	OR405912	OR405927	OR405901	OR671432	OR465269

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Heteroconium citharexyli		HM628775	NA	HM628776	NA	NA
Kosmimatamyces alatophylus	ERA-2019a	LR588888	NA	LR588887	NA	NA
Leptoxyphium cacuminum	MFLUCC 10-0059	JN832603	NG_063545	NA	NA	NA
Leptoxyphium citri	CBS 146162	MN749195	NA	MN749267	MN829378	MN829294
Leptoxyphium fumago	CBS 123.26	MH866361	GU214535	MH854862	GU349051	GU371741
Leptoxyphium glochidion	IFRDCC 2651	KF982308	NG_065036	NR_155316	NA	NA
Leptoxyphium madagascariense	CBS 124766	MH874923	NA	MH863407	MN829380	MN829296
Leptoxyphium kurandae	CBS 129530	NG_064280	NA	NA	MN829379	MN829295
Leptoxyphium madagascariense	CBS 124766	MH874923	NA	MH863407	MN829380	MN829296
Phragmocapnias betle	CPC 21379	MN749223	NA	MN749295	MN829409	MN829325
Phragmocapnias plumeriae	MFLUCC 15-0205	NG_058933	NA	KU358919	NA	NA
Polychaeton citri	CBS 116435	GU214469	NA	GU214649	NA	MN829310
Rasutoria tsugae	ratstk	EF114705	EF114730	EF114688	NA	NA
Rasutoria pseudotsugae	rapssd	EF114704	EF114729	EF114687	NA	NA
Johansonia chapadiensis	CBS 128068	NG_057893	NA	NR_145100	NA	NA
Cippumomyces mortalis	CPC 41587	OK663795	NA	OK664756	NA	OK651181
Cippumomyces romamitchelliae	BRIP 72497a	OR673896	NA	OR673887	NA	NA
Fumiglobus pieridicola	BC F23788	NG_060400	NG_065012	NR_153985	NA	NA
Neoantennariella phylicae	CBS 146168	NG_068683	NA	NR_168835	MN829401	MN829317
Neoasbolisia phylicae	CBS 146163	NG_068682	NA	NR_168834	MN829397	MN829313

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Piedraia hortae	CBS 374.71	GU214464	NA	GU214645	NA	NA
Piedraia quintanilhae	CBS 327.63	NG_057850	NA	NR_160092	NA	NA
Alloscorias syngonii	SDBR-CMU355	MW263929	NA	MW263927	NA	MW269550
Fumagospora capnodioides	CBS 131.34	EU019269	NA	NA	NA	NA
Phaeoxyphiella australiana	CBS 146169	NG_068684	NA	NR_168837	MN829406	MN829322
Phaeoxyphiella phylicae	CBS 146170	MN749219	NA	NR_168836	MN829405	MN829321
Readerielliopsis fuscoporiae	CBS 139900	MH878654	NA	NR_137978	MN829410	MN829326
Readerielliopsis guyanensis	CBS 117550	NG_081444	NA	NR_176103	MN829411	MN829327
Scolecoxyphium blechni	CBS 146174	NG_070478	NA	NR_168838	MN829412	MN829328
Scolecoxyphium blechnicola	CBS 146175	NG_070479	NA	NR_168839	MN829413	MN829329
Scolecoxyphium leucadendri	CBS 146176	NG_070480	NA	NR_168840	MN829414	MN829330
Scolecoxyphium phylicae	CBS 146177	NG_070481	NA	NR_168841	MN829415	MN829331
Scorias aphidis	CBS 325.33	NA	NA	NA	MN829417	NA
Scorias camelliae	CBS 201.30	NA	NA	NA	MN829418	MN829333
Scorias leucadendri	CPC 17088	MN749229	NA	MN749301	MN829420	MN829335
Scorias mangiferae	MFLUCC 15-0230	NG_059604	NA	NR_154422	NA	NA
Scorias spongiosa	AFTOL-ID 1594	DQ678075	DQ678024	NA	DQ677920	DQ677973
Catenulomyces convolutus	TRN9	NA	AY843224	NR_153869	NA	NA
Perusta inaequalis	TRN272	NA	AY843253	NR_144958	NA	NA
Racoleus japonicus	TNSL-132529	LC779822	LC779816		NA	NA

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Ramimonilia apicalis	TRN437	NA	AY843263	AY843135	NA	NA
Stomiopeltis phyllanthi	C241	NA	MK347842	MK347734	NA	NA
Stomiopeltis syzygii	CPC 36323	NG_068323	NA	NR_166321	NA	NA
Stomiopeltis thailandica	NI101	OR498907	NA	OR498908	NA	NA
Stomiopeltis versicolor	GA3_23C2b	FJ147163	NA	NA	NA	NA
Cladoriella eucalypti	CPC 10953	DQ195790	DQ195801	DQ195778	NA	NA
Cladoriella kinglakensis	CPC 32730	NG_059055	NA	NR_156396	NA	NA
Cladoriella paleospora	CBS 124761	MH874922	NA	GQ303272	NA	NA
Cladoriella rubrigena	CBS 124760	MH874921	NA	GQ303273	NA	NA
Cladoriella xanthorrhoeae	CBS 144523	MK442516	NA	MK442574	NA	NA
Aliquandostipite crystallinus	AF007	EF175652	EF175631	NA	NA	NA
Aliquandostipite khaoyaiensis	MFLUCC 21-0106	MT860428	MT860445	MT864350	MT873577	MT873578
Ascagilis guttulaspora	MFLUCC 17-0244	NG_064432	KY828436	NA	NA	NA
Ascagilis submersa	MFLUCC 18-1143	MN888485	NG_073547	NR_171970	NA	NA
Ascagilis thailandensis	MFLUCC 18-1149	MN913693	NA	NR_171969	NA	NA
Brachiosphaera tropicalis	SS2523	JN819284	JN819287	FJ887923	JN819298	NA
Jahnula appendiculata	BCC11400	FJ743446	FJ743440	JN819280	JN819299	NA
Jahnula aquatica	R68-1	EF175655	EF175633	JN942354	NA	NA
Jahnula bipileata	SS44	EF175658	EF175637	JN819281	JN819300	NA
Jahnula dianchia	KUMCC 17-0039	KY928457	KY928458	KY928456	NA	NA
Jahnula granulosa	SS1567	EF175659	EF175638	NA	JN819301	NA

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Jahnula potamophila	F 111-1	GU266242	GU266225	NA	NA	NA
Jahnula rostrata	MFLU 20-0435	MT627657	MT864315	MT627720	NA	NA
Jahnula sangamonensis	A 402-1B	EF175661	EF175639	JN942349	NA	NA
Jahnula seychellensis	SS 2113.2	EF175664	EF175643	NA	NA	NA
Megalohypha aqua-dulces	AF 005-2a	EF175667	EF175646	NA	NA	NA
Neojahnula australiensis	MFLUCC 15-0975	MT627669	MT864305	MT627699	NA	NA
Speiropsis pedatospora	SS2229	JN819285	JN819290	FJ887926	JN819302	NA
Xylomyces chlamydosporus	SS2917	NA	JN819291	FJ887919	NA	NA
Manglicola guatemalensis	BCC20157	FJ743450	FJ743444	JN819282	NA	NA
Lichenothelia calcarea	L1323	KC015061	KC015081	NA	NA	NA
Lichenothelia convexa	L1609	KC015071	KC015086	NA	NA	NA
Lichenothelia intermixta	L2313	MH259028	MH259096	NA	NA	NA
Lichenothelia muriformis	L2303	MH259018	MH259086	NA	NA	NA
Lichenothelia papilliformis	L2316	MH259030	MH259098	NA	NA	NA
Acrocordia cavata	PRA-Vondrak23216	NA	NA	OQ717676	NA	NA
Acrocordia gemmata	PRA-Vondrak23867	NA	NA	OQ717677	NA	NA
Acrocordia subglobosa	HTL940	JN887392	JN887373	NA	JN887417	NA
Anisomeridium biforme	PRA-Vondrak19347	NA	NA	OQ717683	NA	NA
Anisomeridium guangdongensis	HMAS L0143783	NA	NA	NR_173292	NA	NA

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Anisomeridium guttuliferum	HMAS-L0143788	NA	NA	MN181443	NA	NA
Anisomeridium phaeospermum	MPN539	JN887394	JN887374	NA	NA	NA
Anisomeridium ubianum	MPN94	NA	JN887379	NA	JN887421	NA
Funbolia dimorpha	CPC:14170	JF951156	NA	JF951136	NA	NA
Haudseptoria typhae	CBS 146790	NG_076711	NA	NR_173011	NA	NA
Heleiosa barbatula	KUMCC 21-0462	OQ379426	OQ372923	OQ379015	OQ379000	KUMCC 21-0462
Megalotremis verrucosa	MPN104	GU327718	JN887383	NA	JN887426	NA
Neoheleiosa guizhouensis	GZAAS 19-1762	OR209659	OR134424	OR225052	OR140414	OR146928
Neoheleiosa lincangensis	HKAS 111914	NG_075423	NG_074969	NR_172455	MW430100	NA
Phellinocrescentia guianensis	CBS 138913	MH877671	NA	KP004454	NA	NA
Pseudopassalora gouriqua	CBS 101954	MH874368	NA	MH862773	NA	NA
Trypetheliopsis kalbii	MPN243	JN887406	JN887391	NA	JN887435	NA
Patellaria andina	G.M. 2003-05-28	NA	NA	MT293624	NA	NA
Patellaria apiculatae	MCD 096	MN017860	MN017925	MN047094	NA	NA
Patellaria atrata	CBS 958.97	GU301855	GU296181	NA	GU349038	GU371726
Patellaria chromolaenae	MFLUCC 17-1482	MT214475	MT214426	MT214381	MT235796	MT235829
Patellaria guizhouensis	GZCC 19-0222	OR209665	OR134437	OR225070	NA	NA
Patellaria microspora	MFLU 16-0567	MW142388	NA	MW136696	MW164800	NA
Patellaria quercus	CPC 27232	NG_059696	NA	NR_152540	NA	NA
Glyphium elatum	EB 0365	KM220939	KM220936	KM220945	KM220933	NA

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Hysteropatella elliptica	AFTOL-ID 1790	DQ767657	EF495114	NA	DQ767640	DQ767647
Hysteropatella prostii	G.M. 2016-02-20.2	MT341324	NA	MT341324	NA	NA
Yuccamyces citri	CBS 143161	MG386096	NA	MG386043	NA	NA
Yuccamyces pilosus	CBS 579.92	MG386097	NA	MG386044	NA	NA
Phaeotrichum benjaminii	CBS 541.72	NG_057709	NG_062645	NR_160140	NA	GU357788
Phaeotrichum setosum	CBS 151.77	MH872810	NA	MH861042	NA	NA
Trichodelitschia bisporula	CBS 262.69	MH871039	GU296202	MH859305	GU349020	GU371802
Trichodelitschia munkii	Kruys 201	DQ384096	DQ384070	NA	NA	NA
Natipusilla bellaspora	PE91_1a	NG_228724	NG_062154	NA	NA	NA
Natipusilla decorospora	AF236_1A	NG_060263	NG_061107	NA	NA	NA
Natipusilla limonensis	AF286_1A	NG_060264	NG_062150	NA	NA	NA
Natipusilla naponensis	AF217_1A	HM196371	NG_062151	NA	NA	NA
Clypeococcum placopsiiphilum	Diederich 17576	KT383789	NA	NA	NA	NA
Polycoccum pulvinatum	Diederich 17389	KT383805	NA	NA	NA	NA
Mycomicrothelia hemispherica	102	GU327719	NA	NA	NA	NA
Trypethelium eluteriae	CBS 132375	MH877491	NA	NA	NA	NA
Cylindrosympodium variabile	CBS 563.82	NG_070448	NA	NR_168776	NA	NA
Pseudoanungitea syzygii	FMR 11934	KY853484	NA	KY853424	NA	NA
Pseudoanungitea vaccinii	CPC 30523	MK810787	NA	MK810900	MK888725	MK887795

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Pseudoanungitea variabilis	CBS 132716	NA	NA	NA	MK442710	MK442678
Sympodiella acicola	CBS_487.82	KY853530	NA	KY853468	MK442717	MK442681
Sympodiella alternata	CBS 326.69	NA	NA	MK442626	MK442718	MK442682
Sympodiella quercina	CBS 145028	MK442562	NA	MK442627	MK442721	MK442684
Tothia fuscella	CBS 130266	MH877042	NA	MH865619	NA	NA
Tothia spartii	MFLU 14-0739	KR025865	NA	KR025861	NA	NA
Acroconidiellina arecae	NFCCI 3696	KX306776	NA	KX306747	NA	NA
Bellamyces quercus	CPC 28858	MK810788	NA	MK810901	NA	MK887796
Clavatispora thailandica	MFLUCC 17-0072	OL782074	OL780529	OL780496	OL875111	NA
Echinocatena arthrinioides	HKU56	LC158623	LC159308	LC158598	LC439293	NA
Fuscohilum rhodensis	CBS 121641	NG_073681	NA	NR_170746	MK888733	MK887802
Fuscohilum siciliana	CBS 105.85	NG_073682	NG_070110	MK810910	MK888734	MN091924
Fusicladium caryigenum	ATCC 58912	AY352591	NA	AY361999	NA	NA
Fusicladium eucalyptigenum	CBS:145543	MK876431	NA	NR_165562	NA	NA
Fusicladium proteae	CBS 130599	MH877282	NA	MH865855	NA	NA
Fusicladium ramoconidii	CBS 462.82	MH873263		MH861516		
Guizhoumyces acicularis	GUCC 18195	MZ503757	NG_087894	NR_184938	MZ546870	MZ546866
Matsushimaea fasciculata	GUCC 18239	MZ503758	MZ503651	MZ503725	NA	MZ546867
Matsushimaea monilioides	FMR 16505	NG_066393	NA	NR_160581	NA	NA

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Melnikomyces longisporus	HGUP18226	NG_228854	NG_087875	NR_184925	MT739516	NA
Melnikomyces thailandicus	CBS 145767	NG_068685	NA	NR_166358	NA	NA
Melnikomyces vietnamensis	CBS 136209	NG_058087	NA	NR_164227	NA	NA
Mycosisymbrium cirrhosum	GUFCC 18012	KR259884	KR259885	KR259883	NA	NA
Neocoleroa cameroonensis	CBS 129041	NG_073680	NA	NR_170744	MK888727	MK887797
Neocoleroa metrosideri	PDD 107531	NG_059638	NA	NR_138417	NA	NA
Neofusicladium eucalypti	CBS 128216	MK810790	NA	NR_170745	MK888728	MK887798
Neofusicladium eucalypticola	CBS 141301	MH878215	NA	MK810904	MK888729	MK887799
Neofusicladium regnans	CBS 144605	MK442563	NA	MK442628	MK442722	NA
Parafusicladium amoenum	CBS 254.95	MK810793	NA	NR_168748	MK888730	NA
Parafusicladium intermedium	CBS 110746	MK810794	NA	NR_168749	MK888731	MK887800
Parafusicladium paraamoenum	CBS 141322	MK810795	NA	MK810908	MK888732	MK887801
Pinaceicola cordae	CBS 675.82	MH873281	NA	MH861540	MK888736	NA
Pinaceicola pini	CBS 463.82	MK810802	NA	NR_156206	MK888739	MK887804
Pseudosigmoidea alnicola	CBS 145034	MK442556	NA	MK442620	NA	NA
Pseudosigmoidea excentrica	CBS 469.95	NG_058019	NG_065605	NR_156545	NA	NA
Scolecobasidium acanthi	LC19368	OQ448949	NA	OQ448957	OQ442215	OQ442212
Scolecobasidium aegiceratis	LC19370	OQ448951	NA	OQ448959	OQ442217	OQ442214
Sterila eucalypti	CBS 144019	NG_073683	NA	NR_170747	MK888742	MK887807

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Sympoventuria africana	CBS 121639	NG_073684	NA	NR_170748	MK888743	MK887808
Sympoventuria capensis	CBS 120136	MH874632	NA	DQ885906	MK888745	NA
Sympoventuria eucalyptorum	CPC 43332	OQ629063	NA	OQ628481	OQ627951	NA
Troposporella fumosa	MUCL 15695	AY856914	AY856953	DQ351724	NA	NA
Troposporella monilipes	MUCL 19867	AY856871	AY856920	DQ351723	NA	NA
Veronaeopsis simplex	CBS 588.66	NG_070358	NG_061164	NR_164225	NA	MN091925
Verruconis calidifluminalis	CBS 125818	NG_057985	NG_062984	MH875239	KF155959	NA
Verruconis cylindricalis	GUCC 18299	NG_228896	NG_087901	MZ503754	MZ546900	NA
Verruconis gallopava	CBS 437.64	NG_058016	NG_062995	NR_149335	AB569128	AB569127
Yunnanomyces pandanicola	MFLUCC 17-2260	NG_073623	NG_070295	NR_169937	MH388403	MH412736
Yunnanomyces phoenicis	MFLUCC 19-0254	MK976738	MK976740	NA	MK986486	MK986484
Apiosporina collinsii	CBS 118973	GU301798	GU296135	EF114691	GU349057	GU357778
Apiosporina morbosa	dimosp	EF114694	EF114718	NA	NA	NA
Coleroa circinans	CBS 457.64	MH870118	NA	MH858485	MK888753	MK887818
Coleroa robertiani	CBS 458.64	MK810818	NA	MK810932	MK888754	MK887819
Cylindrosympodioides brabeji	CPC 25934	KX228308	NA	KX228256	NA	NA
Fagicola fagi	CBS 621.84	NG_073686	NA	NR_157415	MK888755	MK887820
Fraxinicola europaea	CBS 472.61	NG_070938	NA	NR_171286	MK888756	MK887821
Fraxinicola fraxini	CBS 140930	NG_070939	NA	MK810940	MK888762	MK887827

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Fraxinicola italica	CBS 140918	NG_070940	NA	NR_170750	MK888765	MK887830
Gibbera conferta	CBS 191.53	GU301814	GU296150	NA	GU349041	GU357758
Helicoon myosuroides	CBS 743.96	NG_068577	NA	NR_168778	NA	NA
Helicoon pluriseptatum	CBS 208.53	MH868699	NA	MH857163	NA	NA
Magnohelicospora fuscospora	CBS 206.53	MH868697	NA	MH857161	NA	NA
Metacoleroa dickiei	medipc	EF114695	EF114719	NA	NA	NA
Protoventuria alpina	CBS 373.53	MH868783	NA	MH857249	KF853964	NA
Protoventuria barriae	CBS 300.93	JQ036232	NA	MK810949	MK888771	MK887836
Tyrannosorus hystrioides	CBS 117727	NG_068578	NA	MK810950	MK888772	MK887837
Tyrannosorus lichenicola	CBS 144018	MK810838	NA	MK810953	MK888775	MK887840
Tyrannosorus pinicola	AFTOL-ID 1235	DQ470974	DQ47102	NA	DQ471098	DQ470928
Venturia aceris	CBS 372.53	MH868782	NA	EU035445	NA	NA
Venturia albae	CBS 471.61	MK810840	NA	NR_170752	MK888777	MK887842
Venturia inaequalis	CBS 309.31	MH866676	NA	MH855224	NA	NA
Zeloasperisporium cliviae	CBS 139915	NG_058173	NA	NR_138000	NA	NA
Zeloasperisporium eucalyptorum	CBS 124809	GQ303329	NA	MH863416	NA	NA
Zeloasperisporium ficusicola	MFLUCC 15-0221	NG_059598	KT387734	NA	NA	NA
Zeloasperisporium hyphopodioides	CBS 218.95	NA	NA	EU035442	NA	NA
Zeloasperisporium pterocarpi	MFLUCC 17-0910	MH763755	MH763756	MH763754	NA	NA
Zeloasperisporium searsiae	CPC 25880	NG_059617	NA	NR_155970	NA	NA

Table 3.5 (continued)

Species	Culture/voucher	LSU	SSU	ITS	TEF	RPB2
Zeloasperisporium siamense	IFRDCC 2194	NG_059944	JQ036223	NA	NA	NA
Zeloasperisporium spartii	HKAS 124663	NG_242021	OP555444	NA	NA	NA
Zeloasperisporium wrightiae	MFLUCC 15-0225	NG_059599	KT387738	NA	NA	NA

Note The absence of GeneBank accession numbers is shown by "NA"

3.4 Results

3.4.1 Phylogenetic Analysis

The phylogenetic tree of the family Lichenoconiaceae (Abrothallales) was constructed using RAxML, incorporating 89 strains and 2277 aligned characters including gaps (ITS: 1–526; LSU: 527–1403; TEF1: 1404–2277). *Patellaria chromolaenae* (MFLUCC 17-1482) and *P. guizhouensis* (GZCC 19-0222) from Patellariaceae (Patellariales) were used as outgroup taxa (Figure 3.1). The resulting phylogenetic tree reveals three well-supported clades. The first and largest clade (labeled A) comprises 18 species of *Abrothallus* and 10 strains of *Lichenoconium*. Within this clade, Abrothallus species form three distinct subclades: subclade A1 includes 17 species of *Abrothallus*, subclade A2 consists of *Lichenoconium* taxa, and subclade A3 contains three strains of *A. lobariae* and one strain of *A. cladoniae*, along with an unidentified species. The second clade (labeled B) contains 11 previously described *Abrothallus* species along with five newly identified species introduced in this study. Among these, *Abrothallus flavoparmeliae*, *A. parmelioidea*, and *A. myelochroae* form a well-supported subclade together with nine previously described species. Another well-supported subclade includes two new species, *A. hypogymniaum* and *A. yunnanensis*, grouped with *A. altoandinus*. Additionally, two strains of *Abrothallus usneae* form the third independent, strongly supported clade (labeled C).

Based on their host specificity, these species can be categorized into two ecological groups: those colonizing lichens of the order Peltigerales and those inhabiting lichens of the family Parmeliaceae.

The phylogenetic analysis comprises 16 orders, including Abrothallales, the adjacent 12 orders, and three calibrated orders comprising fossils (Figure 3.2). The final dataset comprises 380 strains with 4127 aligned characters, including gaps (ITS: 1–535, LSU: 536–1378, RPB2: 1379–2236, SSU: 2237–3245, TEF1: 3246–4127). The best fit substitution model of each gene is GTR+F+R6 (ITS), TIM3+F+R6 (LSU), SYM+I+G4 (RPB2), TNe+R4 (SSU), GTR+F+R5 (TEF). The strains *Orbilia auricolor* (AFTOL-ID 906) and *O. vinosa* (AFTOL-ID 905) (Orbiliomycetes, Orbiliomycetidae, Orbiliales, Arthrobotryaceae) were employed as outgroups, following Hongsanan et al. (2020).

Within Abrothallales clade, 39 taxa belonging to one family and two genera are included. Notably, *Abrothallus* is polyphyletic, whereas *Lichenoconium* is monophyletic. The genus *Lichenconium* forms a distinct subclade nested within one *Abrothallus* subclade, sharing a common node with other *Abrothallus* taxa. The sister clade of Abrothallales is Jahnulales, which includes two families and eight genera, with strong statistical support. The clade sister to Abrothallales-Jahnulales is the Asterinales-Cladoriellales clade, comprising two highly supported individual clades.

The orders Muyocopronales and Pleosporales form a sister clade closely related to the clade comprising the four aforementioned orders. Since Pleosporales has been extensively studied in previous studies, only a limited number of representative taxa were included in this study, selected based on the MCC tree from Hongsanan (2020a). These taxa represent key evolutionary lineages, including the earliest-diverging families (Delitschiaceae, Fusculinaceae, Massariaceae, and Neomassariaceae), the most recently diverging family (Neocamarosporiaceae), and the extant genus *Aigialus* associated with the fossil *Margaretbarromyces dictyosporus*. Together, these taxa form a highly supported clade, which is sister to the Muyocopronales clade. The clade sister to the combined Muyocopronales-Pleosporales group is Patellariales, comprising one

family and four genera. Among these, only the genus *Patellaria* forms a highly supported clade.

Capnodiales has previously been used as a calibration point, as the fossil Metacapnodiaceae was hypothesized to represent the common ancestor of the order. However, in this study, Capnodiales was included solely as one ingroup to re-estimate its divergence time. The Capnodiales and Tripetheliales form a clade, which is sister to another clade comprising Monoblastiales and Lichenotheliales. All these clades are well-supported, except for Lichenotheliales, which contains only one genus with five species.

The remain five orders all form well supported clades. Venturiales is a prominent order comprising three families: Cylindrosympodiaceae, Sympoventuriaceae, and Venturiaceae. Each family forms a well-supported subclade, with Sympoventuriaceae including 22 genera, Venturiaceae 14 genera, and Cylindrosympodiaceae 4 genera. Sister to Venturiales, Microthyriales includes a single family with eight genera and forms a strongly supported clade. Notably, the type genus *Microthyrium* is polyphyletic based on the phylogenetic tree. Another sister clade to the Venturiales-Microthyriales group consists of Natipusillales, Phaeotrichales, and Zeloasperisporiales, each containing a single family and genus, all of which form well-supported clades.

3.4.2 Divergence Times Analysis

In the divergence times analysis, the initial 101,785 trees (20%) were considered as the burn-in phase and subsequently discarded. The remaining 407,138 trees were then summarized. The resulting chronograms are shown in Figure 3.3. The first calibration *Aigilus* is with the crown age of 44 (37–54) Mya. The genus *Muyocopron* is with the crown age of 58 (55–62) Mya and the order Muyocopronales is with the crown age of 116 (97–139) Mya. The order Microthyriales is with the crown age of 193 (165–224) Mya. The crown age of Dothideomycetes is 276 (235–320) Mya. The crown age of Abrothallales is 99 (71–132) Mya. The crown age of the other 12 orders is labeled

on the joint of the order in Figure 3.3.

The crown ages of the genera or order calibrated using three fossils in this study and the comparisons to previous studies are listed in Table 3.6. A detailed comparative analysis of the crown age of fossils is presented in the discussion section. The crown ages of all orders in this study and the comparisons to previous studies are listed in Table 3.7.

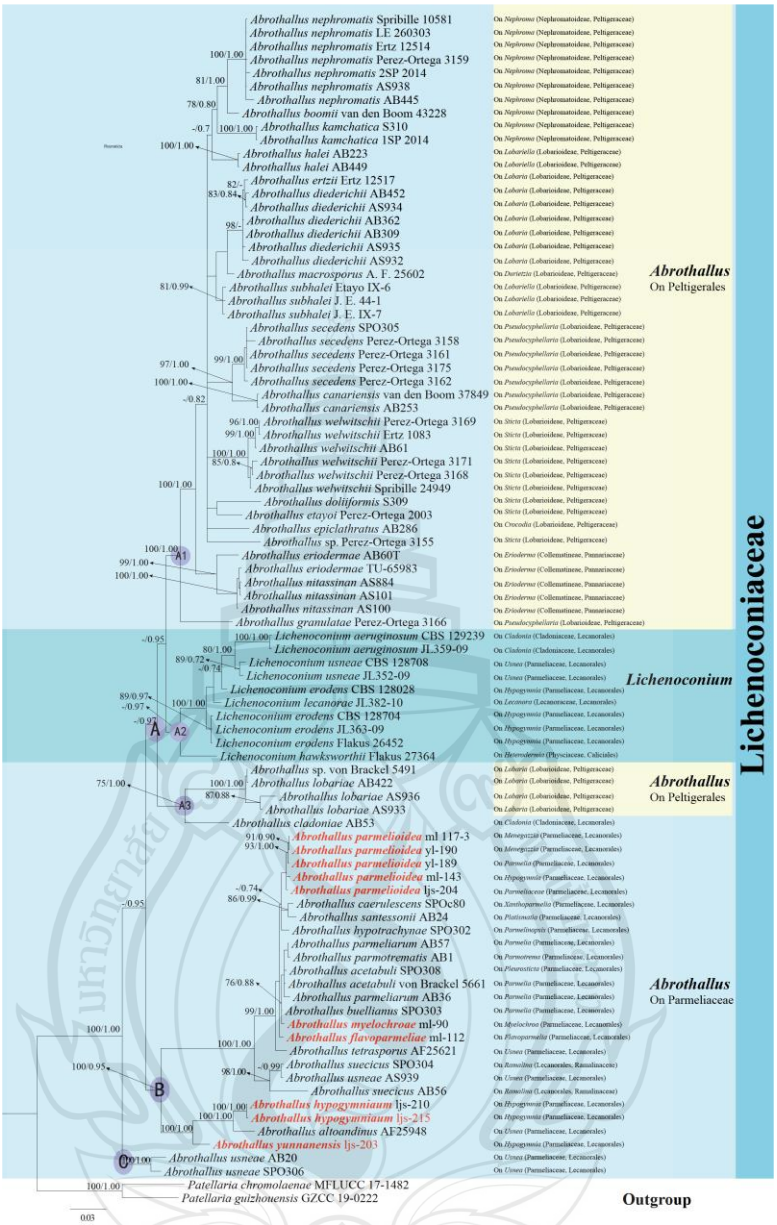
Table 3.6 The crown age of the fossils used for calibrations.

Crown calibrating point	**Designated crown age /Mya**	**Fossil taxa**	**References**	**This study /Mya**
Aigialus (A1)	34	*Margaretbarromyces dictyosporus*	(Mindell et al., 2007)	44.13 (37–54)
Muyocopron (A1)	54	*Muyocopron mucoris* and *M. neyveliensis*	(Pitman et al., 2012)	58.05 (55–62)
Microthyriales (A1)	145	*Phragmothyrites* sp. & *Microthyriacites* sp.	(Krassilov, 1967)	193.02 (165–224)
Dothideomycetes (A2)	321 (247–427)		(Beimforde et al., 2014)	276.19 (235–320)
	293 (213–371)		(Phukhamsakda et al., 2016)	
	366		(Liu et al., 2017)	
	286		(Zhang et al., 2019)	
	367		(Hongsanan et al., 2020)	

Note A1- the first calibration, A2- the secondary calibration

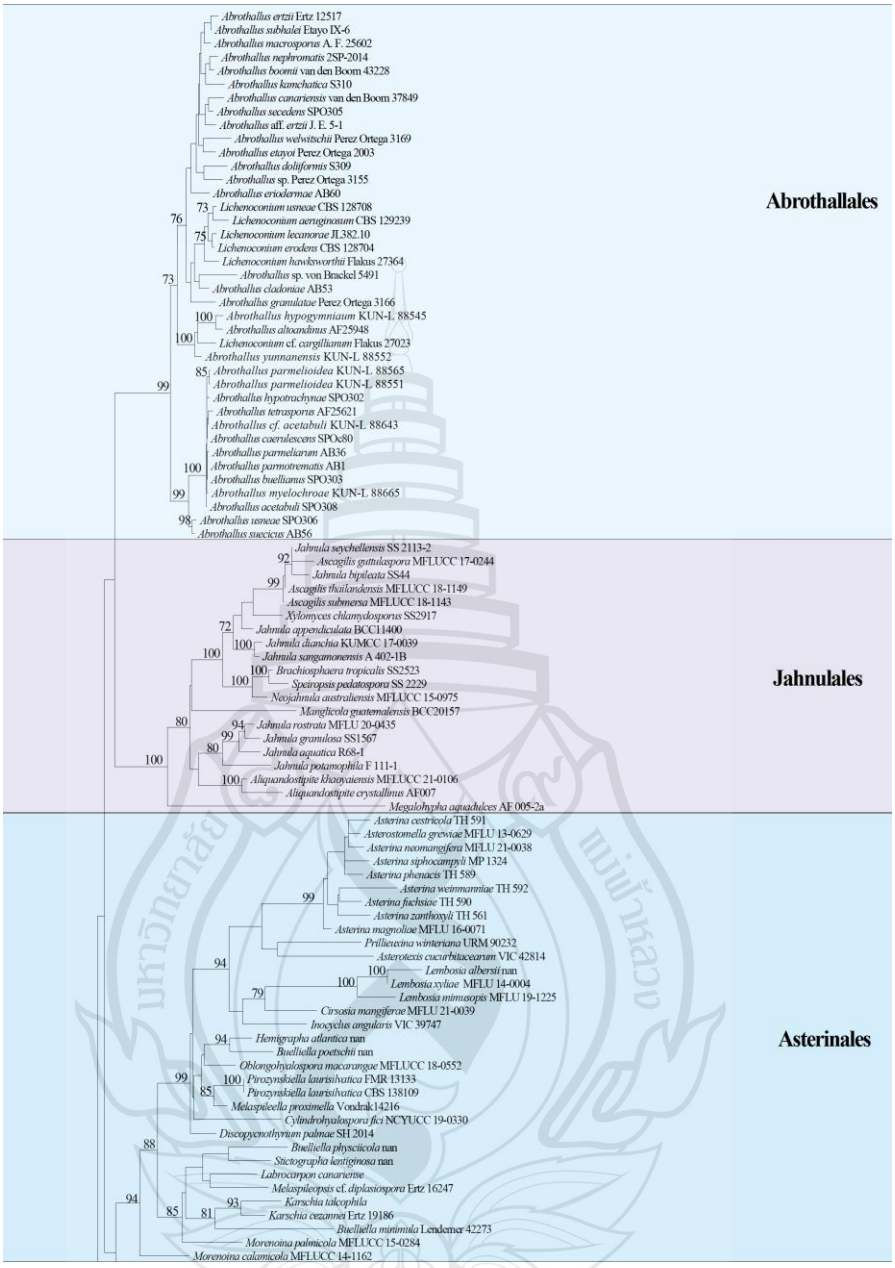
Table 3.7 The comparison of crown ages between this study and previous studies

Orders	Liu et al. (2017)		Hongsanan et al. (2020)		This study	
	Crown age /Mya	Taxa	Crown age / Mya	Taxa	Crown age / Mya	Taxa
Abrothallales	56 (24–102)	6	58.84	4	100.26 (72–134)	33
Asterinales	84 (43–132)	7	192.42	17	193.22 (154–236)	33
Capnodiales	216 (151–283)	28	178.25	32	164 (128–203)	69
Cladoriellales	6 (0.5–17)	2	90.58	2	89.57 (45–143)	5
Lichenotheliales	46 (12–112)	2	47.8	2	69.78 (30–124)	5
Jahnulales	118 (54–190)	5	96.87	4	145 (112–179)	20
Microthyriales	141 (84–217)	2	118.31	2	192.79 (166–223)	33
Monoblastiales	148 (83–228)	4	113.5	2	138.25 (102–183)	17
Muyocopronales	NA		103.85	2	115.67 (96–137)	37
Natipusillales	103 (56–157)	4	56.97	2	91.21 (57–131)	4
Patellariales	164 (72–283)	3	30.82	2	177.25 (120–225)	12
Phaeotrichales	79 (18–146)	3	65.3	2	34.66 (17–60)	4
Pleosporales	204 (148–260)	167	192.65	172	146.02(116–179)	14
Trypetheliales	215 (140–298)	10	248.91	4	165.56 (93–240)	4
Venturiales	189 (112–274)	9	120.35	3	200.23 (166–235)	74
Zeloasperisporiales	54 (21–98)	3	42.53	2	63.54 (36–102)	9



Note Bootstrap support values of maximum likelihood (ML) ≥ 70%, and Bayesian posterior probabilities (PP) ≥ 0.90 are marked above the nodes as ML/ PP. Hyphen (-) represents support values < 70 % ML and < 0.90 PP. *Patellaria chromolaenae* (MFLUCC 17-1482) and *P. guizhouensis* (GZCC 19-0222) were used as the outgroup. The newly generated sequences are shown in red bold font.

Figure 3.1 Phylogram generated from the maximum likelihood and Bayesian analysis based on a combined of LSU, ITS, mtSSU, TEF1 and RPB2 sequence data.



Note Maximum Likelihood Bootstrap values (ML) ≥ 70 % is given at the nodes. An original isolate number or voucher number is noted after the species name. The tree is rooted to *Orbilia auricolor* (AFTOL-ID 906) and *O. vinosa* (AFTOL-ID 905).

Figure 3.2 Phylogram generated from maximum likelihood analysis (RAxML) of parts orders of Dothideomycetes based on combined LSU, SSU, ITS, TEF1 and RPB2 sequence data.

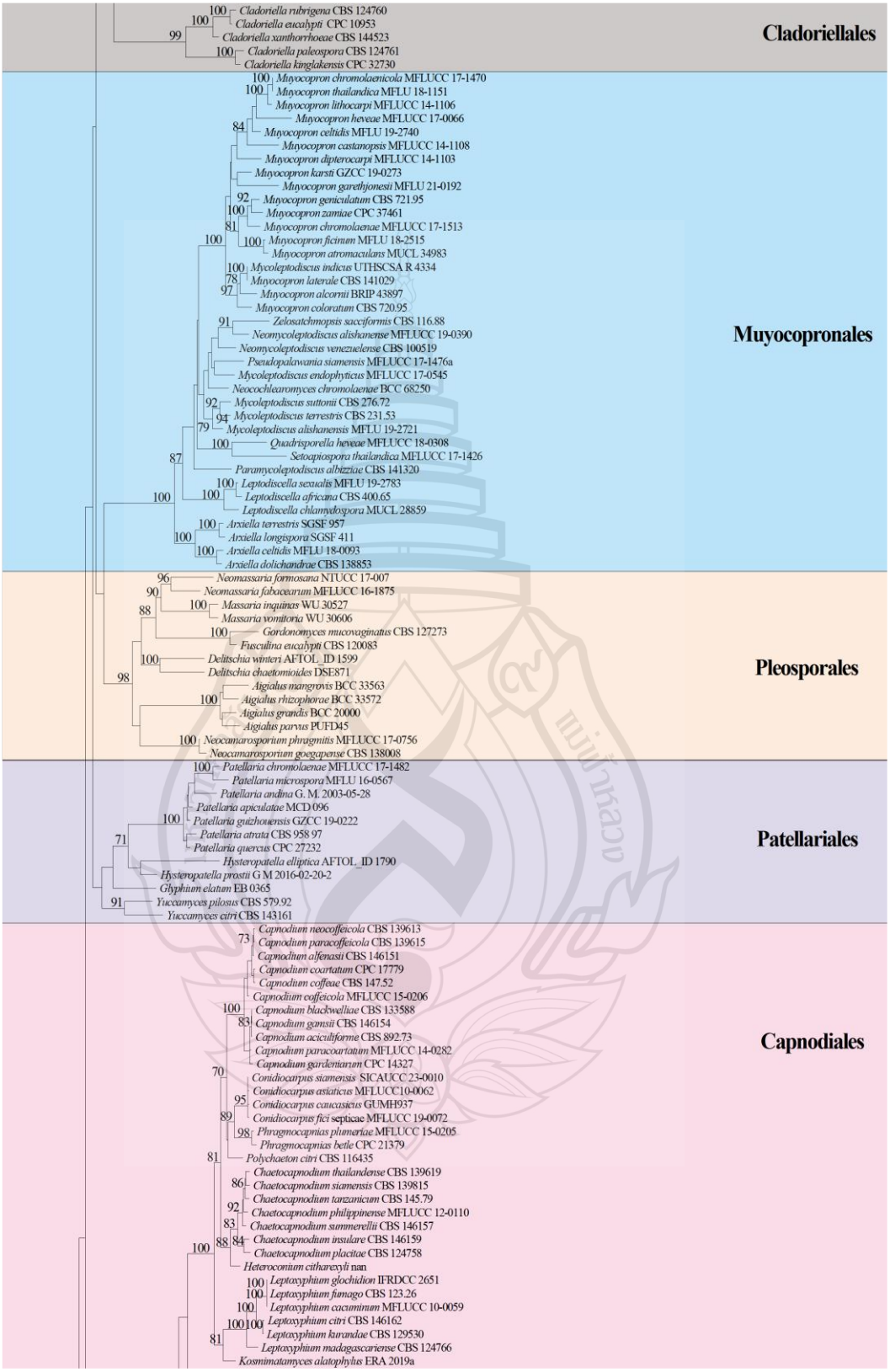


Figure 3.2 (continued)

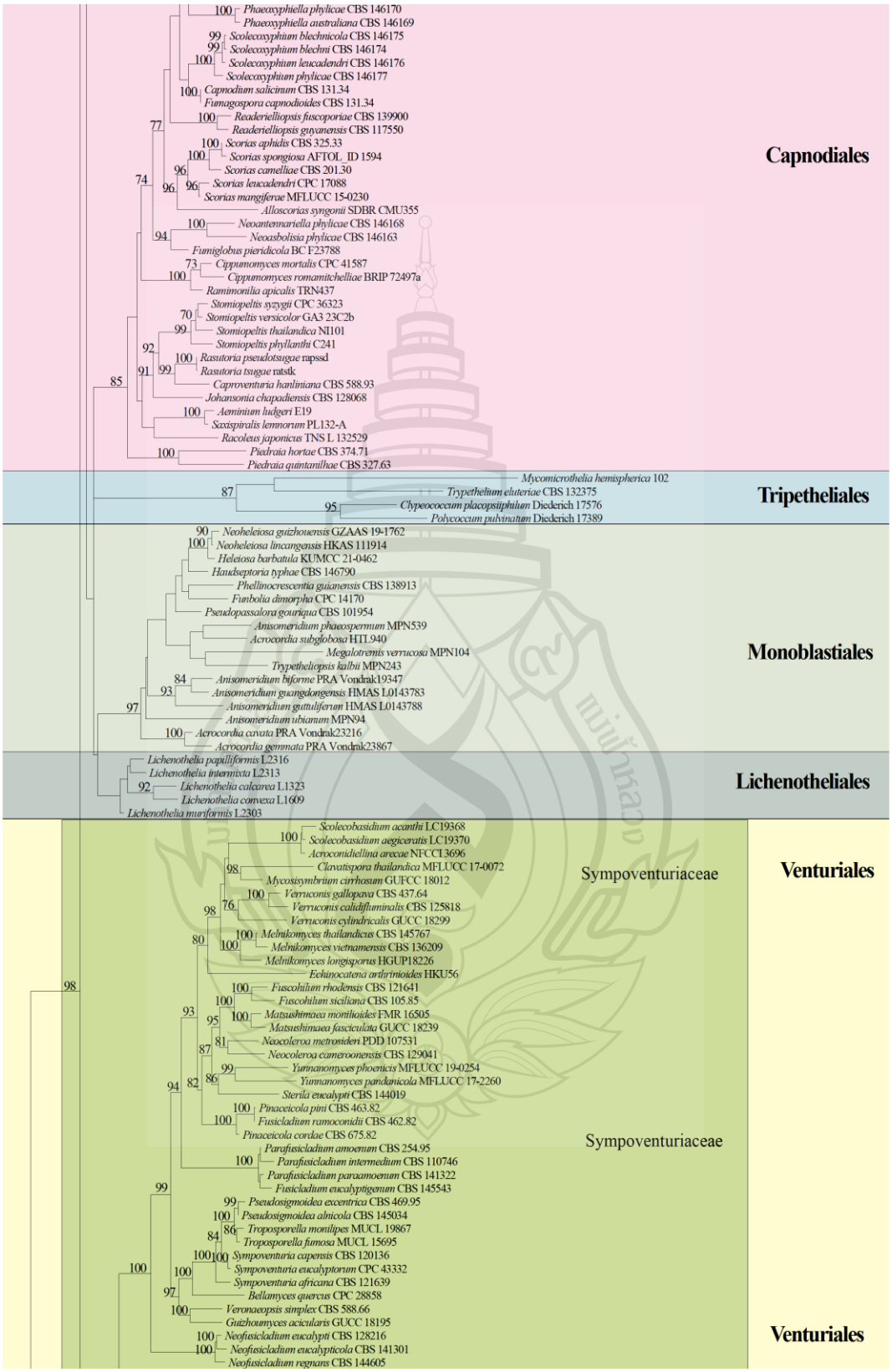


Figure 3.2 (continued)

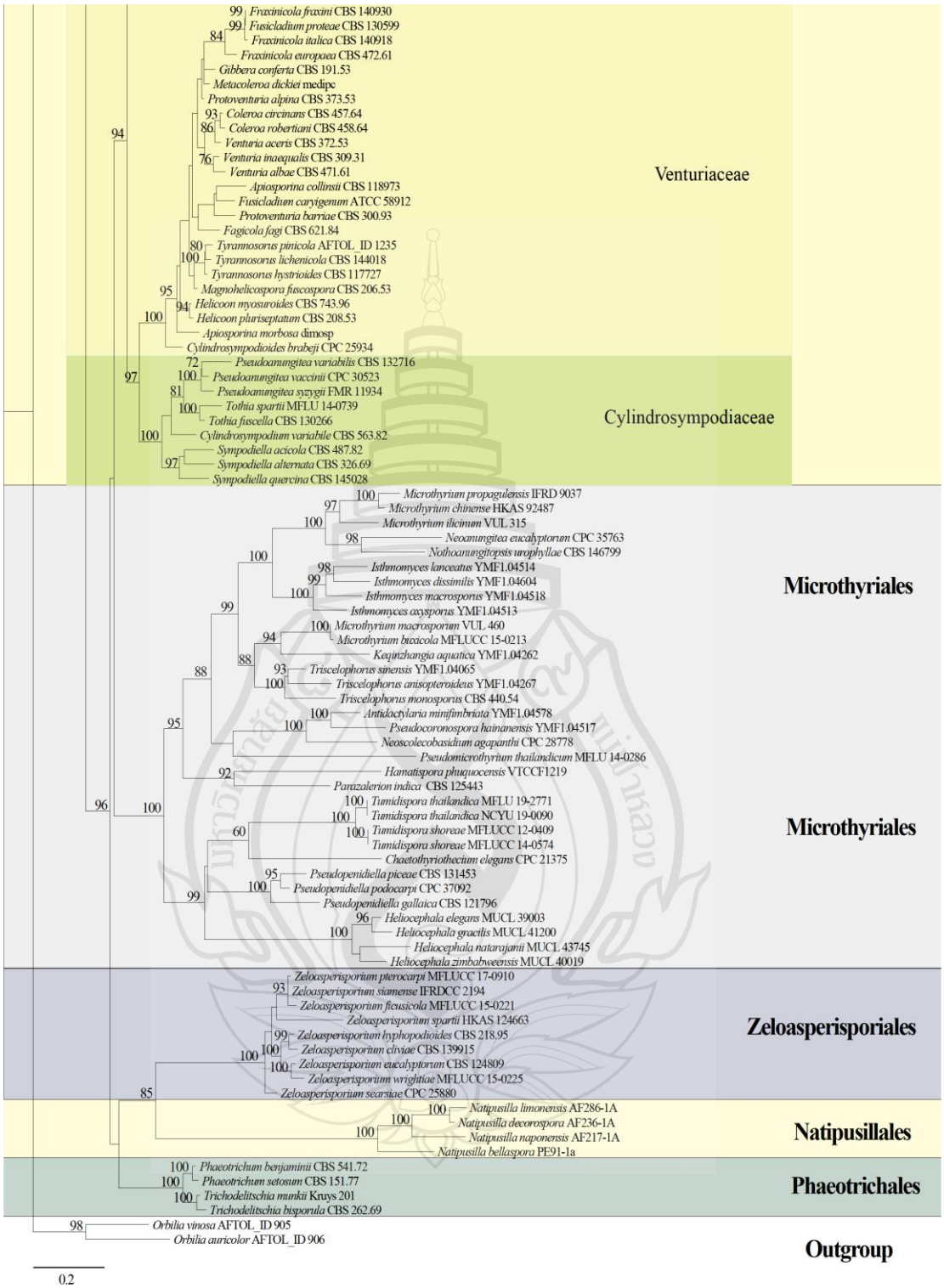
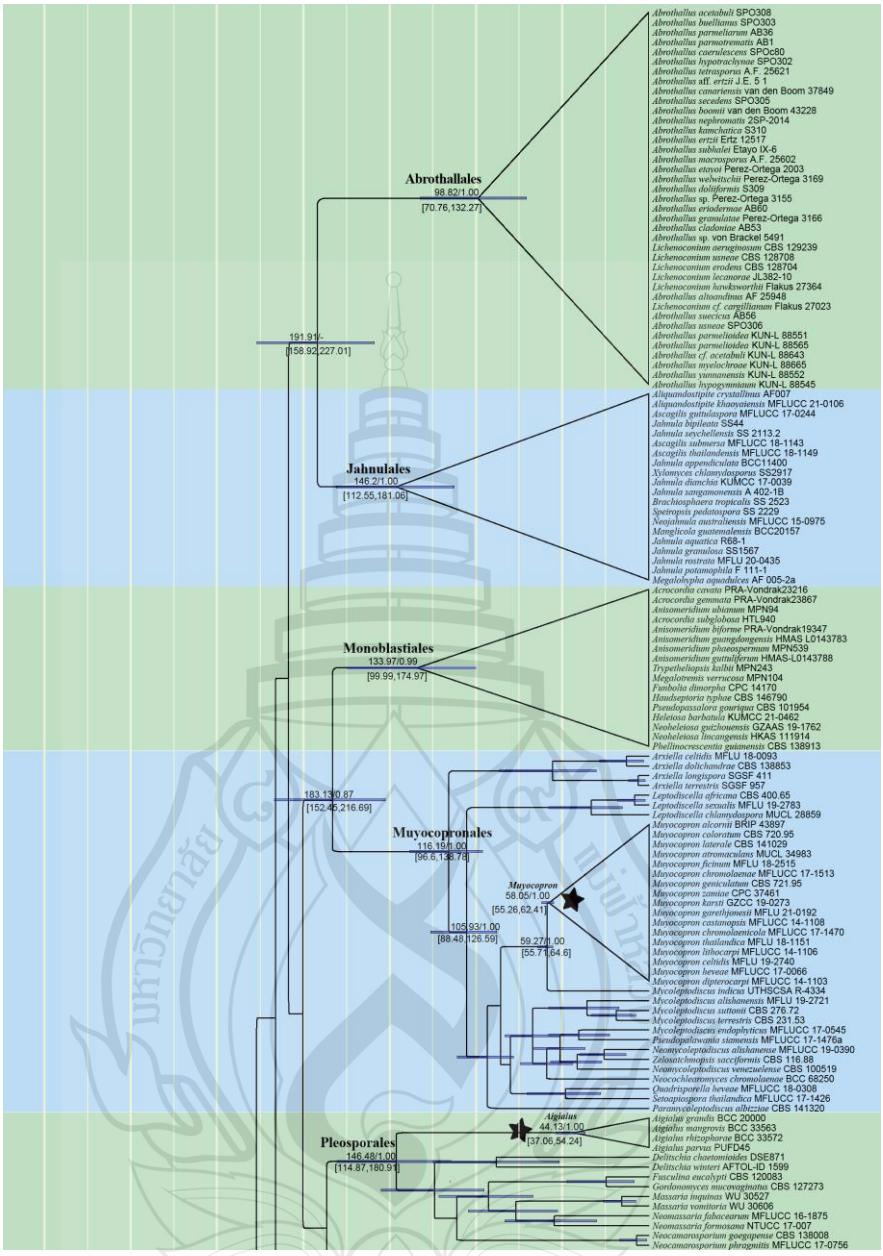


Figure 3.2 (continued)



Note The tree was generated using a Bayesian approach (BEAST), incorporates three primary calibrations (black stars near the nodes) and one secondary calibration (red star near the node). Order names, height medians, posterior probabilities (>0.90), and 95% HPD intervals are labeled at the crown nodes of each order, with bars illustrating the 95% HPD ranges. The scale axis represents divergence times in millions of years ago (Mya), with the time axis displayed along the bottom of the tree.

Figure 3.3 The maximum clade credibility (MCC) tree of orders in Dothideomycetes

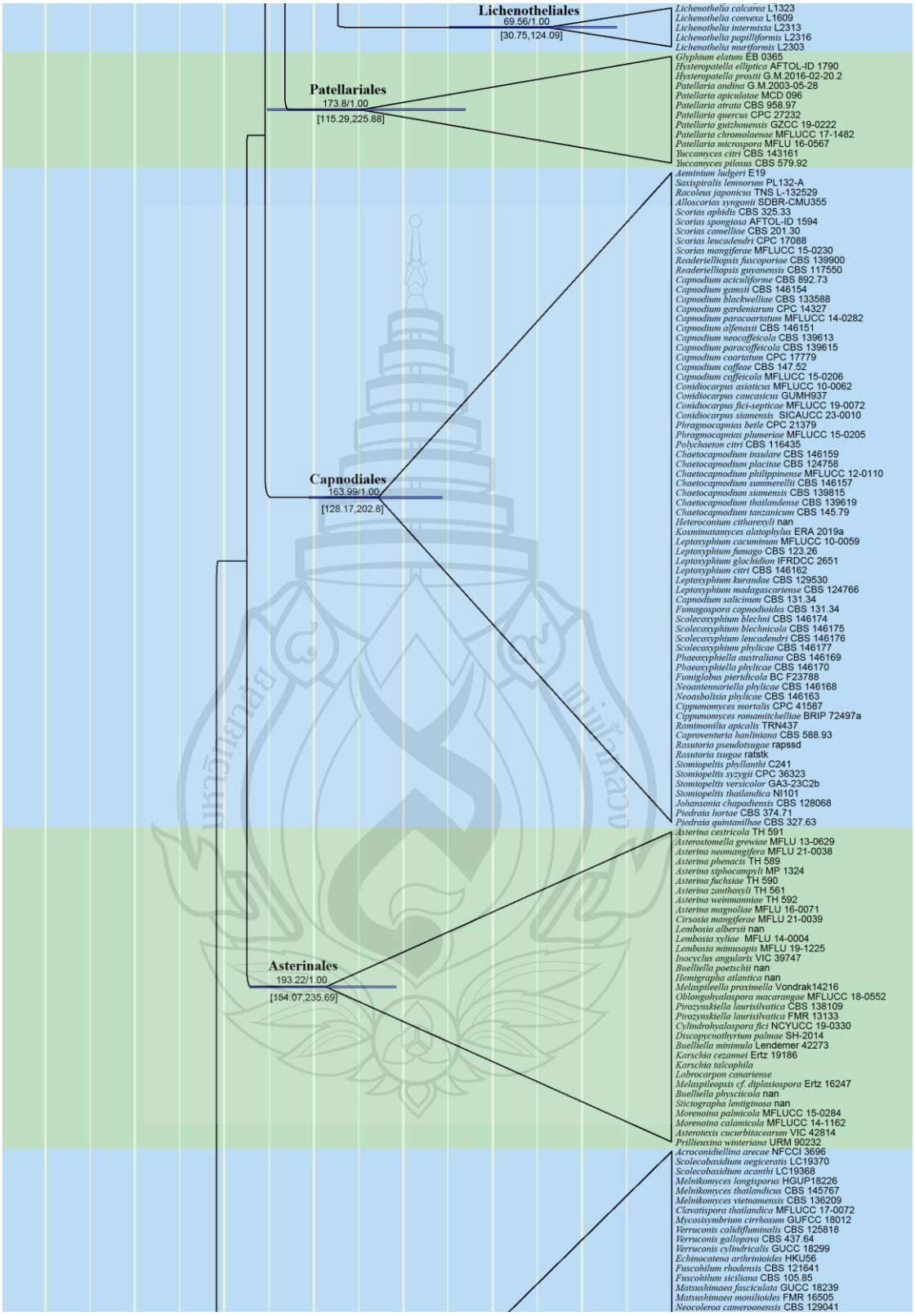


Figure 3.3 (continued)

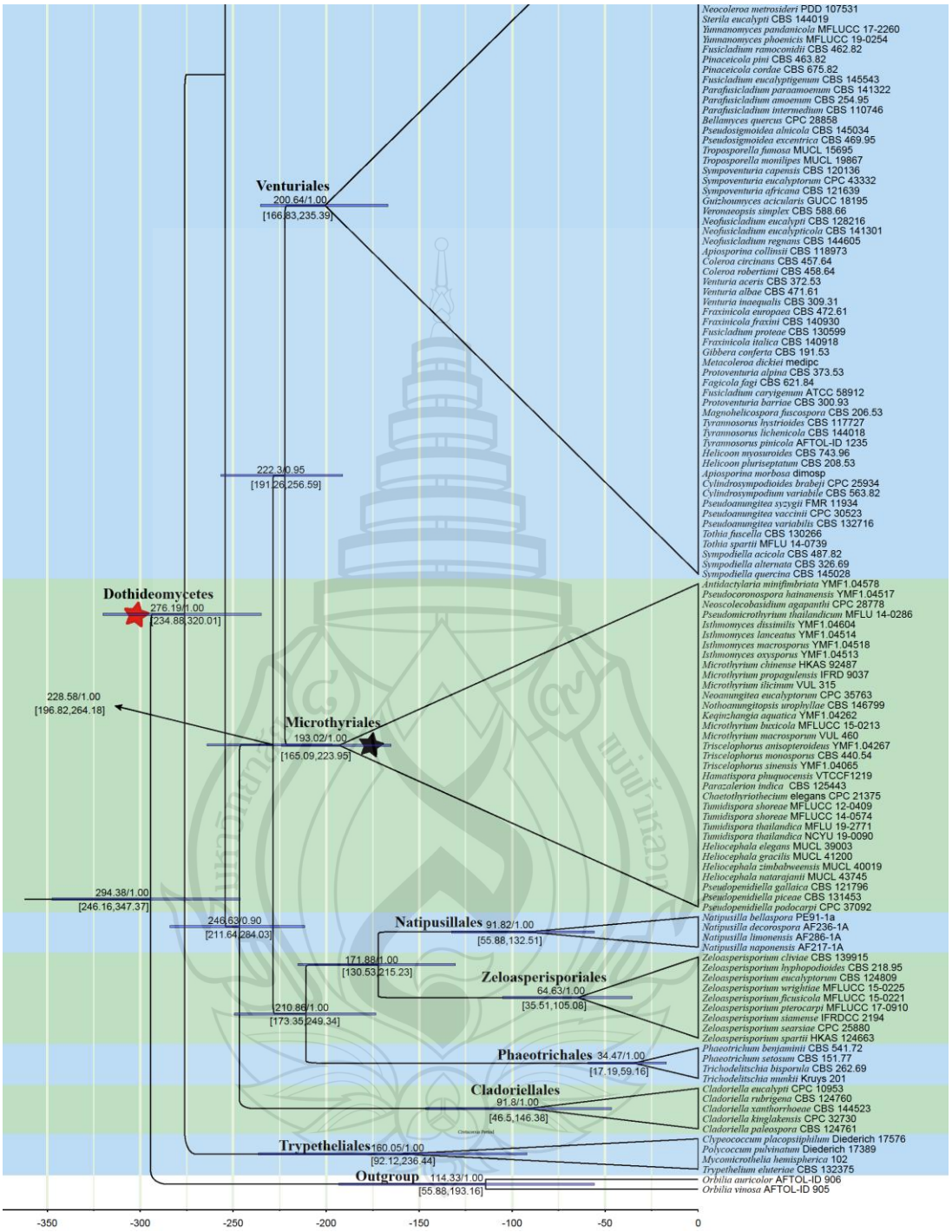


Figure 3.3 (continued)

3.4.2 Divergence Times Analysis

In the divergence times analysis, the initial 101, 785 trees (20%) were considered as the burn-in phase and subsequently discarded. The remaining 407,138 trees were then

summarized. The resulting chronograms are shown in Figure 3.3 The first calibration *Aigilus* is with the crown age of 44 (37–54) Mya. The genus *Muyocopron* is with the crown age of 58 (55–62) Mya and the order Muyocopronales is with the crown age of 116 (97–139) Mya. The order Microthyriales is with the crown age of 193 (165–224) Mya. The crown age of Dothideomycetes is 276 (235–320) Mya. The crown age of Abrothallales is 99 (71–132) Mya. The crown age of the other 12 orders is labeled on the joint of the order in Figure 3.3.

3.4.3 A key to the Species of the Genus *Abrothallus*

1. The asexual morph is the only feature.

1.1. The lichenicolous fungus is only characterized by asexual morph……2

1.2. The fungus is characterized by a sexual morph, sometimes accompanied by an asexual morph…… ……6

2.1. The conidiomata size are less than 500 µm diam……3

2.2. The conidiomata size are greater than 500 µm diam…… ……*Abrothallus brattii* (S.Y. Kondr.) Suija & Pérez-Ort.

3. The conidia size is different

3.1. The conidia are more than 10 µm……4

3.2. The conidia are less than 10 µm……..5

4. The conidia size is different.

4.1. The conidia are slightly smaller, 9.5–(11.9 ±1.09)–14.5 × 6–(7.5 ±0.68)–9.5 µm……*Abrothallus doliiformis* Pérez-Ort. & Suija

4.2. The conidia are slightly larger, 11–(14.1 ±1.67)–17.5 × 7–(8.9 ±0.95)–11 µm……*Abrothallus etayoi* Pérez-Ortega & Suija

5. From 3. The length of conidia is different

5.1. The conidia are smaller, measuring 3–4 × 2.5–3 µm…… ……*Abrothallus lobariae* (Diederich & Etayo) Diederich & Ertz

5.2. The conidia are smaller, measuring 4.8–6.4 × 3.6–4.4µm…… ……*Abrothallus psoromatis* (Zhurb. & U.Braun) Diederich & Zhurb.

6. From 1 The presence or absence of pruina

6.1. From 1The ascomata are absolutely epruinose……7

6.2. The ascomata are covered by more or less pruina……25

7. The septum number

7.1. The ascospore is 3-septate when mature……8

7.2. The ascospore is 1-septate when mature……12

8. The presence or absence of asexual

8.1. The fungus exhibits an asexual morph in addition to its sexual morph.……9

8.2. The fungus only exhibits sexual morph……10

9. The size of ascospores and conidia.

9.1. Ascospores 13.5–18 × 5–6 µm and conidia 6–8(–10) × 4–5 µm…….……
……*Abrothallus stictarum* Etayo

9.2. Ascospores 16–(18.9)–22 × 6.5–(8)–9 µm and Conidia (12.5)14–18(19) × 8.5–11 µm……*Abrothallus macrosporus* Etayo & R. Sant.

10. From 8 The spores' number per ascus

10.1. From 8 Ascus contains 8 spores……11

10.2. Ascus contains 4 spores……
……*Abrothallus epiclathratus* Suija, Etayo & Flakus

11. The difference of paraphyses

11.1. Paraphysoids are net-like, with slightly thickened and only lightly browned tips, embedded in a brown, granular gel……*Abrothallus bryoriarum* Hafellner

11.2. Paraphyses are numerous, yellowish, gelatinous……
……*Abrothallus suecicus* (Kirschst.) Nordin

12. From 7 The fungus exhibits an asexual morph in addition to its sexual morph, or not

12.1. From 7 The fungus exhibits an asexual morph in addition to its sexual morph…
……13

12.2. The fungus only exhibits sexual morph……18

13. The shape of conidia

13.1. The conidia are obpyriform to ellipsoidal……14

13.2. The conidia are filiform……*Abrothallus mairei* Werner

14. The length of ascospores is more than 10 µm, or not

14.1. The length of ascospores is less than 10 µm……15

14.2. The length of ascospores is more than 10 µm……..17

15. The color of Conidiogenous cells and conidia is different.

15.1. The conidiogenous cells are hyaline, and conidia are hyaline.……16

15.2. The conidiogenous cells are hyaline to yellow, and conidia are hyaline.……

……*Abrothallus microspermus* Tul.

16. The color of conidia is different.

16.1. The conidiogenous cells are hyaline, and conidia are hyaline to yellowish……

……*Abrothallus acetabuli* Diederich

16.2. The conidiogenous cells are hyaline, and conidia are hyaline ……

……*Abrothallus flavoparmelia* Meng, Thiyagaraja & Diederich

17. From 14 The size of conidiomata

17.1.From 14 The conidiomata is larger than 100 µm diam.……

……*Abrothallus caerulescens* I. Kotte

17.2.The conidiomata is less than 100 µm diam.……

……*Abrothallus tulasnei* M.S. Cole & D. Hawksw.

18. From 12 The ascospores are easily breaking into part spores

18.1. From 12 The ascospores are not easily breaking into part spores……19

18.2. The ascospores are easily breaking into part spores……*Abrothallus niger* Etayo

19. The length of ascospores is greater than 10 µm, or not

19.1. The length of ascospores is greater than 10 µm……20

19.2.The length of ascospores is less than 10 µm……*Abrothallus curreyi* Linds.

20. The length of ascospores is less than 15 µm or not

20.1.The maximum length of ascospores is greater than 15 µm……21

20.2.The maximum length of ascospores is less than 15 µm……22

21. The epihymenial layer color and N reaction

21.1.The epihymenium is dark brown to violet-brown, N–……
……*Abrothallus peyritschii* (Stein) Kotte

21.2.The epihymenium is dark green or olive green, N+ brown-violet, and later turning orange.……*Abrothallus hypotrachynae* Etayo & Diederich

22. From 20 The violet pigment and N reaction of epihymenium

22.1.From 20The epihymenium consists of brown granules, and N–……23

22.2.The epihymenium consists of additional violet pigment, and N+ greyish……
……*Abrothallus altoandinus* Flakus, Etayo & Rodr. Flakus

23. The ascospores are less than 15 µm or more than 15 µm.

23.1.The ascospores are more than 15 µm……24

23.2.The ascospores are less than 15 µm……
……*Abrothallus myelochroae* Meng, Thiyagaraja & Diederich

24. The difference of the l/w ratio.

24.1.The ascospores are slightly longer, l/w ratio 2.3–3.4……
……*Abrothallus buellianus* De Not

24.2.The ascospores are slightly shorter, l/w ratio 2.15–2.8……
……*Abrothallus cetrariae* I. Kotte

25. From 6. The color of pruina

25.1.From 6. The color of pruina is (slightly) yellownish or yellownish-greennish…26

25.2.The color of pruina is (slightly) greenish, greenish-yellownish, or other color...36

26. The ascospores are easily broken into part-spores or not

26.1.The ascospores readily break into part-spores……27

26.2.The ascospores do not readily break into part-spores.……..30

27. The ascospores size is less than 10 µm or not.

27.1.The ascospores are more than 10 µm in lenght…….…… 28

27.2.The ascospores are less than 10 µm in lenght……

……*Abrothallus stereocaulorum* Etayo & Diederich

28. The ascospores size is more than 13 µm or not.

28.1. The ascospores are slightly smaller, the length of ascospores is less than 13 µm… ……29

28.2. The ascospores are slightly larger, the length of ascospores is more than 13 µm… ……*Abrothallus secedens* Wedin & R. Sant.

29. The color of hymenium and its K reaction are different.

29.1. The hymenium is hyaline to greenish, K–…… ……*Abrothallus heterodermiicola* Etayo & F. Berger

29.2. The hymenium is hyaline at the base, and dark purplish at the top, with K+ producing a bluish-greenish reaction……*Abrothallus stroblii* Hafellner

30. From 26. The ascospores septum number

30.1. From 26. The ascospores are multi-septate……31

30.2. The ascospores are 1-septate……32

31. The septum number

31.1. The ascosores are 2-septate……*Abrothallus granulatae* Wedin

31.2. The ascosores are 3-septate……*Abrothallus subhalei* Etayo, Flakus & Kukwa

32. From 30. Ascospore number is different

32.1. From 30. Ascus contains 8 spores……32

32.2. Ascus contains 4 spores……*Abrothallus tetrasporus* (Etayo & Osorio) Etayo, Flakus & Rodr. Flakus

33. The fungus exhibits asexual morph

33.1. The fungus only exhibits sexual morph……34

33.2. The fungus exhibits asexual morph in addition to sexual morph…… ……*Abrothallus parmotrematis* Diederich

34. The ascospores size is exceed 10 µm, or not

34.1. The length of ascospores is more than 10 µm……35

34.2.The length of ascospores is less than 10 µm……*Abrothallus pezizicola* Diederich & R.C.Harris

35. The ascospores size is slightly different.

35.1.The size of ascospores is slightly smaller, (8.5–)9.5–10.5(–11) × (3–)3.5–4.5 µm……*Abrothallus leifidii* Etayo & Zhurb.

35.2.The size of ascospores is slightly larger, 9–14 × 4.5–6.5 µm…… ……*Abrothallus ramalinae* Diederich

36. From 25. The ascospores number is less than 8

36.1.From 25. Ascus contains less than 8 ascospores……37

36.2.Ascus contains 8 ascospores……38

37. The ascospores number per ascus

37.1.Ascus mainly 4-spored, sometimes contains 6 spores. Ascospores 1-septate, and frequently separated into part-spores…… ……*Abrothallus canariensis* Pérez-Ort., van den Boom & Suija

37.2.Ascus is mainly 6-spored, sometimes contains 4 or 8 spores. Ascospores are usually 2-celled, but mature ascospores may have 2–3 septa, not broken easily……*Abrothallus boomii* Pérez-Ortega & Suija

38. From 36. The ascospores are easily broken into part-spores or not

38.1.From 36. The ascospores easily break into part-spores……..39

38.2.The ascospores are not readily break into part-spores.……46

39. The ascospores are 1-septate or multi-septate

39.1.The ascospores are 3-septate……40

39.2.The ascospores are 1-septate…… 41

40. The fungus exhibits sexual and asexual, or only sexual morph

40.1.The fungus exhibits sexual and asexual……*Abrothallus diederichii* Suija & F. Berger

40.2.he fungus only exhibits sexual morph……*Abrothallus halei* Pérez-Ort., Suija, D. Hawksw. & R. Sant.

41. From 39. The fungus exhibits sexual and asexual, or only sexual morph

41.1.From 39. The fungus exhibits sexual and asexual morph……..42

41.2.The fungus only exhibits sexual morph……43

42. The size of ascomata is different

42.1.The ascomata are slightly larger in diam., measuring 180–(265)–540 µm……

……*Abrothallus eriodermae* Suija, Etayo & Pérez-Ortega

42.2.The ascomata are slightly smaller in diam., measuring 100–200(−400) µm……

……*Abrothallus nitassinan* Arsenault, P. Baines & Suija

43. From 41. The Ascospores size is different

43.1.From 41. The length of ascospores is more than 10 µm……44

43.2.The length of ascospores is less than 10 µm……

……*Abrothallus cladoniae* R. Sant. & D. Hawksw.

44. The length of asci is different

44.1.The asci are slightly longer, measuring 35–50 µm…….……45

44.2.The asci are slightly shorter, measuring 27.5–36.5 × 10–12.5 µm……

……*Abrothallus ertzii* Suija & Pérez-Ortega

45. The size of ascospores is different.

45.1.The ascospores are smaller, measuring 9.3–10.3 × 4.1–4.9 µm……

……*Abrothallus teloschistis* Brackel, Pérez-Ortega & Suija

45.2.he ascospores are smaller, measuring 10.4–12.9 × 4.4–5.2 µm……

……*Abrothallus yunnanensis* Meng, Thiyagaraja & Diederich

46. From 38. The fungus exhibits sexual and asexual morph meanwhile, or not

46.1.From 38. The fungus only exhibits sexual morph…….……47

46.2.The fungus exhibits sexual and asexual morph……..50

47. The maximum length of ascospores is different

47.1.The maximum length of ascospores less than 15 µm……48

47.2.The maximum length of ascospores over 15 µm…….……..49

48. The color of pruina, hymenium thick, and the length of asci are different.

48.1.Ascomata covered by blackish and whitish pruina……
……*Abrothallus hypogymniae* Meng, Thiyagaraja & Diederich

48.2.Ascomata covered by greenish pruina when young……
……*Abrothallus parmelioidea* Meng, Thiyagaraja & Diederich

49. From 47. The l/w ratio of ascospores is different

49.1.From 47. The l/w ratio of ascospores is slightly smaller, l/w ratio = 1.8–3.2……
……*Abrothallus prodiens* (Harm.) Diederich & Hafellner

49.2.The l/w ratio of ascospores is slightly larger, l/w ratio = 2.2–3.5……
……*Abrothallus bertianus* De Not.

50. From 46. The length of conidia is less or more than 10 µm

50.1.From 46. The length of conidia is less than 10 µm……51

50.2.The length of conidia is more than 10 µm……*Abrothallus welwitschii* Mont.

51. Lichen host different

51.1.Growing on Peltigerales lichen……..52

51.2.Growing on Parmelioid lichen……53

52. The ascospores are different in wide

52.1.The ascospores 4.4–(5 ±0.5)–6.2 µm in wide, l/w ratio of 2.7–2.8……
……*Abrothallus nephromatis* Suija & Pérez-Ortega

52.2.The ascospores 15–(6.14 ±0.56)–7.1 in wide, l/w ratio of 1.94–2.76……
……*Abrothallus kamchatica* (Zhurb. & Stepanchikova) Pérez-Ortega & Suija

53. From 51. The host different

53.1.From 51. The host lichen belongs to foliose lichen……54

53.2.The host lichen belongs to fruticose lichen……*Abrothallus usneae* Rabenh.

54. The asci are different

54.1.The asci measuring 34.5–46 × 10.5–15 µm……
……*Abrothallus santessonii* (D. Hawksw.) A. Suija, D. Hawksw. & Pérez-Ort.

54.2.The asci measuring 47–64 × 8–17 µm……

……*Abrothallus parmeliarum* (Sommerf.) Arnold

3.4.4 Taxonomy

Abrothallus flavoparmelia Meng, Thiyagaraja & Diederich

Figure 3.4

Index Fungorum number: IF***; Facesoffungi number: FoF****

Etymology – The species epithet "*flavoparmelia*" refers to "*Flavoparmelia*", the host lichen on which the holotype specimen was found.

Holotype – KUN-L 88643.

Description – Sexual morph: Ascomata apothecial, (250) 265–567 (834) µm ($\bar{x}$ = 416 µm, n = 10) in diameter, superficial, dispersive, black, epruinose, convex, mostly globose, slightly convergent at the bottom. *Epithecium* layer (15.5) 17–25.7 (35.5) µm ($\bar{x}$ = 21.5 µm, n = 31) thick, with dark brownish granules, displaying a clear reddish-violet tinge, K-, I-. *Hymenium* (52.5) 55.8–69.7 (83) µm ($\bar{x}$ = 62.8 µm, n = 26) high, hyaline to slightly brownish, K-, I+ reddish-violet toward the epithecium, interascal pseudoparenchyma transparent, paraphyses (2) 2.7–3.9 (4.8) µm ($\bar{x}$ = 3.3 µm, n = 34) in width, branched to anastomosing, sectionalized, widened. *Exciple* thin or not obvious. *Hypothecium* (93) 121–153 (157) µm ($\bar{x}$ = 137 µm, n = 26) thick brown, K-, I-, thickened, forming a dome-like shape, with brown irregular shaped hypothecial cells. *Asci* (48) 54.4–61 (62.5) × (10) 11–12.8 (13) µm ($\bar{x}$ = 57.7 × 11.9 µm, n = 15), bitunicate, cylindrical to long clavate, 8-spored, K-, I-. *Ascospores* (11.5) 12–14.8 (17.5) × (4.5) 4.7–5.9 (6.8) µm ($\bar{x}$ = 13.4 × 5.3 µm, n = 31), l/w (upper cell) ratio = 2.4–2.5 ($\bar{x}$ = 2.5, n = 31), brown, verruculose, usually soleiform, asymmetric with a larger upper cell, 1-septate, slightly constricted at septum, not easily broken into semi-spores, without guttulae.

Asexual morph: *Pycnidial,* conidiamata (94) 121–170 (198) µm ($\bar{x}$ = 146 µm, n = 15) in diam., immersed to semi-immersed in the thallus of host lichens, blackish, with an ostiole, 50 µm in diameter, with a black rim surrounding the pycnidia on the lichen thallus, the rim (217) 286–420 (482) µm ($\bar{x}$ = 353 µm, n = 14) in diam.

Conidiophores are absent. *Conidiogenous cells* line the pycnidial cavity, hyaline, aseptate, shortly cylindrical to lageniform, 5.1–5.7 × 3–3.5 µm, smooth-walled, and percurrently proliferating. *Conidia* hyaline, aseptate, obpyriform to ellipsoid, distinctly truncated at the base, with a smooth surface, (4.8) 5.4–6.5 (8.6) × (3.5) 3.7–4.4 (6.1) µm ($\bar{x}$ = 6 × 4 µm, n = 31), l/w = 1.3–1.4 ($\bar{x}$ = 1.34 µm, n = 31).

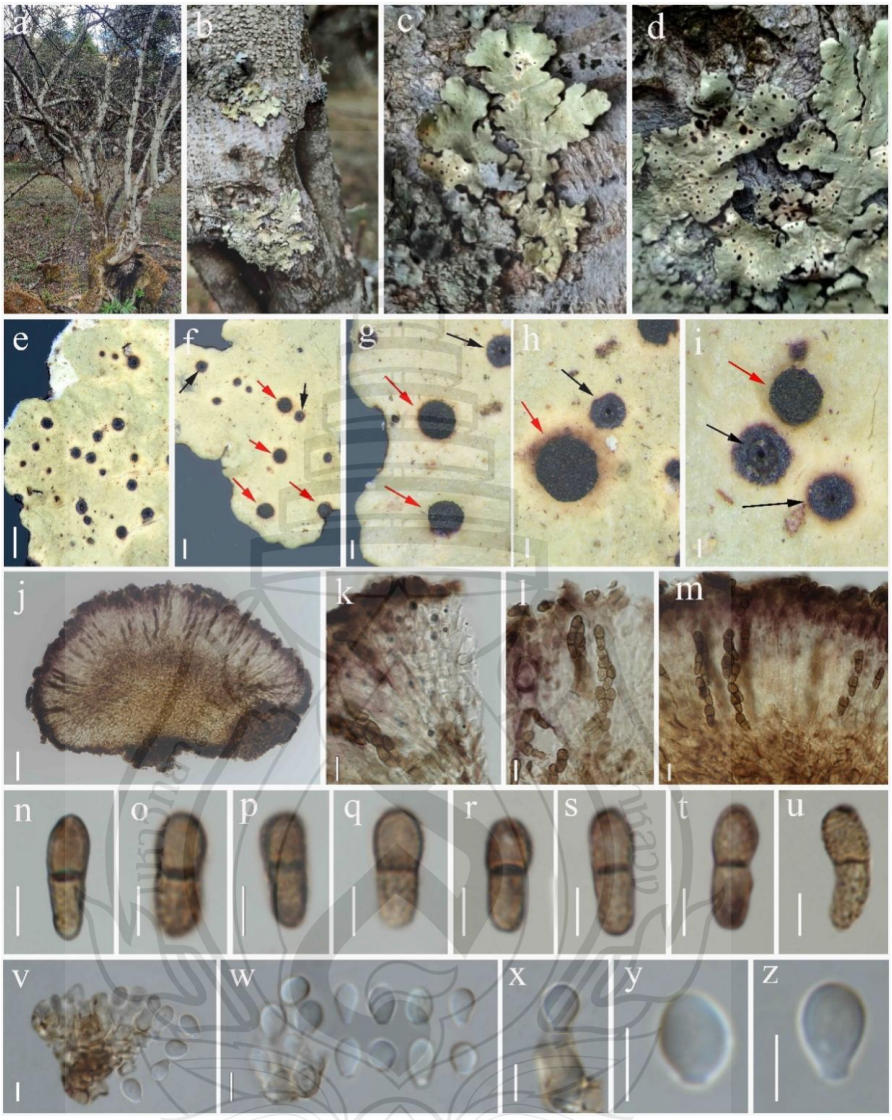
Examined materials – China, Yunnan Province, collected from Meili Mountain National Nature Reserve, Diqing Autonomous Prefecture, 28°23′19.02″N, 98°47′20.14″E, elev. 3082m, 23rd April, 2023 (KUN-L 88643, Coll. No. ml-112)-holotype. Lichenicolous, growing on the thallus of *Flavoparmelia sp.* which grows on the bark of an unknown tree.

GenBank numbers – KUN-L 88643, LSU: PQ772187, ITS: PQ721324, TEF1: PQ723767.

Notes – Phylogenetically, *Abrothallus flavoparmeliae* forms a distinct clade, with its closest relative being *A. buellianus*, however, it is morphologically distinguishable by its smaller ascospore (12–16.7 × 4.7–6.5 µm vs. 14–20 × 5.5–7 µm). While this taxon is extremely similar to *A. acetabuli* in morphology, it exhibits a significant distance from *A. acetabuli* in the phylogenetic tree, and is distinguished by hyaline conidia (vs. hyaline to brown) and smaller conidia (5.4–6.5 × 3.7–4.4 µm vs. 7–8.5 × 4.5–5.0 µm).

Abrothallus flavoparmeliae resembles *A. caerulescens* in having epruinose apothecia, ascospores and conidiomata, but differs by its larger ascomata (341–502 µm vs. 200–300 µm), smaller conidia (5.13–7.1 × 3.8–5.9 µm vs. 9.5–14.5 × 3–6.5) and a lower length-to-width ratio of ascospores (1.26–1.7 vs. 2.2–4.8) (Suija et al., 2018). Additionally, *Abrothallus flavoparmeliae* is similar to *A. tetrasporus* in epruinose ascomata, ascospores size, conidia size, but distinguished by 8-spored ascus (vs. 4-spored), and its smaller conidiogenous cells (5.1–5.7 × 3–3.5 µm vs. 8–10 × 3–5 µm) (Senanayake et al., 2023). *Abrothallus flavoparmeliae* resembles *A. parmotrematis* and *A. santessonii* in characteristics of ascospores and conidia, but can be distiguished by

epruinose ascomata (Vs. heavily green pruinose for *A. santessonii*, and vs. yellowish pruina for *A. parmotrematis*) (Diederich, 2011; Suija et al., 2018).



Note a–d Habitat and the appearance of the host lichen. e–i Apothecia (red arrows) and conidiamata (black arrows). j Longitudinal section of apothecium. k Paraphysis in water. l Asci with ascospores. m Epihymenium, hymenium and hypothecium. n–u Ascospores in water. v–z Conidiogenous cells and conidia in water. Scale bar: e–f = 1 mm, g = 500 µm, h–i = 250 µm, j = 50 µm, k–m = 10 µm, n–z = 5 µm.

Figure 3.4 *Abrothallus flavoparmeliae*, growing on thallus of *Flavoparmelia* sp. (Holotype: KUN-L 88643)

Abrothallus hypogymniae Meng, Thiyagaraja & Diederich sp. nov.

Figure 3.5

Index Fungorum muber: IF***; Facesoffungi number: FoF***.

Etymology – The new species is named after the host lichen genus because it grows on the apothecia surface of the lichen *Hypogymnia* sp.

Holotype – KUN-L 88545.

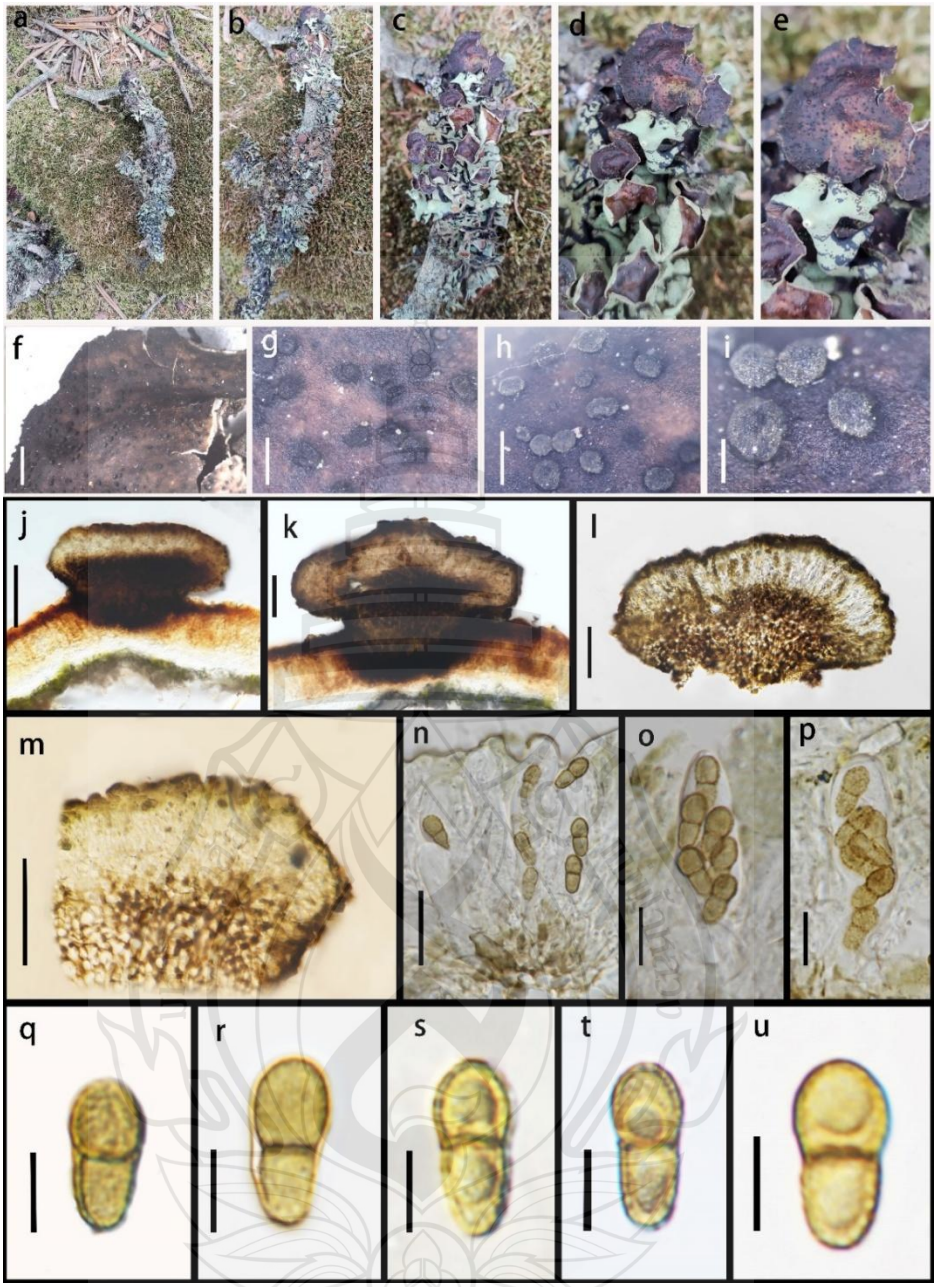
Description – **Sexual morph:** *Ascomata* apothecial, (160) 182–246.5 (293) μm ($\bar{x}$ = 214 μm, n = 30) in diameter, (94) 103–124 (125) μm ($\bar{x}$ = 114 μm, n = 30) high, superficial, numerous, dispersive, sessile, black, with most ascomata covered by blackish and whitish pruina, convex, more or less flat, constricted at the base, a blackish halo surrounding the lichenicolous ascomata on the disc. *Epithecium* (10.2) 11.7–15.3 (16.9) μm ($\bar{x}$ = 13.5 μm, n = 13) thick, with dark brownish granules, K-, I-. *Hymenium* (22) 24.8–33.3 (36.8) μm ($\bar{x}$ = 29 μm, n = 13) high, hyaline to slightly yellowish, K-, I-, interascal pseudoparenchyma transparent, colloidal, and paraphysis segmented. *Exciple* dark brownish, thin or not obvious, 5–7 μm thick. *Hypothecium* dark brown, with the base of the apothecia deeply immersed into the tissue of lichen, and the brown hypothecial cells with irregular shapes, 100–137 μm thick. *Asci* 20–35 × 9–13 μm, bitunicate, clavate, 8-spored, K-, I-. *Ascospores* (8.5) 10–11.7 (14) × (3.5) 4.2–5.2 (6) μm ($\bar{x}$ = 10.9 × 4.7 μm, n = 40), with a length-to-width ratio (upper cell) = (1.9) 2.2–2.5 (2.7) ($\bar{x}$ = 2.3, n = 40), usually 2-celled, with one guttulate per cell or not, light to dark brown, verruculose, asymmetric with a larger upper cell, usually soleiform in shape, slightly constricted at the septum, not breaking into semi-spores. **Asexual morph:** Not observed.

Examined materials – China, Yunnan Province, collected from Laojun Mountain National Nature Reserve, Lijiang City, 26°37′56.05″N, 99°43′58.83″E, elev. 3989m, 30th April, 2023 (KUN-L 88540, Coll. No. ljs-215)-holotype; collected from Laojun Mountain National Nature Reserve, Lijiang City, 26°37′58.25″N, 99°43′57.66″E, elev. 3995m, 30th April, 2023 (KUN-L 88545, Coll. No. ljs-210)-

Topotype. Lichenicolous, growing on the apothecia surface of *Hypogymnia* sp. on the decaying branch of *Rhododendron simsii*.

GenBank numbers – KUN-L 88540, LSU: PQ772194, ITS: PQ721331, TEF1: PQ723774; KUN-L 88545, LSU: PQ772193, ITS: PQ721330, TEF1: PQ723773.

Notes – Abrothallus hypogymniae is phylogenetically close to *A. altoandinus*, but differs in pruinose apothecia (epruinose in *A. altoandinus*), and shorter, ascospores (8.4–13.8 × 3.5–5.9 µm vs. 11–19 × 4–7 µm) (Senanayake et al., 2023). This new collection is morphologically similar to *Abrothallus prodiens* in ascomata size and the length of ascospores, but differs in its parasitic location (on thallus vs. on apothecia) and narrower ascospores (4.2–5.2 µm vs. 5.5–6.5µm) (Brackel et al., 2016). *A. hypogymniae* resembles *A. bertianus* in the size of ascomata and ascospores, but differs in shorter asci (20–35 µm vs. 47–55 µm) and smaller l/w ratio (2.2–2.5 vs. 2.2–3.5) (De Notaris, 1846; Suija et al., 2018). This new species also resembles *A. granulatae*, *A. halei* and *A. kamchatica* in ascospores size, but differs in septum number and apothecia diameter. *A. granulatae* and *A. halei* have more than one septum, and *A. kamchatica* & *A. halei* have a a long genetic distance in phylogenetic tree (Wedin, 1994; Suija et al., 2011; Suija et al., 2015).



Note a–e Habitat and appearance of the host lichen. f–i Appearance of the lichenicolous apothecia. j–l Longitudinal section of apothecium in water. m Part of longitudinal section in Melzer reagent. n–p Asci and ascospores in water. q–u Ascospores in water. Scale bar: f = 2 mm, g–h = 500 µm, i = 200 µm, j = 100 µm, k–m = 50 µm, n = 20 µm, o–p = 10 µm, q–u = 5 µm.

Figure 3.5 *Abrothallus hypogymniae*, growing on apothecia of of *Hypogymnia* sp. (KUN-L 88540)-holotype.

Abrothallus parmelioidea Meng, Thiyagaraja & Diederich sp. nov.

Figure 3.6

Index Fungorum muber: IF***; Facesoffungi number: FoF***.

Etymology – The collections were collected from different locations; however, they all belong to Parmelioids lichen. Therefore, we chose “parmelioidea” as the new species name to indicate its specialization on this particular host.

Holotype – KUN-L 88638.

Description – *Sexual morph*: *Apothecia* (124) 159–234 (247) µm ($\bar{x}$ = 196.8 µm, n = 15) in diameter, superficial on the tuberculate tumor, thallus or on the disc of apothecia of Parmelioid lichens, irregularly dispersive, black, covered by greenish pruina when young, convex, mostly spheroidal or globose, constricted at the base. *Epithecium* (11.7) 17.7–29.6 (34) µm ($\bar{x}$ = 23.7 µm, n = 30) thick, with dark brownish granules, K/I-. *Hymenium* (21.2) 34.7–49 (52.4) µm ($\bar{x}$ = 41.9 µm, n = 30) high, hyaline to slight yellowish, K-, I-, interascal pseudoparenchyma transparent, colloidal, paraphysis anastomosed, branched. *Exciple* thin or inconspicuous. *Hypothecium* brown or dark brown, forming a dome-like shape, especially in the upper part, hypothecial cells irregularly rectangular to sinuose, with brown pigment, K-, 90–140 µm thick. *Asci* (23) 28.7–48.3 (58) × (5.2) 5.7–9.5 (11.0) µm ($\bar{x}$ = 38.5 × 7.1 µm, n = 20), bitunicate, clavate, 8-spored, K/I-. *Ascospores* (7.5) 9.5–11.9 (13.5) × (3.3) 3.8–5.1 (5.9) (upper cell) µm ($\bar{x}$ = 10.7 × 4.4 µm, n = 35), the lower cell is one µm smaller than upper cell, the length to width ratio (upper cell) = (2.2) 2.4–2.6 (2.7) ($\bar{x}$ = 2.5, n = 35), light brown when young to dark brown when mature, 1-septate, verruculose, asymmetric with a larger upper cell, usually soleiform in shape, slightly constricted at septum, ascospores not easily broken into part-spores. *Asexual morph*: Not observed.

Examined materials – China, Yunnan Province: collected from Meili Mountain National Nature Reserve, Diqing Autonomous Prefecture, 28°25′23.07″N, 98°49′09.75″E, elev. 2872m, 24th April, 2023 (KUN-L 88638, Coll. No. ml-117-3)-

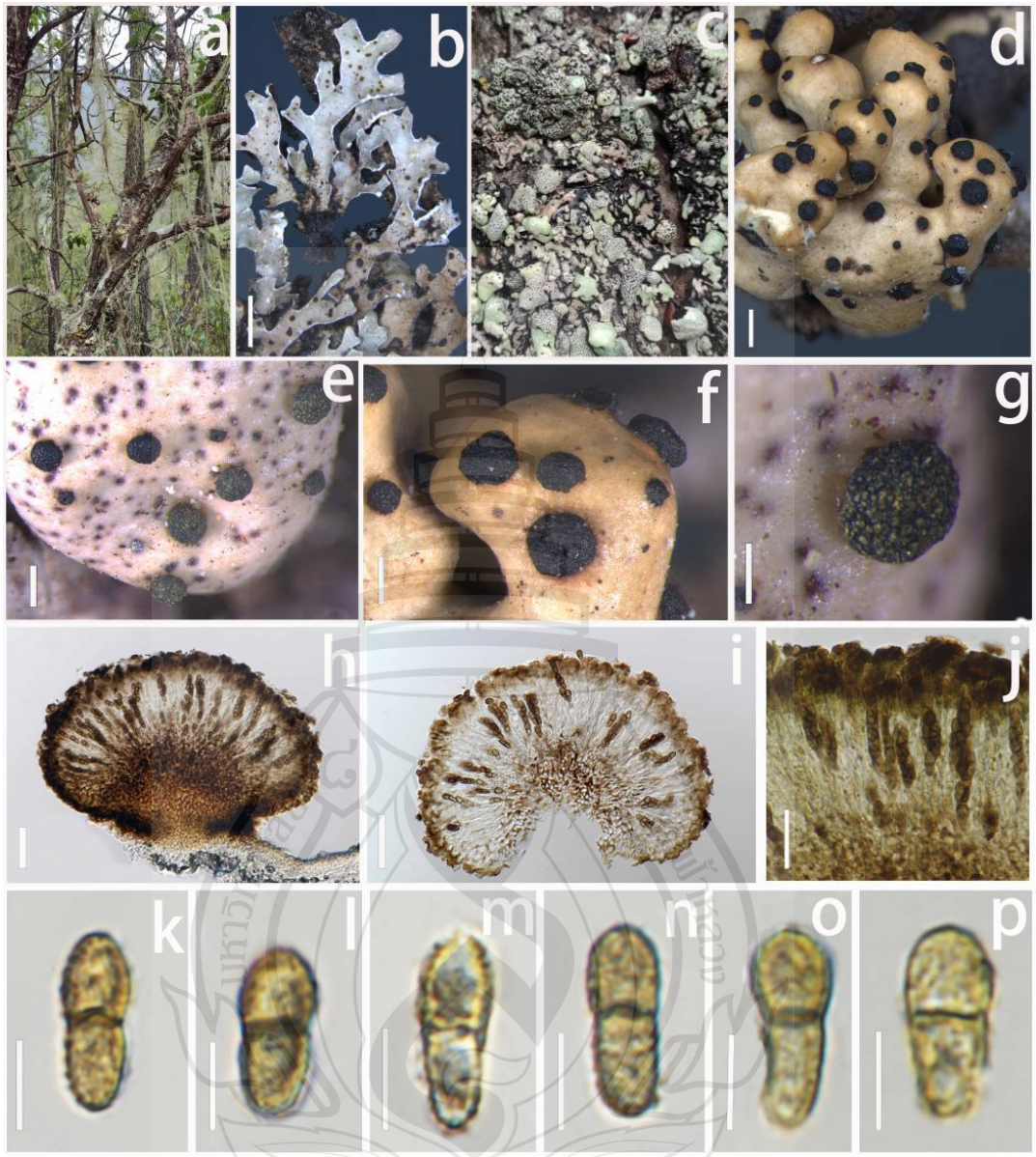
holotype, Lichenicolous fungi grow on the thallus of *Menegazzia sp.* which grows on the bark of an unknown tree. Collected from Meili Mountain National Nature Reserve, Diqing Autonomous Prefecture, 28°26′42.77″N, 98°52′38.95″E, elev. 3490m, 25th April, 2023 (KUN-L 88612, Coll. No. ml-143), Lichenicolous fungi grow on the thallus of *Hypogymnia* sp. which grows on the bark of *Quercus* sp.; collected from Yulong Mountain National Nature Reserve, Lijiang City, 27°00′19.49″N, 100°10′50.45″E, elev. 3293m, 29th April, 2023 (KUN-L 88566, Coll. No. yl-189) -paratype, Lichenicolous fungi grow on the thallus of *Parmelia* sp. which grows on the bark of *Quercus spinosa*; collected from Yulong Mountain National Nature Reserve, Lijiang City, 27°00′21.51″N, 100°10′46.94″E, elev. 3343m, 29th April, 2023 (KUN-L 88565, Coll. No. yl-190)-paratype, Lichenicolous fungi grow on the thallus of *Menegazzia* sp. which grows on the bark of *Quercus spinosa*; collected from Laojun Mountain National Nature Reserve, Lijiang City, 26°37′58.67″N, 99°43′54.71″E, elev. 3942m, 30th April, 2023 (KUN-L 88551, Coll. No. ljs-204), Lichenicolous fungi grow on the thallus of *Parmeliaceae* sp. which grows on the bark of an unknown tree.

GenBank numbers – KUN-L 88551, LSU: Q772192, ITS: PQ721329 , TEF1: PQ723772; KUN-L 88612, LSU: PQ772189, ITS: PQ721326; KUN-L 88638, LSU: PQ772188, ITS: PQ721325, TEF1: PQ723768; KUN-L 88565, LSU: PQ772190, ITS: PQ721327, TEF1: PQ723770; KUN-L 88566, TEF1: PQ723769.

Notes – Phylogenetically, *Abrothallus parmelioidea* is closely related to *A. caerulescens*, *A. santessonii*, and *A. hypotrachynae*, forming a short clade branch. However, morphologically, *A. parmelioidea* differs from *A. caerulescens* and *A. santessonii* by the absence of an asexual morph and its shorter ascospores (9.5–11.9 µm vs. >12 µm for the three species) (Suija et al., 2018). Additionally, *A. parmelioidea* can be distinguished from *A. hypotrachynae* by its smaller ascomata (159–234 µm vs. 250–450 µm), smaller asci (28.7–48.3 × 5.7–9.5 µm vs. 60–70 × 7–11 µm), and smaller ascospores (9.5–11.9 × 3.8–5.1 µm vs. 11–14 × 5–5.5 µm) (Etayo, 2002).

Morphologically, *Abrothallus parmelioidea* resembles to *A. hypogymniae* in the

size of ascomata and ascospores, but is distinguished by greenish pruina on ascomata (vs. blackish and whitish pruina), and thicker hymenium (34.7–49 μm vs. 24.8–33.3 μm). *Abrothallus parmelioidea* is morphologically similar to *A. prodiens* in ascomata size, its parmelioid host, and overlapping ascospore size. However, it differs in having smaller ascospores (9.5–11.9 × 3.8–5.1 μm vs. 10.5–16.5 × 4.5–7 μm) and a narrower length-to-width ratio range (2.4–2.6 vs. 1.8–3.2) (Diederich, 1990). This species also resembles *A. bertianus*, another species growing on Parmelioid lichen, in apothecial appearance and the length-to-width ratio range of ascospores. However, it can be distinguished by its smaller asci (28.7–48.3 × 5.7–9.5 μm vs. 47–55 × 8–12 μm) and smaller ascospores (9.5–11.9 × 3.8–5.1 μm vs. 11–16 × 4–6 μm) (Suija et al., 2018).



Note a Habitat. b–c appearance of the host lichen (b: *Parmelia* sp., KUN-L 88612, collection number ml-143; c–d *Menegazzia* sp., KUN-L 88638). d–g Appearance of the lichenicolous apothecia. h–j section of apothecium in water. k–p ascospores in water. Scale bar: b = 5 mm, d = 1 mm, e–f = 500 µm, g = 250 µm, h–I = 50 µm, j = 20 µm, k–p = 5 µm.

Figure 3.6 *Abrothallus parmelioidea*, growing on thallus or tuberculate strcutres of Parmelioid lichens (KUN-L 88638, collection number ml23-117-3)-holotype.

Abrothallus myelochroae Meng, Thiyagaraja & Diederich sp. nov.

Figure 3.7

Index Fungorum muber: IF***; Facesoffungi number: FoF***.

Etymology – The new species is named after the host lichen genus because it grows on the apothecia surface of the lichen *Myelochroae* sp.

Holotype – KUN-L 88665.

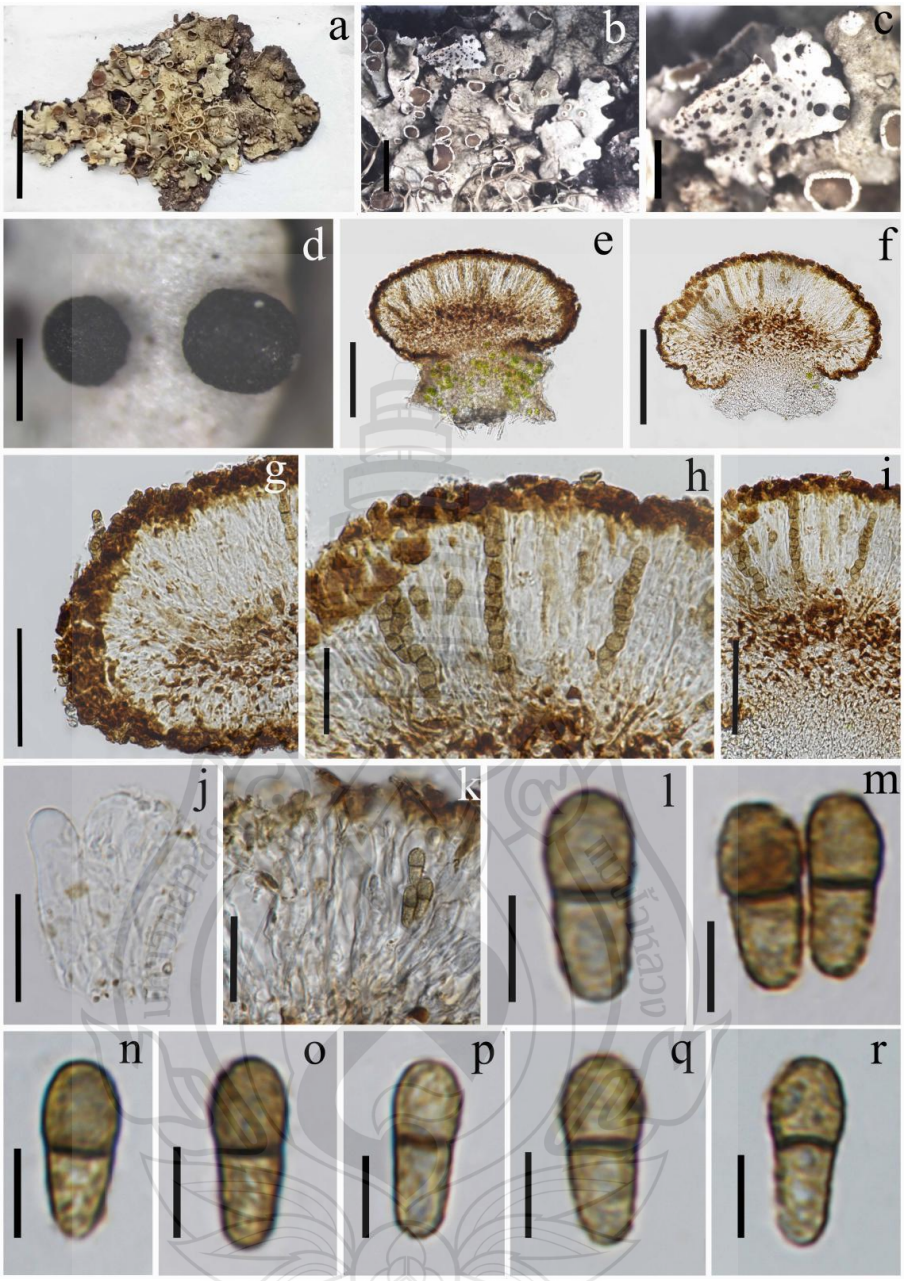
Description – *Sexual morph: Apothecia* (90) 131–256 (311) µm ($\bar{x}$ = 193 µm, n = 45) in diameter, superficial, dispersive, black, convex, sessile, spheroidal or globose, epruinose, the base of the apothecia convergent. *Epithecium* (8) 9–11.9 (13.3) µm ($\bar{x}$ = 10.5 µm, n = 30) thick, containing dark brownish granules, I-. *Hymenium* (28.5) 39.1–54.4 (57.5) µm ($\bar{x}$ = 46.8 µm, n = 30) high, hyaline to slightly yellowish, K-, interascal pseudoparenchyma transparent and colloidal, paraphysis branched and anastomosing, septate, slightly swollen, 2–2.5 µm wide, with tips slightly thickened, covered by a dark yellowish granular pruina. *Excipulum* thin or inconspicuous, composed of radiating septate hyphae with rectangular cells, brownish, 8–12 µm thick. *Hypothecium* (34.5) 39.6–49 (53) µm ($\bar{x}$ = 44.3 µm, n = 30) thick, light brown, K-, the hypothecial cells irregular shapes. *Asci* (27.6) 29.3–40.5 (51) × (5.7) 6.7–9.6 (10) µm ($\bar{x}$ = 34.9 × 8.1 µm, n = 15), bitunicate, narrowly clavate to cylindrical, thickened at the apex, I-, 8-spored. *Ascospores* (9) 10.3–11.5 (12.5) × (3.7) 4.2–5 (5.9) ($\bar{x}$ = 10.9 × 4.6, n = 50) µm, brown, 1-septate, verrucose, asymmetric with a larger upper cell, usually soleiform in shape, l/w (upper cell) ratio = (2.1) 2.2–2.6 (2.8) ($\bar{x}$ = 2.4, n = 50), slightly constricted at the septum, not seasily separating into semispores. *Asexual morph:* Undetermined.

Examined materials – China, Yunnan Province, collected from Meili Mountain National Nature Reserve, Diqing Autonomous Prefecture, 28°24′03.70″N, 98°47′22.82″E, elev. 3391m, 22nd April, 2023 (KUN-L 88665, Coll. No. ml-90)-holotype. Lichenicolous, growing on the apothecia surface of *Myelochroa* sp. which grows on the bark of an unknown tree.

GenBank numbers – KUN-L 88665, LSU: PQ772186, ITS: PQ721323, TEF1: PQ723766

Notes – Phylogenetically, *Abrothallus myelochroae* form a distinct clade which is closely related to *A. buellianus*. However, it is morphologically distinguished by smaller asci (29.3–40.5 × 6.7–9.6 µm vs. 53–68 × 11–15 µm), and smaller ascospores (10.3–11.5 × 4.2–5 µm vs. 14–20 × 5.5–7 µm). *Abrothallus myelochroae* is morphologically similar to *A. acetabuli* in appearance of ascomata, asci size and ascospores shape, but differs in having smaller apothecia (<300 µm vs. >500 µm), smaller ascospores. (Diederich, 1990). *A. myelochroae* has smaller apothecia (<300 µm) compared to *A. acetabuli* (>500 µm) and lacks an asexual morph. The new species is also distinct from *A. caerulescens* in hymenium color (white vs. greenish) and ascospores size (10.6–11.7 µm vs. 14.5–19 µm), with *A. caerulescens* having an asexual pycnidial morph (Diederich, 1990).

Morphologically, *Abrothallus myelochroae* is also similar to *A. peyritschii* in epruinose ascomata and overlapping interval range of ascospores size, but differs in the smaller ascomata (131–256 µm vs. 200–290–380 µm), smaller asci (29.3–40.5 × 6.7–9.6 µm vs. 43–50 × 12–16 µm) (Kotte, 1909; Suija et al., 2018).



Note a–c Habitat and appearance of the host lichen. d Appearance of the lichenicolous apothecia. e–f section of apothecium in water. g excple. h Epihymenium and hymenium in water. i Hypothecium in water. j–k Asci and ascospores in water. l–r ascospores in water. Scale bar: a = 1 cm, b = 5 mm, c = 1 mm, d = 200 µm, e–f = 100 µm, g, i = 50 µm, h = 25 µm, j–k = 20 µm, l–r = 5 µm.

Figure 3.7 *Abrothallus myelochroae*, growing on thallus of *Myelochroae* sp. (KUN-L 88665, collection number ml23-90).

Abrothallus yunnanensis Meng, Thiyagaraja & Diederich sp. nov.

Figure 3.8

Index Fungorum muber: IF***; Facesoffungi number: FoF***

Etymology – The specific epithet "*yunnanensis*" refers to the geographic name of Yunnan Province, where the holotype was collected.

Description – *Sexual morph: Apothecia* (193) 194–328 (425) µm ($\bar{x}$ = 261 µm, n = 15) in diam, superficial, dispersive, black, convex, mostly globose, the bottom of the apothecia slightly convergent, with greenish pruina on some apothecia or not. *Epithecium* layer (16) 19.1–28.1 (34.5) µm ($\bar{x}$ = 23.6 µm, n = 32) thick, with dark brownish granules, K-, I-. *Hymenium* (39) 46–60 (65) µm ($\bar{x}$ = 52.7 µm, n = 29) high, light brown to brown, K-, I-, interascal pseudoparenchyma transparent. Paraphysis branched to anastomosing, widened, 1.5–2.5 µm. *Exciple* thin or not obvious. *Hypothecium* dark brown, K-, I-, thickened, (30) 32.7–45.8 (52.5) µm ($\bar{x}$ = 39.3 µm, n = 26) thick, the hypothecial cells irregular shapes. *Asci* bitunicate, cylindrical to long clavate, (30) 34.4–48.4 (53) × (7.9) 8.4–13.7 (17.6) µm ($\bar{x}$ = 41 × 11 µm, n = 15), (6–)8-spored, K-, I-. *Ascospores* (9.3) 10.4–12.9 (15) × (4.5) 4.4–5.2 (6) µm ($\bar{x}$ = 11.7 × 4.8 µm, n = 37), brown, 1-septum, without guttulae, verruculose, asymmetric with a larger upper cell, l/w (upper cell) ratio = 2.1– 2.3 (2.6) ($\bar{x}$ = 2.2, n = 30), usually soleiform in shape, constricted at septum, without guttulae in cells, easily splited into part-spores. *Asexual morph:* Not observed.

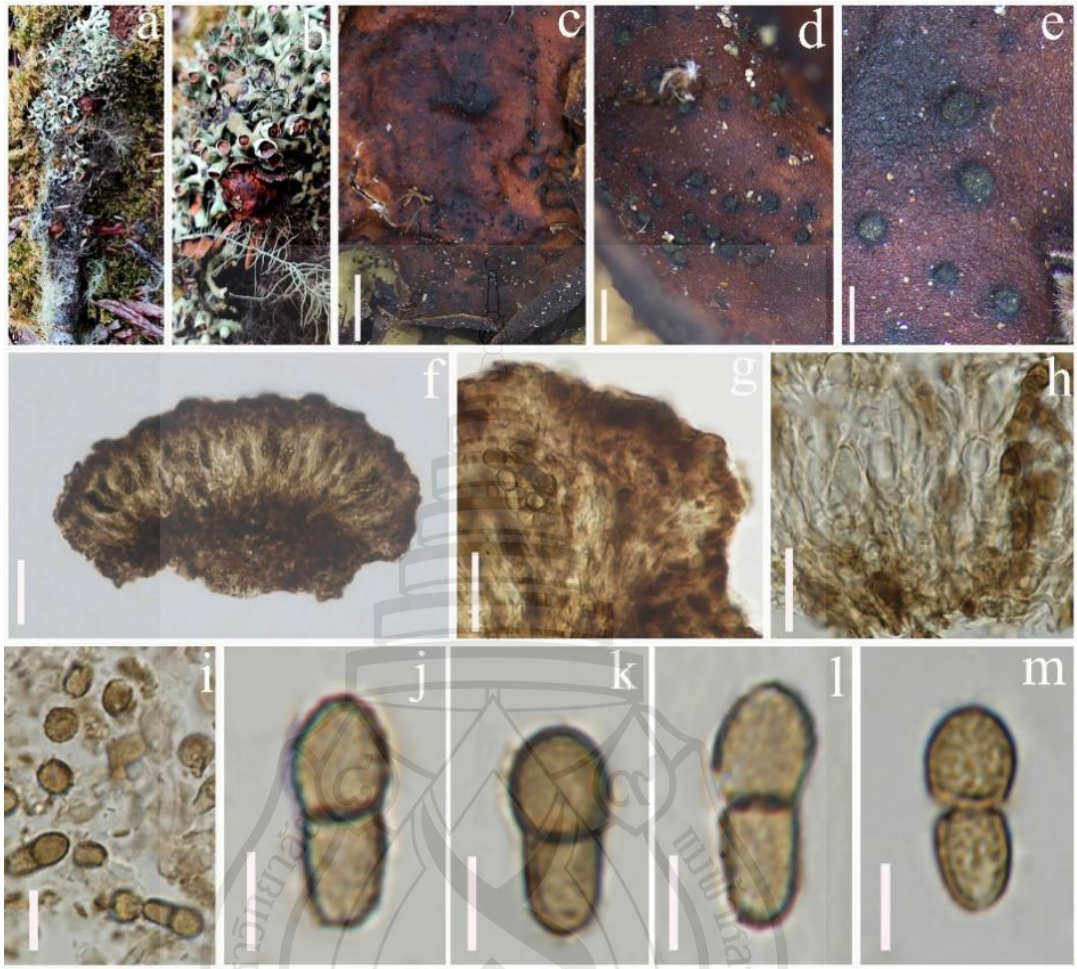
Examined material – China, Yunnan, collected from Laojun Mountain National Nature Reserve, Lijiang City, 26°37′59.07″N, 99°43′54.35″E, elev. 3946m, 30th April, 2023 (KUN-L 88552, Coll. No. ljs-203)-holotype. Lichenicolous, growing on the apothecia surface of *Hypogymnia* sp. which grows on the decaying branch of *Rhododendron simsii*.

GenBank numbers – KUN-L 88552, LSU: PQ772191, ITS: PQ721328, TEF1: PQ723771.

Notes – Phylogenetically, the new species *Abrothallus yunnanensis* is relate to

A. hypogymniae, as both grow on *Hypogymnia* disc and morphologically share features like ascomata shape and ascospores characteristics. However, *A. yunnanensis* is different from *D. hypogymniae* in the greenish pruina (vs. blackish and whitish) and significant base pair difference: 30 different bases pairs in 526 bp of ITS (5.7%), 10 bp difference in 878 bssp of LSU (2.16%) and 51 bp difference in 874 bp of TEF1 (5.84%). *Abrothallus yunnanensis* is also relate to *A. altoandinus* based on the phylogenetic tree, but morphologically differs in the epruinose apothecia and broader spores with a lower length-to-width ratio (2.1– 2.3 vs. up to 4.2) (Hawksworth, 1977; Flakus et al., 2019; Senanayake et al., 2023).

Morphologically, *Abrothallus yunnanensis* is similar to *A. teloschisti* in ascomata, asci and easily broken ascospores, but differs in the slightly larger ascospores (10.4–12.9 × 4.4–5.2 µm vs. 9.3–10.3 × 4.1–4.9 µm), and host (on *Hypogymnia* vs. On *Seirophora* and *Teloschistes*) (Brackel, 2015). This species is also similar to *A. ertzii* in pruina, ascomata size and easily broken ascospores, but differs in longer asci (34.4–48.4 µm vs. 27.5–36.5 µm), and wider ascospores (4.4–5.2 µm vs. 3–4.5 µm).



Note a–b Appearance of the host lichen. c–e Lichenicolous apothecia on the apothecia of *Hypogymnia* sp. f Longitudinal section of Apothecia in water. g Lateral and epihymenium in Melzer's reagent. h Paraphysis and asci in Melzer's reagent. i–m Ascospores in water. Scale bar: c = 5 mm, d = 1 mm, e = 500 µm, f = 50 µm, g–h = 20 µm, i = 10 µm, j–m = 5 µm.

Figure 3.8 *Abrothallus yunnanensis* growing on apothecia of *Hypogymnia* sp. (KUN-L 88552, collection number ljs-203)-holotype.

3.5 Disscussion

Divergence time estimation is crucial for understanding the evolutionary history of fungal populations. However, recent studies have indicated conflicting divergence times for Capnodiales, Abrothallales and allied orders, highlighting inconsistencies in the current

estimates (Beimforde et al., 2014; Liu et al., 2017; Hongsanan et al., 2020a). Therefore, we hypothesized that that the divergence times at the order level should be re-evaluated using an extended sampling of taxa to improve accuracy and resolve these discrepancies.

The phylogenetic findings of this study show both similarities and differences when compared to the results of Hongsanan et al. (2020). In this study, Abrothallales forms a clade adjacent to Jahnulales and Cladoriellales, which is consistent with the phylogenetic relationships reported by Hongsanan et al. (2020). However, a notable difference lies in the placement of Asterinales, which is included in a clade adjacent to Cladoriellales in our analysis (Figure 1), whereas Hongsanan et al. (2020) identified Asterinales as being more closely related to Capnodiales. The grouping of Muyocopronales and Pleosporales as neighboring branches aligns broadly with the results of Hongsanan et al. (2020). Similarly, the close relationship between Venturiales and Microthyriales observed in our analysis is also largely consistent with their findings.

3.5.1 Comparison of Crown Age Estimates with Fossil Records and Previous Studies

In this study, we significantly increased the sampling taxa for Abrothallales, Jahnulales, Asterinales, Capnodiales, Muyocopronales, Venturiales, and Microthyriales, whereas the sampling for these orders in the analysis by Hongsanan et al. (2020) was comparatively limited. This increased sampling likely resulted in earlier crown age estimates for these orders compared to previous studies. However, to ensure the reliability of divergence time estimates, it is crucial to first verify whether the fossil calibration points fall within reasonable ranges (table 3.6).

The crown ages of the genera or orders calibrated using the three fossils in this study are consistent with fossil records, albeit slightly earlier. The crown age of extant *Aigialus* was estimated at 44.13 Mya, slightly earlier than the fossil record of 34 Mya. This estimate is near to Zhang et al. (2019), who also used *Aigialus* fossil for calibration and estimated a crown age of 41 Mya. Similarly, the extant *Muyocopron* was dated to a crown age of 58 Mya, slightly earlier than its fossil record of 54 Mya, while the

estimated crown age of the order Muyocopronales is 127.38 Mya (105–158 Mya), which is slightly earlier than the 103.85 Mya by Hongsanan et al. (2020). For Microthyriales, our estimate of 192.79 Mya (201–301 Mya), which is obviously earlier than its fossile record of 145 Mya, and significantly predates the estimate of 141 Mya by Liu et al. (2017) and 118.31 Mya by Hongsanan et al. (2020). These results are reasonable and validate the overall reliability of our MCC tree. For other orders at the same taxonomic level, the estimated crown ages are expected to fall within this calibration framework.

3.5.2 Reevaluating the Crown Age of Dothideomycetes and Capnodiales

Regarding the crown age of Dothideomycetes, we acknowledge our estimate is lower than the true value. The crown age of Dothideomycetes, estimated at 276 Mya (235–320 Mya) in this study, is later than the estimates provided by Beimforde et al. (2014) at 321 Mya, Phukhamsakda et al. (2016) at 293 Mya, Liu et al. (2017) at 366 Mya, Zhang et al. (2019) at 286 Mya and Hongsanan et al. (2020) at 367 Mya (table 3.6). This is due to the reduced sampling at the class level, where only 16 orders were included (compared to the actual 30–40 orders in Dothideomycetes). Therefore, this result was expected and is consistent with the perspective proposed in our study.

The fossil Metacapnodiaceae has been consistently used in previous studies to calibrate the crown age of the extant order Capnodiales (fossil estimated at 100 Mya). However, the actual crown age estimates have varied significantly (table 3.7). For instance, Beimforde et al. (2014) estimated it at 160 Mya, Phukhamsakda et al. (2016) at 147 Mya, Liu et al. (2017) at 216 Mya using 11 families 28 taxa, Liu et al. (2018) at 120 Mya using 8 taxa, Zhang et al. (2019) at 195 Mya using 8 taxa, and Hongsanan et al. (2020) at 178 Mya using 17 families 32 taxa. Following the reclassification of Metacapnodiaceae into the order Verrucariales within the class Eurotiomycetes by Faezeh (2024), we included Capnodiales as an ingroup in this study to estimate its divergence time. After revisions by Abdollahzadeh et al. (2020), based on phylogenetic analyses, several families were reclassified into other orders or elevated to order rank.

Consequently, we used an expanded dataset comprising six families and 69 taxa without setting it as the calibration point at 100 Mya. Our results indicate a crown age of Capnodiales at 164 Mya (table 3.7).

3.5.3 Revised Divergence Time Estimates for Abrothallales, Jahnulales and Venturiales

The crown age of Abrothallales was estimated at 98.82 Mya (71–132 Mya) in this study, significantly earlier than the estimate of 58.84 Mya provided by Hongsanan et al. (2020). Although Liu et al. (2017) treated *Abrothallus* and *Lichenoconium* species as belonging to two separate orders, Abrothallales and Lichenociniales, they estimated the stem age of the two constituent families, Abrothallaceae and Licheniconiaceae, at 56 Mya (24–102 Mya), effectively serving as a proxy for the order. Hongsanan et al. (2020) included four species to represent Abrothallales, while Liu et al. (2017) selected six species to represent the two families. In contrast, this study expanded the sampling to include 33 species (belonging to two genera), capturing a much broader diversity within the order. This substantial increase in taxon representation likely contributed to the earlier divergence time estimate for Abrothallales, emphasizing the importance of comprehensive taxon sampling in generating more accurate and reliable divergence time.

Jahnulales K.L. Pang, Abdel-Wahab, El-Shar., E.B.G. Jones & Sivichai, an order of freshwater lignicolous ascomycetes, was established by Pang et al. (2002). This order is phylogenetically related to Dothideales, Patellariales, and Pleosporales (Campbell et al., 2007). Liu et al. (2017) included Jahnulales in their molecular clock analysis, employing two families and five species, estimating the crown age of the order at 118 Mya (54–190 Mya). Subsequently, Hongsanan et al. (2020) refined the families within Dothideomycetes and estimated the divergence time of this order at 96.87 Mya based on four species. In this study, we expanded the sampling to include 20 taxa, resulting in an estimated crown age of 145 Mya (112–179 Mya). This estimate is significantly earlier and a narrower range than previous results and likely represents a

more accurate approximation of the true divergence time.

Venturiales, a prominent order within Dothideomycetes (Ascomycota), comprises species with diverse lifestyles and a broad geographic distribution across temperate and tropical regions (Shen et al., 2020). This order comprises three families—Cylindrosympodiaceae, Sympoventuriaceae, and Venturiaceae—encompassing a total of 45 genera (Hyde et al., 2024). Among them, Venturiaceae accounts for approximately 80% of the order and serves as the type family of Venturiales (Shen et al., 2020). Hongsanan et al. (2016) included Venturiales in a molecular clock analysis, utilizing two species and suggesting that its divergence time predates 150 Mya. Liu et al. (2017) estimated the crown age of Venturiales at 189 Mya (112–274 Mya), employing nine species from two families. Hongsanan et al. (2020) represented the order with three species from two families, estimating a crown age of 120.35 Mya. In this study, we expanded the taxon sampling to include 74 species across three families in the molecular clock analysis. The results yielded an earlier crown age of Venturiales at 200.23 Mya (166–235 Mya). This finding supports the viewpoint that increased taxon sampling can lead to earlier divergence time estimates, providing a more refined understanding of evolutionary timelines.

3.5.4 Asterinales and Asterina: Divergence Times and the Role of Fossils in Calibration

Asterina is a highly species-rich genus, including 11 families 50 genera. Nine fossils representing seven species have been identified based on morphological characteristics (Dilcher, 1965; Selkirk, 1975; Vishnu et al., 2017). Samarakoon et al. (2019) proposed using 54 Mya as a minimum age for its crown node, suggesting that the genus could serve as a suitable calibration point for fossil-based studies. However, due to the formation of a mixed clade containing *Asterina* species and *Asterostomella grewiae* (MFLU 13-0629), rather than forming a monophyletic clade, this fossil genus was not utilized as a calibration point in this analyses. If the genus *Asterina* is confirmed to be monophyletic in future studies, it could serve as a suitable fossil calibration point.

Recent molecular dating studies have provided varying estimates for the crown age of Asterinales. Hongsanan et al. (2016) estimated the crown age at 188 Mya using six species, while Liu et al. (2017) included one family with seven species and estimated the crown age at 84 Mya (43–132 Mya). Hongsanan et al. (2020) used 17 species and estimated the crown age at 192 Mya. In our study, the crown age of mixed *Asterina* clade was estimated at 67 Mya, earlier than the proposed age (54 Mya) by Samarakoon et al. (2019), and the crown age of Asterinales at 193 Mya (154–236 Mya). This result is broadly consistent with Hongsanan et al. (2020), highlighting the importance of comprehensive taxon sampling in producing more robust and reliable divergence time estimates.

3.5.5 Refining Divergence Estimates for Other Orders: Expanded Sampling and Future Directions

For the remaining orders, our study expanded taxon sampling, leading to more refined estimates compared to previous research (table 3.7). For Lichenotheliales, while Liu et al. (2017) and Hongsanan et al. (2019) included only two species and estimated crown ages of 46 Mya and 47.8 Mya, respectively, we used five species and estimated a crown age of 69.78 Mya (30–124 Mya). Similarly, for Patellariales, earlier studies used two to three species, with Liu et al. (2017) estimating 164 Mya (72–283 Mya) and Hongsanan et al. (2019) reporting 30.82 Mya, whereas our study, with 12 species, yielded a significantly earlier estimate of 177.25 Mya (120–225 Mya). For Zeloasperisporiales, our inclusion of nine species, compared to two or three in previous studies, resulted in a crown age estimate of 63.54 Mya (36–102 Mya), earlier than previously reported. However, for *Natipusillales*, *Phaeotrichales*, and *Trypetheliales*, we acknowledge that the taxon sampling is limited in these orders. necessitates further refinement when more molecular data become available.

3.5.6 Review of *Abrothallus*

Suija et al. (2024) noted that 46 species have been recognized within the genus *Abrothallus*, while Hyde et al. (2024) reported a higher number of 56 species.

However, based on our comprehensive verification, we recognize 54 species in this genus, of which 52 are lichenicolous. Invalid nomenclature and synonyms assigned to other genera have been excluded based on examinations using Index Fungorum (2025), MycoBank (2025), and related references. Among these species, six are described solely by their asexual morph, while the remaining species exhibit sexual reproduction, including 18 species that display both reproductive types (Table 3.8, 3.9). The sexual species share several common characteristics, such as nearly globose, black ascomata; bitunicate asci with a thickened apical wall; and asymmetric, trans-septate, brown, warted ascospores. Species-level distinctions are primarily based on variations in apothecia size, the presence or absence of pruina and its coloration on the apothecia, asci length, the number of ascospores per ascus, ascospore dimensions, length-to-width ratio, the number of septa, and whether the ascospores split into semi-spores at the median septum. Based on these differences, we compiled a key to the genus to facilitate the identification of each species. However, some species are exceptionally challenging to distinguish based solely on their descriptions. This is particularly true for some early-published species, which are often described very briefly and lack clear, detailed illustrations. As a result, we have to find other minor different features for a distinguishment. Further comparative studies, particularly through examination of their type specimens, will be necessary to determine their distinct characteristics or potential synonymy.

3.5.7 Phylogenetic Results Showed That Abrothallus Had a Host Bias in Its Relatives

Our phylogenetic analysis reveals that the genus *Abrothallus* is polyphyletic. A total of 34 taxa were included in the study, which were grouped into three distinct clades. The largest clade (labeled A) is further subdivided into three subclades: subclade A1, containing 18 *Abrothallus* species, is closely related to the *Lichenoconium* clade (labeled A2), which consists of five species, while subclade A3 includes two named and one unnamed *Abrothallus* species. All species within three subclades are lichenicolous

on the thalli of Peltigerales lichens. The second major clade, labeled B, comprises 16 *Abrothallus* species, including four new species and one new record described in this study and 11 previously published species. The third clade, labeled C, contains only two strains of *Abrothallus usneae*. Species in clades B and C are primarily associated with the lichens of *Parmeliaceae*. In addition to the two main host groups (Parmeliaceae and Peitigerales) included in this study, *Abrothallus* species were also found on lichens belonging to *Acarospora* (Acarosporaceae, Acarosporales), *Cladonia* (Cladoniaceae, Lecanorales), *Heterodermia* (Physciaceae, Caliciales), *Leifidium* (Sphaerophoraceae, Lecanorales), *Stereocaulon* (Stereocaulaceae, Lecanorales), *Seirophora* and *Teloschistes* (Teloschistaceae, Teloschistales) (Maire, 1937; Etayo, 2002; Diederich, 2003; Brackel, 2015; Etayo, 2017; Zhurbenko, 2023).

3.5.8 Interspecific Difference Analysis of *Abrothallus* Species on Parmelioid Lichens

The delimitation of species within *Abrothallus* has long been a subject of debate, particularly for those parasitizing hosts in the lichen family Parmeliaceae. To address this issue and refine the taxonomy of *Abrothallus*, Suija et al. (2018) conducted an examination of historical materials and provided detailed descriptions for seven species. To date, 22 species have been reported to grow on *Parmeliaceae* hosts (Table 3.8). In our phylogenetic analysis, clade B encompasses 11 previously described species, which are further divided into two well-supported subclades. The first subclade includes ten previously published species along with two new collections: *Abrothallus parmelioidea*, *A. myelochroae*, and one new record *A. cf. acetabuli*. The second subclade comprises one previously known species and two newly described species: *A. hypogymniaum* and *A. yunnanensis*. While *A. parmelioidea*, *A. myelochroae*, and *A. flavoparmelia*each form distinct clades, their short branch lengths and similarities to other species within the subclade suggest minimal genetic differentiation. The limited genetic distances between these species raise questions about whether there is sufficient interspecific variation to support their recognition as distinct species.

In clade B of this phylogenetic tree, the smaller subclade comprises two new species, *A. hypogymniaum* and *A. yunnanensis*, along with the previously described species *A. altoandinus*. Based on sequence comparison, *A. hypogymniaum* differs from *A. altoandinus* by 16 base pairs out of 526 bp in the ITS region, corresponding to a 3.04% divergence. Morphologically, *A. hypogymniaum* can be distinguished from *A. altoandinus* by its thicker epihymenium (11.7–15.3 μm vs. 5–10 μm), thinner hymenium (24.8–33.3 μm vs. 40–65 μm), thicker hypothecium (100–137 μm vs. 60–80 μm), shorter asci (20–35 μm vs. 30–60 μm), and smaller ascospores (8.4–13.8 × 3.5–5.9 μm vs. 11–19 × 4–7 μm) (Senanayake et al., 2023).

To further identify morphological differences among the *Abrothallus* species parasitizing Parmeliaceae lichens, we conducted a comparative analysis of their descriptions (Table 3.8, 3.9). As type specimens for these species were not available for our examination, our comparisons relied exclusively on the original descriptions and redescriptions of historical materials. Fortunately, we were able to access most of the descriptions, with the exception of *A. chrysanthus*, an older species for which no records or redescriptions are currently available. Among these species, three exhibit distinctive characteristics that make them easily distinguishable from others: *A. bryoriarum* is characterized by 3-septate ascospores, *A. curreyi* by its smaller ascospores (3 × 2.5 μm), and *A. tetrasporus* by 4-spored asci (Lindsay, 1866; Hafellner, 1994; Senanayake et al., 2023). Our new species clearly cannot be related to these three species

The size of the ascospores may serve as another distinguishing feature, although there is some overlap in their size ranges. For instance, certain species, such as *A. altoandinus*, *A. buellianus*, *A. caerulescens*, and *A. parmotrematis* possess ascospores that can reach up to 20 μm in length (Hafellner, 1994; Suija et al., 2018; Senanayake et al., 2023). In contrast, *A. chrysanthus*, *A. niger* and *A. stroblii* have ascospores that are less than 10 μm but more than 5 μm in length (Hafellner et al., 2008; Etayo, 2017). Based on this characteristic, these seven speces can be excluded from our species.

Another important characteristic is whether ascospores are readily separated from middle septatum naturally in hymenium, or are readily divided into semi-spores under little interference. From the perspective of evolution, the broken semispores are smaller in size and easier to spread in nature, which may be an evolutionary mechanism of species adaptation (Deacon, 2005). Therefore, we think that this feature should also be an important difference between species. Unfortunately, this feature is not mentioned in all species descriptions. However, from the species that do mention this feature, only a few species describe spores that are easily divided into semispores, such as *A. niger* and *A. stroblii* (Hafellner et al., 2008; Etayo, 2017), in addition our two new descripted species: *A. myelochroae* and *A. yunnanensis*. However, the two new species are different from *Abrothallus niger* by longer ascospores (more than 10 μm vs. 6.5–8.5 × 2.5–3.5 μm). Furthermore, *A. myelochroae* is similar to *A. stroblii* in characteristics of ascospores, but differs in epruinose (vs. with yellow-green pruina), thicker hymenium (39.1–54.4 μm vs. 35–40 μm), and the coloration of hymenium (hyaline to slightly yellowish vs. dark purplish) (Hafellner et al., 2008). If we consider the neighboring species within the genetically close subclade, *A. myelochroae* can be distinguished from *A. acetabuli*, *A. buellianus*, *A. parmeliarum*, and *A. parmotrematis* by its shorter ascospores (10.6–11.7 μm vs. more than 12 μm in the other four species). (Diederich, 1990; Diederich, 2011; Suija et al., 2018). *Abrothallus yunnanensis* is morphologically similar to *A. stroblii* in characteristics of ascospores, but differs in greenish pruina on ascomata (vs. with yellow-green pruina), thicker hymenium (35.5–51 μm vs. 35–40 μm) and bigger ascospores (10.1–13 × 4.7–5.7μm vs. 8–11 × 4–5 μm) (Hafellner et al., 2008).

Another notable feature is the presence or absence of asexual conidiomata. Asexual reproduction allows for the rapid production of conidia, which are typically small in size. Once released into the environment, these conidia can disperse more efficiently, increasing the likelihood of finding a suitable habitat for survival, growth, and reproduction (Taylor et al., 1999; Ashu et al., 2015). Therefore, this feature

improves its ability to adapt to the environment and should also be used as one of the distinguishing features between species. Among these species growing on Parmeliaceae lichens, nine species have asexual conidiomata in addition to sexual ascomata, namely: *Abrothallus acetabuli*, *A. caerulescens*, *A. microspermus*, *A. parmeliarum*, *A. parmotrematis*, *A. santessonii*, *A. tetrasporus*, *A. tulasnei*, *A. usneae* and one new collection *A. flavoparmelia* (table 3.9) (Diederich, 1990; Cole et al., 2001; Diederich, 2011; Suija et al., 2018; Senanayake et al., 2023). In the description of asexual type, it is difficult to quantify or qualitaty the morphology of conidiomata and conidia to distinguish the species. There are some common characteristics that every asexual species possesses, for example, black immersed or semi-immersed conidiomata, aseptate, obpyriform conidia with a truncated end. However, based on conidial dimensions, these seven species can be divided into two distinct groups. The first group includes species with larger conidia exceeding 10 μm in length, such as *A. caerulescens* and *A. tulasnei* (Cole et al., 2001; Suija et al., 2018). The second group comprises remaining species with conidia measuring less than 10 μm in length. Within this second group, *A. flavoparmelia*is distinguishable from *A. caerulescens*, *A. parmeliarum* and *A. tetrasporus* by its longer conidiogenous cells (5.1–5.7 μm vs. >8 μm), other five species have no description about this characteristic. *A. usneae* has a long genetic distance with *A. flavoparmelia*in phylogenetic tree. Apart from this distinction, the remaining four species lack significant differences with *A. flavoparmelia*based on the current descriptions in the size of ascomata, sectional structures, ascospores and asexual morph.

Based on taxonomic descriptions across various species, the presence or absence of pruina, along with its coloration, has shown potential as a significant diagnostic feature for species differentiation. However, the reliability of this characteristic is challenged by its developmental variability. Pruina is typically observed on juvenile ascomata but often diminishes or disappears entirely as the ascomata mature in some species. This developmental variability means that taxonomic assessments based solely on fully mature or entirely immature specimens can lead to

inconsistent or conflicting conclusions. Therefore, it is crucial to consider the developmental stages of pruina when using it as a taxonomic criterion. The role of pruina in species identification has been explored in lichen taxonomy, with studies suggesting a connection between pruina formation and production of specific chemical components (Heiđmarsson, 1996). As new species continue to be discovered, this feature may gain formal recognition as an important diagnostic trait.

Based on the above considerations, in the current context, pruina is used to distinguish *Abrothallus flavoparmeliae* from *A. parmeliarum*, *A. parmotrematis* and *A. santessonii*. Specifically, *A. flavoparmeliae* is epruinose, whereas *A. santessonii* has heavily green pruina, *A. parmeliarum* has slightly greenish pruina, and *A. parmotrematis* has yellowish pruina (Diederich, 2011; Suija et al., 2018). Morphologically, *Abrothallus flavoparmeliae* shares the greatest similarity with *A. microspermus* and *A. usneae*. However, it can be distinguished from *A. microspermus* by its larger ascomata (341–502 µm vs. 200–280 µm), and larger ascospores (12–16.7 × 4.7–6.5 µm vs. 9.5–11 × 3.2–4.8 µm) (Tulasne, 1852; Diederich, 1989). It is also distinct from *A. usnea* in having slightnly longer ascospores (12–16.7 × 4.7–6.5 µm vs. 12–13× 4.5–6 µm) and a different host (*Flavoparmelia* vs. *Usnea*). Morphologically, the new collection is extremely similar to *A. acetabuli*. However, its placement on phylogenetic tree reveals a significant distance from *A. acetabuli* though with a short branch length, and is morphologically distinguished by hyaline conidia (vs. hyaline to brown) and smaller conidia (5.4–6.5 × 3.7–4.4 µm vs. 7–8.5 × 4.5–5.0 µm). The closest phylogenetic relative of *A. floroparmeliae* is *A.buellianus*, but morphologically it is distinguished from *A. buellianus* by its significantly smaller ascospore (12–16.7 × 4.7–6.5 µm vs. 14–20 × 5.5–7 µm). Consequently, this specimen is dentified as a new species *Abrothallus flavoparmeliae* based on the genetic distance and different host.

Due to the ascomata covered by greenish pruina, without asexual morph, ascospores not broken into semi-spores, and the base pairs differences, *Abrothallus parmelioidea* is only similar to *A. hypotrachynae*, but differs in the smaller ascomata

(150.4–241.5 µm vs. 245–450 µm for *A. hypotrachynae*), and smaller ascospores (8.8–12.2 × 3.5–5.5 µm vs. 11–14 × 5–5.5 µm)

Table 3.8 Sexual Characteristics of *Abrothallus* Species Growing on Parmeliaceae Lichens

Species	Ascomata		Epihymenium	Hymenium /µm	Hypothecium	Asci /µm	Ascospores /µm	Host	Locations
	Pruinose	diameter /µm							
Abrothallus acetabuli	Epruinose, short-stipitate	(150) 270–470 (650)	Covered by dark brown crystalline layer, dissolves in KOH into yellow substance	hyaline to brownish, K-	Brown, K-	8-spored	1-septate, brown, verruculose, and slightly unequal, (12.5) 13.5–15 (16) × 5.5–6.5 (8)	*Parmelia acetabulum*	Luxembourg, Greece, USA, Russia, Spain, Netherlands, Germany and France,
A. flavoparmeliae	epruinose	(250) 341–502 (833)	17–25.7 µm thick, with dark brownish granules, reddish-violet tinge, K,+ greenish I-	55.8–69.7 µm high, hyaline to slightly brownish, K+greenish, I+, uppart reddish-violet	121–153 thick, brown, K-, I-, thickened, forming a dome-like shape	8-spored, bitunicate, cylindrical to long clavate, K-, I-, 48–60 × 10–13	1-septate, brown, verruculose, usually soleiform, asymmetric with a larger upper cell, slightly constricted at septum, 12–16.7 × 4.7–6.5, l/w ratio of 2.4–2.5	*Flavoparmelia*	Yunnan, China
A. microspermus	Epruinose	200–280	with a dark brown-olive crystalline layer, K+ green	hyaline to faintly brownish, reacting K+ green in the upper part	yellowish-brown, K–	8-spored, 45–60 × 10	1-septate, brownish, verrucose, (7) 9.5–11 (14) × (3) 3.2–4.8 (5.5)	*Parmelia caperata, Flavoparmelia caperata*	France
A. altoandinus	Epruinose	100–350	5–10 µm, dark brown with violet pigment, K+ emerald greenish, N+ greyish	40–65 µm, hyaline to violet in the upper part, K+ emerald green	60–80 µm, pale to dark brown	(4)8-spored, bitunicate, broadly clavate, apically widened with an evident apical dome, 30–60 × 7–22	1-septate, medium to dark brown, verrucose, covered by a gelatinous layer, 11–(15.1 ± 1.5) –19 × 4– (5.2 ± 0.7) –7, (l/b) ratio 2–(3 ± 0.5)–4.2, not break into semi-spores	*Usnea duriezii*	Bolivia
A. bertianus	Epruinose, or green pruinose	170–240–300	consists of dark brown granules, reacting K+ greenish to emerald greenish, N+ violet	hyaline, a. 60 µm tall, and the upper part reacts K+ greenish	brown beneath the hymenium, becoming gradually lighter toward the base	8-spored, clavate, bitunicate, 47–55 × 8–12	2-celled, asymmetric, verruculose, 11–16 × 4–6 (upper cell)/ 3.5–4.5 (lower cell), l/w ratio of 2.2–3.5	*Melanelixia subaurifer, Parmelina tiliacea, P. quercina*	Italy, Croatia

Table 3.8 (continued)

Species	Ascomata		Epihymenium	Hymenium /µm	Hypothecium	Asci /µm	Ascospores /µm	Host	Locations
	Pruinose	diameter /µm							
A. bryoriarum	Epruinose or slightly pruinose	200–400	I-	hyaline, 50–70 µm high, with a granular, brown upper layer, I-	brown and cushion-shaped	(4-, 6-)8-spored, fissitunicate, slightly clavate, with the endoascus thickened at the apex, 40–50 × 12–15, I-	3-septate (2-celled), I-, asymmetric, slightly constricted, with a wart-like sculpture (16) 17–20 × 6–8.	*Bryoria capillaris*	Italy, Austria
A. buellianus	Epruinose	200–300–500	consists of brown granules, with reactions K+ greenish and N–	hyaline, 95 µm high, K–, N–	Brown, gradually lighter toward the base, 170 µm high	8-spored, bitunicate, elongated to subclavate, 53–68 × 11–15	2-celled, brown, verruculose, and asymmetric, 14–20 × 5.5–7 (upper cell) / 4–6 (lower cell), l/w ratio of 2.3–3.4	*Parmelia tiliacea*	Italy, Belgium, Luxembourg, Germany, Greece, USA
A. caerulescens	Epruinose	200–270–300	dark brown granules, K+ greenish, N+ violet	Upper part greenish, downwards hyaline, ca. 55 µm, K+ greenish, N+ violet	dark brown, turns gradually lighter downwards the base	8-spored, bitunicate, clavate, 40–48 × 16	2-celled, asymmetric, brown to dark brown, 14.5–19 × 5.5–8.5 (upper cell)/ 5–6.5 (lower cell), l/w ratio of 2–2.9	*Xanthoparmelia conspersa*	Germany
A. cetrariae	Epruinose	170–280–450	composed of brown granules, K+ olive-green, N–	hyaline, K–, N–, approximately 70 µm tall	light brown, approximately 170 µm tall	8-spored, bitunicate, clavate, 47–61 × 10–12	2-celled, asymmetric, brown to dark brown, 13–17 × 5–7.5 (upper cell)/ 4.5–5.5 (lower cell), l/w ratio of 2.15–2.8	*Platismatia glauca*	Italy, Germany
A. chrysanthus	epruinose or yellow pruinose	120–350					8–10 × 3–4.5	*Usnea*	Spain
A. curreyi	epruinose?		composed of brown granules	consists of closely aggregated elements	hypothecial tissue is dark and granular	8-spored, 12 × 6	1-septate, broadly ellipsoid or sub-oblong, occasionally dividing into two loculi, slightly constricted at the septum, brown, solseform, 3 × 2.5	*Parmelia saxatilis*	New Zealand

Table 3.8 (continued)

Species	Ascomata		Epihymenium	Hymenium /µm	Hypothecium	Asci /µm	Ascospores /µm	Host	Locations
	Pruinose	diameter /µm							
A. hypogymniae	blackish and whitish pruina	182–246.5	11.7–15.3 µm thick, with dark brownish granules, K-, I-	24.8–33.3 µm high, hyaline to slightly yellowish, K-, I-	100–137 µm thick, dark brown	8-spored, bitunicate, clavate, 20–35 × 9–13	2-celled, constricted at the septum, light to dark brown, verruculose, asymmetric, 8.4–13.8 × 3.5–5.9, l/w ratio of 2.2–2.5, not breaking into semi-spores	*Hypogymnia*	China, Yunnan
A. hypotrachynae	green pruina or not	245–450	dark green or olive green, reacting K+ intense green, N+ brown-violet, later turning orange	70–80 µm thick, greenish, with a K+ blue-green	a. 50 µm thick, brown, with K+ olive green and N+ intense orange	8-spored, clavate, bitunicate, 60–70 × 7–11	bicellular, brown from the beginning, ornamented, asymmetric, 11–14 × 5–5.5	parmelioid lichens *(Hypotrachyna, Parmelinopsis)*	Colombia
A. myelochroae	epruinose	131–256	9–11.9µm thick, containing dark brownish granules, I-	39.1–54.4 µm high, hyaline to slightly yellowish, K-	39.6–49 µm thick, light brown, K-	8-spored, bitunicate, narrowly clavate to cylindrical, thickened at the apex, I-, 30.8–40.2 × 6.7–9.6	1-septate, brown, verrucose, asymmetric, (9.3) 10.6–11.7 (12.3) × (3.7) 4.2–5.2 (5.9), l/w ratio of 2.4–2.6, sometimes separating into semispores	*Myelochroa*	Yunnan, China
A. niger	epruinose	120–270	brown, 5 µm thick, and K+ olive-green	black-green, K+ slightly olive-green, and 40–50 µm thick	brown and paraplectenchymatous in section	8-spored, fissitunicate, clavate, with a thickened upper wall, 21–26 × 7–9	ellipsoidal, strongly constricted at the septum, verruculose, dark brown, 6.5–8.5 × 2.5–3.5, breaking very easily	*Everniastrum*	Ecuador
A. parmeliarum	slightly green pruinose	400	composed of brown granules	colorless to slightly greenish at the top, K+ green and N+ violet, 80–90 µm high	light brown to brown, a. 150 µm high	8-spored, bitunicate, subclavate to clavate, 47–64 × 8–17	2-celled, asymmetric, verruculose, and brown, 13–16.5 × 5–7 (upper cell)/ 4–6.5 (lower cell)	*Parmelia saxatilis*	Croatia, Greece
A. parmelioidea	greenish pruina	150.4–241.5	17.7–29.6 µm, with dark brownish granules, K/I-	34.7–49 µm high, hyaline to slight yellowish, K-, I-	brown or dark brown, forming a dome-like shape, K-, 90–140 µm thick	8-spored, bitunicate, clavate, K/I-, 28.2–57.8	1-septate, light brown when young to dark brown when mature, verruculose, asymmetric, (7.5) 8.8–12.2 (13.4) × (3.3) 3.5–5.5 (5.9), l/w ratio of 2.4–2.6, not broken into part-spores	*Menegazzia subsimilis*	Yunnan, China

Table 3.8 (continued)

Species	Ascomata		Epihymenium	Hymenium /µm	Hypothecium	Asci /µm	Ascospores /µm	Host	Locations
	Pruinose	diameter /µm							
A. parmotrematis	with yellowish pruina	(110) 180–290 (400)	dark greenish brown, K+ green and N+ purplish brown, 13–20 µm tall	hyaline to pale greenish brown, K–N–, I–, K/I–, 50–85 µm tall	dark brown, K–, N–	8-spored, clavate, thick-walled, 55–65 × 12–15	1-septate, brown, verruculose, (12.0) 13.1–16.4 (20.0) × (4.8) 5.3–6.1(6.8), l/w ratio of 2.2–3.0	*Parmotrema crinitum*	Great Britain
A. peyritschii	epruinose	200–380	dark brown to violet-brown, K+ greenish, N–	hyaline, with the upper part K+ greenish, N–, a. 65 µm tall	dark brown to violet-brown, a. 80 µm tall	8-spored, bitunicate, clavate, 43–50 × 12–16	2-celled, asymmetric, verruculose, brown, 10–13 × 4.5–6 (upper cell)/ 4–5 (lower cell), l/w ratio of 1.6–2.8	*Vulpicida pinastri*	Italy
A. prodiens	epruinose or slightly pruinose	(100) 150–250 (350)	covered by a reddish-brown to dark olivaceous crystalline layer,	brownish, K+ green in the upper part and K- in the lower part	dark reddish-brown, K- (or K+ yellowish)	8-spored	initially olivaceous, then brown, with a verrucose surface, 1-septate, (10.5) 12–14 (16.5) × (4.5) 5.5–6.5 (7), l/w ratio of 1.8–3.2	*Hypogymnia physodes*	France
A. santessonii	heavily green pruinose	350–400–500	consists of brown granules, reacting K+ greenish and N+ violet	hyaline, with a slightly greenish upper part, 60–70 µm	light brown to brown, 110–140 µm	8-spored, clavate, 34.5–46 × 10.5–15	2-celled, light brown when immature and brown when mature, asymmetric, verruculose, 12.5–15 × 3.5–6 (upper cell)/ 3–5 (lower cell), l/w ratio of 2.2–3.8	*Platismatia glaucae*	Sweden
A. stroblii	with yellow-green pruina	180–250		35–40 µm high, hyaline at the base, and dark purplish at the top, with K+ bluish-greenish	medium brown, developed as a central convex pad	8-spored, fissitunicate, broadly cylindrical with a short foot, 30–38 × 8–12	1-septate, brown, with warty sculpture, 8–11 × 4–5, some spores break at the septum	*Menegazzia terebratae*	Austria
A. suecicus	epruinose?	200–250				8-spored, ovate-clavate, short-stipitate, with thickened and rounded tips, 40–50 × 15–16	oblong-clavate, constricted in the middle, initially 2-celled and hyaline, later 3-septate and brown, 14–18 × 6–7	*Ramalina fraxinea*	Sweden

Table 3.8 (continued)

Species	Ascomata		Epihymenium	Hymenium /µm	Hypothecium	Asci /µm	Ascospores /µm	Host	Locations
	Pruinose	diameter /µm							
A. tulasnei	epruinose	(160) 175–225 (250)	granular, K+ olivaceous green, 5–8 µm tall	K+ olivaceous-green, particularly intense toward the base, 65–85 µm tall	well-developed, dark brown, 90–120 µm tall	8-spored, elongate-clavate to subcylindrical, 50–57×15.5–18.5	1-septate, dark brown, coarsely warted, 15–17 × 7–11	*Xanthoparmelia somloensis*	Québec, Canada
A. usneae	Epruinose, or with a slightly whitish pruina	250–500	dark greenish-brown, K+ green	hyaline to pale brown, K+ green	brown, K-	8-spored, elongate ellipsoid to clavate, 55–65 × 10–11	1-septate, brown, verruculose, (11)12–13 (14) × 4.5–6	*Usnea barbata*, *Biatoropsis*	Florida
A. yunnanensis	with greenish pruina	194–328	19.1–28.1 µm thick, with dark brownish granules, K-, I-	46–60µm high, light brown to brown, K-, I-	dark brown, K-, I-, thickened, (30) 32.7–45.8 µm thick	8-spored, bitunicate, cylindrical to long clavate, K-, I-, (30) 35.5–51 (52.7) × (7.9) 8.8–13.5 (17.6)	1-septum, brown, verruculose, asymmetric, (9.3) 10.1–13 (14.9) × (4.5) 4.7–5.7 (6.1), l/w ratio of 2.1– 2.3, easily splited into part-spores	*Hypogymnia*	Yunnan, China
A. tetrasporus	epruinose or rarely slightly yellowish pruinose	250–550	5–10 µm, dark brownish violet, K+ emerald green, N+ violet (shortly)	40–90 µm high, hyaline to violet in the upper part, K+ emerald green	olive brown to dark brown in the upper part, 90–250 µm high	4-spored, bitunicate, I–, K/I–, narrowly clavate, apically widened with evident apical dome 40–70 × 8–12	1-septate, medium to dark brown, distinctly verruculose, covered by a gelatinous coat when younger, broadly ellipsoid, 8.5– (x = 12.6 ± 1.4) –15 × 4– (x = 5.2 ± 0.5) –6.5, l/b ratio 1.9–3, not breaking easily into semi-spores	*Usnea, Biatoropsis usnearum*	Uruguay, Bolivia, USA

Table 3.9. Asexual Characteristics of *Abrothallus* Species Growing on Parmeliaceae Lichens

Species	Pycnidia diameter (µm)	Conidiogenous cells size (µm)	Conidia			Host	Locations
			morph	color	size (µm)		
Abrothallus acetabuli	100–200		obpyriform to ellipsoid	hyaline to yellowish	2.5–7 × 1–2.5	*Parmelia acetabulum*	Luxembourg, Greece, USA, Russia, Spain, Netherlands, Germany and France,
A. caerulescens	130– (160) –200	8–13 × 2.5–4	obpyriform to clavate with truncated end	hyaline	9.5– (12.43 ± 1.83) –14.5 × 3– (4.08 ± 0.89) –6.5	*Xanthoparmelia conspersa*	Germany
A. flavoparmeliae	(94) 117–180 (197)	5.1–5.7 × 3–3.5	aseptate, obpyriform to ellipsoid, distinctly truncated at the base, with a smooth surface	Hyaline	(4.8) 5.1–7.1 (8.6) × (3.6) 3.8–5.9 (6.1)	*Flavoparmelia*	Yunnan, China
A. microspermus	90–200	5–11 × 3–4 6–9 × 2–3.5	obpyriform to ellipsoidal, contained within a mucilaginous mass, simple, distinctly truncate at the base, with a finely verrucose surface	hyaline	6.3–8.5 × 3.5–5 (5)5.5–6.9(8.5) × (2.8)3.1–4,1(4.5)	*Flavoparmelia caperata*, *Parmelia caperata*	France, Luxembourg, Sweden, Switzerland
A. parmeliarum		8–12 × 3–4	obpyriform, surface finely verruculose, often appearing assmooth	hyaline	7.5–10 × 5.5–7	*Parmelia omphalodes*	Arizona, USA
A. parmotrematis	150–200		elongate ellipsoid, with a truncate base, aseptate, verruculose	Hyaline	(6.0) 6.5–8.5 (10.3) × (3.5) 4.1–4.8 (6.0)	*Parmotrema crinitum*	Great Britain
A. santessonii	150– (200) –350		obpyriform	Hyaline	5–9 × 3–6	*Platismatia glaucae*	Sweden
A. tetrasporus	80–160	8–10 × 3–5	obpyriform with truncated end	Hyaline	4.5– (x = 7.4 ± 0.9)–9 × 4– (x = 4.6 ± 0.4) –5.5	*Usnea, Biatoropsis usnearum*	Uruguay, Bolivia, USA
A. usneae			obpyriform to ellipsoid	hyaline	7 × 5.5	*Usnea barbata v. florid*	Florida
A. tulasnei	(50) 62–100 (125)		narrowly obpyriform, truncated at the base, distinctly minutely warted	Hyaline	(9.5) 11–14.5 (19) × (3.5) 4–5 (6.5)	*Xanthoparmelia somloensis*	Québec, Canada

CHAPTER 4

A NOVEL SPECIES AND A NEW GEOGRAPHICAL RECORD OF CHINA OF *SCLEROCOCCUM* (DACTYLOSPORACEAE, SCLEROCOCCALES, EUROTIOMYCETES)

4.1 Abstract

Sclerococcum stictae, a new lichenicolous species, forms a sister clade relationship to the lichenicolous fungus *S. ricasoliae*. It was found on the thallus of *Sticta*, and is characterized by black apothecia, elongate, cylindrical asci and brown, elliptical, and 1-septate ascospores. *Sclerococcum glaucomarioides* growing on the lichen *Ochrolechia akagiensis* is newly reported from China. This study provides an illustration and morphological description for this species, complemented by phylogenetic analyses based on ITS, LSU, mtSSU sequence data. The taxon is characterized by adpressed to sessile apothecia that are round to angular with black disc, hymenium with brownish color, measures 25 – 40 μm high, broadly cylindrical to subclavate asci with 8-spored, measure 20 – 30 × 10 – 15 μm, with euamyloid apical cap and the brown ascospores with 2 – 3 transverse septate.

Key words: Lichen, *Ochrolechia akagiensis,* Morphology, Phylogeny, Taxonomy

4.2 Introduction

Dactylosporaceae (Sclerococcales, Eurotiomycetes) was established by Bellem. & Hafellner (1982), and comprises of lignicolous, lichenicolous, and beetle-associated fungi (Bellemere et al., 1982; Yang et al., 2023). The family comprised six genera

namely *Cylindroconidiis* Huang Zhang & X.D. Yu, *Fusichalara* S. Hughes & Nag Raj, *Gamsomyces* Hern.-Restr. & Réblová, *Pseudosclerococcum* Olariaga, Teres, J.M. Martín, M. Prieto & Baral, *Rhopalophora*-Réblová, Unter. & W. Gams and the generic type *Sclerococcum* Fr. (Hyde et al., 2024). Sclerococcaceae Réblová represents another family within the order Sclerococcales Unter. & W. Gams, which was initially introduced by Réblová and it served as the type family of Sclerococcales (Réblová *et al.,* 2017).

Sclerococcum is among the species rich lichenicolous genus (Diederich et al., 2018). It was originally idescribed by Fries (1819, 1825) to accommodate the parasitic hyphomycetous fungus, *S. sphaerale* (Ach.) Fr. which was previously classified as *Spiloma sphaerale*, an asexual morph on saxicolous *Pertusaria corallina* (L.) Arnold (Fries, 1819; Fries, 1825). Phylogenetic analysis by Diederich et al. (2013) revealed that *S. sphaerale* clusters with two species of *Dactylospora*. Diederich *et al.*, (2018) proposed adopting the family name *Dactylosporaceae*, with *Sclerococcaceae* as its synonym. They further recommended retaining *Sclerococcum* as the valid genus name and synonymizing *Dactylospora* under it, as *Sclerococcum* (1821) has nomenclatural priority over *Dactylospora* (1855). Consequently, 64 species of *Sclerococcum*, which included 46 new combinations of lichenicolous species that had previously been assigned to *Dactylospora* (Diederich et al., 2018). The sexual morph of *Sclerococcum* has superficial to stalked black apothecia, and amyloid asci with an apical gelatinous cap whereas asexual morph has blackish sporodochial-stromatic conidiomata, dark brown conidia with uni- to multi-cellular (Diederich et al., 2013; Olariaga et al., 2019; Joshi, 2021). The members of *Sclerococcum* include both lichenicolous taxa and also saprotrophs on bark, wood and liverworts (Joshi, 2021).

Ochrolechia A. Massal. is a widespread lichen genus, which usually grows on bark, mosses or soil detritus and mainly siliceous rocks (Cannon et al., 2021). This

genus contains 58 species (Ertz et al., 2016) and hosts more than 40 lichenicolous fungi and two lichenicolous lichens (Diederich et al., 2018; Zhurbenko et al., 2018). The present study provides the first geographical record of *Sclerococcum glaucomarioides* from China. The species was illustrated based on the maximum likelihood and Bayesian phylogenetic analyses coupled with morphological analysis.

4.3 Materials and Methods

4.3.1 Sample Collection and Morphological Examination

The specimens were collected from Yunnan Province, China. Macro-morphological characteristics were observed using a stereomicroscope (Olympus ZX-16) and photographed with a fitted digital camera (Olympus SC180). The ascomata were sliced, temporarily mounted, and observed under a compound microscope (Nikon Y-TV55), with images captured using a fitted digital camera (Nikon DS-Ri2). Distilled water was used as a mounting slide solution and 10 % potassium hydroxide (K) and Lugol's iodine solution (I) were used to examine the stain of the hymenium. Photo plates were assembled using Adobe Photoshop CC 2019 software (Adobe Systems, USA). Measurements were conducted using Image Framework software (Tarosoft, Version 0.9.7). The length, width, and length/width ratio (l/w) of asci and ascospores are provided (where $n \geq 10$) as: (min–) [X−SD]–[X+SD] (–max), where “min” and “max” represent the extreme observed values, X is the arithmetic mean, and SD is the standard deviation. The number of measurements (n) is indicated. Unless otherwise specified, measurements were taken from water mounts. The holotype specimens are deposited in the Lichen Herbarium of Kunming Institute of Botany (KUN-L), Chinese Academy of Science, Yunnan, China.

4.3.2 DNA Extraction, PCR Amplification, and Sequencing

Apothecia were carefully removed with a razor blade under a dissecting

microscope, and the lichen thallus was thoroughly cleaned. The sample was then transferred to a 200 μL centrifuge tube. Total genomic DNA was extracted using a Forensic DNA Kit (Omega Bio-Tek, Norcross, Georgia), following the manufacturer's instructions. The primer pairs ITS1f/ITS4, LR0R/LR5 and mrSSU1/mrSSU3R were used respectively, to amplify the internal transcribed spacer region of rDNA (ITS), the 28S large-subunit of rDNA (LSU), and the mitochondrial small subunit ribosomal RNA gene (mtSSU) (Vilgalys et al., 1990; White et al., 1990; Gardes et al., 1993; Zoller et al., 1999; Rehner et al., 2005).

The polymerase chain reaction (PCR) was performed using a Mastercycler (Bio-RAD T-100) in a 25-μL reaction volume consisting of 12.5 μL of 2×Mix (Solarbio, dNTPs Mix), 9.5 μL of double-distilled water (ddH_2O), 1.0 μL of each primer (10 mM), and 1.0 μL of the DNA template. The PCR conditions were as follows: an initial denaturation at 95℃ for 3 minutes, followed by 35 cycles of denaturation at 95℃ for 45 seconds, annealing at 53℃ for ITS, LSU and mtSSU, for 90 seconds, and elongation at 72℃ for 1 minute. A final extension was performed at 72℃ for 10 minutes, and the reaction was then held at 4℃ indefinitely. PCR products were sequenced by Shanghai Sangon Biotech (Chengdu, Sichuan Province, China).

4.3.3 Sequence Alignment and Phylogenetic Analyses

The quality of chromatogram sequences was verified using BioEdit Sequence Alignment software (Version 7.0.9.0). Forward and reverse sequences were assembled with ContigExpress software (New York, USA). The newly generated sequences were subjected to BLASTn searches (https://blast.ncbi.nlm.nih.gov/Blast.cgi) and deposited in the GenBank database. The BLAST analysis of three genes (LSU, ITS and mtSSU) indicated that these two collections belong to the order Sclerococcales. Sequence data for all available taxa within this order were retrieved from GenBank and are listed in Table 4.1. Two species of *Caliciopsis* (Coryneliaceae, Coryneliales, Coryneliomycetidae, Eurotiomycetes) were included as the outgroup following

Olariaga et al. (2019).

Sequence alignment, concatenation, model selection, and format conversion were performed using the OFPT program (Zeng et al., 2023). Each gene region dataset was aligned using the ‘auto’ strategy in MAFFT (Katoh et al., 2013) and trimmed with the ‘gappyout’ command in TrimAl (Capella-Gutierrez et al., 2009). The best-fit nucleotide substitution models for each dataset were selected using the Bayesian Information Criterion (BIC) from twenty-two common DNA substitution models with rate heterogeneity, as implemented in ModelFinder (Kalyaanamoorthy et al., 2017). The datasets were then concatenated with partition data for subsequent phylogenetic analyses.

Maximum likelihood (ML) analysis was conducted on the IQ-TREE web server applying the ultrafast bootstrap approximation with 1,000 replicates (Hoang et al., 2018), and the SH-like approximate likelihood ratio test (SH-aLRT) (Guindon et al., 2010; Nguyen et al., 2015). The consensus tree was summarized using the extended majority rule. For further verification, an additional ML analysis was performed with RAxML-HPC2 on ACCESS (v8.2.12), using the GTRGAMMA model with a rapid bootstrap analysis of 1000 replicates (Miller et al., 2010; Stamatakis, 2014).

Bayesian inference was carried out using two parallel Metropolis-coupled Markov Chain Monte Carlo (MCMC) runs, each consisting of one 'cold' chain and three heated chains, in MrBayes (Ronquist et al., 2012). Trees were sampled every 1,000 generations, and the run was terminated when the average standard deviation of split frequencies fell below 0.01. The final tree was summarized after discarding the first 25% of samples as burn-in and visualized in FigTree v1.4.4 (Rambaut, 2016). The newly identified taxon was registered in Index Fungorum (2024) and Faces of Fungi database (Jayasiri et al., 2015).

Table 4.1 Sequences used in phylogenetic analysis of Dactylosporaceae with specimens or strains information and GenBank accession numbers.

Species name	Voucher/strains	GenBank accession numbers		
		LSU	ITS	mtSSU
beetle-associated isolate	INB_io4503Q	KM242300	KM242300	NA
beetle-associated isolate	INB_io4513J	KM242356	KM242356	NA
beetle-associated isolate	INB_io4513L	KM242358	KM242358	NA
Caliciopsis orientalis	CBS 138.64	NG_058741	NA	FJ190654
C. pinea	AFTOL-ID 1869 CBS 139.64	DQ678097	NA	FJ190653
Cylindroconidiis aquaticus	MFLUCC 11-0294	MH236579	MH236576	NA
Fusichalara minuta	CBS 709.88	KX537758	KX537754	KX537762
Gamsomyces aquaticum	MFLUCC 18-1015	MN335230	MN335228	NA
G. chiangmaiensis	MFLUCC 18-0982	MN335229	MN335227	NA
G. longisporus	CBS 118.86	MT020877	MT020865	NA
G. longisporus	CBS 240.89	MT020878	MT020866	NA
G. stilboideus	CBS 146494	MT020879	MT020867	NA
Pseudosclerococcum golindoi	ARAN-Fungi 6619	NG_073673	NR_171236	MK759897
Rhopalophora clavispora	CBS 281.75	KX537756	KX537752	KX537760
R. clavispora	CBS 129.74	KX537755	KX537751	KX537759
Sclerococcum ahtii	RP 23 F. Hognabba 1325a (H)	KY661659	KY661630	KY661686
R. clavispora	CBS 637.73	KX537757	KX537753	KX537761
S. ahtii	RP182; CHI17-37a (H)	NA	KY661622	NA
S. chiangraiensis	MFLU 16-0570	NG_066422	NR_163755	NA

Table 4.1 (continued)

Species name	Voucher/strains	GenBank accession numbers		
		LSU	**ITS**	**mtSSU**
S. deminutum	RP235; Pykala 39390	NA	KY661629	NA
S. fusiformis	MFLU 16-0593	NG_066423	NR_163756	NA
S. fusiformis	MFLU 18-0678	NA	MH718442	NA
S. glaucomarioides	RP275; LE 261065	KY661660	KY661632	KY661683
S. glaucomarioides	KUN-L 88756	NA	OQ991232	OR035764
S. haliotrephum	AFTOL-ID 758 ATCC MYA-3590	FJ176855	NA	KJ766382
S. haliotrephum	AFTOL-ID 798	FJ713617	NA	NA
S. lobariellum	Diederich 18109	MH698499	NA	MH698503
S. lobariellum	Diederich 17708	MH698498	NA	MH698502
S. lobariellum	ARAN-Fungi 10091	MK759891	NA	MK759898
S. mangrovei	AFTOL_ID 2108	FJ176890	NA	KJ766383
S. martynii	D. Haelew. F_1567b PUL F27737	MZ221620	MZ221612	NA
S. martynii	D. Haelew. F_1570b PUL F27739	MZ221623	MZ221616	NA
S. martynii	D. Haelew. F_1577a PUL F27741	MZ221619	MZ221610	NA
S. parasiticum	ARAN-Fungi 2724	MK759892	NA	MK759899
S. parasiticum	RP422; LE 260868	KY661666	KY661646	KY661690
S. parasiticum	S F-283586	MK759894	NA	MK759901
S. parasiticum	S F-283587	MK759895	NA	MK759902
S. parasiticum	ARAN-Fungi A3044025	MK759893	NA	MK759900
S. pseudobactrodesmium	CGMCC 3.25577T	OR514703	OR514694	OR588037

Table 4.1 (continued)

Species name	Voucher/strains	GenBank accession numbers		
		LSU	ITS	mtSSU
S. pseudobactrodesmium	GZCC 23-0056	OR514704	OR514695	OR588038
S. pseudobactrodesmium	GZCC 23-0057	OR514705	OR514696	OR588039
S. pseudobactrodesmium	GZCC 23-0549	OR514702	OR514693	OR588036
S. ricasoliae	A.F. 29132	MT153992	MT153963	MT153924
S. ricasoliae	A.F. 25967	MT153991	MT153962	MT153923
S. ricasoliae	A.F. Fla6b	MT153993	MT153964	MT153925
S. ricasoliae	A.F. 25611	MT153990	MT153961	MT153922
S. simplex	MFLU 21-0117	MZ655912	MZ664325	MZ676669
Sclerococcum sp.	A1153	MF071425	NA	MF085485
Sclerococcum sp.	A1016	KT263077	NA	KT263115
Sclerococcum sp.	RP391; Buck 60495a (H)	KY661664	NA	KY661689
S. sphaerale	Diederich 17283	JX081673	NA	JX081678
S. sphaerale	Diederich 17279	JX081672	NA	JX081677
S. sphaerale	Ertz 17425 (BR)	JX081674	NA	JX081676
S. stictae	KUN-L 88687	PQ407923	PQ408029	PQ415057
S. stictae	KUN-L 88687-1	NA	PQ408030	NA
S. tardum	ICMP 24355 PDD 91756	NA	NR_176187	NA
S. tardum	PDD 91756	NA	OL709435	NA
S. tardum	JAC 13187 PDD 105454	NA	MK432753	NA
S. stygium	ARAN-Fungi 00823	NA	MK759886	MK759904
S. stygium	ARAN-Fungi 3395	MK759896	NA	MK759903

Table 4.1 (continued)

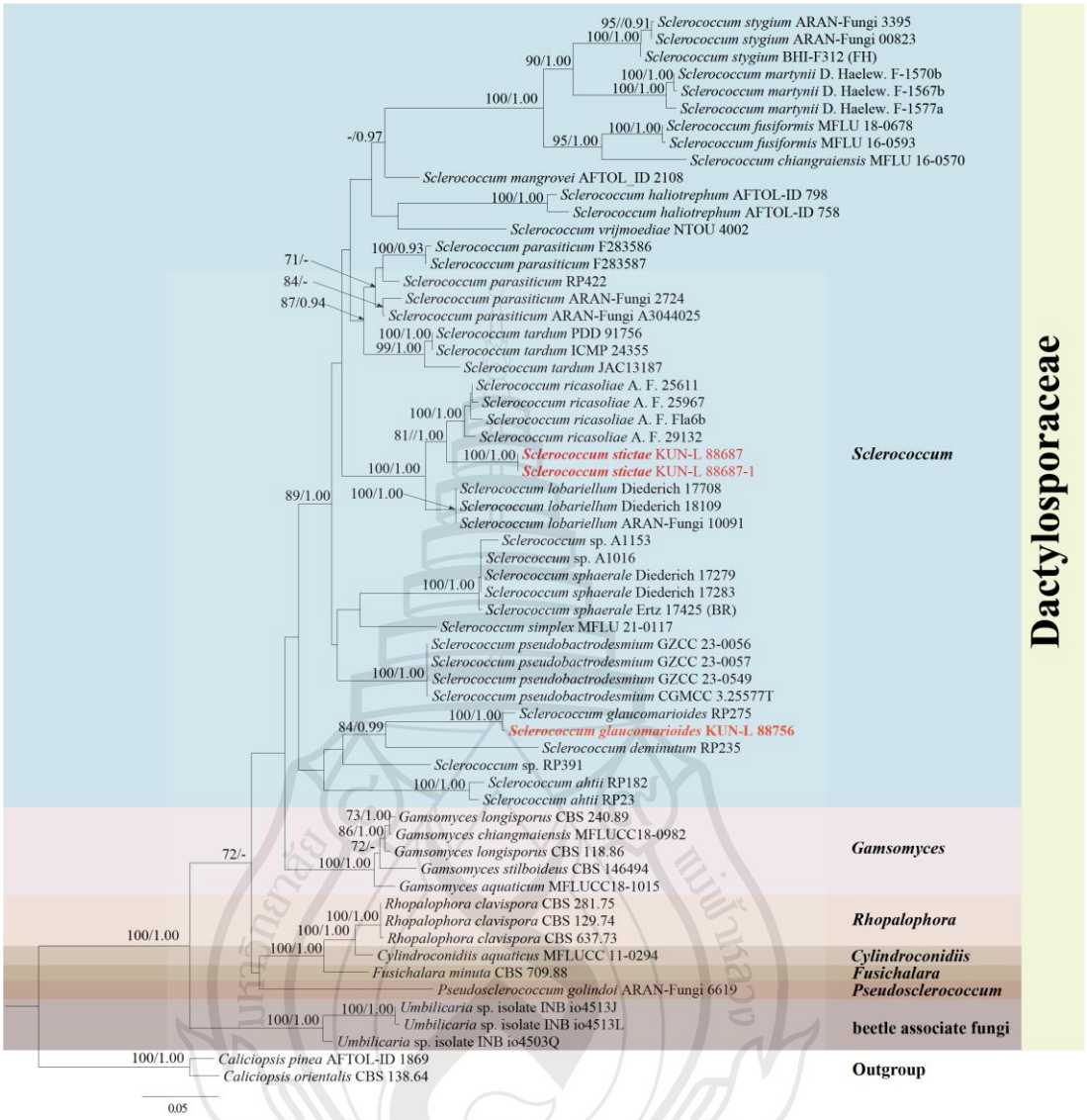
Species name	Voucher/strains	GenBank accession numbers		
		LSU	ITS	mtSSU
S. stygium	BHI-F312 (FH)	NA	MF161218	NA
S. vrijmoediae	NTOU 4002	KC692153	NR_138396	NA

Note Newly obtained sequences are in bold font. "NA" indicates the sequence is unavailable.

4.4 Results

4.4.1 Phylogenetic analysis

In the analysis of Dactylosporaceae, the final dataset comprised 62 taxa (Table 2) with 2041 aligned characters, including gaps (ITS 1–455 bp, LSU 456–1310 bp, and mtSSU 1311–2041 bp). The best-fit nucleotide substitution models, selected based on the Bayesian information criterion (BIC), were as follows: ITS: TIM2e+I+G4, LSU: TNe+I+G4, mtSSU: TVM+F+I+G4. The parameters for the GTRGAMMA model of the combined LSU, ITS and mtSSU were as follows: estimated base frequencies: A = 0.29, C = 0.19, G = 0.25, T = 0.26, and substitution rate AC = 1.01, AG = 2.68, AT = 1.67, CG = 0.85, CT = 5.43, and GT = 1.00. Gamma distribution shape parameter α = 0.256278, and the tree length = 2.405501. The best-scoring RAxML tree was constructed with a final ML optimization likelihood value of - 14773.67. The final tree topologies of ML and BYPP analyses were consistent. The best-scoring RAxML tree, based on combined LSU, ITS and mtSSU sequence datasets, is presented in Figure 4.1. The newly collected specimen clusters within the *Sclerococcum* clade and is closely related to *S. ricasoliae*.



Note Bootstrap support values for maximum likelihood (ML ≥ 70%), and the Bayesian Posterior Probabilities (PP ≥ 0.90) are shown near the nodes as ML/PP. *Caliciopsis orientalis* (CBS 138.64) and *Caliciopsis pinea* (AFTOL-ID, 1869) were used as outgroups. The newly generated sequence is in red bold font.

Figure 4.1 RAxML analysis of Dactylosporaceae based on the combined LSU, ITS and mtSSU sequence data.

4.4.2 Taxonomy

Sclerococcum glaucomarioides (Willey ex Tuck.) Ertz & Diederich

Figure 4.2

=*Dactylospora glaucomarioides* (Tuck.) Hafellner

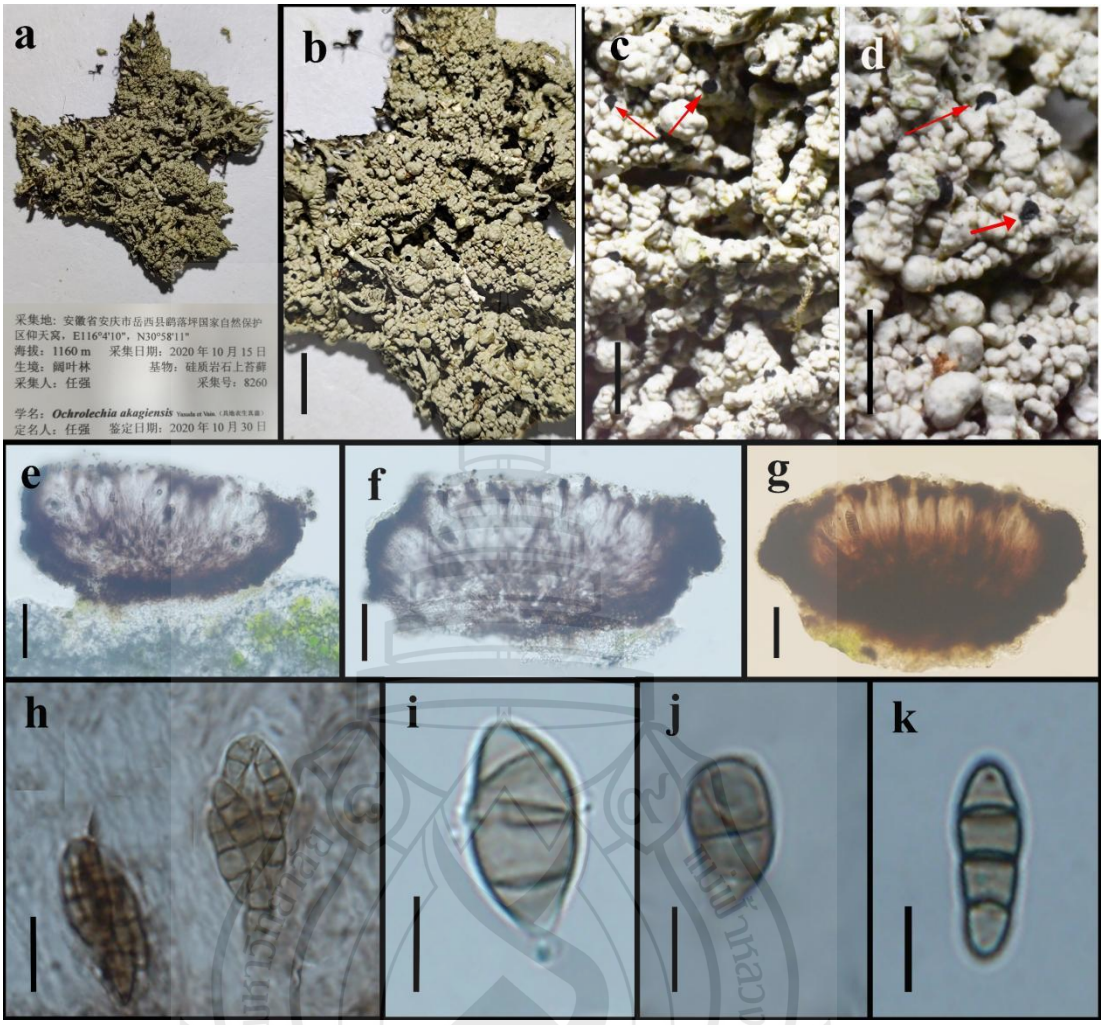
=*Buellia glaucomarioides* Tuck.

Lichenicolous, grows on the thallus of crustose lichen *Ochrolechia akagiensis*

Description: *Sexual morph: Apothecia* superficial, growing dispersed on the lichen tuberculates or in the gap between the tuberculates, adpressed to sessile, disc black, 0.4–0.6 (0.8) mm diam., round to irregularly round, flat or not. *Epihymenium* blackish, paraphysis tips bond in cluster with brown-blackish granular structure, excipulum thin 2–4 µm thick. *Hymenium* with brownish color, 25–40 µm high. *Hypothecium* brownish-black, hymenium transparent with somewhat brownish hyphae tissue. *Paraphyses* thin, 1.5–2 µm wide, with apices expanded, mostly 2–3 µm wide. *Exciple* dark brownish to blackish, pseudoparenchymatous, 8–15µm thick. *Asci* broadly cylindrical to crassly clavate, 20–30 × 10–15 µm, 8-spored. *Ascospores* ellipsoid or oblong, brownish, 3–4-locules with 2–3 lenticular or linear transverse septate, occasional with one longitudinal septate, (6) 8–12 × 5–7 µm, overlapping, multiseriate in asci.

Asexual morph: Not observed.

Specimens examined: Yuexi country, Anqing city, Anhui Province: Yangtianwo, Yaoluoping National Nature Reserve, elev. 1160m, E116°4’10”, N30°58’11”, 15th October 2020, collected by Qiang Ren, Collection No. 8260 (KUN-L 88756). The host lichen grows with moss on siliceous rock.



Note a–d Host substrate. e–g Vertical section of apothecia in water. h Asci and ascospores in water. i–k Ascospores in water. Scale bar: b = 5 mm, c–d = 2.5 mm, e–g =20 µm, h = 10 µm, i–k = 5 µm.

Figure 4.2 *Sclerococcum glaucomarioides* (KUN-L 88756) on the lichen thallus of *Ochrolechia akagiensis*.

Sclerococcum stictae Meng, Diederich & Thiyagaraja sp. nov.

Index Fungorum number: IF903175

Facesoffungi number: FoF17070

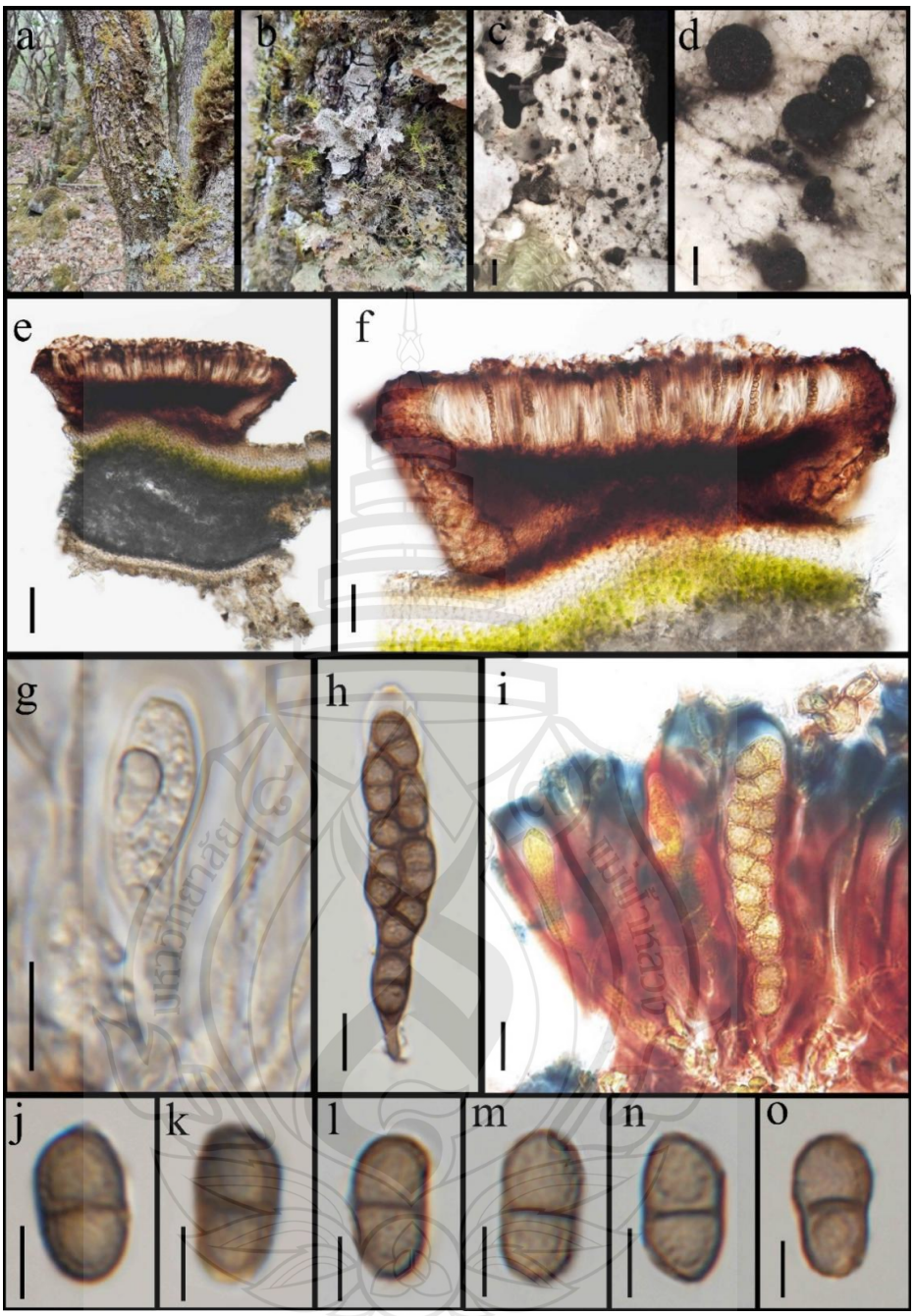
Figure 4.3

Etymology. The species epithet "*stictae*" refers to "*Sticta*", the host lichen from which the holotype specimen was collected.

Holotype: KUN-L 88687

Description. Sexual morph: *Ascomata* apothecioid, 200–300 µm in diam., rounded, cup-shaped, sessile, erumpent from the host thallus with a narrow base, 170–200 µm in diam., either dispersed or occurring in small groups, black, matte. *Disc* flat, black. *Margin* distinct, persistent, and concolorous with the disc. *Exciple* brown, paraplectenchymatous, laterally 40–70 µm wide. *Epithecium* (12–)14.3–21.0(–24) µm thick ($\overline{x}$ = 17.7, n = 30), with dark brownish granules. *Hymenium* (46–)65.2–94.8(–96) µm high ($\overline{x}$ = 80, n = 30), light brown, and distinctly gelatinized, K/I+ reddish with bluish in epihymenium. *Paraphyses* 2–3 µm wide, anastomosing, branched, septate, with swollen, pigmented apices. *Hypothecium* (86–)89.6–95.2(–97) µm thick ($\overline{x}$ = 92.4, n = 30), dark orange-brown, with irregularly shaped hypothecial cells. *Asci* (40–)44.8–67.9(–72) × (7–)7.8–11.9(–12) µm ($\overline{x}$ = 56.3 × 9.9, n = 10), bitunicate, narrowly clavate to cylindrical, ascus wall thickened at the apex, ocular chamber absent, 8-spored, K/I-, except for the K/I+ blue outer gelatinous coat, most intensely coloured around the ascus apex. *Ascospores* (8–)9.2–11.1(–12) × (5–)5.1–6.2(–7) µm ($\overline{x}$ = 10.1 × 5.6, n=30), l/w ratio = (1.5–)1.7–1.9(–2) ($\overline{x}$ = 1.8, n = 30), brown when mature, 1-septate, slightly constricted at the septum, verrucose, slightly asymmetric with a larger upper cell, ellipsoidal, sometimes soleiform. Asexual morph: Not observed.

Material examined. China, Yunnan Province, Diqing Autonomous Prefecture, Meili Mountain National Nature Reserve, 28°24'N, 98°48'E, 3300 m elev., on the thallus of *Sticta* sp., on the bark of *Rhododendron lapponicum* (Ericaceae), 21 Apr 2023, Qing-feng Meng, ml-68 (holotype KUN-L 88687).



Note a–b habitat and appearance of the host lichen. c–d appearance of the apothecia. e–f section of apothecium in water. g immature ascus in water. h mature ascus with ascospores in water. i asci in I. j–o ascospores in water. Scale bars: 1 mm (c), 200 µm (d), 100 µm (e), 50 µm (f), 10 µm (g–i), 5 µm (j–o).

Figure 4.3 *Sclerococcum stictae* sp. nov., growing on the thallus of *Sticta* sp. (KUN-L 88687).

Notes. *Sclerococcum stictae* clusters within a well-supported subclade along with *S. ricasoliae* and *S. lobariellum*. The basepair comparison with *S. ricasoliae* revealed 7.5% differences (34/455 bp) in ITS, 2.2% (19/855 bp) differences in LSU, and 1% (7/730 bp) differences in mtSSU sequences (Flakus et al., 2019). Morphologically, *S. stictae* resembles *S. ricasoliae* in ascomatal and ascospore appearance but can be distinguished by its longer, narrower asci (c. 45–68 × 8–12 µm vs. 35–50 × 10–15 µm) and broader ascospores (c. 9–11 µm vs 4–6 µm), with a smaller length/width ratio (1.7–1.9 vs. 1.5–3.5) (Flakus et al., 2019). Phylogenetically, *S. stictae* is also related to *S. lobariellum*, but the basepair comparison revealed 4.3% (37/855 bp) differences in LSU, and 1.1% (8/730 bp) differences in mtSSU sequences (Hafellner, 1979). Diederich et al. (2024) have shown that both *Sclerococcum lobariellum* and *S. ricasoliae* possess an asexual stage producing dark brown, dispersed, muriform conidia, often co-occurring with the sexual stage. In all other known lichenicolous *Sclerococcum* species with an asexual stage, conidia are produced within compact sporodochia, and this stage is never accompanied by a sexual stage. We anticipate therefore that an asexual stage with dispersed, muriform conidia also exists in the new *S. stictae* and should be searched for when more specimens become available.

Another species, *Sclerococcum dendriscostictae*, also found on *Sticta*, shares morphological traits with *S. stictae*. However, the new species can be distinguished by its longer asci (c. 45–68 × 8–12 µm vs. 33–44 × 9.5–13.5 µm) and verrucose ascospore ornamentation, in contrast to smooth-walled ascospores reported in *S. dendriscostictae* (Joshi, 2021).

4.5 Discussion

The newly obtained sequence clustered together with *Sclerococcum*

glaucomarioides, in the multi-gene phylogenetic tree with high bootstrap support. Morphologically, this new collection shares similarities with *S. glaucomarioides*, featuring adpressed to sessile, round to angular, black disc apothecia. The hymenium is hemiamyloid, measuring 50–65 µm in height, and the asci are broadly cylindrical to subclavate, 8-spored, with dimensions of 48–60 × 14–20 µm. The asci possess an euamyloid apical cap, and ascopores are brown, measuring 12.5–19 × 5.5–7.5 µm, with 3–4 (–7) transverse septate (Joshi, 2021). However, it is noteworthy that the new sample exhibits a brownish-colored hymenium and slight variations from *S. glaucomarioides*. These differences include a smaller height in hymenium (25–40 µm vs. 50–65 µm high), smaller asci (20–30 × 10–15 µm vs. 48–60 × 14–20 µm), and smaller ascospores (8–12 × 5–7 µm vs. 12.5–19 × 5.5–7.5 µm). *S. glaucomarioides* was originally described as *Buellia glaucomarioides*. In the original description, the spores shared a similar shape and septa but were larger (21–25 × 8–9µm). It was reported to grow on different host lichens, such as *Lecanora glaucoma* or *Lecanora tartarea* (Tuckerman, 1888).

Sclerococcum glaucomarioides has been documented in several regions, including Iceland (Svane and Alstrup, 2004), North America (Hafellner, 1979; Hodkinson et al., 2009; Lendemer, 2010), North Korea (Huneck et al., 1994), Russia (Zhurbenko 2004 & 2009; Zhurbenko et al., 2019), and South Korea (Joshi et al., 2010) . Research on lichenicolous fungi in China has been limited, with only 48 species reported in the past 20 years. Among these reported species, only one, *S. simplex*, belonging to the genus *Sclerococcum*, was recorded last year (Thiyagaraja et al., 2022). Notably, *S. glaucomarioides* had previously been reported growing on *Ochrolechia akagiensis, O. tartarea* and *O. yasudae*, with the host lichen found on bark, rock and moss (Tuckerman, 1888; Joshi et al., 2010; Pino-Bodas et al., 2017), as well as on *Megaspora verrucosa* in tundra (Zhurbenko, 2009). Therefore, this marks the first recorded geographical occurance of this species in China, specifically on the host lichen

Ochrolechia akagiensis on siliceous rocks.

Before 2018, *Dactylospora* and *Sclerococcum* were considered distinct genera, with *Sclerococcum* containing 21 species, 19 of which were lichenicolous. Diederich et al. (2018) synonymized *Dactylospora* with *Sclerococcum* and transferred 46 species from *Dactylospora* to *Sclerococcum*. Subsequently, Olariaga et al. (2019) transferred 14 non-lichenicolous species of *Dactylospora* to *Sclerococcum* (Olariaga et al., 2019). Johnston (2022) introduced six new saprophytic species of *Sclerococcum* (Johnston, 2022). Since 2018, ten new lichenicolous species and three combinations have been added to the genus (Elix et al., 2019; Flakus et al., 2019; Fryday, 2019; Navarro-Rosin és et al., 2019; Spribille et al., 2020; Joshi, 2021; Zhurbenko, 2022; Paz-Bermúdez et al., 2023; Diederich et al., 2024; Zhurbenko et al., 2024). Diederich et al. (2024) have accepted a total of 85 species in *Sclerococcum*, with 64 lichenicolous species and the remainder being saprotrophs on liverworts, wood, and bark in both terrestrial and marine habitats (Dong et al., 2020; Thiyagaraja et al., 2022).

The first study of *Sclerococcum* in China was conducted by Thiyagaraja et al. (2022), who reported a new geographical record of *S. simplex*, collected from a corticolous *Pertusaria* thallus in Yunnan province. Ma et al. (2023) described the lignicolous asexual species, *S. pseudobactrodesmium* from Guizhou Province. Meng et al. (2024) reported a new geographical record of *S. glaucomarioides* found on *Ochrolechia akagiensis* from China. This study provides an additional new *Sclerococcum* species from China (Thiyagaraja et al., 2022; Ma et al., 2023; Meng et al., 2024)

CHAPTER 5

LIJIANGOMYCES, A NOVEL GENUS AND SPECIES OF MYTILINIDIACEAE (MYTILINIDIALES, DOTHIDEOMYCETES)

5.1 Abstract

One new genus, *Lijiangomyces* and two new species *Lijiangomyces laojunensis* and *Sclerococcum stictae* are reported from China and identified through molecular analyses (LSU, ITS, TEF1) and morphological characteristics. Phylogenetic analysis showed that *L. laojunensis* forms a distinct lineage within Mytilinidiaceae, closely related to the *Mytilinidion* subclade, leading to the establishment of new generic position within this family. This saprotrophic species, grows on the bark of *Abies fabri*, often surrounded by the thallus of *Pertusaria* species. *Lijiangomyces laojunensis* is characterized by broadly open, black hysterothecia, clavate asci, and uniseriate, hyaline muriform ascospores.

Key words: 2 new taxa, lichen, morphology, phylogeny, saprobe, taxonomy

5.2 Introduction

Mytilinidiaceae belongs to Mytilinidiales, Dothideomycetes, Ascomycota, Fungi (Hyde et al., 2024), and was introduced by Kirschstein (1924) to accommodate four genera that were originally classified under Hysteriaceae. (Kirschstein, 1924). Boehm et al. (2009) introduced Mytilinidiales based on multigene phylogenetic analysis to accommodate Mytilinidiaceae. Pem et al. (2024) included eight genera within Mytilinidiaceae: *Actidium*, *Lophium*, *Mytilinidion*, *Ostreola*, *Peyronelia*,

Pseudocamaropycnis, *Quasiconcha* and *Zoggium* (Pem et al., 2024). Hyde et al. (2024) added three more genera: *Bullatosporium*, *Camaroglobulus* and *Halokirschsteiniothelia*, increasing the total to eleven genera within this family. Members of Mytilinidiaceae are distinguished by their globose or obovoid pseudothecia that are typically oyster- or hatchet-shaped with a longitudinal keel and crested apex. They feature bitunicate asci containing eight ascospores that are arranged uniseriately, biseriately, or in aggregated clusters. The ascospores are hyaline to brown, exhibiting diverse morphologies such as scolecospores, didymospores, phragmospores, or dictyospores, and with bipolar symmetry (Boehm et al., 2009).

Mytilinidion was established to accommodate the type species *M. aggregatum*. This genus is characterized by globoid to obovoid, erect, conchate, or dolabrate ascomata, with a thin-walled peridium, and bitunicate, 8-spored asci. The ascospores are hyaline to brown and transversely 3–5(–7)-septate (Boehm et al., 2009; Jayasiri et al., 2018). *Ostreola* was introduced to accommodate two species characterized by conchiform to hatchet-shaped hysterothecia with a longitudinal slit that opens narrowly. The asci are cylindrical, containing eight, uniseriate, brown and muriform ascospores (Darker, 1963). *Ostreola* shares similarities with *Mytilinidion* and *Lophium* in the ascomatal morphology but is distinguished by the presence of muriform ascospores. Lumbsch and Huhndorf (2007) placed *Ostreola* within Mytilinidiaceae. The members of *Mytilinidion* are primarily saprobic and plant pathogens, while the *Ostreola* species are primarily saprobic. (Darker, 1963; Lumbsch et al., 2007).

5.3 Materials and Methods

5.3.1 Sample Collection and Morphological Examination

The specimens were collected from Yunnan Province, China. Macro-morphological characteristics were observed using a stereomicroscope (Olympus ZX-

16) and photographed with a fitted digital camera (Olympus SC180). The ascomata were sliced, temporarily mounted, and observed under a compound microscope (Nikon Y-TV55), with images captured using a fitted digital camera (Nikon DS-Ri2). Distilled water was used as a mounting slide solution and 10 % potassium hydroxide (K) and Lugol's iodine solution (I) were used to examine the stain of the hymenium. Photo plates were assembled using Adobe Photoshop CC 2019 software (Adobe Systems, USA). Measurements were conducted using Image Framework software (Tarosoft, Version 0.9.7). The length, width, and length/width ratio (l/w) of asci and ascospores are provided (where n ≥ 10) as: (min–) [X−SD]–[X+SD] (–max), where “min” and “max” represent the extreme observed values, X is the arithmetic mean, and SD is the standard deviation. The number of measurements (n) is indicated. Unless otherwise specified, measurements were taken from water mounts. The holotype specimens are deposited in the Lichen Herbarium of Kunming Institute of Botany (KUN-L), Chinese Academy of Science, Yunnan, China.

5.3.2 DNA Extraction, PCR Amplification, and Sequencing

Apothecia were carefully removed with a razor blade under a dissecting microscope, and the lichen thallus was thoroughly cleaned. The sample was then transferred to a 200 μL centrifuge tube. Total genomic DNA was extracted using a Forensic DNA Kit (Omega Bio-Tek, Norcross, Georgia), following the manufacturer’s instructions. The primer pairs ITS1f/ITS4, LR0R/LR5, and 983F/2218R were used respectively, to amplify the internal transcribed spacer region of rDNA (ITS), the 28S large-subunit of rDNA (LSU) and the translation elongation factor 1-alpha (TEF1) (Vilgalys et al., 1990; White et al., 1990; Gardes et al., 1993; Zoller et al., 1999; Rehner et al., 2005).

The polymerase chain reaction (PCR) was performed using a Mastercycler (Bio-RAD T-100) in a 25-μL reaction volume consisting of 12.5 μL of 2×Mix (Solarbio, dNTPs Mix), 9.5 μL of double-distilled water (ddH_2O), 1.0 μL of each primer (10 mM),

and 1.0 µL of the DNA template. The PCR conditions were as follows: an initial denaturation at 95℃ for 3 minutes, followed by 35 cycles of denaturation at 95℃ for 45 seconds, annealing at 53°C for ITS and LSU or at 58°C for TEF1, for 90 seconds, and elongation at 72℃ for 1 minute. A final extension was performed at 72℃ for 10 minutes, and the reaction was then held at 4℃ indefinitely. PCR products were sequenced by Shanghai Sangon Biotech (Chengdu, Sichuan Province, China).

5.3.3 Sequence alignment and phylogenetic analyses

The quality of chromatogram sequences was verified using BioEdit Sequence Alignment software (Version 7.0.9.0). Forward and reverse sequences were assembled with ContigExpress software (New York, USA). The newly generated sequences were subjected to BLASTn searches (https://blast.ncbi.nlm.nih.gov/Blast.cgi) and deposited in the GenBank database. BLAST analysis of three genes (LSU, ITS and TEF1) from specimen KUN-L 88703 indicated that this species might belong to the orders Gloniales, Hysteriales or Mytilinidiales. To confirm its phylogenetic placement, all available sequence data from these orders were downloaded from GenBank (Table 5.1). Additionally, representative species from six adjacent orders including: Botryosphaeriales, Capnodiales, Dothideales, Jahnulales, Patellariales, and Pleosporales were included based on references from Boehm et al. (2009b). Two species of *Orbilia* (Orbiliomycetes, Orbiliales, Orbiliaceae) were selected as the outgroup taxa following Hongsanan et al. (2020) for phylogenetic analysis. (Hongsanan et al., 2020)

Sequence alignment, concatenation, model selection, and format conversion were performed using the OFPT program (Zeng et al., 2023). Each gene region dataset was aligned using the ‘auto’ strategy in MAFFT (Katoh et al., 2013) and trimmed with the ‘gappyout’ command in TrimAl (Capella-Gutierrez et al., 2009). The best-fit nucleotide substitution models for each dataset were selected using the Bayesian Information Criterion (BIC) from twenty-two common DNA substitution models with

rate heterogeneity, as implemented in ModelFinder (Kalyaanamoorthy et al., 2017). The datasets were then concatenated with partition data for subsequent phylogenetic analyses.

Maximum likelihood (ML) analysis was conducted on the IQ-TREE web server applying the ultrafast bootstrap approximation with 1,000 replicates (Hoang et al., 2018), and the SH-like approximate likelihood ratio test (SH-aLRT) (Guindon et al., 2010; Nguyen et al., 2015). The consensus tree was summarized using the extended majority rule. For further verification, an additional ML analysis was performed with RAxML-HPC2 on ACCESS (v8.2.12), using the GTRGAMMA model with a rapid bootstrap analysis of 1000 replicates (Miller et al., 2010; Stamatakis, 2014).

Bayesian inference was carried out using two parallel Metropolis-coupled Markov Chain Monte Carlo (MCMC) runs, each consisting of one 'cold' chain and three heated chains, in MrBayes (Ronquist et al., 2012). Trees were sampled every 1,000 generations, and the run was terminated when the average standard deviation of split frequencies fell below 0.01. The final tree was summarized after discarding the first 25% of samples as burn-in and visualized in FigTree v1.4.4 (Rambaut, 2016). The newly identified taxon was registered in Index Fungorum (2024) and Faces of Fungi database (Jayasiri et al., 2015).

Table 5.1 Sequences used in phylogenetic analysis of Mytilinidiales and adjacent orders, with specimens or strains information and GenBank accession numbers.

Species name	**Voucher/strains**	**GenBank accession numbers**		
		ITS	**LSU**	**TEF1**
Aigialus grandis	BCC 20000	NA	GU479775	NA
A. mangrovis	BCC 33563	NA	GU479776	GU479840

Table 5.1 (continued)

Species name	Voucher/strains	GenBank accession numbers		
		ITS	**LSU**	**TEF1**
A. parvus	PUFD45	MK028710	MK026761	MN520611
A. rhizophorae	BCC 33572	NA	GU479780	GU479844
Aliquandostipite crystallinus	AF007	NA	EF175652	NA
A. khaoyaiensis	MFLUCC 21-0106	MT864350	MT860428	MT873577
Ascagilis guttulaspora	MFLUCC 17-0244	NA	NG_064432	NA
A. submersa	MFLUCC 18-1143	NR_171970	MN888485	NA
A. thailandensis	MFLUCC 18-1149	NR_171969	MN913693	NA
Botryosphaeria dothidea	CBS 115476	NA	DQ678051	DQ767637
Brachiosphaera tropicalis	SS 2523	FJ887923	JN819284	JN819298
Bullatosporium taxicola	a21-004; CBS 151403	PP516536	PP516533	PP514386
B. taxicola	a21-005; CBS 151402	PP516535	PP516534	PP514385
Capnodium aciculiforme	CBS 892.73	NA	GU301847	GU349045
C. alfenasii	CBS 146151	MN749233	MN749165	MN829346
C. coartatum	CPC 17779	MN749236	MN749167	MN829348
Cenococcum geophilum	CG5	KC967409	NA	NA
C. geophilum	CG54	KC967410	NA	NA
Chaetocapnodium insulare	CBS 146159	NR_168830	NG_068681	MN829359
C. philippinense	MFLUCC 12-0110	NR_168831	KP744503	MN829362
C. placitae	CBS 124758	MH863403	MH874920	MN829363
Conidiocarpus asiaticus	MFLUCC10-0062	NA	JN832612	NA
C. caucasicus	GUMH937	NA	KC833050	NA
C. fici-septicae	MFLUCC 19-0072	MW063143	MW063206	NA
C. siamensis	SICAUCC 23-0010	OR405901	OR405912	OR671432

Table 5.1 (continued)

Species name	Voucher/strains	GenBank accession numbers		
		ITS	**LSU**	**TEF1**
Delitschia chaetomioides	DSE871	MW209042	MW209067	MW238837
D. winteri	AFTOL-ID 1599 CBS 225.62	NA	DQ678077	DQ677922
Dothidea insculpta	CBS 189.58	NA	DQ247802	DQ471081
D. sambuci	DAOM 231303	NA	AY544681	DQ497606
Ericboehmia centramura	MFLUCC 12-0808	KM272258	KM272256	KM277819
E. curtisii	CBS 198.34	NA	MH866967	FJ161093
E. doimaeensis	MFLUCC 16-0329	MH535872	MH535894	NA
Fusculina eucalypti	CBS 120083	DQ923531	DQ923531	NA
Gloniopsis arciformis	GKM L166A	NA	GU323211	NA
G. calami	MFLUCC 15-0739	NR_164398	NG_059715	KX671965
G. leucaenae	MFLU 21-0201	OL782134	OL782050	OL875100
G. percutanea	FMR 8713	AM286786	LS997561	LS997569
Glonium circumserpens	CBS 123342	NA	FJ161208	NA
E. doimaeensis	MFLUCC 16-0329	MH535872	MH535894	NA
Fusculina eucalypti	CBS 120083	DQ923531	DQ923531	NA
Gloniopsis arciformis	GKM L166A	NA	GU323211	NA
G. calami	MFLUCC 15-0739	NR_164398	NG_059715	KX671965
G. leucaenae	MFLU 21-0201	OL782134	OL782050	OL875100
G. percutanea	FMR 8713	AM286786	LS997561	LS997569
Glonium circumserpens	CBS 123342	NA	FJ161208	NA
G. circumserpens	CBS 123343	NA	FJ161200	NA
G. stellatum	ANM 32; A. Miller 32, F	NA	GQ221887	GQ221926

Table 5.1 (continued)

Species name	Voucher/strains	GenBank accession numbers		
		ITS	**LSU**	**TEF1**
G. stellatum	CBS 207.34	MZ570257	FJ161179	FJ161095
Glyphium elatum	EB 0365; BPI 892671	KM220945	KM220939	KM220933
Gordonomyces mucovaginatus	CBS 127273	NR_157428	NG_057941	NA
Graphyllium caracolinense	HUEFS 42838	NA	NG_060651	NA
Guignardia gaultheriae	CBS 447.70	MH859790	DQ678089	NA
Halokirschsteiniothelia maritima	3124D	KM272366	NA	NA
H. maritima	CBS 221.60	NA	AY849943	GU349001
H. maritima	NWHC 45703-222	MK782369	NA	NA
Hysterium angustatum	KUMCC 21-0213	OK482567	OK482568	NA
H. pulicare	EB 0238; CBS 123377	NA	FJ161201	FJ161109
H. rhizophorae	MFLUCC 15-0950	NR_189349	NG_241879	MF615401
Hysterobrevium baoshanense	MFLUCC 16-2162	MZ467049	KX772765	KX772769
H. constrictum	KUN-HKAS102101	MN429070	MN429073	MN442088
H. rosae	CBS 149699	OQ990113	OQ990064	OQ989245
Hysterodifractum partisporum	HUEFS 42865	NA	NG_060652	NA
Hysterographium didymosporum	MFLUCC 10-0101	NA	NG_064526	NA
H. fraxini	CBS 109.43	NA	FJ161171	FJ161088
H. minus	JCM 2758	NA	NG_059814	NA
Hysteropatella elliptica	AFTOL-ID 1790	NA	DQ767657	DQ767640

Table 5.1 (continued)

Species name	Voucher/strains	GenBank accession numbers		
		ITS	LSU	TEF1
H. prostii	G.M. 2016-02-20.2	MT341324	MT341324	NA
Jahnula appendiculata	BCC11400	JN819280	FJ743446	JN819299
J. dianchia	KUMCC 17-0039	KY928456	KY928457	NA
J. rostrata	MFLU 20-0435	MT627720	MT627657	NA
Lophium arboricola	CBS 758.71	NA	MH872091	NA
L. arboricola	FMR 3868	KU705825	KU705842	NA
L. arboricola	P99; KRAM F-59986	OR754902	OR754924	NA
L. mytilinum	CBS 114111	EF596819	EF596819	NA
L. mytilinum	CBS 269.34	OM337540	MH867013	NA
L. zalerioides	MFLUCC 14-0417	MF621583	MF621587	NA
Massaria inquinas	WU 30527	HQ599402	HQ599402	HQ599342
M. vomitoria	WU 30606	HQ599437	HQ599437	HQ599375
Mytilinidion acicola	EB 0349; BPI 879794	NA	GU323209	NA
M. acicola	EB 0379; BPI 879793	NA	GU397346	NA
M. andinense	EB 0330; CBS 123562	NA	FJ161199	FJ161107
M. australe	CBS 301.34	NR_160067	MH867035	NA
M. californicum	EB 0385; BPI 879795	NA	GU323208	NA
M. didymospora	MFLUCC 16-0619	NA	MH535902	NA
M. mytilinellum	CBS 303.34	NA	MH867037	FJ161100
M. mytilinellum	EB 0386; CBS 303.34	NA	GU397347	NA
M. resinicola	CBS 304.34	MH855535	MH867038	FJ161101
M. rhenanum	CBS 135.34	NA	NA	FJ161092
M. rhenanum	EB 0341; CBS 135.45	NA	GU323207	NA
M. scolecosporum	CBS 305.34	MH855536	MH867039	FJ161102

Table 5.1 (continued)

Species name	Voucher/strains	GenBank accession numbers		
		ITS	**LSU**	**TEF1**
M. thujarum	EB 0268; BPI 879797	NA	GU323206	NA
M. tortile	CBS 306.34	MH855537	MH867040	NA
M. tortile	EB 0377; BPI 879798	NA	GU323205	NA
Neocamarosporium goegapense	CBS 138008	KJ869163	KJ869220	NA
N. phragmitis	MFLUCC 17-0756	MG844345	NG_070431	MG844351
Neomassaria fabacearum	MFLUCC 16-1875	NA	KX524145	KX524149
N. formosana	NTUCC 17-007	NA	MH714756	MH714762
Oedohysterium insidens	ANM 1443 A. Miller 1443, F	NA	GQ221882	NA
O. insidens	CBS 238.34	NA	FJ161182	FJ161097
O. sinense	EB 0339; BPI 879800	NA	GU397348	GU397339
Orbilia auricolor	AFTOL-ID 906 CBS 547.63	DQ491512	DQ470953	DQ471072
O. vinosa	AFTOL-ID 905 CBS 917.72	DQ491511	DQ470952	DQ471071
Ostreichnion sassafras	CBS 322.34	MH855548	FJ161188	NA
Lijiangomyces laojunensis	KUN-L 88703	PQ049177	PQ047633	PQ267963
Patellaria apiculatae	MFLU 19-1236	MN047094	MN017860	NA
P. atrata	CBS 958.97	NA	GU301855	GU349038
P. chromolaenae	MFLUCC 17-1482	MT214381	MT214475	MT235796
Pseudocamaropycnis pini	CBS 115589	KU728518	KU728557	
Pseudocenococcum floridanum	Culture BA4b001 NBRC 111599	NA	LC095431	LC095383

Table 5.1 (continued)

Species name	Voucher/strains	GenBank accession numbers		
		ITS	**LSU**	**TEF1**
Psiloglonium araucanum	CBS 112412	NA	FJ161172	FJ161089
P. colihuae	MFLU 11-0214	KP744466	KP744511	NA
P. macrosporum	MFLU 18-2218	OR225075	OP612525	OR140436
Purpurepithecium murisporum	MFLUCC 16-0611	NA	NG_059797	KY887666
P. murisporum	MFLUCC 17-0319	NA	KY799174	KY799177
Quasiconcha reticulata	EB QR; RLG 14189	NA	GU397349	NA
Quasiconcha sp.	ZY 22.011 CGMCC 3.25498	OR680490	OR680557	OR865892
Quasiconcha sp.	CGMCC 3.25498	OR680491	OR680558	OR865893
Quasiconcha sp.	CGMCC 3.25498	OR680492	OR680559	OR865894
Rhytidhysteron bannaense	KUMCC 21-0483	OP526399	OP526409	OP572200
R. bruguierae	SDBR-CMU 473	OQ943970	OQ940376	OQ973477
R. camporesii	KUNCC 22-12388	OR807853	OR801302	OR832866
Yuccamyces citri	CBS 143161	MG386043	MG386096	NA
Y. pilosus	CBS 579.92	MG386044	MG386097	NA

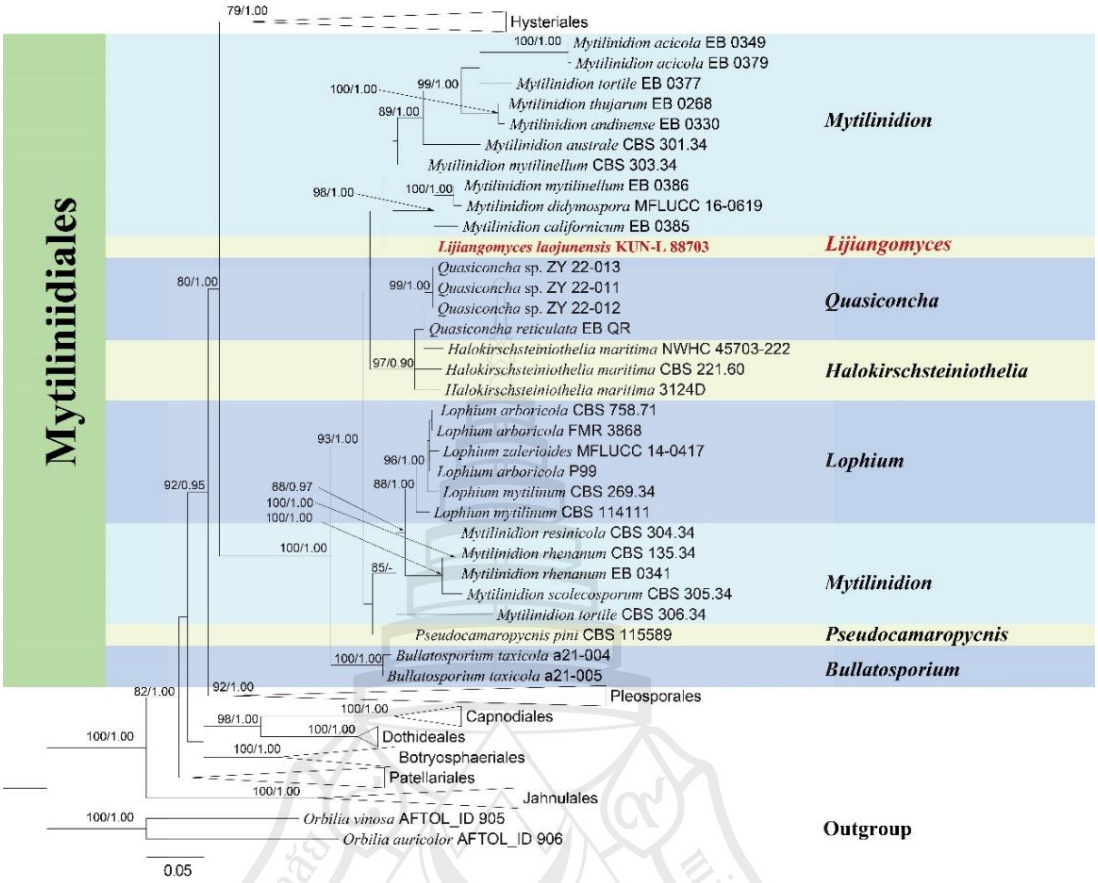
Note "NA" indicates the sequence is unavailable. ARAN-Fungi: The ARAN-Fungi Fungarium; BCC: BIOTEC Culture Collection, Thailand; BPI: United States USDA ARS National Fungus Collections, Beltsville, MD; CBS: CBS Fungal Biodiversity Center, Utrecht, The Netherlands; CGMCC: China General Microbiological Culture Collection Center, Institute of Microbiology, Chinese Academy of Sciences, Beijing, China; CPC: Collection of P.W. Crous; DAOM: Canadian Collection of Fungal Cultures, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada; FH: FH Fungarium of Helsinki University Museum,

Finland; FLAS: University of Florida Herbarium, located at the Florida Museum of Natural History in Gainesville, Florida, USA; FMR: Fungal Biodiversity Centre of the University of Valencia, Spain; GZCC: Guizhou Culture Collection, China; GUMH: Guangxi University Microbial Herbarium, China; GZU: Herbarium of the Institute of Botany, University of Graz, Austria; HUEFS: Herbário da Universidade Estadual de Feira de Santana, Brazil; ICMP: International Collection of Microorganisms from Plants, University of Auckland, New Zealand; JAC: University of Johannesburg Herbarium, USA; JCM: Japan Collection of Microorganisms; KRAM: Władysław Szafer Institute of Botany, Polish Academy of Sciences Herbarium; KUMCC: Kunming Institute of Botany Culture Collection; KUN-HKAS: Herbarium of Kunming Institute of Botany, Chinese Academy of Sciences, Yunnan, China; KUN-L: Lichen Herbarium of Kunming Institute of Botany, Chinese Academy of Science, Yunnan, China; MFLU: the herbarium of Mae Fah Luang University, Chiang Rai, Thailand; MFLUCC: Mae Fah Luang University Culture Collection, Chiang Rai, Thailand; NBRC: NITE Biological Resource Center, Japan; NTOU: National Taiwan Ocean University; NWHC: National Wildlife Health Center of U.S. Geological Survey; PDD: Plant Disease Database at the Auckland Museum, New Zealand; PUFD: Purdue University Forestry Department; PUL: Purdue University Herbarium; RLG: The Robert L. Gilbertson Mycological Herbarium at the University of Arizona; SDBR-CMU: Sustainable Development of Biodiversity Resources, Chiang Mai University, Thailand; SICAUC: Sichuan Agricultural University Culture Collection; WU: Herbarium of the University of Vienna.

5.4 Results

5.4.1 Phylogenetic Analysis

In the analysis of Mytilinidiales, the final dataset comprised 116 taxa (Table 5.1) with 2246 aligned characters, including gaps (ITS 1–494 bp, LSU 495–1346 bp, and TEF1 1347–2246 bp). The best-fit models for each gene, determined using the Bayesian information criterion (BIC), were as follows: ITS: SYM+I+G4, LSU: TN+F+R4, and TEF1: TN+F+I+G4. For the combined dataset (LSU, ITS and TEF1), the parameters of the GTRGAMMA model were as follows: estimated base frequencies: A = 0.24, C = 0.25, G = 0.28, T = 0.23; substitution rate: AC = 1.12, AG = 3.35, AT = 1.77, CG = 0.88, CT = 8.54, GT = 1.00; gamma distribution shape parameter (α) = 0.325118; and tree-length = 6.868758. The best-scoring RAxML tree was constructed with a final maximum likelihood (ML) optimization likelihood value of -34,803.39. Bayesian posterior probabilities (BYPP) were calculated using MCMC analysis, achieving a final average standard deviation of split frequencies of 0.009998. The final tree topologies of ML and BYPP analyses were consistent. The best-scoring RAxML tree, based on combined LSU, ITS and TEF1 sequence datasets, is presented in Figure 1.



Note Bootstrap support values for maximum likelihood (ML ≥ 70%), and the Bayesian Posterior Probabilities (PP ≥ 0.90) are shown near the nodes as ML/PP. *Orbilia auricolor* (AFTOL-ID 906) and *O. vinosa* (AFTOL-ID 905) were used as outgroups. The newly generated sequence is in red bold font.

Figure 5.1 RAxML analysis of Mytilinidiales based on the combined LSU, ITS and TEF1 sequence data.

The resulting phylogram distinguishes eight order-level clades, most of which are well-supported, except for the Patellariales clade. Seven genera form a strongly supported Mytilinidiales clade, with *Mytilinidion* appearing polyphyletic. The newly identified species clusters within the Mytilinidiales clade are closely related to a *Mytilinidion* subclade containing eight species. The remaining *Mytilinidion* species

form a separate clade alongside *Lophium*. *Halokirschsteiniothelia* and *Quasiconcha* form a sister clade to the *Ostreola-Mytilinidion* grouping. Additionally, two *Bullatosporium* strains form a distinct clade closely related to other genera within the Mytlinidiales order.

5.4.2 Taxonomy

Lijiangomyces Meng & Jayaward. gen. nov.

Index Fungorum number: IF903174

Facesoffungi number: FoF 17069

Etymology: The genus name *Lijiangomyces* is refers to "Lijiang", the city in Yunnan Province of China where the holotype specimen was collected.

Description. Sexual morph: *Ascomata* hysterothecia, superficial, solitary, dispersed, sessile, obovoid to broadly shell-shaped or irregularly rounded, with a broadly open, occasionally slit-like disc. *Margin* black, vertically erect, fragile, with the disc surface appearing yellowish-brown. *Peridium* carbonaceous, black in the lateral and upper regions. *Hymenium* hyaline to slightly yellowish, with a densely packed hamathecium. *Paraphyses* filiform, hyaline, non-anastomosed, and non-septate. *Hypothecium* slightly yellowish. *Asci* bitunicate, 8-spored, elongated to clavate, with a rounded apex lacking ascal wall thickening, I-, K-. *Ascospores* uniseriate, arranged obliquely and parallelly, hyaline, thin-walled, smooth, fusiform to ellipsoidal, K-, I+ dark blue, aseptate at immature, becoming muriform at maturity with 4–7 transverse septa and 1–2 longitudinal septa. Asexual morph: Not observed.

Type species. *Lijiangomyces laojunensis* Meng & Jayaward.

Notes. The genus is distinguished by black, broadly shell-shaped to irregularly rounded hysterothecial ascomata, with a broadly open or occasionally closed disc, typically light brown to flesh-yellow. Asci are elongate to clavate, containing eight uniseriate, hyaline and muriform ascospores. Phylogenetic analysis places this genus within the family Mytilinidiaceae (Mytilinidiales, Dothideomycetes) closely related to

Mytilinidion. However, this genus is significantly different from *Mytilinidion* in obovoid to broadly shell-shaped or irregularly rounded, with a broadly open ascomata (vs. globoid to obovoid, conchate, or dolabrate ascomata with narrow slit-like openings) and hyaline and muriform ascospores (vs. hyaline to brown and transverse septa). In addition, this genus shares similar morphology with *Ostreola* in having muriform ascospores but differs in the broadly shell-shaped or irregularly rounded ascomata (vs. conchiform to hatchet-shaped), a broad disc opening (vs. narrowly slit-like), and hyaline ascospores (vs. brown).

Lijiangomyces laojunensis Meng & Jayaward. sp. nov.

Index Fungorum number: IF902457

Facesoffungi number: FoF 16265

Figure 3

Etymology. The species epithet "*laojunensis*" refers to "Laojun", the specific locality Laojun Mountain National Nature Reserve in Yunnan Province of China.

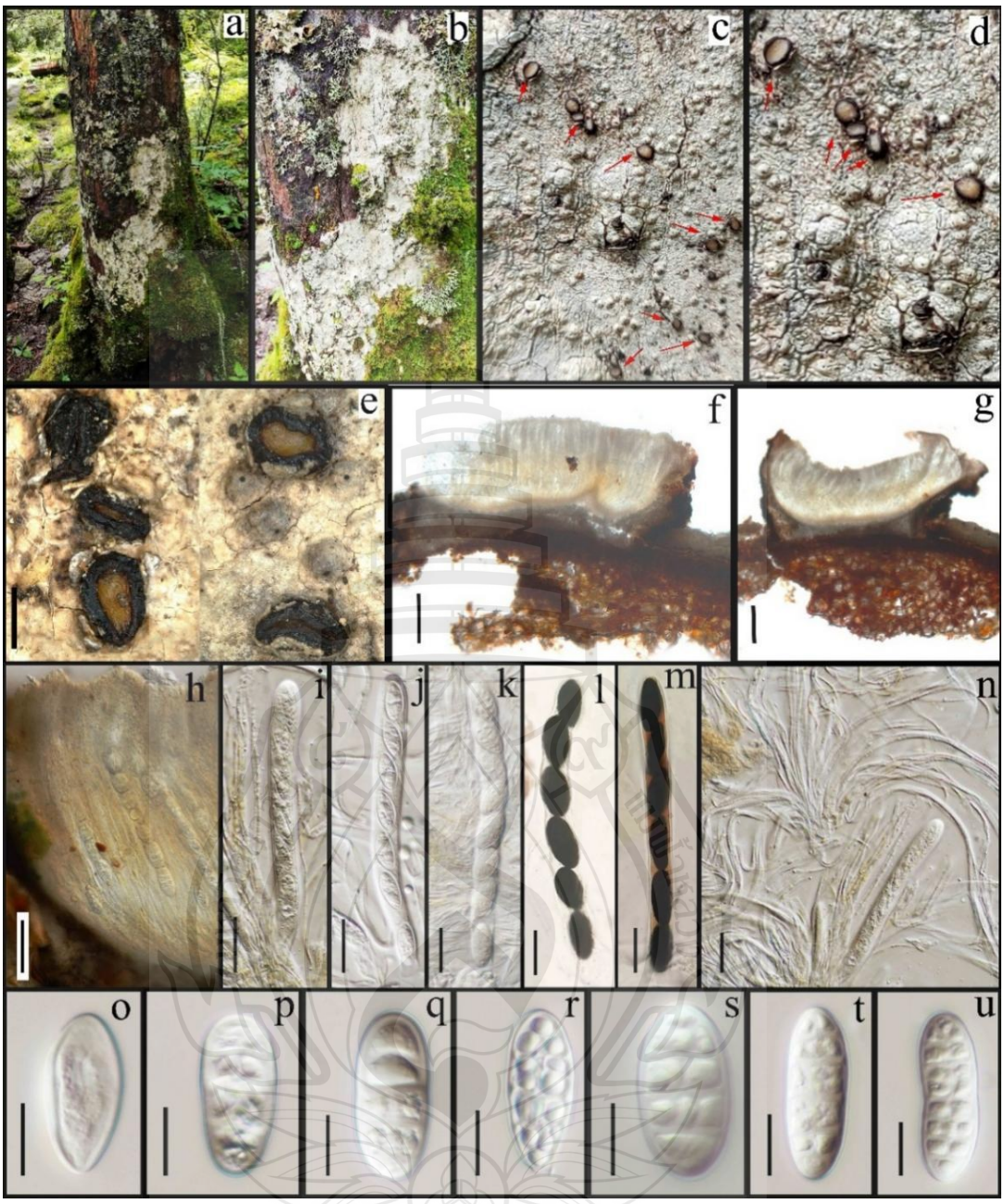
Holotype. KUN-L 88703

Description. Sexual morph: *Ascomata* hysterothecia, (0.8–)0.88–1.05(–1.1) × (0.4–)0.47–0.78(–0.8) mm ($\overline{x}$ = 0.97 × 0.63, n = 10), superficial, solitary, dispersed, sessile, non-stromatic, obovoid to broadly shell-shaped or irregularly rounded, with a broadly open or slit-like disc. *Margin* black, vertically erect, fragile, with a yellowish-brown, slightly depressed disc surface appearing below the rim of the lateral wall. *Peridium* 70–100 μm thick, carbonaceous, black laterally and apically, transitioning to greyish near the base. *Hymenium* 350–400 μm high, hyaline to slightly yellowish, densely packed with hamathecium. *Paraphyses* 1–2 μm wide, unbranched, hyaline, non-anastomosed, non-septate. *Hypothecium* 35–50 μm thick, slightly yellowish. *Asci* (120–)122.6–168.7(–190) × (13–)13.4–16.5(–18) μm ($\overline{x}$ = 145.7 × 14.9, n = 10), bitunicate, 8-spored, elongated to clavate, rounded apex, without apical thickening of

ascal wall, K-, I-. *Ascospores* (20–)20.9–28.8(–37.5) × (9–)10.1–15.4(–17.5) ($\bar{x}$ = 24.8 × 12.8, n = 30) μm, K-, I+ reddish brown, then turn to dark blue, uniseriate, arranged obliquely and parallelly, hyaline, thin-walled, smooth, fusiform to ellipsoidal, aseptate at immature, becoming muriform at maturity with 4–7 transverse septa and 1–2 longitudinal septa, sometimes slightly constricted at the median septum, rounded at the ends in aged ascospores. Asexual morph: Not observed.

Material examined. CHINA, Yunnan Province, Lijiang City, Laojun Mountain National Nature Reserve, 26°39′N, 99°43′E, 3900 m elev., on the bark of *Abies fabri* (Pinaceae), 10 Apr 2022, Qing-feng Meng, ljs-52 (holotype KUN-L 88703).

Notes. *Lijiangomyces laojunensis* closely resembles *Ostreola consociata* (type) and *O. sessilis*, in having cylindrical asci and uniseriate muriform ascospores. However, the new species is distinguished by its ascomatal morphology, which is broadly shell-shaped or irregularly rounded with a widely opened disc, in contrast to *Ostreola* species which have conchiform to hatchet-shaped ascomata with a narrowly slit-like opening. Furthermore, the ascospores of the new species are hyaline and larger in size (20.9–28.8 × 10.1–15.4 μm), in contrast, brown and smaller ascospores (14–22 × 6–8 μm) are the characteristic feature of *Ostreola* (Darker 1963).



Note a, b habitat. c–e ascomata (arrows). f–h section of ascomata in water. i–k asci in water. l, m asci in IKI. n paraphyses in water. o–u ascospores in water. Scale bars: 500 μm (e), 200 μm (f–g), 50 μm (h), 25 μm (i–n), 10 μm (o–u).

Figure 5.2 *Lijiangomyces laojunensis* sp. nov. (KUN-L 88703)

Phylogenetic analysis places this species as a sister clade to *Mytilinidion*,

however, it can be distinguished by its obovoid to broadly shell-shaped or irregularly rounded ascomata (vs. globoid to obovoid, erect, conchate, or dolabrate in *Mytilinidion*), and hyaline, muriform ascospores (vs. hyaline to dark brown and transversely septate in *Mytilinidion*) (Boehm et al., 2009; Jayasiri et al., 2018).

5.5 Discussion

Hysteriaceous fungi are distinguished by their persistent, carbonaceous, navicular pseudothecia with a longitudinal slit opening. Historically, the mytilinidiaceous fungi, which possess fragile, shell-shaped pseudothecia that dehisce through a longitudinal cristate apex, were considered part of the hysteriaceous. However, Boehm et al. (2009a, b) reclassified these fungi based on phylogenetic analyses, leading to the establishment of the order Mytilinidiales.

In our phylogenetic analysis, six genera within Mytilinidiales form a distinct yet complex clade. *Mytilinidion* is split into two subclades, indicating its polyphyletic nature. This is consistent with previous study by Boehm et al. (2009a). One subclade includes four species of *Mytilinidion* alongside all *Lophium* species, forming a well-supported *Lophium-Mytilinidion* clade. The other subclade contains eight *Mytilinidion* species with our new collection, although this grouping is weakly supported. Morphologically, *Mytilinidion* species are defined by globoid to obovoid, conchate, or dolabrate ascomata with narrow slit-like openings, bitunicate, 8-spored asci, and hyaline to dark brown ascospores with 3–5(–7) transverse septa (Boehm et al., 2009; Jayasiri et al., 2018). However, our new species displays distinct morphological features that diverge significantly from those of *Mytilinidion*, supporting its exclusion from this genus based on both phylogenetic and morphological evidence.

Hyde et al. (2024) accepted one family and eleven genera within Mytilinidiales,

most of which lack muriform septation except *Ostreola* which was introduced by Darker (1963). Although molecular evidence for *Ostreola* remains unavailable, our new species shares features with it, such as cylindrical asci and uniseriate muriform ascospores but differs from *Ostreola* in having broadly opened hysterothecia, while *Ostreola* exhibits narrow, slit-like openings. Additionally, *Ostreola* typically has dull-brown muriform spores, whereas our species is distinguished by its hyaline muriform ascospore (Harkness et al., 1878; Darker, 1963; Tilak et al., 1968; Rao et al., 1972; Barr, 1987). (Hyde et al., 2024)

Phylogenetic analysis further positions our new species at a significant distance from the recently described genus *Bullatosporium* (Andreasen et al., 2024). Apart from the six genera included in our phylogenetic analysis, four additional genera within the family including *Actidium*, *Camaroglobulus*, *Peyronelia* and *Zoggium* lack molecular data but exhibit distinct morphological characteristics. *Actidium* is characterized by simple, rounded spores (Fries, 1815). *Camaroglobulus* was introduced as the asexual morph of *Mytilinidion resinae*, though its taxonomic placement requires further molecular confirmation (Speer, 1986). *Peyronelia* is defined by brown, fusiform conidia that form short chains of slender, septate, interconnected cells (Ciferri et al., 1927) and *Zoggium* features broadly filiform or vermiform spores that are transversely septate and pale-colored (Vasilyeva, 2001).

Given these morphological and phylogenetic distinctions, the establishment of a new genus to accommodate our newly identified species is both necessary and justified. This classification will provide a clearer framework for understanding diversity within the order *Mytilinidiales*.

The holotype of *Lijiangomyces laojunensis* exhibits another intriguing feature: the base of its apothecium is surrounded by the thallus of *Pertusaria* sp. This phenomenon has led us to mistakenly identify it as a lichenicolous species. Although

lichenicolous behaviour was not confirmed in this study, the close physical association suggests that the two fungi coexist without conflict. It is also possible that lichenicolous species may be identified as more specimens are collected and studied in the future.

CHAPTER 6

MORPHOLOGICAL AND PHYLOGENETIC APPRAISAL OF A NEW *KIRSCHSTEINIOTHELIA* (DOTHIDEOMYCETES, KIRSCHSTEINIOTHELIALES) SPECIES FROM YUNNAN PROVINCE, CHINA

6.1 Abstract

Kirschsteiniothelia is a saprotrophic genus that occurs in both terrestrial and aquatic habitats. This study introduces a novel species of *Kirschsteiniothelia*, discovered on the bark of *Abies fabri*, collected from Yunnan Province, China, and named *Kirschsteiniothelia laojunensis*. The identification was established through a combination of molecular analyses and morphological characters. The new species formed a sister clade to *Kirschsteiniothelia thujina* with high statistical support (100 ML/1.00 BP), and it differs morphologically by having larger ascomata (1–1.5 mm), smaller asci (130–162 × 20–30 μm) and narrower ascospores (35–55 × 11–14 μm) from the latter. *Kirschsteiniothelia laojunensis* is characterized by its large subglobose to globose, black perithecia, clavate, 8-spored asci, fusiform asymmetric ascospores, which are hyaline when immature and become greenish to brown at maturity. This discovery marks the first occurrence of the genus *Kirschsteiniothelia* on tree bark, with some lichen thallus tissue surrounding the base of the perithecia. Detailed morpho-molecular characterization along with the synopsis table of the genus is provided.

Key words: 1 new species, *Abies fabri*, multi-gene, *Ochrolechia*, taxonomy

6.2 Introduction

Kirschsteiniothelia D. Hawksw., was introduced by Hawksworth (1985) to accommodate the *Microthelia incrustans*-group within Pleosporaceae (Dothideales). Boonmee *et al.* (2012) found that four species, including *Kirschsteiniothelia aethiops* (Sacc.) D. Hawksw., *K. emarceis* Boonmee & K.D. Hyde, *K. lignicola* Boonmee & K.D. Hyde and *K. atra* (Corda) D. Hawksw. (= *Dendryphiopsis atra* (Corda) S. Hughes), formed a monophyletic clade with strong statistical support, and indicated it as a distinct clade within Dothideomycetes. Therefore, the new family Kirschsteiniotheliaceae Boonmee & K.D. Hyde, was established to accommodate this clade (Boonmee et al., 2012). Further taxonomic revision by Hernandez-Restrepo *et al.* (2017) revealed that Kirschsteiniotheliaceae represented a distinct lineage within Dothideomycetes, necessitating the formation of a new order, Kirschsteiniotheliales Hern.-Restr., R.F. Castañeda, Gené & Crous, to accommodate Kirschsteiniotheliaceae, with *Kirschsteiniothelia* as the type genus. Additionally, the three genera *Brachysporiella* Bat., *Solicorynespora* R. F. Castañeda & W. B. Kendr. and *Taeniolella* S. Hughes were placed in incertae sedis within the order (Hernandez-Restrepo et al., 2017; Wijayawardene et al., 2022).

The sexual morph of *Kirschsteiniothelia* is characterized by its superficial, hemispherical or subglobose ascomata with dark pigmentation, pseudoparenchymatous peridium, cylindrical to clavate asci and containing 4–8 ellipsoidal and dark-brown ascospores that are 1-septate (Hawksworth, 1985; Boonmee et al., 2012; Mehrabi et al., 2017). Two types of asexual morphs had been reported: dendryphiopsis-like and sporidesmium-like (Sun et al., 2021). *Dendryphiopsis* S. Hughes had been listed as the anamorph of *Kirschsteiniothelia* (Hawksworth, 1985; Kirk et al., 2008; Hyde et al., 2011). The *Dendryphiopsis* anamorph is characterized by branched conidiophores, brown conidia with 3–4 septa, rounded apices, and a truncate base, which are reported in *Kirschsteiniothelia aethiops*, *K. atra*, *K. binsarensis* and *K. goaensis* (Hyde et al., 2013; Mehrabi et al., 2017). Su *et al.* (2016) reported a sporidesmium-like asexual

morph. The sporidesmium-like anamorph is characterized by unbranched conidiophores, brown conidia with 6–27 septa, tapering towards apex and a truncate base, reported in *Kirschsteiniothelia aquatica*, *K. cangshanensis*, *K. rostrata, K. thailandica* and *K. xishuangbannaensis* (Li et al., 2016; Hyde et al., 2017; Bao et al., 2018; Sun et al., 2021; Xu et al., 2023). The relationship between the sexual and asexual morphs of *Kirschsteiniothelia* is supported by molecular studies (Schoch et al., 2006; Hyde et al., 2011; Boonmee et al., 2012;; Hyde et al., 2013; Wijayawardene et al., 2014).

The taxa of *Kirschsteiniothelia* exhibit a saprobic lifestyle, thriving on dead wood bark, branches or leaves in terrestrial habitats, as well as submerged decaying wood in freshwater environments (Bao et al., 2018; Rodríguez-Andrade et al., 2019; Sun et al., 2021; Verma et al., 2021). They are distributed across tropical or subtropical regions (Su et al., 2016; Mehrabi et al., 2017; Bao et al., 2018). During the microfungi survey (Thiyagaraja et al., 2024), we collected an interesting specimen that grows on the bark. In this study, we introduce it as a new species, *Kirschsteiniothelia laojunensis*, using a combination of multigene phylogenetic analyses along with morphological characters.

6.3 Materials and Methods

6.3.1 Sample Collection and Morphological Examination

The specimen was collected from Laojun Mountain National Nature Reserve, Lijiang City, Yunnan Province, China. Morphological characters were observed and photographed using a compound microscope (Nikon Y-TV55) with a digital camera (Nikon DS-Ri2) and a stereomicroscope (Olympus ZX-16) fitted with a digital camera (Olympus SC180). Measurements were conducted using Image Framework software (Tarosoft, Version 0.9.7). Photoplates were processed with Adobe Photoshop CC 2019 software (Adobe Systems, USA). The holotype specimen was deposited in the Lichen

Herbarium of Kunming Institute of Botany (KUN-L), Chinese Academy of Science, Yunnan, China.

6.3.2 DNA Extraction, PCR Amplification & Sequencing

Single spore isolation was failed to germinate following the method described by Choi *et al.* (1999) (Choi et al., 1999). Therefore, DNA extraction was performed directly from the ascomata. Due to the apothecia growing through the lichen thallus, with the base intermingled with lichen thallus tissue, apothecia were carefully removed using a razor blade under the dissecting microscope, and the lichen thallus was thoroughly cleaned. The sample was transferred to a 200 µl centrifuge tube. Total genomic DNA was extracted using a Forensic DNA Kit (Omega Bio-Tek, Norcross, Georgia), following the manufacturer's instructions. The primer pairs ITS1f and ITS4 were used to amplify the internal transcribed spacer region of rDNA (ITS) (White et al. 1990, Gardes et al., 1993) and the primer pairs LR0R and LR5 were employed to amplify the 28S large-subunit of rDNA (LSU) (Vilgalys et al., 1990). PCR was performed using a Mastercycler (Bio-RAD T-100) for 25-µl reactions with 12.5 µL of 2×Mix (Solarbio, dNTPs Mix), 9.5 µL of double-distilled water (ddH_2O), 1.0 µL for each 10 mM primer, and 1.0 µl of DNA template. The PCR amplification followed the methods outlined in Table 6.1. PCR products were sequenced by Shanghai Sangon Company (Chengdu, Sichuan Province, China).

Table 6.1 Primer pairs and the parameters for PCR

Locus	Primers	Initial Denaturation	Denaturation	Annealing	Elongation	Final Extension	Hold	References
ITS	ITS1f/ITS4	95℃/3 min	95℃/45 s	55℃/90 s	72℃/1 min	72℃/10 min	4℃/+∞	White *et al.* 1990; Gardes and Bruns 1993
LSU	LR0R/LR5	95℃/3 min	95℃/45 s	55℃/90 s	72℃/1 min	72℃/10 min	4℃/+∞	Vilgalys and Hester 1990

40 cycles

40 cycles

6.3.3 Phylogenetic Analyses

The chromatograms of sequence results were checked for quality using BioEdit Sequence Alignment software (Version 7.0.9.0). The forward sequences and reverse sequences were assembled using ContigExpress software (New York, USA). These newly generated sequences were subjected to BLASTn searches (https://blast.ncbi.nlm.nih.gov/Blast.cgi) to confirm their affiliation with the same genus or family and to identify potential sample contamination. Newly generated sequences were submitted to GenBank (Table 2). Additional sequences used as the inner group were downloaded from the NCBI website (https://www.ncbi.nlm.nih.gov) and the outgroup taxa were selected following Xu *et al.* (2023). Phylogenetic analyses were conducted using the OFPT program (Zeng et al., 2023) with the following protocol. Each gene region's dataset was initially dependently aligned using the 'auto' strategy (based on data size) by MAFFT (Katoh et al., 2013) and trimmed with the 'gappyout' method (based on gaps' distribution) by TrimAl (Capella-Gutierrez et al. 2009). Single gene phylogenetic trees were constructed using IQTREE Web Server (http://iqtree.cibiv.univie.ac.at/) to confirm well-supported branches. The best-fit nucleotide substitution models for each dataset were selected based on the Bayesian Information Criterion (BIC) from twenty-two common DNA substitution models with rate heterogeneity by ModelFinder (Kalyaanamoorthy et al., 2017). Subsequently, all datasets were concatenated with partition information for the subsequent phylogenetic analyses. Maximum likelihood with 1000 replicates was performed using ultrafast bootstrap approximation (Hoang et al., 2018) with SH-like approximate likelihood ratio test (SH-aLRT) (Guindon et al., 2010) by IQ-TREE (Nguyen et al., 2015). The consensus tree was summarized based on the extended majority rule. The maximum likelihood analysis was conducted with the RAxML-HPC2 on ACCESS (8.2.12) employing a GTRGAMMA approximation with a rapid bootstrap analysis of 1000 replicates (Miller et al., 2010; Stamatakis, 2014) for verification. Bayesian inference

was performed with two parallel Metropolis-coupled (one 'cold' chain and three heated chains) Markov Chain Monte Carlo runs by MrBayes (Ronquist et al., 2012), with trees sampling every 1000 generations, and the run was automatically stopped when the average standard deviation of split frequencies fell below 0.01. The resulting tree was summarized after discarding the first 25% samples. The resulting trees were visualized in FigTree v1.4.3 (Rambaut, 2016). The new taxon was registered in Index Fungorum (2024) and Faces of Fungi database (Jayasiri et al., 2015).

Table 6.2 Taxa name, voucher/culture, and their GenBank accession numbers used in this study

Species name	Voucher/Culture	Genbank accession numbers		Reference
		LSU	ITS	
Kirschsteiniothelia acutispora	MFLU 21-0127^{T}	ON980758	OP120780	(Jayawardena et al., 2022)
K. aethiops	CBS 109.53	AY016361	NA	(Lumbsch et al., 2001)
K. aethiops	MFLUCC 16-1104	MH182589	MH182583	(Bao et al., 2018)
K. aethiops	S-783	MH182595	MH182586	(Bao et al., 2018)
K. aethiops	S-1406	MH793546	MH793540	(Hongsanan et al., 2020)
K. aethiops	MFLUCC 15-0424	KU500578	NA	(Oliveira et al., 2021)
K. aquatica	MFLUCC 16-1685^{T}	MH182594	MH182587	(Bao et al., 2018)
K. arasbaranica	IRAN 2509C	KX621987	KX621986	(Mehrabi et al., 2017)
K. arasbaranica	IRAN 2508C^{T}	KX621984	KX621983	(Mehrabi et al., 2017)
K. atra	DEN^{T}	NA	MG602687	(Wijayawardene et al., 2014)
K. atra	AFTOL-ID 273	DQ678046	NA	(Schoch et al., 2006)

Table 6.2 (continued)

Species name	Voucher/Culture	Genbank accession numbers		Reference
		LSU	ITS	
K. cangshanensis	GZCC19-0514	MW133828	NA	(Yang et al., 2023)
K. cangshanensis	GZCC19-0515	MW133829	NA	(Yang et al., 2023)
K. cangshanensis	MFLUCC 16-1350^{T}	MH182592	MH182584	(Bao et al., 2018)
K. chiangmaiensis	MFLU 23-0358^{T}	OR575474	OR575473	(Louangphan et al., 2024)
K. crustaceum	T20-1127	MW851854	MW851849	(Jayawardena et al., 2022)
K. ebriosa	CBS 143842 ^{T}	LT985884	NA	(Rodríguez-Andrade et al., 2019)
K. dushanensis	GZCC 19-0415	MW133830	OP377845	(Yang et al., 2023)
K. ebriosa	CBS H-23379^{T}	LT985885	NA	(Rodríguez-Andrade et al., 2019)
K. elaterascus	HKUCC7769	AY787934	NA	(Kodsueb et al., 2006)
K. emarceis	MFLUCC 10-0037^{T}	NG_059454	NR_138375	(de Farias et al., 2024)
K. esperanzae	T. Raymundo 6581^{T}	OQ880482	OQ877253	(Valenzuela et al., 2023)
K. extensum	T20-1129	MW851855	MW851850	(Jayawardena et al., 2022)
K. fluminicola	MFLUCC 16-1263^{T}	MH182588	MH182582	(Bao et al., 2018)
K. guangdongensis	ZHKUCC 22-0233^{T}	OR164974	OR164946	(Senanayake et al., 2023)

Table 6.2 (continued)

Species name	Voucher/Culture	Genbank accession numbers		Reference
		LSU	ITS	
K. inthanonensis	MFLUCC 23-0277^{T}	OR762781	OR762773	(de Farias et al., 2024)
K. lignicola	MFLUCC10-0036^{T}	HQ441568	HQ441567	(de Farias et al., 2024)
K. nabanheensis	HJAUP C2004^{T}	OQ023273	OQ023197	(Liu et al., 2023)
K. nabanheensis	HJAUP C2006	OQ023275	OQ023274	(Liu et al., 2023)
K. laojunensis	KUN-L 88727^{T}	PP081658	PP081651	This study
K. phoenicis	MFLUCC 18-0216^{T}	MG860484	MG859978	(Hyde et al., 2018)
K. phoenicis	MFLU 18-0153^{T}	NG_064508	NR_158532	(Hyde et al., 2018)
K. puerensis	ZHKUCC 22-0271^{T}	OP451017	OP450977	(Hyde et al., 2023)
K. puerensis	ZHKUCC 22-0272^{T}	OP451018	OP450978	(Hyde et al., 2023)
K. ramus	GZCC 23-0596	OR091333	OR098711	(Zhang et al., 2023)
K. rostrata	MFLU 15-1154^{T}	NG_059790	NR_156318	(Hyde et al., 2017)
K. rostrata	MFLUCC 15-0619^{T}	KY697276	KY697280	(Hyde et al., 2017)
K. rostrata	MFLUCC 16-1124	MH182590	NA	(Bao et al., 2018)
K. septemseptatum	MFLU 21-0126^{T}	ON980757	OP120779	(Jayawardena et al., 2022)
K. spatiosum	MFLU 21-0128^{T}	NA	NR_187065	(Jayawardena et al., 2022)
Kirschsteiniotheli. sp.	KUNCC 23-13756	NA	OR589303	Direct Submission
Kirschsteiniotheli. sp.	KUNCC 23-14559	NA	OR589302	Direct Submission
Kirschsteiniotheli. sp.	KUNCC 23-13755	NA	OR589301	Direct Submission
Kirschsteiniotheli. sp.	KUNCC 22-12671	OQ732682	OQ874971	Direct Submission
Kirschsteiniotheli. sp.	KUNCC 10431	NA	OP626354	Direct Submission

Table 6.2 (continued)

Species name	Voucher/Culture	Genbank accession numbers		Reference
		LSU	ITS	
Kirschsteiniotheli. sp.	UTHSCSA DI22-44	ON191450	ON191447	Direct Submission
Kirschsteiniotheli. sp.	UTHSCSA DI22-45	ON191449	ON191448	Direct Submission
Kirschsteiniotheli. sp.	7020611638	MZ380317	MZ380314	Direct Submission
Kirschsteiniotheli. sp.	E38	MN912273	MN912317	(Oliveira et al., 2021)
Kirschsteiniotheli. sp.	CSN604	NA	MT813881	(Spies et al., 2020)
Kirschsteiniotheli. sp.	CSN602	NA	MT813880	(Spies et al., 2020)
K. saprophytica	MFLUCC 23–0275^{T}	OR762783	OR762774	(de Farias et al., 2024)
K. saprophytica	MFLUCC 23–0276	OR762782	OR762775	(de Farias et al., 2024)
K. submersa	MFLUCC 15-0427^{T}	KU500577	KU500570	(Su et al., 2016)
K. submersa	S-601	MH182593	MH182585	(Bao et al., 2018)
K. submersa	S-481	MH182591	NA	(Bao et al., 2018)
K. tectonae	12-0050^{T}	KU764707	NR_148089	(Wijayawardene et al., 2014)
K. tectonae	13-0470	KU764708	KU144924	(Wijayawardene et al., 2014)
K. tectonae	MFLUCC 23-0271	OR762779	OR762771	(de Farias et al., 2024)
K. tectonae	MFLUCC 23–0272	OR762780	OR762772	(de Farias et al., 2024)
K. thailandica	MFLUCC 22-0020	ON870387	ON878074	(Silva et al., 2022)
K. thailandica	MFLUCC 20-0116^{T}	NG_088170	NR_178154	(Sun et al., 2021)

Table 6.2 (continued)

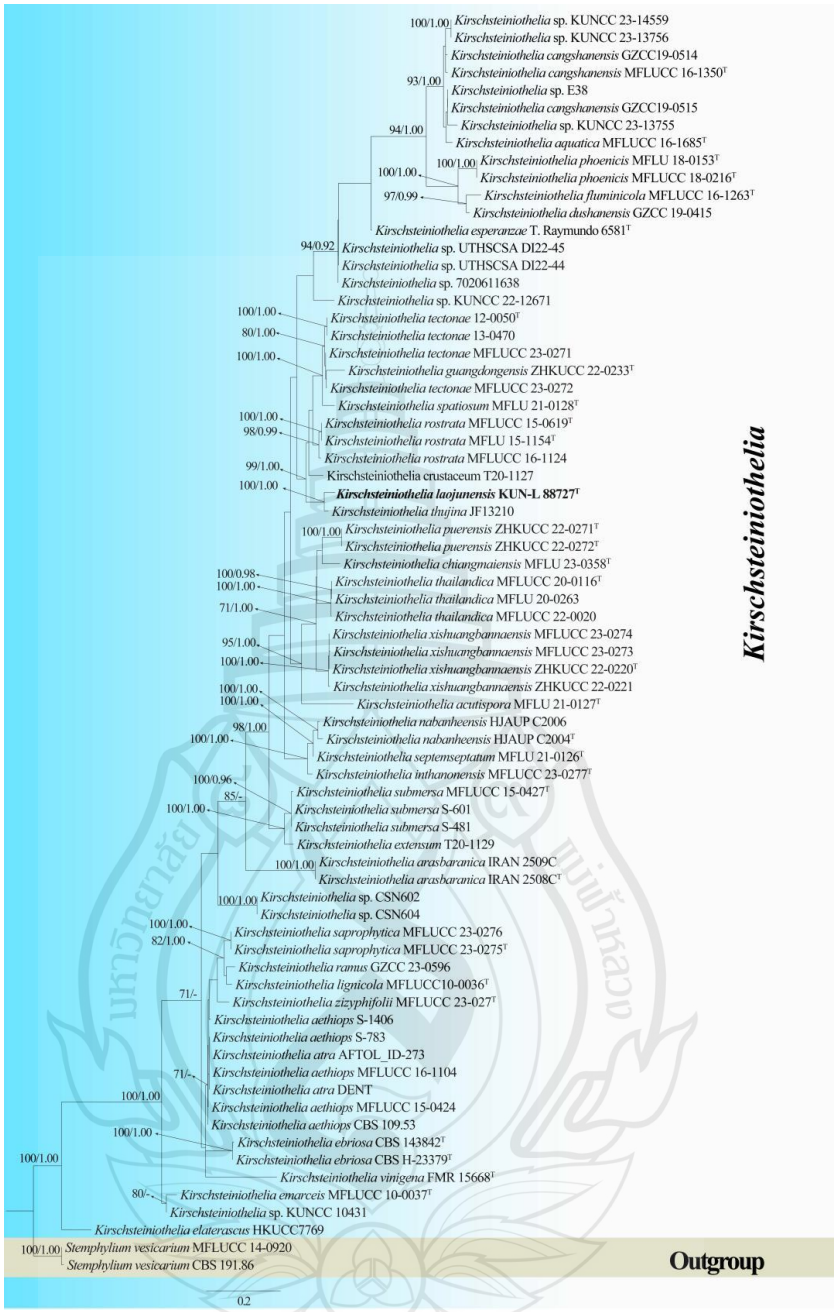
Species name	Voucher/Culture	Genbank accession numbers		Reference
		LSU	ITS	
K. thailandica	MFLU 20-0263	MT984443	MT985633	(Sun et al., 2021)
K. thujina	JF13210	KM982718	KM982716	(Zhang et al., 2015)
K. vinigena	FMR 15668^{T}	NG_075229	NA	(Rodríguez-Andrade et al., 2019)
K. xishuangbannaensis	ZHKUCC 22-0220^{T}	OP303181	OP289566	(Xu et al., 2023)
K. xishuangbannaensis	ZHKUCC 22-0221	OP303182	OP289563	(Xu et al., 2023)
K. xishuangbannaensis	MFLUCC 23-0273	OR762778	OR762770	(de Farias et al., 2024)
K. xishuangbannaensis	MFLUCC 23-0274	OR762777	OR762769	(de Farias et al., 2024)
K. zizyphifolii	MFLUCC 23–027T	OR762776	OR762768	(de Farias et al., 2024)
Stemphylium vesicarium	CBS 191.86	GU238160	MH861935	(Vu et al., 2019)
S. vesicarium	MFLUCC 14-0920	KY659563	KY659560	(Bao et al., 2018)

Note "^{T}" indicates holotype or ex-type strains. The absence of GenBank accession numbers is shown by "NA". The newly generated sequences are shown in black bold font and "^{T}" indicates holotype or ex-type strains. The absence of GenBank accession numbers is shown by "NA".

6.4 Result

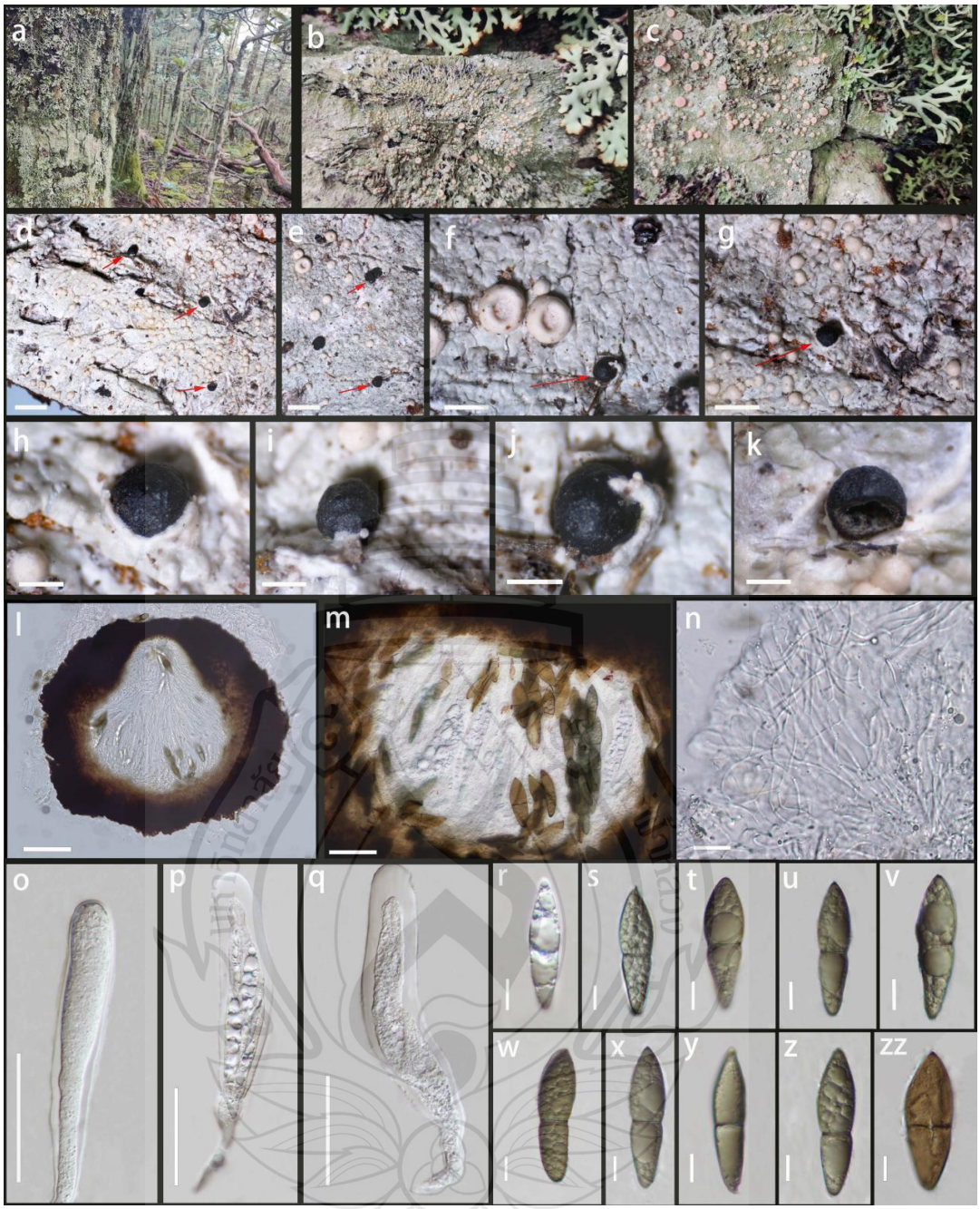
6.4.1 Phylogenetic Analyses

The final dataset comprised 72 taxa with 1277 aligned characters, including gaps (ITS: 512 bp; LSU: 765 bp). BLAST results showed that the new species (KUN-L 88727) and *Kirschsteiniothelia thujina* (JF13210) had ITS-94.66% and LSU-98.27% sequence similarities. The RAxML tree was constructed with a final ML optimization likelihood value of -12733.31. The parameters for the GTR+I+G model of combined LSU and ITS were as follows: estimated base frequencies: estimated base frequencies: A—0.21, C—0.28, G—0.32, T—0.19, substitution rate AC—1.31; AG—2.52; AT—1.03; CG—1.04; CT—6.23 and GT—1.00. Bayesian posterior probabilities from MCMC were evaluated with a final average standard deviation of split frequencies—0.009999. The topologies of both ML and Bayesian analyses were largely concurred (Fig. 6.1).



Note Bootstrap support values for maximum likelihood (ML ≥ 70%), and the Bayesian Posterior Probabilities (PP ≥ 0.95) are shown near the nodes as ML/PP. *Stemphylium vesicarium* (CBS 191.86) and *S. vesicarium* (MFLUCC 14-0920) were used as outgroup taxa. The newly generated sequence is shown in bold font.

Figure 6.1 RAxML analysis based on combined LSU and ITS sequence data.



Note a-c. Habitat and appearanc of host substrate. d-g. Ascomata are marked by red arrows. h-k. Appearance of the perithecium. l. Vertical section of perithecium in water. m. Hymenium. n. Pseudoparaphyses. o-q. Asci in water. r-s. Immature ascospores. t-zz. Mature ascospores in water. Scale bar: d-e = 5 mm, f-g = 2.5 mm, h-k = 1 mm, l-m = 50 µm, o-q = 50 µm, n = 10 µm, r-zz = 10 µm.

Figure 6.2 *Kirschsteiniothelia laojunensis* sp. nov. (KUN-L 88727, ljs-29)

6.4.2 Taxonomy

Kirschsteiniothelia laojunensis Q.F. Meng & S.B. Fu sp. nov.

Index Fungorum IF901188; Face of Fungi FOF15351

Fig. 6.2

Etymology: The specific epithet "laojunensis" refers to the name of Laojun Mountain, where the holotype was collected.

Material examined: China, Yunnan Province, Lijiang City, Laojun Mountain National Nature Reserve, 26°37′54.86″N, 99°43′28.13″E, elev. 4000 m, 9, August, 2022, collected by Qing-Feng Meng, Coll. No. ljs-29 (KUN-L 88727, holotype).

Description:

Sexual morph: *Ascomata* perithecial, superficial, erumpent, on the bark of *Abies fabri*, surrounded at the base by the lichen thallus tissue of *Ochrolechia* sp., irregularly scattered, rarely clustered, sessile, subglobose to globose, black, with a smooth surface, 1–1.5 mm in diameter, and possessing an apex ostiolate. *Peridium* 50–80 μm thick on both sides, the upper part 65–100 μm thick, dark brownish to black, composed of highly melanised irregular cells. *Pseudoparaphyses* 1.5–2.5 μm thick, branched. *Asci* (105–) 130–162 (–180) × (17–) 20–30 μm ($\bar{x}$ = 150 × 26 μm, n = 6), 8-spored, bitunicate, clavate, K-. *Ascospores* (34–) 35–55 (–56) × (10–) 11–14 (–16) μm ($\bar{x}$ = 48 × 13 μm, n = 30), length to width ratio (l/w) = 3.3–3.9 ($\bar{x}$ = 3.8, n = 30), usually 2-celled with a septum, slightly constricted at the septum, hyaline when young and turning dark brown with greenish or bluish coloration at maturity, fusiform, asymmetric with a slightly larger upper cell, both ends slightly subacute, guttulate, with two central globose guttules either side of the septum, smaller guttules elsewhere.

Asexual morph: Not observed.

Notes: The phylogenetic analysis of combined sequence data (LSU and ITS) reveals that *Kirschsteiniothelia laojunensis* forms a sister clade with *K. thujina*. However, nucleotide comparison differences between *K. laojunensis* and *K. thujina*

(JF13210), showed a difference of 1.57% (12/765 bp) for LSU and 5.27% (27/512 bp) for ITS. The new taxon differs from *K. thujina* in having larger ascomata (1000–1500 µm vs. 350–500 µm), larger asci (130–162 × 20–30 µm vs. 100–140 × 17–22 µm) and narrower ascospores (35–55 × 11–14 µm vs. 36–50 × 15–17 µm) (Hawksworth, 1985).

6.5 Discussion

Kirschsteiniothelia taxa are primarily saprobic species (Wang et al., 2004; Chen et al., 2006; Mehrabi et al., 2017; Sun et al., 2021; Verma et al., 2021; Raymundo et al., 2023) (Table 3). Although *Kirschsteniothelia laojunensis* was found on the bark of *Abies fabri*, considering the easy shedding nature of *Abies* bark, it is plausible that the samples initiate growth from deceased bark tissue. This observation remains consistent with the saprobic nature of this genus. The majority of perithecia were present superficially, with only the base partially submerged in the thallus of lichen *Ochrolechia*. Notably, the base of the perithecia is enveloped by some lichen thallus tissue, suggesting a potential closed relationship between the lichen *Ochrolechia* and *Kirschsteiniothelia laojunensis*.

Morphological characteristics of our newly identified taxon, including the shape and color of ascomata, bitunicate asci, the septation of ascospores, and the color of ascospore, supported its placement within *Kirschsteiniothelia*. The new species, *K. laojunensis*, shares similar morphology with *K. arasbaranica, K. atra, K. dolioloides, K. esperanzae, K. smilacis* and *K. thujina*, particularly in the shape of ascomata (hemispherical or globose), asci (cylindrical to clavate), ascospores (ellipsoidal), number of septa per ascospore (1-septate), and the color of ascospores (brown). Most ascomata in *Kirschsteiniothelia* are generally smaller than 600 µm (Wegelin, 1894; Hawksworth, 1985; Chen et al., 2006; Wijayawardene et al., 2014; Raymundo et al., 2023). Our new taxon exhibits a notably larger ascomata size (1–1.5 mm). The asci

length of the new taxon ((105–) 130–162 (–180) × (17–) 20–30 µm) closely aligns with *K. arasbaranica* (120–180 × 30–40 µm) and *K. esperanz*ae ((168–) 178–203 × 32–35 µm), however, the asci width of the latter two taxa is comparatively thicker (Mehrabi et al., 2017; Raymundo et al., 2023). The ascospores' length of our new species resembles that of *K. esperanzae*; however, the latter are wider ((10–) 11–14 (–16) µm vs. 14–17 µm) and have a smaller length-to-width ratio (≥3.3 vs. ≤2.94) (Hawksworth, 1985; Raymundo et al., 2023).

Previously, 11 species of *Kirschsteiniothelia* have been documented in China. Among them, nine species were described based on their asexual morphs, whereas *K. reticulata* and *K. smilacis* were reported based on their sexual morphs in Taiwan (Chen et al., 2006; Su et al., 2016; Bao et al., 2018; Hyde et al., 2023; Liu et al., 2023; Xu et al., 2023). *K. laojunensis* shares similarities in the shape and color of ascomata, asci and ascospores with *K. reticulata*; however, the new species differs from the latter in the larger ascomata (1000–1500 µm vs. 320–450 µm), larger asci (130–180 × 20–30 µm vs. 90–110 × 23–27 µm), and larger ascospores (35–55 × 11–14 µm vs. 17–23 × 7–10 µm). *K. smilacis* and *K. laojunensis* exhibit similarities in the shape and color of ascomata, asci and ascospores. Nonetheless, the former displays wider ascomata (1000–1500 µm vs. 450–600 µm), larger asci (130–180 × 20–30 µm vs. 75–100 × 16–21 µm), and larger ascospores (35–55 ×11–14 µm vs. 20–24 × 6–8 µm).

CHAPTER 7

CONCLUSIONS

7.1 Overall Conclusion

This dissertation provides significant contributions to the study of lichenicolous fungi, offering novel insights into their taxonomy, phylogeny, and biogeography through a systematic, molecular, and field-based approach. The research encompasses three major aspects, each advancing our understanding of these ecologically and evolutionarily important fungi.

7.1.1 Global Overview of Lichenicolous Fungi

The first part of this dissertation is a comprehensive review of lichenicolous fungi worldwide, culminating in an updated checklist encompassing 2,673 species published up to date. These species are distributed across two phyla, 15 classes, 67 orders, 132 families, and 424 genera (Table 7.1). A thorough statistical analysis reveals that 92.8% (390 genera, 2,491 species) belong to the phylum Ascomycota, with the remaining 7.2% (33 genera, 192 species) in Basidiomycota. Within Ascomycota, five classes dominate—Dothideomycetes (26.54%), Lecanoromycetes (17.3%), Eurotiomycetes (13.93%), Arthoniomycetes (12.65%), and Sordariomycetes (10.97%)—accounting for over 80% of the diversity (Figure 7.1). However, 16.27% of the genera remain of uncertain systematic position, highlighting the need for further taxonomic refinement.

A key focus was placed on 219 genera classified as obligate lichenicolous fungi. Detailed notes were prepared for these genera, accompanied by line drawings to enhance identification and understanding. This global synthesis not only consolidates existing knowledge but also serves as a critical reference for future studies on lichenicolous fungi biodiversity and systematics.

7.1.2 Molecular Clock Analysis of Abrothallales and Related Orders

The second component focuses on a molecular clock analysis of Abrothallales and 12 related orders. By incorporating additional representative taxa and refining fossil

calibration points, the divergence times were re-evaluated to better approximate their evolutionary history. This approach yielded more accurate divergence estimates, shedding light on the temporal framework of Abrothallales and its phylogenetic relationships within Ascomycota. These findings enhance our understanding of the evolutionary pathways that have shaped obligate lichenicolous fungi and underscore the utility of molecular clock analyses in resolving complex phylogenies.

7.1.3 Diversity of Lichenicolous Fungi in the Hengduan Mountains, China

The third section investigates the diversity of lichenicolous fungi in the Hengduan Mountains of Yunnan Province, China, an underexplored biodiversity hotspot. Fieldwork across five mountains resulted in 220 lichenicolous fungal specimens, with 62 samples successfully sequenced to obtain at least one gene region. This study revealed five new species in the genus *Abrothallus*, a new species and a new record of *Sclerococcum*, a new genus and species in Mytilinidiaceae, and a new species of *Kirschsteiniothelia*. These discoveries significantly expand the known diversity of lichenicolous fungi in the region and highlight the importance of targeted field studies in uncovering hidden fungal diversity. The molecular data generated also provide valuable resources for future phylogenetic studies.

7.2 Significance and Future Directions

This research advances our understanding of lichenicolous fungi at multiple levels—from global taxonomic frameworks to regional biodiversity assessments and evolutionary timelines. The comprehensive checklist and taxonomic notes serve as indispensable tools for researchers, while the molecular clock analysis establishes a foundation for future evolutionary studies. Furthermore, the discoveries in the Hengduan Mountains emphasize the importance of exploring biodiversity hotspots and integrating molecular techniques with traditional taxonomy.

Future research should focus on expanding geographic sampling, particularly in tropical and alpine regions, to uncover additional undescribed species. Continued integration of advanced genomic tools, such as whole-genome sequencing and

phylogenomics, will further resolve taxonomic uncertainties and illuminate the evolutionary history of lichenicolous fungi.

Moreover, many species have historically been identified based solely on morphological comparisons and the experience of researchers, leaving the phylogenetic positions of numerous genera unclear. This lack of clarity poses significant challenges for novice researchers attempting species identification. In this study, a method combining microextraction and molecular cloning successfully sequenced many specimens, even for genera previously lacking molecular data. This approach not only increases the availability of genetic sequences for lichenicolous fungi but also offers a practical tool for researchers. By obtaining sequences, even those unfamiliar with morphological details can quickly determine a specimen's genus, narrowing the identification scope and facilitating further analysis through literature review.

Following this research, the next step involves conducting detailed morphological studies on specimens for which genetic data are available. Collaborations with experienced taxonomists will allow for precise species identification, enriching the taxonomic and morphological knowledge of lichenicolous genera. Additionally, systematic phylogenetic analyses will be conducted to resolve the positions of genera with uncertain affiliations, further advancing the field.

This work not only enriches the knowledge of lichenicolous fungi but also provides a roadmap for integrating molecular and morphological approaches to overcome traditional taxonomic challenges. It underscores the importance of interdisciplinary methods in addressing the complexities of fungal biodiversity, ensuring the field's continued advancement.

Table 7.1 Statistics of species, genera, families and orders

Phylum	Class	Order	Order %	Family	Families %	Genera	Genera %	Species	Species %
ASCOMYCOTA	ARTHONIOMYCETES	2	2.99	5	3.79	23	5.42	338	12.65
	ASCOMYCETES	0	0	0	0	3	0.71	16	0.6
	CANDELARIOMYCETES	1	1.49	1	0.76	1	0.24	2	0.07
	DOTHIDEOMYCETES	18	26.87	34	25.76	86	20.28	709	26.54
	EUROTIOMYCETES	5	7.46	11	8.33	34	8.02	372	13.93
	LABOULBENIOMYCETES	1	1.49	1	0.76	1	0.24	1	0.04
	LECANOROMYCETES	13	19.4	29	21.97	89	20.99	462	17.3
	LEOTIOMYCETES	5	7.46	13	9.85	33	7.78	152	5.69
	LICHINOMYCETES	1	1.49	1	0.76	1	0.24	1	0.04
	PEZIZOMYCETES	1	1.49	1	0.76	1	0.24	1	0.04
	SORDARIOMYCETES	9	13.43	21	15.91	53	12.5	293	10.97
	Pezizomycotina Ordo incertae sedis	1	1.49	1	0.76	1	0.24	3	0.11
	Pezizomycotina Familiae incertae sedis	0	0	2	1.52	2	0.47	5	0.19
	Ascomycota Genera incertae sedis	0	0	0	0	69	16.27	124	4.64
BASIDIOMYCOTA	AGARICOMYCETES	5	7.46	7	5.3	17	4.01	19	0.71
	TREMELLOMYCETES	2	2.99	2	1.52	7	1.65	145	5.43
	AGARICOSTILBOMYCETES	2	2.99	2	1.52	2	0.47	27	1.01
	MICROBOTRYOMYCETES	1	1.49	1	0.76	1	0.24	1	0.04
	Total	67		132		424		2671	

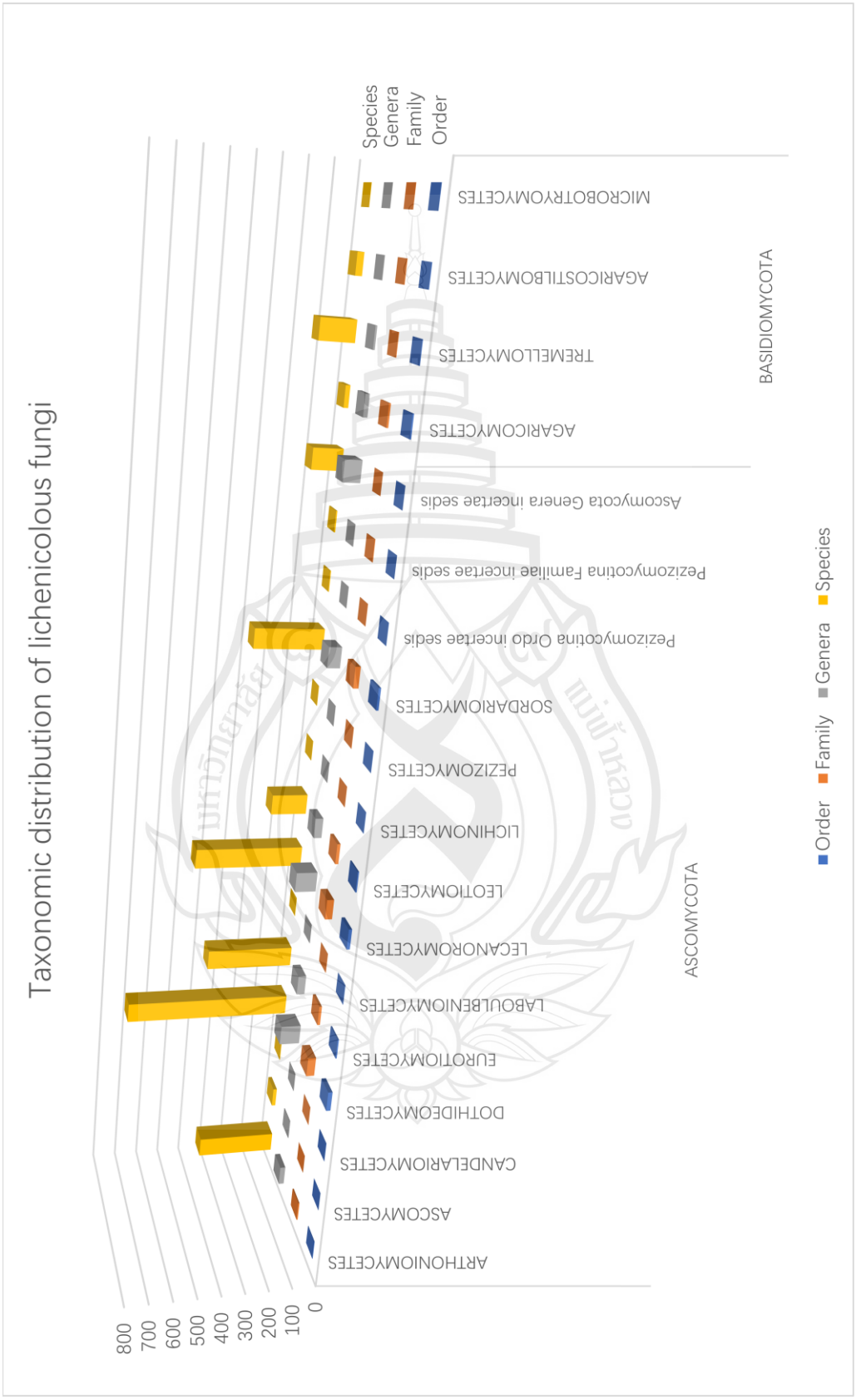


Figure 7.1 Taxonomic distribution of lichenicolous fungi

REFERENCES

Abdollahzadeh, J., Groenewald, J. Z., Coetzee, M. P. A., Wingfield, M. J., & Crous, P. W. (2020). Evolution of lifestyles in Capnodiales. *Studies in Mycology*, *95*(1), 381–414. https://doi.org/10.1016/j.simyco.2020.02.004

Acharius, E. (1795). Nya och mindre kända Svenska Lafarter beskrifne. (Fortsättning). *Kongliga Vetenskaps Academiens Nya Handlingar*, *16*, 127–142.

Acharius, E. (1803). *Methodus qua omnes detectos Lichenes secundum organa carpomorpha ad genera, species et varietates redigere atque observationibus illustrare tentavit E. Archarius*. Impensis SDD Ulrich.

Acharius, E. (1810). *Lichenographia universalis, in qua lichenes omnes detectos, adiectis observationibus et figuris horum vegetabilium naturam et organorum carpomorphorum structuram illustrantibus, ad genera, species, varietates differentis et observationibus sollicite definitas*. Apud Just. Frid. Danckwerts.

Acharius, E. (1817). Afhandling om de cryptogamiske vexter, som komma under namn af Calicioidea. *Kongliga Vetenskaps Academiens Handlingar*, *ser. 3, 5*, 220–244.

Almquist, S. (1879). Monographia Arthoniarum Scandinaviæ. In *Kongliga Svenska Vetenskaps-Akademiens Handlingar.* Kongl. Boktryckeriet (Vol. NY FÖLJD. 17, pp. 1–69). Kongl. Boktryckeriet.

Alstrup, V. (1991). *Sporidesmium bacidiicola* sp. n. *Graphis Scripta*, *3*(2), 44–45.

Alstrup, V. (1992). *Weddellomyces aspiciliicola*, a new lichenicolous fungus found in Czechoslovakia. *Folia Geobotanica*, *27*(2), 185–187.

Alstrup, V. (1993a). News on lichens and lichenicolous fungi from the Nordic Countries. *Graphis Scripta*, (5), 96–104.

Alstrup, V. (1993b). Notes on some lichenicolous fungi from Denmark. *Graphis Scripta*, *5*, 60–64.

Alstrup, V. (1997). New lichenicolous fungi found on the NLF meeting in Norway. . *Graphis Scripta*, *8*, 25–29.

Alstrup, V. (2002). Revisions of some lichens and lichenicolous fungi from Antarctica. *Folia Cryptogamica Estonica*, *39*, 1–2.

Alstrup, V., Christensen, S. N., Hansen, E. S., & Svane, S. (1992). The Lichens ofthe Faroes. *Fróðskaparrit-Faroese Scientific Journal*, 61–121.

Alstrup, V., Christensen, S. N., Hansen, E. S., & Svane, S. (1994). The lichens of the Faroes. *Fródskaparrit*, *40*, 61–121.

Alstrup, V., & Cole, M. S. (1998). Lichenicolous Fungi of British Columbia. *The Bryologist*, *101*(2), 221–229. https://doi.org/10.2307/3244200

Alstrup, V., & Hansen, E. S. (2001). New lichens and lichenicolous fungi from Greenland. *Graphis Scripta*, *12*(2), 41–50.

Alstrup, V., & Hawksworth, D. L. (1990). *The lichenicolous fungi of Greenland* (Vol. 31). Meddelelser om Gronland. https://doi.org/ 10.2307/1223371

Alstrup, V., & Olech, M. (1996). Lichenicolous fungi from the Polish Tatra Mountains. *Fragmenta Floristica et Geobotanica*, *41*(2), 747–752.

Alstrup, V., Olech, M., Wietrzyk-Pelka, P., & Wegrzyn, M. H. (2018). The lichenicolous fungi of the South Shetland Islands, Antarctica: species diversity and identification guide. *Acta Societatis Botanicorum Poloniae*, *87*(4), 1–32.

Alstrup, V., & Søchting, U. (2009). *Galloea cladoniicola*, a new hyphomycetous lichenicolous fungus from Denmark. *Graphis Scripta*, *21*(2), 33–35.

Alstrup, V., Svane, S., & Søchting, U. (2004). Additions to the lichen flora of Denmark VI. *Graphis Scripta*, *15*(1/2), 45–50.

Alstrup, V. O., M. (1993). Lichenicolous fungi from Spitzbergen. *Polish Polar Research*, *14*, 33–42.

Alves, M. M. E., Aptroot, A., Lacerda, S. R., & Cáceres, M. E. d. S. (2014). Three new Arthoniaceae from Chapada do Araripe, Ceará, NE Brazil. *The Lichenologist*, *46*(05), 663–667.

Andreasen, M., Jordal, J. B., & Nordén, B. (2024). *Bullatosporium taxicola*, a new genus and species in Mytilinidiaceae (Pleosporomycetidae, Dothideomycetes) from western Norway. *Fungal Systematics and Evolution*, *14*, 197–207 https://doi.org/10.3114/fuse.2024.14.13

Andreev, M. (2004). New taxonomic combinations for lecidioid lichens. *Novosti sistematiki nizshikh rasteniy [Novit. Syst. Pl. non Vasc.]*, *37*, 188–191.

Andreev, M. (2010). *Halecania santessonii*, a new lichenicolous lichen from Russia. *The Lichenologist*, *42*(3), 249–252.

Anzi, M. (1860). *Catalogus lichenum: quos in provincia Sondriensi et circa Novum-Comum collegit et in ordinem systematicum digessit*. ex officina C. Franchi.

Anzi, M. (1868). Analecta lichenum rariorum vel novorum Italiae superioris. *Atti della Società Italiana di Scienze Naturali*, *11*, 156–181.

Aptroot, A. (1991). A monograph of the Pyrenulaceae (excluding Anthracothecium and Pyrenula) and the Requinellaceae, with notes on the Pleomassariaceae, the Trypetheliaceae and *Mycomicrothelia* (lichenized and non-lichenized Ascomycetes). *Bibl. Lichenol.*, *44*, 1–178.

Aptroot, A. (2002). A new *Phacopsis* species on *Paraparmelia* and *Xanthoparmelia* in southern Africa. *Nova Hedwigia*, 405–409.

Aptroot, A. (2014). Two new genera of Arthoniales from New Caledonia and the Solomon Islands, with the description of eight further species. *The Bryologist*, *117*(3), 282–289.

Aptroot, A., Diederich, P., Sérusiaux, E., & Sipman, H. J. M. (1997). Lichens and lichenicolous fungi from New Guinea. *Bibliotheca Lichenologica*, *64*, 1–220.

Aptroot, A., & Moon, K. H. (2015). New lichen records from Korea, with the description of the lichenicolous *Halecania parasitica*. *Herzogia*, *28*(1), 193–204.

Aptroot, A., & Sipman, H. J. (2001). New Hong Kong lichens, ascomycetes and lichenicolous fungi. *The Journal of the Hattori Botanical Laboratory*, *91*, 317–343. https://doi.org/10.1078/0176-1617-00186

Arcadia, L., & Knudsen, K. (2012). The name *Myriospora* is available for the *Acarospora smaragdula* group. *Opuscula Philolichenum*, *11*, 19–25.

Ariyawansa, H. A., Hyde, K. D., Jayasiri, S. C., Buyck, B., Chethana, K. W. T., Dai, D. Q., Dai, Y. C., Daranagama, D. A., Jayawardena, R. S., Lücking, R., Ghobad-Nejhad, M., Niskanen, T., Thambugala, K. M., Voigt, K., Zhao, R. L.,

Li, G.-J., Doilom, M., Boonmee, S., Yang, Z. L., Hernawati. (2015). Fungal diversity notes 111–252—taxonomic and phylogenetic contributions to fungal taxa. *Fungal Diversity*, *75*(1), 27–274. https://doi.org/10.1007/s13225-015-0346-5

Arnold, F. (1870). Lichenologische Fragmente. VII. *Flora (Regensburg)*, *53*, 121–124.

Arnold, F. (1871). Lichenologische Fragmente. X. *Flora*, *53*(30-31), 465–488.

Arnold, F. (1874a). Lichenologische Fragmente. XVI (Fortsetzung). *Flora*, *57*, 150–155.

Arnold, F. (1874b). Lichenologische Fragmente. XVI (Fortsetzung.). *Flora*, *57*, 97–110.

Arnold, F. (1874c). Lichenologische Fragmente. XVL. *Flora*, *57*(9), 137–144.

Arnold, F. (1881). Lichenologische Fragmente. XXV. *Flora*, *64*, 321–327.

Arnold, F. (1885). Die Lichenen des fränkischen Jura. *Flora (Regensburg)*, *68*, 49–80.

Arnold, F. (1888). *Muellerella thallophila* Arn. n. sp. *Flora*, *71*, 14.

Arnold, F. (1891). Zur Lichenenflora von München. *Berichte der Bayerischen Botanischen Gesellschaft zur Erforschung der Heimischen Flora*, *1*, 1–147.

Arnold, F. (1896). Lichenologische Ausflüge. In C. Fritseh (Ed.), *Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft in Wien.* (Vol. 46, pp. 101–143). Herausgegeben von der Gesellschaft.

Arnold, G. (1971). Über einige neue Taxa und Kombinationen der Sphaeriales. *Zeitschrift für Pilzkunde*, *37*, 187–198.

Arup, U., Søchting, U., & Frödén, P. (2013). A new taxonomy of the family Teloschistaceae. *Nordic Journal of Botany*, *31*(1), 16–83.

Ashu, E. E., & Xu, J. (2015). The roles of sexual and asexual reproduction in the origin and dissemination of strains causing fungal infectious disease outbreaks. *Infection, Genetics and Evolution*, *36*, 199–209.

Association francaise de LICHENOLOGIE. (2024). https://www.afl-lichenologie.fr/Photos_AFL/Photos_ AFL_R/Textes_R/Rosellinula_ haplospora.htm

Atienza, V. (2002). Two new species of *Minutoexcipula* (mitosporic fungi) from Spain. *Bibliotheca Lichenologica*, *82*, 141–152.

Atienza, V., Calatayud, V., & Hawksworth, D. L. (2003). Notes on the genus *Polycoccum* (Ascomycota, Dacampiaceae) in Spain, with a key to the species. *Lichenologist*, *35*(2), 125–135.

Atienza, V., & Hawksworth, D. (1994). *Minutoexcipula tuckerae* gen. et sp. nov., a new lichenicolous deuteromycete on *Pertusaria texana* in the United States. *Mycological Research*, *98*(5), 587–592.

Atienza, V., & Hawksworth, D. L. (2008). *Lichenothelia renobalesiana* sp. nov.(Lichenotheliaceae), for a lichenicolous ascomycete confused with *Polycoccum opulentum* (Dacampiaceae). *The Lichenologist*, *40*(2), 87–96.

Atienza, V., Hawksworth, D. L., & Pérez-Ortega, S. (2021). *Verrucoccum* (Dothideomycetes, Dictyosporiaceae), a new genus of lichenicolous fungi on *Lobaria* s. lat. for the *Dothidea hymeniicola* species complex. *Mycologia*, *113*(6), 1233–1252.

Atienza, V., Pérez-Ortega, S., & Etayo, J. (2009). Two new conidial lichenicolous fungi from Spain indicate the distinction of *Lichenodiplis* and *Minutoexcipula*. *The Lichenologist*, *41*(3), 223–229.

Axsmith, B. J., Taylor, T. N., & Taylor, E. L. (1998). Anatomically preserved leaves of the conifer *Notophytum krauselii* (Podocarpaceae) from the Triassic of Antarctica. *American Journal of Botany*, *85*(5), 704–713.

Baglietto, F. (1871). Prospetto lichenologico della Toscana. *Nuovo Giornale Botanico Italiano*, *3*, 211–297.

Baglietto, F., & Carestia, A. (1864). *Alcuni licheni nuovi dell'alta Valsesia*.

Balfour, B. (1882). Diagnoses Lichenum Socotrensium novorum a participibus expeditionum Prof. Bayley Balfour et Dr. Schweinfurth lectorum, quas elaboravit Dr. J. Müller. *Proceedings of the Royal Society of Edinburgh*, *11*, 457–472. https://doi.org/10.1017/S0370164600047660

Baloch, E., Gilenstam, G., & Wedin, M. (2013). The relationships of *Odontotrema* (Odontotremataceae) and the resurrected *Sphaeropezia* (Stictidaceae)—new

combinations and three new *Sphaeropezia* species. *Mycologia*, *105*(2), 384–397. https://doi.org/10.3852/12-134

Bao, D., Luo, Z., Liu, J., Bhat, J. D., & Hyde, K. (2018). Lignicolous freshwater fungi in China III: Three new species and a new record of *Kirschsteiniothelia* from northwestern Yunnan Province. *Mycosphere*, *9*(4), 755–768. https://doi.org/10.5943/mycosphere/9/4/4

Baral, H. (1993). Beitrage zur taxonomie der discomyceten III. *Z. Mykol.*, *59*, 3–22.

Baral, H. O. (2015). Nomenclatural novelties. *Index Fungorum 225*, 1–3.

Baral, H. O., & Quijada, L. (2020). Nomenclatural novelties. *Index Fungorum*, *454*, 1–3.

Barbero, M., & Navarro-Rosinés, P. (1990). *Immersaria usbekica* (Hertel) Barbero, Nav.-Ros. et Roux comb. nov.[= *Amygdalaria tellensis* Esnault et Roux] nove trovita en Europo. *Bulletin de la Société Linéenne de Provence*, *41*, 139–142.

Barr, M. E. (1979). A classification of Loculoascomycetes. *Mycologia*, *71*(5), 935–957.

Barr, M. E. (1987). New Taxa and Combinations in the Loculoascomycetes. *Mycotaxon*, *29*, 501–505.

Bates, S. T., Donna, B.-L., Lauber, C. L., Walters, W. A., Knight, R., & Fierer, N. (2012). A preliminary survey of lichen associated eukaryotes using pyrosequencing. *The Lichenologist*, *44*(1), 137–146.

Batista, A. C., & Cavalcanti, W. d. A. (1964). Novos Hyphomycetes de micelio hifopodiforme. *Portugaliae Acta Biologica*, *7*(4), 347–360.

Beimforde, C., Feldberg, K., Nylinder, S., Rikkinen, J., Tuovila, H., Dörfelt, H., Gube, M., Jackson, D. J., Reitner, J., Seyfullah, L. J., & Schmidt, A. R. (2014). Estimating the Phanerozoic history of the Ascomycota lineages: Combining fossil and molecular data. *Molecular Phylogenetics and Evolution*, *78*, 386–398. https://doi.org/10.1016/j.ympev.2014.04.024

Bellemere, A., & Hafellner, J. (1982). L'ultrastructure des asques du genre *Dactylospora* (Discomycetes) et son intérêt taxonomique. *Cryptogamie, Mycologie*, *3*, 71–93.

Bensch, K., Groenewald, J., Dijksterhuis, J., Starink-Willemse, M., Andersen, B., Summerell, B., … & Braun, U. (2010). Species and ecological diversity within the *Cladosporium cladosporioides* complex (Davidiellaceae, Capnodiales). *Studies in Mycology*, *67*, 1–94.

Berger, F. (2000). Beitrag zur kenntnis der flechten und lichenicolen pilze Islands. *Acta Botanica Islandica*, *13*, 69–82.

Berger, F., Braun, U., & Heuchert, B. (2015). *Gonatophragmium lichenophilum* sp. nov.–a new lichenicolous hyphomycete from Austria. *Mycobiota*, *5*, 7–13. Https://doi.org/10.12664/mycobiota.2015.05.02

Berger, F., Cezanne, R., & Eichler, M. (2025). *Unguiculariopsis stenospora*, the first parasitic fungus on *Celothelium lutescens*. *Österr. Z. Pilzk.*, *32*, 105–108.

Berger, F., & Diederich, P. (1997). *Lichenodiplis hawksworthii* sp. nov., a third lichenicolous species of *Lichenodiplis* (Coelomycetes). *Herzogia*, *12*, 35–38.

Berger, F., & LaGreca, S. (2014). Contributions to the lichen flora of Bermuda—Part I. New records, new combinations, and interesting collections of lichenized ascomycetes. *Evansia*, *31*(2), 41–68.

Berger, F., & von Brackel, W. (2021). *Lichenohendersonia physciicola* sp. nov., a new coelomycete on *Physcia*. *Herzogia*, *34*(1), 138–141. https://doi.org/10.13158/heia.34.1.2021.138

Berger, F., & Zimmermann, E. (2016). Ergänzungen zur Flechtenflora von Madeira mit besonderer Berücksichtigung lichenicoler Pilze. *Herzogia*, *29*(2), 235–276.

Berger, F., Zimmermann, E., & von Brackel, W. (2020). Species of *Pronectria* (Bionectriaceae) and *Xenonectriella* (Nectriaceae) growing on foliose Physciaceae, with a key of the European species. *Herzogia*, *33*(2), 473–493.

Berkeley, M., & Broome, C. (1875). Notices of British fungi [1402-1500]. *Annals and Magazine of Natural History*, *Ser. 4, 15*, 28–41.

Berkeley, M. J. (1875). Notices of North American fungi. *Grevillea*, *4*(29), 1–16.

Bilderbeek, R. J., & Etienne, R. S. (2018). babette: BEAUti 2, BEAST2 and Tracer for R. *Methods in Ecology and Evolution*, *9*(9), 2034–2040. https://doi.org/10.1101/271866

Boedijn, K. (1929). Beitrag zur Kenntnis der Pilzflora von Sumatra. *Recueil des travaux botaniques néerlandais*, *26*(2/4), 396–439.

Boehm, E. W., Schoch, C. L., & Spatafora, J. W. (2009). On the evolution of the Hysteriaceae and Mytilinidiaceae (Pleosporomycetidae, Dothideomycetes, Ascomycota) using four nuclear genes. *Mycological Research*, *113*(4), 461–479. https://doi.org/10.1016/j.mycres.2008.12.001

Boehm, E. W. A., Mugambi, G. K., Miller, A. N., Huhndorf, S. M., Marincowitz, S., Spatafora, J. W., & Schoch, C. L. (2009). A molecular phylogenetic reappraisal of the Hysteriaceae, Mytilinidiaceae and Gloniaceae (Pleosporomycetidae, Dothideomycetes) with keys to world species. *Studies in Mycology*, *64*, 49–83. https://doi.org/10.3114/sim.2009.64.03

Bommer, E., & Rousseau, M. (1890). Contributions à la flore mycologique de Belgique. *Bulletin de la Société Royale de Botanique de Belgique/Bulletin van de Koninklijke Belgische Botanische Vereniging*, 205–302.

Boom, P. (2020). Lichens and Lichenicolous Fungi of the Azores (Pico, So Jorge), Additional Records and Four New Species. *Acta Botanica Hungarica*, *62*(3–4), 417–434.

Boom, P. (2021). Foliicolous lichens and their lichenicolous fungi in Macaronesia and atlantic Europe. *Bibliotheca Lichenologica*, *111*, 1–197.

Boom, P. v. d., Divakar, P., Ertz, D., Etayo, J., Moberg, R., & Sipman, H. (2022). New or otherwise interesting records of lichens and lichenicolous fungi from mainland Ecuador and surroundings with descriptions of five new species. *Acta Botanica Hungarica*, *64*(3–4), 417–450. https://doi.org/10.1556/034.64.2022.3-4.13

Boonmee, S., Ko, T. W. K., Chukeatirote, E., Hyde, K. D., Chen, H., Cai, L., McKenzie, E. H. C., Jones, E. B. G., Kodsueb, R., & Hassan, B. A. (2012). Two new *Kirschsteiniothelia* species with *Dendryphiopsis* anamorphs cluster

in Kirschsteiniotheliaceae fam. nov. *Mycologia*, *104*(3), 698–714. https://doi.org/10.3852/11-089

Bouly de Lesdain, M. (1908). Notes lichénologiques. VIII. *Bulletin de la Société Botanique de France*, *55*, 420–424.

Bouly de Lesdain, M. (1910). *Recherches sur les lichens dee environs de Dunkerque*. Imprimerie P. Michel.

Brackel, W. (2016). Eine neue flechtenbewohnende Micarea-Art aus Baden-Württemberg. *Carolinea*, *74*, 5-9.

Brackel, W. v. (2024). Voyage armoricain – lichenicolous fungi from northern France. *Herzogia*, *37*, 32–47.

Braun, U. (1988). Studies on *ramularia* and allied genera (I). *International Journal of Mycology and Lichenology*, *3*, 271–285.

Braun, U., Heuchert, B., & Diederich, P. (2009). Two new and another interesting lichenicolous hyphomycete. *Herzogia*, *22*, 165–171.

Braun, U., Khodosovtsev, A. Y., Darmostuk, V. V., & Diederich, P. (2016). *Trichoconis hafellneri* sp. nov. on *Athallia pyracea* and *Xanthoria parietina*, a generic discussion of *Trichoconis* and keys to the species of this genus. *Herzogia*, *29*(2), 307–314.

Breuß, O. (1985). On the lichen genera *Placocarpus* and *Placidiopsis* (Verrucariaceae). *Plant Systematics and Evolution*, *148*, 313–315.

Breuß, O. (1998). On the taxonomy of "Catapyrenium" plumbeum (lichenized Ascomycetes, Verrucariaceae). *Annalen des Naturhistorischen Museums in Wien. Serie B für Botanik und Zoologie*, *100*, 671-676. http://www.jstor.org/stable/41767126

Breuss, O. (1990). Zwei neue Flechtenarten aus Tenerife (Kanarische Inseln). *Linzer Biologische Beiträge*, *22*(2), 327–334.

Breuss, O. (1998). On the taxonomy of "*Catapyrenium*" *plumbeum* (lichenized Ascomycetes, Verrucariaceae). *Annalen des Naturhistorischen Museums in Wien. Serie B für Botanik und Zoologie*, 671–676.

Breuss, O. (2007). Verrucaria. In T. H. Nash III, C. Gries, & F. Bungartz (Eds.), *Lichen Flora of the Greater Sonoran Desert Region* (Vol. 3, pp. 335–377). Lichens Unlimited, Arizona State University.

Bricaud, O. (1991). *Buellia scheideggeriana* Bricaud et Roux sp. nov., espece nouvelle de lichen. *Nova Hedwigia*, *52*(1–2), 161–172.

Brusse, F. (1985). *Glyphopeltis* (Lecideaceae), a new lichen genus from southern Africa. *Lichenologist*, *17*(3), 267–268.

Cáceres, M., & Lücking, R. (2000). Three new species and one new combination of foliicolous lichens and lichenicolous fungi from the Atlantic Rainforest in Pernambuco state, Brazil. *Nova Hedwig*, *70*(1–2), 217–226. https://doi.org/10.1127/nova.hedwigia/70/2000/217

CÁCeres, M. E. d. S., Aptroot, A., & Ertz, D. (2014). New species and interesting records of Arthoniales from the Amazon, Rondônia, Brazil. *The Lichenologist*, *46*(4), 573-588. https://doi.org/10.1017/S0024282914000036

Calatayud, V., & Atienza, V. (1995). *Epaphroconidia hawksworthii* gen. et sp. nov., a new lichenicolous conidial fungus on *Pertusaria pertusa* in Spain. *Mycological Research*, *99*(7), 850–852.

Calatayud, V., & Atienza, V. (2000). *Polycoccum epizoharyi* (Dacampiaceae, Fungi), a new lichenicolous fungus on *Buellia zoharyi* in Spain. *Nova Hedwigia*, *70*(1/2), 265–271.

Calatayud, V., Atienza, V., & Barreno, E. (1995). Lichenicolous fungi from the Iberian Peninsula and the Canary Islands. *Mycotaxon*, *55*, 363–382.

Calatayud, V., & Barreno, E. (1995). *Buellia vouauxii* Calatayud & Barreno sp. nov., a new lichenicolous fungus on *Rhizoplaca melanophthalma* (Ramond) Leuckert & Poelt from the Canary Islands. *Cryptogamie. Bryologie, lichénologie*, *16*(4), 257–262.

Calatayud, V., & Barreno, E. (2003). A new *Lichenostigma* on vagrant *Aspicilia* species. *Lichenologist*, *35*(4), 279–285. https://doi.org/10.1016/S0024-2829(03)00052-5

Calatayud, V., Barreno, E., & Eriksson, O. E. (1997). *Nimisiostella lichenicola* (Lecanorales inc. sed), a new lichenicolous fungus from Spain. *Systema Ascomycetum*, *15*, 111–116.

Calatayud, V., Barreno, E., & Rico, V. (2004). Two lichenicolous species of *Arthonia* on vagrant *Aspicilia* species. *Bibliotheca Lichenologica*, *88*, 67–78.

Calatayud, V., & Etayo, J. (1999a). *Codonmyces* and *Lichenostella*, two new genera of lichenicolous conidial fungi. *Lichenologist*, *31*(6), 593–601.

Calatayud, V., & Etayo, J. (1999b). *Fenestroconidia caloplacae*, a new sporodochial lichenicolous fungus with catenate conidiogenous cells. *Lichenologist*, *31*(6), 587–592.

Calatayud, V., & Etayo, J. (2001). Five new species of lichenicolous conidial fungi from Spain. *Canadian Journal of Botany*, *79*(2), 223–230.

Calatayud, V., Etayo, J., & Diederich, P. (2001). *Paralethariicola aspiciliae* (Ostropales, Odontotremataceae), a new genus and species of lichenicolous fungi. *Lichenologist*, *33*(6), 477–482.

Calatayud, V., & Navarro-Rosines, P. (1998). *Weddellomyces xanthoparmeliae* sp. nov. and additions to the chorology of other species of the genus. *Mycotaxon*, *69*, 503–514.

Calatayud, V., & Navarro-Rosinés, P. (2001). Bellemerella acarospo rae and B. polyspo rinae (Verrucariales), two new species of lichenicolous fungi from Spain. *Nova Hedwigia*, 473-478.

Calatayud, V., Navarro-Rosinés, P., & Calvo, E. (2000). *Lichenochora Mediterraneae* (phyllacorales, Ascomycota) a new Lichenicolous Fungus from Spain. *Lichenologist*, *32*(3), 225–231.

Calatayud, V., Navarro-Rosinés, P., & Hafellner, J. (2002). A synopsis of *Lichenostigma* subgen. *Lichenogramma* (Arthoniales), with a key to the species. *Mycological Research*, *106*(10), 1230–1242.

Calatayud, V., Navarro Rosinés, P., & Hafellner, J. (2013). Contributions to a revision of *Cercidospora* (Dothideales), 2: Species on *Lecanora* s. l., *Rhizoplaca* and *Squamarina*. *Mycosphere*, *4*(3), 539–557.

Calatayud, V., & Rambold, G. (1998). Two new species of the lichen genus *Immersaria* (Porpidiaceae). *Lichenologist*, *30*(3), 231–244.

Calatayud, V., & Rico, V. J. (1995). *Polycoccum evae* (Dothideales), a new lichenicolous fungus on *Dimelaena oreina*. *Mycotaxon*, *53*, 29–32.

Calatayud, V., Sanz, M. J., & Aptroot, A. (2001). *Lichenopyrenis galligena* (Pleomassariaceae), a new genus of gall-forming lichenicolous fungi on *Leptochidium*. *Mycological Research*, *105*(5), 634–637. https://doi.org/10.1017/S0953756201003963

Calatayud, V., & Triebel, D. (1999). *Stigmidium neofusceliae* (Dothideales s.l.), a new lichenicolous fungus from Spain. *Nova Hedwigia*, *69*, 439–448. https://doi.org/10.1127/nova.hedwigia/69/1999/439

Calatayud, V., & Triebel, D. (2001). Stigmidium acetabuli (Dothideales sens. lat.), a new lichenicolous fungus on Pleurosticta acetabulum. *Bibliotheca Lichenologica*, *78*, 27–34.

Calatayud, V., & Triebel, D. (2003). Three new species of *Stigmidium* sl (lichenicolous ascomycetes) on *Acarospora* and *Squamarina*. *Lichenologist*, *35*(2), 103–116.

Calatayud, V., Triebel, D., & Pérez-Ortega, S. (2007). *Zwackhiomyces cervinae*, a new lichenicolous fungus (Xanthopyreniaceae) on *Acarospora*, with a key to the known species of the genus. *The Lichenologist*, *39*(2), 129–134.

Campbell, J., Ferrer, A., Raja, H. A., Sivichai, S., & Shearer, C. A. (2007). Phylogenetic relationships among taxa in the Jahnulales inferred from 18S and 28S nuclear ribosomal DNA sequences. *Botany*, *85*(9), 873–882.

Candan, M., & Halici, M. G. (2009). Two new lichenicolous *Arthonia* species from Turkey. *Mycotaxon*, *107*, 209–213.

Candoussau, F., Boqueras, M., Gómez-Bolea, A., Læssøe, T., Lowen, R., Rogers, J., Rossman, A., & Samuels, G. (2007). Observations on *Neobarya,* including new species and new combinations. *Sydowia*, *59*(2), 179–215.

Cannon, P., Coppins, B., Aptroot, A., Sanderson, N., & Simkin, J. (2023). Perithecial genera I including *Acrocordia, Alloarthopyrenia, Anisomeridium,*

Antennulariella, Arthopyrenia, Celothelium, Cyrtidula, Dichoporis, Eopyrenula, Julella, Leptorhaphis, Leptosillia, Lithothelium, Mycomicrothelia, Mycoporum, Naetrocymbe, Pyrenula, Rhaphidicyrtis, Sarcopyrenia, Swinscowia and *Tomasellia*. *Revisions of British and Irish Lichens*, *37*, 1–59.

Cannon, P., Coppins, B., Ertz, D., Fletcher, A., Pentecost, A., & Simkin, J. (2021). Arthoniales: Opegraphaceae, including the genera *Llimonaea, Opegrapha, Paralecanographa* and *Sparria*. *Revisions of British and Irish Lichens*, *13*, 1–19.

Cannon, P., Coppins, B., Ertz, D., Pentecost, A., Sanderson, N., … & Wolseley, P. (2021). Arthoniales: Lecanographaceae including the genera Alyxoria, Lecanographa, Phacographa, Plectocarpon and Zwackhia [Journal article]. *Revisions of British and Irish Lichens*, *14*, 1–15.

Cannon, P., Ertz, D., Frisch, A., Aptroot, A., Chambers, S., Coppins, B., … & Wolseley, P. (2020). Arthoniales: Arthoniaceae, including the genera *Arthonia, Arthothelium, Briancoppinsia, Bryostigma, Coniocarpon, Diarthonis, Inoderma, Naevia, Pachnolepia, Reichlingia, Snippocia, Sporodophoron, Synarthonia* and *Tylophoron*. *Revisions of British and Irish Lichens*, *1*, 3–48. https://doi.org/10.34885/173

Cannon, P., Kukwa, M., Coppins, B., Fletcher, A., Sanderson, N., & Simkin, J. (2021). Pertusariales: Ochrolechiaceae including the genera *Lepra*, *Ochrolechia* and *Varicellaria*. *Revisions of British and Irish Lichens*, *5*, 1–17.

Cannon, P., Malíček, J., Ivanovich, C., Printzen, C., Aptroot, A., Coppins, B., Sanderson, N., Simkin, J., & Yahr, R. (2022). Lecanorales: Lecanoraceae, including the genera *Ameliella*, *Bryonora*, *Carbonea*, *Claurouxia*, *Clauzadeana*, *Glaucomaria*, *Japewia*, *Japewiella*, *Lecanora*, *Lecidella*, *Miriquidica*, *Myriolecis*, *Palicella*, *Protoparmeliopsis*, *Pyrrhospora* and *Traponora*. *Revisions of British and Irish Lichens*, *25*, 1–83.

Capella-Gutierrez, S., Silla-Martinez, J. M., & Gabaldon, T. (2009). trimAl: a tool for automated alignment trimming in large-scale phylogenetic analyses.

Bioinformatics, *25*(15), 1972–1973. https://doi.org/10.1093/bioinformatics/btp348

Carl, F. (1892). *Verhandlungen der kaiserlich-Königlichen* (Vol. 42). Zoologisch-botanischen Gesellschaft in Wien.

Carroll, I. (1859). Contributions to Irish Lichenology. II. *Natural History Review and Quarterly Journal of Science Dublin*, *6*, 531–533.

Castañeda Ruíz, R., Kendrick, B., & Guarro, J. (1998). Notes on conidial fungi. XVIII. New species of *Pseudomicrodochium* and *Refractohilum* from rainforest litter. *Mycotaxon*, *68*, 23–32.

Chen, C. Y., Wang, C. L., & Huang, J. W. (2006). Two new species of *Kirschsteiniothelia* from Taiwan. *Mycotaxon*, *98*(5), 153–158.

Choi, Y.-W., Hyde, K. D., & Ho, W. (1999). Single spore isolation of fungi. *Fungal Diversity*, *3*, 29–38.

Chomnunti, P., Schoch, C. L., Aguirre-Hudson, B., Ko-Ko, T. W., Hongsanan, S., … & Bahkali, A. H. (2011). Capnodiaceae. *Fungal Diversity*, *51*, 103–134. https://doi.org/10.1007/s13225-011-0145-6

Christiansen, M. S. (1954). Nanostictis, a new genus of scolecosporous Discomycetes. *Botanisk Tidsskrift*, *51*, 59–65.

Christiansen, M. S. (1956). A New Species of the Form-Genus *Lichenoconium* Petr. and Syd.[Fungi Imperfecti] *L. Xanthoriae* sp. N. *Friesia*, *5*, 212–217.

Christiansen, M. S. (1993). *Chalara lichenicola* n. sp. (Deuteromycotina), a lichenicolous hyphomycete from Svalbard. *Nordic Journal of Botany*, *13*(3), 309–312. https://doi.org/10.1111/j.1756-1051.1993.tb00054.x

Ciferri, R., & Fragoso-Romualdo, G. (1927). Hongos parásitos y saprofitos de la República Dominicana In *Boletin de la Real Sociedad EspaÑola de Historia Natural* (Vol. 27, pp. 323–336). Madrid, Museo Nacional De Ciencias Naturales.

Ciferri, R., & Tomaselli, R. (1952). Scissioni di generi di licheni sulla base delle caratteristische del fungo. *Archivio Botanico Italiano*, *28*, 1–15.

Ciffrri, R., & Tomaselli, R. (1953). Saggio di una sistematica micolichenologica. *Atti del'Istituto Botanico e del Laboratorio Crittogamico dell'Università di Pavia*, *5*(10), 25–84.

Clauzade, G., Diederich, P., & Roux, C. (1989). Nelikenigintaj fungoj likenlogaj. Ilustrita determinlibro. *Bulletin de la Société linnéenne de Provence*, *1*, 1–142.

Clauzade, G., & Roux, C. (1985). Likenoj de Okcidenta Eŭropo. *Ilustrita determinlibro*, 1–893.

Clements, F. E. (1909). *The Genera of Fungi*. Wilson.

Clements, F. E., & Shear, C. L. (1931). *The Genera of Fungi. Edn 2*. Wilson.

Cohn. (1879). Schlesischen Gesellschaft für vaterländische Cultur *Kryptogamen-Flora von Schlesien*, *2*(2), 211.

Cohn, F. (1879). *Kryptogamen-Flora vonSchlesien* (Vol. 2). J. U. Kern's Verlag.

Cole, M. S., & Hawksworth, D. (2001). Lichenicolous fungi, mainly from the USA, including *Patriciomyces* gen. nov. *Mycotaxon*, *77*, 305–338.

Cole, M. S., & Hawksworth, D. (2002). *Lichenopeltella heterodermiicola*, a new lichenicolous ascomycete on *Heterodermia speciosa* in Arkansas. *Mycotaxon*, *83*, 391–396.

Cole, M. S., & Hawksworth, D. L. (2004). *Lichenoconium christiansenii* sp.nov. from *Nodobryoria abbreviata* (Parmeliaceae) in the Pacific Northwest, with a key to the known lichenicolous species. *The Lichenologist*, *36*(1), 1–6. https://doi.org/10.1017/S0024282904013970

Cometto, A., Leavitt, S. D., Grube, M., De Hoog, S., & Muggia, L. (2023). Tackling fungal diversity in lichen symbioses: molecular and morphological data recognize new lineages in Chaetothyriales (Eurotiomycetes, Ascomycota). *Mycological Progress*, *22*(8), 53.

Constantinescu, O., & Santesson, R. (1987). *Choreospora* gen. nov., a new lichenicolous hyphomycete from Australia. *Lichenologist*, *19*(2), 177–181. https://doi.org/10.1017/S0024282987000148

Cooke, M. C. (1879). New British fungi. *Grevillea*, *8*(45), 1–11.

Coppins, B. (1987). Two new lichenicolous species of *Opegrapha* from western Scotland. *Notes from the Royal Botanic Garden Edinburgh*, *44*, 601–606.

Coppins, B. (1989). Notes on the Arthoniaceae in the British Isles. *Lichenologist*, *21*(3), 195–216.

Coppins, B., & James, P. (1979). New or interesting British lichens IV. *Lichenologist*, *11*(2), 139–179. https://doi.org/10.1017/S0024282979000190

Coppins, B., & Kondratyuk, S. (1995). *Stygiomyces* and *Pseudonitschkia*: two new genera of lichenicolous fungi. *Edinburgh Journal of Botany*, *52*(2), 229–236.

Coppins, B., Kondratyuk, S. Y., Etayo, J., & Cannon, P. (2021). Notes on lichenicolous species of *Opegrapha* s. lat. (Arthoniales) on Arthoniaceae and Verrucariaceae , with a key to British and Irish lichenicolous Opegraphaceae. *The Lichenologist*, *53*(2), 159–169. https://doi.org/10.1017/S0024282921000025

Coppins, B. J. (2002). *Checklist of lichens of Great Britain and Ireland*. Twayne Publishers.

Coppins, B. J., & Aptroot, A. (2008). New species and combinations in The Lichens of the British Isles. *The Lichenologist*, *40*(5), 363–374.

Coppins, B. J., & Aptroot, A. (2009). *Lichens of Great Britain and Ireland—Arthonia*. British Lichen Society.

Crivelli, P. (1983). *Ueber die heterogene Ascomycetengattung Pleospora Rabenh* Eidgenös-sische Technische Hochschule]. Zürich, Switzerland.

Crombie, J. M. (1871). *Lichenes britannici: seu, Lichenum in Anglia, Scotia, et Hibernia Vigentium, enumeratio cum eorum stationibus et distributione*. L. Reeve.

Crombie, J. M. (1877). The lichens of the `Challenger' Expedition (with a revision of those enumerated by Dr. J. Stirton in Linn. Journ. Bot. xiv + pp. 366–375). *Journal of the Linnean Society Botany*, *16*, 211–231.

Crouan, P. L., & Crouan, H. (1867). *Florule du Finistère, Contenant des Descriptions de 360 Espèces Nouvelles de Sporogames, des Nombreuses Observations*.

Crouan, P. L., & Crouan, H. M. (1867). *Florule du Finistère, Contenant des Descriptions de 360 Espèces Nouvelles de Sporogames, des Nombreuses Observations*. F. Klincksieck.

Crous, P. W., Boers, J., Holdom, D., Steinrucken, T., Tan, Y. P., Vitelli, J. S., Shivas, R. G., Barrett, M., Boxshall, A.-G., & Broadbridge, J. (2022). Fungal Planet description sheets: 1383–1435. *Persoonia-Molecular Phylogeny and Evolution of Fungi*, *48*(1), 261–371. https://doi.org/10.3767/persoonia.2022.48.08

Crous, P. W., Braun, U., Schubert, K., & Groenewald, J. Z. (2007). Delimiting *Cladosporium* from morphologically similar genera. *Studies in Mycology*, *58*, 33–56.

Crous, P. W., Costa, M. M., Kandemir, H., Vermaas, M., Vu, D., Zhao, L., Arumugam, E., Flakus, A., Jurjević, Ž., Kaliyaperumal, M., Mahadevakumar, S., Murugadoss, R., Shivas, R. G., Tan, Y. P., Wingfield, M. J., Abell, S. E., Marney, T. S., Danteswari, C., Darmostuk, V.,…Groenewald, J. Z. (2023). Fungal Planet description sheets: 1550–1613. *Persoonia - Molecular Phylogeny and Evolution of Fungi*, *51*(1), 280–417. https://doi.org/10.3767/persoonia.2023.51.08

Crous, P. W., Lombard, L., Sandoval-Denis, M., Seifert, K. A., Schroers, H. J., Chaverri, P., Gene, J., Guarro, J., Hirooka, Y., Bensch, K., Kema, G. H. J., Lamprecht, S. C., Cai, L., Rossman, A. Y., Stadler, M., Summerbell, R. C., Taylor, J. W., Ploch, S., Visagie, C. M.,…Thines, M. (2021). Fusarium: more than a node or a foot-shaped basal cell. *Stud Mycol*, *98*, 100116. https://doi.org/10.1016/j.simyco.2021.100116

Crous, P. W., Osieck, E. R., Jurjević, Ž., Boers, J., Van Iperen, A., Starink-Willemse, M., Dima, B., Balashov, S., Bulgakov, T., & Johnston, P. (2021). Fungal Planet description sheets: 1284–1382. *Persoonia: Molecular Phylogeny and Evolution of Fungi*, *47*, 178–374.

Crous, P. W., Osieck, E. R., Shivas, R. G., Tan, Y. P., Bishop-Hurley, S. L., Raventós, F. E., Larsson, E., Luangsa-Ard, J. J., Pancorbo, F., & Balashov, S.

(2023). Fungal Planet description sheets: 1478–1549. *Persoonia*, *50*(1), 158–310. https://doi.org/10.3767/persoonia.2023.50.05

Crous, P. W., Wingfield, M. J., Lombard, L., Roets, F., Swart, W. J., Alvarado, P., Carnegie, A. J., Moreno, G., Luangsaard, J., & Thangavel, R. (2019). Fungal Planet description sheets: 951–1041. *Persoonia*, *43*, 223–425. https://doi.org/10.3767/persoonia.2019.43.06

Currey, F. (1863). Notes on British Fungi. In *The Transactions of the Linnean Society of London* (Vol. 29. Part II, pp. 151–160). Taylor And Francis, Red Lion Court.

Dai, D.-Q., Tang, L.-Z., Liu, C., Wang, H.-B., & Hyde, K. D. (2018). Studies on Parmulariaceae I. A phylogeny based on available sequence data; introducing Parmulariales ord. nov., and Hemigraphaceae, Melaspileellaceae and Stictographaceae fam. nov. *Phytotaxa*, *369*(2), 63–79. https://doi.org/10.11646/PHYTOTAXA.369.2.1

Dalla Torre, K. W., & graf von Sarthein, L. (1900). *Flora der gefürsteten Grafschaft Tirol, des Landes Vorarlberg und des Fürstenthumes Liechtenstein: Bd. Die Litteratur der Flora von Tirol, Vorarlberg und Liechtenstein. 1900* (Vol. 1). Wagner'sche Universitäts-Buchhandlung.

Dalla Torre, K. W., & Sarnthein, L. G. (1905). *Flora der gefürsteten Grafschaft Tirol, des Landes Vorarlberg und des Fürstenthumes Liechtenstein*. Wagner'sche Universitäts-Buchhandlung.

Damien, E. (2017). A remarkable, endohymenial species of *Arthothelium* (Arthoniales) from Campbell Island, New Zealand. *The Lichenologist*, *49*(1), 93–97. https://doi.org/10.1017/S0024282916000554

Damien, E., & Diederich, P. (2006). *Gelatinopsis leptogii* (Helotiales, Ascomycota), a new lichenicolous fungus on *Leptogium byssinum* from Belgium and Germany. *The Lichenologist*, *38*(6), 515–518.

Darker, G. D. (1963). A new genus of the Lophiaceae. *Canadian Journal of Botany*, *41*(10), 1383–1388. https://doi.org/10.1139/b63-120

Darmostuk, V. (2021). *Pronectria gromakovae*, a new lichenicolous fungus on *Lecanora populicola* and notes on other records from Kharkiv region (Ukraine). *Lindbergia*, *2021*(1), 1–7. https://doi.org/10.25227/linbg.01141

Darmostuk, V., Fačkovcová, Z., Breidy, J., Dokmak, H., van den Boom, P. P., & Guttová, A. (2022). *Solenopsora* species (Leprocaulaceae) as hosts of lichenicolous fungi. *Herzogia*, *35*(1), 115–130. https://doi.org/10.13158/heia.35.1.2022.115

Darmostuk, V., Khodosovtsev, A., Naumovych, A., & Kharechko, N. (2018). *Roselliniella lecideae* sp. nov. and other interesting lichenicolous fungi from the Northern Black sea Region (Ukraine). *Doga, Turkish Journal of Botany*, *42*, 354–361. https://doi.org/ 10.3906/bot-1709-5

Darmostuk, V. V. (2021). Lichenicolous fungi on *Verrucaria* s. lat. in Ukraine with the description of *Zwackhiomyces khodosovtsevii* sp. nov. and a key to the lichenicolous fungi on *Verrucaria* s. lat. *Botanica Serbica*, *45*(2), 293–301.

David, J., & Etayo, J. (1995). A new lichenicolous fungus from *Collema*: *Endococcus caudisporus* sp. nov.(Dothideales, incertae sedis). *Lichenologist*, *27*(4), 314–316.

David, J., & Hawksworth, D. (1995). *Zevadia*: a new lichenicolous hyphomycete from western Ireland. *Bibliotheca Lichenologica*, *58*, 63–71.

de Farias, A. R. G., Afshari, N., Silva, V. S. H., Louangphan, J., Karimi, O., & Boonmee, S. (2024). Three novel species and new records of *Kirschsteiniothelia* (Kirschsteiniotheliales) from northern Thailand. *MycoKeys*, *101*, 347–370. https://doi.org/10.3897/mycokeys.101.115286

De Lesdain, M. B. (1907). Lichens des environs de Versailles. In *Bulletin de la Société Botanique de France* (Vol. VII, pp. 680–698). Société Botanique De France.

De Lesdain, M. L. M. B. (1911). Notes Lichénologiques XIV. *Bulletin de la Société Botanique de France*, *58*(6), 660–662.

De Notaris, G. (1844). Cenno sulla tribu de'pirenomiceti sferiacei e descrizione di alcuni nuovi generi. *Giornale Botanico Italiano*, *1.1*, 322–335.

De Notaris, G. (1846a). *Frammenti lichenografici di un lavoro inedito* (Vol. 2). éditeur non identifié.

De Notaris, G. (1846b). Frammenti lichenografici di un lavoro inedito. Abbozzo di una nova dispozione della Caliciée. *Giornale Botanico Italiano*, *2*, 192–195.

De Notaris, G. (1849). Micromycetes italici novi vel minus cogniti. Decas 5. *Memorie della Reale Accademia delle Scienze di Torino. Ser. 2*, *10*, 333–350.

de Silanes, M. E. L., Etayo, J., & Paz-Bermúdez, G. (2009). *Pronectria pilosa* (Hypocreaceae) sp. nov. and Other Lichenicolous Fungi Found on Collemataceae in the Iberian Peninsula. *The Bryologist*, *112*(1), 101–108.

Deacon, J. (2005). Fungal spores, spore dormancy, and spore dispersal. *Fungal Biology*, 184–212.

Deighton, F. C. (1960). African fungi. I. *Mycological Papers*, *78*, 1–43. https://doi.org/10.1139/b69-087

Deighton, F. C., & Pirozynski, K. A. (1965). Microfungi. I: African species of Uncinula; some species of Fusicladiella; various hyphomycetes, mainly tropical. *Mycological Papers*(101), 28–43.

Didelot, X., Siveroni, I., & Volz, E. M. (2021). Additive Uncorrelated Relaxed Clock Models for the Dating of Genomic Epidemiology Phylogenies. *Molecular Biology and Evolution*, *38*(1), 307–317. https://doi.org/10.1093/molbev/msaa193

Diederich, P. (1986). Lichenicolous fungi from the Grand Duchy of Luxembourg and surrounding areas. *Lejeunia*, *119*, 1–26.

Diederich, P. (1989). Les lichens épiphytiques et leurs champignons lichénicoles (macrolichens exceptés) du Luxembourg. *Travaux Scientifiques du Musée national d'histoire naturelle de Luxembourg*, *14*, 1–268.

Diederich, P. (1990). New or interesting lichenicolous fungi 1. Species from Luxembourg. *Mycotaxon*, *37*, 297–330.

Diederich, P. (1992). New or interesting lichenicolous fungi 2. *Taeniolella beschiana* new species and *Taeniolella serusiauxi* new species (Hyphomycetes). *Bull. Soc. Nat. Luxembourg*, *93*, 155–162.

Diederich, P. (1992). *Stromatopogon Baldwinii* Zahlbr., A Lichenicolous Elomycete With Dimorphic Conidia. *Lichenologist*, *24*(4), 371–375. https://doi.org/10.1017/S0024282992000483

Diederich, P. (1994). New or interesting lichenicolous fungi. 4. *Clauzadeomyces verrucosus* gen. et sp. nov. (Deuteromycotina). *Bulletin de la Société Linéenne de Provence*, *45*, 417–420.

Diederich, P. (1995). New or interesting lichenicolous fungi. 6. *Arthonia follmanniana*, a new species from the Galapagos Islands. *Flechten Follmann. Contributions to lichenology in Honour of Gerhard Follmann. Geobotanical and Phytotaxonomical Study Group, Botanical Institute, University of Cologne, Cologne*, 179–182.

Diederich, P. (1996). The lichenicolous heterobasidiomycetes. *Bibliotheca Lichenologica*, *61*, 1–198.

Diederich, P. (2002). *Kalchbrenneriella*, A New Genus to Accommodate the Lichenicolous Hyphomycete Torula cyanescens. *Bryologist*, *105*(Fall 2002), 411–414. https://doi.org/10.1639/0007-2745(2002)105[0411:KANGTA]2.0.CO;2

Diederich, P. (2003). Neue Arten und neue Funde von amerkanischen lichenicolen Pilzen. *Herzogia*, *16*, 41–90.

Diederich, P. (2003). New species and new records of American lichenicolous fungi. *Herzogia*, *16*, 41–90.

Diederich, P. (2004). *Abrothallus*. In T. H. Nash III, B. D. Ryan, P. Diederich, C. Gries, & F. Bungartz (Eds.), *Lichen Flora of the Greater Sonoran Desert Region* (Vol. 2, pp. 626–630). Lichens Unlimited, Arizona State University.

Diederich, P. (2004). Lichenicolous fungi. In T. H. Nash III, B. D. Ryan, P. Diederich, C. Gries, & F. Bungartz (Eds.), *Lichen Flora of the Greater Sonoran Desert Region* (Vol. 2, pp. 617–742). Lichens Unlimited Arlzona State University.

Diederich, P. (2007a). New or interesting lichenicolous heterobasidiomycetes. *Opuscula Philolichenum*, *4*(1), 11–22.

Diederich, P. (2007b). *Sphaerellothecium gallowayi* sp. nov., a new lichenicolous ascomycete on Heterodermia from Australia and Papua New Guinea. *Bibliotheca Lichenologica*, *95*, 165–169.

Diederich, P. (2011). Description of *Abrothallus parmotrematis* sp. nov. (lichenicolous Ascomycota). *Bulletin de la Société des naturalistes luxembourgeois*, *112*, 25–34.

Diederich, P. (2014). *Aabaarnia* and *Normanogalla*, two new lichenicolous genera of Ostropales, Ascomycota. *Bull. Soc. Nat. luxemb*, *115*, 141–149.

Diederich, P. (2015). Two new lichenicolous species of *Sclerococcum* (asexual Ascomycetes) growing on Graphidaceae. *Bulletin de la Société des naturalistes luxembourgeois*, *117*, 35–42.

Diederich, P. (2021). Notes on lichenicolous taxa of the asexual fungal genera *Intralichen* and *Trimmatostroma*, with a revised key and descriptions of four new species. *Herzogia*, *34*(1), 101–126. https://doi.org/10.13158/heia.34.1.2021.101

Diederich, P., Braun, U., Heuchert, B., & Ertz, D. (2010). Four new lichen-associated *Trimmatostroma* species (hyphomycetes). *Bulletin de la Société des naturalistes luxembourgeois*, *111*, 47–55.

Diederich, P., & Christianse, M. (1994). *Biatoropsis usnearum* Räsänen, and Other Heterobasidiomycetes on *Usnea*. *Lichenologist*, *26*, 47–66. https://doi.org/10.1006/lich.1994.1004

Diederich, P., Common, R. S., Braun, U., Heuchert, B., Millanes, A., Suija, A., & Ertz, D. (2019). Lichenicolous fungi from Florida growing on Graphidales. *Plant and Fungal Systematics*, *64*(2), 249–282. https://doi.org/10.2478/pfs-2019-0021

Diederich, P., & Coppins, B. (2014). Diplolaeviopsis symmictae (Helotiales, Ascomycota), a new lichenicolous fungus on Lecanora symmicta. *Bulletin de la Société des naturalistes luxembourgeois*, *115*, 151-155.

Diederich, P., Damien, E., & Etayo, J. (2010). An enlarged concept of *Llimoniella* (lichenicolous Helotiales), with a revised key to the species and notes on related genera. *The Lichenologist*, *42*(3), 253–269.

Diederich, P., & Ertz, D. (2020). First checklist of lichens and lichenicolous fungi from Mauritius, with phylogenetic analyses and description of new taxa. *Plant and Fungal Systematics*, *65*(1), 13–75. https://doi.org/10.35535/pfsyst-2020-0003

Diederich, P., Ertz, D., & Braun, U. (2024). *Flora of lichenicolous fungi, Vol. 2, Hyphomycetes* (Vol. 2). National Museum of Natural History, Luxembourg.

Diederich, P., Ertz, D., Etayo, J., & Zhurbenko, M. P. (2024). *Sclerococcum*. *Flora of Lichenicolous Fungi*, *2*, 360–390.

Diederich, P., Ertz, D., Lawrey, J. D., Sikaroodi, M., & Untereiner, W. A. (2013). Molecular data place the hyphomycetous lichenicolous genus *Sclerococcum* close to *Dactylospora* (Eurotiomycetes) and *S. parmeliae* in *Cladophialophora* (Chaetothyriales). *Fungal Diversity*, *58*(1), 61–72. https://doi.org/10.1007/s13225-012-0179-4

Diederich, P., & Etayo, J. (1994). Taxonomic notes on the genus *Plectocarpon* (lichenicolous Ascomycetina). *Nordic Journal of Botany*, *14*, 589–600. https://doi.org/10.1111/j.1756-1051.1994.tb00654.x

Diederich, P., & Etayo, J. (2000). A synopsis of the genera *Skyttea, Llimoniella* and *Rhymbocarpus* (lichenicolous Ascomycota, Leotiales). *Lichenologist*, *32*(5), 423–485. https://doi.org/10.1006/lich.2000.0290

Diederich, P., & Lawrey, J. D. (2007). New lichenicolous, muscicolous, corticolous and lignicolous taxa of *Burgoa* s. l. and *Marchandiomyces* s. l. (anamorphic Basidiomycota), a new genus for *Omphalina foliacea*, and a catalogue and a key to the non-lichenized, bulbilliferous basidiomycetes. *Mycological Progress*, *6*(2), 61–80. https://doi.org/10.1007/s11557-007-0523-3

Diederich, P., Lawrey, J. D., Capdet, M., Pereira, S., Romero, A. I., Etayo, J., Flakus, A., Sikaroodi, M., & Ertz, D. (2014). New lichen-associated bulbil-forming

species of Cantharellales (Basidiomycetes). *The Lichenologist*, *46*(03), 333–347.

Diederich, P., Lawrey, J. D., & Ertz, D. (2018). The 2018 classification and checklist of lichenicolous fungi, with 2000 non-lichenized, obligately lichenicolous taxa. *The Bryologist*, *121*(3), 340–425. https://doi.org/10.1639/0007-2745-121.3.340

Diederich, P., Lawrey, J. D., Sikaroodi, M., & Gillevet, P. M. (2011). A new lichenicolous teleomorph is related to plant pathogens in *Laetisaria* and *Limonomyces* (Basidiomycota, Corticiales). *Mycologia*, *103*(3), 525–533. https://doi.org/.3852/10-255

Diederich, P., Lawrey, J. D., Sikaroodi, M., van den Boom, P., & Ertz, D. (2012). *Briancoppinsia*, a new coelomycetous genus of Arthoniaceae (Arthoniales) for the lichenicolous *Phoma cytospora*, with a key to this and similar taxa. *Fungal Diversity*, *52*(1), 1–12. https://doi.org/ 10.1007/s13225-011-0105-1

Diederich, P., Lücking, R., Aptroot, A., Sipman, H. J. M., & Wert, D. (2017). New Species and New Records of Lichens and Lichenicolous Fungi from the Seychelles. *Herzogia*, *30*(1), 182–236. https://doi.org/10.13158/heia.30.1.2017.182

Diederich, P., & Marson, G. (1988). Tremella coppinsii, a new lichenicolous basidiomycete from Sarawak. *Notes from the Royal Botanic Garden Edinburgh*.

Diederich, P., Millanes, A., & Wedin, M. (2014). *Tremella umbilicariae* (Tremellomycetes, basidiomycota), a new lichenicolous species on *Umbilicaria* from Peru. *Bulletin de la Société des naturalistes luxembourgeois 115*, 167–172.

Diederich, P., Millanes, A., & Wedin, M. (2022a). Class Tremellomycetes, order Filobasidiales. In P. Diederich, A. M. Millanes, M. Wedin, & J. D. Lawrey (Eds.), *Flora of Lichenicolous Fungi, Vol. 1 - Basidiomycota* (pp. 83–104). National Museum of Natural History, Luxembourg.

Diederich, P., Millanes, A., & Wedin, M. (2022b). Class Tremellomycetes, order Tremellales. In P. Diederich, A. M. Millanes, M. Wedin, & J. D. Lawrey (Eds.), *Flora of Lichenicolous Fungi, Vol. 1 - Basidiomycota* (pp. 105–282). National Museum of Natural History, Luxembourg.

Diederich, P., Millanes, A. M., Coppins, B., & Wedin, M. (2020). *Tremella imshaugiae* and *T. tubulosae* (Tremellomycetes, Basidiomycota), two new lichenicolous fungi on Imshaugia aleurites and *Hypogymnia tubulosa*. *Bulletin de la Société des naturalistes luxembourgeois*, *121*, 239–246.

Diederich, P., Millanes, A. M., Etayo, J., van den Boom, P. P., & Wedin, M. (2022). Finding the needle in the haystack: a revision of *Crittendenia*, a surprisingly diverse lichenicolous genus of Agaricostilbomycetes, Pucciniomycotina. *The Bryologist*, *125*(2), 248–293.

Diederich, P., Millanes, A. M., Wedin, M., & Lawrey, J. D. (2022). *Flora of lichenicolous fungi, Vol. 1, Basidiomycota*. National Museum of Natural History, Luxembourg.

Diederich, P., & Puntillo, D. (1995). New or interesting lichenicolous fungi: 7. *Nectria brutia* sp. nov. (Ascomycotina, Hypocreales). *Bulletin de la Société des naturalistes luxembourgeois*, *96*, 95-98.

Diederich, P., & Scheidegger, C. (1996). *Reichlingia leopoldii* gen. et sp. nov., a new lichenicolous hyphomycete from Central Europe. *Bulletin de la Société des naturalistes luxembourgeois*, *97*(4), 3–8.

Diederich, P., & Scholz, P. (1994). New or interesting lichenicolous fungi. 5. *Sclerococcum leuckertii* spec. nova (Deuteromycotina). *Bibliotheca Lichenologica*, *57*, 113–116.

Diederich, P., & Schultz, M. (2009). *Zwackhiomyces namibiensis*, a new lichenicolous ascomycete (Xanthopyreniaceae) on *Psorotichia* from Namibia. *Herzogia*, *22*, 173–176.

Diederich, P., & Sérusiaux, E. (2003). *Stromatopogon cladoniae* sp. nova, a remarkable new lichenicolous coelomycete from Belgium. *Bibliotheca Lichenologica*, *86*, 103–106.

Diederich, P., Serusiaux, E., & Sipman, H. (1995). Lichens and lichenicolous fungi of Laing Island (Papua New Guinea). *Bibliotheca Lichenologica*, *57*, 19–48.

Diederich, P., & van den Boom, P. (2017). *Sclerococcum phaeophysciae* and *S. toensbergii*, two new lichenicolous asexual Ascomycetes, with a revised key to the species of *Sclerococcum*. *Bull. Soc. Nat. luxemb*, *119*, 71–78.

Diederich, P., Van Den Boom, P., & Aptroot, A. (2001). *Cladoniicola staurospora* gen. et sp. nov., a new lichenicolous coelomycete from Western Europe. *Belgian Journal of Botany*, *134*(2), 127–130.

Diederich, P., & Wedin, M. (2000). The species of *Hemigrapha* (lichenicolous Ascomycetes, Dothideales) on Peltigerales. *Nordic Journal of Botany*, *20*(2), 203–214. https://doi.org/10.1111/j.1756-1051.2000.tb01571.x

Diederich, P., & Zhurbenko, M. (1997). *Taeniolella rolfii* sp. nov., a new lichenicolous hyphomycete from the Siberian Arctic. *Symbolae Botanicae Upsalienses*, *32*(1), 11–16.

Diederich, P., & Zhurbenko, M. P. (2009). *Sphaerellothecium phaeorrhizae* and *Zwackhiomyces sipmanii* spp. nov. on *Phaeorrhiza sareptana* from north-eastern Asia, with a key to the species of *Sphaerellothecium*. *Bibliotheca Lichenologica*, *99*, 113–122.

Diederich, P., Zhurbenko, M. P., Kuznetsov, A. N., & Boom, P. v. d. (2020). *Trimmatostroma commonii*, a new lichenicolous hyphomycete inhabiting Graphidaceae hosts. *Folia Cryptog. Estonica, Fasc*, *57*, 33–36. https://doi.org/10.12697/fce.2020.57.05

Diederich, P., Zimmermann, E., Sikaroodi, M., Ghobad-Nejhad, M., & Lawrey, J. (2018). A first lichenicolous *Corticium* species (Corticiaceae, Corticiales), described from Thamnolia in Switzerland. *Bull. Soc. Nat. luxemb.*, *120*, 49–56.

Dilcher, D. L. (1965). Epiphyllous fungi from Eocene deposits in western Tennessee, USA. *Palaeontographica Abteilung B*, *116*, 1–54.

Dillenius, J. J. (1742). Historia muscorum. In. Sheldonian Theatre.

Divakar, P. K., Crespo, A., Kraichak, E., Leavitt, S. D., Singh, G., Schmitt, I., & Lumbsch, H. T. (2017). Using a temporal phylogenetic method to harmonize

family- and genus-level classification in the largest clade of lichen-forming fungi. *Fungal Diversity*, *84*(1), 101–117. https://doi.org/10.1007/s13225-017-0379-z

Divakar, P. K., Crespo, A., Wedin, M., Leavitt, S. D., Hawksworth, D. L., Myllys, L., McCune, B., Randlane, T., Bjerke, J. W., & Ohmura, Y. (2015). Evolution of complex symbiotic relationships in a morphologically derived family of lichen-forming fungi. *New Phytologist*, *208*(4), 1217–1226.

Döbbeler, P. (1978). Moosbewohnende Ascomyceten.-1. Die pyrenocarpen, den Gametophyten besiedelnden Arten. *Mitteilungen aus der Botanischen Staatssammlung München*, *14*, 1–360.

Döbbeler, P. (1994). *Epigloea urosperma* (Ascomycetes)–ein neuer Flechtenparasit. *Sendtnera*, *2*, 277–282.

Döbbeler, P., & Buck, W. R. (2017). *Dactylospora inopina* (Lecanorales), a new biotrophic parasite on *Radula* (Hepaticae) from the Cape Horn Archipelago, Chile. *Nova Hedwigia Zeitschrift Fur Kryptogamenkunde*, *105*(1–2), 87–93.

Dodge, C. W. (1948). Lichens and lichen parasites. *British Australian and New Zealand Antarctic Research Expedition Scientific Reports*, *Ser. B, 7*, 1–276.

Dodge, C. W. (1953). Some lichens of tropical Africa. *Annals of the Missouri Botanical Garden*, *40*(4), 271–401.

Dodge, C. W., & Baker, G. E. (1938). The second Byrd Antarctic expedition: Botany. II. Lichens and lichen parasites. *Annals of the Missouri Botanical Garden*, *25*(2), 515–718.

Dong, W., Hyde, K. D., Doilom, M., Yu, X.-D., Bhat, D. J., Jeewon, R., Boonmee, S., Wang, G.-N., Nalumpang, S., & Zhang, H. (2020). *Pseudobactrodesmium* (Dactylosporaceae, Eurotiomycetes, Fungi) a novel lignicolous genus [Original Research]. *Frontiers in microbiology*, *11*, 456. https://doi.org/10.3389/fmicb.2020.00456

Driscoll, K. E., Clayden, S. R., & Harris, R. C. (2016). *Lecanora insignis* (Lecanoraceae) and its lichenicolous fungi in North America, including a new species of *Skyttea* (Helotiales). *The Bryologist*, *119*(1), 39–51.

Dufour, J. M. L. (1818). Révision du genre Opégraphe de la flore française. *Journal de Physiologie de Chimistrie d'Histoire Naturelle et des Arts*, *87*, 201–225.

Dughi, R. (1936). Un demi-lichen nouveau: Le ‘‘Scutula Leptogii n. sp.’’. *Revue Mycologique. NS*, *1*, 105–112.

Durand, T. (1891). *Primitiae florae costaricensis* (Vol. 1). Jardin botanique de l'état.

Earland-Bennett, P., & Hawksworth, D. (1999a). *Lichenopeltella coppinsii*, a new species on *Verrucaria muralis* from the British Isles. *Lichenologist*, *31*(6), 575–578. https://doi.org/10.1006/lich.1999.0218

Earland-Bennett, P., & Hawksworth, D. (1999b). Observations on the genus *Psammina*, including the description of two new algicolous and lichenicolous species. *Lichenologist*, *31*(6), 579–586.

Earland-Bennett, P., Hitch, C., & Hawksworth, D. (2006). New records and new species of lichens and lichenicolous fungi from Mataelpino (Sierra de Guadarrama, Comunidad de Madrid). *Boletín de la Sociedad Micológica de Madrid*, *30*, 243–248.

Earland-Bennett, P. M., & Hawksworth, D. L. (2005). The first lichen-forming species of *Psammina*, *P. palmata* sp. nov., with notes on the status of *Cheiromycina* and *Pycnopsammina*. *The Lichenologist*, *37*(3), 191–197.

Egea, J., & Torrente, P. (1995). Especies saxícolas del género *Arthonia* (Arthoniaceae) en áreas costeras de California y Baja California (Estados Unidos y México). *Flechten Follmann. Contributions to lichenology in Honour of Gerhard Follmann. Geobotanical and Phytotaxonomical Study Group, Botanical Institute, University of Cologne, Cologne*, 193–204.

Egea, J., & Torrente, P. (1997). Tres nuevas especies de hongos liquenizados de la provincia del Cabo (SudAfrica): Correccion. *Cryptogamie. Bryologie, lichénologie*, *18*(1), 77.

Egea, J. M., & Torrente, P. (1994). El género de hongos liquenizados Lecanactis (Ascomycotina). *Bibliotheca Lichenologica*, *54*.

Ehrenberg, C. G. (1819). Fungorum nova genera tria. *Jahrbücher der Gewächskunde*, *1*, 51–58.

Eitner. (1900). Nachtrag Zur Schlesischen Flechtenflora. In *Jahres-Bericht der Schlesischen Gesellschaft für vaterländische cultur.* (Vol. II. Abtheilung: Naturwissenschaften. b. Sitzungen der Zoologisch-botanischen Section, pp. 5–27). Breslau. G. P. Aderholz' Buchhandlung.

Eitner, E. (1895). Nachträge zur Flechtenflora Schlesiens *Jahresbericht der Schlesischen Gesellschaft für vaterländische Kultur II. Abtheilung: Naturwissenschaften. b. Zoologisch-botanische Section*, *73*, 2–26.

Eitner, E. (1911). Dritten Nachtrag zur Schlesischen Flechtenflora. *Jahresbericht der Schlesischen Gesellschaft für Vaterländische Kultur*, *88*(1), 20–60.

Ekanayaka, A. H., Jones, E. B. G., Hyde, K. D., & Zhao, Q. (2019). A Stable Phylogeny for Dactylosporaceae. *Cryptogamie Mycologie*, *40*(3), 23–44.

Elenkin, A. A., & Woronichin, N. N. (1908). Epifill'nye lisajniki na Kavkaz. *Zhurnal Bolezni Rastenii*, *2*(3-4), 109–142.

Elix, J. (2018). Three new species and five new records of corticolous and lichenicolous buellioid lichens (Caliciaceae, Ascomycota) from New Zealand's subantarctic islands. *Australasian Lichenology*, *82*, 60–67.

Elix, J., Kantvilas, G., & McCarthy, P. (2017). Thirteen new species and a key to buellioid lichens (Caliciaceae, Ascomycota) in Australia. *Australasian Lichenology*, *81*, 26–67.

Elix, J. A. (2015). A new species of the lichen genus *Monerolechia* (Ascomycota, Physciaceae) from Australia. *Telopea*, *18*, 91–95.

Elix, J. A. (2016). New species and new records of buellioid lichens from islands of the South Pacific Ocean. *Telopea*, *19*, 1–10.

Elix, J. A. (2022). A new lichenicolous species of *Cratiria* (Caliciaceae, Ascomycota) from north Queensland, Australia. *Australasian Lichenology*, *91*, 60–61.

Elix, J. A., & Hale, M. E. (1987). Canomaculina, Myelochroa, Parmelinella, Parmelinopsis and Parmotremopsis, five new genera in the Parmeliaceae (lichenized Ascomycotina). *Mycotaxon*, *29*, 233-244.

Elix, J. A., Mccarthy, P. M., & Hafellner, J. (2019). A new lichenicolous species of *Sclerococcum* (Dactylosporaceae, Ascomycota) from south-eastern Australia. *Australasian Lichenology*, *85*, 43–45.

Ellis, J. B. (1881). New species of North American fungi. *Bulletin of the Torrey Botanical Club*, *8*(7), 73–75.

Engler, A. (1895). Die Pflanzenwelt Ost-Afrikas und der Nachbargebiete. *Teil C*, 1–433.

Engler, H. G. A., & Prantl, K. A. E. (1903). *Die Natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten* (Vol. 1).

Eriksson, O. (1981). The families of bitunicate ascomycetes. *Nordic Journal of Botany*, *1*(6), 800. https://doi.org/10.1111/j.1756-1051.1981.tb01167.x

Eriksson, O., Baral, H.-O., Currah, R. S., Hansen, K., Kurtzman, C. P., Læssøe, T., & Rambold, G. (2001). Notes on ascomycete systematics Nos. 3128–3302. *Myconet*, *6*, 1–26.

Eriksson, O., & Hawksworth, D. L. (1987). Notes on ascomycete systematics. Nos. 225–463. *Systema Ascomycetum*, *6*, 111–165.

Eriksson, O., & Hawksworth, D. L. (1993). Outline of the Ascomycetes - 1993. *Systema Ascomycetum*, *12*(1–2), 51–207.

Eriksson, O., & Hawksworth, D. L. (1995). Notes on ascomycete systematics - Nos. 1885–2023. *Systema Ascomycetum*, *14*, 41–77.

Eriksson, O., & Santesson, R. (1986). Lasiosphaeriopsis stereocaulicola. *Mycotaxon*, *25*, 569–580.

Eriksson, O. E. (1992). *The non-lichenized pyrenomycetes of Sweden*. Edited and distributed by SBT.

Eriksson, O. E., & Hawksworth, D. L. (1986). Outline of the Ascomycetes. *Systema Ascomycetum*, *5*, 185–324.

Eriksson, O. E., & Hawksworth, D. L. (1991). Outline of the ascomycetes-1990. *Systema Ascomycetum*, *9*, 39–271.

Ertz, D. (2004). *Corticifraga*. In T. H. Nash III, B. D. Ryan, P. Diederich, C. Gries, & F. Bungartz (Eds.), *Lichen Flora of the Greater Sonoran Desert Region* (Vol. 2, pp. 643–644). Lichens Unlimited, Arizona State University.

Ertz, D., Christnach, C., Wedin, M., & Diederich, P. (2005). A world monograph of the genus *Plectocarpon* (Roccellaceae, Arthoniales). *Bibliotheca Lichenologica*, *91*, 1–155.

Ertz, D., & Diederich, P. (2003). *Opegrapha cladoniicola*, a new lichenicolous fungus from Hawaii. *Lichenologist*, *35*(2), 147–149. https://doi.org/10.1016/S0024-2829(02)00098-1

Ertz, D., & Diederich, P. (2006). The First Lichenicolous Species of *Schismatomma* (Roccellaceae), *S. physconiicola* sp. nov., from Mexico. *The Bryologist*, *109*(3), 415–420. https://doi.org/10.1639/0007-2745(2006)109[415:TFLSOS]2.0.CO;2

Ertz, D., & Diederich, P. (2015). Dismantling Melaspileaceae: a first phylogenetic study of *Buelliella, Hemigrapha, Karschia, Labrocarpon* and *Melaspilea*. *Fungal Diversity*, *71*(1), 141–164. https://doi.org/10.1007/s13225-015-0321-1

Ertz, D., Diederich, P., Lawrey, J. D., Berger, F., Freebury, C. E., Coppins, B., Gardiennet, A., & Hafellner, J. (2015). Phylogenetic insights resolve Dacampiaceae (Pleosporales) as polyphyletic: *Didymocyrtis* (Pleosporales, Phaeosphaeriaceae) with Phoma-like anamorphs resurrected and segregated from *Polycoccum* (Trypetheliales, Polycoccaceae fam. nov.). *Fungal Diversity*, *74*(1), 53–89.

Ertz, D., Diederich, P., & Miadlikowska, J. (2004). The lichenicolous *Opegrapha* species (Roccellaceae, Ascomycota) with 3-septate ascospores on *Pertusaria* and *Ochrolechia*. *Botanical Journal of the Linnean Society*, *144*, 235–241. https://doi.org/10.1111/j.1095-8339.2003.00239.x

Ertz, D., Driscoll, K. E., & Clayden, S. R. (2021). Two New Lichenicolous Species of *Opegrapha* (Arthoniales) from Canada. *The Bryologist*, *124*(1), 39–51. https://doi.org/10.1639/0007-2745-124.1.039

Ertz, D., Fryday, A., Schmitt, I., Charrier, M., Dudek, M., & Kukwa, M. (2016). *Ochrolechia kerguelensis* sp. Nov. from the Southern Hemisphere and *O. Antarctica reinstated* from the synonymy of *O. parella*. *Phytotaxa*, *280*(2), 129–140. http://dx.doi.org/10.11646/phytotaxa.280.2.3

Ertz, D., Heuchert, B., Braun, U., Freebury, C. E., Common, R. S., & Diederich, P. (2016). Contribution to the phylogeny and taxonomy of the genus *Taeniolella*, with a focus on lichenicolous taxa. *Fungal Biology*, *120*(11), 1416–1447. https://doi.org/10.1016/j.funbio.2016.05.008

Ertz, D., Lawrey, J. D., Common, R. S., & Diederich, P. (2014). Molecular data resolve a new order of Arthoniomycetes sister to the primarily lichenized Arthoniales and composed of black yeasts, lichenicolous and rock-inhabiting species. *Fungal Diversity*, *66*, 113–137. https://doi.org/10.1007/s13225-013-0250-9

Ertz, D., & Tehler, A. (2011). The phylogeny of Arthoniales (Pezizomycotina) inferred from nucLSU and RPB2 sequences. *Fungal Diversity*, *49*, 47–71.

Ertz, D., Tehler, A., Irestedt, M., Frisch, A., Thor, G., & van den Boom, P. (2015). A large-scale phylogenetic revision of Roccellaceae (Arthoniales) reveals eight new genera. *Fungal Diversity*, *70*(1), 31–53.

Ertz, D., & van den Boom, P. (2012). *Plectocarpon dirinariae* (Arthoniales), a new lichenicolous species from Cape Verde. *The Lichenologist*, *44*(5), 591–593. https://doi.org/10.1017/S0024282912000345

Ertz, D., Zhurbenko, M., Diederich, P., & Miadlikowska, J. (2003). A new species of *Plectocarpon* (lichenicolous Roccellaceae, Ascomycota) on *Peltigera*. *The Bryologist*, *106*(3), 465–467.

Etayo, J. (1991). *Dactylospora microspora* spec. nov., nuevo hongo liquenícola de la flora española. *Candollea*, *46*(2), 391–393.

Etayo, J. (1993). *Arthonia pantherina*, a new species of lichenicolous fungi from north Spain. *Nova Hedwigia*, *57*(3–4), 469–471.

Etayo, J. (1994). Líquenes y hongos liquenícolas de los Pirineos occidentales, III. *Candollea*, *49*, 245–249.

Etayo, J. (1995). *Mixtoconidium canariense*, a new genus and species of lichenicolous coelomycetes with dimorphic conidia. *Mycotaxon*, *53*(6), 425–430.

Etayo, J. (1995). Two new species of lichenicolous fungi from the Pyrenees. *Nova Hedwigia*, *61*(1–2), 189–197.

Etayo, J. (1996). Aportación a la flora liquénica de las Islas Canarias. I. Hongos liquenícolas de Gomera. *Bulletin de la Société linnéenne de Provence*, *47*, 93–110.

Etayo, J. (1996). Contribución al conocimiento de los líquenes y hongos liquenícolas de Mallorca (Islas Baleares, España). *Bull. Soc. Linn. Provence*, *47*, 111–121.

Etayo, J. (1998). Aportación a la flora liquénica de las Islas Canarias. iv. Líquenes epifitos de La Gomera (Islas Canarias). *Tropical Bryology*, *14*, 85–107.

Etayo, J. (1998). Some hypocrealean lichenicolous fungi from Southwest Europe. *Nova Hedwigia*, 499-509.

Etayo, J. (2000). Aportación a la flora liquénica de las Islas Canarias. VI. Hongos liquenícolas de La Palma. *Bulletin de la Société linnéenne de Provence*, *51*, 152–162.

Etayo, J. (2001). Hongos liquenícolas de Ecuador. I. Dos especies nuevas del orden Hypocreales (Ascomycota): *Pronectria parmotrematis* y *Trichonectria leptogiicola*. *Anales del Jardín Botánico de Madrid*, *58*(2), 219–222.

Etayo, J. (2002a). Aportación al conocimiento de los hongos liquenícolas de Colombia. *Bibliotheca Lichenologica*, *84*, 1–154.

Etayo, J. (2002). Catálogo de líquenes y hongos liquenícolas del Parque Natural de Bértiz (Navarra, España). *Bulletin de la Société linnéenne de Provence*, *53*, 155–170.

Etayo, J. (2002b). Hongos liquenícolas de Ecuador. II: Dos nuevas especies sobre *Placopsis*. Anales del Jardín Botánico de Madrid,

Etayo, J. (2007). Two new lichenicolous fungi: An *Opegrapha* and a *Plectocarpon* species (Ascomycota: Roccellaceae) from Chile. *The Lichenologist*, *39*(6), 543–547. https://doi.org/10.1017/S0024282907007128

Etayo, J. (2008). Líquenes y hongos liquenícolas del LIC de Ablitas (S. Navarra, España). *Cryptogamie-Mycologie*, *29*(1), 63–94.

Etayo, J. (2010a). Hongos liquenícolas de Perú Homenaje a Rolf Santesson. *Bulletin de la Société linnéenne de Provence*, *61*, 83–128.

Etayo, J. (2010). Lichenicolous fungi from the western Pyrenees. V. Three new ascomycetes. *Opuscula Philolichenum*, *8*, 131–139.

Etayo, J. (2010b). Líquenes y hongos liquenícolas de Aragón. *Guineana*, *16*, 1–501.

Etayo, J. (2011). *Lichenochora hyperphysciae*, a new lichenicolous fungus found in Mexico and Spain. *Bibliotheca Lichenologica*, *106*, 53–56.

Etayo, J. (2017). *Hongos liquenícolas de Ecuador* (Vol. 50). https://doi.org/10.1639/0007-2745-120.4.551

Etayo, J. (2018). Hongos liquenícolas de las islas Azores. I. Terceira. *Ascomycete.org*, *10*(3), 107–116.

Etayo, J., Aptroot, A., & da Silva Cáceres, M. E. (2020). New lichenicolous fungi from Brazil, with a checklist of all lichenicolous fungi known from Brazil. *The Bryologist*, *123*(3), 483–491.

Etayo, J., & Berger, F. (2002). Aportación a la flora liquénica de las Islas Canarias. VII. Algunos líquenes y hongos liquenícolas. In A. M. Hernández (Ed.), *Estudios Canarios: Anuario del Instituto de Estudios canarios* (pp. 9–24). Gráficas Sabater Isaac Peral.

Etayo, J., & Berger, F. (2009). *Carnegieispora rimeliae*, a new genus of lichenicolous fungus from the Azores. *Opuscula Philolichenum*, *7*, 17–20.

Etayo, J., & Berger, F. (2013). *Isthmoconidium bacidiicola,* a new genus and species of lichenicolous hyphomycetes on *Bacidia* from Bermuda. *Opuscula Philolichenum*, *12*, 1–5.

Etayo, J., & Breuss, O. (1996). Líquenes y hongos liquenícolas de los Pirineos occidentales y norte de la Península Ibérica, IV. *Cryptogamie. Bryologie, lichénologie*, *17*(3), 213–230.

Etayo, J., & Breuss, O. (1998). New species and interesting records of lichenicolous fungi. *Österreichische Zeitschrift für Pilzkunde*, *7*, 203–213.

Etayo, J., & Breuss, O. (2001). Über *Caloplaca canariensis* (Lichenisierte Ascomyceten, Teloschistiaceae). *Österreichische Zeitschrift für Pilzkunde*, *10*, 315–317.

Etayo, J., & Breuss, O. (2004). *Stromatopogon geminatum* spec, nova, a further lichenicolous fungus growing on *Usnea*. *Österr. Z. Pilzk.*, *13*, 277–279.

Etayo, J., & Calatayud, V. (2005). *Taeniolella diederichiana*, a new lichenicolous hyphomycete on *Placopsis*. *The Lichenologist*, *37*, 303–305. https://doi.org/10.1017/S0024282905014970

Etayo, J., & Diederich, P. (1995). Lichenicolous fungi from the Western Pyrenees, France and Spain I. New species of Deuteromycetes. *Contributions to Lichenology in Honour of Gerhard Follmann*, 205–221.

Etayo, J., & Diederich, P. (1996). Lichenicolous fungi from the western Pyrenees, France and Spain. II. More deuteromycetes. *Mycotaxon*, *60*, 415–428.

Etayo, J., & Diederich, P. (1996). Lichenicolous Fungi from the Western Pyrenees, France and Spain. III. Species on *Lobaria pulmonaria*. *Bull. Soc. Nat. luxemb*, *97*, 93–118.

Etayo, J., & Diederich, P. (1998). Lichenicolous fungi from the western Pyrenees, France and Spain. IV. Ascomycetes. *Lichenologist*, *30*(2), 103–120.

Etayo, J., & Diederich, P. (2000). *Echinodiscus lesdainii* gen. et comb. nov., a new name for *Phacopsis lesdainii* Vouaux (lichenicolous Ascomycetes, Leotiales). *Bull. Soc. Nat. luxemb.* , *100*, 63–66.

Etayo, J., & Diederich, P. (2001). *Gyalideopsis floridae*, sp. nov. a new lichenicolous lichen from Florida (Gomphillaceae, Ascomycetes). *The Bryologist*, *104*(1), 130–133.

Etayo, J., & Diederich, P. (2009). *Arthonia protoparmeliopseos*, a new lichenicolous fungus on *Protoparmeliopsis muralis* from Spain and Luxembourg. *Bulletin de la Société des naturalistes luxembourgeois*, *110*, 93–96.

Etayo, J., & Diederich, P. (2011). *Rhymbocarpus aggregatus*, a new species of lichenicolous fungi (Helotiales) growing on *Buellia griseovirensin* Spain, with a revised key to species of the genus. *Bull. Soc. Nat. luxemb.*, *112* 35–38.

Etayo, J., Flakus, A., & Kukwa, M. (2013a). *Capronia paranectrioide*s (Herpotrichiellaceae, Ascomycota), a new lichenicolous fungus from Bolivia. *The Lichenologist*, *45*, 623–626. https://doi.org/10.1017/S0024282913000315

Etayo, J., Flakus, A., & Kukwa, M. (2013b). *Niesslia echinoides* (Niessliaceae, Ascomycota), a new lichenicolous fungus on *Erioderma* from Bolivia. *The Lichenologist*, *45*(1), 21–24. https://doi.org/10.1017/S0024282912000540

Etayo, J., Flakus, A., & Kukwa, M. (2018). Three new lichenicolous species of the genus *Plectocarpon* (Ascomycota: Lecanographaceae) discovered in the Bolivian Andes. *Phytotaxa*, *357*(4), 275–283. https://doi.org/10.1017/S0024282912000345

Etayo, J., Flakus, A., Kukwa, M., & Flakus, P. (2013). *Lichenochora tertia* (Phyllachorales): The third species of the genus growing on *Xanthoria elegans*. *Mycotaxon -Ithaca Ny-*, *113*, 9–13. https://doi.org/10.5248/123.9

Etayo, J., Flakus, A., Suija, A., & Kukwa, M. (2015). *Macroskyttea parmotrematis* gen. et sp. nov. (Helotiales, Leotiomycetes, Ascomycota), a new lichenicolous fungus from Bolivia. *Phytotaxa*, *224*(3), 247–257. https://doi.org/10.11646/phytotaxa.224.3.3

Etayo, J., & López de Silanes, M. (2024). Contribution to the Study of Lichenicolous Fungi from Northwest Iberian Peninsula (León and Lugo Provinces). *Journal of Fungi*, *10*, 60. https://doi.org/10.3390/jof10010060

Etayo, J., & Navarro-Rosinés, P. (2008). Una combinación y tres especies nuevas de Lichenochora (Phyllachorales, ascomicetes liquenícolas), y notas adicionales para el género. *Revista Catalana de Micologia*, *30*, 27–44.

Etayo, J., & Osorio, H. S. (2004). Algunos hongos liquenícolas de Sudamérica, especialmente del Uruguay. *Comunicaciones Botanicas Museo Nacional de Historia Natural Natural y Antropologia*, *6*(129), 1–19.

Etayo, J., & Pérez-Ortega, S. (2016). Lichenicolous Lichens and Fungi from Monfragüe National Park (Western Spain). *Herzogia*, *29*, 315–328. https://doi.org/10.13158/heia.29.2.2016.315

Etayo, J., & Pino-Bodas, R. (2021). Notes on lichenicolous Pleosporales, with two new species, *Didymocyrtis azorica* and *Pseudopyrenidium epipertusariae* (Phaeosphaeriaceae). *Phytotaxa*, *494*(1), 75–88. https://doi.org/10.11646/phytotaxa.494.1.4

Etayo, J., & Rosato, V. G. (2008). Observations on lichenicolous fungi described by Spegazzini. *The Lichenologist*, *40*, 227–232. https://doi.org/10.1017/S0024282908007056

Etayo, J., Sancho, L., & Pino-Bodas, R. (2023). Taxonomic and phylogenetic approach to some Antarctic lichenicolous fungi. *Mycological Progress*, *22*(9), 1–18. https://link.springer.com/article/10.1007/s11557-022-01860-7

Etayo, J., & Sancho, L. G. (2006). Two lichenicolous ascomycetes on austral species of *Usnea* (Lecanorales, Ascomycota). *Nova Hedwigia*, *83*(3), 483–488.

Etayo, J., & Sancho, L. G. (2008). Hongos liquenícolas del sur de Sudamérica, especialmente de Isla Navarino (Chile). *Bibliotheca Lichenologica*, *98*, 1–302.

Etayo, J., & Triebel, D. (2010). New and interesting lichenicolous fungi at the Botanische Staatssammlung München. *The Lichenologist*, *42*(3), 231–240.

Etayo, J., & van den Boom, P. (2005). Contribution to the lichen flora of the Canary Islands. VIII. Some lichenicolous fungi. *Nova Hedwigia*, *81*, 157–162. https://doi.org/10.1127/0029-5035/2005/0081-0157

Etayo, J., & van den Boom, P. (2006). Some lichenicolous fungi from Guatemala, with the description of a new species. *Herzogia*, *19*, 191–197.

Etayo, J., & van den Boom, P. (2013). A first checklist of lichenicolous fungi from the Dominican Republic, including the description of a new species of *Xenonectriella*. *Opuscula Philolichenum*, *12*(1), 142–150.

Etayo, J., & Yazici, K. (2009). *Microsphaeropsis caloplacae* sp. nov. on Caloplaca persica in Turkey. *Mycotaxon*, *107*(1), 297–302.

Faezeh, A. (2024). *Taxonomy and phylogeny of the leaf–inhabiting sooty molds in family Metacapnodiaceae* [Master's thesis, University of British Columbia].

Farkas, E. (2010). Notes and schedae to Lichenes Delicati Exsiccati Editae in memoriam Antonín Vězda (1920–2008), Fasc. 1. *Acta Botanica Hungarica*, *52*(3-4), 331–340.

Farkas, E., & FlAKuS, A. (2016). *Trichonectria calopadiicola* sp. nov.(Hypocreales, Ascomycota): The second species of the family Bionectriaceae parasitic on foliicolous lichens discovered in Tanzania. *Phytotaxa*, *278*(3), 281–286.

Farkas, E., & Lőkös, L. (2003). Pyrenolichens of the Hungarian lichen flora II *Sarcopyrenia gibba* (Nyl.) Nyl. new to Hungary. *Acta Botanica Hungarica*, *45*(3–4), 273–278.

Fée, A. L. A. (1825). *Essai sur les cryptogames des écorces exotiques officinales*. Firmin Didot.

Fée, A. L. A. (1837). *Essai sur les cryptogames des écorces exotiques officinales: deuxiéme partie: supplement et revision*. Firmin Didot. https://doi.org/10.5962/bhl.title.110077

Fernández-Brime, S., Gaya, E., Llimona, X., Wedin, M., & Navarro-Rosinés, P. (2020). *Rhagadodidymellopsis endocarpi* gen. et sp. nov. and *Arthopyrenia symbiotica* (Dothideomyceta), two lichenicolous fungi growing on *Endocarpon* species. *Plant and Fungal Systematics*, 176–184.

Fernández-Brime, S., Llimona, X., Molnar, K., Stenroos, S., Hognabba, F., Bjork, C., Lutzoni, F., & Gaya, E. (2011). Expansion of the Stictidaceae by the addition of the saxicolous lichen-forming genus *Ingvariella*. *Mycologia*, *103*(4), 755–763.

Fernandez-Brime, S., Llimona, X., & Navarro-Rosines, P. (2010). *Lichenostigma rupicolae* (Lichenotheliaceae), a new lichenicolous species growing on *Pertusaria rupicola*. *The Lichenologist*, *42*(3), 241–247.

Fernández, J. M. E. (1984). La vegetación liquénica saxícola de los volcanes del Mar Menor (Murcia, SE de España). *Butlletí de la Institució Catalana d'Història Natural*, *51*, 77–99.

Fink, B. (1935). *The lichen flora of the United States*. https://doi.org/10.3998/mpub.9690813

Flagey, C. (1896). *Catalogue des lichens de l'Algérie*. Typographie Adolphe Jourdan, imprimeur-librarie-éditeur.

Flakus, A., Etayo, J., & Kukwa, M. (2014). *Melaspilea tucumana*, a new gall-forming lichenicolous fungus from the tropical Andes in Bolivia. *The Lichenologist*, *46*(5), 657–662.

Flakus, A., Etayo, J., Miadlikowska, J., Lutzoni, F., Kukwa, M., Matura, N., & Rodriguez-Flakus, P. (2019a). Biodiversity assessment of ascomycetes inhabiting *Lobariella* lichens in Andean cloud forests led to one new family, three new genera and 13 new species of lichenicolous fungi. *Plant and Fungal Systematics*, *64*(2), 283–344. https://doi.org/10.2478/pfs-2019-0022

Flakus, A., Etayo, J., Miadlikowska, J., Lutzoni, F., Kukwa, M., Matura, N., & Rodriguez-Flakus, P. (2019b). Biodiversity assessment of ascomycetes inhabiting Lobariella lichens in Andean cloud forests led to one new family, three new genera and 13 new species of lichenicolous fungi. *Plant & Fungal Systematics*, *64*(2).

Flakus, A., & Kukwa, M. (2012). New species of lichenicolous fungi from Bolivia. *The Lichenologist*, *44*(4), 469–477.

Flakus, A., Kukwa, M., & Czarnota, P. (2006). Some interesting records of lichenized and lichenicolous Ascomycota from South America. *Polish Botanical Journal*, *51*(2), 209–215.

Flakus, A., & Lücking, R. (2008). New species and additional records of foliicolous lichenized fungi from Bolivia. *The Lichenologist*, *40*(5), 423–436.

Flörke, H. G. (1815). Deutsche Lichenen gesammelt und mit Anmerkungen herausgegeben. *6*, 3–16.

Follmann, G., & Werner, B. C. (2003). Lichenicolous fungi occurring on Roccellaceae (Arthoniales) I. New species from south America. *The Journal of the Hattori Botanical Laboratory*, *94*, 261–292.

Freire-Rallo, S., Diederich, P., Millanes, A. M., & Wedin, M. (2023). Five new species in the *Tremella caloplacae* complex. *The Lichenologist*, *55*(5), 223–239. https://doi.org/10.1017/S0024282923000154

Friedl, T. (1987). Thallus development and phycobionts of the parasitic lichen *Diploschistes muscorum*. *Lichenologist*, *19*(2), 183–191. https://doi.org/10.1017/S002428298700015X

Fries, E. (1829). *Systema Mycologicum, Sistens Fungorum Ordines, Genera et Species, huc usque cognitas, ad normam methodi naturalis determinavit, disposuit atque descripsit* (Vol. III. et Ultimum). Ernestus Mauritius.

Fries, E. (1829). *Systema Mycologicum, Sistens Fungorum Ordines, Genera et Species, huc usque cognitas, ad normam methodi naturalis determinavit, disposuit atque descripsit* (Vol. III. et Ultimum). Ernestus Mauritius.

Fries, E. M. (1815). *Observationes mycologicae* (Vol. 1). G. Bonnieri.

Fries, E. M. (1819a). Novitiae florae suecicae. *Nov. Fl. Suec.*, *5*, 79.

Fries, E. M. (1819b). Novitiae florae svecicae. *5*(2), 73–80.

Fries, E. M. (1825). *Systema orbis vegetabilis: Primas lineas novae constructionis periclitatur Elias Fries* (Vol. 1). e Typographia academica.

Fries, T. M. (1861). *Lichenes arctoi Europae Groenlandiaeque hactenus cogniti* (Vol. 3). Leffler.

Fries, T. M. (1865). Nya skandinaviska laf-arter. *Botaniska Notiser*, *1865*, 99–102.

Fries, T. M. (1866). Nya skandinaviska laf-arter. *Botaniska Notiser*, 14–18.

Fries, T. M. (1867). Lichenes Spitsbergenses. *Kongliga Svenska Vetenskapsakademiens Handlinger*, *ser. 2, 7*, 3–53. https://www.jstor.org/stable/23642315

Fries, T. M. (1867a). Nya skandinaviska laf-arter. *Botaniska Notiser*, 105–110.

Fries, T. M. (1867b). Nya skandinaviska laf-arter. *Botaniska Notiser*, 151-155.

Fries, T. M. (1871). *Lichenographia Scandinavica* (Vol. 1).

Fries, T. M. (1874). *Lichenographia Scandinavica* (Vol. 2).

Frisch, A., & Holien, H. (2018). *Arthonia toensbergii*, a new lichenicolous fungus on *Mycoblastus affinis* from the boreal rainforests in Norway. *Graphis Scripta*, *30*(6), 4–43.

Frisch, A., Ohmura, Y., Holien, H., & Bendiksby, M. (2022). A phylogenetic survey of the ascomycete genus *Arthrorhaphis* (Arthrorhaphidaceae,

Lecanoromycetes) including new species in *Arthrorhaphis citrinella* sensu lato. *Taxon*, *71*(5), 936–962.

Frisch, A., Thor, G., Ertz, D., & Grube, M. (2014). The arthonialean challenge: restructuring Arthoniaceae. *Taxon*, *63*(4), 727–744. http://dx.doi.org/10.12705/634.20

Frisch, A., Thor, G., & Sheil, D. (2014). Four new Arthoniomycetes from Bwindi Impenetrable National Park, Uganda – supported by molecular data. *Nova Hedwigia*, *98*(3), 295–312.

Fritsch, K. (1900). Beitrag zur Flora von Constantinopel. In *Denkschriften der Kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe* (Vol. 68, pp. 219–250). Aus der Kaiserlich-Königlichen Hof- und Staatsdruckerei.

Fritze, R., & Ilse, H. (1870). *Karpaten-Reise: gemeinschaftlich ausgeführt im Juli und August 1868*. KK Zoologisch-botanische Gesellschaft.

Frolov, I., Vondrák, J., Košnar, J., & Arup, U. (2021). Phylogenetic relationships within *Pyrenodesmia* sensu lato and the role of pigments in its taxonomic interpretation. *Journal of Systematics and Evolution*, *59*(3), 454–474.

Fryday, A. (2019). Corrections to reports of buellioid lichens from New Zealand's subantarctic islands, including *Sclerococcum thelotrematicola* comb. nov. and *Epilichen scabrosus* new to the southern hemisphere. *Australasian Lichenology*, *84*, 26–32.

Fryday, A. M., & Øvstedal, D. O. (2012). New species, combinations and records of lichenized fungi from the Falkland Islands (Islas Malvinas). *The Lichenologist*, *44*(4), 483–500.

Fryday, A. M., Wheeler, T. B., & Etayo, J. (2021). A new species of *Aspicilia* (Megasporaceae), with a new lichenicolous *Sagediopsis* (Adelococcaceae), from the Falkland Islands. *The Lichenologist*, *53*(4), 307–315. https://doi.org/10.1017/s0024282921000244

Fuckel, K. W. G. L. (1870). Symbolae mycologicae. Beiträge zur Kenntniss der Rheinischen Pilze. *Jahrbücher des Nassauischen Vereins für Naturkunde*, *23-24*, 1-459.

Fuckel, L. (1866). *Fungi Rhenani Exsiccati, Supplementi* (Vol. Fasc. 3).

Fungi of Great Britain and Ireland. (2024). https://www.fungi.myspecies.info/all-fungi/zevadia-peroccidentalis.

Fungi Outer Hebrides. (2024). https://www.outerhebridesfungi.co.uk/lichenicolous-species.php?id=536.

Galloway, D. (2004). New lichen taxa and names in the New Zealand mycobiota. *New Zealand Journal of Botany*, *42*(1), 105–120.

Galloway, D. J. (1992). Studies in *Pseudocyphellaria* (lichens) III. The South American species. *Bibl. Lichenol*, *46*, 1–275, 244 pl.

Gams, W. (1971). Cephalosporium-artige schimmelpilze (Hyphomycetes). 1–262.

Gardes, M., & Bruns, T. D. (1993). ITS primers with enhanced specificity for basidiomycetes-application to the identification of mycorrhizae and rusts. *Molecular Ecology*, *2*(2), 113–118. https://doi.org/10.1111/j.1365-294X.1993.tb00005.x

Gardiennet, A., & Lechat, C. (2011). Une nouvelle espece du genre *Trichonectria* découverte en France, *T. pyrenaica* sp. nov. *Bulletin de la Société Mycologique de France*, *127*, 295–299.

Gerber, K. (1931). Die epiphytische Verbreitung von" Flechtenparasiten". 477.

Gesellschaft, H. v. d. (1873). Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien. *23*, 1–628.

Gierl, C., & Kalb, K. (1993). Die Flechtengattung Dibaeis. Eine Übersicht über die rosafrüchtigen Arten von *Baeomyces* sens. lat. nebst Anmerkungen zu *Phyllobaeis* gen. nov. *Herzogia*, 593–645.

Giralt, M., & Hawksworth, D. (1991). *Diplolaeviopsis ranula*, a new genus and species of lichenicolous coelomycetes growing on the *Lecanora strobilina* group in Spain. *Mycological Research*, *95*(6), 759–761.

Giralt, M., Paz-Bermúdez, G., & Elix, J. A. (2009). The saxicolous, xanthone-containing species of the genus *Buellia* sl (Physciaceae, Ascomycota) in the Iberian Peninsula. *Nova Hedwigia*, *89*(3–4), 321–334.

Giralt, M., van den Boom, P., & Elix, J. A. (2010). *Endohyalina*, the genus in the Physciaceae to accommodate the species of the *Rinodina ericina*-group. *Mycological Progress*, *9*, 37–48. https://doi.org/10.1007/s11557-009-0616-2

Grube, M. (2005). *Frigidopyrenia*: a new genus for a peculiar subarctic lichen, with notes on similar taxa. *Phyton*, *45*(2), 305–318.

Grube, M., & Hafellner, J. (1990). Studien an flechtenbewohnenden Pilzen der Sammelgattung *Didymella* (Ascomycetes, Dothideales). *Nova Hedwigia*, *51*(3–4), 283–360.

Grube, M., & Matzer, M. (1997). Taxonomic concept of lichenicolous *Arthonia* species. *Bibliotheca Lichenologica, 68,* 1–17).

Grube, M., Matzer, M., & Hafellner, J. (1995). A Preliminary Account of the Lichenicolous *Arthonia* Species with Reddish, K+ Reactive Pigments. *Lichenologist*, *27*, 25–42. https://doi.org/ 10.1017/S0024282995000053

Guderley, R., Lumbsch, H. T., & Feige, G. B. (1997). *Ingvariella*, a new genus in the Thelotremataceae (lichenized Ascomycotina). *Nova Hedwigia*, 147–154.

Gueidan, C. (2022). *Verrucariopsis Gueidan*, Monnat et Cl. Roux gen. nov., genre nouveau de lichens (Ascomycota, Verrucariaceae). *Bull. Soc. Linn. Provence*, *73*, 61–77.

Gueidan, C., Roux, C., & Lutzoni, F. (2007). Using a multigene phylogenetic analysis to assess generic delineation and character evolution in Verrucariaceae (Verrucariales, Ascomycota). *Mycological Research*, *111*(10), 1145–1168.

Gueidan, C., Savić, S., Thüs, H., Roux, C., Keller, C., Tibell, L., Prieto, M., Heiðmarsson, S., Breuss, O., & Orange, A. (2009). Generic classification of the Verrucariaceae (Ascomycota) based on molecular and morphological evidence: recent progress and remaining challenges. *Taxon*, *58*(1), 184–208.

Guindon, S., Dufayard, J.-F., Lefort, V., Anisimova, M., Hordijk, W., & Gascuel, O. (2010). New algorithms and methods to estimate maximum-likelihood

phylogenies: assessing the performance of PhyML 3.0. *Systematic Biology*, *59*(3), 307–321. https://doi.org/10.1093/sysbio/syq010

Haelewaters, D., Gorczak, M., Kaishian, P., De Kesel, A., & Blackwell, M. (2021). *Laboulbeniomycetes*, enigmatic fungi with a turbulent taxonomic history. *Encyclopedia of mycology*, *1*, 263–283.

Haelewaters, D., Stallman, J. K., Henkel, T. W., & Aime, M. C. (2022). Molecular phylogenetic analyses and micromorphology reveal placement of the enigmatic tropical discomycete *Polydiscidium* in *Sclerococcum* (Sclerococcales, Eurotiomycetes). *Mycologia*, 1–16.

Hafellner, J. (1978). Catolechia Flotow ex Massalongo emend. Körber und Epilichen Clements ex Hafellner-zwei nahe verwandte Flechtengattungen. *Nova Hedwigia*, *30*, 673–695.

Hafellner, J. (1979). *Karschia*. Revision einer Sammelgattung an der Grenze von lichenisierten und nichlichenisier ten Ascomyceten. *Beiheft zur Nova Hedwigia*, *62*, 1–248. https://doi.org/10.2307/3759305

Hafellner, J. (1982). Studien über lichenicole Pilze und Flechten I. Die Gattung Pleoscutula Vouaux. *Herzogia*, *6*, 289–298.

Hafellner, J. (1983). Studien über lichenicole Pilze und Flechten II *Lichenostigma maureri* gen. et spec. nov., ein in den Ostalpen häufiger lichenicoler Pilz (Ascomycetes, Arthoniales). *Herzogia*, 299–308.

Hafellner, J. (1984). Studien in Richtung einer natürlicheren Gliederung der Sammelfamilien Lecanoraceae und Lecideaceae. *Beihefte zur Nova Hedwigia*(79), 241-371.

Hafellner, J. (1985a). Studien über lichenicole Pilze und Flechten IV. Die auf Brigantiaea-Arten beobachteten Ascomyceten. *Herzogia*, *7*, 163–180.

Hafellner, J. (1985b). Studies of lichenicolous fungi and lichens III: The genus Roselliniella Vainio emend. Haf.(Ascomycotina, Dothideales). *Herzogia*, *7*(1–2), 145–162.

Hafellner, J. (1987a). Studien über lichenicole Pilze und Flechten V. Über die Gattung Phacopsis Tul. emend. Körber (Lecanorales). *Herzogia*, *7*, 343–352. https://doi.org/ 10.1127/herzogia/7/1987/343

Hafellner, J. (1987b). Studien über lichenicole Pilze und Flechten VI. Ein verändertes Gattungskonzept für Cercidospora. *Herzogia*, *7*, 353–365.

Hafellner, J. (1989). Studien über lichenicole Pilze und Flechten. VII: Über die neue Gattung *Lichenochora* (Ascomycetes, Phyllachorales). *Nova Hedwigia*, *48*(3–4), 357–370.

Hafellner, J. (1993a). *Llimoniella* gen. nov.-eine weitere Gattung lichenicoler Discomyceten (Ascomycotina, Leotiales). *Herzogia*, 769–778.

Hafellner, J. (1993b). Über Funde von lichenicolen Pilzen und Flechten im südlichen Norwegen. *Herzogia*, 749–768.

Hafellner, J. (1994a). Beiträge zu einem Prodromus der lichenicolen Pilze Österreichs und angrenzender Gebiete. I. Einige neue oder seltene Arten. *Herzogia*, *10*, 1–28. https://doi.org/10.1127/herzogia/10/1994/1

Hafellner, J. (1994b). Über Funde lichenicoler Pilze und Flechten auf Korsika (Frankreich). *Bulletin de la Société linnéenne de Provence*, *44*, 219–234.

Hafellner, J. (1996a). Beiträge zu einem Prodromus der lichenicolen Pilze Österreichs und angrenzender Gebiete. II. Über einige in der Steiermark erstmals gefundene Arten. *Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark*, *125*, 73–88.

Hafellner, J. (1996b). Studies on lichenoid fungus and lichen VIII. *Perigrapha*, a new ascomycete genus for '*Melanotheca' superveniens* Nyl. (Arthoniales). *Nova Hedwigia*, *63*, 173–181.

Hafellner, J. (1997). A world monograph of *Brigantiaea* (lichenized Ascomycotina, Lecanorales). *Symbolae Botanicae Upsalienses*, *32*(1), 35–74.

Hafellner, J. (1998a). Studien an lichenicolen Pilzen und Flechten IX. Was ist *Abrothallus friesii* Hepp? *Herzogia*, 139–144.

Hafellner, J. (1998b). Studien an lichenicolen Pilzen und Flechten. X. *Arthophacopsis*, eine neue Gattung lichenicoler ascomyceten (Arthoniales). *Cryptogamie. Bryologie, lichénologie*, *19*(2–3), 155–168.

Hafellner, J. (1998c). Bemerkenswerte Funde von Flechten und lichenicolen Pilzen auf makaronesischen Inseln VI. Über einige Neufunde. *Fritschiana*, *36*, 11–17.

Hafellner, J. (1999a). Additions and corrections to the checklist and bibliography of lichens and lichenicolous fungi of insular Laurimacaronesia. I. *Fritschiana*, *17*, 3–26.

Hafellner, J. (1999b). Beiträge zu einem Prodromus der lichenicolen Pilze Österreichs und angrenzender Gebiete. IV. Drei neue Arten und weitere bemerkenswerte Funde hauptsächlich in der Steiermark. *Linzer biol. Beitr.*, *31/1*, 507–532.

Hafellner, J. (2000). Zur Biodiversität lichenisierter und lichenicoler Pilze in den Eisenerzer Alpen (Steiermark). *Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark*, *130*, 71–106.

Hafellner, J. (2001). Studies in lichenicolous fungi and lichens. XII: On the genus *Trematosphaeriopsis* (Dothideales). *Mycotaxon*, *80*, 381–387.

Hafellner, J. (2002a). Additions and corrections to the checklist and bibliography of lichens and lichenicolous fungi of insular Laurimacaronesia. III. *Fritschiana (Graz)*, *50*, 1–13.

Hafellner, J. (2002b). Studien an lichenicolen Pilzen und Flechten XI. *Scoliciosporum vouauxii*, eine lichenicole Flechte auf Ramalina-Arten. *Herzogia*, *15*, 13–18.

Hafellner, J. (2004a). A further evolutionary lineage to lichenicolous growth in Physciaceae (Lecanorales). *Bibliotheca Lichenologica*, *88*, 175–186.

Hafellner, J. (2004b). Notes on Scoliciosporum intrusum. *Fritschiana*, *49*, 29-41.

Hafellner, J. (2004c). *Buelliella*. In N. I. T. H., B. D. Ryan, P. Diederich, C. Gries, & F. Bungartz (Eds.), *Lichen Flora of the Greater Sonoran Desert Region* (Vol. II, pp. 633–635). Lichens Unlimited Arizona State University Tempe.

Hafellner, J. (2006). Lecanoralean and other fungi invading yellow *Rhizocarpon* species. *Fritschiana*, *52*, 31–48.

Hafellner, J. (2007). The lichenicolous fungi inhabiting Tephromela species. *Bibliotheca Lichenologica*, *96*, 103–128.

Hafellner, J. (2009). *Phacothecium* resurrected and the new genus *Phacographa* (Arthoniales) proposed. *Bibliotheca Lichenologica*, *100*, 85–121.

Hafellner, J. (2011). *Halospora* resurrected and segregated from *Merismatium*. *Bibliotheca Lichenologica*, *106*, 75–93.

Hafellner, J. (2015). Distributional and other data for some species of *Didymocyrtis* (Dothideomycetes, Pleosporales, Phaeosphaeriaceae), including their Phoma-type anamorphs. *Fritschiana (Graz) 80*, 43–88.

Hafellner, J. (2018). Lichenicolous Biota (Nos 271–300). *Fritschiana*, *90*, 1–22.

Hafellner, J. (2019a). Lichenicolous Biota (Nos 301–320). *Fritschiana*, *94*, 25–42.

Hafellner, J. (2019b). A reinvestigation of *Microthelia umbilicariae* results in a contribution to the species diversity in *Endococcus*. *Fritschiana*, *94*, 1–23.

Hafellner, J., & Berger, F. (2000). Über zwei seltene lichenicole Pilze auf Trapelia. *Herzogia*, *14*, 31–34.

Hafellner, J., & Calatayud, V. (1999). *Lichenostigma cosmopolites*, a common lichenicolous fungus on *Xanthoparmelia* species. *Mycotaxon*, 107–114.

Hafellner, J., & Grube, M. (2023). *Arthonia epipolytropa* and *Arthonia subclemens*, two new lichenicolous species on *Lecanora polytropa*, with a key to the microfungi known on this common species. *The Lichenologist*, *55*(5), 241–251.

Hafellner, J., Herzog, G., & Mayrhofer, H. (2008). Zur Diversität von lichenisierten und lichenicolen Pilzen in den Ennstaler Alpen (Österreich: Steiermark, Oberösterreich). *Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark*, *137*, 131–204.

Hafellner, J., & JoHn, V. (2006). Über Funde lichenicoler nicht-lichenisierter Pilze in der Türkei, mit einer Synopsis der bisher im Land nachgewiesenen Taxa. *Herzogia*, *19*, 155–176.

Hafellner, J., & Mayrhofer, H. (1977). Rhizocarpon malenconianum (Llimona et Werner) comb, nov., ein weiterer parasymbiotischer Vertreter der Flechtengattung Rhizocarpon. *Herzogia*, 345–350.

Hafellner, J., & Mayrhofer, H. (2007). A contribution to the knowledge of lichenicolous fungi and lichens occuring in New Zealand. *Bibliotheca Lichenologica*, *95*, 225–266.

Hafellner, J., Obermayer, S., & Obermayer, W. (2005). Zur Diversität der Flechten und lichenicolen Pilze im Hochschwab-Massiv (Nordalpen, Steiermark). *Mitt. naturwiss. Ver. Steiermark*, *134*, 57–103.

Hafellner, J., & Obermayer, W. (1995). *Cercidospora trypetheliza* und einige weitere lichenicole Ascomyceten auf *Arthrorhaphis*. *Cryptogamie, Bryologie-Lichénologie*, *16*(3), 177–190.

Hafellner, J., & Obermayer, W. (2007). Flechten und lichenicole Pilze im Gebiet der Stubalpe (Österreich: Steiermark und Kärnten). *Mitteilungen des Naturwissenschaftlichen Vereines für Steiermark*, *136*, 5–59.

Hafellner, J., Obermayer, W., & Tretiach, M. (2014). *Miriquidica invadens*, an obligate youth parasite on *Sporastatia*, with remarks and a key to species of the *M. griseoatra* group. *The Lichenologist*, *46*(3), 303–331.

Hafellner, J., & Poelt, J. (1976). Rhizocarpon schedomyces spec. nov., eine fast delichenisierte parasitische Flechte, und seine Verwandten. *Herzogia*, 5–14.

Hafellner, J., & Sancho, L. (1990). Über einige lichenicole Pilze und Flechten aus den Gebirgen Zentralspaniens und den Ostalpen. *Herzogia*, 363–382.

Hafellner, J., Triebel, D., Ryan, B. D., & Nash Iii, T. (2002). On lichenicolous fungi from North America. II. *Mycotaxon*, *84*, 293–329.

Hafellner, J., & Zimmermann, E. (2012). A lichenicolous species of *Pleospora* (Ascomycota) and a key to the fungi invading *Physcia* species. *Herzogia*, *25*(1), 47–60. https://doi.org/10.13158/heia.25.1.2010.47

Haftet, T. (1883). Havainnoita Suomen Lapin ja Pohjais-Suomen jäkäläkasvistosta. *Meddelanden af Societas Pro Fauna Et Flora Fennica.*, 1–230.

Hakulinen, R. (1954). Die Flechtengattung Candelariella Müller Argoviensis: mit besonderer Berücksichtigung ihres Auftretens und ihrer Verbreitung in Fennoskandien; mit 4 Tabellen. *Annales Botanici Societatis Zoologicae-Botanicae Fennicae "Vanamo"*, *27*(3), 1–127.

Halıcı, M. (2008). *Llimoniella muralicola* sp. nov. (Ascomycota, Helotiaceae) on *Protoparmeliopsis muralis* from western Turkey. *Mycotaxon*, *105*, 203–206.

Halici, M., Atienza, V., & Hawksworth, D. (2007). Two new *Polycoccum* (Dothideales, Dacampiaceae) species on lichens from Turkey. *Mycotaxon*, *101*, 157–163.

Halici, M., & Candan, M. (2009). New lichenicolous fungi from Turkey. *Nova Hedwig*, *88*(3–4), 483–490.

Halıcı, M., & Candan, M. (2011). *Arthonia anatolica* sp. nov. (Arthoniaceae) on *Aspicilia contorta* subsp. *hoffmanniana*, a new lichenicolous species from Turkey. *Mycotaxon*, *116*, 335–339. https://doi.org/ 10.5248/116.335

Halıcı, M., Candan, M., & Calatayud, V. (2009). *Dacampia rubra* sp. nov. (Ascomycota, Dacampiaceae), a lichenicolous fungus on vagrant *Aspicilia* species. *Mycotaxon*, *108*, 235–240. https://doi.org/10.5248/108.235

Halıcı, M., & Hawksworth, D. (2007). Two new species of lichenicolous fungi from Turkey. *The Lichenologist*, *39*(5), 439–443. https://doi.org/10.1017/S0024282907006251

Halici, M., Knudsen, K., Candan, M., & Turk, A. (2009). A new species of *Polycoccum* (Dothideales, Dacampiaceae) from Turkey. *Nova Hedwigia*, *89*(3–4), 431–436.

Halici, M., Orange, A., & Aksoy, A. (2005). *Weddellomyces turcicus*, a new species on a grey *Acarospora* from Turkey. *Mycotaxon*, *94*, 249–252.

Halici, M., Tuerk, A., & Candan, M. (2008). *Dacampia cladoniicola* sp. nov. (Ascomycota, Dacampiaceae) on *Cladonia* sp. from Turkey. *Mycotaxon*, *103*, 53–57.

Halici, M. G. (2008). *Arthonia hawksworthii* sp. nov. (Ascomycota, Arthoniaceae) on *Dimelaena oreina* from Turkey. *Mycotaxon*, *105*(4), 89–93.

Halıcı, M. G. (2010). *Weddellomyces pertusariicola* (Ascomycota, Dacampiaceae), a new species growing on *Pertusaria lactea* in Turkey. Annales Botanici Fennici,

Halici, M. G., Akgül, H. E., Öztürk, C., & Kiliç, E. (2013). *Polycoccum anatolicum* sp. nov. on *Lepraria incana* and a key to *Polycoccum* species known from Turkey. *Mycotaxon*, *124*(1), 45–50.

Halici, M. G., Etayo, J., & Candan, M. (2009). Two new lichenicolous species of *Dacampia* on Teloschistaceae. *Mycotaxon*, *109*(1), 393–398.

Halıcı, M. G., Güllü, M., & Parnikoza, I. (2017). *Sagediopsis bayozturkii* sp. nov. on the lichen *Acarospora macrocyclos* from Antarctica with a key to the known species of the genus (Ascomycota, Adelococcaceae). *Polar Record*, *53*(3), 271–275. https://doi.org/10.1017/S0032247417000043

Halici, M. G., & Hawksworth, D. L. (2008). Two new species of *Dacampia* (Ascomycota, Dacampiaceae), with a key to and synopsis of the known species of the genus. *Fungal Diversity*, *28*, 49–54.

Halıcı, M. G., Hawksworth, D. L., Candan, M., & Türk, A. Ö. (2010). A new lichenicolous species of *Capronia* (Ascomycota, Herpotrichiellaceae), with a key to the known lichenicolous species of the genus. *Fungal Diversity*, *40*(1), 37–40. https://doi.org/10.1007/s13225-009-0003-y

Halici, M. G., Knudsen, K., & Candan, M. (2009). *Lichenochora atrans* (Phyllachoraceae), a new lichenicolous species on *Psora decipiens* from Turkey. *Mycotaxon*, *109*(1), 239–243.

Halıcı, M. G., Kocakaya, M., & Aksoy, A. (2009). *Lichenostigma anatolicum* sp. nov.(Ascomycota, Lichenotheliaceae) on a brown *Acarospora* from central Turkey. *Mycotaxon*, *108*(1), 67–72.

Halıcı, M. G., Kocourková, J., Diederich, P., & Aksoy, A. (2007). *Endococcus variabilis*, a new species on Staurothele areolata. *Mycotaxon*, *100*, 337–342.

Hansen, E., & Alstrup, V. (1995). The lichenicolous fungi on *Cladonia* subgenus *Cladina* in Greenland. *Graphis Scripta*, *7*(1), 33–38.

Hansen, E. S., Poelt, J., & Søchting, U. (1987). Die Flechtengattung Caloplaca in Grönland. *Meddelelser om Grønland. Bioscience*, *25*, 1–52.

Hansford, C. (1943). Contributions towards the fungus flora of Uganda. V. Fungi Imperfecti. 34–67. https://doi.org/10.1111/j.1095-8312.1943.tb00340.x

Harada, H. (2000). *Distopyrenis japonica* (Ascomycota, Pyrenulaceae), a new lichen-allied lichenicolous fungus from Chiba-ken, central Japan. *Mycoence*, *41*(5), 491–493.

Hariharan, G., Mibey, R., & Hawksworth, D. (1996). A new species of *Lichenopeltella* on Porina in India. *Lichenologist*, *28*(3), 294–296. https://doi.org/10.1017/S0024282996000370

Harkness, H. W., & Cooke, M. C. (1878). Californian fungi. *Grevillea*, *7*, 1–4.

Harris, R. C. (1995). *More Florida lichens. Including the 10 cent tour of the pyrenolichens*. The New York Botanical Garden.

Harris, R. C., & Ladd, D. (2007). New taxa of lichens and lichenicolous fungi from the Ozark Ecoregion. *Opuscula Philolichenum*, *4*, 57–68.

Hawksworth, D. (1981). *Lichenothelia*, a new genus for the *Microthelia aterrima* group. *Lichenologist*, *13*(2), 141–153.

Hawksworth, D. (1982). *Melaspilea canariensis* sp. nov. and other lichenicolous fungi from Tenerife. *Lichenologist*, *14*(1), 83–86.

Hawksworth, D. (1985). A new gall-forming *Polycoccum* on *Psoromidium versicolor* from Tasmania. *Lichenologist*, *17*(3), 298–300.

Hawksworth, D. (1990). *Globosphaeria*, a remarkable new pyrenomycete on *Normandina* from Tasmania. *Lichenologist*, *22*(3), 301–305. https://doi.org/10.1017/S0024282990000330

Hawksworth, D. (2016). A synopsis of the tropical pleomorphic lichenicolous genus *Koordersiella* (syn. *Hansfordiellopsis*) under a unified nomenclature. *J Fungal Res*, *13*, 227–232.

Hawksworth, D., & Atienza, V. (1994). The lichenicolous fungi described by Veli Räsänen. *Acta Botanica Fennica*, *150*, 47–55.

Hawksworth, D., & Dyko, B. (1979). *Lichenodiplis* and *Vouauxiomyces*: Two New Genera of Lichenicolous Coelomycetes. *Lichenologist*, *11*, 51–61. https://doi.org/10.1017/S0024282979000062

Hawksworth, D., & Eriksson, O. (1988). (895)-(906) Proposals to Conserve 11 Family Names in the Ascomycotina (Fungi). *Taxon*, 190–193.

Hawksworth, D., & Galloway, D. (1984). The identity of *Plectocarpon* Fée, and its implications for *Lichenomyces pseudocyphellaria* and the typification of *Sticta delisea*. *Lichenologist*, *16*(1), 85–89. https://doi.org/10.1017/S002428298400013X

Hawksworth, D., & Hafellner, J. (1986). *Phaeosporobolus usneae*, a new and widespread lichenicolous deuteromycete. *Nova Hedwigia*, *43*(3–4), 525–530.

Hawksworth, D., Halıcı, M., Kocakaya, Z., & Kocakaya, M. (2016). *Henfellra muriformis* gen. et sp. nov., a New *Dictyosporous* Pycnidial Fungus on *Candelariella*, with a Key to the Lichenicolous Fungi Known from that Genus. *Herzogia*, *29*, 329–336. https://doi.org/10.13158/heia.29.2.2016.329

Hawksworth, D., & Pirozynski, K. (1977). The generic names Paranectria and Paranectriella and their synonyms. *Canadian Journal of Botany*, *55*(19), 2555–2557.

Hawksworth, D., & Santesson, R. (1990). A revision of the lichenicolous fungi previously referred to *Phragmonaevia*. *Bibliotheca Lichenologica*, *38*, 121–143.

Hawksworth, D. L. (1972). Lichens 1961-1969. *Index of Fungi Supplement*, 1–78.

Hawksworth, D. L. (1975a). Notes on British lichenicolous fungi: I. *Kew Bulletin*, *30*(1), 183–203. https://doi.org/10.2307/4102884

Hawksworth, D. L. (1975b). A revision of lichenicolous fungi accepted by Keissler in *Coniothecium*. *Transactions of the British Mycological Society*, *65*(2), 219–238. https://doi.org/10.1016/S0007-1536(75)80005-2

Hawksworth, D. L. (1976). New and interesting microfungi from Slapton, south Devonshire: Deuteromycotina III. *Transactions of the British Mycological Society*, *67*(1), 51–59. https://doi.org/10.1016/S0007-1536(76)80007-1

Hawksworth, D. L. (1977). Taxonomic and biological observations on the genus *Lichenoconium* (Sphaeropsidales). *Persoonia-Molecular Phylogeny and Evolution of Fungi*, *9*(2), 159–198.

Hawksworth, D. L. (1977). Three new genera of lichenicolous fungi. *Botanical Journal of the Linnean Society*, *75*(2), 195–209. https://doi.org/10.1111/j.1095-8339.1977.tb01484.x

Hawksworth, D. L. (1978). Notes on British lichenicolous fungi. II. *Notes from the Royal Botanic Garden Edinburgh*, *36*, 181–197.

Hawksworth, D. L. (1979a). The lichenicolous hyphomycetes. *Bulletin of the British Museum (Natural History), Botany*, *6*(3), 183–300.

Hawksworth, D. L. (1979b). Studies in the genus *Endococcus* (Ascomycotina, Dothideales). *Bot. Notiser*, *132*, 283–290.

Hawksworth, D. L. (1980a). Notes on British lichenicolous fungi. III. *Notes from the Royal Botanic Garden Edinburgh*.

Hawksworth, D. L. (1980b). Notes on some fungi occurring on *Peltigera*, with a key to accepted species. *Transactions of the British Mycological Society*, *74*(2), 363–386. https://doi.org/10.1016/S0007-1536(80)80167-7

Hawksworth, D. L. (1981). The lichenicolous Coelomycetes. *Bulletin of the British Museum (Natural History), Botany*, *9*(1), 1–98.

Hawksworth, D. L. (1982a). A new species of *Nectriella* with ornamented spores from Iceland, with a key to the lichenicolous species. *Nova Hedwigia*, *35*, 755–762.

Hawksworth, D. L. (1982b). Notes on British lichenicolous fungi. IV. *Notes from the Royal Botanic Garden Edinburgh*, *40*, 375–397.

Hawksworth, D. L. (1982c). Secondary fungi in lichen symbioses: Parasites, saprophytes and parasymbionts. *Journal Hattori Botanical Laboratory*, *52*, 357–366.

Hawksworth, D. L. (1983). A key to the Lichen-Forming, Parasitic, Parasymbiotic and Saprophytic Fungi Occurring on Lichens in the British Isles. *Lichenologist*, *15*(1), 1–44. https://doi.org/10.1017/S0024282983000031

Hawksworth, D. L. (1984). Two interesting lichenicolous Hyphomycetes from Austria. *Beihefte zur Nova Hedwigia*(79), 373–379.

Hawksworth, D. L. (1985a). *Kirschsteiniothelia*, a new genus for the *Microthelia incrustans*-group (Dothideales). *Botanical Journal of the Linnean Society*, *91*(1–2), 181–202. https://doi.org/10.1111/j.1095-8339.1985.tb01144.x

Hawksworth, D. L. (1985b). A redisposition of the species referred to the ascomycete genus *Microthelia*. *Bulletin of the British Museum for Natural History*, *14*(2), 43–181.

Hawksworth, D. L. (1986). Notes on British lichenicolous fungi. V. *Notes from the Royal Botanic Garden Edinburgh*, *43*, 497–519.

Hawksworth, D. L. (1990). Notes on British lichenicolous fungi. VI. *Notes from the Royal Botanic Garden Edinburgh*, *46*(3), 391–403.

Hawksworth, D. L. (1991). *Charcotia* Hue, and *Arthonia* species lichenicolous on *Umbilicaria*. *Systema Ascomycetum*, *10*, 127–134.

Hawksworth, D. L. (2003). The lichenicolous fungi of Great Britain and Ireland: an overview and annotated checklist. *Lichenologist*, *35*(3), 191–232.

Hawksworth, D. L., Atienza, V., & Cole, M. S. (2004). Lichenicolous species of *Homostegia* (Dothideomycetes), with the description of *H. hertelii* sp. nov., a new fungus on *Flavoparmelia* species. *Bibliotheca Lichenologica*, *88*, 187–194.

Hawksworth, D. L., & Cole, M. (2002). Intralichen, a new genus for lichenicolous '*Bispora*' and '*Trimmatostroma*' species. *Fungal Diversity*, *11*, 87–97.

Hawksworth, D. L., & Diederich, P. (1988). A synopsis of the genus *Polycoccum* (Dothideales), with a key to accepted species. *Transactions of the British Mycological Society*, *90*(2), 293–312. https://doi.org/10.1016/S0007-1536(88)80101-3

Hawksworth, D. L., Earland-BennEtt, P. M., & Coppins, B. J. (2006). *Lichenophoma haematommatis*, a previously overlooked European sorediate species of *Cliostomum* (Lecanorales, Ramalinaceae). *Herzogia*, *19*, 5–10.

Hawksworth, D. L., & Esslinger. (1993). *Haleomyces oropogonicola*, a New Pyrenocarpous Lichenicolous Genus and Species on *Oropogon lopezii* in the Neotropics. *The Bryologist*, *96*(3), 349–354. https://doi.org/10.2307/3243865

Hawksworth, D. L., & Etayo, J. (2010). *Calongia gibelluloides* gen. sp. nov., a remarkable minute new lichenicolous conidial fungus from northern Spain. *The Lichenologist*, *42*(4), 355–359.

Hawksworth, D. L., & Etayo, J. (2011). *Calongea*, *Calongia*, and *Calongeomyces* nom. nov. *The Lichenologist*, *43*(3), 275–276.

Hawksworth, D. L., & Halici, M. G. (2007). *Gemmaspora*, a new verrucarialean genus with remarkable ascospores for *Adelococcus lecanorae* growing on *Aspicilia* species in Syria and Turkey. *The Lichenologist*, *39*(2), 121–128. https://doi.org/10.1017/S0024282907006548

Hawksworth, D. L., & Henrici, A. (2015). New resting places for *Laeticorticium quercinum* and *Marchandiobasidium aurantiacum*. *Field Mycology*, *16*(1), 16–17.

Hawksworth, D. L., & Iturriaga, T. (2006). Lichenicolous fungi described from Antarctica and the sub-Antarctic islands by Carroll W. Dodge (1895–1988). *Antarctic Science*, *18*(3), 291–301.

Hawksworth, D. L., James, P. W., & Coppins, B. J. (1980). Checklist of British lichen-forming, lichenicolous and allied fungi. *Lichenologist*, *12*(1), 1–115.

Hawksworth, D. L., & Kalb, K. (1992). A new species of *Ascochyta* on *Candelariella aurella* from Baja California, Mexico. *The Bryologist*, *95*(3), 338–339.

Hawksworth, D. L., & Miadlikowska, J. (1997). *Vagnia*, a remarkable coelomycete producing a black columnar cirrus on *Peltigera* in Poland. *Lichenologist*, *29*(1), 45–49.

Hawksworth, D. L., & Miądlikowska, J. (1997). New species of lichenicolous fungi occurring on *Peltigera* in Ecuador and Europe. *Mycological Research*, *101*(9), 1127–1134.

Hawksworth, D. L., Millanes, A. M., & Wedin, M. (2010). *Roselliniella* revealed as an overlooked genus of Hypocreales, with the description of a second species on parmelioid lichens. *Persoonia*, *24*, 12–17.

Hawksworth, D. L., & Santesson, R. (1988). *Skyttella*, a new genus for *Phacopsis mulleri* Willey (syn. *Agyrium flavescens* Rehm). *Graphis Scripta*, *2*, 33–37.

Hawkworth, D. L., & Mariette. (2003). A first checklist of lichenicolous fungi from China. *Mycosystema*, *22*(3), 359–363. https://europepmc.org/article/cba/363031

Hedrick, J. (1933). New genera and species of lichens from the herbarium of Bruce Fink I. *Mycologia*, *25*(4), 303–316.

Heiđmarsson, S. (1996). Pruina as a taxonomic character in the lichen genus *Dermatocarpon*. *The Bryologist*, *99*(3), 315–320.

Helfrich, P., Rieb, E., Abrami, G., Lücking, A., & Mehler, A. (2018). TreeAnnotator: versatile visual annotation of hierarchical text relations. Proceedings of the eleventh international conference on language resources and evaluation (LREC 2018),

Henssen, A. (1987). *Lichenothelia*, a genus of microfungi on rocks. *Bibliotheca Lichenologica*, *25*, 257–293.

Henssen, A. (1995). Studies on the biology and structure of *Dacampia* (Dothideales), a genus with lichenized and lichenicolous species. *Cryptogamic Botany*, *5*, 149–158.

Henssen, A., & Kantvilas, G. (1985). *Wawea fruticulosa*, a new genus and species from the Southern Hemisphere. *Lichenologist*, *17*(1), 85–97.

Hepp, P. (1867). *Die Flechten Europas* (Vol. 16).

Hernandez-Restrepo, M., Gené, J., Castañeda-Ruiz, R., Mena-Portales, J., Crous, P. W., & Guarro, J. (2017). Phylogeny of saprobic microfungi from Southern Europe. *Studies in Mycology*, *86*(1), 53–97. https://doi.org/10.1016/j.simyco.2017.05.002

Hernández-Restrepo, M., Giraldo, A., Van Doorn, R., Wingfield, M. J., Groenewald, J. Z., Barreto, R. W., Colmán, A. A., Mansur, P., & Crous, P. W. (2020). The

Genera of Fungi–G6: *Arthrographis, Kramasamuha, Melnikomyces, Thysanorea,* and *Verruconis*. *Fungal Systematics and Evolution*, *6*(1), 1–24. https://doi.org/10.3114/fuse.2020.06.01

Hertel, H. (1970a). Beiträge zur Kenntnis der Flechtenfamilie Lecideaceae III. *Herzogia*, *2*, 37–62.

Hertel, H. (1970b). Parasitische lichenisierte Arten der Sammelgattung Lecidea in Europa. *Herzogia*, 405–438.

Hertel, H. (1977). Gesteinsbewohnende Arten der Sammelgattung *Lecidea* (Lichenes) aus Zentral-, Ost- und Südasien. *Khumbu Himal*, *6*, 145–378.

Hertel, H. (1983). Über einige aus Lecidea und Melanolecia (Ascomycetes lichenisati) auszuschliessende Arten. *Mitteilungen der Botanischen Staatssammlung, Munchen*, *19*, 441–447.

Hertel, H. (1984). Über saxicole, lecideoide Flechten der Subantarktis. *Nova Hedwigia*, *79*, 399–499.

Hertel, H., & Leuckert, C. (1979). Rhizocarpon dinothetes n. sp., eine auf Lecanora badia parasitierende Flechte in den Alpen. *Herzogia*, 25–37.

Hertel, H., & Rambold, G. (1987). Miriquidica genus novum Lecanoracearum (Ascomycetes lichenisati). *Mitteilungen aus der Botanischen Staatssammlung München.*, *23*, 377–392.

HeucHert, B., & Braun, U. (2006). On some dematiaceous lichenicolous hyphomycetes. *Herzogia*, *19*, 11–21.

Heuchert, B., & Braun, U. (2015). Two New Lichen-Associated *Trimmatostroma* Species. *Herzogia 27*(2), 227–236.

Heuchert, B., Braun, U., Diederich, P., & Ertz, D. (2018). Taxonomic monograph of the genus *Taeniolella* s. lat. (Ascomycota). *Fungal Systematics and Evolution*, *2*(1), 69–261.

Heuchert, B., Diederich, P., Zhurbenko, M., & Braun, U. (2019). *Taeniolella diploschistis* sp. nov. – a new lichenicolous fungus on *Diploschistes scruposus*. *Herzogia*, *32*(1), 94–100.

Heuchert, B., Sancho, L. G., Braun, U., & Hawksworth, D. L. (2015). *Bicoloromyces kyffinensis*: a new genus and species of lichen-inhabiting conidial fungi from 83° 46'S. *Antarctic Science*, *27*(5), 421–428. https://doi.org/10.1017/S0954102015000048

Heuchert, B., Zhurbenko, M. P., & Braun, U. (2014). Reassessment of the lichenicolous hyphomycete genus *Talpapellis*. *Herzogia*, *27*(1), 83–93.

Hipsley, C. A., & Müller, J. (2014). Beyond fossil calibrations: realities of molecular clock practices in evolutionary biology. *Frontiers in genetics*, *5*, 138.

Hoang, D. T., Chernomor, O., Von Haeseler, A., Minh, B. Q., & Vinh, L. S. (2018). UFBoot2: improving the ultrafast bootstrap approximation. *Molecular Biology and Evolution*, *35*(2), 518–522. https://doi.org/10.1093/molbev/msx281

Hodkinson, B. P., Harris, R. C., & Case, M. A. (2009). A checklist of Virginia lichens. *Evansia*, *26*(2), 64–88. https://doi.org/10.1639/0747-9859-26.2.64

Hoffmann, N., & Hafellner, J. (2000). Eine Revision der lichenicolen Arten der Sammelgattungen *Guignardia* und *Physalospora* (Ascomycotina). *Bibliotheca Lichenologica*, *77*, 1–181.

Höhnel, F. (1909). Fragmente zur Mykologie (VII. Mitteilung, Nr. 289 bis 353). *Sitzungsberichten Kaiserliche Akad. Wiss. Wien Math. Naturwissenschaftliche Klasse Abt*, *118*, 813–904.

Höhnel, F. (1919a). Fragmente zur Mykologie: XXIII. Mitteilung (Nr. 1154 bis 1188). *Sitzungsber Akad Wiss Wien Math Naturwiss Kl Abt*, *1*(128), 535–625.

Höhnel, F. (1919b). Vierte vorläufige Mitteilung mykologischer Ergebnisse (Nr. 305-398). *Berichte Der Deutschen Botanischen Gesellschaft*, *37*, 107–115.

Höhnel, F. X. R., & Weese, J. K. (1910). Zur Synonymie in der Gattung Nectria. *Annales Mycologici*, *8*(4), 464–468.

Holien, H., & Frisch, A. (2022). *Microcalicium loraasii*, a new calicioid fungus from old-growth boreal forest in Norway. *Graphis Scripta*, *34*, 42–50.

Hollinger, J. P., & Lendemer, J. C. (2021). *Capronia harrisiana* (Ascomycota, Chaetothyriales), a new lichenicolous species on *Crocodia aurata* from the

southern Appalachian Mountains of southeastern North America. *The Bryologist*, *124*(4), 522–532.

Hongsanan, S., Hyde, K. D., Phookamsak, R., Wanasinghe, D. N., McKenzie, E., Sarma, V., Boonmee, S., Lücking, R., Bhat, D., Liu, N., Tennakoon, D., Pem, D., Karunarathna, A., Jiang, S., Jones, E., Phillips, A., Manawasinghe, I., Tibpromma, S., Jayasiri, S.,…Xie, N. (2020). Refined families of Dothideomycetes: Dothideomycetidae and Pleosporomycetidae. *Mycosphere*, *11*(1), 1553–2107. https://doi.org/10.5943/mycosphere/11/1/13

Hongsanan, S., Hyde, K. D., Phookamsak, R., Wanasinghe, D. N., McKenzie, E. H. C., Sarma, V. V., Lücking, R., Boonmee, S., Bhat, J. D., Liu, N. G., Tennakoon, D. S., Pem, D., Karunarathna, A., Jiang, S. H., Jones, G. E. B., Phillips, A. J. L., Manawasinghe, I. S., Tibpromma, S., Jayasiri, S. C.,…Xie, N. (2020a). Refined families of dothideomycetes: Dothideomycetidae and pleosporomycetidae. *Mycosphere*, *11*, 1553–2107. https://doi.org/10.5943/mycosphere/11/1/13

Hongsanan, S., Hyde, K. D., Phookamsak, R., Wanasinghe, D. N., McKenzie, E. H. C., Sarma, V. V., Lücking, R., Boonmee, S., Bhat, J. D., Liu, N. G., Tennakoon, D. S., Pem, D., Karunarathna, A., Jiang, S. H., Jones, G. E. B., Phillips, A. J. L., Manawasinghe, I. S., Tibpromma, S., Jayasiri, S. C.,…Xie, N. (2020b). Refined families of Dothideomycetes: orders and families incertae sedis in Dothideomycetes. *Fungal Diversity*, *105*, 17–318. https://doi.org/10.1007/s13225-020-00462-6

Horáková, J., & Alstrup, V. (1994). *Phaeospora arctica*, a new lichenicolous fungus. *Graphis Scripta*, *6*(2), 61–63.

Huanraluek, N., Ertz, D., Phukhamsakda, C., Hongsanan, S., Jayawardena, R., & Hyde, K. (2019). The family Pyrenidiaceae resurrected *Mycosphere*, *10*(1), 634–654

Hue, A. (1909). Lichenes morphologice et anatomice disposuit. In *Nouvelles Archives du Museum* (Vol. Fascicule 2, pp. 111–166). Masson Et C". Éditeurs.

Hughes, S. J. (1958). Revisiones hyphomycetum aliquot cum appendice de nominibus rejiciendis. *Canadian Journal of Botany*, *36*(6), 727–836. https://doi.org/10.1139/b58-06

Huhtinen, S. (1987). The genus *Protounguicularia* in Europe. *Beiträge zur Kenntnis der Pilze Mitteleuropas*, *3*, 457–463.

Huhtinen, S., Hawksworth, D. L., & Ihlen, P. G. (2008). Observations on two glassy-haired lichenicolous discomycetes. *The Lichenologist*, *40*(6), 549–557.

Huhtinen, S., & Santesson, R. (1997). A new lichenicolous species of *Polydesmia* (Leotiales: Hyaloscyphaceae). *Lichenologist*, *29*(3), 205–208.

Huneck, S., Lumbsch, H. T., & Yoshimura, I. (1994). Contribution to the lichen flora of the Diamond Mountains (Korea). *Journal of the Hattori Botanical Laboratory*, *75*, 365–369.

Hyde, K., Chaiwan, N., Norphanphoun, C., Boonmee, S., Camporesi, E., Chethana, K., Dayarathne, M., de Silva, N., Dissanayake, A., Ekanayaka, A., Hongsanan, S., Huang, S., Jayasiri, S., Jayawardena, R., Jiang, H., Karunarathna, A., Lin, C., Liu, J., Liu, N.,…Zhao, Q. (2018). Mycosphere notes 169–224. *Mycosphere*, *9*(2), 271–430. https://doi.org/10.5943/mycosphere/9/2/8

Hyde, K. D., Jones, E. B. G., Liu, J.-K., Ariyawansa, H., Boehm, E., Boonmee, S., Braun, U., Chomnunti, P., Crous, P. W., Dai, D.-Q., Diederich, P., Dissanayake, A., Doilom, M., Doveri, F., Hongsanan, S., Jayawardena, R., Lawrey, J. D., Li, Y.-M., Liu, Y.-X.,…Zhang, M. (2013). Families of Dothideomycetes. *Fungal Diversity*, *63*(1), 1–313. https://doi.org/10.1007/s13225-013-0263-4

Hyde, K. D., Maharachchikumbura, S. S., Hongsanan, S., Samarakoon, M. C., Lücking, R., Pem, D., Harishchandra, D., Jeewon, R., Zhao, R.-L., & Xu, J.-C. (2017). The ranking of fungi: a tribute to David L. Hawksworth on his 70th birthday. *Fungal Diversity*, *84*, 1-23.

Hyde, K. D., McKenzie, E., & KoKo, T. (2011). Towards incorporating anamorphic fungi in a natural classification–checklist and notes for 2010. *Mycosphere*, *2*(1), 1–88.

Hyde, K. D., Noorabadi, M., Thiyagaraja, V., He, M., ohnston, P., Wijesinghe, S., Armand, A., Biketova, A., Chethana, K., Erdoğdu, M., Ge, Z. W., Groenewald, J., Hongsanan, S., Kušan, I., Leontyev, D., Li, D., Lin, C., Liu, N., Maharachchikumbura, S.,…Zvyagina, E. (2024). The 2024 Outline of Fungi and fungus-like taxa. *Mycosphere*, *15*, 5146–6239. https://doi.org/10.5943/mycosphere/15/1/25

Hyde, K. D., Norphanphoun, C., Abreu, V. P., Bazzicalupo, A., Thilini Chethana, K., Clericuzio, M., Dayarathne, M. C., Dissanayake, A. J., Ekanayaka, A. H., & He, M.-Q. (2017). Fungal diversity notes 603–708: taxonomic and phylogenetic notes on genera and species. *Fungal Diversity*, *87*, 1–235. https://doi.org/10.1007/s13225-017-0391-3

Hyde, K. D., Norphanphoun, C., Ma, J., Yang, H., Zhang, J., Du, T., Gao, Y., Gomes, d. F. A., Gui, H., He, S., He, Y., Li, C., Liu, X., Lu, L., Su, H., Tang, X., Tian, X., Wang, S., Wei, D.,…Zhao, Q. (2023). Mycosphere notes 387–412 – novel species of fungal taxa from around the world. *Mycosphere*, *14*(1), 663–744. https://doi.org/10.5943/mycosphere/14/1/8

Hyde, K. D., Tennakoon, D. S., Jeewon, R., Bhat, D. J., Maharachchikumbura, S. S. N., Rossi, W., Leonardi, M., Lee, H. B., Mun, H. Y., Houbraken, J., Nguyen, T. T. T., Jeon, S. J., Frisvad, J. C., Wanasinghe, D. N., Lücking, R., Aptroot, A., Cáceres, M. E. S., Karunarathna, S. C., Hongsanan, S.,…Doilom, M. (2019). Fungal diversity notes 1036–1150: taxonomic and phylogenetic contributions on genera and species of fungal taxa. *Fungal Diversity*, *96*(1), 1–242. https://doi.org/10.1007/s13225-019-00429-2

Ihlen, P. (1995). The lichenicolous fungi on *Thamnolia vermicularis* in Norway. *Graphis Scripta*, *7*(1), 17–24.

Ihlen, P. (1998). The lichenicolous fungi on species of the genera *Baeomyces*, *Dibaeis*, and *Icmadophila* in Norway. *Lichenologist*, *30*(1), 27–57. https://doi.org/10.1006/lich.1997.0112

Ihlen, P. G. (2004). A new species of *Lichenostigma* (Lichenotheliaceae, Arthoniales) from Scandinavia. *The Lichenologist*, *36*(3–4), 183–189. https://doi.org/10.1017/S0024282904014185

Ihlen, P. G., Holien, H., & Tønsberg, T. (2004). Two new species of *Dactylospora* (Dactylosporaceae, Lecanorales), with a key to the known species in Scandinavia. *The Bryologist*, *107*(3), 357–362.

Ihlen, P. G., & Tønsberg, T. (1996). The Lichenicolous Genus *Lettauia* in North America. *Bryologist*, *99*(1), 32–33.

Ihlen, P. G., & Wedin, M. (2005). Notes on Swedish lichenicolous fungi. *Nova Hedwigia*, *81*(3–4), 493–500.

Inoue, J., Donoghue, P. C., & Yang, Z. (2010). The impact of the representation of fossil calibrations on Bayesian estimation of species divergence times. *Systematic Biology*, *59*(1), 74–89.

Isbrand, S., & Alstrup, V. (1992). *Opegrapha sphaerophoricola* sp. nov. *The Bryologist*, *95*(2), 233–234.

ITALIC 8.0. (2024). https://italic.units.it/index.php?procedure=taxonpage&num=953.

Iturriaga, T., & Hawksworth, D. L. (2004). *Skyttea richardsonii* sp. nov. from Maine, with a key to the species known from North America. *Mycologia*, *96*(4), 925–928.

Iturriaga, T., Hawksworth, D. L., & Crane, J. L. (2008). *'Sporidesmium' lichenicola* sp. nov., a new lichenicolous fungus on *Leptogium* from Venezuela. *Mycologia*, *100*(3), 392–396.

Jaklitsch, W., Baral, H. O., Lücking, R., & Lumbsch, H. T. (2016). Ascomycota. In W. Frey (Ed.), *Syllabus of Plant Families – Adolf Engler's Syllabus der Pflanzenfamilien* (pp. 290). Borntraeger Science Publishers.

Jason, P. H., Perry, A. S., & James, C. L. (2024). Two new species of lichenicolous *Arthonia* (Arthoniaceae) from southeastern North America highlight the need for comparative studies of lichen parasites and their hosts. *The Bryologist*, *127*(1), 2–21. https://doi.org/10.1639/0007-2745-127.1.001

Jatta, A. (1892). Materiali Per Un Censimento Generale Del Licheni Italiani. Fascicolo I. *Nuovo Giornale Botanico Italiano*, *24*(1), 1–754.

Jatta, A. (1900). *Sylloge Lichenum Italicorum*.

Jatta, A. (1906). Lichenes lecti in Chili a el. G. I. SCOTT-ELLIOT, quos determinavit *Malpighia*, *1*, 1–19.

Javier, E., & Aptroo, A. (2005). Epiphytic lichens and lichenicolous fungi from Bahia Honda (Veraguas, Panama). In S. Castroviejo & A. Ibánez (Eds.), *Studies on the Biodiversity of the Bahia Honda Region (Veraguas, Panama) III. El Medio Biológico /The Biological Environment* (pp. 65–94). CSIC Press.

Jayasiri, S. C., Ariyawansa, H. A., Jones, E. G., Kang, J.-C., Promputtha, I., Bahkali, A. H., & Hyde, K. D. (2016). Towards a natural classification of Dothideomycetes: 8. The genera *Cocconia, Dianesea, Endococcus* and *Lineostroma*. *Phytotaxa*, *255*(1), 66–74.

Jayasiri, S. C., Hyde, K. D., Ariyawansa, H. A., Bhat, J., Buyck, B., Cai, L., Dai, Y.-C., Abd-Elsalam, K. A., Ertz, D., & Hidayat, I. (2015). The Faces of Fungi database: fungal names linked with morphology, phylogeny and human impacts. *Fungal Diversity*, *74*, 3–18. https://doi.org/10.1007/s13225-015-0351-8

Jayasiri, S. C., Hyde, K. D., Jones, E., Peršoh, D., Camporesi, E., & Kang, J. C. (2018). Taxonomic novelties of hysteriform Dothideomycetes. *Mycosphere*, *9*(4), 803–837.

Jayawardena, R. S., Hyde, K. D., Wang, S., Sun, Y.-R., Suwannarach, N., Sysouphanthong, P., Abdel-Wahab, M. A., Abdel-Aziz, F. A., Abeywickrama, P. D., Abreu, V. P., Armand, A., Aptroot, A., Bao, D.-F., Begerow, D., Bellanger, J.-M., Bezerra, J. D. P., Bundhun, D., Calabon, M. S., Cao, T.,…Wang, Y. (2022). Fungal diversity notes 1512–1610: taxonomic and phylogenetic contributions on genera and species of fungal taxa. *Fungal Diversity*, *117*(1), 1–272. https://doi.org/10.1007/s13225-022-00513-0

Jeewon, R., & Hyde, K. (2016). Establishing species boundaries and new taxa among fungi: Recommendations to resolve taxonomic ambiguities. *Mycosphere*, *7*, 1669–1677. https://doi.org/10.5943/mycosphere/7/11/4

Johnston, P. (2022a). Leotiomycetes phylogeny updated October 2022. *Phylogeny and Taxonomy of New Zealand's Fungi*.

Johnston, P. (2022b). Nomenclatural novelties. *Index Fungorum*, *519*, 1–6.

Johnston, P., Park, D., & Renner, M. (2019). *Sphaeropezia leucocheila* sp. nov.(Stictidaceae): A liverwort pathogen from New Zealand. *Phytotaxa*, *409*(4), 222–226.

Jones, E. B. G., Abdel-Wahab, M. A., Alias, S. A., & Hsieh, S. Y. (1999). *Dactylospora mangrovei* sp. nov. (Discomycetes, ascomycota) from mangrove wood. *Mycoscience*, *40*(4), 317–320. https://doi.org/10.1007/BF02463875

Joseph, S., & Sinha, G. P. (2015). The lichenicolous species of *Melaspilea* (Melaspileaceae) in India. *Taiwania*, *60*(1), 18–22.

Joshi, S., Upreti, D. K., & Nayaka, S. (2013). A new lichenicolous *Arthonia* species (Arthoniaceae) on *Diorygma* from India. *The Lichenologist*, *45*(03), 323–327.

Joshi, Y. (2018). Documentation of lichenicolous fungi from India - Some additional Reports. *Kavaka*, *51*, 30–34.

Joshi, Y. (2019). *Opegrapha physciae* (Arthoniales: Opegraphaceae), a new lichenicolous species from The Philippines. *Kew Bulletin*, *74*(57), 1–5.

Joshi, Y. (2020). *Polycoccum Hawksworthianum* (Polycoccaceae, Trypetheliales), A New Lichenicolous Fungus on *Lepra* and *Varicellaria* from India. *Acta Botanica Hungarica*, *62*(3–4), 217–224.

Joshi, Y. (2021). New species and new records of lichenicolous fungus *Pyrenidium* from India. *Acta Botanica Hungarica*, *63*(3–4), 343–349.

Joshi, Y. (2021). Two new species of lichenicolous fungus *Sclerococcum* (Dactylosporaceae, Sclerococcales) from India. *Acta Botanica Hungarica*, *63*(1–2), 67–75. https://doi.org/10.1556/034.63.2021.1-2.5

Joshi, Y. (2022a). *Ajaysinghia dendriscostictae* a new genus and species of lichenicolous fungus growing on *Dendriscosticta praetextata* (Peltigerales:

Peltigeraceae) in India. *Journal of Asia-Pacific Biodiversity*, *15*(1), 76–79. https://doi.org/10.1016/j.japb.2021.09.014

Joshi, Y. (2022). A New Species of *Labrocarpon* (Asterinales), a Lichenicolous Ascomycota With Submuriform Ascospores From India. *Acta Botanica Hungarica*, *64*(3–4), 285–291. https://doi.org/10.1556/034.64.2022.3-4.5

Joshi, Y. (2022b). Three new species of lichenicolous fungi from India. *Kew Bulletin*, *77*(1), 333–340.

Joshi, Y. (2024). New Species and New Records of Lichenicolous Fungi from India. *Kavaka*, *60*(4), 70–77. https://doi.org/10.36460/Kavaka/60/4/2024/70-77

Joshi, Y., & Bansal, P. (2023). *Knudsenia flavoparmeliarum*: A new Genus and Species of Lichenicolous Fungus Growing on *Flavoparmelia Caperata* and *Flavopunctelia Flaventior* (Parmeliaceae) from India. *Acta Botanica Hungarica*, *65*(3–4), 325–335. https://doi.org/10.1556/034.65.2023.3-4.5

Joshi, Y., & Bansal, P. (2023a). The lichenicolous genus *Arthophacopsis* Hafellner (Arthoniales) from India. *Journal of Asia-Pacific Biodiversity*, *17*, 280–283.

Joshi, Y., & Bansal, P. (2023b). A new species of *Stigmidium* (Mycosphaerellaceae) on *Bulbothrix setschwanensis* (Parmeliaceae) from India. *Herzogia*, *36*(1), 161–168.

Joshi, Y., Bansal, P., & Yadav, A. L. (2022). *Cercidospora navarroi*, a new species of lichenicolous fungus from the Central Himalayan region of India. *Phytotaxa*, *549*(2), 241–246.

Joshi, Y., Bisht, K., & Suda, N. (2020). Lichenicolous fungi colonising members of the lichen-forming family Teloschistaceae in India. *Kew Bulletin*, *75*(54), 1–7. https://doi.org/10.1007/s12225-020-09912-5

Joshi, Y., Falswal, A., Bajpai, R., & Upreti, D. (2016). A new species of Didymocyrtis (Phaeospheriaceae, Ascomycota) growing on Thamnolia vermicularis from India. *Kavaka*, *46*, 27-29.

Joshi, Y., Falswal, A., & Halda, J. P. (2017). *Polycoccum ochvarianum*–a new species of Dothideomycetes from India. *Sydowia*, *69*, 147–151.

Joshi, Y., Falswal, A., & Joshi, R. (2017). A new species of lichenicolous fungus *Epicladonia* from India. *Kavaka*, *48*, 42–43.

Joshi, Y., Falswal, A., Tripathi, M., & Halda, J. P. (2017). *Lichenodiplis ochrolechiae*, a new species of lichenicolous fungi from India. *Sydowia*, *69*, 19–22.

Joshi, Y., Knudsen, K., Wang, X., & Hur, J.-S. (2010). *Dactylospora glaucomarioides* (Ascomycetes, Dactylosporaceae): A lichenicolous fungus new to South Korea. *Mycobiology*, *38*, 321–322. https://www.tandfonline.com/doi/abs/10.4489/MYCO.2010.38.4.321

Joshi, Y., Kondratyuk, S., Lokös, L., Halda, J., Oh, S., & Hur, J. (2015). New species and new records of lichenicolous fungi from South Korea. *Mycosphere*, *6*(4), 493–500.

Joshi, Y., Kumar, P., Yadav, A. L., Suda, N., & Halda, J. P. (2020). Distribution and diversity of lichenicolous fungi from western Himalayan Cold Deserts of India, including a new *Zwackhiomyces* species. *Sydowia*, *73*, 171–183.

Joshi, Y., Tripathi, M., Bisht, K., Upadhyay, S., Kumar, V., Pal, N., Gaira, A., Pant, S., Rawat, K. S., & Bisht, S. (2018). Further contributions to the documentation of lichenicolous fungi from India. *Kavaka*, *50*, 26–33.

Joshi, Y., Upadhyay, S., Chandra, K., Bisht, K., & Falswal, A. (2016). A new species of *Plectocarpon* (Roccellaceae, lichenised ascomycetes) from India. *Acta Botanica Hungarica*, *58*(3–4

Jülich, W. (1972). Monographie der Athelieae (Corticiaceae, Basidiomycetes). *Willdenowia. Beiheft*, 3–283.

Kalb, K. (1982). Neue bzw. interessante Flechten aus (Mittel-) Europa II. *Herzogia*, *6*(1–2), 71–83.

Kalb, K. (1988). Lichenes Neotropici. *10*, 401–450.

Kalb, K. (2001). New or otherwise interesting lichens. I. *Bibliotheca Lichenologica*, *78*, 141–168.

Kalb, K. (2004). New or otherwise interesting lichens II. *Bibliotheca Lichenologica*, *88*, 301–329.

Kalb, K., Buaruang, K., Mongkolsuk, P., & Boonpragob, K. (2012). New or otherwise interesting lichens. VI, including a lichenicolous fungus. *Phytotaxa*, *42*(1), 35–47.

Kalb, K., & Elix, J. A. (1995). The lichen genus *Physcidia*. *Bibliotheca Lichenologica*, *57*, 265–297.

Kalb, K., Hafellner, J., & Staiger, B. (1995). *Haematomma*-Studien. II. Lichenicole Pilze auf Arten der Flechtengattung. *Bibliotheca Lichenologica*, *59*, 199–222.

Kalb, K., & Josef, H. (1992). Bemerkenswerte Flechten und lichenicole Pilze von der Insel Madeira. *Herzogia*, 45–102.

Kalb, K., & Vezda, A. (1994). Neue Arten der Flechtengattung *Gyalideopsis Vezda* (Gomphillaceae). *Nova Hedwigia*, *58*(3–4), 511–528.

Kalb, K., & Vězda, A. (1988). Neue oder bemerkenswerte Arten der Flechtenfamilie Gomphillaceae in der Neotropis. *Bibliotheca Lichenologica, 29*.

Kalgutkar, R. (1985). Fossil fungal fructifications from Bonnet Plume Formation, Yukon Territory. *Geological Survey of Canada Paper*, *85*, 259–268.

Kalyaanamoorthy, S., Minh, B. Q., Wong, T. K. F., von Haeseler, A., & Jermiin, L. S. (2017). ModelFinder: fast model selection for accurate phylogenetic estimates. *Nature Methods*, *14*(6), 587–589. https://doi.org/10.1038/nmeth.4285

Kantvilas, G., & Motiejūnaitė, J. (2023). Two new lichenicolous species of *Arthonia* (Ascomycota: Arthoniomycetes) from Tasmania. *Folia Cryptogamica Estonica*, *60*, 13–19. https://doi.org/10.12697/fce.2023.60.03

Kantvilas, G., Suija, A., & Motiejūnaitė, J. (2021). *Caloplaca tephromelae* (Teloschistaceae), a new lichenicolous species from Tasmania. *The Lichenologist*, *53*, 317–325. https://doi.org/ 10.1017/S0024282921000207

Kantvilas, G., & Vezda, A. (1992). Additions to the lichen flora of Tasmania. *Telopea*, *4*(4), 661–670.

Kantvilas, G., & Wedin, M. (2015). Lichenicolous species of the ascomycete genus *Arthonia* Ach. from Kangaroo Island. *Journal of the Adelaide Botanic Gardens*, *29*, 1–6.

Kärnefelt, I., Kondratyuk, S., Søchting, U., Frödén, P., & Arup, U. (2002). Two new species of *Caloplaca* (Teloschistaceae) from the Southern Hemisphere. *The Bryologist*, *105*(3), 301–309.

Karsten, P. A. (1873). Mycologia fennica. Pars secunda. Pyrenomycetes. *Bidrag till Kännedom av Finlands Natur och Folk*, *23*, 1–252.

Karsten, P. A. (1885). Revisio monographica atque Synopsis Ascomycetum in Fennia hucusque detectorum. In *Acta Societatis Pru Fauna Ep Flura Fennica* (Vol. 2, pp. 1–174). Officina Typographica Heredum J. Simelt.

Karsten, P. A. (1887). Symbolae ad mycologiam Fennicam. XXI. *Meddelanden af Societas pro Fauna et Flora Fennica*, 103–110.

Karsten, P. A., & Hariot, P. (1890). Ascomycetes novi. *Revue Mycologique Toulouse*, *12*, 169–173.

Katoh, K., & Standley, D. (2013). MAFFT multiple sequence alignment software version 7: improvements in performance and usability. *Molecular Biology & Evolution*, *30*(4), 772–780. https://doi.org/10.1093/molbev/mst010

Kaufmann, M., & Hofmann, P. (1998). Beitrag zur Flechtenflora von Vorarlberg (Austria): Pfändergebiet und Leiblachtal im Bezirk Bregenz. *Linzer Biologische Beiträge*, *30*, 105–125.

Keissler, K. (1925). Systematische Untersuchungen Über Flechtenparasiten Und Lichenoide Pilze. (III. Teil), Nr. 21–30. *Annalen des Naturhistorischen Museums in Wien*, 162–168.

Keissler, K. v. (1911). Zwei neue Flechtenparasiten aus Steiermark. *Hedwigia*, *50*, 294–298.

Keissler, K. V. (1930). *Rabenhorst's Kryptogamen-Flora, Pilze - Die Flechtenparasiten* (2 ed., Vol. 8).

Kernstock, E. (1894). Lichenologische Beiträge. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien*, *44*, 191–224.

Khodosovtsev, A., & Darmostuk, V. (2016). *Pleospora xanthoriae* sp. nov. (Pleosporaceae, Pleosporales), a new lichenicolous fungus on Xanthoria

parietina from Ukraine, with a key to the known lichenicolous species of *Dacampia* and *Pleospora*. *Opuscula Philolichenum*, *15*, 6–11.

Khodosovtsev, A., Darmostuk, V., Suija, A., & Ordynets, A. (2018). *Didymocyrtis trassii* sp. nov. and other lichenicolous fungi on *Cetraria aculeata*. *The Lichenologist*, *50*(5), 529–540. https://doi.org/10.1017/S0024282918000294

Khodosovtsev, A., Vondrák, J., Naumovich, A., Kocourková, J., Vondráková, O., & Motiejnait, J. (2012). Three new *Pronectria* species in terricolous and saxicolous microlichen communities (Bionectriaceae, Ascomycota). *Nova Hedwigia*, *95*(1–2), 211–220.

Khodosovtsev, A. Y., & Darmostuk, V. V. (2017). *Zwackhiomyces polischukii* sp. nov., and other noteworthy lichenicolous fungi from Ukraine. *Polish Botanical Journal*, *62*(1), 27–35.

Khodosovtsev, A. Y., Gavrylenko, L. M., & Klymenko, V. M. (2016). *Katherinomyces cetrariae* gen. et sp. nov. asexual Ascomycota and *Sphaerellothecium aculeatae* sp. nov. Mycosphaerellaceae, new lichenicolous fungi on *Cetraria aculeata* in Ukraine. *Nova Hedwig*, *103*(1–2), 47–55. https://doi.org/10.1127/nova_hedwigia/2016/0333

Kirk, P. M., Cannon, P. F., Minter, D. W., & Stalpers, J. A. (2008). *Dictionary of the Fungi* (Tenth Edition ed.). CABI Europe – UK.

Kirschstein, W. (1924). Beiträge zur Kenntnis der Ascomyceten. *Verhandlungen des Botanischen Vereins der Provinz Brandenburg*, *66*, 23–29.

Kirschstein, W. (1935). Neue und seltene Ascomyceten. *Annales Mycologici*, *33*(3–4), 202–229.

Kistenich, S., Timdal, E., Bendiksby, M., & Ekman, S. (2018). Molecular systematics and character evolution in the lichen family Ramalinaceae (Ascomycota: Lecanorales). *Taxon*, *67*(5), 871–904.

Knoph, J.-G. (2004). Cornutispora herteliana, a new lichenicolous coelomycete from Japan. *Bibliotheca Lichenologica*, *88*, 345–348.

Knudsen, K. (2008). *Endococcus janae*, a new species from Peru on *Acarospora rhabarbarina*. *Opuscula Philolichenum*, *5*, 25–28.

Knudsen, K. (2011). *Acarospora nashii*, a lichenicolous lichen from western North America. *Bibliotheca Lichenologica*, *106*, 169–172.

Knudsen, K., Breuss, O., & Kocourkova, J. (2009). A new species of *Placocarpus* (Verrucariaceae) from southern California. *The Lichenologist*, *41*(6), 627–630.

Knudsen, K., Breuss, O., & Kocourková, J. (2014). A new lichenicolous *Heteroplacidium* (Verrucariaceae) from the deserts of southern California. *Opuscula Philolichenum*, *13*, 26–33.

Knudsen, K., & Kocourková, J. (2008). A study of lichenicolous species of *Polysporina* (Acarosporaceae). *Mycotaxon*, *105*, 149–164.

Knudsen, K., & Kocourková, J. (2009). Lichens, lichenicolous and allied fungi of the Santa Monica Mountains, Part 4: Additions and corrections to the annotated checklist. *Opuscula Philolichenum*, *7*, 29–48.

Knudsen, K., & Kocourková, J. (2010). A new *Lichenostigma* species (Genus incertae sedis) from southern California. *The Bryologist*, *113*(2), 229–234.

Knudsen, K., & Kocourková, J. (2010a). A new species of *Stigmidium* from corticolous *Caloplaca* in southern California (USA) and Baja California (Mexico). *Bibliotheca Lichenologica*, *105*, 25–31.

Knudsen, K., & Kocourková, J. (2010b). *Pyrenidium aggregatum*, a new species from North America. *Pyrenidium aggregatum, a new species from North America.*, *8*, 71–74.

Knudsen, K., & Kocourková, J. (2018). *Acarospora mayrhoferi* (Acarosporaceae), a new species from the European Alps (Italian part) and the French Massif Central. *Herzogia*, *31*(1), 510–517.

Knudsen, K., Kocourková, J., & Etayo, J. (2009). A New Species of *Sphaerellothecium* (Mycosphaerellaceae) on *Placidium lacinulatum*. *Opuscula Philolichenum*, *6*, 41–44.

Knudsen, K., Kocourková, J., Hodková, E., & Schiefelbein, U. (2021). A new species of *Myriospora* (Acarosporaceae) and a report of *Myriospora rufescens* from Central Europe. *Herzogia*, *34*(2), 327–338.

Knudsen, K., Kocourková, J., & Wheeler, T. (2015). *Protoparmelia ryaniana* is a synonym of *Lecanora verrucariicola,* which belongs in the genus *Miriquidica* (Lecanoraceae). *Opuscula Philolichenum*, *14*, 138–142.

Knudsen, K., & Lendemer, J. C. (2007). Studies in lichens and lichenicolous fungi: Notes on some North American taxa. *Mycotaxon*, *101*, 81–87.

Knudsen, K., & Lendemer, J. C. (2007). Studies in lichens and lichenicolous fungi: Notes on some North American taxa. *Mycotaxon*, *101*, 81-87.

Knudsen, K., Sheard, J. W., Kocourková, J., & Mayrhofer, H. (2013). A new lichenicolous lichen from Europe and western North America in the genus *Dimelaena* (Physciaceae). *The Bryologist*, *116*(3), 257–263.

Kocakaya, M., Halıcı, M. G., & Aksoy, A. (2011). *Zwackhiomyces turcicus* sp. nov.(Ascomycota, Xanthopyreniaceae) from Turkey. *Mycotaxon*, *116*(1), 329–333.

Kocourkov, J., & Hawksworth, D. L. (2008). *Acaroconium punctiforme* gen. sp. nov., a new lichenicolous coelomycete on *Acarospora* species and *Sarcogyne regularis*. *The Lichenologist*, *40*(2), 105–109.

Kocourková, J. (1994). *Arthonia pragensis* spec. nov. (Ascomycetes, Arthoniales), a new lichenicolous fungus from the Czech Republic. *Czech Mycology*, *47*, 139–143. https://doi.org/ 10.33585/cmy.47202

Kocourková, J. (2009). Observations on the genus *Neolamya*, with the description of the new species *N. xanthoparmeliae* (Ascomycota, genera incertae sedis). *Opuscula Philolichenum*, *6*, 137–148.

Kocourková, J., & Berger, F. (1999). *Polycoccum minutulum* (Dothideales, Ascomycetes), a new lichenicolous fungus on *Trapelia placodioides*. *Czech Mycology*, *51*, 171–178.

Kocourková, J., & Knudsen, K. (2009a). A new species of *Stigmidium* (Mycosphaerellaceae, Ascomycetes) from western North America. *Czech Mycology*, *61*(1), 73–80.

Kocourková, J., & Knudsen, K. (2009b). *Stigmidium epistigmellum* (Mycosphaerellaceae), a lichenicolous fungus from maritime *Caloplaca* in North America. *The Bryologist*, 578–583.

Kocourková, J., & Knudsen, K. (2010). A new species of *Dacampia* (Dacampiaceae) on *Lecania fuscella*. *Bibliotheca Lichenologica*, *105*, 33–36.

Kocourková, J., & Knudsen, K. (2011). *Endococcus thelommatis*, a new lichenicolous fungus from southern California. *Bibliotheca Lichenologica*, *106*, 173–178.

Kocourková, J., & Knudsen, K. (2012). A new species of Stigmidium (Mycosphaerellaceae) on Aspicilia from North America. *Mycotaxon -Ithaca Ny-*, *121*, 45–52. https://doi.org/10.5248/121.45

Kocourková, J., & van den Boom, P. (2005). Lichenicolous fungi from the Czech Republic II. *Arthrorhaphis arctoparmeliae* spec. nov. and some new records for the country. *Herzogia*, *18*, 23–35.

Kodsueb, R., Dhanasekaran, V., Aptroot, A., Lumyong, S., McKenzie, E. H., Hyde, K. D., & Jeewon, R. (2006). The family Pleosporaceae: intergeneric relationships and phylogenetic perspectives based on sequence analyses of partial 28S rDNA. *Mycologia*, *98*(4), 571–583. https://doi.org/10.1080/15572536.2006.11832660

Kohlmeyer, J. (1965). New marine fungi from mangroves and trees along eroding shore lines. *Nova Hedwigia*, *9*, 89–104.

Kohlmeyer, J. (1998). *Dactylospora canariensis* sp. nov. and notes on *D. haliotrepha*. *Mycotaxon*, *67*, 247–250.

Kondratyuk, S., Kärnefelt, I., Lőkös, L., Hur, J.-S., & Thell, A. (2018). *Coppinsiella* and *Seawardiella*–two new genera of the Xanthorioideae (Teloschistaceae, lichen-forming Ascomycota). *Acta Botanica Hungarica*, *60*(3–4), 369–386.

Kondratyuk, S., Khodosovtsev, A., & Kärnefelt, I. (2006). *Llimoniella caloplacae* sp. nova (Leothiales), a new lichenicolous fungus on *Caloplaca borysthenica* sp. nova (Lecanorales, Ascomycota). *Mycologia Balcanica*, *3*(2), 95–98.

Kondratyuk, S., & Kudratov, I. (2002). *Opegrapha romsae* sp. nova (Arthoniales), a new lichenicolous fungus from Tajikistan. *Ukrayins' kyi Botanichnyi Zhurnal*, *59*, 420–425.

Kondratyuk, S., Lőkös, L., Farkas, E., Kärnefelt, I., Thell, A., Yamamoto, Y., & Hur, J.-S. (2020). Three new genera of the Teloschistaceae proved by three gene phylogeny. *Acta Botanica Hungarica*, *62*(1–2), 109–136.

Kondratyuk, S., Lokos, L., Farkas, E., Oh, S.-O., & Hur, J.-S. (2015). New and noteworthy lichen-forming and lichenicolous fungi 2. *Acta Botanica Hungarica*, *57*(1–2), 108–142. https://doi.org/10.1556/abot.57.2015.1-2.10

Kondratyuk, S., Lőkös, L., Halda, J., Farkas, E., Upreti, D. K., Thell, A., Woo, J.-J., Oh, S.-O., & Hur, J.-S. (2018). New and noteworthy lichen-forming and lichenicolous fungi 7. *Acta Botanica Hungarica*, *60*(1–2), 115–184.

Kondratyuk, S., Lőkös, L., Halda, J., Haji Moniri, M., Farkas, E., Park, J., Lee, B., Oh, S.-O., & Hur, J.-S. (2016). New and noteworthy lichen-forming and lichenicolous fungi 4. *Acta Botanica Hungarica*, *58*(1–2), 75–136. https://doi.org/10.1556/034.58.2016.1-2.4

Kondratyuk, S., Lőkös, L., Halda, J., Lee, B. G., Jang, S.-H., Woo, J.-J., Park, J. S., Oh, S.-O., Han, S.-K., & Hur, J.-S. (2019). *Arthonia dokdoensis* and *Rufoplaca toktoana*–two new taxa from Dokdo Islands (South Korea). *Mycobiology*, *47*(4), 355–367. https://www.tandfonline.com/doi/full/10.1080/12298093.2019.1688074

Kondratyuk, S., Lőkös, L., Halda, J., Roux, C., Upreti, D., Schumm, F., Mishra, G., Nayaka, S., Farkas, E., & Park, J. (2017). New and noteworthy lichen-forming and lichenicolous fungi 6. *Acta Botanica Hungarica*, *59*(1–2), 137–260.

Kondratyuk, S., Lőkös, L., Halda, J., Upreti, D., Mishra, G., Haji Moniri, M., Farkas, E., Park, J. S., Lee, B., Liu, D., Woo, J., Jayalal, R., Oh, S., & Hur, J. (2016). New and noteworthy lichen-forming and lichenicolous fungi 5. *Acta Botanica Hungarica*, *58*(3–4), 319–396.

Kondratyuk, S., Lőkös, L., & Hur, J.-S. (2014). New lichen-forming and lichenicolous fungi from Ukraine. *Acta Botanica Hungarica*, *56*(3–4), 361–368.

Kondratyuk, S., Lőkös, L., Oh, S.-O., Kondratiuk, T., Parnikoza, I. Y., & Hur, J.-S. (2020). New and noteworthy lichen-forming and lichenicolous fungi 11. *Acta Botanica Hungaricae*, *62*(3–4), 225–291. https://doi.org/10.1556/034.62.2020.3-4.3

Kondratyuk, S., Lőkös, L., Tschabanenko, S., Haji Moniri, M., Farkas, E., Wang, X., Oh, S.-O., & Hur, J.-S. (2013). New and noteworthy lichen-forming and lichenicolous fungi. *Acta Botanica Hungarica*, *55*(3–4), 275–349.

Kondratyuk, S., Upreti, D., Mishra, G., Nayaka, S., Ingle, K., Orlov, O., Kondratiuk, A., Lőkös, L., Farkas, E., & Woo, J.-J. (2020). New and noteworthy lichen-forming and lichenicolous fungi 10. *Acta Botanica Hungarica*, *62*(1–2), 69–108.

Kondratyuk, S. Y. (1995). Lichenicolous fungi and chemical patterns in *Pseudocyphellaria*. *Bibliotheca Lichenologica*, *57*, 327–345.

Kondratyuk, S. Y. (1996). New species of *Pronectria, Vouauxiomyces, Wentiomyces* and *Zwackhiomyces* from Australasia. In *Muelleria* (Vol. 9, pp. 93–104). National Herbarium of Victora, Royal Botanic Gardens, Melb.

Kondratyuk, S. Y., & Galloway, D. (1995). Some new species of lichenicolous fungi. *Bibl. Lichenol. , 58*, 235–244.

Kondratyuk, S. Y., & Galloway, D. (1995). Two new lichenicolous fungi from *Lobaria* and *Sticta* (Stictaceae). In F. J. A. Danielis, M. Schulz, & J. Peine (Eds.), *Contributions to Lichenology in Honour of Gerhard Follmann. ,* (pp. 255–261). Geobotanical and Phytotaxonomical Study Group, Botanical Institute, University of Cologne.

Kondratyuk, S. Y., Galloway, D., & Hawksworth, D. (1994). *Unguiculariopsis ahtii*, and some other new lichenicolous fungi from *Pseudocyphellaria*. *Acta Botanica Fennica*, *150*, 93–97.

Kondratyuk, S. Y., Kudratov, I., & Bielczyk, U. (2002). *Lichenodiplisiella makarevichae*, a new lichenicolous coelomycete from Tajikistan. *Polish Botanical Journal*, *47*, 1–3.

Kondratyuk, S. Y., Lőkös, L., Farkas, E., Jang, S.-H., Liu, D., Halda, J., Persson, P.-E., Hansson, M., Kärnefelt, I., & Thell, A. (2019). New and noteworthy lichen-forming and lichenicolous fungi 9. *Acta Botanica Hungarica*, *61*(3–4), 325–367.

Kondratyuk, S. Y., Lokos, L., Kärnefelt, I., Thell, A., Jeong, M.-H., Oh, S.-O., Kondratiuk, A., Farkas, E., & Hur, J.-S. (2021). Contributions to Molecular Phylogeny of Lichen-Forming Fungi 2. Review of Current Monophyletic Branches of the Family Physciaceae. *Acta Botanica Hungarica*, *63*, 351–390. https://doi.org/10.1556/034.63.2021.3-4.8

Kondratyuk, S. Y., Lokos, L., Kim, J. A., Kondratiuk, A. S., Jeong, M.-H., Zarei, B., & Hur, J.-S. (2014). *Oxnerella safavidiorum* Gen. Et spec. Nov. (lecanoromycetidae, ascomycota) from Iran (Asia) proved by phylogenetic analysis. *Acta Botanica Hungarica*, *56*, 379–398. https://doi.org/10.1556/ABot.56.2014.3-4.13

Kondratyuk, S. Y., & Zelenko, S. D. (2002). New lichens and lichenicolous fungi from Israel and the Near East. *Bot. Zhurn. (Kiev)*, *59*, 598–607.

Körber, G. W. (1855). *Systema lichenum Germaniae*.

Körber, G. W. (1859). Parerga lichenologica. *Ergänzungen zum Systema lichenum Germaniae*, *1*, 1–96.

Körber, G. W. (1861). Parerga lichenologica: Ergänzungen zum Systema lichenum Germaniae. *Ergänzungen zum Systema lichenum Germaniae*, *3*.

Körber, G. W. (1865a). Parerga lichenologica. *Ergänzungen zum Systema lichenum Germaniae*, *5*, 385–501.

Körber, G. W. (1865b). *Parerga lichenologica. Ergänzungen zum Systema lichenum Germaniae* (Vol. 5). E. Trewendt.

Kotte, I. (1909). *Einige neue Fälle von Nebensymbiose Parasymbiose*. Fischer.

Kraichak, E., Huang, J.-P., Nelsen, M., Leavitt, S., & Lumbsch, T. (2018). A revised classification of orders and families in the two major subclasses of Lecanoromycetes (Ascomycota) based on a temporal approach. *Botanical Journal of the Linnean Society*, *188*(3), 233–249. https://doi.org/10.1093/botlinnean/boy060

Krassilov, V. A. (1967). *Early Cretaceous flora of South Primorye and its bearing on the stratigraphy.* Moscow: Nauka.

Krog, H. (1982). Punctelia, a new lichen genus in the Parmeliaceae. *Nordic Journal of Botany*, *2*(3), 287–292.

Kukwa, M., & Diederich, P. (2005). *Monodictys epilepraria*, a new species of lichenicolous hyphomycetes on *Lepraria*. *The Lichenologist*, *37*, 217–220. https://doi.org/ 10.1017/S002428290501491X

Kukwa, M., Etayo, J., & Flakus, A. (2012). *Plectocarpon stereocaulicola* (Roccellaceae, Ascomycota), a new lichenicolous fungus from Bolivia. *The Lichenologist*, *44*(4), 479–482. https://doi.org/10.1017/S0024282912000151

Kuntze, O. (1898). *Revisio generum plantarum* (Vol. 3).

Kutorga, E., & Hawksworth, D. L. (1997). A reassessment of the genera referred to the family Patellariaceae (Ascomycota). *Systema Ascomycetum*, *15*(1–2), 1–110.

Ladd, D., & Morse, C. A. (2018). A new lichenicolous species of *Toninia* (Ramalinaceae) on *Dermatocarpon* in central North America. *The Bryologist*, *121*(2), 214–220.

Lamb, I. M. (1963). Index Nominum Lichenum Inter Annos 1932–1960. *Divulgatorum*, 1–810.

Lamy, E. (1878). Catalogue raisonné des lichens du Mont-Dore et de la Haute-Vienne. *Bulletin de la Société Botanique de France*, *25*, 321–536.

Larsson, A. (2014). AliView: a fast and lightweight alignment viewer and editor for large datasets. *Bioinformatics*, *30*(22), 3276–3278. https://doi.org/10.1093/bioinformatics/btu531

Lawrey, & James, D. (1995). The chemical ecology of lichen mycoparasites: a review. *Canadian Journal of Botany*, *73*(S1), 603–608.

Lawrey, J. D. (1986). Biological role of lichen substances. *Bryologist*, *89*(2), 111–122.

Lawrey, J. D., & Diederich, P. (2003). Lichenicolous fungi: interactions, evolution, and biodiversity. *The Bryologist*, *106*(1), 80–120. https://doi.org/10.2307/3244800

Lawrey, J. D., Diederich, P., Nelsen, M. P., Freebury, C., Van den Broeck, D., Sikaroodi, M., & Ertz, D. (2012). Phylogenetic placement of lichenicolous *Phoma* species in the Phaeosphaeriaceae (Pleosporales, Dothideomycetes). *Fungal Diversity*, *55*(1), 195–213. https://doi.org/10.1007/s13225-012-0166-9

Lawrey, J. D., Diederich, P., Nelsen, M. P., Sikaroodi, M., Gillevet, P. M., Brand, A. M., & Van den Boom, P. (2011). The obligately lichenicolous genus *Lichenoconium* represents a novel lineage in the Dothideomycetes. *Fungal Biology*, *115*(2), 176–187. https://doi.org/10.1016/j.funbio.2010.12.002

Lawrey, J. D., Etayo, J., Dal-Forno, M., Driscoll, K. E., & Diederich, P. (2015). Molecular data support establishment of a new genus for the lichenicolous species *Neobarya usneae* (Hypocreales). *The Bryologist*, *118*(1), 83–92.

Lawrey, J. D., Rossman, A. Y., & Lowen, R. (1994). Inhibition of selected hypocrealean fungi by lichen secondary metabolites. *Mycologia*, *86*(4), 502–506.

Lawrey, J. D., Sikaroodi, M., Gillevet, P. M., & Diederich, P. (2020). A new species of bulbil-forming lichenicolous fungi represents an isolated clade in the Cantharellales. *The Bryologist*, *123*(2), 155–162.

Lawrey, J. D., Torzilli, A. P., & Chandhoke, V. (1999). Destruction of lichen chemical defenses by a fungal pathogen. *American Journal of Botany*, *86*(2), 184–189. https://doi.org/ 10.2307/2656935

Lawrey, J. D., Zimmermann, E., Sikaroodi, M., & Diederich, P. (2016). Phylogenetic diversity of bulbil-forming lichenicolous fungi in Cantharellales including a new genus and species. *Bryologist*, *119*(4), 341–349.

Le Gal, M. (1949). Deux Discomycètes mal connus: *Ascodesmis nigricans* van Tieghem et *Ascodesmis microscopica* (Crouon) Le Gai, non Seaver. *Revue Mycologie*, *14*(2), 85–99.

Le Renard, L., Stockey, R. A., Upchurch, G., & Berbee, M. L. (2020). A new epiphyllous fly-speck fungus from the Early Cretaceous Potomac Group of Virginia (125–112 Ma): *Protographum luttrellii*, gen. et sp. nov. *Mycologia*, *112*(3), 504–518. https://doi.org/10.1080/00275514.2020.1718441

Lechat, C., Gardiennet, A., & Fournier, J. (2017). First report of a lichenicolous species of *Hypomyces* (Hypocreaceae), *H. peltigericola* sp. nov. *Ascomycete.org*, *9*(2), 23–26.

Leighton. (1875). Lichenological Memorabilia No. 6. *Grevillea*, *3*, 113–116.

Leighton, W. (1854). The British species of Angiocarpous Lichens. 1851. Monograph of the British Graphideae. *Ann. and Mag. Nat. Hist., 2nd Ser., xiii*.

Leighton, W. A. (1871). The lichen of Ceylon collected by G.H.K. Thwaites, Esq., Ph.D., F.R.S., F.L.S. In *Transactions of the Linnaean Society of London* (Vol. 27).

Leighton, W. A. (1878). New British Lichens. *Transactions of the Linnean Society of London. 2nd Series: Botany*, *1*(5), 237–240.

Leighton, W. A. (1879). *The Lichen-flora of Great Britain, Ireland, and the Channel Islands*.

Lendemer, J., Harris, R., & Tripp, E. A. (2013). The lichens and allied fungi of Great Smoky Mountains National Park: An annotated checklist with comprehensive keys. *Memoirs of the New York Botanical Garden*, *104*, 1–152.

Lendemer, J. C. (2010). Contributions to the lichen flora of Pennsylvania—further new and interesting reports of lichens and lichenicolous fungi. *Evansia*, *27*(2), 47–65. http://dx.doi.org/10.1639/0747-9859-27.2.47

Lendemer, J. C., Harris, R. C., & Ruiz, A. M. (2016). A Review of the Lichens of the Dare Regional Biodiversity Hotspot in the Mid-Atlantic Coastal Plain of North Carolina, Eastern North America. *Castanea*, *81*(1), 1–77. https://doi.org/10.2179/15-073R2

Lettau, G. (1954). Flechten aus Mitteleuropa IX. *Repertorium novarum specierum regni vegetabilis*, *56*(3), 193–278. https://doi.org/10.1002/fedr.19540560302

Li, G.-J., Hyde, K. D., Zhao, R.-L., Hongsanan, S., Abdel-Aziz, F. A., Abdel-Wahab, M. A., Alvarado, P., Alves-Silva, G., Ammirati, J. F., Ariyawansa, H. A., Baghela, A., Bahkali, A. H., Beug, M., Bhat, D. J., Bojantchev, D., Boonpratuang, T., Bulgakov, T. S., Camporesi, E., Boro, M. C.,…Maharachchikumbura, S. S. N. (2016). Fungal diversity notes 253–366: taxonomic and phylogenetic contributions to fungal taxa. *Fungal Diversity*, *78*(1), 1–237. https://doi.org/10.1007/s13225-016-0366-9

Lichens marins. (2024). http://www.lichensmaritimes.org/index.php?task=fiche&-lichen=633

Lindgren, H., Diederich, P., Goward, T., & Myllys, L. (2015). The phylogenetic analysis of fungi associated with lichenized ascomycete genus *Bryoria* reveals new lineages in the Tremellales including a new species *Tremella huuskonenii* hyperparasitic on *Phacopsis huuskonenii*. *Fungal Biology*, *119*(9), 844–856. https://doi.org/10.1016/j.funbio.2015.06.005

Lindsay, W. L. (1857). Monograph of the genus *Abrothallus*. (De Notaris and Tulasne emend.). *Quarterly Journal of Microscopical Science*, *5*, 27–63.

Lindsay, W. L. (1866). Observations on New Lichens and Fungi collected in Otago, New Zealand. *Transactions of the Royal Society of Edinburgh*, *24*(2), 407–456.

Lindsay, W. L. (1869). Observations on New Lichenicolous Micro-Fungi. *Earth and Environmental Science Transactions of The Royal Society of Edinburgh*, *25*(2), 513–555. https://doi.org/10.1017/S0080456800035316

Link, H. (1809). Observationes in ordines plantarum naturales. Dissertatio Ima. *Magazin für die Neuesten Entdeckungen in der Gesammten Naturkunde, Gesellschaft Naturforschender Freunde zu Berlin*, *3*(1), 3–42.

Lisická, E. (2005). *The lichens of the Tatry Mountains*. VEDA, Slovak Academy of Sciences.

Liu, J.-W., Hu, Y.-F., Luo, X.-X., Castañeda-Ruíz, R. F., Xia, J.-W., Xu, Z.-H., Cui, R.-Q., Shi, X.-G., Zhang, L.-H., & Ma, J. (2023). Molecular phylogeny and morphology reveal four novel species of *Corynespora* and *Kirschsteiniothelia* (Dothideomycetes, Ascomycota) from China: A checklist for *Corynespora* reported worldwide. *Journal of Fungi*, *9*(1), 107. https://doi.org/10.3390/jof9010107

Liu, J. K., Hyde, K. D., Jeewon, R., Phillips, A., Maharachchikumbura, S., Ryberg, M., Liu, Z. Y., & Zhao, Q. (2017). Ranking higher taxa using divergence times: a case study in Dothideomycetes. *Fungal Diversity*, *84*, 75–99. https://doi.org/10.1007/s13225-017-0385-1

Liu, J. K., Hyde, K. D., Jones, E. G., Ariyawansa, H. A., Bhat, D. J., Boonmee, S., Maharachchikumbura, S. S., McKenzie, E. H., Phookamsak, R., & Phukhamsakda, C. (2015). Fungal diversity notes 1–110: taxonomic and phylogenetic contributions to fungal species. *Fungal Diversity*, *72*, 1–197. https://doi.org/10.1007/s13225-015-0324-y

Liu, N.-G., Hyde, K. D., Sun, Y.-R., Bhat, D. J., Jones, E. B. G., Jumpathong, J., Lin, C.-G., Lu, Y.-Z., Yang, J., Liu, L.-L., Liu, Z.-Y., & Liu, J.-K. (2024). Notes, outline, taxonomy and phylogeny of brown-spored hyphomycetes. *Fungal Diversity*. https://doi.org/10.1007/s13225-024-00539-6

Liu, N.-G., Lin, C.-G., Liu, J.-K., Samarakoon, M. C., Hongsanan, S., Bhat, D. J., Hyde, K. D., McKenzie, E. H., & Jumpathong, J. (2018). Lentimurisporaceae, a new Pleosporalean family with divergence times estimates. *Cryptogamie, Mycologie*, *39*(2), 259–282. https://doi.org/10.7872/crym/v39.iss2.2018.259

Liu, Y. J., Whelen, S., & Hall, B. D. (1999). Phylogenetic relationships among ascomycetes: evidence from an RNA polymerse II subunit. *Molecular Biology and Evolution*, *16*(12), 1799–1808.

Locquin, M. (1984). *Mycologie générale et structurale*. Elsevier Masson.

Looman, J. (1962). Some Lichens of Saskatchewan. *The Bryologist*, *65*(4), 294–304. https://doi.org/10.2307/3240731

Louangphan, J., Perera, R. H., & De Farias, A. R. G. (2024). A new addition to Kirschsteiniotheliaceae: *Kirschsteiniothelia chiangmaiensis* sp. nov. from Northern Thailand. *Phytotaxa*, *634*(1), 49–62. https://doi.org/10.11646/PHYTOTAXA.634.1.4

Lowen, R. (1990). New combinations in *Pronectria*. *Mycotaxon*, *39*, 461–463.

Lowen, R. (1995). *Acremonium* section *Lichenoidea* section nov. and *Pronectria oligospora* species nov. *Mycotaxon*, *53*, 81–95.

Lowen, R., Brady, B. L., Hawksworth, D. L., & Paterson, R. R. M. (1986). Two New Lichenicolous Species of Hobsonia. *Mycologia*, *78*(5), 842–846. https://doi.org/10.1080/00275514.1986.12025332

Lowen, R., & Diederich, P. (1990). *Pronectria xanthoriae* and *P. terrestris*, two new lichenicolous fungi (Hypocreales). *Mycologia*, *82*(6), 788–791.

Lücking, R. (1997). Additions and corrections to the knowledge of the foliicolous lichen flora of Costa Rica. The genus *Fellhanera*, with notes on *Bacidia pauciseptata*. *Tropical Bryology*, 141–174.

Lücking, R. (1998). Foliicolous lichens and their lichenicolous fungi collected during the Smithsonian International Cryptogamic Expedition to Guyana 1996. *Tropical Bryology*, *15*, 45–76.

Lücking, R. (2019). Stop the abuse of time! Strict temporal banding is not the future of rank-based classifications in fungi (including lichens) and other organisms. *Critical Reviews in Plant Sciences*, *38*(3), 199–253.

Lücking, R., Aime, M. C., Robbertse, B., Miller, A. N., Aoki, T., Ariyawansa, H. A., Cardinali, G., Crous, P. W., Druzhinina, I. S., & Geiser, D. M. (2021). Fungal taxonomy and sequence-based nomenclature. *Nature microbiology*, *6*(5), 540–548.

Lücking, R., & Leavitt, S. (2017). Corrections and amendments to the 2016 classification of lichenized fungi in the Ascomycota and Basidiomycota. *The Bryologist*, *120*, 58–69. https://doi.org/10.1639/0007-2745-120.1.058

Lücking, R., & Sérusiaux, E. (1998). *Gyalideopsis cochlearifer*, a new pantropical, commensalistic species on foliicolous Gomphillaceae. *The Lichenologist*, *30*(6), 543–549.

Lumbsch, H. T. (1989). Die holarktischen Vertreter der Flechtengattung *Diploschistes* (Thelotremataceae). *The Journal of the Hattori Botanical Laboratory*, *66*, 133–196.

Lumbsch, H. T. (1997). Systematic studies in the suborder *Agyriineae* (Lecanorales). *The Journal of the Hattori Botanical Laboratory*, *83*, 1–73.

Lumbsch, H. T., & Huhndorf, S. M. (2007). Outline of Ascomycota—2007. *Myconet*, *13*, 1–58.

Lumbsch, H. T., & Huhndorf, S. M. (2010). Myconet Volume 14. Part one. Outline of Ascomycota—2009. Part two. Notes on ascomycete systematics. Nos. 4751–5113. *Fieldiana Life Earth Science*, *1*, 1–64.

Lumbsch, H. T., & Lindemuth, R. (2001). Major lineages of Dothideomycetes (Ascomycota) inferred from SSU and LSU rDNA sequences. *Mycological Research*, *105*(8), 901–908. https://doi.org/10.1017/S0953756201004385

Lumbsch, H. T., Morris, C., & McCune, B. (2023). A new species of *Diploschistes* (Lecanoromycetes) occurring on *Stereocaulon* from the Pacific Northwest of North America. *Plant and Fungal Systematics*, *68*(2), 335–339.

Lumbsch, H. T., Schmitt, I., Lindemuth, R., Miller, A., Mangold, A., Fernandez, F., & Huhndorf, S. (2005). Performance of four ribosomal DNA regions to infer higher-level phylogenetic relationships of inoperculate euascomycetes (Leotiomyceta). *Molecular Phylogenetics and Evolution*, *34*(3), 512–524. https://doi.org/10.1016/j.ympev.2004.11.007

Lumbsch, H. T., Schmitt, I., Palice, Z., Wiklund, E., Ekman, S., & Wedin, M. (2004). Supraordinal phylogenetic relationships of Lecanoromycetes based on a Bayesian analysis of combined nuclear and mitochondrial sequences. *Mol Phylogenet Evol*, *31*(3), 822–832. https://doi.org/10.1016/j.ympev.2003.11.001

Lumbsch, T., Ahti, T., Altermann, S., Amo de Paz, G., Aptroot, A., Arup, U., PeÑA, A., Bawingan, P., Navarro Benatti, M., Betancourt Macuase, L., BjÖRk, C., Boonpragob, K., Brand, M., Bungartz, F., Cáceres, M., Candan, M., Chaves, J., Clerc, P., Common, R., & Lücking, R. (2011). One hundred new species of lichenized fungi: A signature of undiscovered global diversity. *Phytotaxa*, *18*, 1–127. https://doi.org/10.11646/phytotaxa.18.1.1

Lynge, B. (1928). *Lichens from Novaya Zemlya:(Excl. of Acrospora and Lecanora)*. AW Brøggers Boktrykkeri.

Ma, J., Liu, N.-G., Tang, X., Xiao, X.-J., Chen, X.-M., Xiao, Y.-P., Zhang, Y.-Z., Lu, Y.-Z., & Boonmee, S. (2023). *Sclerococcum pseudobactrodesmium* sp. nov. from a terrestrial habitat in China. *Phytotaxa*, *630*(1), 69–79. https://doi.org/10.11646/phytotaxa.630.1.6

Magaña-Dueñas, V., Cano-Lira, J. F., & Stchigel, A. M. (2021). New Dothideomycetes from freshwater habitats in Spain. *Journal of Fungi*, *7*(12), 1102.

Magnus, P. (1895). Lichenologische Fragmente. In F. Arnold (Ed.), *Österreichische botanische Zeitschrift* (Vol. XLV, pp. 146–147). Verlag Von Carl Gerold's Sohn.

Magnusson, A. (1940). Lichens from Central Asia 1.

Magnusson, A. (1944). Lichens from Central Asia 2.

Magnusson, A. H. (1924a). *A monograph of the Scandinavian species of the genus Acarospora*. Elanders boktryckeri.

Magnusson, A. H. (1924b). New species of the genus Acarospora. *Svensk Botanisk Tidskrift*, *18*, 329–342.

Magnusson, A. H. (1927). New species of lichens in the north of U.S.S.R. . *Izvestija Glavnogo Botaniceskogo Sada SSSR*, *26*(4), 359–370.

Magnusson, A. H. (1929). A monograph of the genus acarospora. *Kongliga Svenska Vetenskapsakademiens Handlinger*, *7*(4), 1–400.

Magnusson, A. H. (1930). The lichen genus Acarospora in New Mexico. *Meddelelser från Götebörgs Botaniska Trädgård*, *5*, 55–72.

Magnusson, A. H. (1936). *Neue Flechten aus dem Jenisei-Gebiet*.

Magnusson, A. H. (1942). New or otherwise interesting Swedish lichens XI. *Botaniska Notiser*(1), 1–18.

Magnusson, A. H. (1946). Lichens from Lycksele Lappmark and adjacent part of Norway. *Arkiv för Botanik*, *33A*(1), 1–146.

Magnusson, A. H. (1954). Some new European lichens. *Mitteilungen aus der Botanischen Staatssammlung München*, *1*, 451–455.

Magnusson, A. H. b. (1952). Lichens from Torne Lappmark. *Arkiv för Botanik*, *2*, 45–249.

Maharachchikumbura, S. S. N., Hyde, K. D., Jones, E. B. G., McKenzie, E. H. C., Bhat, J. D., Dayarathne, M. C., Huang, S. K., Norphanphoun, C., Senanayake, I. C., Perera, R. H., Shang, Q. J., Xiao, Y. P., D'Souza, M. J., Hongsanan, S., Jayawardena, R. S., Daranagama, D. A., Konta, S., Goonasekara, I. D., Zhuang, W. Y.,…Wijayawardene, N. N. (2016). Families of Sordariomycetes. *Fungal Diversity*, *79*(1), 1–317. https://doi.org/ 10.1007/s13225-016-0369-6

Maire, R. W., R.G. (1937). Fungi maroccani. Catalogue raisonné des champignons connus jusqu'ici au Maroc. *Mémoires de la Société des Sciences Naturelles du Maroc*, *45*, 1–147.

Malme, G. O. A. (1914). Västra Jämtlands Rhizocarponariei. *Svensk Botanisk Tidskrift*, *8*(3), 273–294.

Mapook, A., Hyde, K., Hongsanan, S., Phukhamsakda, C., Li, J., & Boonmee, S. (2016). Palawaniaceae fam. nov., a new family Dothideomycetes, Ascomycota to accommodate *Palawania* species and their evolutionary time estimates. *Mycosphere*, *7*(11), 1732–1745.

Mapook, A., Hyde, K. D., McKenzie, E. H., Jones, E. G., Bhat, D. J., Jeewon, R., Stadler, M., Samarakoon, M. C., Malaithong, M., & Tanunchai, B. (2020). Taxonomic and phylogenetic contributions to fungi associated with the invasive weed *Chromolaena odorata* (Siam weed). *Fungal Diversity*, *101*, 1–175. https://doi.org/10.1007/s13225-020-00444-8

Marchand, L. (1896). *Énumération méthodique et raisonnée des familles et des genres de la classe des Mycophytes (Champignons & Lichens)*.

Marthinsen, G., Rui, S., & Timdal, E. (2019). OLICH: A reference library of DNA barcodes for Nordic lichens. *Biodiversity Data Journal*, *7*, e36252.

Martınez, A. (1968). Fossil Microthyriales (fungi, Ascomycetes) from the lower Cretaceous of Santa Cruz Province, Argentina. *Revista de la Asociación Paleontológica Argentina. Ameghiniana*, *5*, 257–263.

Massalongo, A. (1853). *Memorie Lichenographiche*.

Massalongo, A. B. (1853). *Ricerche sull'autonomia dei licheni crostosi*. H.F. Münster.

Massalongo, A. B. (1853). *Sulla Lecidea hookeri di Schaerer Nota*. Ramanzini.

Massalongo, A. B. (1854). *Geneacaena Lichenum noviter proposita ac descripta*. Typis Ramanzinianis.

Massalongo, A. B. (1855). *Schedulae criticae in lichenes exsiccatos Iatliae AB Massalongo*.

Massalongo, A. D. B. (1856). *Miscellanea lichenologic*.

Matruchot, M. (1899). Notes mycologiques. I. Gliocephalis hyalina. *Bull Soc Mycol France*, *15*, 254–262.

Matsushima, T. (1993). Matsushima Mycological Memoirs. No. 7. *Kobe: Matsushima Fungus Collection*, 1–75.

Matzer, M. (1993). Beitrag zur Kenntnis der Ascomycetengattungen *Globosphaeria, Roselliniopsis* und *Synaptospora*. *Cryptogamie Mycologie*, *14*(1), 11–19.

Matzer, M. (1996). Lichenicolous ascomycetes with fissitunicate asci on foliicolous lichens. *Mycological Papers*, *171*, 1–202.

Matzer, M., & Hafellner, J. (1990). *Eine Revision der lichenicolen Arten der Sammelgattung Rosellinia (Ascomycetes)* (Vol. 37). J. Cramer.

Maurya, P., Mishra, G. K., & Upreti, D. K. (2024). New Lichenicolous *Phyllopsora* (Ramalinaceae) Species on *Phaeophyscia* from India. *Biology Bulletin*, *51*(3), 537–539.

Mayrhofer, H. (1987). Ergänzende Studien zur Taxonomie der Gattung Protothelenella. *Herzogia*, 313–342.

Mayrhofer, H., & Poelt, J. (1985). Die Flechtengattung Microglaena sensu Zahlbruckner in Europa. *Herzogia*, 13–79.

Mayrhofer, M. (1987). Studien über die saxicolen Arten der Flechtengattung Lecania in Europa 1. Halecania gen. nov. *Herzogia*, 381–406.

McCarthy, P. M., & Elix, J. A. (2020). A new species of the lichenicolous genus *Phaeospora* Hepp ex Stein (Verrucariales) from Australia. *Australasian Lichenology*, *87*, 48–51.

Mehrabi, M., Hemmati, R., & Asgari, B. (2017). *Kirschsteiniothelia arasbaranica* sp. nov.*,* and an emendation of the Kirschsteiniotheliaceae. *Cryptogamie Mycologie*, *38*(1), 13–25. https://doi.org/10.7872/crym/v38.iss1.2017.13

Meng, Q.-F., Thiyagaraja, V., Ertz, D., Worthy, F. R., Saichana, N., & Fu*, S.-B. (2024). *Sclerococcum glaucomarioides*: a new geographical record from China. *Phytotaxa*, *642*(1), 95–103. https://doi.org/10.11646/phytotaxa.642.1.8

Merinero, S., & Gauslaa, Y. (2018). Specialized fungal parasites reduce fitness of their lichen hosts. *Annals of Botany*, *121*(1), 175–182. https://doi.org/10.1093/aob/mcx124

Miądlikowska, J., & Alstrup, V. (1995). Some peltigericolous fungi and lichens mainly from Poland. *Graphis Scripta*, *7*(1), 7–10.

Millanes, A., Diederich, P., Westberg, M., Pippola, E., & Wedin, M. (2015). *Tremella cetrariellae* (Tremellales, Basidiomycota, Fungi), a new lichenicolous fungus on *Cetrariella delisei*. *The Lichenologist*, *47*(6), 359–368.

Millanes, A., Westberg, M., Wedin, M., & Diederich, P. (2012). *Tremella diploschistina* (Tremellales, Basidiomycota, Fungi), a new lichenicolous species growing on *Diploschistes*. *The Lichenologist*, *44*(3), 321–332.

Millanes, A. M., Diederich, P., & Wedin, M. (2016). *Cyphobasidium* gen. nov., a new lichen-inhabiting lineage in the Cystobasidiomycetes (Pucciniomycotina, Basidiomycota, Fungi). *Fungal Biology*, *120*(11), 1468–1477.

Millanes, A. M., Diederich, P., Westberg, M., Knutsson, T., & Wedin, M. (2014). *Tremella rhizocarpicola* sp. nov. and other interesting Tremellales and Filobasidiales in the Nordic countries. *MycoKeys*, *8*, 31–41.

Millanes, A. M., Diederich, P., Westberg, M., & Wedin, M. (2016). Three new species in the *Biatoropsis usnearum* complex. *Herzogia*, *29*(2), 337–354.

Millanes, A. M., Diederich, P., Westberg, M., & Wedin, M. (2021). *Crittendenia* gen. nov., a new lichenicolous lineage in the Agaricostilbomycetes (Pucciniomycotina), and a review of the biology, phylogeny and classification of lichenicolous heterobasidiomycetes. *The Lichenologist*, *53*(1), 103–116. https://doi.org/10.1017/S002428292000033X

Miller, M. A., Pfeiffer, W., & Schwartz, T. (2010). Creating the CIPRES Science Gateway for inference of large phylogenetic trees. 2010 gateway computing environments workshop (GCE),

Miller, M. A., Pfeiffer, W., & Schwartz, T. (2010). Creating the CIPRES Science Gateway for inference of large phylogenetic trees. Grid Computing Environments, San Diego Supercomputer Center.

Mindell, R. A., Stockey, R. A., Beard, G., & Currah, R. S. (2007). *Margaretbarromyces dictyosporus* gen. sp. nov.: a permineralized corticolous ascomycete from the Eocene of Vancouver Island, British Columbia. *Mycological Research*, *111*(6), 680–684.

Molitor, F., & Diederich, P. (1997). Les pyrénolichens aquatiques du Luxembourg et leurs champignons lichénicoles. *Bulletin-Societe Des Naturalistes Luxembourgeois*, *98*, 69–92.

Möller, C., & Gams, W. (1993). Two new hyphomycetes isolated from Antarctic lichens. *Mycotaxon*, *48*(1), 441–450.

Montagne, J. N. (1849). Sixième centurie de plantes cellulaires nouvelles, tant indigènes qu'exotiques. Décades VIII a X. Annales des Sciences Naturelles. *Botanique.*, *Sér. 3, 12*, 285–320.

Montagne, J. P. F. C. (1845). Cinquième Centurie de plantes cellulaires exotiques nouvelles. Décades VII à X. *Annales des Sciences Naturelles. Botanique*, *ser. 3, 4*, 346–367.

Montagne, J. P. F. C. (1851). Cryptogamia Guyanensis seu Plantarum cellularium in Guyana gallica annis 1835-1849 a cl. Leprieur collectarum enumerato universalis. *Annales des Sciences Naturelles. Botanique*, *16*, 47–81.

Monteiro, J. S. M. (2009). *Hifomicetos (fungos anamorfos) associados a palmeira na floresta nacional de Caxiuanã, Melgaço, Pará, Brasil.* UFRA/Campus Belém].

Moreau, F. (1951). Un Champignon lichénicole cécidogène, *Phyllosticta galligena*, sp. nov. *Bulletin de la Société Botanique de France*, *98*(4–6), 100–102. https://doi.org/10.1080/00378941.1951.10834888

Moriyama, T., Tanaka, C., & Masumoto, H. (2024). *Skyttella mulleri*, a lichenicolous fungus new to Japan. *Japanese Journal of Mycology*, *65*(1), 9–16.

Morse, C. (2013). A new lichenicolous *Enterographa* (Arthoniales, Roccellaceae) from Central North America. *Opuscula Philolichenum*, *12*, 233–240.

Moser, M. (1996). *Botanika i Mikologiya na Puti v Tret'e Tysyacheletie*.

Motiejūnaitė, J., & Alstrup, V. (2006). *Graphium samogiticum*-a new hyphomycete species from Lithuania. *Nova Hedwigia*, *83*(1–2), 249–252.

Motiejūnaitė, J., & Kukwa, M. (2008). *Pronectria minuta*, a new lichenicolous ascomycete from Poland and Russia. *Mycotaxon*, *104*, 229–234.

Motiejunaite, J., Zhurbenko, M., Suija, A., & Kantvilas, G. (2019). Lichenicolous ascomycetes on *Siphula*-like lichens, with a key to the species. *The Lichenologist*, *51*(1), 45–73. https://doi.org/ 10.1017/S0024282918000579

Mudd, W. (1861). *A Manual of British Lichens: Containing Descriptions of All the Species and Varieties*. Harrison Penney.

Muggia, L., & Grube, M. (2018). Fungal diversity in lichens: from extremotolerance to interactions with algae. *Life*, *8*(2), 15.

Muggia, L., Kocourková, J., & Knudsen, K. (2015). Disentangling the complex of Lichenothelia species from rock communities in the desert. *Mycologia*, *107*(6), 1233–1253. https://doi.org/10.3852/15-021

Muggia, L., Kopun, T., & Ertz, D. (2015). Phylogenetic placement of the lichenicolous, anamorphic genus Lichenodiplis and its connection to

Muellerella-like teleomorphs. *Fungal Biol*, *119*(11), 1115–1128. https://doi.org/10.1016/j.funbio.2015.08.011

Müller, E., & von Arx, J. A. (1962). *Die Gattungen der didymosporen pyrenomyceten* (Vol. 11). Büchler.

Müller, J. (1862). Principes de classification des lichens et énumeration des lichens de Genève. *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève*, *16*, 343–433.

Müller, J. (1874). Lichenologische Beiträge. I. *Flora (Regensburg)*, *57*, 185–192.

Müller, J. (1874). Lichenologische Beiträge. III. *Flora (Regensburg)*, *57*, 529–539.

Müller, J. (1875). Lichenologische Beiträge. IV. *Flora*, *58*, 59–63.

Müller, J. (1877). Lichenologische Beiträge. VI. *Flora*, *60*, 471–479.

Müller, J. (1882). Lichenologische Beiträge XVI. *Flora (Regensburg)*, *65*(33), 515–519.

Müller, J. (1887). Lichenologische Beiträge XXVI. *Flora*, *70*, 396–402.

Müller, J. (1887). *Mémoires de la société de physique et d'histoire naturelle de genève* (Vol. 29). Graphidezae Feeanzae.

Müller, J. (1888). Lichenes Paraguayenses. *Rev. Mycol. (Toulouse). 10*, 113–120.

Müller, J. (1890). Lichenologische Beiträge XXXIII. *Flora*, *73*, 187–202.

Müller, J. (1895). Graphideae eckfeldtianae in Louisiana et Florida lectae additis observationibus in graphidear calkinsianas ejusdem regionis. *Bulletin de l'Herbier Boissier*, *3*(2), 41–50.

Muniz, D., Llop, E., & Hladun, N. (2013). *Sphinctrina paramerae*, a new Mediterranean lichenicolous species with non-septate spores. *The Lichenologist*, *45*(2), 137–143.

Muntañola-Cvetković, M., & Gómez-Bolea, A. (1998). *Arborillus llimonae* nov. gen. et sp., a synnematous lichenicolous hyphomycete. *Mycotaxon -Ithaca Ny-*, *68*, 145–155.

Muscavitch, Z. M., Lendemer, J. C., & Harris, R. C. (2017). A synopsis of the lichenicolous fungi occurring on *Phlyctis* including description of a new *Monodictys widespread* on *P. speirea*. *Bryologist*, *120*(4), 418–426.

Nannfeldt, J., & Santesson, R. (1975). Stray studies in the Coronophorales (Pyrenomycetes) 4-8. *Svensk Botanisk Tidskrift*, *69*(3), 289–335.

Nascimbene, J., Nimis, P. L., Klüßendorf, J., & Thüs, H. (2023). Freshwater lichens, including new species in the genera *Verrucaria*, *Placopyrenium* and *Circinaria*, associated with *Lobothallia hydrocharis* (Poelt & Nimis) Sohrabi & Nimis from watercourses of Sardinia. *Journal of Fungi*, *9*(3), 380.

Nash III, T. H., Ryan, B. D., Diederich, P., Gries, C., & Bungartz, F. (2004). *Lichen Flora of the Greater Sonoran Desert Region* (Vol. 2).

Nash, T., Diederich, P., Bungartz, F., & Ryan, B. (2002). Lichen Flora of the Greater Sonoran Desert Region vol. I. 1-532.

Navarro-Rosinés, P. (1998). Validación de *Wernerella maheui* (R.-G. Werner) Nav.-Ros., Cl. Roux et Giralt (Dothideales, Ascomycetes) y adición de una nueva localidad. *Bulletin de la Société linnéenne de Provence*, *49*, 137–138.

Navarro-Rosinés, P. (2017). *Sphaerellothecium aipolium* Vouaux ex Nav.–Ros. et Cl. Roux sp. nov.(Mycosphaerellaceae, Dothideomycetes), un hongo liquenícola no liquenizado que crece sobre *Physcia*. *Bulletin de la Société linnéenne de Provence*, *68*, 141–149.

Navarro-Rosinés, P., Boqueras, M., & Roux, C. (1998). Nuevos datos para el género *Lichenochora* (Phyllachorales, Ascomicetes liquenícolas). *Bull. Soc. Linn. Provence*, *49*, 107–124.

Navarro-Rosinés, P., Calatayud, V., & Hafellner, J. (2004). Cercidospora. In T. H. I. Nash, B. D. Ryan, P. Diederich, C. Gries, & F. Bungartz (Eds.), *Lichen Flora of the Greater Sonoran Desert Region, Volume 2. Lichens Unlimited* (pp. 635–639). Arizona State University.

Navarro-Rosinés, P., Calatayud, V., & Hafellner, J. (2009). Contributions to a revision of the genus *Cercidospora* (Dothideales) 1. Species on Megasporaceae. *Mycotaxon*, *110*(1), 5–25.

Navarro-Rosinés, P., & Etayo, J. (2001). *Lichenochora epinashii* sp. nov. and *L. sinapispermae* sp. nov. (Phyllachorales, Ascomicetes), two new lichenicolous fungi growing in *Caloplaca*. *Cryptogamie Mycologie*, *22*(2), 147–158.

Navarro-Rosinés, P., & Etayo, J. (2018). Sobre la presencia de *Pseudopyrenidium tartaricola* (Eurotiomycetes, hongos liquenícolas) en los Pirineos. *Revista Catalana de Micologia*, 69–76.

Navarro-Rosinés, P., Gueidan, C., Simón, N. L. H., & Roux, C. (2009). Sinopsis del género *Sarcopyrenia* (Ascomycota, hongos liquenícolas), con la descripción de tres nuevas especies. *Revista Catalana de Micologia*, 49–69.

Navarro-Rosinés, P., & Hafellner, J. (1996). *Lichenostigma elongata* spec. Nov. (Dothideales), a lichenicolous ascomycete on *Lobothallia* and *Aspicilia* species. *Mycotaxon*, *57*, 211–225.

Navarro-Rosinés, P., & Hladun, N. (1990). El género *Sarcopyrenia* Nyl.(ascomicetes liquenícolas) en Europa y norte de Africa. *Candollea*, *45*(2), 469–489.

Navarro-Rosinés, P., & Hladun, N. (1995). *Opegrapha rouxiana* sp. nov., nelikeniginta fungo likenloga ce enpetraj *Polyblastia*. *Bulletin de la Société Linéenne de Provence*, *46*, 85–90.

Navarro-Rosinés, P., & Pérez, D. M. (2009). *Skyttea heterochroae* comb. et nom. nov.(Helotiales) un hongo liquenícola propio de *Pertusaria heterochroa*, presente en Catalunya, Islas Baleares y Maltra. *Revista Catalana de Micologia*, *31*, 77–85.

Navarro-Rosinés, P., & Romero, C. (2019). *Sclerococcum stigma* (Dactylosporaceae) una nueva combinación para *Dactylospora stigma*, un hongo liquenícola olvidado que crece sobre *Porpidia macrocarpa*. *Revista Catalana de Micologia*, *40*, 35–42.

Navarro-Rosinés, P., & Roux, C. (1995). Le genre *Weddellomyces* (Dothideales, Dacampiaceae) en Catalogne et en Provence. *Mycotaxon*, *53*, 161–187.

Navarro-Rosinés, P., & Roux, C. (1996). Le *Clauzadella gordensis* gen. et sp. nov., ascomycète lichénicole non lichénisé (Verrucariales, Verrucariaceae). *Canadian Journal of Botany*, *74*(9), 1533–1538.

Navarro-Rosinés, P., & Roux, C. (1997). *Weddellomyces protearius* sp. nov et *Lichenochora xanthoriae*, champignons lichénicoles non lichénises parasites de *Caloplaca* Proteus. *Mycotaxon*, *61*, 433–440.

Navarro-Rosinés, P., & Roux, C. (1998). *Polycoccum clauzadei* sp. nov.(Ascomycetes, Dothideales), champignon lichénicole non lichénisé sur *Xanthoria elegans*. *Mycotaxon*, *69*, 327–338.

Navarro-Rosinés, P., Roux, C., & Bricaud, O. (1998). *Sarcopyrenia acutispora* Nav.–Ros. et Cl. Roux sp. nov., nelikeniĝinta fungo likenloĝa (Ascomycetes, Verrucariales, Sarcopyreniaceae Nav.–Ros. et Cl. Roux fam. nov.). *Bull. Soc. Linn. Provence*, *49*, 125–135.

Navarro-Rosinés, P., Roux, C., & Casares, M. (1995). Hongos liquenícolas de Squamarina II: Sobre la identidad de "*Didymella*" *crozalsiana* (Ascomycetes). *Cryptogamie Bryologie Lichénologie*, *16*(2), 99–103.

Navarro-Rosinés, P., Roux, C., & Diederich, P. (1998). *Lichenochora bellemerei* sp. nov., champignon lichénicole non lichénisé (Ascomycetes, Phyllachorales). *Cryptogamie, Bryologie-Lichénologie*, *19*(2–3), 211–219.

Navarro-Rosinés, P., Roux, C., & Giralt, M. (1996). *Wernerella* gen. nov. (Dothideales, Ascornycetes) un género para incluir *Leptosphaeria* maheui Werner. *Bulletin de la Société linnéenne de Provence*, *47*, 167–177.

Navarro-Rosinés, P., Roux, C., & Gueidan, C. (2007). La genroj *Verrucula* kaj *Verruculopsis* (Verrucariaceae, Verrucariales). *Bull. Soc. Linn. Provence*, *58*, 133–180.

Navarro-Rosinés, P., Roux, C., & Hafellner, J. (2018). *Sphaerellothecium pumilum* comb. nov.(hongos liquenícolas, Dothideomycetes), un nombre prioritario sobre *S. aipolium*. *Revista Catalana de Micologia*, 117–127.

Navarro-Rosinés, P., Roux, C., & Llimona, X. (1994). Nelikenigintaj fungoj ce Squamarina: *Clypeococcum epicrassum* comb. nov. kaj *Lichenochora clauzadei* sp. nov.(Ascomycetes). *Bulletin de la Société linnéenne de Provence*, *45*, 421–429.

Navarro-Rosinés, P., Zhurbenko, M., & Roux, C. (2010). *Pseudopyrenidium* un nouveau genre pour inclure *Weddellomyces tartaricola* (champignon lichénicole non lichénisé, Ascomycota). *Bulletin de la Société linnéenne de Provence*, *61*, 129–140.

Navarro, R. P., & Roux, C. (1997). *Bellemerella trapeliae* gen. and sp. nov., a lichenicolous Ascomycete not a lichen (Verrucariaceae). *Mycotaxon*, *61*, 441–454.

Navrotskaya, I., Kondratyuk, S. Y., Wasser, S., Nevo, E., & Zelenko, S. (1996). Lichens and lichenicolous fungi new for Israel and other countries. *Israel Journal of Plant Sciences*, *44*(2–3), 181–193. https://doi.org/10.1080/07929978.1996.10676646

Nguyen, L.-T., Schmidt, H. A., Von Haeseler, A., & Minh, B. Q. (2015). IQ-TREE: a fast and effective stochastic algorithm for estimating maximum-likelihood phylogenies. *Molecular Biology and Evolution*, *32*(1), 268–274. https://doi.org/10.1093/molbev/msu300

Nimis, P. (1993). *The Lichens of Italy. An Annotated Catalogue* (Vol. 99).

Nimis, P., Poelt, J., Tretiach, M., Ottonello, D., Puntillo, D., & Vezda, A. (1994). Contributions to lichen floristics in Italy. VII. The Lichens of Marettimo (Egadi Islands, Sicily). *Bulletin de la Société linnéenne de Provence*, *45*, 247–262.

Nimis, P. L., & Poelt, J. (1987). The lichens and lichenicolous fungi of Sardinia (Italy).

Nordin, A., & Tibell, L. (2005). Additional species in Tetramelas. *The Lichenologist*, *37*(6), 491–498.

Nordin, I. (1964). *Abrothallus suecicus*, a common lichenicolous fungus. *Svensk Botanisk Tidskrift*, *58*, 225–232.

Nylander. (1856). Synopsis du genre *Arthonia*. *Mém. Soc. Imp. Sci. Nat. Cherbourg*, *4*, 85–104.

Nylander, W. (1852). Observationes aliquot ad synopsin lichenum Holmiensium. *Botaniska Notiser*, *11–12*, 161–192.

Nylander, W. (1853). Collectanea lichenologica in Gallia meridionali et Pyrenaeis. *Botaniska Notiser*, 151-165.

Nylander, W. (1854). Études sur les lichens d'Algérie. *Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg*, *2*, 305–344.

Nylander, W. (1855). Essai d'une nouvelle classification des lichens: Second mémoire. *Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg*, *3*, 161–202.

Nylander, W. (1857). Prodromus lichenographiae Galliae et Algeriae. *Actes de la Société Linnéenne de Bordeaux*, *21*, 249–461.

Nylander, W. (1858a). Enumération générale de lichens, avec l'indication sommaire de leur distribution géographique. *Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg*, *5*, 85–146.

Nylander, W. (1858b). *Expositio synoptica pyrenocarpeorum quam conscripsit W. Nylander* (Vol. 4). Ex typ. Cosnier et Lachèse.

Nylander, W. (1860). *Synopsis Methodica Lichenum Omnium hucusque Cognitorum, Praemissa Introductione Lingua Gallica* (Vol. 1).

Nylander, W. (1861). Lichenes Scandinaviae sive prodromus lichenographiae Scandinaviae. *Notiser ur Sällskapets pro Fauna et Flora Fennica Förhandlingar*, *5*.

Nylander, W. (1863). Lichenographia Novogranatensis prodromus. *Acta Societatis Scientiarum Fennicae*, *7*, 415–504.

Nylander, W. (1865). Novitatiae quaedum lichenum europaeorum variarum tribuum. *Flora (Regensburg)*, *48*(14), 209–213.

Nylander, W. (1866a). Addenda nova ad lichenographiam Europaeam. Contin. II. *Flora*, *49*, 369–374.

Nylander, W. (1866b). Collectio lichenum ex insula Cuba. *Flora*, *49*, 289–295.

Nylander, W. (1866c). Lichenes Lapponiae orientalis. 101–192.

Nylander, W. (1867). Addenda quodam Lichenographiam Novae Zelandiae. *Flora*, *50*, 438–440.

Nylander, W. (1868a). Addenda nova ad lichenographiam Europaeam. Contin. VII. *Flora*, *51*, 161–165.

Nylander, W. (1868). Addenda nova ad lichenographiam europaeam. Continuatio octava. *Flora*, *51*, 342–348.

Nylander, W. (1868b). Synopsis Lichenum Novae Caledoniae. *Bulletin de la Société Linnéenne de Normandie*, *Ser. 2, 2*.

Nylander, W. (1869). Addenda nova ad Lichenographiam Europaeam. Continuatio undecima. *Flora (Regensburg)*, *52*, 293–298.

Nylander, W. (1872). Addenda nova ad Lichenographiam Europaeam. Contin. XIV. *Flora*, *55*, 353–365.

Nylander, W. (1873). *Observata lichenologica in Pyrenaeis orientalibus*. Typographie de F. Le Blanc-Hardel, libraire.

Nylander, W. (1874). Addenda nova ad Lichenographiam Europaeam. Contin. XIV. *Flora*, *57*, 6–16.

Nylander, W. (1875a). Addenda nova ad lichenographiam europaeam. Cont. XX. *Flora (Regensburg)*, *58*, 102–106.

Nylander, W. (1875b). Addenda nova ad lichenographiam Europaeam. Contin. XXI. *Flora*, *58*, 297–303.

Nylander, W. (1876). Addenda nova ad lichenographiam Europaeam. Contin. XXIV. *Flora*, *59*, 231–239.

Nylander, W. (1877). Addenda nova ad lichenographiam Europaeam. Contin. XXVII. *Flora (Regensburg)*, *60*, 220–233.

Nylander, W. (1879a). Addenda nova ad Lichenographiam Europaeam. Cont. XXXI. *Flora (Regensburg)*, *62*, 220–224.

Nylander, W. (1879b). Addenda nova ad Lichenographiam Europaeam. Cont. XXXII. *Flora*, *62*, 353–362.

Nylander, W. (1884). Addenda nova ad Lichenographiam europaeam. Contin. XLII. *Flora (Regensburg)*, *67*(21), 387–393.

Nylander, W. (1886). Lichenes Insulae San Thomé. *Flora*, *69*, 171–178.

Nylander, W. (1896). *Les lichens des environs de Paris*. Typographie Paul Schmidt.

Nylander, W., & Hue, A. M. (1886). Addenda nova ad lichenographiam europaeam. Contin. XLV. *Flora (Regensburg)*, *69*, 97–102.

Obermayer, W. (1994). Die Flechtengattung *Arthrorhaphis* (Arthrorhaphidaceae, Ascomycotina) in Europa und Grönland. *Nova Hedwigia*, *58*(3), 275–334.

Ohlert, A. (1870). Zusammenstellung der Lichenen der Provinz Preussen. *Schriften der Königlichen Physikalisch-Ökonomischen Gesellschaft zu Königsberg*, *11*, 1–51.

Ohmaki, A., Okane, I., Crous, P., & Verkley, G. (2023). *Cylindromonium dirinariae* sp. nov.(Ascomycota, Hypocreales), a new nectrioid lichenicolous species on *Dirinaria applanata* in Japan. *Fungal Systematics and Evolution*, *11*(1), 1–10.

Olariaga, I., Teres, J., Martín, J., Prieto, M., & Baral, H.-O. (2019). *Pseudosclerococcum golindo*i gen. et sp. nov., a new taxon with apothecial ascomata and a *Chalara*-like anamorph within the Sclerococcales (Eurotiomycetes). *Mycological Progress*, *18*(7), 895–905. https://doi.org/10.1007/s11557-019-01500-7

Olech, M., & Alstrup, V. (1990). *Thelocarpon cyaneum* sp. nov. *Nordic Journal of Botany*, *9*(5), 575–576.

Olech, M., & Alstrup, V. (1996). *Dactylospora dobrowolskii* sp. nov. and additions tothe flora of lichens and lichenicolous fungiof Bunger Oasis, East Antarctica. *Polish Polar Research*, *17*(3–4), 165–168.

Olech, M., & Søchting, U. (1993). Four new species of *Caloplaca* from Antarctica. *The Lichenologist*, *25*(3), 261–269.

Oliveira, T. G. L., Bezerra, J. D. P., Silva, I. R. d., Souza-Motta, C. M., & Magalhães, O. (2021). Diversity of endophytic fungi in the leaflets and branches of *Poincianella pyramidalis*, an endemic species of Brazilian tropical dry forest. *Acta Botanica Brasilica*, *34*, 755–764. https://doi.org/10.1590/0102-33062020abb0253

Olivier, H. (1905). Les principaux parasites de nos lichens francais. *Bulletin de l'Academie Internationale de Geographie Botanique*, *15*, 273–284.

Olivier, H. (1906). Les Principaux parasites de nos lichens français. *Bulletin de l'Academie Internationale de Geographie Botanique*, *16*, 187–200.

Olivier, H. (1907). Les principaux parasites de nos lichens frangais. *Bulletin de l'Academie Internationale de Geographie Botanique*, *17*, 123–128.

Orange, A. (2002). Lichenicolous fungi on Ionaspis lacustris. *Mycotaxon*, *81*, 265–279.

Orange, A. (2009). Two parasitic species of *Placopyrenium* (Verrucariaceae) from freshwater habitats in north-west Europe. *The Lichenologist*, *41*(2), 131–139.

Øvstedal, D., Tønsberg, T., & Elvebakk, A. (2009). The lichen flora of Svalbard. *Sommerfeltia*, *33*(1), 1–393.

Øvstedal, D. O., Broady, P. A., & Fryday, A. M. (2021). A new *Sclerococcum* (Dactylosporaceae, Ascomycota) on *Gloeocapsa* from Antarctica. *Australasian Lichenology*, *88*, 40–44.

Øvstedal, D. O., Broady, P. A., & Fryday, A. M. (2021). A new Sclerococcum (Dactylosporaceae, Ascomycota) on Gloeocapsa from Antarctica. *Australasian Lichenology*, *88*, 40-44.

Øvstedal, D. O., & Hawksworth, D. L. (1986). Lichenicolous ascomycetes from Bouvetoya. *Norsk Polarinstitutt Skrifter*, *185*, 57–60.

Palice, Z., Printzen, C., Spribille, T., Svensson, M., TØNsberg, T., Urbanavichene, I., Yakovchenko, L. S., & Ekman, S. (2013). Taxonomy of the genus *Myrionora*, with a second species from South America. *The Lichenologist*, *45*(2), 159–167. https://doi.org/10.1017/S0024282912000692

Pang, K.-L., Abdel-Wahab, M. A., Sivichai, S., El-Sharouney, H. M., & Jones, E. G. (2002). Jahnulales (Dothideomycetes, Ascomycota): a new order of lignicolous freshwater ascomycetes. *Mycological Research*, *106*(9), 1031–1042.

Pang, K.-L., Guo, S.-Y., Alias, S. A., Hafellner, J., & Jones, E. B. G. (2014). A new species of marine *Dactylospora* and its phylogenetic affinities within the Eurotiomycetes, Ascomycota. *Botanica Marina*, *57*(4), 315–321. https://doi.org/ 10.1515/bot-2014-0025

Pärtel, K., Baral, H.-O., Tamm, H., & Põldmaa, K. (2017). Evidence for the polyphyly of *Encoelia* and *Encoelioideae* with reconsideration of respective families in Leotiomycetes. *Fungal Diversity*, *82*, 183–219. https://doi.org/10.1007/s13225-016-0370-0

Paz-Bermúdez, G., Divakar, P. K., Etayo, J., & Araujo, E. (2023). The lichen collection from Angola and Mozambique in COI (Coimbra, Portugal). *The Bryologist*, *126*(1), 19–34. https://doi.org/10.1639/0007-2745-126.1.019

Paz-Bermúdez, G., & Etayo, J. (2019). On three lichenicolous species on *Roccella montagnei* from Angola with a description of the new species *Lecanographa rosea* (Lecanographaceae) and a key to the lichenicolous fungi growing on *Roccella* (Roccellaceae). *Nova Hedwigia*, *108*(3–4), 547–554. https://doi.org/10.1127/nova_hedwigia/2018/0515

Pegler, D. N. (1983). Agaric flora of the Lesser Antilles. *Kew Bulletin Additional Series*, *9*, 1–668.

Pegler, D. N., Spooner, B., & Smith, R. L. (1980). Higher fungi of Antarctica, the subantarctic zone and Falkland Islands. *Kew Bulletin*, 499–562.

Pem, D. (2019). Mycosphere notes 275–324: A morpho-taxonomic revision and typification of obscure Dothideomycetes genera (incertae sedis). *Mycosphere*, *10*, 1115–1246. https://doi.org/10.5943/mycosphere/10/1/22

Pem, D., Hyde, K. D., McKenzie, E. H. C., Hongsanan, S., Wanasinghe, D. N., Boonmee, S., Darmostuk, V., Bhat, J. D., Tian, Q., Htet, Z. H., Senanayake, I. C., Niranjan, M., Sarma, V. V., Doilom, M., & Dong, W. (2024). A comprehensive overview of genera in Dothideomycetes. *Mycosphere*, *15*(1), 2175-4568. https://doi.org/10.5943/mycosphere/15/1/18

Penzig, A. J. O., & Saccardo, P. A. (1902). Diagnoses fungorum novorum in insula Java collectorum. Series Tertia. *Malpighia*, *15*(7–9), 201–260.

Perera, R. H., Hyde, K. D., Jones, E. B. G., Maharachchikumbura, S. S. N., Bundhun, D., Camporesi, E., Akulov, A., Liu, J. K., & Liu, Z. Y. (2023). Profile of Bionectriaceae, Calcarisporiaceae, Hypocreaceae, Nectriaceae, Tilachlidiaceae, Ijuhyaceae fam. nov., Stromatonectriaceae fam. nov. and Xanthonectriaceae fam. nov. *Fungal Diversity*, *118*(1), 95-271. https://doi.org/10.1007/s13225-022-00512-1

Pérez-Ortega, S., & Calatayud, V. (2009). *Lichenostigma epirupestre*, a new lichenicolous species on *Pertusaria* from Spain. *Mycotaxon*, *107*(1), 189–195. https://doi.org/10.1007/s00294-006-0080-3

Pérez-Ortega, S., & Etayo, J. (2008). A new species of *Lecanora* s. lat., growing on *Lasallia pustulata*. *The Lichenologist*, *40*(2), 111–118.

Pérez-Ortega, S., & Etayo, J. (2010). *Labrocarpon* gen. nov. for *Melaspilea canariensis*, with the description of *Buelliella protoparmeliopsis* sp. nov. from South America. *The Lichenologist*, *42*(3), 271–276. https://doi.org/10.1017/S0024282909990624

Pérez-Ortega, S., Etayo, J., Elix, J. A., & Crespo, A. (2011). A new species of *Zwackhiomyces* (Xanthopyreniaceae, Ascomycota) growing on *Austroparmelina* from Australia. *Nova Hedwigia*, *93*(3–4), 395–400. https://doi.org/ 10.1127/0029-5035/2011/0093-0395

Pérez-Ortega, S., Etayo, J., & Spribille, T. (2011). A new species of *Llimoniella* (Ascomycota, Helotiales) on *Ramboldia cinnabarina* from Alaska. *The Lichenologist*, *43*, 363–366. https://doi.org/10.1017/S0024282911000272

Pérez-Ortega, S., & Halici, M. G. (2008). *Lasiosphaeriopsis lecanorae* sp. nov. (Ascomycota, Nitschkiaceae) on *Lecanora polytropa* from Spain with a key to the known species of the genus. *Mycotaxon*, *104*, 247–251.

Pérez-Ortega, S., Halici, M. G., Knudsen, K., & Candan, M. (2010). A new species of *Stigmidium* sensu stricto on *Thelenella muscorum*. *The Lichenologist*, *42*(4), 397–403. https://doi.org/10.1017/S0024282910000150

Pérez-Ortega, S., & Spribille, T. (2007). *Bellemerella ritae* sp. nov. (Verrucariaceae), a new lichenicolous ascomycete from northwest North America. *Nova Hedwigia*, *85*(3), 515–520. https://doi.org/ 10.1127/0029-5035/2007/0085-0515

Pérez-Ortega, S., & Spribille, T. (2009). Three new species of *Lichenopeltella* (Microthyriaceae, Ascomycota) from northwest North America. *Nova Hedwigia*, *89*(1–2), 219–228.

Pérez-Ortega, S., Suija, A., Crespo, A., & de los Ríos, A. (2014). Lichenicolous fungi of the genus *Abrothallu*s (Dothideomycetes: Abrothallales ordo nov.) are sister to the predominantly aquatic Janhulales. *Fungal Diversity*, *64*(1), 295–304. https://doi.org/10.1007/s13225-013-0269-y

Pérez-Ortega, S., Suija, A., & de los Ríos, A. (2011). The connection between *Abrothallus* and its anamorph state *Vouauxiomyces* established by Denaturing Gradient Gel Electrophoresis (DGGE). *The Lichenologist*, *43*(3), 277–279. https://doi.org/10.1017/S0024282911000089

Pérez-Vargas, I., Etayo, J., & Padrón, C. (2013). New species of lichenicolous fungi from the Canary Islands. *Phytotaxa*, *99*(2), 58–64. https://doi.org/10.11646/phytotaxa.99.2.2

Peršoh, D., & Rambold, G. (2002). *Phacopsis* — A lichenicolous genus of the family Parmeliaceae. *Mycological Progress*, *1*(1), 43–55.

Persoon, C. (1794a). Dispositio methodica fungorum in classes, ordines, Familias et Genera. *Neues Magazin für die Botanik, Ziegler u. Söhne, Zürich*, 63–128.

Persoon, C. (1794b). Einige Bemerkungen über die Flechten: Nebst Beschreibungen einiger neuen Arten aus dieser Familie der Aftermoose. *Ann. Bot.(Usteri)*, *7*, 1–32.

Persoon, C. (1794c). Nähere Bestimmung und Beschreibungen einiger sich nahe verwandter Pflanzen. *Annalen der Botanik (Usteri)*, *11*, 1–32.

Persoon, C. (1797). *Tentamen dispositionis methodicae Fungorum*. Leipzig.

Persoon, C. H. (1818). *Traité sur les champignons comestibles: contenant l'indication des espèces nuisibles*. Belin-Leprieur.

Persoon, C. H. (1822). *Mycologia Europaea seu completa omnium fungorum in variis Europaeae regionibus detectorum enumeratio, methodo naturali disposita; descriptione succincta, synonymia selecta et observationibus criticis additis* (Vol. 1).

Petch, T. (1937). Yorkshire Hypocreales. In W. H. Pearsall, F. L. S. D.Sc., & W. R. Grist (Eds.), *The Naturalist* (Vol. 35, pp. 279–283). A. Brown & Sons, Ltd.

Petrak, F., & Sydow, H. (1927). Die Gattungen der Pyrenomyzeten. Sphaeropsideen und Melanconieen. Teil 1. Die phaeosporen Sphaeropsideen und die Gattung *Macrophoma*. *Repertorium Specierum Novarum Regni Vegetabilis Beih*, *42*, 1–551.

Phukhamsakda, C., Hongsanan, S., Ryberg, M., Ariyawansa, H., Chomnunti, P., Bahkali, A., & Hyde, K. (2016). The evolution of Massarineae with Longipedicellataceae fam. nov. *Mycosphere*, *7*(11), 1713–1731. https://doi.org/10.5943/mycosphere/7/11/7

Pino-Bodas, R., Zhurbenko, M., & Stenroos, S. (2017). Phylogenetic placement within Lecanoromycetes of lichenicolous fungi associated with *Cladonia* and some other genera. *Persoonia-Molecular Phylogeny and Evolution of Fungi*, *39*(1), 91–117. https://doi.org/10.3767/persoonia.2017.39.05

Pirogov, M., & Sharavara, S. (2012). *Phaeospora rimosicola* (Verrucariaceae, Ascomycota)–new species of lichenicolous fungi for Ukraine. *Studia Biologica*, *6*(1), 201–204.

Pirozynski, K. A. (1973). Three Hyperparasites of Ascomycetes. *Mycologia*, *65*(4), 761–767.

Pitman, J. K., & Rowan, E. L. (2012). Temperature and petroleum generation history of the Wilcox Formation, Louisiana. 1–55. https://doi.org/10.3133/ofr20121046

Poelt, J. (1958). Über parasitische Flechten. II. *Planta*, *51*(3. H), 288–307.

Poelt, J. (1960). Mitteleuropäische Flechten VI. *Mitteilungen aus der Botanischen Staatssammlung München*, *3*, 568–584.

Poelt, J. (1961). Mitteleuropäische Flechten VII. *Mitteilungen aus der Botanischen Staatssammlung München*, *4*, 171–197.

Poelt, J. (1962). Parasitische Flechten III. *Österreichische botanische Zeitschrift*, *109*, 521–528.

Poelt, J. (1970). Mitteleuropäische Flechten ix. . *Mitt. bot. Staatsamml. München*, *8*, 191–210.

Poelt, J. (1985). Rhizocarpon bryonthae spec. nov. aus Grönland, eine parasitische Flechte auf der epibryen Pertusaria bryontha. *Herzogia*, 93–98.

Poelt, J. (1990). Parasitische Arten der Flechtengattung *Rhizocarpon*: eine weitere Übersicht. *Mitteilungen der Botanische Staatssammlung München*, *29*, 515–538.

Poelt, J., & Döbbeler, P. (1979). *Bryostigma leucodontis* nov. gen. et spec., eine neue Flechte mit fast unsichtbaren Fruchtkörpern/*Bryostigma leucodontis* nov. gen. et spec., a New Lichen With Almost Invisible Fruiting Bodies. *Plant Systematics and Evolution*, *131*, 211–216. https://www.jstor.org/stable/23642315

Poelt, J., & Hafellner, J. (1975). Schlauchpforten bei der Flechtengattung Thelocarpon. *Phyton (Austria)*, *17*(1-2), 66–77.

Poelt, J., & Hafellner, J. (1976). Die Flechte Neonorrlinia trypetheliza und die Familie Arthrorhaphidaceae.

Poelt, J., & Hafellner, J. (1983). Rhizocarpon vorax spec. nov.(Lichenes) und seine Beutegenossen auf Pertusaria. *Herzogia*, 309–321.

Poelt, J., & Leuckert, C. (1991). Der Formenkreis von *Protoparmelia atriseda* (Lichenes, Lecanoraceae) in Europa. *Nova Hedwigia*, *52*(1–2), 39–64.

Poelt, J., & Übermayer, W. (1995). *Rhizocarpon mosigiae* spec. nov., ein neuer parasitischer Vertreter der Gattung aus Tirol (Österreich). *Herzogia*, 111–113.

Poelt, J., & Vezda, A. (1969). *Bestimmungsschlüssel europäischer Flechten*. Cramer.

Poelt, J., & Vězda, A. (1984). *Rhizocarpon inimicum* spec. nov. another parasitic lichen on *Lecanora rupicola* spec. coll. *Herzogia*, *6*(3–4), 469–475.

Poelt, J., Zhurbenko, M., & Matzer, M. (1997). *Lecanora gyrophorina* sp. nov., eine bemerkenswerte, auf *Umbilicaria hyperborea* parasitierende Flechte aus Sibirien. *Herzogia*, 1–6.

Pollock, D. D., Zwickl, D. J., McGuire, J. A., & Hillis, D. M. (2002). Increased taxon sampling is advantageous for phylogenetic inference. *Systematic Biology*, *51*(4), 664.

Poumarat, S. (2022). *Zwackhiomyces fuscatus* Poumarat, Daval et Cl. Roux sp. nov., champignon lichénicole (Ascomycota, Xanthopyreniaceae) parasite d'*Acarospora fuscata*. *Bull. Soc. Linn. Provence*, *73*, 43–50.

Preuss, C. G. T. (1848). Deutschlands Flora, Abt. III. Die Pilze Deutschlands. *6*, 1–48.

Prieto, M., Baloch, E., Tehler, A., & Wedin, M. (2013). Mazaedium evolution in the Ascomycota (Fungi) and the classification of mazaediate groups of formerly unclear relationship. *Cladistics*, *29*(3), 296–308.

Prieto, M., & Wedin, M. (2013). Dating the diversification of the major lineages of Ascomycota (Fungi). *Plos One*, *8*(6), e65576. https://doi.org/10.1371/journal.pone.0065576

Prieto, M., & Wedin, M. (2017). Phylogeny, taxonomy and diversification events in the Caliciaceae. *Fungal Diversity*, *82*(1), 221–238.

Punithalingam, E. (2003). Nuclei, micronuclei and appendages in tri-and tetraradiate conidia of *Cornutispora* and four other coelomycete genera. *Mycological Research*, *107*(8), 917–948.

Puolasmaa, A., Toivanen, A., Marsh, T., Huhtinen, S., & Stenroos, S. (2012). Peltigericolous fungi from Finland–three genera and six species new to Finland. *Karstenia*, *52*(1), 1–50.

Rabenhorst, G. (1861). Flecht. Europ., 551.

Rabenhorst, G. (1868). Lichenes Europaei exsiccati. 816.

Rabenhorst, L. (1863). *Kryptogamen-Flora von Sachsen, der Ober-Lausitz, Thüringen und Nordböhmen: mit Berücksichtigung der benachbarten Länder* (Vol. 1). E. Kummer.

Raesaenen, V. (1934). Ein paar flechtensystematische Bemerkungen. *Annales Botanici Societatis Zoologicae-Botanicae Fennicae "Vanamo"*, *5*(9), 3–12.

Raesaenen, V. (1943). Bestimmungschlüssel für die gelben Rhizocarpon-Arten,-Varietäten und Formen. *Feddes Repertorium Specierum Novarum Regni Vegetabilis*, *52*, 127–136.

Rambaut, A. (2016). *FigTree*. In (Version 1.4.4)

Rambaut, A., Drummond, A. J., Xie, D., Baele, G., & Suchard, M. A. (2018). Posterior summarization in Bayesian phylogenetics using Tracer 1.7. *Systematic Biology*, *67*(5), 901–904. https://doi.org/10.1093/sysbio/syy032

Rambold, G. (1989). A monograph of the saxicolous lecideoid lichens of Australia (excl. Tasmania). *Bibliotheca Lichenologica*, *34*, 1–334.

Rambold, G. (1992). The inter-lecanoralean associations. *Bibliotheca Lichenologica*, *48*, 1-201.

Rambold, G., & Triebel, D. (1990). *Gelatinopsis, Geltingia* and *Phaeopyxis*: three helotialean genera with lichenicolous species. *Notes from Royal Botanic Garden, Edinburgh*, *46*(3), 375–389.

Rambold, G., & Triebel, D. (1992). *The Inter-lecanoralean Associations* (Vol. 48).

Rao, R., & Modak, C. D. (1972). Saprophytic fungi on *Vitis pallida* Wt. & Arn. *M. V. M. Patrika*, *7*(1 & 2), 44–46.

Räsänen, V. (1939). Die Flechtenflora der nördlichen Küstengegend am Laatokka-see. *Annales Botanici Societatis Zoologicae-Botanicae Fennicae "Vanamo"*, *12*, 1–240.

Rathnayaka, A. R., Tennakoon, D. S., Jones, G. E., Wanasinghe, D. N., Bhat, D. J., Priyashantha, A. H., Stephenson, S. L., Tibpromma, S., & Karunarathna, S. C. (2024). Significance of precise documentation of hosts and geospatial data of fungal collections, with an emphasis on plant-associated fungi. *New Zealand Journal of Botany*, 1-28. https://doi.org/10.1080/0028825X.2024.2381734

Raymundo, T., Valenzuela, R., Martínez-González, C. R., García-Jiménez, J., Cobos-Villagrán, A., Sánchez-Flores, M., de la Fuente, J., Martínez-Pineda, M., Pérez-Valdespino, A., Ramírez-Martínez, J. C., & Luna-Vega, I. (2023). New Ascomycetes from the Mexican Tropical Montane Cloud Forest. *Journal of Fungi*, *9*(9), 933. https://doi.org/10.3390/jof9090933

Réblová, M., Untereiner, W., & Štěpánek, V. (2017). Disentangling *Phialophora* section Catenulatae: disposition of taxa with pigmented conidiophores and recognition of a new subclass, Sclerococcomycetidae (Eurotiomycetes). *Mycological Progress*, *16*, 27–46. https://doi.org/10.1007/s11557-016-1248-y

Redhead, S. (2002). Phylogeny of agarics: partial systematics solutions for core omphalinoid genera in the Agaricales (euagarics). *Mycotaxon*, *83*, 19–57.

Redinger, K. (1938). Familie Graphidaceae. In G. Rabenhorst (Ed.), *Flora von Deutschland, Österreich und der Schweiz* (pp. 181–404). Leipzig, Akad. Verlagsges.M.B.H.

Rehm, H. (1881). Ascomyceten In getrockneten Exemplaren herausgegeben. *Berichte des Naturhistorischen Vereins Augsburg*, *26*, 1–132.

Rehm, H. (1882). Beiträge zur Ascomyceten-flora der deutschen Alpen und Voralpen. *Hedwigia*, *21*(8), 113–123.

Rehm, H. (1888). *Rabenhorst's Kryptogamen-Flora, Pilze - Ascomyceten* (Vol. 1.3).

Rehm, H. (1889). Rabenhorst's Kryptogamen-Flora, Pilze - Ascomyceten. *1.3*, 209–336.

Rehm, H. (1896a). Die Pilze Deiitselilauds, Oesterreiclis und der Schweiz. III. Abtheiluiiö: Ascomyceten: Hysteriaceen und Discomyceten. In L. Rabenhorst (Ed.), *Rabenhorst's Kryptogamen-Flora* (2 ed., Vol. 1.3, pp. 1–1273). Verlag von Eduard Kummer.

Rehm, H. (1896b). *Rabenhorst's Kryptogamen-Flora, Pilze - Ascomyceten* (Vol. 1.3).

Rehm, H. (1904). Beiträge zur Pilzflora von Südamerika XIV. *Hedwigia*, *44*, 1–13.

Rehner, S. A., & Buckley, E. (2005). A Beauveria phylogeny inferred from nuclear ITS and EF1-α sequences: evidence for cryptic diversification and links to *Cordyceps* teleomorphs. *Mycologia*, *97*(1), 84–98. https://doi.org/10.1080/15572536.2006.11832842

Reichert, I. (1921). Die Pilzflora Agyptens. *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie*, *Heft 5/6*, 598–727.

Rikkinen, J., Dörfelt, H., Schmidt, A. R., & Wunderlich, J. (2003). Sooty moulds from European Tertiary amber, with notes on the systematic position of *Rosaria* (‘Cyanobacteria’). *Mycological Research*, *107*(2), 251–256. https://doi.org/10.1017/S0953756203007330

Rodríguez-Andrade, Stchigel, Guarro, & Cano-Lira. (2019). Fungal Diversity of Deteriorated Sparkling Wine and Cork Stoppers in Catalonia, Spain. *Microorganisms*, *8*(1), 1–29. https://doi.org/10.3390/microorganisms8010012

Rodway, L. (1924). Tasmanian discomycetes.

Rogers, R., & Hafellner, J. (1988). *Haematomma* and *Ophioparma*: two superficially similar genera of lichenized fungi. *Lichenologist*, *20*(2), 167–174.

Ronquist, F., Teslenko, M., Van Der Mark, P., Ayres, D. L., Darling, A., Höhna, S., Larget, B., Liu, L., Suchard, M. A., & Huelsenbeck, J. P. (2012). MrBayes 3.2: efficient Bayesian phylogenetic inference and model choice across a large model space. *Systematic Biology*, *61*(3), 539–542. https://doi.org/10.1093/sysbio/sys029

Roshinikumar, N., Shweta, S., Siljo, J., & Sanjeeva, N. (2022). *Endohyalina parmotrematis*, a new species of lichenicolous fungi from India. *Taiwania*, *67*(4), 555–559. https://doi.org/10.6165/tai.2022.67.555

Rossman, A. Y. (1979). A preliminary account of the taxa described in Calonectria. *Mycotaxon*, *8*(2), 485–558.

Rossman, A. Y., Allen, W. C., Braun, U., Castlebury, L. A., Chaverri, P., Crous, P. W., Hawksworth, D. L., Hyde, K. D., Johnston, P., & Lombard, L. (2016). Overlooked competing asexual and sexually typified generic names of Ascomycota with recommendations for their use or protection. *IMA Fungus*, *7*, 289–308.

Rossman, A. Y., Samuels, G. J., Rogerson, C. T., & Lowen, R. (1999). Genera of Bionectriaceae, Hypocreaceae and Nectriaceae (Hypocreales, Ascomycetes). *Studies in Mycology*, *42*(1), 1–248.

Rostrup, E. (1870). Færøernes Flora. *Botanisk Tidsskrift*, *4*, 1–109.

Roux, C. (2007). Likenoj de Okcidenta Eŭropo Suplemento 4a: eltiraĵoj 2 (extraits 2). *Bulletin d'information de l'Association Française de Lichénologie*, *32*(2), 5–36.

Roux, C. (2009). *Naetrocymbe saxicola*, likeno kun *Trentepohlia*. *Bulletin de la Société linnéenne de Provence*, *60*, 127–142.

Roux, C. (2012). Liste des lichens et champignons lichénicoles de France. *Bulletin de la Société linnéenne de Provence Numéro spécial*, *16*, 1–220.

Roux, C. (2014). *Catalogue des lichens et champignons lichénicoles de France métropolitaine*. Association française de lichénologie Fontainebleau.

Roux, C. (2021). Echinothecium rhizoplacae P. Pinault et Cl. Roux sp. nov., champignon lichénicole non lichénisé (Ascomycota) et remarques sur le genre Echinothecium. *Bull. Soc. Linn. Provence*, *72*, 55–62.

Roux, C. (2022). Corticifraga ramalinae P. Pinault, Ertz et Cl. Roux sp. nov., champignon lichénicole non lichénisé (Ascomycota, Gomphillaceae). *Bull. Soc. Linn. Provence*, *73*, 29–35.

Roux, C. (2023). *Zwackhiomyces lecaniae* D. Gonnet, O. Gonnet et Cl. Roux sp. nov., champignon lichénicole non lichénisé, et clé des *Zwackhiomyces* (Ascomycota, Xanthopyreniaceae). *Bull. Soc. Linn. Provence*, *74*, 131–146.

Roux, C. (2024a). *Corticifraga melanohaleae* P. Pinault et Cl. Roux sp. nov., champignon lichénicole non lichénisé (Ascomycota, Gomphillaceae). *Bull. Soc. Linn. Provence*, *75*, 145–150.

Roux, C. (2024b). Zwackhiomyces bagliettoanus Brien, Cl. Roux, P. Diederich et Poumarat sp. nov. *Bull. Soc. Linn. Provence*, *75*, 151–156.

Roux, C., & Barbero, M. (2011). *Lecanora nohedensis* sp. nov., nova likenspecio *Lecanora nohedensis* sp. nov., espèce nouvelle de lichen. *Bull. Soc. Linn. Provence*, *14*, 152–162.

Roux, C., & Bellemère, A. (1991). Systématique des champignons lichénicoles non lichénisés: nouveautés et changements importants depuis la parution de Nelikeniĝintaj fungoj likenloĝaj. *Bull. Ass. fr. Lichénol*, *16*(2), 71–83.

Roux, C., Bricaud, O., Coeur, D. L., & Etayo, J. (1997). Les *Refractohilum* (Hyphomycètes, Moliniacés) à conidies pluriseptées en Europe et au Canada. *Canadian Journal of Botany*, *75*(9), 1592–1600.

Roux, C., Bricaud, O., Coeur, D. L., & Triebel, D. (1995). Le *Stigmidium lecidellae* sp. nov. et remarques sur le genre *Stigmidium* (champignons lichénicoles non lichénisés, Ascomycètes). *Canadian Journal of Botany*, *73*(4), 662–672.

Roux, C., Brien, Y., Monnat, J. Y., & Gardiennet, A. (2022). *Muellerella solenopsorae* Brien, Cl. Roux et Monnat sp. nov., champignon lichénicole (Ascomycota) sur *Solenopsora holophaea*. *Bull. Soc. Linn. Provence*, *73*, 37–42.

Roux, C., Bültmann, H., & Navarro-Rosinés, P. (2009). Syntaxonomie des associations de lichens saxicoles–calcicoles du sud-est de la France. 1. *Clauzadeetea immersae, Verrucarietea nigrescentis, Incertae saedis. Bulletin de la Société linnéenne de Provence*, *60*, 151–175.

Roux, C., Diederich, P., Brand, M., & Schiefelbein, U. (2023). Quelques espèces nouvelles d'*Endococcus*, champignons lichénicoles non lichénisés (Dothideomycetes incertae sedis). *Bull. Soc. Linn. Provence*, *74*, 147–156.

Roux, C., & Gueidan, C. (2011). Deux espèces nouvelles de Verrucariaceae des Pyrénées-Orientales (France): *Placocarpus melanophthalmosus* sp. nov. et *Placopyrenium breussii* sp. nov. *Bulletin de la Société linnéenne de Provence, numéro spécial*, *14*, 163–176.

Roux, C., Gueidan, C., & Navarro-Rosinés, P. (2002). La position systématique de *Polyblastia deminuta*. *Mycotaxon*, *84*, 1–20.

Roux, C., Monnat, J.-Y., Gonnet, D., Poumarat, S., Esnault, J., Bertrand, M., Gardiennet, A., Masson, D., Bauvet, C., Lagrandie, J., Derrien, M.-C., Houmeau, J.-M., Diederich, P., David, V., Ragot, R., Carlier, G., Van Haluwyn, C., Chipon, B., Vallade, J., & Schmitt, A. (2020a). *Catalogue des lichens et champignons lichénicoles de France métropolitaine*. Association française de lichénologie Fontainebleau.

Roux, C., Monnat, J.-Y., Gonnet, D., Poumarat, S., Esnault, J., Bertrand, M., Gardiennet, A., Masson, D., Bauvet, C., Lagrandie, J., Derrien, M.-C., Houmeau, J.-M., Diederich, P., David, V., Ragot, R., Carlier, G., Van Haluwyn, C., Chipon, B., Vallade, J., & Schmitt, A. (2020b). *Catalogue des lichens et champignons lichénicoles de France métropolitaine. 3e édition revue et augmentée (2020). Édit. Association française de lichénologie (AFL), Fontainebleau, 1769 p*.

Roux, C., & Navarro-Rosinés, P. (1994). *Stigmidium clauzadei* sp. nov., nelikeniginta fungo likenloga (Ascomycetes). *Bulletin de la Société linnéenne de Provence*, *44*, 443–450.

Roux, C., Navarro-Rosinés, P., & Tranchida, F. (1998). *Stigmidium bellemerei* sp. nov., champignon lichénicole non lichénisé (Verrucariales). *Cryptogamie Bryologie Lichénologie*, *19*(2-3), 221–228.

Roux, C., & Pinault, P. (2021). *Lichenostigma cupreogriseae* P. Pinault et Cl. Roux sp. nov. et *L. spermatomanis* P. Pinault et Cl. Roux sp. nov., champignons lichénicoles non lichénisés (Ascomycota). *Bull. Soc. Linn. Provence*, *72*, 63–71.

Roux, C., & Pinault, P. (2023). *Lichenostigma epiumbilicariae* P. Pinault et Cl. Roux sp. nov. champignon lichénicole non lichénisé (Ascomycota). *Bull. Soc. Linn. Provence*, *74*, 125–129.

Roux, C., Pinault, P., Ertz, D., & Gardiennet, A. (2020). Deux *Capronia* sl (Ascomycota, Chaetothyriales) lichénicoles sur *Cladonia*. *Bulletin de la Société linnéenne de Provence*, *71*, 75–86.

Roux, C., Poumarat, S., Gueidan, C., Navarro-Rosinés, P., Monnat, J. Y., & Houmeau, J. M. (2019). La Acarosporaceae de Okcidenta Eŭropo. *Bulletin de la Société linnéenne de Provence*, *70*, 107–167.

Roux, C., & Triebel, D. (1994). Révision des espèces de *Stigmidium* et de *Sphaerellothecium* (champignons lichénicoles non lichénisés, Ascomycetes) correspondant à *Pharcidia epicymatia* sensu Keissler ou à *Stigmidium schaereri* auct. *Bull. Soc. Linn. Provence*, *45*, 451–542.

Runemark, H. (1956). Studies in Rhizocarpon. I. Taxonomy of the yellow species in Europe. *Opera Botanica*, *2*(1), 1–152.

Saccardo, P. (1878). Enumeratio Pyrenomycetum Hypocreaceorum hucusque cognitorum systemate carpologico dispositorum. *Michelia*, *1*, 277–325.

Saccardo, P. A. (1881). Fungi Veneti novi vel critici v. mycologiae Veneti addendi. Series XII. *Michelia*, *2*(7), 241–301.

Saccardo, P. A. (1883). Sylloge Pyrenomycetum, Vol. II. *Sylloge Fungorum*, *2*, 1–813.

Saccardo, P. A. (1884). Conspectus generum discomycetum hucusque congitorum. *Botanisches Centralblatt*, *18*, 213–256.

Saccardo, P. A. (1889). Discomyceteae et Phymatosphaeriaceae. *Sylloge Fungorum*, *8*, 1–1143.

Saccardo, P. A. (1902). *Sylloge Fungorum. Vol. XVI*.

Saccardo, P. A., & Saccardo, D. (1905). Supplementum universale. Pars VI. Hymenomycetae-Laboulbeniomycetae. *Sylloge Fungorum*, *17*, 1–991.

Saccardo, P. A., & Saccardo, D. (1906). Supplementum universale. Pars VII. Discomycetae-Deuteromycetae. *Sylloge Fungorum*, *18*, 1–838.

Samarakoon, M. C., Hyde, K. D., Hongsanan, S., McKenzie, E. H. C., Ariyawansa, H. A., Promputtha, I., Zeng, X.-Y., Tian, Q., & Liu, J.-K. (2019). Divergence time calibrations for ancient lineages of Ascomycota classification based on a modern review of estimations. *Fungal Diversity*, *96*(1), 285–346. https://doi.org/10.1007/s13225-019-00423-8

Samuels, G. (1988). Fungicolous, lichenicolous, and myxomyceticolous species of Hypocreopsis, Nectriopsis, Nectria, Peristomialis, and Trichonectria. *Mem New York Bot Gard*, *48*, 1–78.

Sanderson, N., Hawksworth, D., & Aptroot, A. (2009). *Melaspilea* Nyl. (1857). In C. Smith, A. Aptroot, B. Coppins, A. Fletcher, O. Gilbert, P. James, & P. Wolseley (Eds.), *The lichens of Great Britain and Ireland* (pp. 576–579). The British Lichen Society, the Natural History Museum.

Sandoval-Denis, M., Gené, J., Sutton, D. A., Wiederhold, N. P., & Guarro, J. (2015). *Acrophialophora,* a poorly known fungus with clinical significance. *Journal of clinical microbiology*, *53*(5), 1549–1555.

Santesson, R. (1952). Foliicolous lichens I. A revision of the taxonomy of the obligately foliicolous, lichenized fungi. *Symbolae Botanicae Upsalienses*, *12*(1), 1–590.

Santesson, R. (1960). Lichenicolous fungi from northern Spain. *Svensk Bot. Tidskr.*, *54*, 499–522.

Santesson, R. (1986). *Fungi lichenicoli exsiccati. Fasc. 3–4 (Nos 51–100)* (Vol. 3). Herbarium, Uppsala University.

Santesson, R. (1988). Fungi Lichenicoli Exsiccati. Fasc. 5–6 (nos 101–150). *Thunbergia*, *6*, 1–18.

Santesson, R. (1989). Parasymbiotic fungi on the lichen-forming basidiomycete *Omphalina foliacea*. *Nordic Journal of Botany*, *9*(1), 97–99. https://doi.org/10.1111/j.1756-1051.1989.tb00991.x

Santesson, R. (1993a). The lichens and lichenicolous fungi of Sweden and Norway. *(No Title)*.

Santesson, R. (1993b). *lichens and lichenicolous fungi of Sweden and Norway* (Vol. 97).

Santesson, R. (1993). *Stigmidium degelii*, a new lichenicolous fungus. *Graphis Scripta*, *5*(1), 3–4.

Santesson, R. (1994a). Fungi Lichenicoli Exsiccati: Fasc. 7–8 (nos 151–200). *Thunbergia*, *21*, 1–18.

Santesson, R. (1994b). Fungi Lichenicoli Exsiccati: Fasc. 9–10 (Nos 201–250). *Thunbergia*, 1–24.

Santesson, R. (1998). Fungi lichenicoli exsiccati. Fasc. 11–12 (Nos 251–300). *Fungi lichenicoli exsiccati*, *28*, 1–19.

Santesson, R. (2001). Fungi lichenicoli exsiccati. Fasc. 13–14 (Nos 301–350). *Thunbergia*, *31*, 1–18.

Santesson, R., Moberg, R., Nordin, A., Tønsberg, T., & Vitikainen, O. (2004). Lichen-forming and lichenicolous fungi of Fennoscandia. *Museum of Evolution*, 1–359.

Santesson, R., & Tønsberg, T. (1994). *Arthrorhaphis aeruginosa* and *A. olivaceae*, two new lichenicolous fungi. *Lichenologist*, *26*(3), 295–299.

Sarrión, F., Hafellner, J., & Burgaz, A. (2002). Three new species of the genus Dactylospora in Spain. *Lichenologist*, *34*(5), 361–368.

Sawada, K. (1959). Descriptive catalogue of Taiwan (Formosan) fungi. Part XI. *Special Publication College of Agriculture National Taiwan University*, *8*, 1–268.

Scheidegger, C. (1987). Buellia uberior und B. miriquidica (Physciaceae, Lecanorales), zwei lichenicole Krustenflechten auf Schaereria tenebrosa. *Botanica Helvetica*, *97*(1), 99–116.

Scheidegger, C. (1993). A revision of European saxicolous species of the genus *Buellia* de Not. and formerly included genera. *Lichenologist*, *25*(4), 315–364.

Schmidt, A. F. W. (1970). Anatomisch-taxonomische Untersuchungen an europäischen Arten der FlechtenfamilieCaliciaceae. *Mitt. Staatsinst. Allg. Bot. Hamburg 13*, 111–166.

Schmidt, A. R., Beimforde, C., Seyfullah, L. J., Wege, S.-E., Dörfelt, H., Girard, V., Grabenhorst, H., Gube, M., Heinrichs, J., & Nel, A. (2014). Amber fossils of sooty moulds. *Review of Palaeobotany and Palynology*, *200*, 53–64. http://dx.doi.org/10.1016/j.revpalbo.2013.07.002

Schneider, R. (1979). Die Flechtengattung Psora sensu Zahlbruckner. *Bibliotheca Lichenologica*, *13*(1), 1–308.

Schoch, C., Shoemaker, R. A., Seifert, K., Hambleton, S., & Crous, P. W. (2006). A multigene phylogeny of the Dothideomycetes using four nuclear loci Supplemental. *Mycologia*, *98*(6), 1041–1052. https://doi.org/10.1080/15572536.2006.11832632

Scholz, P., & Knoph, J.-G. (1995). *Buellia vezdana*, a new lichenicolous species from coastal rocks in Great Britain. *Bibliotheca Lichenologica*, *58*, 405–410.

Schröter, J. (1885). *Kryptogamen-Flora von Schlesien* (Vol. 3.2).

Schubert, K., Groenewald, J., Braun, U., Dijksterhuis, J., Starink, M., Hill, C., Zalar, P., De Hoog, G., & Crous, P. (2007). Biodiversity in the *Cladosporium herbarum* complex (Davidiellaceae, Capnodiales), with standardisation of methods for *Cladosporium* taxonomy and diagnostics. *Studies in Mycology*, *58*, 105–156. https://doi.org/10.3114/sim.2007.58.05

Seavey, F., & Seavey, J. (2012). Caloplaca lecanorae (Teloschistaceae), a new lichenicolous lichen and several additions to the North American lichenized mycota from Everglades National Park. *The Bryologist*, *115*(2), 322–328.

Seavey, F., Seavey, J., Gagnon, J., Guccion, J., Kaminsky, B., Pearson, J., Podaril, A., & Randall, B. (2017). The lichens of Dagny Johnson Key Largo Hammock Botanical State Park, Key Largo, Florida, USA. *Bulletin of the Florida Museum of Natural History*, *53*(5), 201400–468268.

Selkirk, D. R. (1975). Tertiary fossil fungi from Kiandra, New South Wales. *Proceedings of the Linnean Society of New South Wales*, *100*, 70–94.

Selva, S. (2004). *Coniocybe gracilescens* and species of *Sphinctrina* with 1-septate spores. *Symbolae Botanicae Upsalienses*, *34*(1), 19–23.

Selva, S. B. (2013). The calicioid lichens and fungi of the Acadian Forest ecoregion of northeastern North America, I. New species and range extensions. *The Bryologist*, *116*(3), 248–256.

Selva, S. B., McMullin, R. T., Bell-Doyon, P., Henderson, B., & Lay, E. (2023). Calicioid lichens and fungi in North America: Species new to science, reported as new from elsewhere and placed into synonymy. *The Bryologist*, *126*(4), 427–446.

Senanayake, I., Rathnayaka, A., Sandamali, D., Calabon, M., & Vedprakash, H. G. (2020). Morphological approaches in studying fungi: collection, examination, isolation, sporulation and preservation. *Mycosphere*, *11*(1), 2678–2754. https://doi.org/10.5943/mycosphere/11/1/20

Senanayake, I. C., Rossi, W., Leonardi, M., Weir, A., McHugh, M., Rajeshkumar, K. C., Verma, R. K., Karunarathna, S. C., Tibpromma, S., Ashtekar, N., Ashtamoorthy, S. K., Raveendran, S., Kour, G., Singh, A., De la Peña-Lastra, S., Mateos, A., Kolařík, M., Antonín, V., Ševčíková, H.,…Song, J. (2023). Fungal diversity notes 1611–1716: taxonomic and phylogenetic contributions on fungal genera and species emphasis in south China. *Fungal Diversity*, *122*(1), 161–403. https://doi.org/10.1007/s13225-023-00523-6

Sérusiaux, E. (2005). *Lambinonia*, a new genus for Melanconium strigulae, a lichenicolous hyphomycete on foliicolous species of *Strigula*. *The Lichenologist*, *37*(6), 499–506.

Sérusiaux, E., Diederich, P., Brand, A. M., & van den Boom, P. (1999). New or interesting lichens and lichenicolous fungi from Belgium and Luxembourg. VIII. *Lejeunia*, *162*(17), 1–95.

Sérusiaux, E., Diederich, P., Ertz, D., & van den Boom, P. (2003). New or interesting lichens and lichenicolous fungi from Belgium, Luxembourg and northern France. IX. *Lejeunia, Revue de Botanique*, *173*, 1–48.

Sérusiaux, E., & Wessels, D. (1984). Santessonia (Lecanorales, Buelliaceae) in the Namib Desert (South West Africa). *Mycotaxon*, *19*, 479–502.

Shen, M., Zhang, J. Q., Zhao, L. L., Groenewald, J. Z., Crous, P. W., & Zhang, Y. (2020). Venturiales. *Studies in Mycology*, *96*, 185–308. https://doi.org/10.1016/j.simyco.2020.03.001

Sherwood-Pike, M. (1985). New and unusual ascomycetes from the Western United States. *Sydowia*, *38*, 267–277.

Sherwood, M., Hawksworth, D., & Coppins, B. J. (1980). Skyttea, a new genus of odontotremoid lichenicolous fungi. *Transactions of the British Mycological Society*, *75*(3), 479–490.

Sherwood, M. A. (1977). The Ostropalean fungi. *Mycotaxon*, *5*(1), 1–277.

Shivarov, V. V. (2019). *Clypeococcum hemiamyloideum* (Polycoccaceae, Ascomycota), a novel lichenicolous fungus on *Verrucaria latebrosa*. *Herzogia*, *32*(2), 438–443.

Sierra, R., & Molinari-Novoa, E. A. (2020). *Neoechinodiscus*, a new name for *Echinodiscus* Etayo & Diederich (lichenicolous Helotiales). *Opuscula Philolichenum*, *19*, 172–173.

Sikaroodi, M., Lawrey, J. D., Hawksworth, D. L., & Depriest, P. T. (2001). The phylogenetic position of selected lichenicolous fungi: *Hobsonia, Illosporium*, and *Marchandiomyces*. *Mycological Research*, *105*(4), 453–460. https://doi.org/10.1017/S0953756201003768

Silva, N. I. d., Thambugala, K. M., Tennakoon, D. S., Karunarathna, S. C., Kumla, J., Suwannarach, N., & Lumyong, S. (2022). Taxonomy and phylogenetic appraisal of dothideomycetous fungi associated with *Magnolia*, *Lilium Longiflorum* and *Hedychium Coronarium*. *Journal of Fungi*, *8*(10), 1094. https://doi.org/10.3390/jof8101094

Singh, P., Joshi, Y., & Singh, K. (2017). A new lichenicolous species of *Melaspilea* (Melaspileaceae, Arthoniales) from India. *Acta Botanica Hungarica*, *59*, 439–443. https://doi.org/ 10.1556/034.59.2017.3-4.9

Singh, P., & Singh, K. (2019). *Buelliella indica* (Dothideomycetes), a new lichenicolous species from India. *Acta Botanica Hungarica*, *61*(3–4), 435–439. https://doi.org/10.1556/034.61.2019.3-4.12

Smith, A. L. (1911). A Monograph of the British Lichens. *2*, 1–409.

Smith, A. L. (1926). *A Monograph of the British Lichens. Edn. 2* (Vol. 118). https://doi.org/10.1038/118440c0

Sochting, U., Ovstedal, D., & Sancho, L. (2004). The lichens of Hurd Peninsula, Livingston Island, South Shetlands, Antarctica. *Bibliotheca Lichenologica*, *88*, 607–658.

Sommerfelt, S. (1826). *Supplementum florae lapponicae*.

Sparrius, L., & Aptroot, A. (2007). A new lichenicolous *Enterographa* species from Britanny (France). *The Lichenologist*, *39*(4), 315–317. https://doi.org/ 10.1017/S0024282907007001

Speer, E. O. (1986). A propos de champignons du Brésil. III: *Mytilidion resinae* sp. nov.(Hysteriales) et sa forme conidienne, *Camaroglobulus resinae* gen. et spec. nov.(Sphaeropsidales). *Bulletin trimestriel de la Societe mycologique de France*, *102*(1), 97–100.

Spegazzini, C. (1879). Nova addenda ad Mycologiam Venetam. *Michelia*, *1*(5), 453–487.

Spegazzini, C. (1885). Fungi guaranitici. Pugillus I. *Anales de la Sociedad Científica Argentina*, *19*(1), 34–48.

Spegazzini, C. (1899). *Fungi argentini novi vel critici*. Imprenta de J.A. Alsina.

Spies, C. F. J., Mostert, L., Carlucci, A., Moyo, P., Van Jaarsveld, W. J., du Plessis, I. L., Van Dyk, M., & Halleen, F. (2020). Dieback and decline pathogens of olive trees in South Africa. *Persoonia-Molecular Phylogeny and Evolution of Fungi*, *45*(1), 196-220. https://doi.org/10.3767/persoonia.2020.45.08

Spribille, T., Fryday, A. M., Pérez-Ortega, S., Svensson, M., Tønsberg, T., Ekman, S., Holien, H., Resl, P., Schneider, K., Stabentheiner, E., Thüs, H., Vondrák, J., & Sharman, L. (2020). Lichens and associated fungi from Glacier Bay National Park, Alaska. *The Lichenologist*, *52*(2), 61–181. https://doi.org/10.1017/S0024282920000079

Spribille, T., & Mayrhofer, H. (2016). Nomenclatural novelties. *Index Fungorum*, *309*, 1-1.

Spribille, T., Pérez-Ortega, S., Tønsberg, T., & Schirokauer, D. (2010). Lichens and lichenicolous fungi of the Klondike Gold Rush National Historic Park, Alaska, in a global biodiversity context. *The Bryologist*, *113*(3), 439–516.

Stamatakis, A. (2014). RAxML version 8: a tool for phylogenetic analysis and post-analysis of large phylogenies. *Bioinformatics*, *30*(9), 1312–1313. https://doi.org/10.1093/bioinformatics/btu033

Stein. (1882). Bericht über die Thätigkeit der einzelnen Sectionen. IV. Botanische Section. Von Schadenberg auf Mindanao und von Fritze auf Madeira gesammelte Flechten. . In *Jahres-Bericht der Schlesischen Gesellschaft für Vaterländische Cultur* (Vol. 60, pp. 227–234). G. P. Aderholz Buchhandlung.

Stein, B. (1872). Flechten der Babiagora. *Verhandlungen des Botanischen Vereins der Provinz Brandenburg*, *14*, 94–97.

Stein, B. (1879). Kryptogamen-Flora von Schlesien. *JU Kern's Verlag (Max Müller), Breslau*, *2*, 1–400.

Steiner, J. (1896). Beiträge zur Flechtenflora Südpersiens. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften Math.-naturw. Klasse Abt. I.*, *105*, 436–446.

Steiner, J. (1897). Flechten aus Britiseh-Ostafrika. In *Sitzungsberichte Der Mathematisch-Naturwissenschaftlichen Class* (Vol. 106, pp. 207–234). The Museum Of Comparative Zoology.

Steiner, J. (1898). Prodromus einer Flechtenflora des griechischen Festlandes. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften Math.-naturw. Klasse Abt. I.*, *107*, 103–189.

Steiner, J. (1919). Beiträge zur Kenntnis der Flora Griechenlands. Bearbeitung der anlässlich der zweiten Wiener Universitätsreise im April 1911 in Griechenland gesammelten Pflanzen-C. Lichenes. *Verhandlungen der Zoologisch-Botanischen Gesellschaft zu Wien*, *69*, 52–101.

Steiner, J. J. (1893). Beiträge zur Lichenenflora Griechenlands und Egyptens. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften Math.-naturw. Klasse Abt. I.*, *102*, 152–176.

Steiner, M., & Poelt, J. (1987). Drei parasitische Flechten auf Caloplaca polycarpoides/Three parasitic lichens on Caloplaca polycarpoides. *Plant Systematics and Evolution*, 133–141.

Stirton, J. (1879). New and rare lichens from India and the Himalayas. *Proceedings of the Philosophical Society of Glasgow*, *11*, 306–322.

Stirton, J. (1881). Additions to the lichen flora of Queensland. *Transactions and Proceedings of the Royal Society of Victoria*, *17*, 66–79.

Stizenberger, E. (1863). Kritische Bemerkungen über die Lecideaceen mit nadelförmigen Sporen. *Nova Acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum*, *30*, 1–76.

Su, H.-Y., Hyde, K. D., Maharachchikumbura, S. S., Ariyawansa, H. A., Luo, Z.-L., Promputtha, I., Tian, Q., Lin, C.-G., Shang, Q.-J., & Zhao, Y.-C. (2016). The families Distoseptisporaceae fam. nov., Kirschsteiniotheliaceae, Sporormiaceae and Torulaceae, with new species from freshwater in Yunnan Province, China. *Fungal Diversity*, *80*, 375–409. https://doi.org/10.1007/s13225-016-0362-0

Suija, A., & Alstrup, V. (2004). *Buelliella lecanorae*, a new lichenicolous fungus. *The Lichenologist*, *36*(3–4), 203–206. https://doi.org/10.1017/S0024282904014239

Suija, A., Asunción, D., & Pérez-Ortega, S. (2015). A molecular reappraisal of *Abrothallus* species growing on lichens of the order Peltigerales. *Phytotaxa*, *195*(3), 201–226. http://dx.doi.org/10.11646/phytotaxa.195.3.1

Suija, A., Berger, F., Arsenault, A., Baines, P., Zimmermann, E., & Etayo, J. (2024). New species, a taxonomic combination, and records of lichenicolous *Abrothallus* (Abrothallales, Dothideomycetes): species on Peltigeraceae and Pannariaceae. *Mycological Progress*, *23*(1), 58. https://doi.org/10.1007/s11557-024-01994-w

Suija, A., Delhoume, A., Poumarat, S., & Diederich, P. (2021). *Didymocyrtis microxanthoriae* (Phaeosphaeriaceae, Dothideomycetes), a new lichenicolous fungus from France. *Bull. Soc. Nat. luxemb*, *123*, 129–136.

Suija, A., Ertz, D., Lawrey, J. D., & Diederich, P. (2015). Multiple origin of the lichenicolous life habit in Helotiales, based on nuclear ribosomal sequences. *Fungal Diversity*, *70*(1), 55–72. https://doi.org/ 10.1007/s13225-014-0287-4

Suija, A., Hawksworth, D. L., & Pérez-Ortega, S. (2018). The generic name *Abrothallus* (Abrothallales, Dothideomycetes), and names proposed in the genus by Giuseppe De Notaris, Søren Christian Sommerfelt, and Ignaz Kotte. *Taxon*, *67*(6), 1169–1179. https://doi.org/10.12705/676.13

Suija, A., Kaasalainen, U., Kirika, P. M., & Rikkinen, J. (2018). *Taitaia*, a novel lichenicolous fungus in tropical montane forests in Kenya (East Africa). *The Lichenologist*, *50*(2), 173–184.

Suija, A., & MotieJūnaitė, J. (2017). *Calycina alstrupii* sp. nov.(Pezizellaceae, Helotiales), a new lichenicolous fungus from Norway. *Phytotaxa*, *307*(2), 113–122.

Suija, A., Pérez-Ortega, S., & Hawksworth, D. L. (2011). *Abrothallus halei* (Ascomycota, incertae sedis), a new lichenicolous fungus on *Lobaria* species

in Europe and North America. *The Lichenologist*, *43*(01), 51–55. https://doi.org/10.1017/S002428291000054X

Suija, A., Tsurykau, A., Zimmermann, E., & Diederich, P. (2018). Molecular and morphological data suggest that the cladoniicolous Pezizella ucrainica belongs to *Hyphodiscus* (Hyaloscyphaceae, Helotiales). *Graphis Scripta*, *30*(6), 121–129.

Suija, A., van den Boom, P., Zimmermann, E., Zhurbenko, M. P., & Diederich, P. (2017). Lichenicolous species of *Hainesia* belong to Phacidiales (Leotiomycetes) and are included in an extended concept of *Epithamnolia*. *Mycologia*, *109*(6), 882–899.

Suija, A., Zhurbenko, M. P., Stepanchikova, I., Himelbrant, D. E., & Motiejūnait, J. (2020). *Kukwaea pubescens* gen. et sp. nova (Helotiales, incertae sedis), a new lichenicolous fungus on *Cetraria islandica*, and a key to the lichenicolous fungi occurring on *Cetraria* s. str. *Phytotaxa*, *459*(1), 39–50.

Summerbell, R., Gueidan, C., Schroers, H., De Hoog, G., Starink, M., Rosete, Y. A., Guarro, J., & Scott, J. (2011). *Acremonium* phylogenetic overview and revision of *Gliomastix, Sarocladium*, and *Trichothecium*. *Studies in Mycology*, *68*(1), 139–162.

Sun, Y.-R., Jayawardena, R. S., Hyde, K. D., & Wang, Y. (2021). *Kirschsteiniothelia thailandica* sp. nov. (Kirschsteiniotheliaceae) from Thailand. *Phytotaxa*, *490*(2), 172–182. https://doi.org/10.11646/phytotaxa.490.2.3

Sutton, B. C. (1973). Hyphomycetes from Manitoba and Saskatchewan, Canada.

Sutton, B. C. (1980). *The Coelomycetes. Fungi imperfecti with pycnidia, acervuli and stromata*. Commonwealth Mycological Institute.

Svane, S. J., & Alstrup, V. (2004). Some lichenicolous fungi from Iceland. *Acta Botanica Islandica*, *14*, 53–58.

Svensson, M., & Westberg, M. (2021). A new lichenicolous species of *Carbonea* (Ascomycota, Lecanoraceae) from northern Sweden. *Phytotaxa*, *522*, 221–230. https://doi.org/10.11646/PHYTOTAXA.522.3.5

Swinscow, T. D. V. (1965). The Marine Species of *Arthopyrenia* in the British Isles. *Pyrenocarpous lichens: 8*, *3*, 55–64.

Tadome, K., & Ohmura, Y. (2021). Two lichenicolous fungi, *Illosporium carneum* and *Ovicuculispora parmeliae* (Bionectriaceae, Ascomycota), new to Japan. *Bull. Natl. Mus. Nat. Sci., Ser. B*, *47*(1), 21–25.

Tauern, F. i. N. H. (1995). Über Funde lichenicoler Pilze und Flechten im Nationalpark Hohe Tauern (Kärntner Anteil, Osterreich). *Klagenfurt*, 599–635.

Taylor, J., Jacobson, D., & Fisher, M. (1999). The evolution of asexual fungi: reproduction, speciation and classification. *Annual review of phytopathology*, *37*(1), 197–246.

Telfer, A. C., Young, M. R., Quinn, J., Perez, K., Sobel, C. N., Sones, J. E., Levesque-Beaudin, V., Derbyshire, R., Fernandez-Triana, J., & Rougerie, R. (2015). Biodiversity inventories in high gear: DNA barcoding facilitates a rapid biotic survey of a temperate nature reserve. *Biodiversity Data Journal*, *3*, e6313. https://doi.org/10.3897/BDJ.3.e6313

Thambugala, K. M., Ariyawansa, H. A., Li, Y.-M., Boonmee, S., Hongsanan, S., Tian, Q., Singtripop, C., Bhat, D. J., Camporesi, E., & Jayawardena, R. (2014). Dothideales. *Fungal Diversity*, *68*, 105–158.

Thambugala, K. M., Daranagama, D. A., Phillips, A. J., Bulgakov, T. S., Bhat, D. J., Camporesi, E., Bahkali, A. H., Eungwanichayapant, P. D., Liu, Z.-Y., & Hyde, K. D. (2017). Microfungi on Tamarix. *Fungal Diversity*, *82*, 239–306. https://doi.org/10.1007/s13225-016-0371-z

Theissen, F. v., & Sydow, H. (1918). Vorentwürfe zu den Pseudosphaeriales. *Annales Mycologici*, *16*(1–2), 1–34.

Thell, A., Crespo, A., Divakar, P. K., Kärnefelt, I., Leavitt, S. D., Lumbsch, H. T., & Seaward, M. R. (2012). A review of the lichen family Parmeliaceae–history, phylogeny and current taxonomy. *Nordic Journal of Botany*, *30*(6), 641-664.

Thiyagaraja, V., Ertz, D., Hyde, K. D., Karunarathna, S. C., TO-ANUN, C., & Cheewangkoon, R. (2022). Morphological and phylogenetic reassessment of

Sclerococcum simplex from China. *Phytotaxa*, *559*(2), 167–175. https://doi.org/10.11646/phytotaxa.559.2.5

Thiyagaraja, V., He, S.-C., Luo, L., Meng, Q.-F., Yang, H., & Yang, Y.-Y. (2024). Research Profiles – I. The research of Vinodhini Thiyagaraja and her team at Kunming Institute of Botany, CAS, P.R. China. *Current Research in Environmental & Applied Mycology (Journal of Fungal Biology)*, *14*(1), 49–62. https://doi.org/10.5943/cream/14/1/2

Thor, G., Lücking, R., & Matsumoto, T. (2000). The foliicolous lichen flora of Japan. *Symbolae Botanicae Upsalienses*, *32*, 1–72.

Thorn, R., Malloch, D., & Ginns, J. (1998). *Leucogyrophana lichenicola* sp. nov., and a comparison with basidiomes and cultures of the similar *Leucogyrophana romellii*. *Canadian Journal of Botany*, *76*(4), 686–693.

Tibell, L. (1975). The Caliciales of boreal North America. *Symbolae Botanicae Upsalienses*, *21*(2), 1–128.

Tibell, L. (1978). The genus Microcalicium. *Botaniska Notiser*, *131*, 229–246.

Tibell, L. (1979). Caliciales exsiccatae: Fasc. 2 (No 26–50). *Publications from the Herbarium University of Uppsala*, *4*, 1–9.

Tibell, L. (1982). Caliciales of Costa Rica. *Lichenologist*, *14*(3), 219–254.

Tibell, L. (1984). A reappraisal of the taxonomy of Caliciales. *Beihefte zur Nova Hedwigia*, *79*, 597–713.

Tibell, L. (1985). Caliciales exsiccatae: Fasc. 5 (No 101–125). *Publications from the Herbarium University of Uppsala*, *16*, 1–9.

Tibell, L. (1987). Australasian Caliciales. *Symbolae Botanicae Upsalienses*, *27*(1), 1–279.

Tibell, L. (1991). Revision of some taxa of Caliciales described by W. Nylander. Annales Botanici Fennici,

Tibell, L. (1998). Crustiose mazaediate lichens and the Mycocaliciaceae in temporate South America. *Bibliotheca Lichenologica*, *71*, 1–107.

Tibell, L., Frisch, A., & Thor, G. (2014). Additions to the calicioid flora of Japan and Korea, with the descriptions of two new species. Annales Botanici Fennici,

Tibell, L., & Ryman, K. (1995). Revision of species of *Chaenothecopsis* with short stalks. *Nova Hedwigia*, *60*(1–2), 199–218.

Tilak, S. T., & Kale, S. B. (1968). Contributions to the genus *Ostreola*. *Indian Phytopathology*, *21*(3), 289–293.

Timdal, E. (1984). The delimitation of Psora (Lecideaceae) and related genera, with notes on some species. *Nordic Journal of Botany*, *4*(4), 525–540.

Timdal, E. (1986). Rhizocarpon santessonii, a new parasitic lichen from Norway. *The Lichenologist*, *18*(4), 317–320.

Timdal, E. (1988). Glyphopeltis eburina and Xanthopsorella llimonae are Glyphopeltis ligustica, comb. nov. *Mycotaxon*, *31*(1), 101–102.

Timdal, E. (1991). A monograph of the genus Toninia (Lecideaceae, Ascomycetes). *Opera Botanica*, *110*, 1-137.

Titov, A. (2001). Further Notes on Calicioid Lichens and Fungi From the Gongga Mountains (Sichuan, China). *Lichenologist*, *33*, 303–314. https://doi.org/10.1006/lich.2001.0329

Titov, A., Kuznetsova, E., & Himelbrant, D. (2004). Calicioid lichens and fungi from the Kamchatka Peninsula, Russia. *Symbolae Botanicae Upsalienses*, *34*(1), 455–464.

Titov, A. N. (2006). *Mikokalizievye griby (porjadok Mycocaliciales) Golarktiki*. KMK Scientific Press.

Tobisch, J. (1934). Beiträge zur Kenntnis der Pilzflora von Kärnten. IV. *Österreichische botanische Zeitschrift*, *83*, 109–150.

Topham, P. B., & Walker, F. J. (1982). New and interesting lichen records. *The Lichenologist*, *14*(1), 61-75.

Torzilli, A., Balakrishna, S., O'Donnell, K., & Lawrey, J. (2002). The degradative activity of a lichenicolous *Fusarium* sp. compared to related entomogenous species. *Mycological Research*, *106*, 1204–1210. https://doi.org/10.1017/S0953756202006627

Torzilli, A., Mikelson, P., & Lawrey, J. (1999). Physiological effect of lichen secondary metabolites on the lichen parasite *Marchandiomyces corallinus*. *The Lichenologist*, *31*(3), 307–314.

Torzilli, A. P., & Lawrey, J. D. (1995). Lichen metabolites inhibit cell wall-degrading enzymes produced by the lichen parasite *Nectria parmeliae*. *Mycologia*, *87*(6), 841–845.

Trakunyingcharoen, T., Lombard, L., Groenewald, J. Z., Cheewangkoon, R., Toanun, C., Alfenas, A. C., & Crous, P. W. (2014). Mycoparasitic species of *Sphaerellopsis*, and allied lichenicolous and other genera [journal article]. *IMA Fungus*, *5*(2), 391–414. https://doi.org/10.5598/imafungus.2014.05.02.05

Tretiach, M. (2002). *Niesslia robusta*, a new lichenicolous fungus on *Tephromela grumosa* from Tuscany, Italy. *Nova Hedwigia*, *75*(3–4), 357–365. https://doi.org/10.1127/0029-5035/2002/0075-0357

Tretiach, M., & Navarro-Rosinés, P. (1996). Sarcopyrenia sigmoideospora sp. nov., a lichenicolous Ascomycete growing on Verrucaria gr. parmigera. *Nova Hedwigia*, *62*(1-2), 249-254.

Trevisan, V. (1856). *Brigantiaea*, novum Lichenum. genus. *Linnaea*, *28*, 283–298.

Trevisan, V. B. (1853). *Spighe e paglie*.

Trevisan, V. B. A. (1860). *Conspectus verrucarinarum: prospetto dei generi e delle specie dei licheni verrucarini*. Roberti.

Triebel, D. (1989). Lecideicole Ascomyceten. Eine Revision der obligat lichenicolen Ascomyceten auf lecideoiden Flechten. *Bibliotheca Lichenologica*, *35*, 1–278.

Triebel, D. (1993). Notes on the genus *Sagediopsis* (Verrucariales, Adelococcaceae). *Sendtnera*, *1*, 273–280.

Triebel, D., & Rambold, G. (1988). *Cecidonia* and *Phacopsis* (Lecanorales): zwei lichenicole Pilzgattungen mit cecidogenen Arten. *Nova Hedwigia*, *47*, 279–309.

Triebel, D., Rambold, G., & Elix, J. A. (1995). A conspectus of the genus *Phacopsis* (Lecanorales). *Bryologist*, 71–83.

Triebel, D., Rambold, G., & Nash III, T. (1991). On lichenicolous fungi from continental North America. *Mycotaxon*, *42*, 263–296.

Triebel, D., Rambold, G., & Nash, T. (1991). On lichenicolous fungi from continental North America. *Mycotaxon*, *42*, 263–296.

Triebel, D., & Scholz, P. (2001). Lichenicolous fungi from Bavaria as represented in the Botanische Staatssammlung München. *Sendtnera*, *7*, 211–231.

Triebel, D., Wedin, M., & Rambold, G. (1997). The genus *Scutula* (lichenicolous ascomycetes, Lecanorales): species on the *Peltigera canina* and *P. horizontalis* groups. *Symbolae Botanicae Upsalienses*, *32*(1), 323–337.

Tsurykau, A., & Etayo, J. (2017). *Capronia suijae* (Herpotrichiellaceae, Eurotiomycetes), a new fungus on *Xanthoria parietina* from Belarus, with a key to the lichenicolous species growing on *Xanthoria* s. str. *The Lichenologist*, *49*, 1–12. https://doi.org/10.1017/S0024282916000530

Tuckerman, E. (1866). *Lichens of California, Oregon, and the Rocky Mountains: so far as yet known*. JS & C. Adams.

Tuckerman, E. (1872). *Genera Lichenum: an arrangement of the North American lichens*. E. Nelson.

Tuckerman, E. (1888a). A synopsis of North American lichens Part II, comprising the lecideacei, and (in part) the Graphidacei *2*, 1–108.

Tuckerman, E. (1888b). *A synopsis of the North American lichens* (Vol. II). SE Cassino.

Tulasne, L.-R. (1852). Mémoire pour servir à l'histoire organographique et physiologique des Lichens. *Annales des Sciences Naturelles. Botanique*, 5–128.

Upadhyay, H. (1964). Three new hyperparasites for *Mazosia phyllosema* (Nyl.) A. Zahlbr. from Amazonas valley. *Publicações do Instituto de Micologia da Universidade do Recife*, *402*, 1–11.

Urbanavichus, G., & Ismailov, A. (2013). The lichen flora of Gunib plateau, inner-mountain Dagestan (North-East Caucasus, Russia). *Turkish Journal of Botany*, *37*(4), 753–768.

Váczi, P., & Hawksworth, D. (2001). *Polycoccum crespoae* sp. nov., the first report of a lichenicolous fungus on *Chondropsis semiviridis* (Parmeliaceae). *Lichenologist*, *33*(6), 513–517.

Vainio, E. (1921). Lichenes ab A. Yasuda in Japonia collecti. Continuatio I. *Botanical Magazine Tokyo*, *35*, 45–79.

Vainio, E. A. (1883). *Adjumenta ad lichenographiam Lapponiae fennicae atque Fenniae borealis II: Havainnoita suomen Lapin ja Pohjais-suomen jäkäläkasvistosta* (Vol. 10). J. Simelii Arfingars Tryckeri.

Vainio, E. A. (1896). Lichenes *Antillarum* a W.R. Elliott collecti. *Journal of botany, British and foreign*, *34*, 258–266.

Vainio, E. A. (1899). *Lichenes in Caucaso et in Peninsula Taurica annis 1884–1885 ab H. Lojka et M. a Déchy collecti*. nom de l'éditeur non disponible.

Vainio, E. A. (1909). Lichenes in viciniis hibemae expeditionis Vegae prope pagum Pitlekai in Sibiria septentrionali a Dre E. Almquist collecti. *Arkiv för Botanik*, *8*, 1–175.

Vainio, E. A. (1915). Additamenta ad Lichenographiam Antillarum illustrandam. *Annales Academiae Scientiarum Fennicae.*, *6*(7), 1–226.

Vainio, E. A. (1921a). Lichenes insularum Philippinarum, III. *Annales Academiae Scientiarum Fennicae.*, *15*(6), 1–368.

Vainio, E. A. (1921b). Lichenographia Fennia I. - Pyrenolichenes iisque proximi Pyrenomycetes et Lichenes imperfecti. *Acta Societatis pro Fauna et Flora Fennica*, *49*(2), 1–274.

Vainio, E. A. (1927). Lichenographia Fennica III. Coniocarpeae. *Acta Societatis pro Fauna et Flora Fennica*, *57*, 1–138.

Valadbeigi, T., & von Brackel, W. (2011). Two new species of *Lichenostigma* (Lichenotheliaceae, lichenicolous fungi) from Iran. *Willdenowia*, 191–195.

Valenzuela, R., Luna-Vega, I., Martínez-Pineda, M., Martínez-González, C. R., García-Jiménez, J., de la Fuente, J., Bautista-Hernández, S., Acosta-Castellanos, S., & Raymundo, T. (2023). Novelties in Macrofungi of the

Tropical Montane Cloud Forest in Mexico. *Journal of Fungi*, *9*(4), 477. https://doi.org/10.3390/jof9040477

van den Boom, P. (2009). New *Halecania* species (Catillariaceae) from Europe and South America. *The Bryologist*, *112*(4), 827–832.

van den Boom, P. (2010). New or interesting lichens and lichenicolous fungi of Gran Canaria (Canary Islands, Spain). *Willdenowia*, *40*(2), 359–368.

van den Boom, P. (2012). Additions and notes to the checklist of lichens and lichenicolous fungi of Cape Verde. *Österreichische Zeitschrift für Pilzkunde*, *21*, 5–16.

van den Boom, P. (2015). Lichens and lichenicolous fungi from graveyards of the area of Eindhoven (the Netherlands), with the description of two new species. *Annalen des Naturhistorischen Museums in Wien. Serie B für Botanik und Zoologie*, *117*, 245–276.

van den Boom, P. (2016). Lichens and lichenicolous fungi of the Azores (Portugal), collected on São Miguel and Terceira with the descriptions of seven new species. *Acta Botanica Hungarica*, *58*(1–2), 199–222.

Van den Boom, P. (2020). Further interesting lichens and lichenicolous fungi from Tenerife (Canary Islands, Spain), with the description of two new species. *Ascomycete.org*, *12*(5), 199–204.

van den Boom, P., & Clerc, P. (2017). Further new or interesting lichens and lichenicolous fungi from La Palma (Canary Islands, Spain). *Folia Cryptogamica Estonica*, *54*, 117–123.

van den Boom, P., Clerc, P., & Ertz, D. (2015). New records of lichens and lichenicolous fungi from La Gomera (Canary Islands, Spain), including the new species: *Usnea boomiana* P. Clerc. *Candollea*, *70*(2), 165–177. https://doi.org/10.15553/c2015v702a1

van den Boom, P., & Elix, J. A. (2005). Notes on *Halecania* species, with descriptions of two new species from Asia. *The Lichenologist*, *37*(3), 237–246.

van den Boom, P., & Ertz, D. (2012). Lichens and lichenicolous fungi from El Hierro (Canary Islands), a survey, including five new species. *Cryptogamie, Mycologie*, *33*(1), 59–98.

van den Boom, P., & Ertz, D. (2014). A new species of *Micarea* (Pilocarpaceae) from Madeira growing on *Usnea*. *The Lichenologist*, *46*(3), 295–301. https://doi.org/10.1017/S0024282913000698

van den Boom, P., & Etayo, J. (2001). Two new sorediate species of lichens in the Catillariaceae from the Iberian Peninsula. *Lichenologist*, *33*(2), 103–110.

van den Boom, P., & Etayo, J. (2006). New records of lichens and lichenicolous fungi from Fuerteventura (Canary Islands), with descriptions of some new species. *Cryptogamie Mycologie*, *27*(4), 341–374.

van den Boom, P., & Etayo, J. (2014). New records of lichenicolous fungi and lichenicolous lichens from the Iberian Peninsula, with the description of four new species and one new genus. *Opuscula Philolichenum*, *13*, 44–79.

van den Boom, P., & Etayo, J. (2017). Further interesting lichens and lichenicolous fungi from Fuerteventura, Canary Islands (Spain), with three new species and notes on *Mixtoconidium*. *Ascomycete.org*, *9*, 124–134.

van den Boom, P., & Giralt, M. (2012). Checklist and three new species of lichens and lichenicolous fungi of the Algarve (Portugal). *Sydowia*, *64*, 149–208.

van den Boom, P., Sipman, H. J. M., Divakar, P. K., & Ertz, D. (2017). New or interesting records of lichens and lichenicolous fungi from Panama, with descriptions of ten new species. *Sydowia*, *69*, 47–72.

van den Boom, P. P., Etayo, J., & de Silanes, M. E. L. (2023). Notes on Lichenicolous *Micarea* species in Spain and Macaronesia, with the description of two new species. *Nova Acta Científica Compostelana*, *30*, 1–7.

van den Boom, P. P., & Moniri, M. H. (2018). Notes on the lichen genus *Lecania* (Ramalinaceae) in Iran, with the description of a new *Arthonia* species (Arthoniaceae). *Nova Hedwigia*, *107*(3/4), 407–421.

Van den Boom, P. P. G., Sipman, H. J. M., Divakar, P. K., & Ertz, D. (2018). New or interesting records of lichens and lichenicolous fungi from Suriname, with descriptions of eight new species. *Ascomycete.org*, *10*(6), 244–258.

Van Den Broeck, D., & Ertz, D. (2018). *Enterographa confusa* sp. nov.(Roccellaceae, Arthoniales) discovered by chance in type material of its host lichen *Arthonia ochraceella*, described more than a century ago. *Phytotaxa*, *343*(1), 89–93.

van Der Kolk, H.-J., Earland-Bennett, P. M., & Hawksworth, D. L. (2020). A new *Psammina* species with exceptionally long conidial arms, with a key to the ten known species of the genus. *The Lichenologist*, *52*(5), 337–343.

van der Kolk, H.-J., Ertz, D., Hessen, B., & Boers, J. (2025). *Chaenothecopsis inconspicua*, a new sporodochioid lichenicolous fungus growing on *Lecanora expallens*. *The Lichenologist*, *57*(2), 82–90. https://doi.org/10.1017/s0024282925000076

Vasilyeva, L. (2001). Hysteriaceous fungi in the Russian Far East. IV. *Glyphium*, *Lophium* and *Mytilinidion*. *MIKOLOGIIA I FITOPATOLOGIIA*, *35*(1), 15–18.

Vaughan, T. G. (2023). ReMASTER: Improved phylodynamic simulation for BEAST 2.7. *bioRxiv*, 1–3. https://doi.org/10.1101/2023.10.09.561485

Velenovský, J. (1934). Monographia Discomycetum Bohemiae. *Czechoslovakia, Prague*, *1*, 1–436.

Verma, R. K., Prasher, I. B., Sushma, Gautam, A. K., Rajeshkumar, K. C., & Castañeda-Ruiz, R. F. (2021). *Kirschsteiniothelia shimlaensis* sp. nov. from Himachal Pradesh, India. *Mycotaxon*, *136*, 401–407. https://doi.org/10.5248/136.401

Vězda. (1989). *Lichenes Selecti Exsiccati, Fascicle 92 (nos 2276-2300) (Průhonice)*, *5*, 2292.

Vězda, A. (1969). Beiträge zur Kenntnis der flechtenbewohnenden Pilze in der Tschechoslowakei: II.-Zwei neue Arten: *Opegrapha rinodinae* sp. nov. und *Polycoccum galligenum* sp. nov. . *Ceska Mykologie*, *23*, 104–109.

Vězda, A. (1970). Beitrag zur Kenntnis der flechtenbewohnenden Pilze aus der Tschechoslowakei. III. *Czech Mycology*, *24*(4), 220–229.

Vězda, A. (1973). Lichenes Selecti Exsiccati. *Fascicles (Průhonice) 47*, 1151–1175.

Vězda, A. (1978). Neue oder wenig bekannte Flechten in der Tschechoslowakei. II. *Folia Geobotanica et Phytotaxonomica*, *13*, 397–420.

Vilgalys, R., & Hester, M. (1990). Rapid genetic identification and mapping of enzymatically amplified ribosomal DNA from several *Cryptococcus* species. *Journal of Bacteriology*, *172*(8), 4238–4246. https://doi.org/10.1128/jb.172.8.4238-4246.1990

Vishnu, A., Khan, M. A., Bera, M., Dilcher, D. L., & Bera, S. (2017). Fossil Asterinaceae in the phyllosphere of the eastern Himalayan Neogene Siwalik forest and their palaeoecological significance. *Botanical Journal of the Linnean Society*, *185*(2), 147–167.

von Albertini, J. B., & von Schweinitz, L. D. (1805). *Conspectus fungorum in Lusatiae Superioris agro Niskiensi crescentium, e methodo Persooniana*. sumtibus Kummerianis.

Von Arx, J., & Müller, E. (1975). A re-evaluation of the bitunicate ascomycetes with keys to families and genera. *Stud. Mycol.*, *9*, 1–159.

von Brackel, W. (2008). *Zwackhiomyces echinulatus* sp. nov. and other lichenicolous fungi from Sicily, Italy. *Herzogia*, *21*, 181–198.

von Brackel, W. (2010a). *Dacampia cyrtellae*, a new name for *Dacampia lecaniae* Brackel. *Herzogia*, *23*(2), 315–316.

von Brackel, W. (2010). Some lichenicolous fungi and lichens from Iceland, including *Lichenopeltella uncialicola* sp. nov. *Herzogia*, *23*(1), 93–110.

von Brackel, W. (2010b). Weitere Funde von flechtenbewohnenden Pilzen in Bayern. Beiträge zu einer Checkliste V. *Berichte der Bayerischen Botanischen Gesellschaft*, *80*, 5–32.

von Brackel, W. (2011a). Lichenicolous fungi and lichens from Puglia and Basilicata (southern Italy). *Herzogia*, *24*(1), 65–102.

von Brackel, W. (2011b). *Lichenopeltella rangiferinae* sp. nov. and some other lichenicolous fungi from Iceland. *Acta Botanica Islandica*, *15*, 51–60.

von Brackel, W. (2013a). Miscellaneous records of lichenicolous fungi from the Italian Alps. *Herzogia*, *26*(1), 141–158.

von Brackel, W. (2013b). *Pronectria rhizocarpicola*, a new lichenicolous fungus from Switzerland. *Mycosphere*, *4*, 926–928.

von Brackel, W. (2014). Kommentierter Katalog der flechtenbewohnenden Pilze Bayerns. *Bibliotheca Lichenologica*, *109*, 1–476.

von Brackel, W. (2015a). Lichenicolous fungi from Central Italy with notes on some remarkable hepaticolous, algicolous and lichenized fungi. *Herzogia*, *28*(1), 212–281.

von Brackel, W. (2015b). Lichenicolous fungi from Central Italy with notes on some remarkable hepaticolous, algicolous and lichenized fungi. *Herzogia*, *28*(1), 212–282. https://doi.org/10.13158/heia.28.1.2015.212

von Brackel, W. (2019). Weitere Funde von flechtenbewohnenden Pilzen in Bayern – Beitrag zu einer Checkliste VI. *Berichte der Bayerischen Botanischen Gesellschaft*, *89*, 105–126.

von Brackel, W. (2021a). Lichenicolous fungi from Campania (Italy). *Borziana*, *2*, 31–68. 10.7320/Borz.002.031

von Brackel, W. (2021b). Weitere Funde von flechtenbewohnenden Pilzen in Bayern – Beitrag zu einer Checkliste VII. *Berichte der Bayerischen Botanischen Gesellschaft*, *91*, 95–117.

von Brackel, W. (2023). Weitere Funde von flechtenbewohnenden Pilzen in Bayern – Beitrag zu einer Checkliste VIII. *Archive for Lichenology*, *35*, 1–22.

von Brackel, W. (2024). Voyage armoricain – lichenicolous fungi from northern France. *Herzogia*, *37*(1), 32–47. https://doi.org/10.13158/heia.37.1.2024.32

von Brackel, W. (2025). *Pronectria raetzelii*, a new lichenicolous fungus on Peltigera from Brandenburg (northeastern Germany). *Graphis Scripta*, *37*, 1–6.

von Brackel, W., & Berger, F. (2010). Gall-inducing species of *Polycoccum* (Ascomycota) on the lichen genus *Placopsis*. *Herzogia*, *23*(2), 195–204.

von Brackel, W., & Berger, F. (2019). Lichenicolous fungi from Sardinia (Italy): new records and a first synopsis. *Herzogia*, *32*(2), 444–471. https://doi.org/10.13158/heia.32.2.2019.444

von Brackel, W., & Etayo, J. (2010). *Pronectria collematis* (Bionectriaceae, Hypocreales), a new species on *Collema* from Germany and Spain. *The Lichenologist*, *42*(4), 361–364.

von Brackel, W., Etayo, J., & Lechat, C. (2012). Notes on three lichenicolous species of *Acremonium* including two new species. *Mycosphere*, *3*, 854–862.

Von Brackel, W., & KocourkovÁ, J. (2006). *Endococcus karlstadtensis* sp. nov. und weitere Funde von flechtenbewohnenden Pilzen in Bayern–Beitrag zu einer Checkliste II. *Berichte der Bayerischen Botanischen Gesellschaft*, *76*, 5–32.

von Brackel, W., & Puntillo, D. (2016). New records of lichenicolous fungi from Calabria (southern Italy), including a first checklist. *Herzogia*, *29*(2), 277–306. https://doi.org/10.13158/heia.29.2.2016.277

von Brackel, W., & Puntillo, D. (2023). Additions to the flora of lichenicolous fungi of Southern Italy. *Borziana*, *4*, 5–31. https://doi.org/10.7320/Borziana.004.005

von Brackel, W., & Svetlana, M. (2009). A new lichenicolous species of *Endophragmiella* from Bavaria/Germany. *Nova Hedwigia*, *88*, 513–519.

Von Brackel, W., & Wirth, V. (2023). Flechtenbewohnende Pilze im Naturraum Schwarzwald (südwestliches Deutschland). *Herzogia*, *36*(1), 84–130. https://doi.org/10.13158/heia.36.1.2023.84

von Brackel, W., & Zimmermann, D. G. (2010). Eine Neue Nectriopsis-Art auf *Cladonia* aus Nordrhein-Westfalen. *Herzogia*, *25*(2), 231–234.

von Halácsy, E. (1894). Flechten in Halácsy: Botanische Ergebnisse einer im Auftrage der hohen Kais. Akademie der Wissenschaften unternommenen Forschungsreise in Griechenland. *Denkschriften der Akademie der Wissenschaften (Wien) Mathematisch-naturwissenschaftliche Klasse*, *61*, 521–533.

Vondrak, J., Frolov, I., Davydov, E. A., Yakovchenko, L., Malíček, J., Svoboda, S., & Kubásek, J. (2019). The lichen family Teloschistaceae in the Altai-Sayan region (Central Asia). *Phytotaxa*, *396*(1), 1–66.

Vondrak, J., & Jaroslav, Š. (2007). *Lichenostigma svandae*, a new lichenicolous fungus on *Acarospora cervina*. *The Lichenologist*, *39*(3), 211–216. https://doi.org/10.1017/S0024282907006731

VondrAK, J., & KocourkovA, J. (2008). New lichenicolous *Opegrapha* species on *Caloplaca* from Europe. *The Lichenologist*, *40*(3), 171–184. https://doi.org/10.1017/S0024282908007536

Vondrak, J., Palice, Z., Mares, J., & Kocourková, J. (2013). Two Superficially Similar Lichen Crusts, *Gregorella humida* and *Moelleropsis nebulosa*, and a Description of the New Lichenicolous Fungus *Llimoniella gregorellae*. *Herzogia*, *26*(1), 31–48. https://doi.org/ 10.13158/heia.26.1.2013.31

Vondrák, J., Svoboda, S., Malíček, J., Palice, Z., Kocourková, J., Knudsen, K., Mayrhofer, H., Thüs, H., Schultz, M., & Košnar, J. (2022). From Cinderella to princess: an exceptional hotspot of lichen diversity in a long-inhabited central-European landscape. *Preslia*, *94*(1), 143–181.

Vouaux, L. (1912). Synopsis des champignons parasites de lichens. *Bulletin de la Société Mycologique de France*, *28*, 177–256.

Vouaux, L. (1912). *Synopsis des champignons, parasites des lichens*. Au siège de la société.

Vouaux, L. (1913a). Synopsis des champignons, parasites des lichens. *Bulletin de la Société Mycologique de France*, *29*(1), 447–494.

Vouaux, L. (1913b). Synopsis des champignons, parasites des lichens. *Bulletin de la Société Mycologique de France*, *29*(1), 33–128.

Vouaux, L. (1913c). Synopsis des champignons, parasites des lichens. *Bulletin de la Société Mycologique de France*, *29*(1), 399–446.

Vouaux, L. (1914). Synopsis des champignons parasites de lichens. *Bulletin trimestriel de la Societe mycologique de France*, *30*(2), 135–198.

Vouaux, L. (1914). Synopsis des champignons parasites des lichens. *Bulletin trimestriel de la Societe mycologique de France*, *30*, 281–329.

Vu, D., Groenewald, M., Vries, M., Gehrmann, T., Stielow, B., Eberhardt, U., Al-Hatmi, A., Groenewald, J. Z., Cardinali, G., & Houbraken, J. (2019). Large-scale generation and analysis of filamentous fungal DNA barcodes boosts coverage for kingdom fungi and reveals thresholds for fungal species and higher taxon delimitation. *Studies in Mycology*, *92*, 135–154. https://doi.org/10.1016/j.simyco.2018.05.001

Wainio, E. (1878). Florula Tavastia Orientalis. —Havaiunoita Ita-Hameen Kasvistosta. *Meddelanden af Societas Pro Fauna Et Flora Fennica.*, 1–121.

Wakefield, E. (1934). Contributions to the flora of tropical America: XXI. Fungi collected in British Guiana, chiefly by the Oxford university expedition, 1929. *Bulletin of Miscellaneous Information (Royal Botanic Gardens, Kew)*, *1934*(6), 238–258.

Wallroth, F. W. (1825). *Naturgeschichte der Flechten nach neuen Normen und in ihrem Umfange bearbeitet: Ein faßlicher Unterricht zum Selbststudium der Flechtenkunde* (Vol. Erster Theil. Von dem Flechtenlager im Allgemeinen). Friedrich Wilmans.

Wallroth, F. W. (1833). *Flora Cryptogamica Germaniae* (Vol. Pars Posterior-Algas et Fungos). J. L. Schrag.

Wang, Y. Z., Aptroot, A., & Hyde, K. D. (2004). *Revision of the Ascomycete Genus Amphisphaeria*. Fungal Diversity Press. https://doi.org/10.5353/th_b3124239

Weddell, M.-A. (1874). Florule lichénique des laves d'Agde. *Bulletin de la Société Botanique de France*, *21*(8), 330–347.

Wedin, M. (1993). *Arthonia pseudocyphellariae*, a new lichenicolous fungus from the Southern Hemisphere. *Lichenologist*, *25*(3), 301–303.

Wedin, M. (1994). New and Noteworthy Lichenicolous Fungi From Southernmost South America. *Lichenologist*, *26*(3), 301–310. https://doi.org/10.1006/lich.1994.1022

Wedin, M., & Hafellner, J. (1998). Lichenicolous species of *Arthonia* on Lobariaceae with notes on excluded taxa. *Lichenologist*, *30*(1), 59–91. https://doi.org/10.1006/lich.1997.0116

Wedin, M., & Kondratyuk, S. Y. (1997). *Dactylospora Plectocarpoides*, a Gall-Forming Species of *Arthonia* on *Pseudocyphellaria*. *Lichenologist*, *29*(1), 97–99.

Weese, J. (1919). Beiträge zur Kenntnis der Hypocreaceen: Mitteilung 2. *Sitzungsberichte, Akademie der Wissenschaften in Wien. Mathematisch-naturwissenschaftliche Klasse. Abteilung 1*, *128*, 693–754.

Wegelin, H. (1894). Beitrag zur Pyrenomycetenflora der Schweiz. *Mitteilungen der Thurgauischen Naturforschenden Gesellschaft*, *11*, 1–12.

Werner, R.-G. (1963). Notes de lichénologie libano-syrienne. VII. *Bulletin de la Société Botanique de France*, *110*(7–8), 311–315.

Westberg, M., Isaksson, R., & Frisch, A. (2025). Two new lichenicolous *Arthonia* species from Scandinavia. *Phytotaxa*, *682*(1), 68–80. https://doi.org/10.11646/phytotaxa.682.1.4

Westendorp, G., & Wallays, A. (1849). Herbier cryptogamique ou collection des plantes cryptogames et agames qui croissent en Belgique. *Herb. Crypt. Belg.*, *9*, 414.

White, T. J., Bruns, S., Lee, S., & Taylor, J. (1990). Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. *Pcr Protocols A Guide to Methods & Applications*(1), 315–322.

White, T. J., Bruns, T., Lee, S., & Taylor, J. (1990). Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. *PCR protocols: a guide to methods and applications*, *18*(1), 315–322.

Wijayawardene, N., Hyde, K., Al-Ani, L., Tedersoo, L., Haelewaters, D., Rajeshkumar, K., Zhao, R., Aptroot, A., Leontyev, D., & Saxena, R. (2020). Outline of Fungi and fungus-like taxa. *Mycosphere*, *11*(1), 1060–1456.

Wijayawardene, N. N., Crous, P. W., Kirk, P. M., Hawksworth, D. L., Boonmee, S., Braun, U., Dai, D.-Q., D'souza, M. J., Diederich, P., Dissanayake, A., Doilom,

M., Hongsanan, S., Jones, E. B. G., Groenewald, J. Z., Jayawardena, R., Lawrey, J. D., Liu, J.-K., Lücking, R., Madrid, H.,…Hyde, K. D. (2014). Naming and outline of Dothideomycetes–2014 including proposals for the protection or suppression of generic names. *Fungal Diversity*, *69*(1), 1–55. https://doi.org/10.1007/s13225-014-0309-2

Wijayawardene, N. N., Hyde, K. D., Dai, D.-Q., Sanchez-Garcia, M., Goto, B. T., Saxena, R., Erdoğdu, M., Selçuk, F., Rajeshkumar, K., Aptroot, A., Błaszkowski, J., Boonyuen, N., da Silva, G., de Souza, F., Dong, W., Ertz, D., Haelewaters, D., Jones, E., Karunarathna, S.,…Thines, M. (2022). Outline of Fungi and fungus-like taxa – 2021. *Mycosphere*, *13*(1), 53–453. https://doi.org/10.5943/mycosphere/13/1/2

Wijayawardene, N. N., Hyde, K. D., Lumbsch, H. T., Liu, J. K., Maharachchikumbura, S. S. N., Ekanayaka, A. H., Tian, Q., & Phookamsak, R. (2018). Outline of Ascomycota: 2017. *Fungal Diversity*, *88*(1), 167–263. https://doi.org/ 10.1007/s13225-018-0394-8

Wijayawardene, N. N., Hyde, K. D., Rajeshkumar, K. C., Hawksworth, D. L., Madrid, H., Kirk, P. M., Braun, U., Singh, R. V., Crous, P. W., Kukwa, M., Lücking, R., Kurtzman, C. P., Yurkov, A., Haelewaters, D., Aptroot, A., Lumbsch, H. T., Timdal, E., Ertz, D., Etayo, J.,…Karunarathna, S. C. (2017). Notes for genera: Ascomycota. *Fungal Diversity*, *86*(1), 1–594. https://doi.org/10.1007/s13225-017-0386-0

Wijayawardene, N. N., Phillips, A. J. L., Tibpromma, S., Dai, D. Q., Selbmann, L., Monteiro, J. S., Aptroot, A., Flakus, A., Rajeshkumar, K. C., & Coleine, C. (2021). Looking for the undiscovered asexual taxa: case studies from lesser studied life modes and habitats. *Mycosphere*, *12*(1), 1290–1333. https://doi.org/10.5943/mycosphere/12/1/17

Winter, G. (1886). Nachträge und Berichtigungen zu Saccardo's Sylloge Fungorum. Vol. I, II. *Hedwigia*, *25*, 10–28.

Wirth, V. (1987). Die Flechten Baden-Württembergs: Verbreitungsatlas. 1–528.

Wu, H. X., Schoch, C. L., Boonmee, S., Bahkali, A. H., Chomnunti, P., & Hyde, K. D. (2011). A reappraisal of Microthyriaceae. *Fungal Diversity*, *51*, 189–248. https://doi.org/10.1007/s13225-011-0143-8

Xia, J.-W., Mu, T.-C., Zhang, Z.-X., Li, Z., & Zhang, X.-G. (2022). *Neoacrodictys elegans* gen. & sp. nov. from Hainan Province, China. *Mycotaxon*, *137*(1), 63–71.

Xu, R.-F., Phukhamsakda, C., Dai, D.-Q., Karunarathna, S. C., & Tibpromma, S. (2023). *Kirschsteiniothelia xishuangbannaensis* sp. nov. from pará rubber (*Hevea brasiliensis*) in Yunnan, China. *Current Research in Environmental & Applied Mycology*, *13*(1), 34–56. https://doi.org/10.5943/cream/13/1/3

Yacharoen, S., Tian, Q., Chomnunti, P., Boonmee, S., Chukeatirote, E., Bhat, J., & Hyde, K. (2015). Patellariaceae revisited. *Mycosphere*, *6*(3), 290–326.

Yang, J., Liu, L.-L., Jones, E. B. G., Hyde, K. D., Liu, Z.-Y., Bao, D.-F., Liu, N.-G., Li, W.-L., Shen, H.-W., Yu, X.-D., & Liu, J.-K. (2023). Freshwater fungi from karst landscapes in China and Thailand. *Fungal Diversity*, *119*(1), 1–212. https://doi.org/10.1007/s13225-023-00514-7

Yang, J., Liu, L.-L., Jones, E. G., Hyde, K. D., Liu, Z.-Y., Bao, D.-F., Liu, N.-G., Li, W.-L., Shen, H.-W., & Yu, X.-D. (2023a). Freshwater fungi from karst landscapes in China and Thailand. *Fungal Diversity*, *119*(1), 1–212. https://doi.org/10.1007/s13225-023-00514-7

Yang, J., Liu, L.-L., Jones, E. G., Hyde, K. D., Liu, Z.-Y., Bao, D.-F., Liu, N.-G., Li, W.-L., Shen, H.-W., & Yu, X.-D. (2023b). Freshwater fungi from karst landscapes in China and Thailand. *Fungal Diversity*, *119*(1), 1-212.

Yeshitela, K., Fischer, E., Killmann, D., & Serusiaux, E. (2009). Two new foliicolous species of *Enterographa* (Roccellaceae) from Kenya. *The Lichenologist*, *41*(1), 17–23.

Zahlbruckner, A. (1897). *Stromatopogon*, eine neue Flechtengattung. *Annalen des Naturhistorischen Museums in Wien*, *12*(häft 2), 99–101.

Zahlbruckner, A. (1922). *Catalogus Lichenum Universalis*. *1*, 1–696.

Zahlbruckner, A. (1923). *Catalogus Lichenum Universalis* (Vol. 2).

Zahlbruckner, A. (1926). *Catalogus lichenum universalis* (Vol. 4). Gebrüder Borntraeger.

Zahlbruckner, A. (1931). *Catalogus lichenum universalis* (Vol. 7). Borntraeger.

Zahlbruckner, A. (1941). *Lichenes Novae Zelandiae: a Cl. HH Allan eiusque collaboratoribus lecti*. Hölder-Pichler-Tempsky.

Zamora, J. C., Millanes, A., Etayo, J., & Wedin, M. (2018). *Tremella mayrhoferi*, a New Lichenicolous Species on *Lecanora allophana*. *Herzogia*, *31*, 666–676. https://doi.org/ 10.13158/heia.31.1.2018.666

Zamora, J. C., Millanes, A., Wedin, M., Rico, V., & Pérez-Ortega, S. (2016). Understanding lichenicolous heterobasidiomycetes: new taxa and reproductive innovations in Tremella s.l. *Mycologia*, *108*, 381–396. https://doi.org/10.3852/15-090

Zamora, J. C., Pérez-Ortega, S., & Rico, V. (2011). *Tremella macrobasidiata* (Basidiomycota, Tremellales), a new lichenicolous fungus from the Iberian Peninsula. *The Lichenologist*, *43*, 407–415. https://doi.org/10.1017/S0024282911000405

Zamora, J. C., Pérez-Ortega, S., & Rico, V. (2014). *Heteroacanthella ellipsospora* sp. nov., the first lichenicolous basidiomycete with acanthoid basidia. *The Lichenologist*, *46*(1), 17–23. https://doi.org/10.1017/S0024282913000765

Zeng, X., Tan, T., Tian, F., Wang, Y., & Wen, T. (2023). OFPT: a one-stop software for fungal phylogeny. *Mycosphere*, *14*(1), 1730–1741. https://doi.org/10.5943/mycosphere/14/1/20

Zhang, J. F., Liu, J. K., Hyde, K. D., Chen, Y. Y., Ran, H. Y., & Liu, Z. Y. (2023). Ascomycetes from karst landscapes of Guizhou Province, China. *Fungal Diversity*, *122*(1), 1–160. https://doi.org/10.1007/s13225-023-00524-5

Zhang, S.-N., Hyde, K. D., Jones, E. G., Jeewon, R., Cheewangkoon, R., & Liu, J.-K. (2019). Striatiguttulaceae, a new pleosporalean family to accommodate *Longicorpus* and *Striatiguttula* gen. nov. from palms. *MycoKeys*, *49*, 99–129.

Zhang, Y.-Z., Chen, Q.-L., Ma, J., Lu, Y.-Z., Chen, H.-B., & Liu, N.-G. (2023). Morphological and multi-gene phylogenetic analyses reveal five new

hyphomycetes from freshwater habitats. *Frontiers in microbiology*, *14*, 1253239. https://doi.org/10.3389/fmicb.2023.1253239

Zhang, Y., & Fournier, J. (2015). *Kirschsteiniothelia thujina* (Peck) D. Hawksw. (Kirschsteiniotheliaceae), reported from Europe for the first time. *Ascomycete.org*, *7*(1), 31–37.

Zhdanov, I. (2020). *Halecania ahtii* (Leprocaulaceae), a new lichen species from the Russian Far East. *Novosti sistematiki nizshikh rastenii*, *54*(2), 405–411.

Zhuang, W.-Y. (1988). A monograph of the genus Unguiculariopsis (Leotiaceae, Encoelioideae). *Mycotaxon*, *32*, 1–83.

Zhuang, W.-Y. (2000). Two new species of *Unguiculariopsis* (Helotiaceae, Encoelioideae) from China. *Mycological Research*, *104*(4), 507–509.

Zhurbenko, M. (2002). *Arthonia triebeliae* (Arthoniales), a new lichenicolous fungus from the Arctic. *Mycological Progress*, *1*(2), 137–141.

Zhurbenko, M. (2007). *Corticifraga santessonii* and *C. chugachiana* (Lecanoromycetes, Ascomycota), new species of lichenicolous fungi from the Holarctic. *The Lichenologist*, *39*(3), 221–226.

Zhurbenko, M. (2008). *Lichenochora thorii* (Phyllachorales), a new lichenicolous ascomycete from Europe. *Nova Hedwigia*, 509–512.

Zhurbenko, M. (2009). New and interesting lichenicolous hypocrealean fungi from the Northern Hemisphere. *Sydowia*, *61*(7), 177–188.

Zhurbenko, M. (2010). New and interesting lichenicolous fungi from Eurasia. II. *Mycosphere*, *1*(3), 213–222.

Zhurbenko, M. (2013). *Hainesia peltigerae* sp. nov. and some other interesting lichenicolous fungi from Eurasia. *Graphis Scripta*, *25*, 39–43.

Zhurbenko, M. (2013). Lichenicolous fungi and some allied lichens from the Canadian Arctic. *Opuscula Philolichenum*, *12*(1), 180–197.

Zhurbenko, M., Braun, U., Heuchert, B., & Kobzeva, A. (2015). Three new lichenicolous hyphomycetes from Asia. *Herzogia*, *28*(2), 584–598.

Zhurbenko, M., & Diederich, P. (2008). *Stigmidium cladoniicola*, a new lichenicolous fungus from Northern Ural, Russia. *Graphis Scripta*, *20*, 13–18.

Zhurbenko, M., Diederich, P., & Braun, U. (2023). *Randlanea usneicola* gen. & sp. nov., a new lichenicolous coelomycete on *Usnea* from the Russian Caucasus. *Herzogia*, *36*, 497–503. https://doi.org/ 10.13158/heia.36.2.2023.497

Zhurbenko, M., Diederich, P., & Otnyukova, T. (2008). *Plectocarpon hypogymniae* (Roccellaceae), a new lichenicolous species from Siberia. *The Bryologist*, *111*(2), 328–330. https://doi.org/10.1639/0007-2745(2008)111[328:PHRANL]2.0.CO;2

Zhurbenko, M., & Dillman, K. (2010). *Polycoccum hymeniicola* comb. nov.(Dacampiaceae) and other interesting lichenicolous fungi from southeastern Alaska. *The Bryologist*, *113*(2), 260–267.

Zhurbenko, M., & Etayo, J. (2012). *Stigmidium lobariae*, a new lichenicolous fungus from the Holarctic. *Mycosphere*, *3*(1), 62–64.

Zhurbenko, M., & Etayo, J. (2013). *Biazrovia*, a new genus of lichenicolous ascomycetes from Asia. *Mycobiota*, *1*, 51–56. https://doi.org/10.12664/mycobiota.2013.01.05

Zhurbenko, M., Heuchert, B., & Braun, U. (2015). *Talpapellis solorinae* sp. nov. and an updated key to the species of *Talpapellis* and *Verrucocladosporium*. *Phytotaxa*, *234*, 191–194. https://doi.org/10.11646/phytotaxa.234.2.10

Zhurbenko, M., Tadome, K., & Ohmura, Y. (2018). *Pronectria japonica* species nova and a key to the lichenicolous fungi and lichens growing on *Ochrolechia*. *Herzogia*, *31*((1) Teil 2), 494–504. https://doi.org/10.13158/heia.31.1.2018.494

Zhurbenko, M., & Triebel, D. (2002). *Cercidospora lecidomae* (Dothideales, Ascomycetes), a new lichenicolous fungus from the North Holarctic. *Bibliotheca Lichenologica*, *86*, 205–214.

Zhurbenko, M., & Zhdanov, I. (2013). *Melaspilea galligena* sp. nov. and some other lichenicolous fungi from Russia. *Folia Cryptogamica Estonica*, *50*, 89–99. https://doi.org/ 10.12697/fce.2013.50.12

Zhurbenko, M. P. (2004). Lichenicolous and some interesting lichenized fungi from the Northern Ural, Komi Republic of Russia. *Herzogia*, *17*, 77–86.

Zhurbenko, M. P. (2007). New lichenicolous fungi from Eurasia. *Graphis Scripta*, *19*(1), 1–9.

Zhurbenko, M. P. (2008). Lichenicolous fungi from Russia, mainly from its Arctic. II. *Mycologia Balcanica*, *5*(1–2), 13–22.

Zhurbenko, M. P. (2009a). Lichenicolous fungi and lichens from the Holarctic. Part II. *Opuscula Philolichenum*, *7*, 121–186.

Zhurbenko, M. P. (2009b). Lichenicolous fungi and some lichens from the Holarctic. *Opuscula Philolichenum*, *6*, 87–120.

Zhurbenko, M. P. (2009c). *Sagediopsis pertusariicola* (Verrucariales), a new lichenicolous ascomycete from the Arctic. *Nova Hedwigia*, *88*(3), 549–555.

Zhurbenko, M. P. (2010). Lichenicolous fungi and lichens growing on *Stereocaulon* from the Holarctic, with a key to the known species. *Opuscula Philolichenum*, *8*, 9–39.

Zhurbenko, M. P. (2012). Lichenicolous fungi growing on *Thamnolia*, mainly from the Holarctic, with a worldwide key to the known species. *The Lichenologist*, *44*(2), 147–177.

Zhurbenko, M. P. (2015). *Sphaerellothecium siphulae* (Dothideomycetes incertae sedis), a new lichenicolous fungus on *Siphula ceratites* from the Arctic. *Nova Hedwigia*, *101*(3–4), 419–425.

Zhurbenko, M. P. (2017). Lichenicolous fungi of the Caucasus: new species, new records and a second synopsis. *Opuscula Philolichenum*, *16*, 267–311.

Zhurbenko, M. P. (2020). *Clypeococcum lenae* (Dothideomycetes), a new lichenicolous species from the Arctic, with a key to species of lichenicolous fungi on *Solorina*. *Opuscula Philolichenum*, *19*, 199–207.

Zhurbenko, M. P. (2021a). *Arthonia buelliae* sp. nov. (Arthoniaceae, Arthoniales, Ascomycota) and other noteworthy lichenicolous fungi from the Primorye Territory of Russia. *Phytotaxa*, *483*(2), 183–189. https://doi.org/10.11646/phytotaxa.483.2.11

Zhurbenko, M. P. (2021b). Lichenicolous fungi from the Holarctic. Part IV: New reports and a key to species on *Dermatocarpon*. *Opuscula Philolichenum*, *20*, 44–53.

Zhurbenko, M. P. (2021a). *Lichenochora sedelnikoviorum*, a new species from the Russian Arctic with a synopsis of published additions to the Panarctic checklist of lichenicolous fungi. *Opuscula Philolichenum*, *20*, 73–80.

Zhurbenko, M. P. (2021b). New species of lichenicolous fungi on *Solorina*. *Herzogia*, *34*(1), 127–137. https://doi.org/10.13158/heia.34.1.2021.127

Zhurbenko, M. P. (2021c). Studies on lichenicolous fungi in the Uppsala (UPS) collection curated by the late Rolf Santesson. *Herzogia*, *34*(2), 493–507. https://doi.org/10.13158/heia.34.2.2021.493

Zhurbenko, M. P. (2022a). *Atronectria thelotrematis* (Sordariomycetes), a remarkable new pyrenomycete on *Thelotrema lepadinum* from Chile, with a key to the lichenicolous fungi growing on *Thelotrema*. *Plant and Fungal Systematics*, *67*(2), 34–39. https://doi.org/10.35535/pfsyst-2022-0004

Zhurbenko, M. P. (2022b). *Endococcus grumantianus* sp. nov.(Ascomycota, Verrucariales) from Svalbard, with a key to *Endococcus* species growing on terricolous lichens. *Herzogia*, *35*(2), 656–663. https://doi.org/10.13158/heia.35.2.2022.656

Zhurbenko, M. P. (2022c). *Sclerococcum knudsenii* (Ascomycota, Sclerococcales), a new lichenicolous fungus on *Polycauliona bolacina* from California. *Herzogia*, *35*(1), 131–137. https://doi.org/10.13158/heia.35.1.2022.131

Zhurbenko, M. P. (2022d). Two new species of *Lichenotubeufia* (Dothideomycetes, Tubeufiales) from Chile and New Zealand, with a revised key to the genus. *The Lichenologist*, *54*(2), 117–122. https://doi.org/10.1017/S0024282922000081

Zhurbenko, M. P. (2023a). *Clypeococcum wedinii* (Dothideomycetes), a new lichenicolous fungus on *Bunodophoron*, with an updated key to species of *Clypeococcum*. *The Lichenologist*, 1–5. https://doi.org/10.1017/S0024282922000391

Zhurbenko, M. P. (2023b). Contributions to the knowledge of lichenicolous fungi growing on Pannariaceae, including four new species and an identification key. *Herzogia*, *36*(1), 131–160. https://doi.org/10.13158/heia.36.1.2023.131

Zhurbenko, M. P. (2023). Contributions to the knowledge of lichenicolous fungi growing on Sphaerophoraceae, with a key to the species. *Herzogia*, *36*(2), 501–523.

Zhurbenko, M. P., & Alstrup, V. (2004). Lichenicolous fungi on *Cladonia* mainly from the Arctic. *Symb. Bot. Ups.* , *34*(1), 477–499.

Zhurbenko, M. P., & Braun, U. (2012). *Cecidiomyces*, a new subantarctic lichenicolous hyphomycete genus. *The Lichenologist*, *44*(6), 801–806.

Zhurbenko, M. P., & Diederich, P. (2024). One new genus and six new species of lichenicolous hyphomycetes. *Herzogia*, *37*(1), 48–61. https://doi.org/10.13158/heia.37.1.2024.48

Zhurbenko, M. P., Diederich, P., & Gagarina, L. V. (2020). Lichenicolous fungi from Vietnam, with the description of four new species. *Herzogia*, *33*(2), 525–543. https://doi.org/10.13158/heia.33.2.2020.525

Zhurbenko, M. P., Enkhtuya, O., & Javkhlan, S. (2019). A first synopsis of lichenicolous fungi of Mongolia, with the description of five new species. *Plant and Fungal Systematics*, *64*(2), 345–366.

Zhurbenko, M. P., Etayo, J., Demidova, A. N., & Zhdanov, I. S. (2016). *Capronia josefhafellneri* sp. nov. (Ascomycota, Herpotrichiellaceae) and some other Lichenicolous Fungi from Vietnam. *Herzogia*, *29*(2), 364–373. https://doi.org/10.13158/heia.29.2.2016.364

Zhurbenko, M. P., Etayo, J., Fedrowitz, K., & Thor, G. (2015). Miscellaneous reports of lichenicolous fungi from Argentina including the new species *Didymellopsis nephromatis*. *Opuscula Philolichenum*, *14*, 82–89.

Zhurbenko, M. P., Ezhkin, A. K., Skirina, I. F., & Ohmura, Y. (2017). *Dactylospora anziae*, a new lichenicolous ascomycete on *Anzia* from East Asia. *Folia Cryptogamica Estonica*, *54*, 13–16.

Zhurbenko, M. P., Frisch, A., Ohmura, Y., & Thor, G. (2015). Lichenicolous Fungi from Japan and Korea: New Species, New Records and a First Synopsis for Japan. *Herzogia*, *28*(2), 762–789. https://doi.org/10.13158/heia.28.2.2015.762

Zhurbenko, M. P., & Grube, M. (2010). *Arthonia pannariae* (Arthoniaceae, Arthoniales), a new lichenicolous fungus from northern Holarctic. *Graphis Script*, *22*, 47–51.

Zhurbenko, M. P., Himelbrant, D. E., Kuznetsova, E. S., & Stepanchikova, I. S. (2012). Lichenicolous fungi from the Kamchatka Peninsula, Russia. *The Bryologist*, *115*(2), 295–312. https://doi.org/10.1639/0007-2745-115.2.295

Zhurbenko, M. P., Kukwa, M., & Oset, M. (2009). *Roselliniella stereocaulorum* (Sordariales, Ascomycota), a new lichenicolous fungus from the Holarctic. *Mycotaxon*, *109*(1), 323–328.

Zhurbenko, M. P., Laursen, G., & Walker, D. (2005). New and rare lichenicolous fungi and lichens from the North American Arctic. *Mycotaxon*, *92*, 201–212. https://doi.org/10.1007/s00296-008-0822-2

Zhurbenko, M. P., & Ohmura, Y. (2018). *Perigrapha cetrariae*, a new lichenicolous ascomycete on *Cetraria* from Japan. *Folia Cryptogamica Estonica*, *55*, 17–19.

Zhurbenko, M. P., & Ohmura, Y. (2019). New and interesting records of lichenicolous fungi from the TNS Herbarium: Part I. *Opuscula Philolichenum*, *18*, 74–89.

Zhurbenko, M. P., & Ohmura, Y. (2020). Contributions to the knowledge of lichenicolous fungi growing on baeomycetoid lichens and *Icmadophila*, with a key to the species. *The Lichenologist*, *52*(6), 437–453. https://doi.org/10.1017/S002428292000047X

Zhurbenko, M. P., & Pino-Bodas, R. (2015). New lichenicolous fungi growing on *Cladia* in New Zealand. *The Lichenologist*, *47*(6), 395–402.

Zhurbenko, M. P., & Pino-Bodas, R. (2017). A revision of lichenicolous fungi growing on *Cladonia*, mainly from the northern hemisphere, with a worldwide key to the known species. *Opuscula Philolichenum*, *16*, 188–266.

Zhurbenko, M. P., Stepanchikova, I. S., & Himelbrant, D. E. (2020). New species and new records of lichenicolous fungi from the Kamchatka Territory of Russia. *Herzogia*, *33*(2), 512–524. https://doi.org/10.13158/heia.33.2.2020.512

Zhurbenko, M. P., Tadome, K., & Ohmura, Y. (2025). *Roselliniopsis falklandica* sp. nov. and Some Other Noteworthy Species of Lichenicolous Fungi Found in the TNS Herbarium (Japan). *Herzogia*, *37*(2), 381–387. https://doi.org/10.13158/heia.37.2.2024.381

Zhurbenko, M. P., & Triebel, D. (2005). *Lasiosphaeriopsis pilophori* sp. nov.(Sordariales) and other lichenicolous fungi on *Pilophorus*. *Mycological Progress*, *4*, 317–323.

Zhurbenko, M. P., & Triebel, D. (2008). Three new species of *Stigmidium* and *Sphaerellothecium* (lichenicolous ascomycetes) on *Stereocaulon*. *Mycological Progress*, *7*, 137–145.

Zhurbenko, M. P., & Vershinina, S. E. (2014). *Opegrapha bryoriae* sp. nov. and Other Lichenicolous Fungi from Asian Russia. *Herzogia*, *27*(1), 93–109. https://doi.org/10.13158/heia.27.1.2014.93

Zhurbenko, M. P., & von Brackel, W. (2013). Checklist of Lichenicolous Fungi and Lichenicolous Lichens of Svalbard, Including New Species, New Records and Revisions. *Herzogia*, *26*(2), 323–359.

Zhurbenko, M. P., & Yakovchenko, L. S. (2014). A new species, *Sagediopsis vasilyevae*, and other lichenicolous fungi from Zabaikal'skii Territory of Russia, southern Siberia. *Folia Cryptogamica Estonica*, *51*(0), 121–130. https://doi.org/10.12697/fce.2014.51.14

Zimmermann, E., & Berger, F. (2018). Ein Beitrag zur Kenntnis der Lichenicolen Mycobiota Österreichs. Funde aus Tirol I. *Herzogia*, *31*(p1), 732–762.

Zimmermann, E., & Berger, F. (2021). Lichenicole Pilze auf *Thamnolia* in den Alpen. *Herzogia*, *34*(2), 461–492. https://doi.org/10.13158/heia.34.2.2021.461

Zmitrovich, I., Kalinovskaya, N., & Myasnikov, A. (2019). Funga photographica. Boletales I: Coniophoraceae, Hygrophoropsidaceae, Paxillaceae, Serpulaceae, Tapinellaceae boreales. *Folia Cryptogamica Petropolitana*, *7*, 58.

Zoller, S., Scheidegger, C., & Sperisen, C. (1999). PCR primers for the amplification of mitochondrial small subunit ribosomal DNA of lichen-forming Ascomycetes. *Lichenologist*, *31*(5), 511–516. https://doi.org/10.1006/lich.1999.0220

Zopf, W. (1897a). Ueber Nebensymbiose (Parasymbiose). *Berichte der Deutschen Botanischen Gesellschaft 15*, 90–92.

Zopf, W. (1897b). Untersuchungen über die durch parasitische Pilze hervorgerufenen Krankheiten der Flechten. *Nova Acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum*, *70*(2), 99–190.

Zopf, W. (1898). Untersuchungen über die durch parasitische Pilze hervorgerufenen Krankheiten der Flechten. *Nova Acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum*, *70*(4), 243–288.

Zopf, W. F. (1896). Übersicht der auf Flechten schmarotzenden Pilze. *Hedwigia*, *35*, 312–366.

Zschacke, H. (1934). *Epigloeaceae, Verrucariaceae und Dermatocarpaceae*. Akademische Verlagsgesellschaft.

Zukal, H. (1887). Ueber einige neue Ascomyceten. In R. v. Wettstein (Ed.), *Verhandlungen der kaiserlich-königlichen zologisch-botanischen Gesellschaft in Wien* (Vol. 37, pp. 39–46). Adolf Holzhausen, K. K. Hof-und Universitats Buchdrucker in Vienna.

Zwickl, D. J., & Hillis, D. M. (2002). Increased taxon sampling greatly reduces phylogenetic error. *Systematic Biology*, *51*(4), 588–598.

APPENDIX A

MEDIA

1. Malt Extract Agar (MEA) used for fungal cultivation

Agar 15 g

Peptone 0.78 g

Glycerol 2.35 g

Dextrin 2.75 g

Maltose, Technical 12.75 g

Suspend 33.6 g of malt extract agar in distilled water and mix thoroughly. Heat with frequent agitation and boil for 1 minute to completely dissolve the power and bring volume to 1000 ml. Autoclave at 121ºC for 20 minutes.

2. Potato dextrose agar (PDA) used for fungal cultivation

Potato starch (from the infusion) 4 g

Dextrose 20 g

Agar 15 g

Suspend 39 g of Potato dextrose agar in distilled water and mix thoroughly. Heat with frequent agitation and boil for 1 minute to completely dissolve the powder and bring volume to 1000 ml. Autoclave at 121ºC for 20 minutes.

3. Water Agar (WA) Used for Fungal Isolation

Agar 15 g

Suspend 15 g of agar in distilled water and mix thoroughly. Heat with frequent agitation and boil for 1 minute to completely dissolve the powder and bring volume to 1000 ml. Autoclave at 121°C for 20 minutes.

APPENDIX B

ABSTRACT OF PUBLICATIONS

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Sclerococcum glaucomarioides: a new geographical record from China

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Abstract

The lichenicolous species *Sclerococcum glaucomarioides* growing on the lichen *Ochrolechia akagiensis* is newly reported from China. This study provides an illustration and morphological description for this species, complemented by phylogenetic analyses based on ITS, LSU and mtSSU sequence data. The taxon is characterized by adpressed to sessile apothecia that are round to angular with black disc, hymenium with brownish color, 25–40 µm high, broadly cylindrical to subclavate 8-spored asci, 20–30 × 10–15 µm, with euamyloid apical cap and brown ascospores with 2–3 transverse septa.

Key words: Dactylosporaceae, multi-gene, new record, taxonomy

Introduction

Lichenicolous fungi are highly specialized organisms that grow on lichens as pathogens, saprotrophs or commensals, comprising over 2300 species (Diederich *et al.* 2018). Dactylosporaceae (Sclerococcales, Eurotiomycetes) was established by Bellem. & Hafellner (1982), and comprises of lignicolous, lichenicolous, and beetle-associated fungi (Bellemere and Hafellner 1982; Yang *et al.* 2023). The family comprised six genera namely *Cylindroconidiis* Huang Zhang & X.D. Yu, *Fusichalara* S. Hughes & Nag Raj, *Gamsomyces* Hern.-Restr. & Réblová, *Pseudobactrodesmium* H. Zhang, W. Dong & K.D. Hyde, *Rhopalophora*-Réblová, Unter. & W. Gams and the generic type *Sclerococcum* Fr. (Wijayawardene *et al.* 2022). Sclerococcaceae Réblová assigned as a type family within Sclerococcales Unter.. & W. Gams, which was initially introduced by Réblová *et al.* (2017). In the past, Dactylosporaceae and Sclerococcaceae were distinct families within the same order Sclerococcales. Nevertheles, Diederich *et al.* (2018) found that the two type genera, *Dactylospora* Körb. and *Sclerococcum* Fr. from these two families appeared to form a monophyletic group in phylogenetic analyses. Consequently, the separation of these two genera became challenging. As a result, Diederich *et al.* (2018) proposed that Sclerococcaceae be considered as a new synonym, advocating for the reinstatement of Dactylosporaceae with *Sclerococcum* as the type genus. Subsequently, numerous species of *Dactylospora* were combined into the genus *Sclerococcum* (Diederich *et al.* 2013; Pino-Bodas *et al.* 2017; Réblová *et al.* 2017; Diederich *et al.* 2018).

Sclerococcum is one of the species-rich lichenicolous genera (Diederich *et al.* 2018; Joshi 2021) . It was originally introduced to accommodate a lichenicolous hyphomycete, *S. sphaerale* (Ach.) Fr. that was reported in its asexual

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Morphological and phylogenetic appraisal of a new *Kirschsteiniothelia* (Dothideomycetes, Kirschsteiniotheliales) species from Yunnan Province, China

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Abstract

Kirschsteiniothelia is a saprotrophic genus that occurs in both terrestrial and aquatic habitats. This study introduces a novel species of *Kirschsteiniothelia*, discovered on the bark of *Abies fabri*, collected from Yunnan Province, China, and named *K. laojunensis*. The identification was established through a combination of molecular analyses and morphological characteristics. *Kirschsteiniothelia laojunensis* is characterized by its large subglobose to globose, black perithecia, clavate, 8-spored asci, fusiform asymmetric ascospores, which are hyaline when immature and become greenish to brown at maturity. This discovery marks the first occurrence of *Kirschsteiniothelia* on tree bark, with some lichen thallus tissue surrounding the base of the perithecia. Detailed morpho-molecular characterization along with a synopsis table for the genus are provided.

Key words: 1 new species, *Abies fabri*, multi-gene, *Ochrolechia*, taxonomy

Introduction

Kirschsteiniothelia D. Hawksw., was introduced by Hawksworth (1985) to accommodate the *Microthelia incrustans*-group within Pleosporaceae (Dothideales). Boonmee *et al.* (2012) revealed four species, including *Kirschsteiniothelia aethiops* (Sacc.) D. Hawksw., *K. emarceis* Boonmee & K.D. Hyde, *K. lignicola* Boonmee & K.D. Hyde and *K. atra* (Corda) D. Hawksw. (= *Dendryphiopsis atra* (Corda) S. Hughes), formed a monophyletic clade with strong statistical support, and indicated they were a distinct clade within Dothideomycetes. Therefore, the new family Kirschsteiniotheliaceae Boonmee & K.D. Hyde was established to accommodate this clade (Boonmee *et al.* 2012). Subsequently, Hernandez-Restrepo *et al.* (2017) revealed that Kirschsteiniotheliaceae represented a distinct lineage within Dothideomycetes, necessitating the formation of a new order, Kirschsteiniotheliales Hern.-Restr., R.F. Castañeda, Gené & Crous, to accommodate Kirschsteiniotheliaceae, with *Kirschsteiniothelia* as the type genus. Additionally, the three genera *Brachysporiella* Bat., *Solicorynespora* R. F. Castañeda & W. B. Kendr. and *Taeniolella* S. Hughes were placed in *incertae sedis* within the order (Hernandez-Restrepo *et al.* 2017; Wijayawardene *et al.* 2022).

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Research Article

Lijiangomyces laojunensis gen. et sp. nov. (Mytilinidiaceae), and *Sclerococcum stictae* (Dactylosporaceae), a new lichenicolous species from Yunnan, China

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Abstract

Lijiangomyces laojunensis gen. et sp. nov. and *Sclerococcum stictae* sp. nov. are reported from China and identified through DNA sequence analyses (LSU, ITS, and *tef*1-α) and morphological characteristics. Phylogenetic analysis showed that *L. laojunensis* forms a distinct lineage within Mytilinidiaceae, closely related to the *Mytilinidion* subclade, leading to the establishment of a new genus within this family. This saprotrophic species grows on the bark of *Abies fabri*, often surrounded by the thallus of *Pertusaria* species. *Lijiangomyces laojunensis* is characterized by broadly open, black hysterothecia, clavate asci, and uniseriate, hyaline muriform ascospores. *Sclerococcum stictae*, a new lichenicolous species, forms a sister clade relationship to a lichenicolous fungus, *S. ricasoliae*. It was found on the thallus of *Sticta*, and is characterized by black apothecia, elongate, cylindrical asci, and brown, elliptical, and 1-septate ascospores. Descriptions, illustrations, and phylogenetic analysis results of the new taxa are provided.

Key words: 2 new taxa, lichen, morphology, phylogeny, saprobe, taxonomy

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Introduction

Mytilinidiaceae belongs to Mytilinidiales, Dothideomycetes (Hyde et al. 2024), and was introduced by Kirschstein (1924) to accommodate four genera that were originally classified under Hysteriaceae. Boehm et al. (2009a) introduced Mytilinidiales based on multigene phylogenetic analysis to accommodate Mytilinidiaceae. Pem et al. (2024) included eight genera

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Meng, Q.-F., Diederich, P., Thiyagaraja, V., Ertz, D., Wang, X.-Y., Saichana, N., Hyde, K. D., Jayawardena, R. S., & Fu, S.-B. (2025). *Lijiangomyces laojunensis* gen. et sp. nov. (Mytilinidiaceae), and *Sclerococcum stictae* (Dactylosporaceae), a new lichenicolous species from Yunnan, China. *MycoKeys*, *114*, 277–298. https://doi.org/10.3897/mycokeys.114.146031

Meng, Q.-F., Jeewon, R., Hongsanan, S., Zeng, X.-Y., Ertz, D., Jayawardena, R. S., Diederich, P., Al-Otibi, F., Hyde, K. D., Thiyagaraja, V., & Fu, S.-B. (2025). Reassessing the Divergence Times of the lichenicolous order Abrothallales and its Adjacent Orders *Molecular Phylogenetics and Evolution*. [Submitted]

Meng, Q.-F., Thiyagaraja, V., Ertz, D., Worthy, F. R., Saichana, N., & Fu, S.-B. (2024). *Sclerococcum glaucomarioides*: a new geographical record from China. *Phytotaxa*, *642*(1), 95–103. https://doi.org/10.11646/phytotaxa.642.1.8

Meng, Q.-F., Thiyagaraja, V., Jayawardena, R. S., Hyde, K. D., & Fu, S.-B. (2025). Fungalpedia: Illustrated Genera of Obligate Lichenicolous Fungi. *Mycosphere*. [Submitted]

Meng, Q.-F., Thiyagaraja, V., Worthy, F. R., Ertz, D., Wang, X.-Y., Jayawardena, R. S., Fu, S.-B., & Saichana, N. (2024). Morphological and phylogenetic appraisal of a new Kirschsteiniothelia (Dothideomycetes, Kirschsteiniotheliales) species from Yunnan Province, China. *Phytotaxa*, *661*(3), 267–281. https://doi.org/10.11646/phytotaxa.661.3.4

Co-author

He, Y.-D., Tan, M., Cao, Q.-P., Xu, L.-H., Yang, Z., Meng, Q.-F., & Fu, S.-B. (2024). The Liquid Fermentation Process for Mycelia of Poria cocos (Agaricomycetes) by Single-Factor Experimentation and Response Surface Methodology. *International Journal of Medicinal Mushrooms*, *26*(4), 41–51.

Hu, W.-T., Li, Y.-C., He, Y.-D., Meng, Q.-F., Ju, J.-H., & Fu, S.-B. (2023). Chemical Constituents from Mycelia of *Lepista sordida* (Agaricomycetes) and Their ABTS Radical Scavenging Activity. *International Journal of Medicinal Mushrooms*, *25*(6), 31–39. 10.1615/IntJMedMushrooms.2023048194

Hyde, K., Abdel-Wahab, M.A., Abdollahzadeh, J., Abeywickrama, P.D., Absalan, S., Afshari, N., Ainsworth, A.M., Akulov, O.Y., Aleoshin, V.V., Al-Sadi, A.M., Alvarado, P., Alves, A., Alves-Silva, G., Amalfi, M., Amira, Y., Amuhenage, TB, Anderson, J, Antonín, V, Aouali, S,…Zucconi, L. (2023). Global consortium for the classification of fungi and fungus-like taxa. *Mycosphere*, *14*, 1960–2012. https://doi.org/10.5943/mycosphere/14/1/23

Hyde, K., Amuhenage, T., Apurillo, C., Asghari, R., Aumentado, H., Bahkali, A., Bera, I., Bhunjun, C., Calabon, M., Chandrasiri, S., Chethana, K., Doilom, M., Dong, W., Fallahi, M., Gajanayake, A., Gomdola, D., Gunarathne, A., Hongsanan, S., Huanraluek, N., Dai, D. (2023). Fungalpedia, an illustrated compendium of the fungi and fungus-like taxa. *Mycosphere*, *14*(1), 1835–1959. https://doi.org/10.5943/mycosphere/15/1/25

Hyde, K. D., Noorabadi, M., Thiyagaraja, V., He, M., ohnston, P., Wijesinghe, S., Armand, A., Biketova, A., Chethana, K., Erdoğdu, M., Ge, Z. W., Groenewald, J., Hongsanan, S., Kušan, I., Leontyev, D., Li, D., Lin, C., Liu, N., Maharachchikumbura, S., Zvyagina, E. (2024). The 2024 Outline of Fungi and fungus-like taxa. *Mycosphere*, *15*, 5146–6239. https://doi.org/10.5943/mycosphere/15/1/25

Thiyagaraja, V., He, S.-C., Luo, L., Meng, Q.-F., Yang, H., & Yang, Y.-Y. (2024). Research Profiles – I. The research of Vinodhini Thiyagaraja and her team at Kunming Institute of Botany, CAS, P.R. China. *Current Research in Environmental & Applied Mycology (Journal of Fungal Biology)*, *14*(1), 49–62. https://doi.org/10.5943/cream/14/1/2

Zhou, X., Wang, M.-Y., Cao, Q.-P., Yang, Z., Meng, Q.-F., & Fu, S.-B. (2023). Chemical synthesis and mechanism of a natural product from endolichenic fungus with a broad-spectrum anti microorganism activity. *Frontiers in microbiology*, *14*, 1168386.